ISSN 0704-7797

THE 1980 SPRUCE BUDWORM SITUATION IN ONTARIO

PART A: DAMAGE AND FORECASTS

PART B: AERIAL SPRAYING OPERATIONS

G. M. HOWSE, A. A. HARNDEN AND J. H. MEATING

GREAT LAKES FOREST RESEARCH CENTRE

SAULT STE. MARIE, ONTARIO

J. R. CARROW

ONTARIO MINISTRY OF NATURAL RESOURCES

MAPLE, ONTARIO

INFORMATION REPORT O-X-336

CANADIAN FORESTRY SERVICE

DEPARTMENT OF THE ENVIRONMENT

1982

Copies of this report may be obtained from

Information Office,
Great Lakes Forest Research Centre,
Canadian Forestry Service,
Department of the Environment,
Box 490, Sault Ste. Marie, Ontario.
P6A 5M7

ABSTRACT

The spruce budworm situation worsened in Ontario in 1980. Part A of this report describes changes in the infestations in 1980 and forecasts, in cartographic and tabular form, the damage liable to occur in 1981. Part B describes aerial spraying operations covering 10 500 ha which were conducted against the spruce budworm in Ontario in 1980.

RÉSUMÉ

En 1980, l'infestation de la tordeuse des bourgeons de l'épinette a empiré en Ontario. La partie A de ce rapport décrit les fluctuations des infestations survenues en 1980 et prévoit, en se basant sur des cartes et des tableaux, les dégâts probables en 1981. La partie B décrit les arrosages aériens effectués contre la tordeuse des bourgeons de l'épinette en Ontario en 1980 sur une superficie de 10 500 ha.

TABLE OF CONTENTS

TABLES

Page

PART A: DAMAGE AND FORECASTS

(continued)

TABLES (continued)

(continued)

TABLES (concluded)

FIGURES

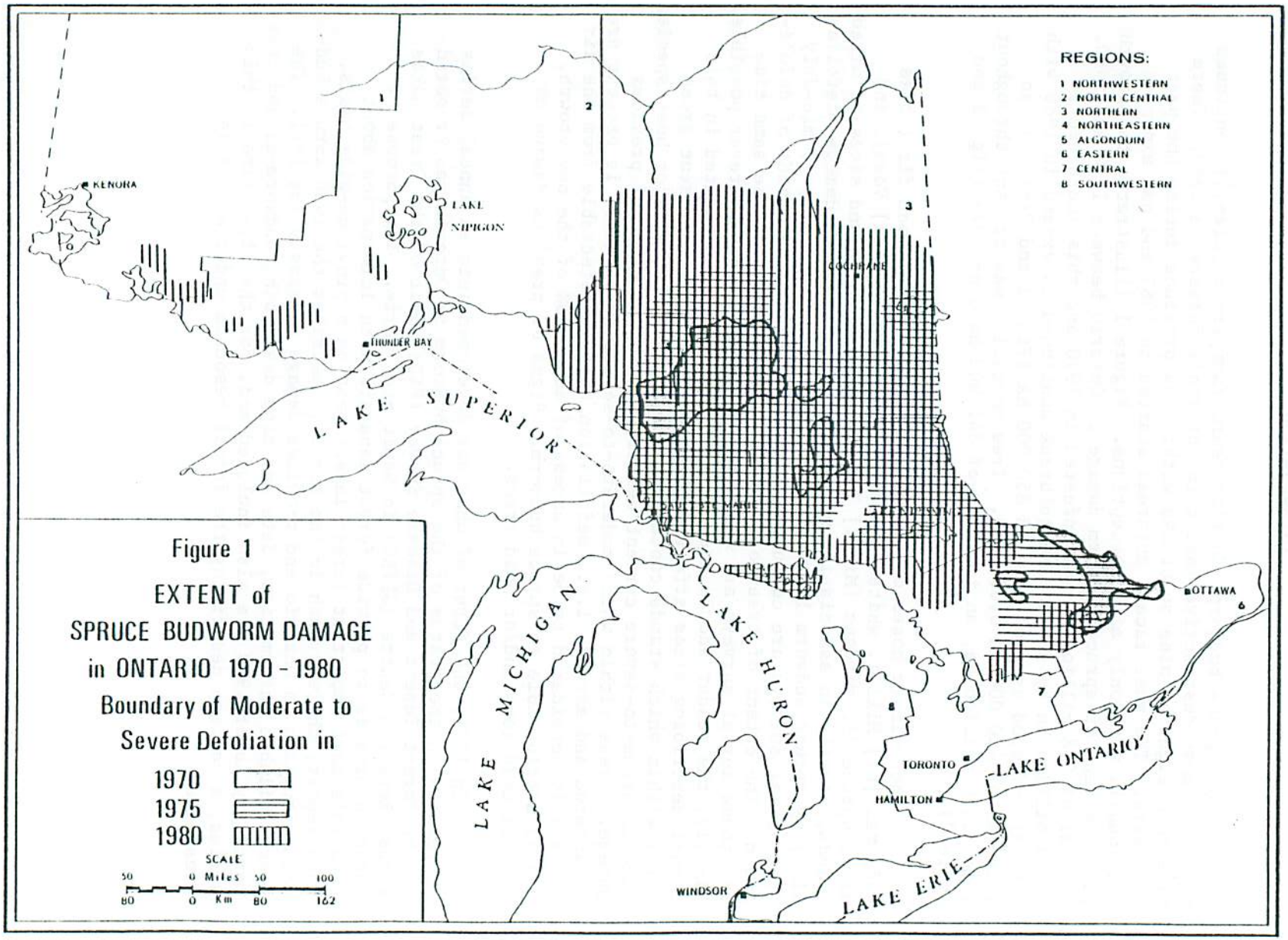
PART A: DAMAGE AND FORECASTS

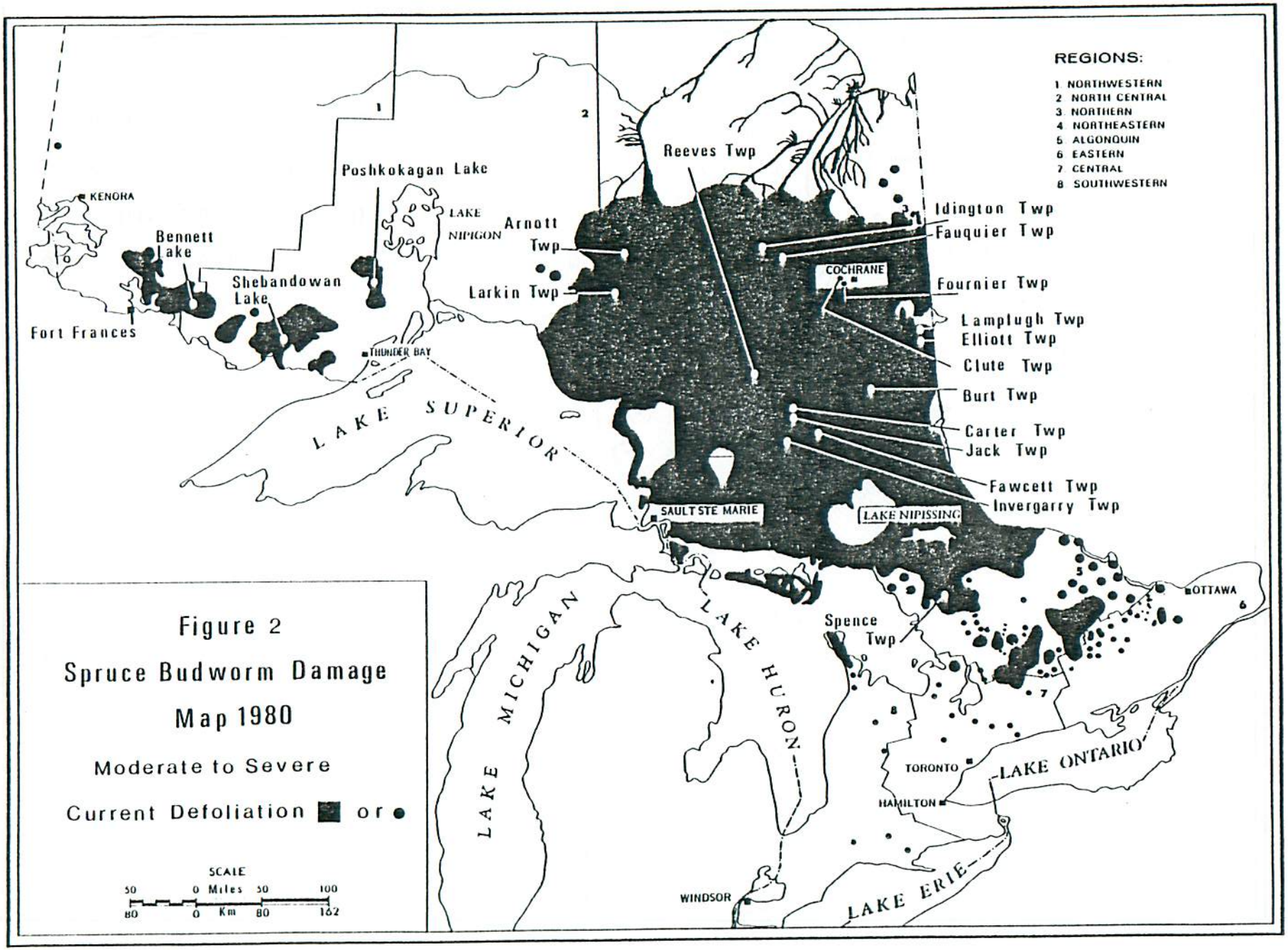
INTRODUCTION

The spruce budworm (*Choristoneura fumiferana* [Clem.]) continued to be the most destructive insect in Ontario's forests in 1980. There have been eight or nine outbreaks within the province during the past 275 years. The most recent outbreak started in 1967 and has expanded continually with only minor exceptions. Figure 1 illustrates the growth in the extent of spruce budworm damage in Ontario between 1970 and 1980. A total of 2.8 million ha was infested in 1970 and this increased to 13.45 million ha by 1975. The outbreak continued to expand in 1980 with a total infested area of some 18 850 000 ha (Fig. 2 and Table 1), an increase of 420 000 ha over 1979. Tree mortality was present throughout some 8.356 million ha, an increase of 841 000 ha over 1979 (Fig. 3 and Table 2).

The primary hosts of budworm in Ontario are balsam fir (*Abies balsamea* [L.] Mill.), white spruce (*Picea glauca* [Moench] Voss), and black spruce (*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 to detect and map the extent of defoliation. The extent of tree mortality is sketch-mapped at the same time and these aerial surveys are supported by ground checks wherever possible. Finally, the reader should keep in mind that figures presented in this report describing areas affected by budworm actually represent gross areas within which stands containing one or more of the major host species show moderate-to-severe current defoliation and/or signs of previous damage. Areas within which moderate-to-severe defoliation is present are delineated and mapped, i.e., defoliation that is detectable from the air is usually considered to be in excess of about 30% of the new growth, and is attributable to spruce budworm. Signs of previous damage may include dead tops and/or dead trees.

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 eleventh in the series, describes the 1980 spruce budworm situation in Ontario and provides damage forecasts for 1981. The best available information, data and maps describing budworm-caused tree mortality as of 1980 are also included and, for the first time in this series, a section describing the forest resource under attack is presented.


REGIONS:
1 NORTHWESTERN
2 NORTH CENTRAL
3 NORTHERN
4 NORTHEASTERN
5 ALGONQUIN
6 EASTERN
7 CENTRAL
8 SOUTHWESTERN
KENORA
LAKE NIPIGON
THUNDER BAY
COCHRANE
LAKE SUPERIOR
SAULT STE MARIE
TIMMINS
OTTAWA
LAKE MICHIGAN
LAKE HURON
TORONTO
LAKE ONTARIO
HAMILTON
WINDSOR
LAKE ERIE
Figure 1
EXTENT of
SPRUCE BUDWORM DAMAGE
in ONTARIO 1970 - 1980
Boundary of Moderate to
Severe Defoliation in
1970
1975
1980
SCALE
50 0 Miles 50 100
80 0 Km 80 162


REGIONS:
1 NORTHWESTERN
2 NORTH CENTRAL
3 NORTHERN
4 NORTHEASTERN
5 ALGONQUIN
6 EASTERN
7 CENTRAL
8 SOUTHWESTERN
Reeves Twp
Idington Twp
Fauquier Twp
COCHRANE
Fournier Twp
Lamplugh Twp
Elliott Twp
Clute Twp
Burt Twp
Carter Twp
Jack Twp
Fawcett Twp
Invergarry Twp
Poshkokagan Lake
LAKE NIPIGON
Arnott Twp
Larkin Twp
KENORA
Bennett Lake
Shebandowan Lake
Fort Frances
THUNDER BAY
LAKE SUPERIOR
SAULT STE MARIE
LAKE NIPISSING
OTTAWA
Spence Twp
LAKE MICHIGAN
LAKE HURON
TORONTO
LAKE ONTARIO
HAMILTON
WINDSOR
LAKE ERIE
Figure 2
Spruce Budworm Damage
Map 1980
Moderate to Severe
Current Defoliation ■ or ●
SCALE
50 0 Miles 50 100
80 0 Km 80 162

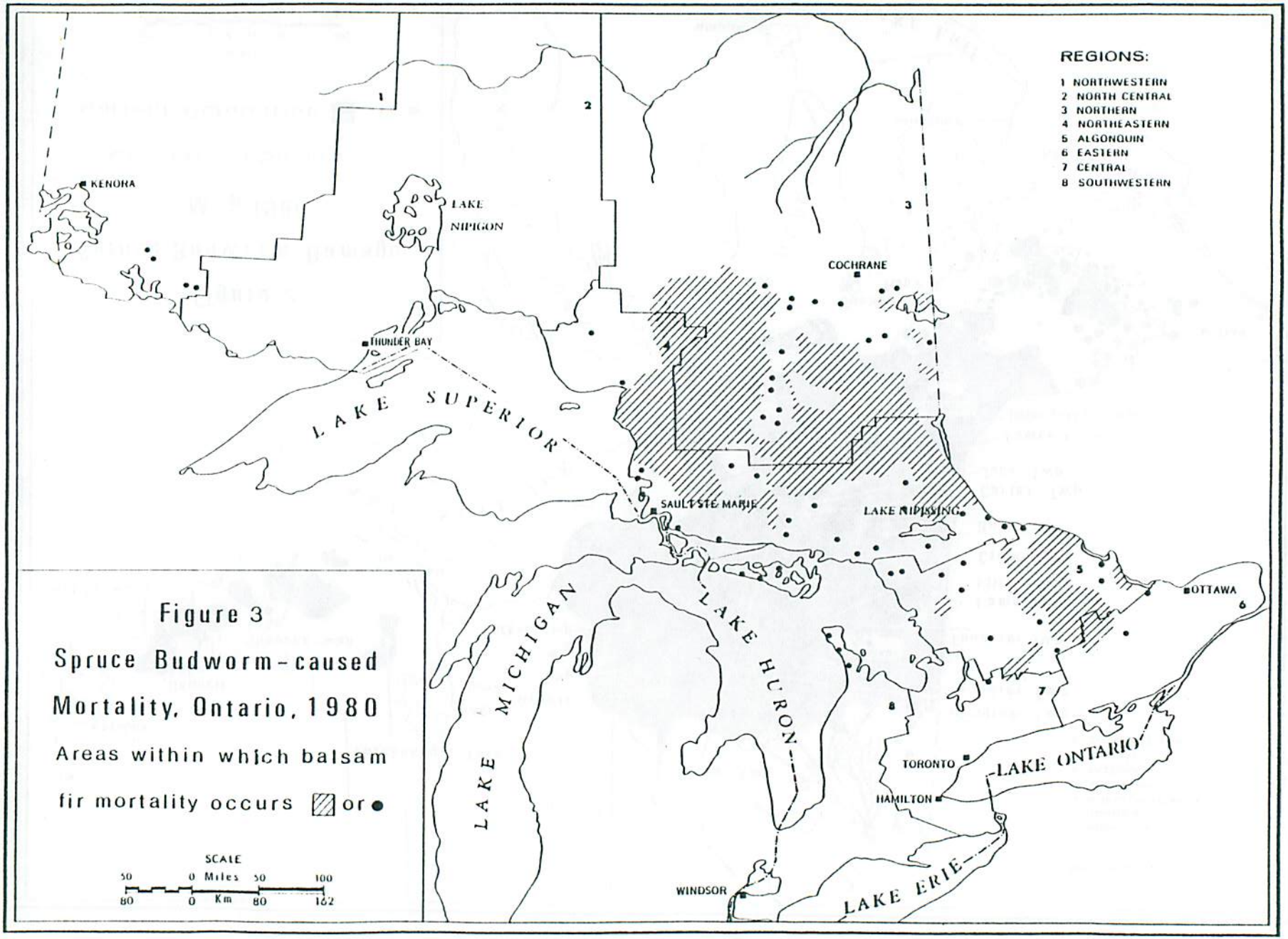


Figure 3

Spruce Budworm-caused Mortality, Ontario, 1980

Areas within which balsam fir mortality occurs ▨ or ●

Table 1. Comparison of the area of forest in Ontario defoliated by spruce budworm in 1979 and 1980.

Outbreak region in Ontario	Gross area of moderate-to-severe defoliation (000 000 ha)		
	1979	1980	increase
Northwestern	.488	.724	.236
Northeastern	16.940	17.119	.179
Southern	1.002	1.007	.005
Total	18.430	18.850	.420

Table 2. Comparison of the area of budworm-associated tree mortality in Ontario in 1979 and 1980.

Region in Ontario	Gross area of budworm-associated tree mortality (000 000 ha)		
	1979	1980	increase
Northwestern	.020	.024	.004
Northeastern	6.111	6.839	.728
Southern	1.384	1.493	.109
Total	7.515	8.356	.841

THE FOREST

As stated previously, the primary hosts of budworm in Ontario are balsam fir and white spruce. Black spruce growing on upland sites in mixed stands is also affected. The regions in Ontario primarily affected by budworm are the Algonquin, Northeastern, Northern, North Central (Thunder Bay and Atikokan districts) and Northwestern (Fort Frances District) (Fig. 2 and 3). The percentage composition by species (based on volume) of primary growing stock on productive forest land in the four regions of northern Ontario and the Algonquin Region is given in Table 3.

Table 3. Percentage composition by species (based on volume) of primary growing stock on productive forest land in the forest regions affected by spruce budworm. Source of data - Ontario Forest Resources Inventory (OFRI).

Species	Region				
	Northwestern	North Central	Northern	Northeastern	Algonquin
Balsam fir (*Abies balsamea* [L.] Mill.)	3.3	6.4	6.9	8.1	5.1
White spruce (*Picea glauca* [Moench] Voss)	1.2	1.8	3.1	4.6	2.6
Black spruce (*Picea mariana* [Mill.] B.S.P.	47.3	48.3	48.2	17.4	1.7
Jack pine (*Pinus banksiana* Lamb.)	25.5	14.8	9.6	11.6	.3
White pine (*Pinus strobus* L.)	.4	.1	.4	5.4	7.2
Red pine (*Pinus resinosa* Ait.)	.2	T	T	1.8	1.7
White cedar (*Thuja occidentalis* L.)	.5	.9	2.2	3.1	1.3
Tamarack (*Larix laricina* [Du Roi] K. Koch)	.1	.7	.9	.3	.2
White birch (*Betula papyrifera* Marsh.)	5.6	9.9	8.6	16.9	5.1
Poplar (*Populus* spp.)	15.8	17.1	19.8	17.9	10.3
Red maple (*Acer rubrum* L.)	T	T	.1	1.6	4.2
Ash (*Fraxinus* spp.)	.1	T	T	.4	.6
Elm (*Ulmus* spp.)	T	T	nil	T	.6
Red oak (*Quercus rubra* L.)	T	nil	nil	.3	2.3
Sugar maple (*Acer saccharum* Marsh.)	T	T	.1	6.8	36.3
Yellow birch (*Betula alleghaniensis* Britton)	T	T	.1	3.0	9.6
Hemlock (*Tsuga* spp.)	T	T	T	.7	6.8
Beech (*Fagus* spp.)	T	nil	nil	nil	3.3

T = trace

Balsam fir is the fifth most prevalent species, averaging from 3% to 8% in the four northern regions and increasing in relation to other species from west to east across the north. The percentage composition by species for the forest districts in the Northeastern and Northern regions, respectively, is given in Tables 4 and 5. Balsam fir constitutes some 17% of the primary growing stock in Kirkland Lake District and nearly 14% in Gogama--in both cases considerably higher than the regional average. The area of balsam fir working group expressed as a percentage of total productive area is given in Table 6 for the five regions, for the districts of the Northeastern and Northern regions, and for several management units or townships. Volumes of balsam fir in balsam fir working groups average from 41 to 60 m^3/ha at the regional level (Table 7). As one moves from the broader picture (regions) and focuses on local situations (districts, management units or townships), balsam fir becomes a more significant factor in some locations. Another point highlighted by these data is that balsam fir is common, albeit at relatively low levels, across northern Ontario, but frequently there are local concentrations. White spruce has a similar distribution; however, the volume of white spruce is less than half (42%) that of balsam fir.

The dominant species in northern Ontario forests is black spruce. It is susceptible to budworm attack when growing in mixture with balsam fir and can be expected to die concurrently with the balsam fir. In contrast, large stands of pure black spruce on lowland sites rarely show damage, whereas small stands occasionally do, particularly during peak years of attack and when they are surrounded with balsam fir. Rarely is infestation persistent enough in pure stands of black spruce to cause high levels of mortality. If we consider site, upland versus lowland, and other factors, at least half and perhaps closer to two-thirds of the black spruce may be susceptible to spruce budworm.

Table 4. Percentage composition by species (based on volume) of primary growing stock on productive forest land in the forest districts of the Northeastern Region. Source of data - OFRI.

Species	Wawa	Sault Ste. Marie	Blind River	Espanola	Sudbury	North Bay	Temagami
Balsam fir	7.9	13.7	4.8	6.2	7.0	9.6	10.8
White spruce	3.3	4.6	3.2	6.2	7.3	4.3	4.8
Black spruce	32.7	16.7	12.2	9.0	6.4	7.2	14.0
Jack pine	13.3	7.5	27.1	13.8	12.3	2.4	8.0
White pine	.1	12.0	8.6	5.5	10.7	6.6	8.2
Red pine	T	T	2.2	2.0	4.2	2.2	3.8
White birch	14.3	18.8	17.2	16.7	21.1	16.2	20.8
Poplar	18.2	5.6	13.6	22.9	18.8	17.0	17.8
Sugar maple	4.2	10.3	6.7	5.2	3.0	16.5	3.1
Yellow birch	3.2	5.8	2.6	.8	1.0	6.0	2.0

T = trace

Table 5. Percentage composition by species (based on volume) of primary growing stock on productive forest land in the forest districts of the Northern Region. Source of data - OFRI.

Species	Hearst	Kapuskasing	Cochrane	Kirkland Lake	Timmins	Gogama	Chapleau
Balsam fir	7.2	4.5	6.1	17.3	8.7	13.8	5.6
White spruce	3.7	1.8	3.2	2.2	6.5	2.0	4.1
Black spruce	47.7	59.6	65.4	25.0	27.5	18.9	29.5
Jack pine	7.6	3.2	3.9	21.7	13.9	25.9	19.1
White birch	5.9	4.4	5.2	12.7	15.6	16.0	16.3
Poplar	24.1	22.3	14.7	18.4	19.9	17.2	19.7

Table 6. Area of balsam fir working group expressed as a percentage of the total productive area. Source of data - OFRI.

Region	District in the Northeastern Region	District in the Northern Region	Management Unit or Township
Northwestern - 3.2	Wawa - 9.4	Hearst - 6.9	Beemer Twp - 7.8
North Central - 8.3	Sault Ste. Marie - 19.7	Kapuskasing - 3.5	Elliott Twp - 39.4
Northern - 7.8	Blind River - 4.9	Cochrane - 4.4	Braithwaite Twp - 33.4
Northeastern - 8.2	Espanola - 4.6	Kirkland Lake - 23.7	Black Sturgeon - 29.8
Algonquin - 5.7	Sudbury - 6.9	Timmins - 12.6	Burchell Lake - 20
	North Bay - 8.4	Gogama - 12.1	
	Temagami - 10.9	Chapleau - 7.8	

Table 7. Volume of balsam fir in balsam fir working groups expressed as m^3/ha. Source of data - OFRI.

Region	District in the Northeastern Region	District in the Northern Region	Management Unit or Township
Northwestern - 41.3	Wawa - 49.7	Hearst - 74.9	Beemer - 23.1
North Central - 52.5	Sault Ste. Marie - 53.2	Kapuskasing - 47.6	Elliott - 79.8
Northern - 59.5	Blind River - 50.4	Cochrane - 57.4	Braithwaite - 60.9
Northeastern - 53.9	Espanola - 58.1	Kirkland Lake - 64.4	Black Sturgeon - 45.5
Algonquin - 53.9	Sudbury - 37.1	Timmins - 42.0	Burchell Lake - 49.7
	North Bay - 60.9	Gogama - 71.4	
	Temagami - 68.6	Chapleau - 56.7	

OVERALL SITUATION, 1980

Infestations and damage caused by budworm are present in three major geographical areas of the province (Fig. 2): southern Ontario (primarily Algonquin Region), northeastern Ontario (Northeastern and Northern regions) and northwestern Ontario (Northwestern and North Central regions). In 1980, infestations increased somewhat in extent in all areas (Table 1). Over all, in southern Ontario, there was only a slight increase in the extent of defoliation. In northeastern Ontario, the net change between 1979 and 1980 was a small increase in the total extent of budworm-infested area. This year the more significant changes occurred in northwestern Ontario. Moderate-to-severe defoliation increased by 50% and a number of new infestations were found.

Budworm emerged generally in early May and development progressed rapidly, and ahead of normal, until early June. However, cool weather for about two weeks from early to mid-June slowed things considerably, and development was normal or later than normal by the latter part of June in most locations. During the cool period in early June, temperatures frequently dipped below freezing at night. Significant mortality of budworm larvae was noted in Harker Township, Kirkland Lake District, following a period of below-freezing temperatures and snow for three days from 8 to 10 June. Up to 70% of the larvae on balsam fir and 30% on white spruce died, presumably as a result of the combination of cold temperatures and snow. Most of the larvae affected were fourth instar. Although some frost damage to balsam and spruce foliage was noted, it was not as heavy as expected in view of the high larval mortality. There were other reports of budworm larval mortality associated with cold temperatures, e.g., from the Blind River District.

Forecasts of population trends and damage expected from larval feeding in the following year (1981) are based on the number of egg-masses per unit area of foliage. These samples, which collectively are termed an egg-mass survey, are collected and counted in August. Egg-mass surveys were carried out in 1980, and more than 600 locations were sampled in Ontario. As in previous years, considerable emphasis was placed on sampling "high-value" stands as suggested or requested by the Ontario Ministry of Natural Resources (OMNR). Over all, egg-mass densities decreased by some 45% in 1980 from those recorded in similar locations in 1979. The largest decline, 68%, occurred in southern Ontario, while in northeastern Ontario there was an overall decrease of some 50%. Egg-mass densities increased sharply in the eastern part of the North Central Region but decreased by some 14% in northwestern Ontario. In each case, an index of accumulated damge 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 spruce budworm outbreak in northeastern and northwestern Ontario continued to worsen in 1980. Aerial and ground surveys showed that the area of moderate-to-severe defoliation had increased in these regions of the province by 179,000 ha and 236,000 ha, respectively. Even in the areas in which egg masses decreased, little change is expected in the extent of defoliation since populations are still high enough, on the average, to cause moderate-to-severe defoliation. In southern Ontario the situation is somewhat different. The area of infestation in this part of the province showed a slight increase of 5 000 ha in 1980 but because of the large decrease in egg masses the total area of moderate-to-severe defoliation in southern Ontario will likely diminish in 1981. The total area of budworm-associated tree mortality (Fig. 3 and Table 2) increased from 7 515 000 ha in 1979 to 8 356 000 ha in 1980.

Southern Ontario

Situation in 1980: In southern Ontario the spruce budworm infestation showed a slight increase in area from 1 002 000 ha in 1979 to 1 007 000 ha in 1980 (Fig. 4). As in 1979 much of this increase was in the Algonquin Region, particularly in the northern townships of the Algonquin Park District. Infestations expanded into Limerick and Cashel townships in Bancroft District and into Tudor and Grimsthorpe townships in Tweed District. Small areas of new or expanded infestation were mapped in Albemarle Township, Owen Sound District and in Pakenham and Ramsay townships, Lanark District. New pockets of defoliation appeared in the northern portions of Lanark and Tweed districts, probably as a result of dispersal from the Pembroke and Bancroft infestations. Generally, populations in 1980 were down in the Southwestern Region, about the same in the Algonquin Region and up in the Central and Eastern regions from those in 1979.

In the Eastern Region damage to fir and spruce as a result of budworm activity generally occurred in small scattered pockets along the northern edge of the region in Lanark District. These pockets of moderate-to-severe defoliation were observed in Lavant, Darling and Pakenham townships. A large area of defoliation was found northeast of the town of Almonte in Ramsay Township. In Tweed District large areas of continuous defoliation were noted in Denbigh, Grimsthorpe and Tudor townships, and small pockets of moderate-to-severe defoliation were found in Anglesea, Abinger, Miller and Lake townships. In Ottawa District a small area of white spruce suffered moderate-to-severe defoliation in Fitzroy Township. In Brockville District light defoliation of white spruce was noted at the OMNR Tree Nursery in Kemptville.

Budworm populations in the Algonquin Region remained high in most of the region in 1980. In Algonquin Park District the area of budworm infestation increased but remained confined to the northern townships of Freswick, Anglin, Bishop and Fitzgerald. New pockets of moderate-to-severe

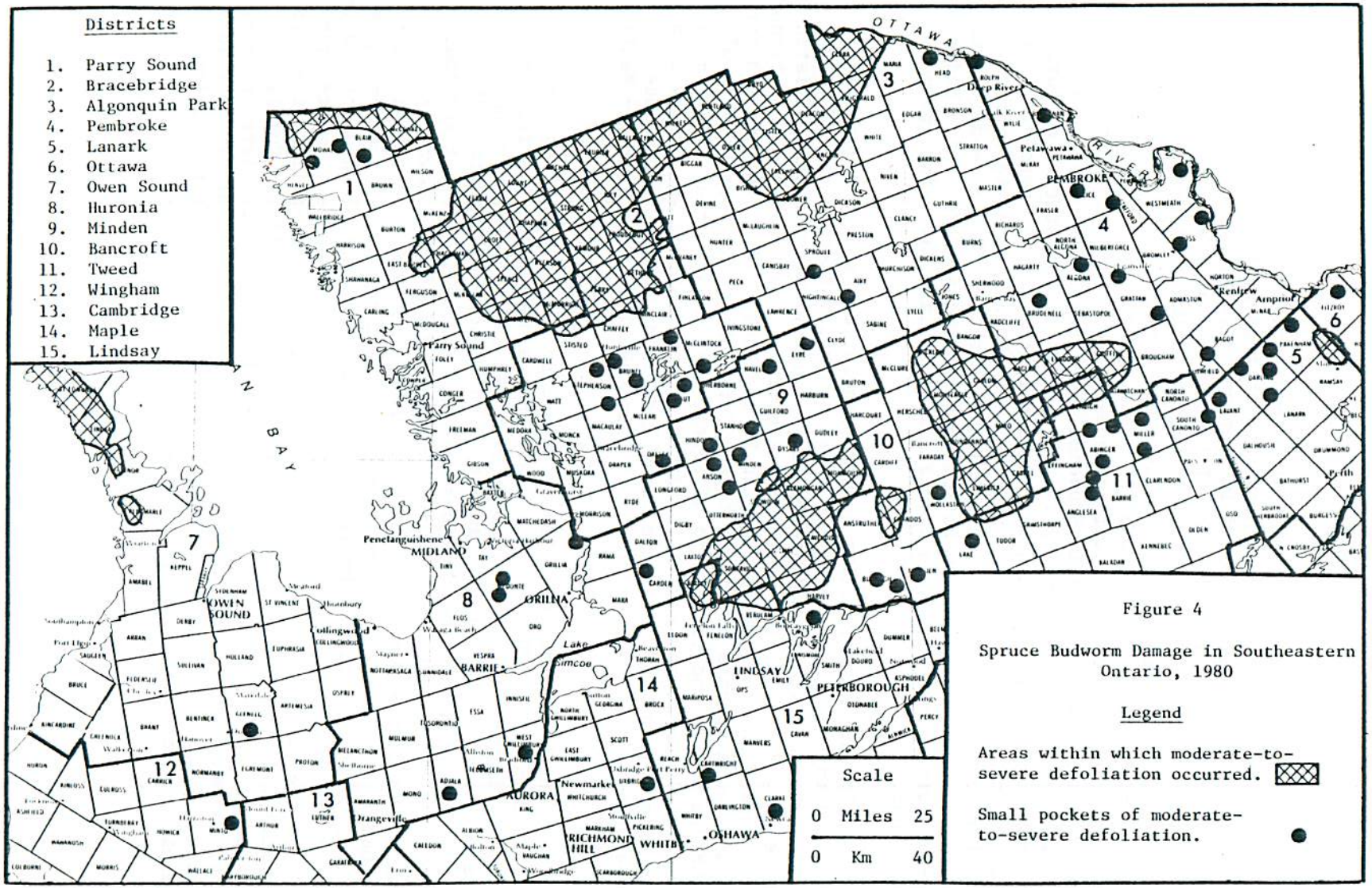


Figure 4

Spruce Budworm Damage in Southeastern Ontario, 1980

Legend

Areas within which moderate-to-severe defoliation occurred.

Small pockets of moderate-to-severe defoliation.

defoliation appeared in Head and Airy townships. Populations increased in Proudfoot and Bethune townships, Bracebridge District and a new pocket of defoliation was found in Stephenson Township. Defoliation of white spruce was severe at Pickerel Lake in Armour Township. In Minden District populations declined in Cavendish, Galway and Harvey townships but increased in Hindon, Anson, Minden and Snowdon townships. A new area of defoliation was located in Havelock Township. In Parry Sound and Pembroke districts populations appeared to be down in East Burpee and Ferguson townships and in Brudenell, Grattan, Westmeath, Ross, Sherwood and Brougham townships. New pockets of infestation appeared in Rolph and Buchanan townships. In Bancroft District large areas of budworm infestation were observed in Limerick and Cashel townships with smaller pockets in Methuen and Burleigh townships. Moderate defoliation was noted on white spruce in Petroglyphs Provincial Park, which had been sprayed with *Bacillus thuringiensis* (*B.t.*) in late May using ground equipment.

In the Central Region budworm populations showed a general increase in the Huronia District where new moderate-to-severe infestations were observed in Medonte Township. Heavy infestations persisted in Vespra, West Gwillimbury, Adjala and Orillia townships. Populations also showed an increase at Canadian Forces Base Borden. In Maple District high budworm numbers persisted in the Durham Regional Forest south of Uxbridge and in the York Regional Forest east of Newmarket. In Lindsay District light-to-moderate defoliation of white spruce was observed in Cartwright Township and at the Orono Tree Seed Orchard, while moderate-to-severe defoliation occurred at Balsam Lake Provincial Park in Bexley Township.

In the Southwestern Region spruce budworm populations were generally down from 1979 in most areas. In the Owen Sound District, pockets of heavy infestation were observed from Red Bay to Tobermory encompassing the townships of Albemarle, Eastnor, Lindsay and St. Edmunds. Plantations supporting high populations were also noted in Glenelg and Amabel townships, and medium infestations were noted in Osprey Township. Low numbers of larvae were common throughout the remainder of the district. In Cambridge District pockets of medium infestation were found on white spruce north of Elmira. In Wingham District a relatively new infestation was noted in the Wellington County Forest in Minto Township where over 50% of the new foliage was consumed. In Aylmer District light-to-moderate defoliation was observed in the Woodstock Public Utilities Commission tract near Ingersoll in West Oxford Township. In Simcoe District, populations remained at the light-to-moderate level, particularly near Turkey Point. Infestations in Middleton Township, just west of the village of Delhi, increased from moderate to heavy on white spruce.

Infestation Forecasts for 1981: Spruce budworm egg-mass surveys were carried out in southern Ontario in August 1980. Foliage samples were collected from a total of 117 locations; egg masses were counted, current defoliation and accumulated damage were estimated and damage forecasts were prepared for 1981. (See Table 8 for detailed results and Figure 5 for area forecasts.)

In southern Ontario, all districts except Bracebridge showed a decrease in egg-mass numbers in 1980. The overall decrease from 1979, based on a comparison of egg counts from 98 locations, was about 68%. This is the first year since 1976 that this area has shown an overall decrease in egg masses. The largest decreases occurred in Ottawa, Lindsay and Aylmer districts where egg-mass counts were down at least 90% from 1979. The smallest decrease (10%) occurred in Cornwall District. In Bracebridge District the average egg-mass count increased in 1980 because of one extremely high count (1,067 per 9.29 m^2) at Pickerel Lake. Egg-mass counts at the other three locations in this district decreased from 1979.

On balsam fir the average egg-mass count from 45 locations was 92/9.29 m^2, down 69% from 1979. The average count on white spruce (67 locations) was 196/9.29 m^2, a decrease of 57%. The highest egg-mass count recorded was 1,067 per 9.29 m^2 on white spruce at Pickerel Lake in Bracebridge District, as previously mentioned.

As a result of the overall decrease in egg-mass numbers in 1980, there will likely be a general decrease in the total area of moderate-to-severe defoliation in southern Ontario in 1981. Scattered patches of moderate-to-severe defoliation are forecast to occur in the northern townships of Parry Sound, Bracebridge and Algonquin Park districts. Another band of scattered moderate-to-severe defoliation is expected from Carden Township in Minden District east to Pakenham Township in Lanark District.

Tree Mortality: In 1980 the total area of budworm-associated tree mortality in southern Ontario was about 1.493 million ha (Fig. 6). This was an increase of about .109 million ha from 1979. New areas of mortality were observed in Algonquin Park District, particularly in Bishop and Freswick townships. Balsam fir mortality was also observed in Deacon (50%) and Clara (60%) townships. Smaller areas of mortality were found in Bracebridge, Minden, Pembroke and Lanark districts.

A total of 57 ground checks (33 balsam fir, 24 white spruce) were made in 10 districts in 1980. On the basis of 20 locations checked in each of the last two years, average balsam fir mortality has increased from 42% in 1979 to 65% in 1980. Concurrently, white spruce mortality has increased from 20% to 31% (six locations). A number of areas showed dramatic increases in fir mortality in 1980. For example, in Canisbay

Table 8. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981.

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Algonquin Park District (14 locations)					
Airy Twp - East Gate	wS	13	0	0	1
Canisbay Twp					
- Lake of Two Rivers	wS	4	90	M-S	0
- Mew Lake Camp Ground	bF	10	18	L-M	1
Clara Twp	wS	75	484	S	3
Clyde Twp	bF	2	0	0	8
Deacon Twp	bF	98	123	M-S	5
Freswick Twp - Hogan Lake	bF	82	320	M-S	5
Guthrie Twp					
- North of Basin Depot	wS	5	0	0	1
Head Twp - Grant Creek	wS	18	14	L	1
Hunter Twp	bF	17	14	L	1
Nightingale Twp - Rock Lake	wS	32	64	L-M	6
Preston Twp - Tattler Lake	bF	4	21	L-M	6
Stratton Twp - Achray (Plot C)	bF	8	42	L-M	5
White Twp					
- N. of Petawawa River	bF	40	43	L-M	5
Aylmer District (4 locations)					
Lobo Twp	wS	11	54	L-M	1
McGillivray Twp					
- Conservation Area	wS	8	8	L	0
West Oxford Twp					
- Con III - P.U.C.	bF	8	0	0	2
West Oxford Twp - P.U.C.	wS	45	27	L	1
Bancroft District (7 locations)					
*Burleigh Twp					
- Petroglyphs Prov. Pk.	wS	43	404	S	2
Cardiff Twp	wS	39	367	S	2
Chandos Twp	bF	70	136	M	5
Harcourt Twp	bF	1	0	0	0
Limerick Twp	bF	70	15	L-M	5

(cont'd)

Table 8. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Bancroft District (cont'd) (7 locations)					
Mayo Twp	wS	67	932	S	3
Wicklow Twp	wS	93	719	S	5
Bracebridge District (4 locations)					
*Armour Twp - Pickerel Lake	wS	96	1067	S	2
Bethune Twp	bF	71	235	M-S	2
*Oakley Twp - Clear Lake	bF	18	0	0	1
*Sinclair Twp - Bella Lake	bF	28	0	0	0
Brockville District (1 location)					
*Oxford Twp - OMNR Tree Nursery, Kemptville	wS	5	39	L-M	1
Cornwall District (2 locations)					
*Cambridge Twp - Larose Forest	wS	0	17	L-M	0
*Clarence Twp - Larose Forest	wS	1	87	M-S	1
Huronia District (3 locations)					
Vespra Twp - OMNR Tree Nursery Windbreak, Midhurst	wS	18	44	L-M	2
- OMNR Tree Nursery Windbreak, Midhurst	nS	15	50	L-M	2
- OMNR Tree Nursery Windbreaks, Midhurst	blS	1	82	M-S	2

(cont'd)

Table 8. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Lanark District (3 locations)					
Lavant Twp - Robertson Lake	wS	5	16	L	1
Pakenham Twp	wS	90	266	M-S	3
Ramsay Twp	wS	2	14	L	1
Lindsay District (3 locations)					
Cartwright Twp	wS	32	39	L-M	1
*Clarke Twp - OMNR Orono Tree Seed Orchard	wS	28	95	M-S	2
Bexley Twp - Balsam Lake Prov. Pk.	wS	68	275	S	2
Maple District (1 location)					
Uxbridge Twp	wS	64	14	L-M	3
Minden District (4 locations)					
Carden Twp	wS	78	346	M-S	8
Hindon Twp	bF	96	53	L-M	0
Minden Twp	bF	60	53	L-M	2
Somerville Twp	bF	92	26	L-M	4
Ottawa District (3 locations)					
Fitzroy Twp	wS	3	45	L-M	1
Huntley Twp	wS	1	14	L	1
Marlborough Twp	wS	1	37	L-M	1
Owen Sound District (4 locations)					
Amabel Twp - Sauble Falls	wS	44	34	L-M	2
Glenelg Twp	wS	20	17	L-M	2

(cont'd)

Table 8. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Owen Sound District (cont'd) (4 locations)					
Lindsay Twp	wS	8	75	L-M	1
St. Edmunds Twp - Crane River	wS	83	89	M-S	5
Parry Sound District (33 locations)					
Burton Twp	bF	78	118	M-S	0
Christie Twp	bF	88	181	M-S	3
Croft Twp - Check Plot 5	bF	2	9	L	0
- Check Plot 5	wS	6	21	L-M	0
Ferguson Twp	bF	82	85	M-S	2
McConkey Twp	wS	22	24	L-M	1
McKenzie Twp	bF	70	212	M-S	2
McMurrich Twp	bF	23	63	M-S	1
*Mowat Twp - Grundy Prov. Pk.					
- Clear Lake	wS	99	246	M-S	3
- Nature Trail	wS	61	414	S	3
- Swan Lake	wS	17	247	S	0
- Gate	wS	13	195	M-S	1
- Hwy 69	wS	81	424	S	3
*Spence Twp					
- Plot 1[c]	bF	59	285	S	2
- Plot 1[d]	wS	88	893	S	3
- Plot 2[c]	bF	90	91	M-S	3
- Plot 2[d]	wS	70	331	S	3
- Plot 3[d]	bF	52	126	M-S	3
- Plot 4[d]	bF	63	141	M-S	0
- Plot 4[d] (plantation)	wS	67	270	S	1
- Plot 6[c]	bF	2	8	L	3
- Plot 7[d]	bF	86	89	M	3
- Plot 8[d]	bF	43	95	M-S	3
- Plot 9[d]	bF	57	58	M-S	2
- Plot 10[d]	bF	45	87	M-S	3
- Check Plot 1	bF	95	308	S	3
- Check Plot 1	wS	86	425	S	3
- Check Plot 2	bF	99	319	S	3
- Check Plot 2	wS	99	516	S	4

(cont'd)

Table 8. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Parry Sound District (cont'd) (33 locations)					
*Spence Twp					
- Check Plot 3A	bF	94	250	M-S	3
- Check Plot 3A	wS	94	216	S	3
- Check Plot 4A	bF	96	303	S	1
- Check Plot 4A	wS	82	468	S	1
Pembroke District (18 locations)					
Admaston Twp	wS	63	145	M-S	5
Alice Twp	bF	49	60	M	5
Bromley Twp	wS	11	55	M	1
Brougham Twp	bF	3	0	0	0
Brudenell Twp	bF	5	0	0	1
Buchanan Twp (Petawawa National Forestry Institute)					
- Orange Rd	wS	2	0	0	5
Grattan Twp	wS	24	74	M	0
Griffith Twp	wS	94	443	S	5
McNab Twp	wS	10	80	M-S	1
Richards Twp - Round Lake	bF	6	13	L	1
Rolph Twp	wS	38	17	L-M	0
Ross Twp - Dist. Boundary	wS	10	86	M	1
Sherwood Twp					
- west of Barry's Bay	wS	13	133	M-S	1
Stafford Twp - NPV, Rankin	wS	59	939	S	5
- NPV, Rankin	bF	17	14	L	5
- Micksburg	wS	37	252	M-S	5
Westmeath Twp					
- east of Westmeath	bF	16	103	M-S	5
Wilberforce Twp	wS	42	123	M-S	5
Simcoe District (2 locations)					
Charlotteville Twp					
- Turkey Point	wS	21	110	M-S	2
South Walsingham Twp					
- OMNR Tree Nursery	wS	8	130	M-S	2

(cont'd)

Table 8. Southern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (concl'd).

Locaton	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Tweed District (7 locations)					
Clarendon Twp	wS	2	7	L	1
Denbigh Twp - Slate Falls Rd	bF	68	19	L-M	2
*Effingham Twp	bF	16	17	L-M	-
	wS	32	57	M	-
	rS	5	124	M-S	-
	bS	4	24	L	-
Tudor Twp	wS	2	20	L-M	1
Wingham District (4 locations)					
Ellice Twp - Ellice Swamp	wS	1	0	0	0
Colborne Twp	wS	5	22	L	0
Downie Twp	wS	53	9	L	2
Minto Twp	wS	51	25	L-M	1

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

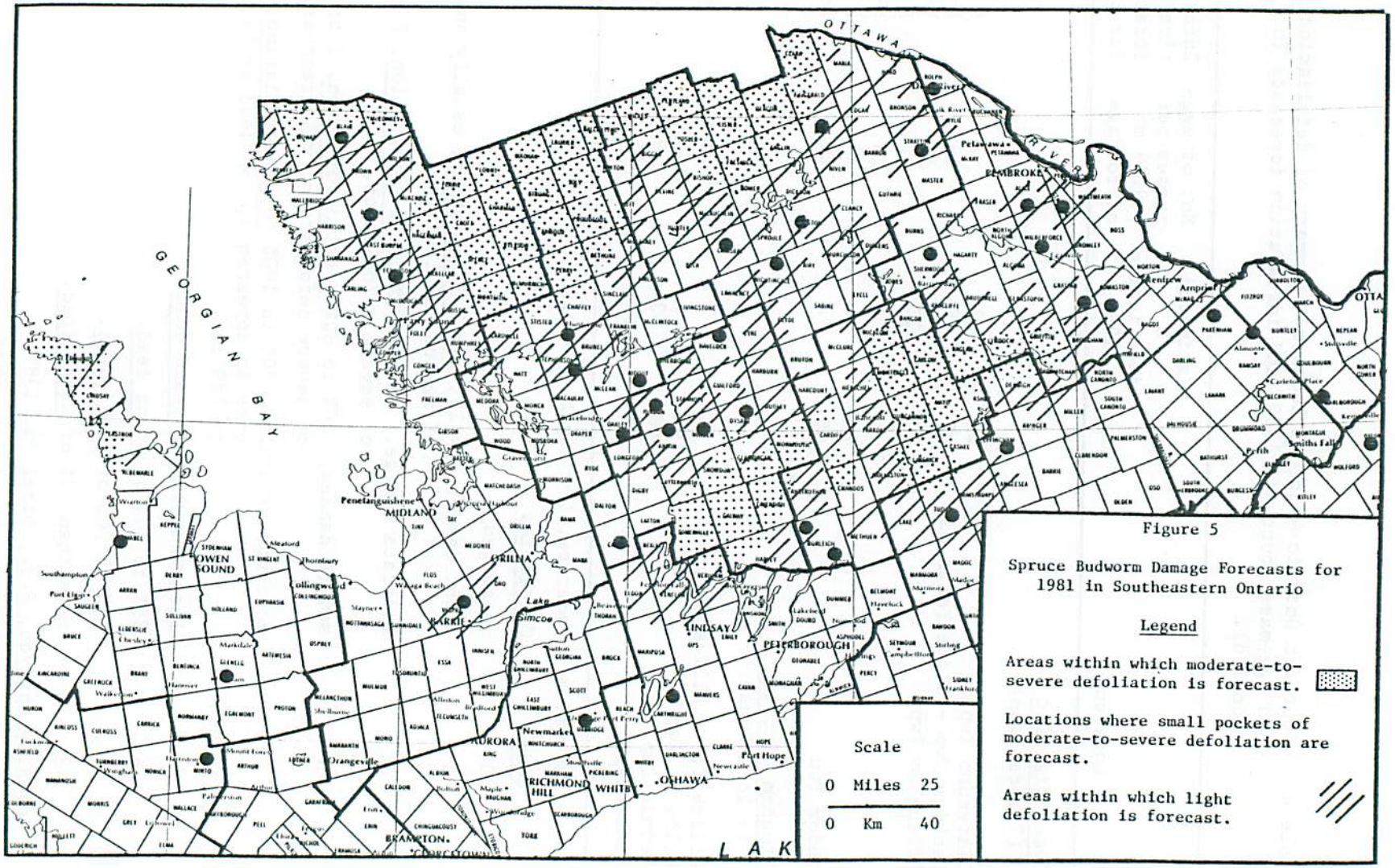
[b]

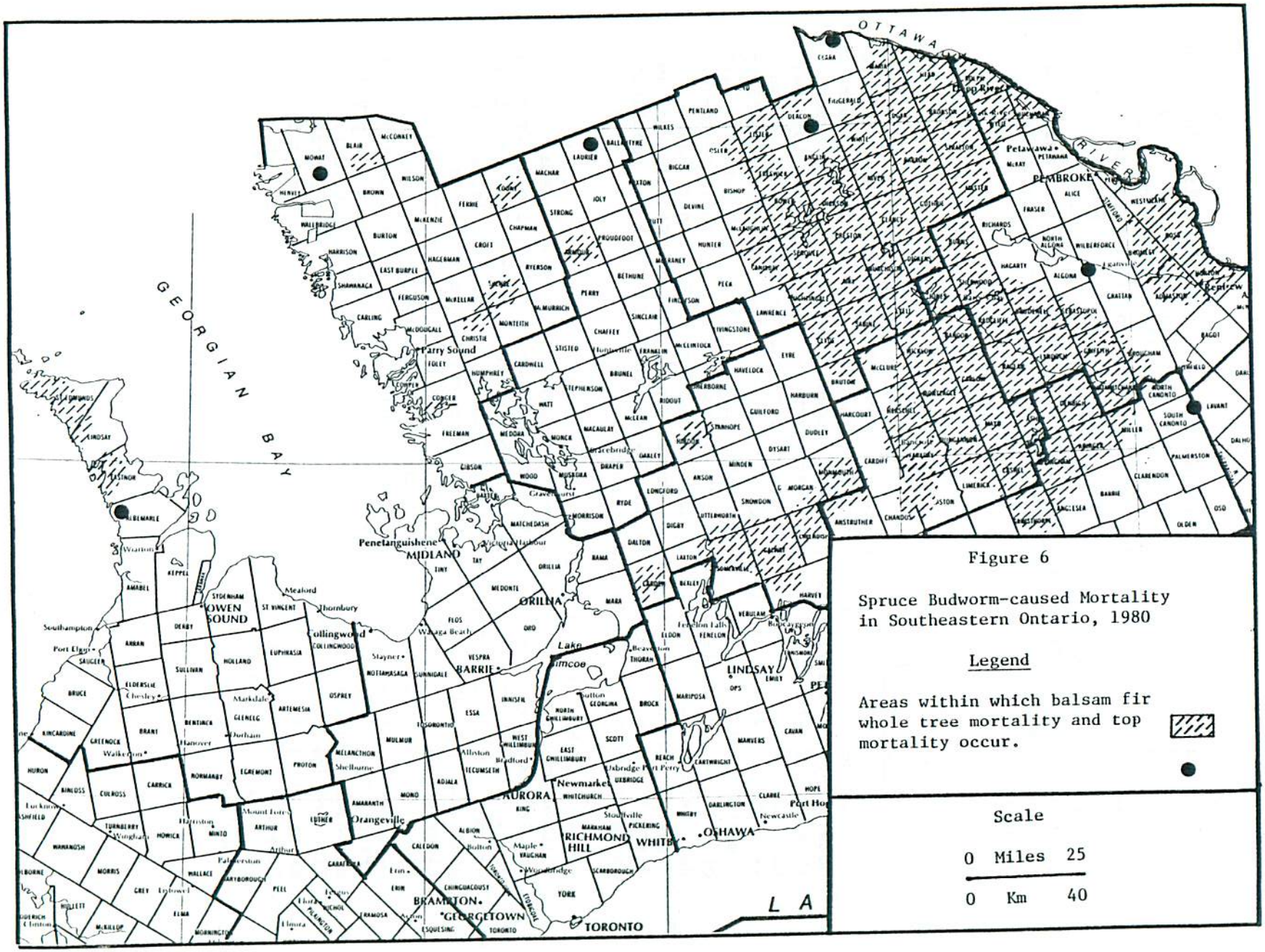
Code	Categories
0	undamaged
1	light damage. < 25% total defoliation, usually one season of severe defoliation.
2	moderate damage. 25% to 60% total defoliation, 2 or 3 seasons of severe defoliation.
3	severe damage. 60% to 80% total defoliation, 3 to 5 seasons of severe defoliation, will recover.
4	moribund 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, 1980

[d] Aerially sprayed, *B.t.*, Thuricide, 1980

* Samples requested by OMNR.


OTTAWA
RIVER
GEORGIAN BAY
PEMBROKE
Renfrew
Arnprior
Penetanguishene
MIDLAND
OWEN SOUND
ORILLIA
BARRIE
Lake Simcoe
LINDSAY
PETERBOROUGH
Newmarket
AURORA
Port Hope
RICHMOND HILL
OSHAWA
BRAMPTON
Scale
0 Miles 25
0 Km 40
Figure 5
Spruce Budworm Damage Forecasts for 1981 in Southeastern Ontario
Legend
Areas within which moderate-to-severe defoliation is forecast.
Locations where small pockets of moderate-to-severe defoliation are forecast.
Areas within which light defoliation is forecast.


OTTAWA
RIVER
GEORGIAN BAY
PEMBROKE
Petawawa
Renfrew
Parry Sound
Penetanguishene
MIDLAND
ORILLIA
Lake Simcoe
BARRIE
OWEN SOUND
Collingwood
Orangeville
LINDSAY
AURORA
Newmarket
RICHMOND HILL
OSHAWA
BRAMPTON
GEORGETOWN
TORONTO
Figure 6
Spruce Budworm-caused Mortality in Southeastern Ontario, 1980
Legend
Areas within which balsam fir whole tree mortality and top mortality occur.
Scale
0 Miles 25
0 Km 40

and Nightingale townships in Algonquin Park District, mortality increased 47% and 39%, respectively. In Mayo Township, Bancroft District and in Armour Township, Bracebridge District mortality increased 66% and 48%, respectively. Other areas showing substantial increases were in Spence Township, Parry Sound District and Ashby Township, Tweed District. A substantial increase in white spruce mortality was observed in Griffith Township, Pembroke District. A summary of all tree mortality data, based on ground checks for the last seven years for southern Ontario, is presented in Table 9.

Northeastern Ontario

Situation in 1980: In northeastern Ontario (Northern and Northeastern regions) the area of budworm infestation changed only slightly from 1979. An increase of about 179 000 ha of moderate-to-severe defoliation was recorded this year (Fig. 7). Much of this increase occurred in the western part of Wawa District in Labonte, Labelle, Goodwill, Peever, Broome and Brimacombe townships, and in Sault Ste. Marie District in Slater, Kincaid, Ryan, Palmer, Nicole and Smilsky townships. A further extension of the infestation into the eastern part of Terrace Bay and Geraldton districts was also noted. Moderate-to-severe defoliation was observed in Rhodes, Botha, Tyrone, Kitchener, Roberts and Creelman townships in Sudbury District. In Blind River District balsam fir was severely defoliated in Mississagi Provincial Park and populations increased in the Rocky Island Lake area.

In the Northern Region a severe frost in early June damaged new foliage on fir and spruce in several districts (Timmins, Gogama, Chapleau and Kapuskasing). Generally, however, budworm mortality due to frost was not as high as expected and moderate-to-severe budworm-caused defoliation was noted throughout the region. In Gogama District, the infestation expanded into McNamara, Cotton, Frechette and Scotia townships. Populations continued to build up in Hearst and Kapuskasing districts and in Moosonee District, where white spruce was defoliated along the Kenogami, Missinaibi, Mattagami, Abitibi, Albany and Moose rivers and many of their tributaries as far north as James Bay. A new infestation was observed on white spruce along the Harricanaw River near the Quebec border. In Kirkland Lake District white spruce was severely defoliated in most areas except those aerially sprayed with insecticides in Elliott Township. Elsewhere in the Northeastern and Northern regions, virtually all of the living susceptible forest is infested and there have been few changes since last year.

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

Location	Host	Tree mortality (%) 1974	1975	1976	1977	1978	1979	1980
Algonquin Park District								
Canisbay Twp - Wildlife Station	bF	25		32	41	44	49	96
	wS							38
- Madawaska River	bF	55						
Clara Twp - E. of Deux Rivieres	bF							60
Clyde Twp - Cauliflower Lake	bF				37	47	53	73
Deacon Twp - Brent Road	bF							50
Nightingale Twp - Rock Lake	bF		49	33	39	47	45	84
	wS							28
Preston Twp - Annie Bay Dam	bF	38		41				95
- 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
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
	wS							8
Faraday Twp	bF		24					
Herschel Twp	bF			21	29	26	29	49
Mayo Twp	bF			14	21	27	34	100
	wS							72
McClure Twp	bF	15		21				
Monteagle Twp	bF	39						
Wicklow Twp	bF		45	49	63	66	69	
	wS						22	

(cont'd)

Table 9. Southern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks for the past seven years (cont'd).

Location	Host	Tree mortality (%) 1974	1975	1976	1977	1978	1979	1980
Bancroft District (cont'd).								
Wicklow Twp								
- Papineau Creek	bF							66
	wS							6
- Ryan Road	bF							92
	wS							44
Bracebridge District								
Armour Twp	bF						32	80
	wS							18
Laurier Twp	bF							82
	wS							8
Lanark District								
Pakenham Twp	wS				0	0	0	0
Minden District								
Carden Twp	bF						10	78
	wS						52	22
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	
Harvey Twp	bF	15			51	63		
Hindon Twp - Anson Creek	bF							44
	wS							16
Monmouth Twp	bF			60	63	74		
	wS					38		
Somerville Twp								
- Victoria Co. Forest	bF	31		37	48	60	78	84
	wS						64	76
Owen Sound District								
St. Edmunds Twp								
- Eagle Hbr. Rd	bF						62	76
	wS						0	0

(cont'd)

Table 9. Southern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks for the past seven years (cont'd).

Location	Host	Tree mortality (%) 1974	1975	1976	1977	1978	1979	1980
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	
Spence Twp								
- Lot 47 Range B	bF					16	62	78
	wS					0	6	20
- Lot 55 Range B	bF					8	44	76
	wS					0	4	14
Pembroke District								
Griffith Twp	bF	34	57		68			100
	wS				39	43	44	76
Matawatchan Twp								
- Camel Chute	bF		38	43	52	57	68	78
	wS		10					12
Sebastopol Twp	bF						16	47
Wylie Twp PNFI	bF		65					98
	wS							32
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
	wS							6
- Hwy 41 2 km N. of Mackavoy Lk	bF							36
	wS							6
Ashby Twp	bF			6	8	5	5	
	bF						49	96
	wS							42
Denbigh Twp								
- Slate Falls Road	bF		18	24	34	38	43	15
- Hwy 41 near Dist. Boundary	bF		5		7	7	5	2

(cont'd)

Table 9. Southern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks for the past seven years (concl'd).

Location	Host	Tree mortality (%) 1974	1975	1976	1977	1978	1979	1980
Tweed District (cont'd)								
Denbigh Twp								
- Hwy 41 near Buckshot Lk. Rd	bF		4		6	8	10	7
- Ashby Lake Rd	bF							12
	wS							0
Effingham Twp	bF			8	8	11	10	11
Wingham District								
Minto Twp - Lot 1 Con VII	wS							0

Infestation Forecasts for 1981: In northeastern Ontario, egg-mass counts were obtained for 304 locations in 1980 (Table 10). Over all, egg-mass counts decreased by about 50% from 1979. Decreases were noted in all districts except Blind River, Moosonee and North Bay. The largest decreases were in Timmins (85%), Kapuskasing (69%), Gogama (68%) and Kirkland Lake (66%).

Although there was an overall decrease in egg masses in 1980, the average count per 9.29 m^2 of foliage is still high in all districts, ranging from 224 in Hearst District to 1377 in Moosonee District. As a result, moderate-to-severe defoliation of fir and spruce is likely throughout most of the Northern and Northeastern regions (Fig. 8).

The overall average egg-mass count in 1980 was 460 per 9.29 m^2 of foliage. High average counts were recorded in Temagami (805/9.29 m^2 of foliage), Moosonee (1377), Wawa (449) and Blind River (556) districts. The highest single egg-mass count, 2813/9.29 m^2, was obtained from a white spruce stand in Gurd Township, North Bay District. The highest egg-mass count on balsam fir was 1830/9.29 m^2 in Mississagi Provincial Park, Blind River District.

Tree Mortality: In northeastern Ontario the area of budworm-caused tree mortality increased from 6 111 000 ha in 1979 to 6 839 000 ha in 1980 (Fig. 9). New areas of tree mortality

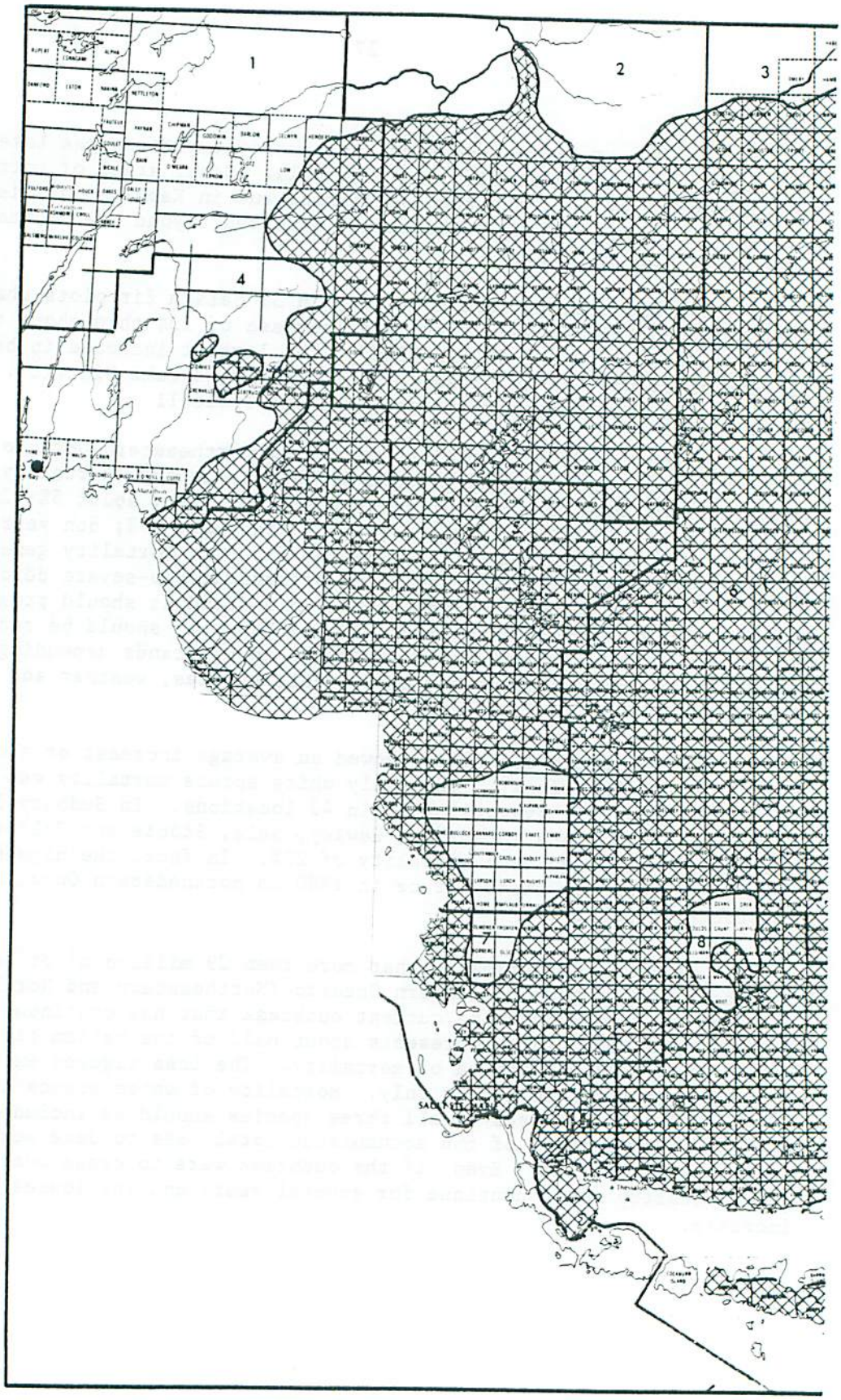
were observed in Cochrane and Kirkland Lake districts in the Lake Abitibi area, and in Wawa, Blind River and Espanola. Other areas of mortality were observed south of the town of Timmins and in Kapuskasing District. A number of small pockets of mortality appeared beyond the boundaries of continuous tree mortality.

A comparison of tree mortality in 53 balsam fir plots checked in both 1979 and 1980 showed an average increase of 13% throughout the region (47% in 1979 and 60% in 1980). The largest increase in balsam fir mortality was 48% in Gross Township, Kirkland Lake District. A summary of tree mortality data is presented in Table 11.

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

White spruce mortality showed an average increase of about 3% over 1979 (10 locations). Generally white spruce mortality was quite low with an overall average of 9% in 42 locations. In Sudbury District a number of new plots in Antrim, Hawley, Sale, Stobie and Telfer townships had an average tree mortality of 22%. In fact, the highest mortality level for white spruce in 1980 in northeastern Ontario was 33% in Stobie Township.

It has been estimated that more than 29 million m^3 of balsam fir have been killed in northeastern Ontario (Northeastern and Northern regions) as a result of the current outbreak that has continued for 14 years (Table 12). This represents about half of the balsam fir volume within the 6.839 million ha of mortality. The loss figures in Table 12 are for balsam fir mortality only. Mortality of white spruce and black spruce and growth losses of all three species should be included. A conservative estimate of the accumulated total loss to date would likely exceed 56 million m^3. Even if the outbreak were to cease overnight, tree mortality would continue for several years and the losses would increase.


1
2
3
4
7
8

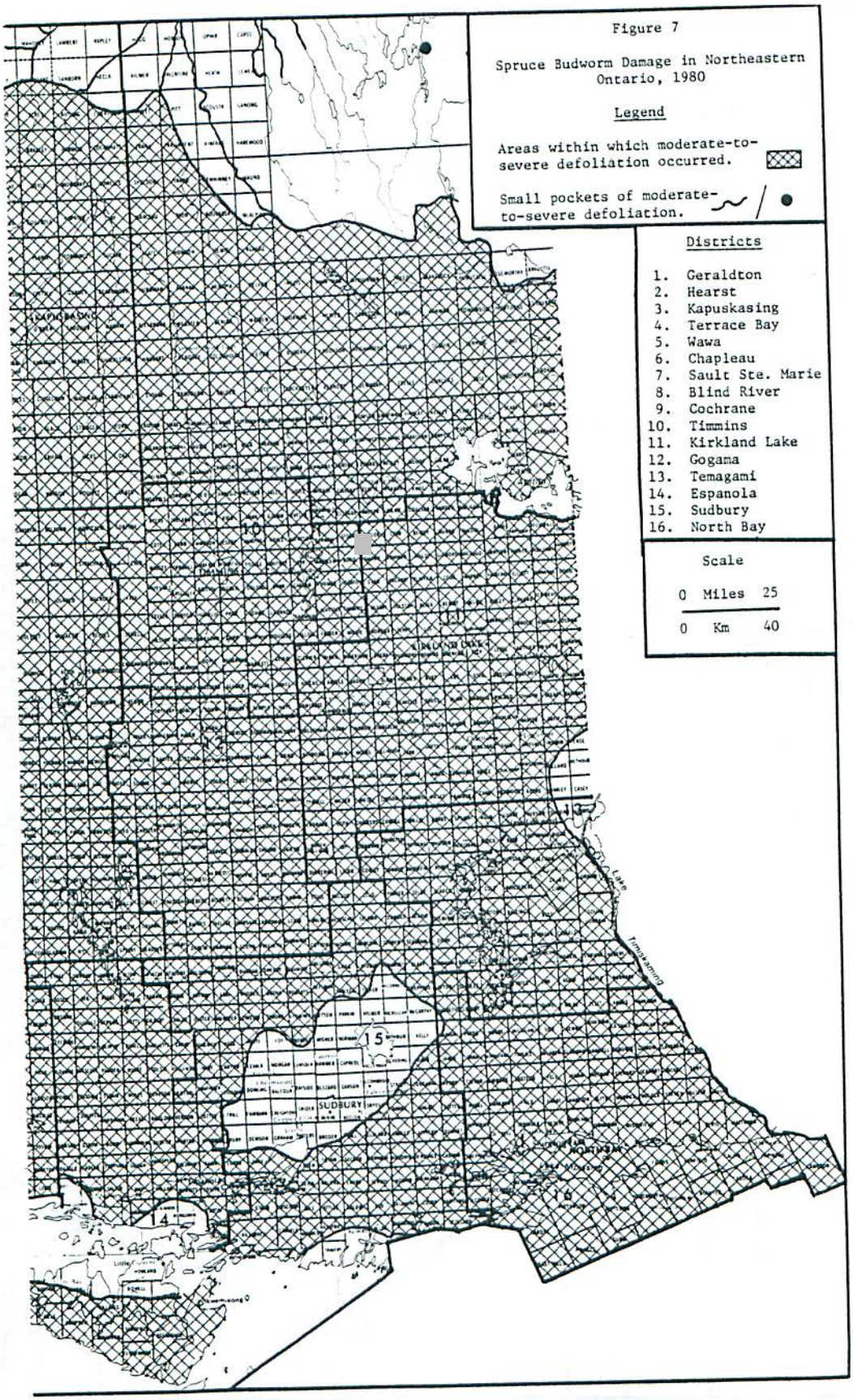


Figure 7
Spruce Budworm Damage in Northeastern Ontario, 1980
Legend
Areas within which moderate-to-severe defoliation occurred.
Small pockets of moderate-to-severe defoliation.
Districts
1. Geraldton
2. Hearst
3. Kapuskasing
4. Terrace Bay
5. Wawa
6. Chapleau
7. Sault Ste. Marie
8. Blind River
9. Cochrane
10. Timmins
11. Kirkland Lake
12. Gogama
13. Temagami
14. Espanola
15. Sudbury
16. North Bay
Scale
0 Miles 25
0 Km 40
SUDBURY
NORTH BAY
Lake Timiskaming

Figure 7. Spruce Budworm Damage in Northeastern Ontario, 1980 (concl'd).

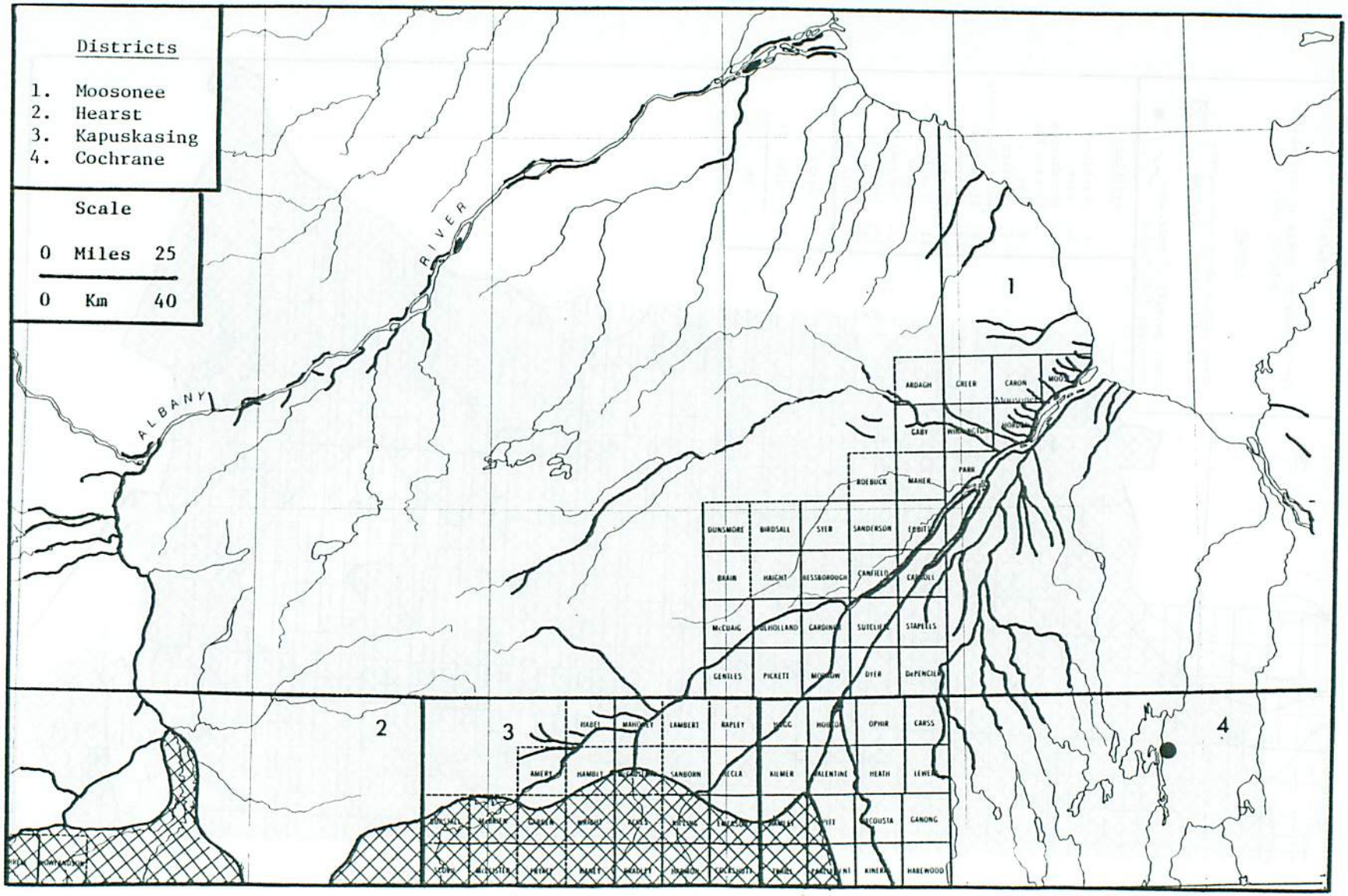


Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981.

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Blind River District (18 locations)					
*Bridgland Twp	wS	78	264	S	0
- Area 2	wS	0	0	0	0
Bright Twp	bF	100	677	S	5
Dagle Twp	bF	100	239	S	4
Esten Twp	wS	75	240	M-S	2
Galbraith Twp	bF	100	405	S	2
*Kirkwood Twp	wS	85	422	S	2
- OMNR Tree Nursery	wS	61	828	S	2
Nicholas Twp	wS	100	310	S	3
*Parkinson Twp	wS	98	770	S	3
*Patton Twp	wS	0	0	0	0
Raimbault Twp - Mississagi Prov. Pk	bF	95	1830	S	4
*Rose Twp - Plantation	wS	83	627	S	2
*Tweedle Twp	wS	3	0	0	0
*Vance Twp	wS	1	9	L	0
*Villeneuve Twp	wS	97	2009	S	7
*Wells Twp	wS	84	1243	S	2
*Yaremko Twp	wS	2	0	0	0
Chapleau District (23 locations)					
Birch Twp - Horton Lake	bF	91	255	M-S	6
Carew Twp	bF	88	39	L-M	4
*Caverley Twp - Plantation[c]	wS	1	0	0	0
- Check Plot	wS	8	24	M	0
*Chapleau Twp - OMNR Tree Nursery[c]	bF	25	78	M	1
- OMNR Tree Nursery (60 seedlings)[c]	wS	0	0	0	0
Denyes Twp - Denyes Lake	bF	100	271	S	6
Genoa Twp - Rush Lake	bF	100	633	S	6
Horwood Twp - Horwood Lake	bF	69	100	M-S	3
*Ivanhoe Twp - Ivanhoe Prov. Pk	bF	100	1123	S	6

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Chapleau District (cont'd) (23 locations)					
*Kirkwall Twp					
- Dunrankin Lake	bF	100	383	S	6
Lincoln Twp - Lincoln Lake	bF	95	621	S	5
*Manning Twp - Plantation[c]	wS	2	3	L	0
- Check Plot	wS	2	0	0	0
Moen Twp	bF	67	43	L-M	7
Montcalm Twp - Elf Lake	bF	100	471	S	6
*Neelands Twp					
- Wakami Prov. Pk	bF	100	630	S	5
Ossin Twp - Komak Lake	bF	100	79	M-S	6
*Peters Twp					
- Shoals Prov. Pk	bF	92	319	S	6
*Reaney Twp					
- Five Mile Prov. Pk	bF	90	941	S	5
*Reeves Twp					
- OMNR Tree Seed Production Area[c]	wS	76	260	S	3
- Check Plot	wS	84	921	S	3
Sandy Twp	bF	95	162	M-S	6
Cochrane District (20 locations)					
Adanac Twp - km 37	bF	95	256	S	2
†Aurora Twp - Stand 8	bF	99	373	S	3
Blakelock Twp - Mikiwan Lake	bF	66	110	M-S	3
Bonis Twp	bF	83	134	M-S	5
*Colquhoun Twp					
- Greenwater Prov. Pk	wS	81	734	S	2
	wS	92	391	S	2
*Clute Twp					
- OMNR Tree Seed Production Area #3202[c]	wS	84	926	S	2
- OMNR Tree Seed Production Area #3201[c]	wS	34	433	S	2

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Cochrane District (cont'd) (20 locations)					
*Fournier Twp - OMNR Tree Seed Production Area #3220[c]	wS	6	375	S	2
Kesagami Lake	bF	85	63	M	2
Lake Abitibi - NE of Rabbit Creek	bF	76	196	M-S	5
Lake Abitibi (south)	bF	97	125	M-S	5
Moody Twp - Bingle Area	bF	83	512	S	5
Nesbitt Twp	bF	44	57	M	2
†Ottaway Twp - Stand 38	wS	69	86	M-S	2
*Ottaway - OMNR Tree Seed Production Area	bS	15	148	M-S	4
Pinard Twp - Abitibi Canyon	bF	48	427	S	2
Sargeant Twp	bF	86	160	M-S	3
†St. John Twp - Stand 177	bF	72	155	M-S	3
*Swartman Twp - Pierre Lake	wS	99	1059	S	3
Espanola District (11 locations)					
Allan Twp	wS	83	377	S	1
Boon Twp	wS	76	403	S	1
Burpee Twp	bF	63	58	M	5
*Curtin Twp - OMNR Tree Seed Production Area	wS	64	354	S	1
Dawson Twp	wS	15	239	M-S	1
- 10 seedlings	wS	0	0	0	-
Foster Twp	wS	2	14	L	1
*Nairn Twp - OMNR Tree Seed Production Area	wS	63	343	M-S	1
Oshell Twp	bF	98	220	S	2
Robinson Twp - Deer Yard	bF	99	185	M-S	6
Tehkummah Twp	bF	24	209	S	0

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Gogama District (12 locations)					
*Carter Twp - Check Plot	wS	61	1404	S	3
- OMNR Tree Seed Production Area[d]	wS	54	541	S	3
Dublin Twp	bF	46	38	L-M	5
Fawcett Twp	bF	100	158	M-S	6
	wS	100	1556	S	3
Garvey Twp - Westree	bF	68	104	M-S	6
Halliday Twp - Relic Lake	bF	100	956	S	6
*Invergarry Twp - Check Plot	wS	86	881	S	3
- OMNR Tree Seed Production Area[d]	wS	48	295	S	3
*Jack Twp - Check Plot	wS	67	836	S	3
- OMNR Tree Seed Production Area[d]	wS	89	606	S	3
Kelvin Twp	bF	92	180	S	3
Hearst District (66 locations)					
*Arnott Twp					
- .8 km S of East Arnott Rd	wS	93	915	S	3
- 1.6 km N of West Arnott Rd	wS	86	703	S	3
- OMNR Tree Seed Production Area[c]	wS	60	788	S	3
- OMNR Seed Tree Area E side of Twp[c]	wS	25	177	M-S	3
- OMNR Seed Tree Area W side of Twp[c]	wS	35	27	L-M	3
‡Bayfield Twp - Stand 11	wS	98	426	S	4
†Chelsea Twp - Stand 169	bF	94	332	S	3
- Stand 332	bF	93	359	S	3
- Stand 7	bF	70	250	S	3
†Cholette Twp - Stand 4	wS	30	215	M-S	2
- Stand 4	bF	58	127	M-S	2
- Stand 19	bF	97	319	S	3
- Stand 56	bF	75	172	S	3

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Hearst District (cont'd) (66 locations)					
†Cholette Twp (cont'd)					
- Stand 98	bF	83	158	M-S	3
- Stand 172	wS	93	457	S	3
- Stand 172	bF	99	364	S	3
- Stand 215	bF	65	183	S	2
- Stand 334	bF	77	366	S	3
- Stand 313	bF	95	238	S	3
†Drew Twp - Stand 192	bF	68	260	S	3
*Eilber Twp - Plantation	bS	58	610	S	3
†Ermine Twp - Stand 350	wS	97	712	S	3
- Stand 350	bF	99	218	M-S	3
- Stand 48	bF	94	213	S	3
†Foch Twp - Stand 414	bF	96	542	S	3
Franz Twp	bF	93	209	M-S	5
*Frost Twp					
- 1.8 km N or Nagagamisis River Bridge	wS	92	345	S	3
- 4.8 km N of Nagagamisis River Bridge	wS	78	513	S	3
- Nagagamisis Lake Boat Launch	wS	88	511	S	2
*Fushimi Twp					
- Fushimi Prov. Pk	wS	98	545	S	3
- Fushimi Prov. Pk	bF	99	376	S	3
*Hanlan Twp					
- OMNR Tree Seed Production Area[c]	wS	32	686	S	2
†Irving Twp - Stand 197	bF	98	364	S	3
Kabinakagami River	wS	96	385	S	2
Kohler Twp	bF	30	36	L-M	2
*Larkin Twp					
- OMNR Seed Tree Area E of Hwy 631[c]	wS	86	409	S	3
- OMNR Seed Tree Area W of Hwy 631[c]	wS	41	64	M-S	3

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Hearst District (cont'd) (66 locations)					
†Lessard Twp - Stand 12	bF	92	498	S	4
- Stand 229	wS	97	287	S	3
†Lizar Twp - Stand 316	bF	99	229	M-S	3
- Stand 238	wS	99	677	S	3
*McEwing Twp					
- 8.8 km N of Nagagamisis River Bridge	wS	90	523	S	3
- 10.1 km N of Nagagamisis River Bridge	wS	93	632	S	3
- Nagagamisis Prov. Pk Time Trail	wS	99	400	S	2
- Nagagamisis Prov. Pk SE shore	wS	93	607	S	2
- Nagagamisis Prov. Pk S shore central	wS	92	2154	S	2
- Nagagamisis Prov. Pk NE shore	wS	94	328	S	2
- Nagagamisis Prov. Pk W of McEwing Creek	wS	92	1097	S	3
Minnipuka Twp - Goat Lake	wS	98	12	L	8
Mulvey Twp	bF	38	400	S	2
*Rogers Twp					
- Plantation 30 (63)	wS	37	150	M-S	2
- Plantation 31 (63)	wS	68	222	M-S	2
- Plantation 43 (66)	wS	29	251	S	2
- Plantation 26 (63)	wS	42	37	L-M	1
Staunton Twp	bF	23	182	M-S	3
*Stoddart Twp	bS	17	37	L-M	1
*Studholme Twp					
- Treatment Plot (Residual mature)[c]	wS	10	113	M-S	2
- Treatment Plot (Plantation)[c] 10 whole trees	wS	1	0	0	0
- Check Plot (Residual mature)	wS	65	384	S	3

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Hearst District (cont'd) (66 locations)					
*Studholme Twp (cont'd)					
- Check Plot (Plantation) 10 whole trees	wS	2	0	0	0
- Abram Lake (Residual mature)	wS	53	244	M-S	3
- Abram Lake (Plantation) 37 (69)	wS	6	109	M-S	1
- Abram Lake (Plantation) 37 (69)	bS	0	0	0	0
- Abram Lake (Plantation) 24 (63)	wS	6	63	M	1
†Wicksteed Twp - Stand 75	bF	97	299	S	4
Wicksteed Twp - .8 km S of Hornepayne	bF	90	103	M-S	2
Kapuskasing District (31 locations)					
Cumming Twp	wS	95	1722	S	3
	bS	27	424	S	2
*Fauquier Twp (Bonner Tree Improvement Centre)					
- Picnic Area (Check Plot)	wS	64	432	S	3
- Snow Machine Trail (Check Plot)	bS	7	146	M-S	1
- Compartment 6B[e]	wS	15	49	L-M	1
- Compartment 10B (Check Plot)	wS	60	345	S	2
- Compartment 14A (Check Plot)	wS	66	536	S	2
- Compartment 15A (Check Plot)	bS	31	306	S	2
- Compartment 16A[f]	wS	22	157	M-S	2
- Compartment 16E[f]	bS	15	49	L-M	1

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981.(cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Kapuskasing District (cont'd) (31 locations)					
*Fauquier Twp (Bonner Tree Improvement Centre)[f] (cont'd)					
- Compartment 17A[f]	bS	1	0	0	1
- Compartment 19C[e]	wS	6	102	M-S	1
	bS	6	30	L-M	1
- Compartment 21B[e]	bS	12	178	M-S	1
- Compartment 21D[e]	wS	9	64	M	1
	bS	5	137	M-S	1
- Compartment 22A[e]	wS	18	458	S	1
- Compartment 22B[f]	bS	2	119	M-S	1
- Compartment 22C[f]	wS	13	25	L-M	1
- Compartment 23B[e]	wS	2	208	S	1
- Compartment 26D[f]	wS	2	612	S	2
- Compartment 26B[f]	bS	2	56	M	1
*Fauquier Twp					
- Plantation 19 (65)[d]	wS	10	198	S	2
- Remi Lake Prov. Pk	bF	98	324	S	3
Fenton Twp					
- km 37, Chain-of-Lakes Rd	bF	93	269	S	3
* Idington Twp					
- Plantation 07 (65)[d]	wS	5	101	M-S	1
	bS	1	37	L-M	1
- Plantation 05 (64)	bS	5	361	S	1
Kipling Twp - Kipling Dam	bF	96	389	S	2
Lisgar Twp					
- km 66, Chain-of-Lakes Rd	bF	99	660	S	4
	wS	80	84	M-S	4
Kirkland Lake District (48 locations)					
Alma Twp	bF	90	88	M-S	4
Bowman Twp	bF	26	27	L-M	3
*Burt Twp					
- OMNR Tree Nursery[g]	wS	22	483	S	3
- OMNR Tree Seed Production Area[c]	wS	8	373	S	3

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Kirkland Lake District (cont'd) (48 locations)					
Chown Twp	bF	95	67	M-S	4
*Elliott-Lamplugh Twp Area					
- Elliott, Plot 1[h]	wS	63	371	S	3
	bF	32	104	M-S	3
- Plot 3[i]	wS	88	476	S	3
	bF	17	216	S	3
- Plot 4[j]	wS	35	371	S	3
	bF	20	78	M-S	3
- Plot 5[h]	wS	45	402	S	3
	bF	18	159	M-S	3
- Plot 6[j]	wS	26	394	S	3
	bF	77	120	M-S	3
- Plot 7[h]	wS	52	344	S	3
	bF	10	134	M-S	3
- Plot 9[i]	wS	42	129	M-S	3
	bF	53	212	S	3
- Plot 10[k]	wS	31	236	S	3
	bF	16	97	M-S	3
- Plot 11[i]	wS	25	755	S	3
	bF	13	32	L-M	3
- Plot 12	wS	18	198	M-S	3
	bF	45	160	M-S	3
- Plot C[l] (Experimental)	wS	43	275	S	3
	bF	55	112	M-S	3
- Plot D[l] (Experimental)	wS	50	710	S	3
	bF	25	129	M-S	3
- Plot E[m] (Experimental)	wS	73	184	M-S	3
	bF	30	103	M-S	3
- Plot F (Dickson Check)	wS	80	218	S	3
	bF	84	217	S	3
- Plot G[n] (Experimental)	wS	79	304	S	3
	bF	60	410	S	3
- Harker Twp (Check Plot)	wS	89	668	S	4
	bF	92	202	S	4
- Lamplugh Twp	wS	70	367	S	4
	bF	99	713	S	4

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Kirkland Lake District (cont'd) (48 locations)					
*Elliott-Lamplugh Twp Area (cont'd)					
- Lamplugh Twp (Check Plot)	wS	92	619	S	4
	bF	99	264	S	4
Hearst Twp	bF	82	236	S	5
Katrine Twp	bF	94	129	M-S	5
Maisonville Twp	bF	99	586	S	4
Mulligan Twp	bF	95	472	S	4
Pacaud Twp	bF	96	753	S	4
Truax Twp	bF	89	86	M-S	4
Yarrow Twp	bF	84	124	M-S	4
Moosonee District (4 locations)					
Albany River - Anderson Island	wS	25	17	L-M	2
Albany Forks	wS	64	150	M-S	3
Ghost River - Cheepay Island	wS	88	2603	S	2
Moosonee	wS	6	54	M	2
North Bay District (11 locations)					
*Cameron Twp	bF	95	215	M-S	6
*Gurd Twp	wS	87	2813	S	1
*Jocko Twp	bF	95	139	M-S	5
*Latchford Twp - Plantation	wS	0	0	0	0
*Mattawan Twp	bF	95	215	M-S	2
*McNish Twp - Plantation	wS	0	0	0	0
Notman Twp	bF	83	171	M-S	5
*Patterson Twp - Restoule Prov. Pk	bF	90	13	L	1
Phelps Twp	bF	68	28	L-M	1
*Sisk Twp - Martin River Prov. Pk	bF	95	189	M-S	5
*South Himsworth Twp - Freeman Chute	bF	95	970	S	2

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Sault Ste. Marie District (9 locations)					
Butcher Twp	bF	100	143	M-S	7
Gapp Twp - Ragged Lake	wS	100	500	S	2
*Gaudette Twp - Abitibi Plantation (Tree Seed Orchard)	wS	92	315	S	1
Haviland Twp	bF	58	316	S	1
Herrick Twp - Pancake Prov. Pk	bF	99	383	S	1
Jollineau Twp	bF	100	173	M-S	6
McIlveen Twp	wS	85	1029	S	6
Tarbutt Additional Twp	bF	99	1333	S	5
Vibert Twp - Wart Lake	bF	46	76	M-S	3
Sudbury District (5 locations)					
Antrim Twp - Halfway Lake Prov. Pk	wS	95	516	S	3
Dowling Twp	bF	47	56	M	0
Dunnett Twp	bF	93	146	M-S	1
Hawley Twp	wS	31	523	S	1
Parkin Twp	wS	72	564	S	1
Temagami District (12 locations)					
Askin Twp	bF	100	395	S	4
Aston Twp	wS	97	901	S	3
Barr Twp	wS	95	2633	S	4
Cynthia Twp	wS	98	1727	S	3
Eldridge Twp	wS	92	453	S	4
Gillies Limit Twp	bF	99	438	S	5
Hartle Twp	wS	95	2567	S	5
Riddell Twp	bF	80	255	S	4

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

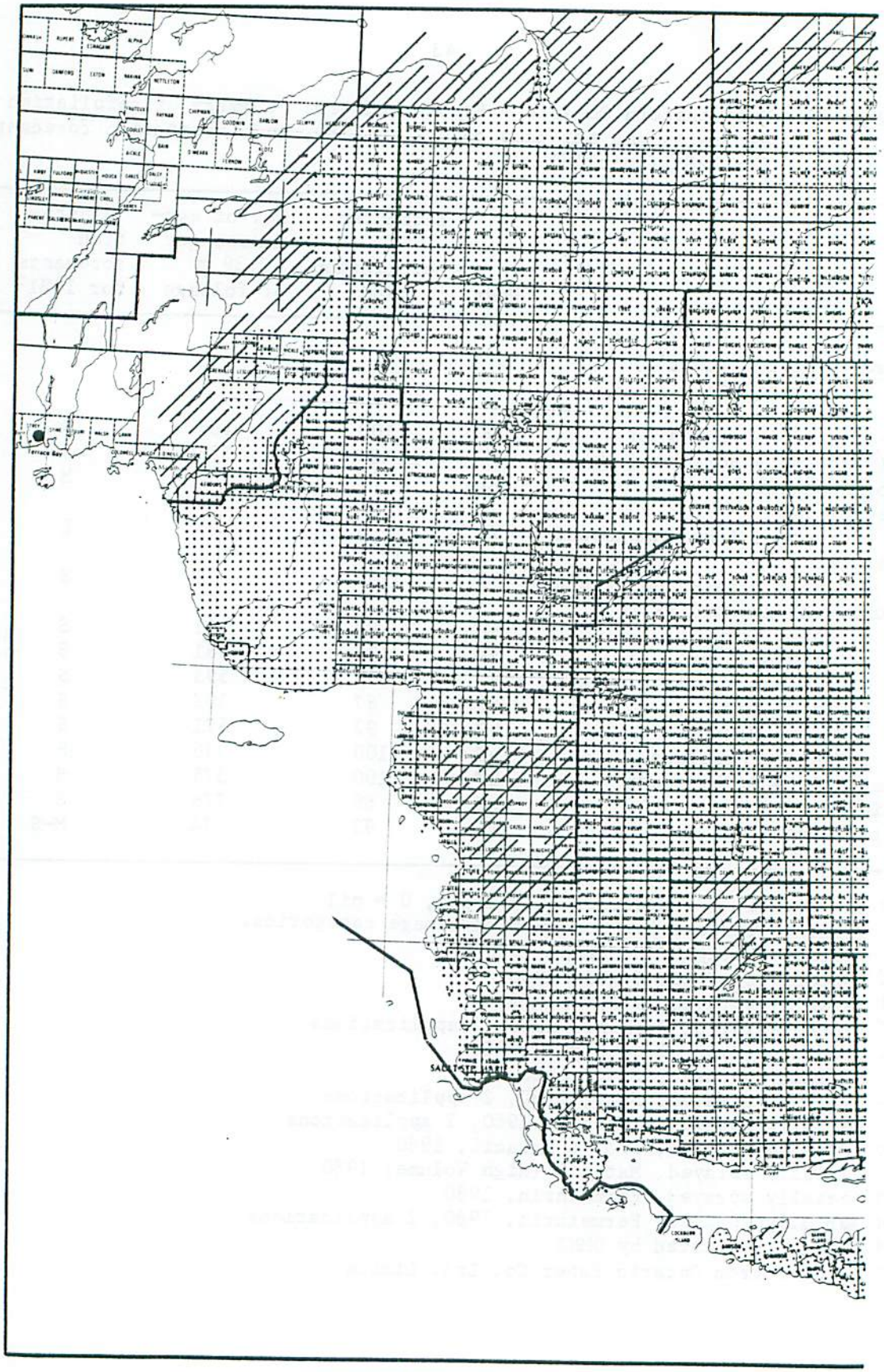
Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Temagami District (cont'd) (12 locations)					
*South Lorrain Twp	wS	95	452	S	3
	bF	95	288	M-S	3
- OMNR Tree Seed Production Area	wS	95	981	S	3
Strathy Twp	bF	96	400	S	4
Timmins District (7 locations)					
Carnegie Twp	bF	50	17	L	3
Evelyn Twp	bF	93	484	S	3
Godfrey Twp	bF	100	299	S	3
Hassard Twp	bF	96	119	M-S	4
Keefer Twp	bF	97	287	S	3
*Loveland Twp	wS	89	1123	S	3
	bF	100	583	S	3
Wawa District (27 locations)					
Abraham Twp	bF	88	233	M-S	2
Asselin Twp	bF	45	386	S	2
Bailloquet Twp - Black Trout Lake	bF	86	443	S	2
*Bryant Twp - OMNR Tree Seed Production Area	bS	10	167	M-S	1
Challener Twp	bF	100	198	M-S	5
Cudney Twp - Esnagi Lake	bF	99	116	M-S	5
Dahl Twp - Obatanga Prov. Pk	bF	100	435	S	3
Debassige Twp	wS	98	504	S	6
Dumas Twp	bS	24	149	M-S	1
Dunphy Twp	bF	100	177	M-S	2
Huotari Twp	wS	100	1791	S	2
Hydro Rd - Umbata Falls	bF	100	819	S	4
Labelle Twp - Agawa Prov. Pk	wS	80	121	M-S	0

(cont'd)

Table 10. Northeastern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (concl'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Wawa District (cont'd) (27 locations)					
McCron Twp - Access Rd	bF	100	465	S	3
*Mikano Twp - Horsehead Lk	wS	16	556	S	1
Noganosh Twp	wS	97	70	M	5
Peever Twp - Crescent Lake Campground	bF	5	7	L	0
Peterson Twp - Rabbit Blanket Campground	bF	100	273	S	2
Pukaskwa National Pk - Bonami Cove	bF	88	463	S	3
- Cascade River	bF	100	381	S	4
- Oiseau Bay - 11.2 km east	bF	100	593	S	3
- Oiseau Bay	bF	67	362	S	3
- Simons Harbour	bF	92	571	S	3
- Tip Top Mountain	bF	100	736	S	3
Regan Rd - 14 km south	bF	100	375	S	3
Simpson Twp	wS	86	776	S	5
Strickland Twp	wS	92	74	M-S	3

[a] S = severe, M = moderate, L = light, 0 = nil
[b] Refer to Table 8 for accumulated damage categories.
[c] Aerially sprayed, Orthene, 1980
[d] Aerially sprayed, Cygon, 1980
[e] Aerially sprayed, Virus, 1979
[f] Ground sprayed, Orthene, 1980, 2 applications
[g] Ground sprayed, *B.t.* Dipel, 1980
[h] Aerially sprayed, *B.t.*, 1980
[i] Aerially sprayed, *B.t.*, 1980, 2 applications
[j] Aerially sprayed, Matacil, 1980, 2 applications
[k] Aerially sprayed, *B.t.* & Matacil, 1980
[l] Aerially sprayed, Matacil (High Volume) 1980
[m] Aerially sprayed, Permethrin, 1980
[n] Aerially sprayed, Permethrin, 1980, 2 applications
* Samples requested by OMNR
† Samples from Ontario Paper Co. Ltd. Limits


Prince Rupert
Kitimat
Terrace
Smithers
Houston
Burns Lake
Vanderhoof
Fort St. James
Fort St. John
Dawson Creek
Chetwynd
Hudson Hope
Mackenzie
Prince George
Quesnel
Williams Lake
100 Mile House
Clinton
Lillooet
Ashcroft
Cache Creek
Kamloops
Salmon Arm
Revelstoke
Golden
Invermere
Cranbrook
Kimberley
Fernie
Creston
Nelson
Castlegar
Trail
Grand Forks
Greenwood
Penticton
Oliver
Osoyoos
Princeton
Hope
Chilliwack
Abbotsford
Mission
Langley
Surrey
Delta
Richmond
Vancouver
New Westminster
Burnaby
North Vancouver
West Vancouver
Port Moody
Coquitlam
Port Coquitlam
Pitt Meadows
Maple Ridge
Sechelt
Gibsons
Powell River
Campbell River
Courtenay
Comox
Port Alberni
Nanaimo
Ladysmith
Duncan
Cowichan Lake
Victoria
Sooke
Saanich
Sidney
Gulf Islands
Queen Charlotte Islands
Haida Gwaii

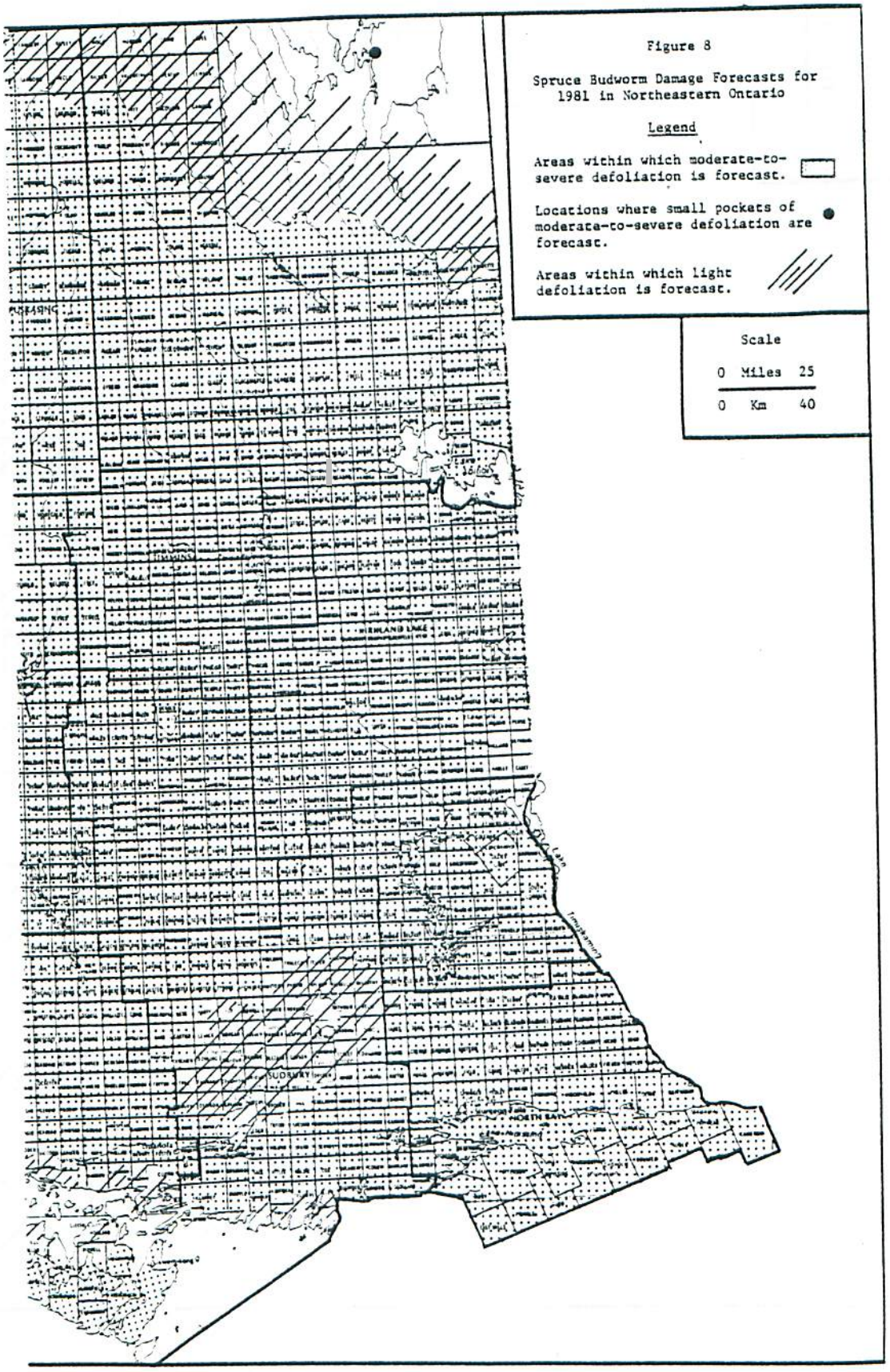


Figure 8
Spruce Budworm Damage Forecasts for 1981 in Northeastern Ontario
Legend
Areas within which moderate-to-severe defoliation is forecast.
Locations where small pockets of moderate-to-severe defoliation are forecast.
Areas within which light defoliation is forecast.
Scale
0 Miles 25
0 Km 40
HEMLAND LAKE
SUDBURY
NORTH BAY

Figure 8. Spruce Budworm Damage Forecasts for 1981 in Northeastern Ontario (concl'd).

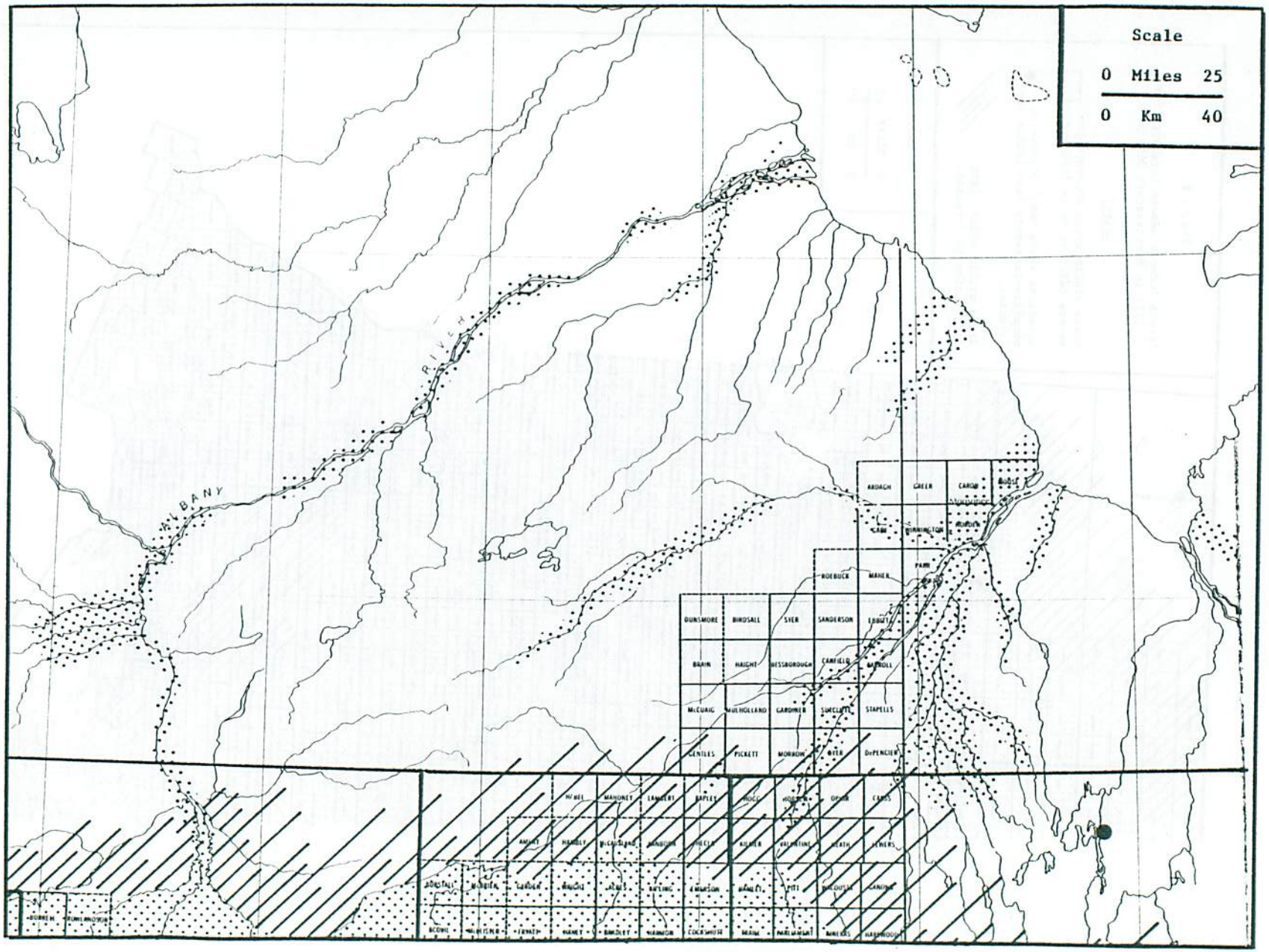


Table 11. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks over the past six years.

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980
Blind River District							
McNie Twp	bF	4		49	66	94	
Nicholas Twp	bF					23	40
	wS					0	0
Renwick Twp	bF	26	68	77	85	97	
	bF	15	24	55	63	77	72
	bF	2	47	56	43	70	87
Sturgeon Twp	bF	1	6	10	29	56	81
	wS					0	2
Timbrell Twp	bF	16	55	61	88	91	
Villeneuve Twp	bF	3	10	11	34	69	84
	wS					0	6
Chapleau District							
Abney Twp	bF					12	
	wS					0	
Birch Twp	bF			20	29	37	46
	wS				0	0	0
Bliss Twp	bF	14	30	51	55		61
	wS				0		0
Bonar Twp	bF		25		68		
Bordeleau Twp - Gale Lake	bF	64		70			90
Borden Twp - Westover Lake	bF	19	20				72
Borden Twp	bF	55	73	85	87	90	
	wS			12	18	22	32
	wS				9	17	
Bounsall Twp	bF				41	68	
Brackin Twp	bF			61			
Brutus Twp	bF		13		19	72	
Buckland Twp - Addison Lake	bF		74				
Caouette Twp	bF	27	39		62		71
Chewett Twp - Hwy 101	bF	10	15		37	69	72
- Cedric Lake Rd	bF	0		12		39	
Cochrane Twp - Kanipahow Rd	bF	28	32			62	
	wS						6
- Hwy 101	bF	52		62			
Cosens Twp	bF	2	10		23		38
Dalmas Twp	bF	32		72	83	84	90
	wS	2		28	28	29	30
Dupuis Twp	bF	56	71	75	78	93	

(cont'd)

Table 11. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks over the past six years. (cont'd).

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980
Chapleau District (cont'd)							
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
	wS						2
Gilliland Twp	bF	21	33		40	63	68
	wS				11	12	12
Green Twp	bF	8	10		15	37	58
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
	wS						12
Ivanhoe Twp - Ivanhoe Park	bF				30	54	69
	wS					23	29
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
	wS						2
Marshall Twp	bF	23				93	
Muskego Twp	bF				33		78
Nimitz Twp	bF						14
	wS						4
Pattinson Twp	bF	9		34		72	94
Reaney Twp	bF	10		22		35	58
	bF	22					43
Sadler Twp	bF	21		42		87	93
Sandy Twp	bF						69
	wS						14
Windego Twp	bF		66		68	78	

(cont'd)

Table 11. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks over the past six years (cont'd).

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980
Cochrane District							
Abitibi Lake - north	bF					0	0
- south	bF					8	7
Bonis Twp	bF					0	3
Haggart Twp	bF						0
Moody Twp	bF					0	2
Nesbitt Twp	bF					0	0
	wS						0
Stimson Twp	bF						8
Espanola District							
Allan Twp	bF						6
	wS						2
Gaiashk Twp	bF						11
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
- Wood Carrol Bay Road	bF						42
Salter Twp	bF						15
Teasdale Twp	bF						12
Gogama District							
Asquith Twp	bF		39	86	88	94	
	bF				18	47	50
Chester Twp	bF					12	16
Dublin Twp	bF					13	17
Fawcett Twp	bF				10		39
Garibaldi Twp	bF				99		
	bF				31	43	49
Gouin Twp	bF					14	19
Hazen Twp	bF			36	38	58	69
Invergarry Twp	bF						16
	wS						2
Kelvin Twp	bF				6	23	38
Macmurchy Twp	bF			15	27	76	89
Marshay Twp	bF	39					

(cont'd)

Table 11. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks over the past six years (cont'd).

Location	Host	Tree mortality (%)					
		1975	1976	1977	1978	1979	1980
Gogama District (cont'd)							
Miramichi Twp	bF		70	100			
	bF				87		
Ogilvie Twp	bF			4	20		
Onaping Twp	bF	77					
Paudash Twp	bF					21	33
St. Louis Twp	bF				20	40	48
Valin Twp - Welcome Lake	bF			75			
Hearst District							
Cholette Twp	bF				0	0	
	wS						0
Franz Twp	bF					14	6
	wS						0
Hook Twp	bF				34		
Minnipuka Twp	bF				16		
	wS				4		
	bF				37	87	95
	wS				14	40	
	wS						7
Staunton Twp	bF					0	0
Kapuskasing District							
Abbott Twp - Brunswick Lake	bF				71	96	
	wS					22	
- Main Road	bF						94
Cromlech Twp	bF		14		0		
Cummings Twp	bF					2	0
	wS						0
Fauquier Twp	bF					2	7
Fenton Twp	bF					0	0
Lisgar Twp	bF					4	21
Machin Twp	bF						2
Mons Twp	bF				61		
	wS				36		
Opasatika Twp - Opasatika Lake	bF		2		0	2	
- Rufus Lake	bF						6
Shanley Twp	bF					3	4
Slack Twp	bF						0
Stringer Twp	bF					0	0
	wS						0

(cont'd)

Table 11. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks over the past six years (cont'd).

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980
Kirkland Lake District							
Alma Twp	bF			46	78	86	96
Charters Twp - Montreal R.	bF	14	44	53	64		
Chown Twp	bF		3	8	17	23	26
Doon Twp	bF			75	92		
Dufferin Twp - McKee Lake	bF			83	87		
Elliott Twp - Dickson Check	bF						4
- Plot C & D	bF						9
- Plot E	bF						8
- Plot G	bF						17
- Plot 1	bF						21
- Plot 3	bF						0
- Plot 4	bF						4
- Plot 5	bF						5
- Plot 6	bF						8
- Plot 7	bF						16
- Plot 9	bF						16
- Plot 11	bF						16
- Plot 11	wS						0
- Plot 12	bF						14
Garrison Twp	bF						24
	wS						1
Gauthier Twp	bF			13	17	35	58
Gross Twp	bF		7	10	24	45	93
Harker Twp	bF						21
	bS						1
Hearst Twp	bF			4	25	71	97
Hincks Twp	bF			53			
James Twp	bF			18	32	58	79
McFadden Twp	bF			16	20	49	54
McNeil Twp	bF				11		
Milner Twp	bF	4					
Truax Twp	bF		36	46	87	87	
Van Hise Twp	bF		51	62	95	95	
Yarrow Twp - Mistinikon Lake	bF		75				
Yarrow Twp	bF			70	91		
North Bay District							
Bastedo Twp	bF					2	
Cameron Twp	bF					11	

(cont'd)

Table 11. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks over the past six years (cont'd).

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980
North Bay District (cont'd)							
Clarkson Twp	bF						28
	wS						7
French Twp	bF						8
Jocko Twp	bF						23
	bS						10
Kirkpatrick Twp	bF						12
	wS						0
Lyman Twp	bF					9	
Mattawan Twp	bF						54
	wS						12
McLaren Twp	bF					8	
McNish Twp	bF						39
	wS						8
Nipissing Twp	bF						3
Pedley Twp	bF					8	
Sisk Twp	bF					29	
Thistle Twp	bF					40	
Sault Ste. Marie District							
Bracci Twp - North Chubb Lake	bF	13		68		79	
Butcher Twp - Goulais Lake	bF	22		70			
Hoffman Twp	bF	6		43			
Jollineau Twp	bF						2
	wS						0
Pine Twp							
- (km 34.6 Aubinadong Road)	bF	7	22	42	49	74	69
	bS						8
- (km 31.1 Aubinadong Road)	bF	9	27	52	59	80	92
	wS						20
	bS						16
Smilsky Twp	bF	44	93	100			
Snow Twp	bF					19	25
	wS						0
Wlasy Twp - Dyson Lake	bF	29		66		73	
Sudbury District							
Antrim Twp - Halfway Lake	bF	62	86	94	97		
	wS	0	0	8			

(cont'd)

Table 11. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks over the past six years (cont'd).

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980
Sudbury District (cont'd)							
Antrim Twp							
- Halfway Lake Prov. Pk.	bF						66
	wS						20
Beaumont Twp - Graveyard Lake	bF	89		87		74	
- Helen Lake	bF	81		62			
Botha Twp - Rome Lake Road	bF	82		94			
- near Morin Lake	bF	65		82		96	
Cascaden Twp - Cascaden Rd	bF						37
- Ministic Lake Rd	bF						24
Dunbar Twp - Scotia Lake	bF	93		88	81	96	
Ellis Twp - Scarecrow Lake	bF			40	35	41	
Emo Twp - Onaping Lake	bF	54		69	91	90	
Fairbairn Twp - Onaping Lake	bF	68		63	98		
Hawley Twp - Nepawassi Lk. Rd	bF						74
	wS						21
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		
Sale Twp - Tyson Lake	bF						68
	wS						25
Seagram Twp - Linger Lake	bF			16	34	62	
Stobie Twp	bF						87
	wS						33
Sweeny Twp - Ayotte Lake	bF	67		80		94	
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
Best Twp	bF			11	21	35	49
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			

(cont'd)

Table 11. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks over the past six years (cont'd).

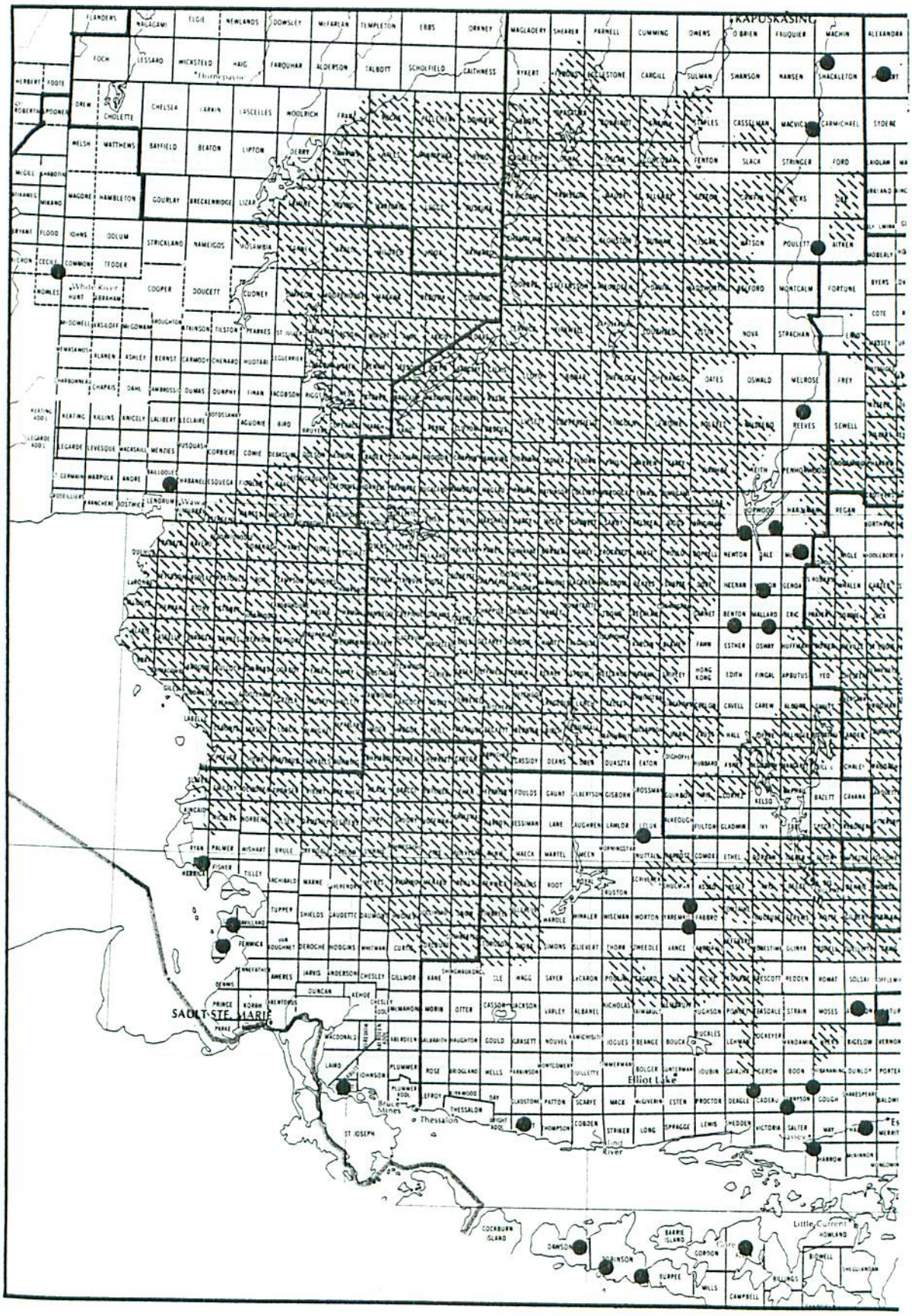
Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980
Temagami District (cont'd)							
Eldridge Twp	bF			19	24	37	66
Flett Twp - Fanny Lake	bF			10	28	52	
Gillies Limit Twp - Bay Lake	bF		0	1	4	6	15
Hartle Twp	wS						4
	bF						52
Hebert Twp	bF				34	39	
Hebert Twp - East of Angle Lake	bF				33	53	57
Medina Twp	bF			32	58	78	
Milne Twp - Boyce Lake	bF			32	43	59	
Parker Twp - Florence Lake	bF			28	21	52	
Riddell Twp - Camp 16 Rd	bF			6	49	72	75
Speight Twp							
- Mendelssohn Lake (S end)	bF	17			54	78	
- Mendelssohn Lake (N end)	bF	36	65	81			
Strathcona Twp	bF		4		38		94
Trethewey Twp - Banks Lake	bF			41	83	91	
Vogt Twp	bF			21	28	61	
Wallis Twp	bF		33				
Timmins District							
Bartlett Twp - Scott Lake	bF				25	63	95
Carnegie Twp	bF						0
English Twp - Ferrier Lake	bF				7		
Hassard Twp	bF					21	33
Hillary Twp	bF					3	29
Kidd Twp	bF					0	
McKeown Twp	bF					4	6
Semple Lake	bF				28		
Wawa District							
Asselin Twp - Gargantua Rd #1	bF		15	23	46	61	68
Asselin Twp - Gargantua Rd #2	bF						82*
Barager Twp	wS						34*
	wS						48*
Beaudry Twp - Black Spruce Lake	bS	91		74		96	
Beauparlant Twp - McEwen Lake	bF	47		70		83	
Brimacombe Twp - Hwy 17	bF		4	16	19	20	23
Broome Twp	bF			82		89	
Cecile Twp	bF					34	59

(cont'd)

Table 11. Northeastern Ontario - Summary of spruce budworm-associated tree mortality based on ground checks over the past six years (concl'd).

Location	Host	Tree mortality (%) 1975	1976	1977	1978	1979	1980
Wawa District (cont'd)							
Copenace Twp - Poon L.	bF	27		46			
Esquega Twp - Hwy 101	bF		8	15	13	12	32
	wS						0
Giles Twp - Coldwater R.	bF	31				45	34
Hallett Twp - Hoppy Lake	bF	71		98			
Labelle Twp - Agawa	bF	8	14	19			
Laforme Twp - Hwy 651	bF	31	53	81	87	98	
LaRonde Twp - Hwy 17	bF		23	56	77	84	95
Larson Twp - Little Agawa Lake	bF	48		75		82	91
Makawa Twp - Woodesgoon Lake	bF					35	33
- Fire River	wS					17	
Michano Twp - Miskokomon Twp boundary	bF	63	89	92			
Naveau Twp - High Falls Rd	bF	16	21	43	39	37	35
	bS						2
Nebonaionquet Twp - Anjigami Rd	bF	53					
Peterson Twp	wS						60*
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				
Tiernan Twp - Red Rock River Rd	bF						90
	wS						22
	bS						6
- south of J.R. camp, east side of Hwy 17	bF						83
	wS						56
	bS						38
- Kasubek Ck #1	wS						22*
Kasubek #2	wS						90*
Kasubek #3	wS						38*

*checked May 1980


KAPUSKASING
SAULT STE. MARIE
Elliot Lake
Thessalon
Bruce Mines
St Joseph
Little Current
Manitoulin Island
Cockburn Island

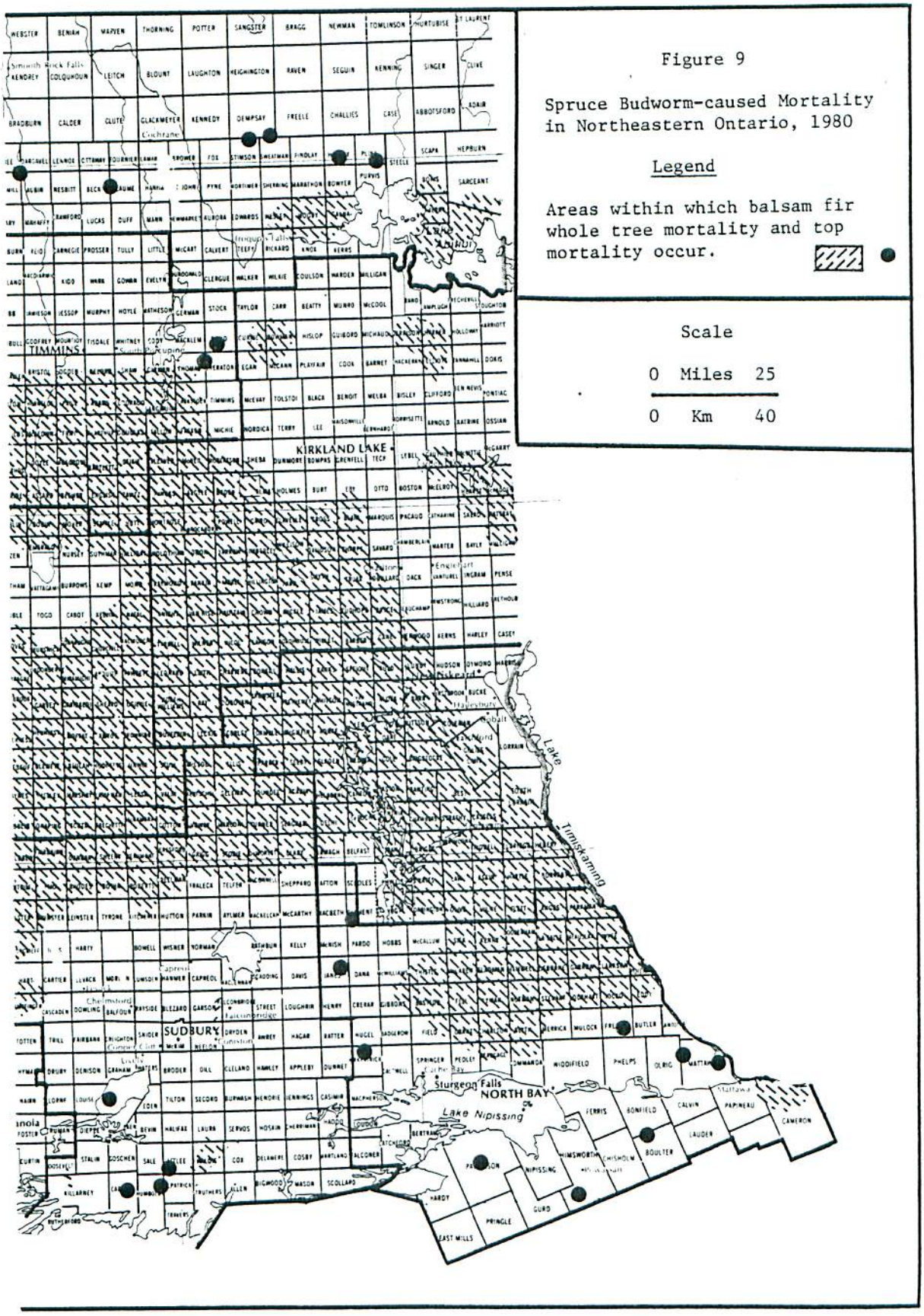


Figure 9

Spruce Budworm-caused Mortality in Northeastern Ontario, 1980

Legend

Areas within which balsam fir whole tree mortality and top mortality occur.

Scale

0 Miles 25

0 Km 40

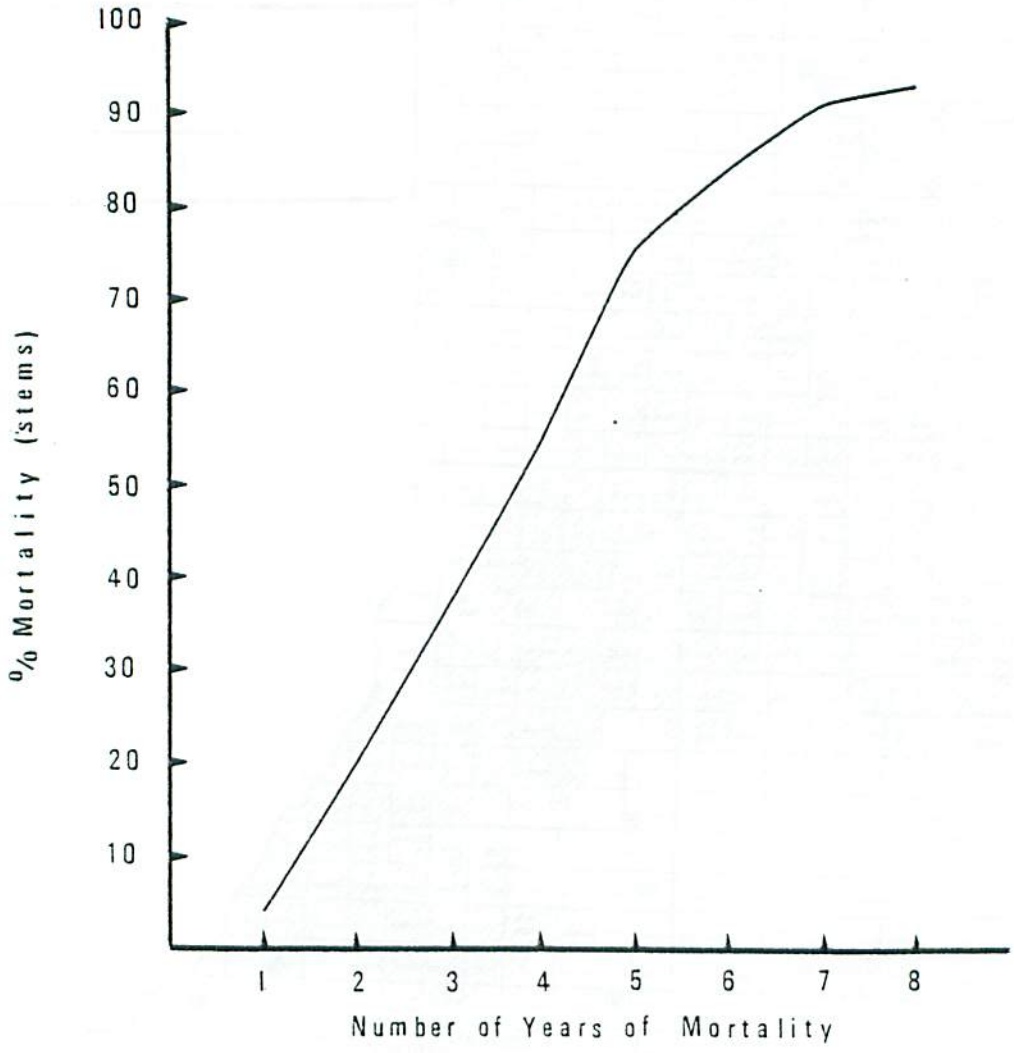


Figure 10. Tree mortality curve for balsam fir based on data from northeastern Ontario 1975-1979.

Table 12. Areas of defoliation and tree mortality, and volumes of balsam fir killed by spruce budworm in northeastern Ontario, 1967-1980.

Year	Area of moderate-to-severe defoliation (ha)	Area of mortality (ha)	Balsam fir mortality (m^3)
1967	25 900[a]		
1968	202 347		
1969	667 746		
1970	2 104 411		
1971	3 480 372		
1972	5 422 906	80 939	141 600
1973	5 058 681	202 347	198 240
1974	7 486 847	667 746	608 880
1975	11 007 689	1 214 083	1 146 960
1976	14 042 898	2 630 514	2 548 800
1977	13 468 231	4 168 353	4 361 280
1978	14 789 543	4 734 925	5 664 000
1979	16 939 972	6 110 886	7 249 920
1980	17 119 384	6 839 336	7 476 480
		TOTAL	29 396 160

[a] Light defoliation

North Central Ontario

Situation in 1980: For the purposes 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.

In 1980, as in 1979, an increase in the area of moderate-to-severe defoliation was observed in north central Ontario as the infestation continued to spread to the west. Defoliation is moderate to severe throughout the northwestern part of the Wawa District (formerly White River District) and has extended into Terrace Bay District all along the eastern border. Expansion of the infestation was observed in Mapledoram, Gemmell, and Leslie townships in the Manitouwadge area and in Frances and Flanders townships in Terrace Bay District. In Geraldton District there was a substantial western expansion of the Pagwa infestation in the eastern part of the district in 1980, especially in Downer, Bill and Henderson townships. Nipigon District continued to be free of budworm defoliation.

Infestation Forecasts for 1981: In north central Ontario egg-mass counts were obtained from a total of 76 locations in 1980 (Table 13). Based on 37 locations sampled in 1979 and 1980 the overall egg-mass density increased by about 59%. Both Geraldton and Terrace Bay districts showed increases of 59% and 64%, respectively, while in Nipigon District egg-mass counts decreased by 100%. As in previous years, considerable variation was observed within these districts. For example, the average egg-mass density (per 9.29 m^2 of foliage) in Geraldton District was 755, in Terrace Bay District 325 and in Nipigon 5.

In the eastern part of the North Central Regon, egg-mass densities increased considerably in Geraldton and Terrace Bay districts whereas populations which have been low in Nipigon District declined even further. A westward expansion of the infestation in Geraldton and Terrace Bay districts is expected in 1981. The districts of Nipigon and most of Geraldton should remain relatively free of budworm.

Northwestern Ontario

Situation in 1980: This year, the more significant changes in the budworm situation within the province occurred in northwestern Ontario. Moderate-to-severe defoliation increased by 50% and now totals 724 000 ha compared with 488 000 last year (Fig. 11). Most of this increase occurred in the Thunder Bay and Atikokan districts. The infestation extending from Kawnipi Lake, Atikokan District to Lower Shebandowan Lake, Thunder Bay District nearly

Table 13. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981.

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Geraldton District (32 locations)					
Caramat Rd.					
- 2.8 km south of Hwy 11	bF	0	0	0	0
- km 24	bF	0	0	0	0
Catlonite Rd - km 115.7	bF	0	0	0	0
Croll Twp	bF	0	0	0	0
Hwy 11					
- SE of Nibbs Lake (1980 #6)	bF	100	515	S	2
Klotz Lake					
- Prov. Pk (1980 #7)	bF	0	36	L-M	0
*Bicknell Twp					
- km 36.5 Pagwa Rd (1980 #8)	wS	100	813	S	3
	bF	100	513	S	3
*Boyce Twp					
- SW Jct Eastside and Pagwa (1980 #1)	wS	95	2625	S	3
	bF	100	457	S	3
- NE of Lemon L (1980 #2)	wS	100	1040	S	3
	bF	100	574	S	3
- 88 Cut near island in Pagwa R. (1980 #3)	wS	100	963	S	3
	bF	100	325	S	3
- 87 Cut NE side Sunshine Lake (1980 #4)	wS	68	368	S	2
	bF	92	1241	S	2
- 83 Cut, W of Boyce Twp, E of Eastside Lake (1980 #5)	wS	91	569	S	2
	bF	99	1297	S	3
*Clavet Twp					
- Check Plot 1, Jinx Lake (1980 #9)	wS	100	946	S	3
	bF	100	930	S	3
	bS	70	260	S	3

(cont'd)

Table 13. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Geraldton District (cont'd) (32 locations)					
*Clavet Twp (cont'd)					
- Check Plot 3, Hwy 11 W of Pipeline (1980 #10)	wS	100	3138	S	3
	bF	100	658	S	3
- Plot A, Hwy 11, E of W Twp Line (1980 #11)	wS	97	2441	S	3
	bF	100	349	S	3
- Plot B, Pagwa R Rd (1980 #12)	wS	95	2320	S	3
	bF	94	553	S	3
- Plot E, Hwy 11 4.5 km E of W Twp Line (1980 #13)	wS	85	336	S	3
	bF	93	133	M-S	3
- Plot F, Hwy 11, W of Pagwa R Bridge (1980 #14)	wS	100	679	S	3
	bF	99	146	M-S	3
Wintering Lake Rd - km 89.8	bF	0	16	L-M	0
Nipigon District (8 locations)					
Black Sturgeon Lake	wS	7	7	L	0
Kilkenny Twp - Macdiarmid	bF	0	0	0	0
Legault Twp	bF	0	0	0	0
Muskrat Lake - 3.2 km S of	bF	39	31	M	0
Parks Lake - km 48 Domtar Rd	bF	0	0	0	0
Patience Twp - Jackpine River	bF	0	0	0	0
Shillabeer Creek	bF	2	0	0	0
Summers Twp	bF	0	0	0	0

(cont'd)

Table 13. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Terrace Bay District (23 locations)					
†Agonzon Lake - Stand 459	bF	2	19	L-M	0
*Barbara Lake - OMNR Tree Seed Production Area	wS	3	886	S	0
†Bomby Twp - Stand 396	bF	92	1977	S	2
†Camp 60 Rd - N of Billet Lake Rd, Stand #377	bF	20	17	L-M	1
Catlonite Rd - km 46.7, Monitor Plot	bF	0	0	0	0
†Garnham Lake - E Side, Stand 204	bF	85	324	M-S	3
†Gowan Lake - N end, Stand 269	bF	24	519	S	1
†Harriet Lake - Stand 375	bF	18	22	L-M	1
†Herbert Twp - Ice Cream Lake, Stand 525	bF	89	27	L-M	3
Hourglass Lake	wS	94	808	S	3
†Hwy 614 - E of Barehead Lake, Stand 360	wS	14	256	S	1
- S of Billet Lake, Stand 561	bF	4	128	M-S	1
- .6 km N of Hwy 17, Stand 312	bF	97	400	S	3
Industrial and Camp 15 Rd	bF	32	106	M-S	1
Killraine Twp - Rainbow Falls Prov. Pk	bF	0	0	0	0
†Lecours Twp - Stand 364	bF	53	577	S	2
†Lorna Lake - Stand 211	bF	2	0	0	0
†Lunny Lake - Stand 201	bF	72	588	S	2
Pic Twp - Black River, Hwy 17	wS	3	60	M	1

(cont'd)

Table 13. North Central Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (concl'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Terrace Bay District (cont'd). (23 locations					
Stevens - Microwave Tower	bF	27	85	M-S	1
Syine Twp - Jackfish Lake Monitor Plot	wS	2	188	M-S	0
†Wabikoba Rd - Stand 616	bF	93	492	S	3
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 Table 8 for this footnote

* Samples requested by OMNR

† Samples from Ontario Paper Co. Ltd. limits

doubled in size from 180 000 ha in 1979 to 342 120 ha in 1980, spreading to Lac des Mille Lacs in the north and Horne Township in the east. Furthermore, budworm were easily collected east of the infestation and south of a line extending from Raith to Black Bay on Lake Superior. Generally, defoliation within this area was light with some small scattered pockets of moderately defoliated trees. Elsewhere in the Thunder Bay District, a new infestation totalling 60 700 ha was mapped west of Black Sturgeon Lake and the infestation at Arrow Lake, detected in 1979, expanded in 1980. In the Atikokan District, a small pocket of defoliation was reported again at Win Lake while a new area of some 20 200 ha of moderate-to-severe defoliation was found between Beaverhouse and Wolseley lakes. The infestation which occurs primarily in the Fort Frances District and extends west from Bennett Township to Watten Township and north to Lower Manitou Lake experienced a variety of boundary changes in 1980, but changed very little in overall size. The area within which moderate-to-severe defoliation was mapped totalled 292 000 ha in 1980 (compared with 306 000 ha in 1979). A new infestation was detected on white spruce at Umfreville Lake, Kenora District, about 11 km east of the Manitoba border.

Infestation Forecasts for 1981: Egg-mass samples were collected from a total of 94 locations in northwestern Ontario in 1980 (Table 14). Egg-mass densities decreased by about 14% over all. The largest decrease (76%) occurred in Atikokan District. There was little change in Fort Frances District (-1%) and a relatively small decrease in Thunder Bay District (-20%).

The highest average egg counts (per 9.29 m^2 of foliage) were recorded in Fort Frances (198) and Thunder Bay (138) districts. The highest single count was 1639 per 9.29 m^2 on balsam fir at Eltrut Lake in Fort Frances District.

In 1981, moderate-to-severe defoliation is likely to occur throughout the infested areas. Significant expansion of these areas is not expected (Fig. 12).

Tree Mortality: Ground checks of balsam fir mortality, which was first observed in 1979 in the Vista Lake-Moose Lake area, were rechecked in 1980. Mortality in the two locations was 12% and 23%, up 7% and 6%, respectively, from the previous year (Fig. 13). Approximately 24 000 ha of tree mortality was mapped in 1980 (compared with 20 000 ha in 1979).

Table 14. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981.

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Atikokan District (12 locations)					
Allan Lake	bF	0	10	L	0
Beaverhouse Lake	bF	41	62	M	1
Clearwater West Lake	bF	0	10	L	0
Crowrock Lake	bF	0	0	0	0
Eye Lake	bF	2	0	0	0
Factor Lake	bF	34	13	L	1
Flood River	bF	1	0	0	0
French Lake	wS	2	11	L	0
French Lake	bF	3	0	0	0
Joe Lake	bF	41	29	L	0
Joyce Lake	bF	1	10	L	0
Melema Lake	bF	7	0	0	0
Fort Frances District (27 locations)					
Bear Pass - km 2.4 west	bF	45	26	L-M	2
Bennett Lake	bF	76	585	S	2
Big Sawbill Lake	bF	2	30	L-M	0
Boffin Lake - northeast side	bF	0	0	0	0
Carleton Lake	bF	8	0	0	0
Eltrut Lake	bF	100	1639	S	2
Entwine Lake	bF	0	0	0	0
Eric Lake	bF	1	0	0	0
Hwy 11 - Farrington Twp	bF	0	0	0	1
Jones Lake	bF	9	73	M-S	0
Kaiarskons Lake	bF	0	55	M	0
Kawawia Lake	bF	1	45	L-M	0
*Lake of the Woods Prov. Pk.	wS	1	53	M	1
Lawrence Lake	bF	11	100	M-S	1
Little Turtle Lake Rd - km 15	bF	0	13	L	1
Makomesut Lake - southeast side	bF	2	0	0	1
Manion Lake Rd - km 23.2	bF	42	600	S	2
- Hillyer Creek	bF	53	444	S	3

(cont'd)

Table 14. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Fort Frances District (cont'd) (27 locations)					
Manitou Stretch	bF	93	819	S	2
Mather Twp	bF	0	0	0	0
Mount Lake	bF	0	0	0	0
Penassi Lake	bF	2	0	0	0
Pipestone Lake - east end	bF	2	37	L-M	0
Potts Twp	bF	0	0	0	0
Rainy Lake - Ash Bay, west end	bF	0	17	L	0
Sphene Lake	bF	0	0	0	0
Vickers	bF	93	1073	S	1
Ignace District (1 location)					
Smirch Lake	bF	0	0	0	0
Kenora District (5 locations)					
Crowduck Lake - north of	bF	4	0	0	0
Rowan Lake - south	bF	1	18	L	0
Tetu Lake - north end	bF	0	0	0	0
Umfreville Lake - east end	bF	0	27	L-M	0
- northwest side	wS	23	582	S	1
Thunder Bay District (50 locations)					
Aldina Twp	bF	7	0	0	0
Arrow Lake	bF	60	70	M	1
Bedivere Lake	bF	9	0	0	0
Blackwell Twp	bF	4	0	0	0
Burchell Lake	bF	91	367	S	1
Camp 45 - Great Lakes Forest Products Co.	bF	88	117	M-S	1

(cont'd)

Table 14. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (cont'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Thunder Bay District (cont'd) (50 locations)					
Crayfish Lake	bF	31	28	L-M	0
Conacher Twp - Drift Lake Road	bF	9	12	L	0
Flatrock Lake	bF	3	0	0	0
Forbes Twp - N of Flett	bF	5	14	L	0
Fowler Twp - SW of Hawkeye Lake	bF	5	0	0	0
Glen Twp - Wolf Lake Road	bF	2	0	0	0
Golding Twp - Microwave Tower	bF	4	0	0	0
Gorham Twp - S of Stepstone	bF	14	0	0	0
Greenwater Lake - east side	bF	84	147	M-S	2
- Shelter Island	bF	43	125	M-S	1
Greenwood Lake	bF	96	690	S	2
Hagey Twp - Hwy 586	bF	84	105	M-S	1
Haines Twp - Postans	bF	46	0	0	1
Hood Lake	bF	99	560	S	3
Hoof Lake	bF	75	216	S	2
Kabitotikwia Lake	bF	15	0	0	0
Kekekuab Lake	bF	50	156	M-S	1
Lac des Mille Lacs - Baril Bay	bF	17	6	L	1
- Bolton Bay	bF	35	0	0	0
- Poplar Point	bF	3	6	L	0
Marks Lake	bF	2	44	M-S	0
*Matawin Road - OMNR Tree Seed Orchard	wS	0	0	0	0
Mawn Lake - NE of	bF	25	30	L-M	0
McGinnis Lake	bF	92	1292	S	3
McTavish Twp - Ministry of Transportation and Communications	wS	18	32	L-M	0
Moss Lake	bF	80	585	S	1
Mountain Lake	bF	35	25	L-M	0

(cont'd)

Table 14. Northwestern Ontario - Spruce budworm: Summary of defoliation estimates and egg-mass counts in 1980, and infestation forecasts for 1981 (concl'd).

Location	Host	Estimated % defoliation 1980	No. of egg-masses per 9.29 m^2 of foliage	Infestation forecasts for 1981[a]	Accumulated damage[b]
Thunder Bay District (cont'd) (50 locations)					
Northern Light Lake					
- Curran Bay	bF	90	174	S	2
- Trout Bay Rd, km 16.8	bF	89	450	S	2
North Fowl Lake Rd					
- km 3.7 south	bF	29	12	L	0
*O'Connor Twp					
- OMNR Tree Seed Orchard	wS	0	53	L-M	0
- OMNR Tree Seed Production Area	wS	7	11	L	0
*Pearson Twp					
- OMNR Tree Seed Orchard	wS	0	0	0	0
Pie Island	bF	0	0	0	0
Plummes Lake	bF	62	463	S	3
Ross Lake	bF	98	662	S	4
Sandstone Lake	bF	15	12	L	1
Scoble Twp					
- S of Oliver Lake	bF	8	6	L	0
Shebandowan Lake					
- Sawmill Bay	bF	39	89	M-S	1
Squeers Lake - W of	bF	96	271	S	2
Sump Lake	bF	79	47	M	1
*Thunder Bay					
- OMNR Tree Nursery	wS	4	12	L-M	0
Ware Twp	bF	18	5	L	0
Wolf River Rd - km 28	bF	3	0	0	0

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

[b] See Table 8 for this footnote

* Samples requested by OMNR

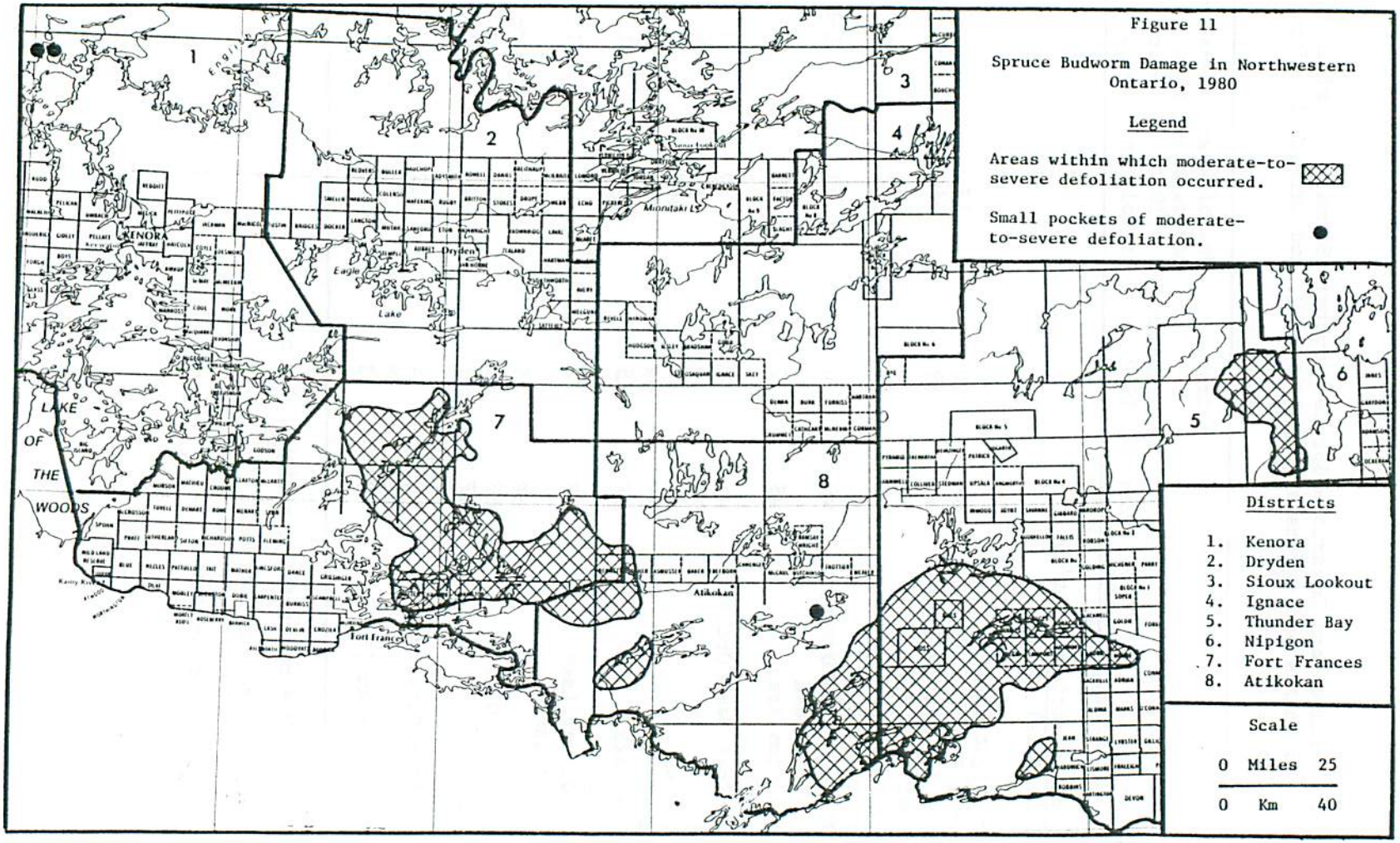
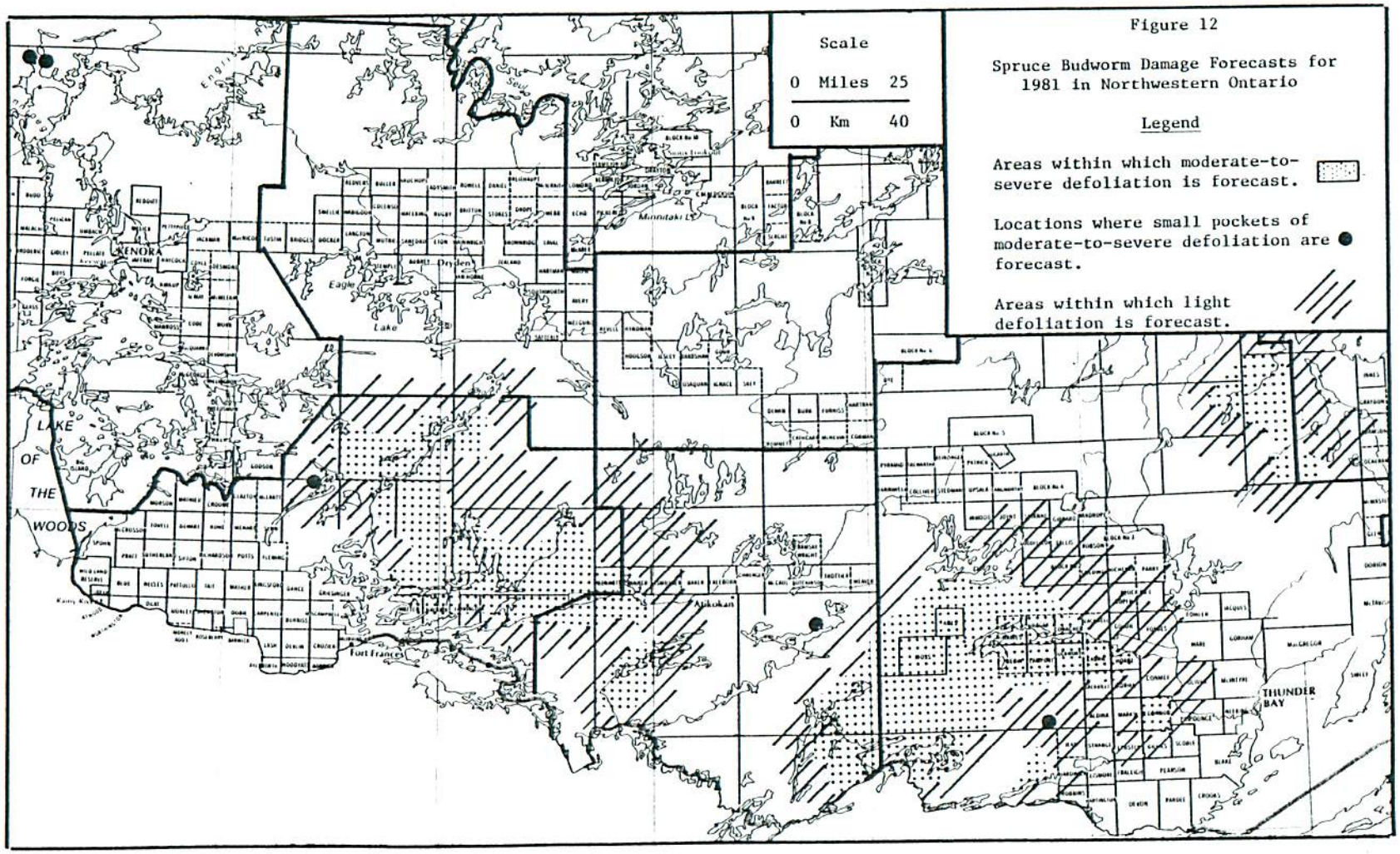


Figure 11
Spruce Budworm Damage in Northwestern Ontario, 1980
Legend
Areas within which moderate-to-severe defoliation occurred.
Small pockets of moderate-to-severe defoliation.
Districts
1. Kenora
2. Dryden
3. Sioux Lookout
4. Ignace
5. Thunder Bay
6. Nipigon
7. Fort Frances
8. Atikokan
Scale
0 Miles 25
0 Km 40
KENORA
Dryden
Eagle Lake
Mountain
LAKE OF THE WOODS
Fort Frances
Atikokan


Scale
0 Miles 25
0 Km 40
Figure 12
Spruce Budworm Damage Forecasts for 1981 in Northwestern Ontario
Legend
Areas within which moderate-to-severe defoliation is forecast.
Locations where small pockets of moderate-to-severe defoliation are forecast.
Areas within which light defoliation is forecast.
KENORA
Dryden
Eagle Lake
LAKE OF THE WOODS
Fort Frances
Atikokan
THUNDER BAY

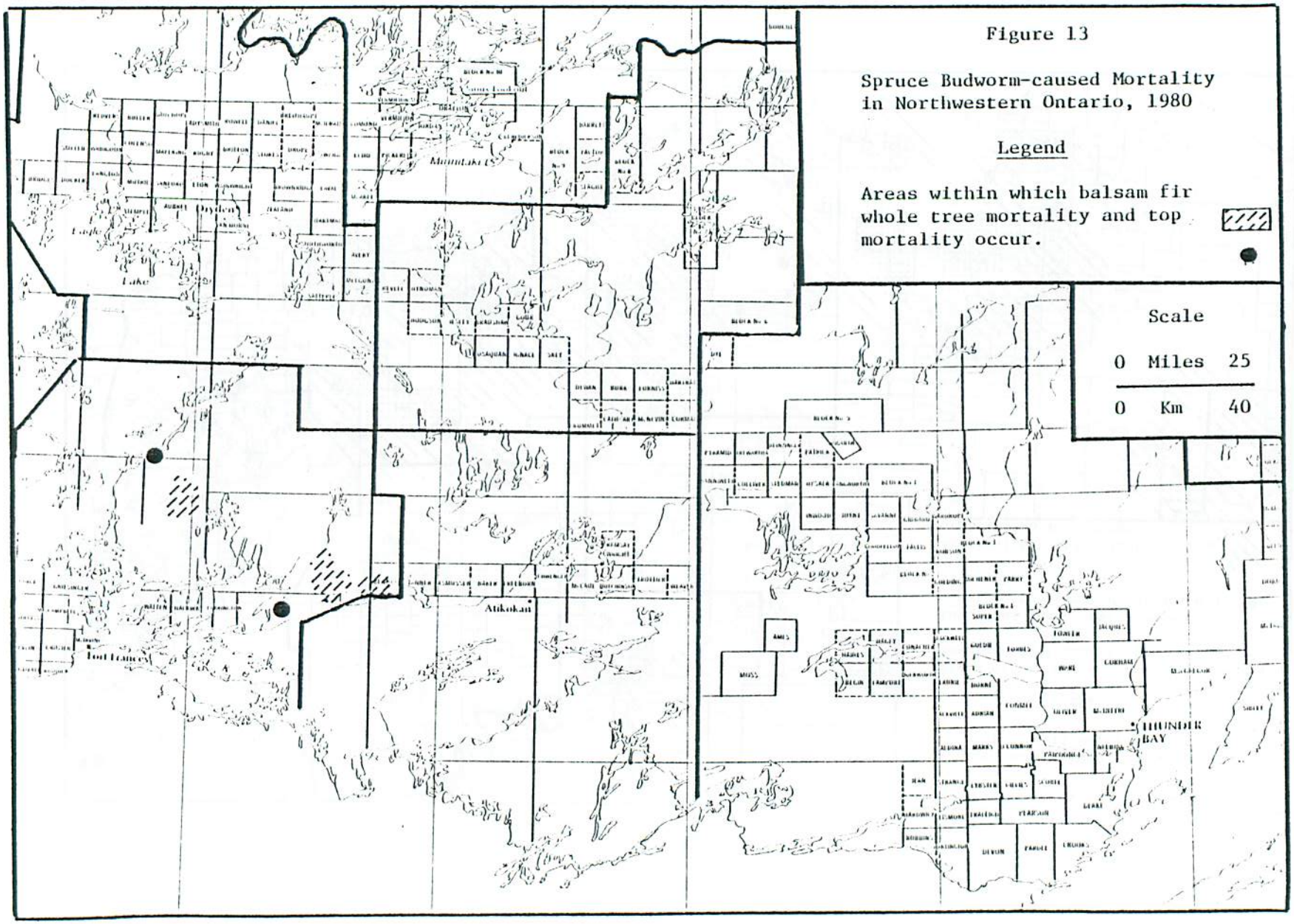


Figure 13
Spruce Budworm-caused Mortality in Northwestern Ontario, 1980
Legend
Areas within which balsam fir whole tree mortality and top mortality occur.
Scale
0 Miles 25
0 Km 40
Atikokan
THUNDER BAY

PART B: AERIAL SPRAYING OPERATIONS

INTRODUCTION

A total area of about 10 500 ha in seven districts was sprayed against spruce budworm by OMNR in 1980. Insecticides used in the program were Matacil (aminocarb, Chessargo Ltd.), Orthene (Chevron Chemical Ltd.), Cygon (Cyanamid Canada Inc.), Permethrin (Chipman Chemicals Ltd.) and three *B.t.* formulations: Thuricide 16B (Sandoz Inc.), Novabac 3 (Cyanamid Canada Inc.) and Dipel 88 (Abbott Laboratories Ltd.). A breakdown of area, dates and treatment for all operations appears in Table 15. A more complete description of the 1980 operations is available in OMNR's Pest Control Report No. 10.

OMNR was responsible for the logistics of the spray operations. Input by the CFS consisted of providing the biological information necessary for the planning and timing of operations (Table 16) and assessing the various treatments biologically (Tables 17-28). In addition, aerial and ground surveys to map the extent of spruce budworm defoliation and to determine, by egg-mass counts, damage forecasts for 1981 were carried out by FIDS field technicians using some 200 hours of aircraft time provided by OMNR.

Southern Ontario

1980 Operations: The only area aerially sprayed in southern Ontario in 1980 was an 850 ha deer yard in Spence Township, Parry Sound District. This represented the first time that OMNR had undertaken to protect a wildlife management area against spruce budworm. The area was treated with two *B.t.* formulations: 567 ha were treated with Dipel 88 and 283 ha were sprayed with Thuricide 16B. Both formulations were mixed with water and applied at a rate of 20 BIU/ 9.4 L/ha.

The majority of larvae were 3rd instar on 22 May when budworm development was measured. Spraying was carried out on 27 and 28 May with a Grumman AgCat to apply the Dipel 88 and a Piper Pawnee to apply the Thuricide 16B. Both were equipped with boom and nozzle delivery systems. The spraying was carried out by Can Ag Spray (Kincardine, Ont.). The cost of material and application of the Thuricide 16B was $23.17 per ha.

Results: The spray operation conducted in Parry Sound District in 1980 was assessed for effectiveness: the results are presented in Table 17. Basic data such as pre- and post-spray population densities, larval mortality (due to treatment) and foliage protection are presented in this table.

Table 15. Summary of aerial spraying in Ontario against spruce budworm in 1980.

Location	Area[a] (ha)	Spray dates	Treatment
Kapuskasing District			
Fauquier Twp SPA	93	5-10 June	1 application, Cygon, 560 g/18.8 L/ha
Idington Twp SPA	53	15 & 16 June	1 application, Cygon, 560 g/18.8 L/ha
	146		
Cochrane District			
Clute Twp SPA (#3201)	3	3 & 4 June	1 application, Orthene, 1.12 kg/9.4 L/ha
Clute Twp SPA (#3202)	6	3 & 4 June	1 application, Orthene, 1.12 kg/9.4 L/ha
Fournier Twp SPA (#3220)	5	3 & 4 June	1 application, Orthene, 560 g/9.4 L/ha
	14		
Kirkland Lake District			
Burt Twp SPA	81	1 June	2 applications, Orthene, 560 g/9.4 L/ha
Elliott Twp	1716	5-17 June	1 application, Novabac, 25 BIU/4.7 L/ha
Elliott Twp	2160	5 June	1st application, Novabac, 25 BIU/4.7 L/ha
		16 June	2nd application, Novabac or Thuricide, 15 BIU/4.7 L/ha
Elliott Twp	3527	1-16 June	2 applications, Matacil, 86 g/1.4 L/ha
Elliott Twp	182	5 June	1st application, Novabac, 25 BIU/4.7 L/ha
		17 June	2nd application, Matacil, 86 g/1.4 L/ha
Elliott Twp	248	4 June	1 application, Matacil, 86 g/1.4 L/ha
	125	4 June	1 application, Matacil, 86 g/4.7 L/ha
Elliott Twp	89	1 June	1 application, Permethrin, 17.5 g/1.4 L/ha
Elliott Twp	190	1 & 8 June	2 applications, Permethrin, 17.5 g/1.4 L/ha
Lamplugh Twp	69	5 June	2 applications, Matacil, 86 g/1.4 L/ha
	593		1 application, Matacil, 86 g/1.4 L/ha
	247		1st application, Matacil, 86 g/1.4 L/ha
	9 227		

(continued)

Table 15. Summary of aerial spraying in Ontario against spruce budworm in 1980 (concluded).

Location	Area[a] (ha)	Spray dates	Treatment
Parry Sound District			
Spence Twp	567	27-28 May	1 application, Dipel 88, 20 BIU/9.4 L/ha
Spence Twp	283	27-28 May	1 application, Thuricide 16B, 210 BIU/9.4 L/ha
	850		
Chapleau District			
Chapleau Nursery	6	24 May	1 application, Orthene, 560 g/9.4 L/ha
Manning Twp (plantation)	90	26 May	1 application, Orthene, 560 g/9.4 L/ha
Reeves Twp SPA	12	27 May & 2 June	2 applications, Orthene, 560 g/9.4 L/ha
Caverley Twp	32	26 May	1 application, Orthene, 560 g/9.4 L/ha
	140		
Gogama District			
Jack Twp SPA	12	28 May	1 application, Cygon, 560 g/9.4 L/ha
Invergarry Twp SPA	8	28 May	1 application, Cygon, 560 g/9.4 L/ha
Carter Twp SPA	3	28 May	1 application, Cygon, 560 g/9.4 L/ha
Fawcett Twp	13	28 May	1 application, Cygon, 560 g/9.4 L/ha
	36		
Hearst District			
Arnott Twp SPA	5	17 & 18 June	1 application, Orthene, 1.12 kg/9.4 L/ha
Arnott Twp STA west	109	17 & 18 June	1 application, Orthene, 560 g/9.4 L/ha
Arnott Twp STA	121		1 application, Orthene, 560 g/9.4 L/ha
Hanlan Twp SPA	4	17 June	1 application, Orthene, 1.12 kg/9.4 L/ha
Larkin Twp STA east	96	19 June	1 application, Orthene, 560 g/9.4 L/ha
Larkin Twp STA west	130	19 June	1 application, Orthene, 560 g/9.4 L/ha
Studholme Twp	40	16 June	1 application, Orthene, 560 g/9.4 L/ha
	505		

[a] Total = 10 918 ha (includes 279 ha of experimental aerial applications of Permethrin and 125 ha of high-volume application of Matacil in Elliott Twp, Kikrland Lake District).

Table 16. Summary of spruce budworm larval development on host species at various stages of the spray operations in six districts in 1980.

Location	Date	Tree species	Developmental stage (%) II	III	IV	V	VI	Pupae	Remarks
Chapleau District									
Caverley Twp	25 May	wS		10	80	10			Sprayed 26 May
Chapleau Nursery	22 May	wS	18	82					Sprayed 24 May
Manning Twp	26 May	wS		25	75				Sprayed 26 May
Reeves Twp	28 May	wS		38	62				1st spray application 27 May
	3 June	wS				76	24		2nd spray application 2 June
Gogama District									
Carter Twp SPA	29 May	wS		5	70	25			Sprayed 28 May
Jack Twp SPA	29 May	wS		10	72	18			Sprayed 28 May
Invergarry Twp SPA	29 May	wS		4	70	26			Sprayed 28 May
Hearst District									
Arnott Twp	18 June	wS				16	82	2	Sprayed 17 & 18 June
Hanlan Twp	19 June	wS			7	12	81		Sprayed 17 June
Larkin Twp	19 June	wS				10	90		Sprayed 19 June
Studholme Twp	19 June	wS			5	23	72		Sprayed 16 June
Cochrane District	2 June	wS		64	32	4			Sprayed 3 & 4 June
Kapuskasing District									
Fauquier Twp	7 June	wS	1	16	43	40			Sprayed 5-10 June
Idington Twp	10 June	wS			54	35	11		Sprayed 15 & 16 June
Bonner Centre	4 June	wS		32	48	20			Sprayed 5-7 June
	4 June	bS		12	53	31	4		Sprayed 5-7 June
Kirkland Lake District									
Harker Twp	31 May	bF	17	38	45				Spraying started 1 June
(for Elliott	8 June	bF	2	21	54	23			
Twp operation)	16 June	wS		12	56	23	9		
	17 June	bF		7	58	35			Spraying ended 17 June
Parry Sound District									
Spence Twp	22 May	bF							Sprayed 27-28 May

Table 17. Population reduction and foliage protection attributable to *B.t.* aerial treatments in a deer yard in Spence Township, Parry Sound District. Sprayed 27-28 May 1980.

	Host	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment	% 1980 defoliation
Dipel 88, 19.8 BIU/9.4 L/ha					
Treated	bF	24.3	1.1	56	48
Check	bF	19.6	2.0		71
Treated	wS	28.6	4.7	34	50
Check	wS	29.0	7.2		60
Thuricide 16B, 19.8 BIU/9.4 L/ha					
Treated	bF	48.6	1.0	68	62
Check	bF	44.7	2.8		93
Treated	wS	66.9	3.2	72	70
Check	wS	49.7	8.6		66

Table 18. Population reduction, pupal survival and foliage protection attributable to various aerial spray treatments on balsam fir and white spruce in Elliott Township, Kirkland Lake District, 1980.

	No. of plots	Prespray larvae per 46 cm branch tip		Surviving pupae per 46 cm branch tip		% population reduction due to treatment		% 1980 defoliation	
		bF	wS	bF	wS	bF	wS	bF	wS
B.t. (Novabac), 1 application, 25 BIU/4.7 L/ha									
Spray	3	21.8	25.4	.5	.7	82	66	28	27
Check	3	20.5	20.9	2.5	1.8			86	77
B.t., 2 applications (Novabac 1st application, 25 BIU/4.7 L/ha; Novabac or Thuricide 16B 2nd application, 15 BIU/4.7 L/ha)									
Spray	3	18.8	20.5	.2	1.1	93	64	18	41
Check	3	20.5	19.3	2.5	2.9			86	77
Matacil, 2 applications 12-14 days apart, 86 g/1.4 L/ha									
Spray	2	13.2	14.2	.6	1.0	76	53	29	36
Check	2	18.5	16.2	3.2	2.4			84	73
B.t. (Novabac), 1st application, 25 BIU/4.7 L/ha; Matacil, 2nd application, 86 g/1.4 L/ha									
Spray	1	36.2	47.2	0	.5	100	38	10	32
Check	1	43.7	30.2	2.9	.5			98	85
Matacil, high volume, 1 application, 86 g/4.7 L/ha									
Spray	4	19.0	32.6	.8	.8	69	54	19	30
Check	4	24.8	32.9	3.1	1.8			88	74
Permethrin, 1 application, 17.5 g/1.4 L/ha									
Spray	1	27.3	53.3	1.1	1.0	8	28	19	38
Check	1	24.5	69.0	1.1	1.8			90	64
Permethrin, 2 applications, each 17.5 g/1.4 L/ha									
Spray	1	30.0	43.9	1.2	2.7	14	0	46	47
Check	1	24.5	30.2	1.1	.5			90	85

Table 19. Population reduction, pupal survival and foliage protection attributable to two applications of Cygon (.56 kg/9.34 L/ha) delivered from a helicopter 5-7 days apart on white spruce and balsam fir within *white spruce* seed production areas in Gogama District, 1980.

	L_2 per branch[a]		Surviving pupae per 46 cm branch tip		% population reduction due to treatment		1980 defoliation	
	bF	wS	bF	wS	bF	wS	bF	wS
Jack Twp SPA	36.3	52.8	3.2	1.6	0	0	87	92
Check	32.3	58.0	2.0	1.7			100	59
Invergarry Twp SPA	20.7	19.5	3.0	2.3	0	0	67	85
Check	32.3	57.4	2.0	1.1			100	82
Carter Twp SPA	30.9	32.3	3.6	1.4	0	0	90	59
Check	32.2	58.0	2.0	1.7			100	59
Over all	29.3	34.9	3.3	1.8	0	0	81	79
Check	32.3	57.8	2.0	1.5			100	67

[a] L_2 per branch was determined by collecting foliage in April and forcing overwintering larvae under controlled conditions.

Table 20. Population reduction, pupal survival and foliage protection attributable to Cygon delivered from a helicopter at a rate of .56 kg/18.68 L/ha on *white spruce* in seed production areas in Kapuskasing District, 1980.

	Prespray larvae per 46 cm branch tip		Surviving pupae per 46 cm branch tip		% population reduction due to treatment		% 1980 defoliation	
	wS	bS	wS	bS	wS	bS	wS	bS
Fauquier Twp SPA	27.3		6.2		0		23	
Check	8.1		.9				2	
Idington Twp SPA	11.0	5.0	1.1	1.0	5	-	7	14
Check	8.1		.9				2	
Over all	19.2		3.6		0		15	
Check	8.1		.9				2	

Table 21. Population reduction, pupal survival and foliage protection attributable to Orthene applied by helicopter on high-value stands in Chapleau and Kirkland Lake districts, 1980.

	L_2 per branch[a]		Surviving pupae per 46 cm branch tip		% population reduction due to treatment		1980 defoliation	
	bF	wS	bF	wS	bF	wS	bF	wS
Orthene, 1 application, .56 kg/9.34 L/ha								
Chapleau Nursery	7.6	5.8	.3	.5	78	33	5	8
Check	16.0	17.8	2.9	2.3			83	9
Manning Twp (plantation)		4.2		.1		95		2
Check		9.4		2.4				9
Orthene, 2 applications, .56 kg/9.34 L/ha 5-7 days apart								
Chapleau District								
Reeves Twp SPA		70.2		.6		79		67
Check		53.4		2.2				46
Kirkland Lake District								
Burt Twp SPA		65.3		1.8		0		29
Check		56.9		.7				71

[a] L_2 per branch was determined by collecting foliage in April and forcing overwintering larvae under controlled conditions.

Table 22. Population reduction, pupal survival and foliage protection attributable to Orthene delivered from a helicopter on *white spruce* seed production areas in Cochrane District, 1980.

	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment	% 1980 defoliation
Orthene, 1.12 kg/9.34 L/ha				
Clute Twp SPA (#3201)	30.7	2.3	0	32
Check	30.2	.5		85
Clute Twp SPA (#3202)	62.4	2.6	0	64
Check	69.0	1.8		64
Orthene, .56 kg/9.34 L/ha				
Fournier Twp SPA (#3220)	46.5	2.1	0	12
Check	30.2	.5		85
Over all	46.5	2.3	0	36
Check	43.1	.9		78

Table 23. Population reduction, pupal survival and foliage protection attributable to Orthene applied by helicopter at two different rates on high-value *white spruce* in Hearst District, 1980.

	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment	% 1980 defoliation
Orthene, 1 application, 1.12 kg/9.34 L/ha				
Arnott Twp SPA	57.9	.3	32	83
Check	40.5	.3		98
Hanlan Twp SPA	73.6	.6	87	9
Check	43.0	2.6		68
Over all	65.8	.4	82	46
Check	41.8	1.4		83
Orthene, 1 application, .56 kg/9.34 L/ha				
Arnott Twp STA west	35.8	.4	0	45
Check	40.5	.3		98
Larkin Twp STA east	69.2	1.0	74	95
Check	47.7	2.8		93
Larkin Twp STA west	29.0	.1	98	39
Check	47.7	2.8		93

(continued)

Table 23. Population reduction, pupal survival and foliage protection attributable to Orthene applied by helicopter at two different rates on high-value *white spruce* in Hearst District, 1980 (concluded).

	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment	% 1980 defoliation
Orthene, 1 application, .56 kg/9.34 L/ha				
Studholme Twp (overstory)	48.7	.6	45	74
Check	40.7	1.0		90
Over all	45.7	.5	71	63
Check	44.2	1.7		94

	Prespray larvae per tree	Surviving pupae per tree	% population reduction due to treatment	% 1980 defoliation
Studholme Twp (regeneration)	17.1	1.8	0	18
Check	16.0	1.5		13

Table 24. Population reduction, pupal survival and foliage protection attributable to Orthene applied by mistblower on *white spruce* at the Bonner Tree Improvement Centre, Kapuskasing District, 1980.

Compartment	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment	% 1980 defoliation
16A	111.2	.2	88	72
Check	70.2	1.0		88
22C	29.6	.2	67	19
Check	21.4	.4		52
26D	35.6	.4	56	27
Check	37.6	1.0		66
Over all	58.8	.3	76	39
Check	43.1	.8		69

Table 25. Population reduction, pupal survival and foliage protection attributable to Orthene applied by mistblower on *black spruce* at the Bonner Tree Improvement Centre, Kapuskasing District, 1980.

Compartment	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment	% 1980 defoliation
16E	13.4	.2	0	40
Check	22.6	.2		31
17A	5.6	0	100	5
Check	22.6	.2		31
22B	14.6	0	100	16
Check	22.6	.2		31
26B	13.4	0	100	2
Check	22.6	.2		31
Over all	11.8	.1	54	16
Check	22.6	.2		31

Table 26. Population reduction, pupal survival and foliage protection attributable to NPV carry-over from 1979 spray applications on *white spruce* at the Bonner Tree Improvement Centre, Kapuskasing District, 1980.

Compartment	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to NPV carry-over	% 1980 defoliation
9D	55.4	.6	25	-
Check	70.2	1.0		88
19C	19.2	1.2	0	6
Check	21.4	.4		64
21D	49.6	.2	85	-
Check	37.6	1.0		66
22A	52.2	0	100	38
Check	37.6	1.0		66
Over all	44.1	.5	43	22
Check	41.7	.8		71

Table 27. Population reduction, pupal survival and foliage protection attributable to NPV carry-over from 1979 spray applications on *black spruce* at the Bonner Improvement Centre, Kapuskasing District, 1980.

Compartment	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to NPV carry-over	% 1980 defoliation
6B	27.4	.6	0	6
Check	31.2	.4		40
19C	13.4	.6	0	6
Check	22.6	.2		31
21B	29.8	.2	50	12
Check	31.2	.4		40
21D	61.4	0	100	10
Check	31.2	.4		40
Over all	33.0	.4	12	8
Check	29.1	.4		38

Table 28. Overall population reduction of associated species, mainly spruce coneworm (*Dioryctria reniculelloides*), due to various treatments on *white spruce* in three districts in 1980.

Treatment	No. of plots	Prespray larvae per 46 cm branch tip	Surviving pupae per 46 cm branch tip	% population reduction due to treatment
Kapuskasing District				
Cygon, 1 application, 560 g/18.8 L/ha	2	1.33	.16	15
Checks	2	1.26	.20	
Hearst & Kirkland Lake districts				
Orthene, 560 g or 1.12 kg/9.4 L/ha	7	7.74	.33	66
Checks	7	9.83	1.25	
Kirkland Lake District				
Novabac, 25 BIU/4.7 L/ha	4	1.60	.42	76
Checks	4	1.03	1.15	
Matacil, 86 g/4.7 L/ha	2	1.80	.65	29
Checks	2	2.18	1.12	
Permethrin, 17.5 g/1.4 L/ha	2	3.60	.48	60
Checks	2	3.33	1.10	
Novabac, 25 BIU/4.7 L/ha + Matacil, 86 g/1.4 L/ha	1	1.80	1.10	45
Check	1	1.03	1.15	

Results of the pre-spray larval survey and post-spray pupal survey indicate that spruce budworm mortality, attributable to the spray treatments, was substantial. However, moderate-to-severe defoliation of both balsam fir and white spruce still occurred. Foliage protection in areas treated with Dipel 88 was generally better than in areas treated with Thuricide 16B. This may have been due to the higher pre-spray budworm populations in the Thuricide-treated areas.

Northern Ontario

1980 Operations: About 1,300 ha of high-value forests (spruce seed production areas and regeneration) in five districts were treated in 1980 to reduce budworm damage. The intention was to improve application and deposit in these areas and to compare two insecticides with systemic action (Orthene and Cygon). The original plans were to compare three application regimes--one application of 9.4 L/ha, two applications of 9.4 L/ha 5-7 days apart, and two applications of 9.4 L/ha on the same day (effectively 18.8 L/ha). All spraying was done with a Hughes 300 helicopter. Poor weather conditions in June and other technical problems made it impossible to complete all the proposed applications.

In Kirkland Lake District, protection spraying of balsam fir continued in 1980. About 8 700 ha in Elliott and Lamplugh townships were treated with various chemical and biological insecticides to prevent development of significant mortality. The objective of this program is to preserve enough current foliage to keep the balsam component alive until the area can be harvested. The program is being conducted in compliance with OMNR's Spruce Budworm Spraying Policy (TM 13-04), which requires that the area being protected by spraying be harvested within 5 years of the start of spraying. As in 1979, the 1980 program relied on the chemical insecticide, Matacil, and two bacterial (*B.t.*) insecticides, Thuricide 16B and Novabac 32B. However, in 1980, a larger proportion of the area (ca. 46%) was treated with *B.t.* than in 1979. Generally, Matacil applications were completed as planned, although the interval between spraying was longer than intended, again because of poor weather. The original plans called for two applications of *B.t.* at 15 BIU/ha + 10 BIU/ha. However, rapid larval development in late May and early June indicated that the second application may have been too late to be effective; consequently, a decision was made to use a single application of 25 BIU/ha. Following this application, a period of cold weather (8-10 June) arrested larval development. This permitted a second application of *B.t.* at 15 BIU/ha in an effort to achieve an extra measure of protection in some of the more valuable stands along the Magusi River. Two experimental spraying trials were included in the 1980 program in Kirkland Lake. A block of 125 ha was treated with a single high-volume application of Matacil (86 g/4.7 L/ha) to determine whether this regime would be as effective as the two low-volume applications used as a standard operational treatment. As well, a new synthetic pyrethroid insecticide,

Permethrin, was field tested. An 89 ha block was treated with a single application of 17.5 g active/1.4 L/ha and a 190 ha block received two applications at the same rate, seven days apart. The carrier for all experimental applications was diluent 585. All three experimental blocks were located in Elliott Township. A summary of the 1980 Ontario spray operations is given in Table 15.

In most areas spraying began when larval development reached peak third or fourth instars. In Hearst District, however, most larvae were in the sixth instar when spraying began. This was due to the unusually rapid development of the larvae in this area. Development at the time of the spray applications is shown in Table 16.

Aerial spraying in northern Ontario was carried out by two companies--General Air Spray Ltd. (St. Thomas, Ont.) using three Grumman AgCats and Falcon Helicopter Ltd. (Kingston, Ont.) using a Hughes 300. A third company, Arrow Smith Inc. (Bell 47 helicopter), was subcontracted to complete the program in Hearst District before insect development was too advanced.

The costs (aircraft and materials) of the preceding aerial applications were as follows: Matacil $3.95-$7.90 ha, Matacil plus *B.t.* $15.56/ha, *B.t.* $11.61-$23.22/ha, Orthene $51.55-$103.07/ha, and Cygon $40.05/ha. Costs varied widely depending on aircraft, insecticide cost and number of applications.

Results: The various spray treatments conducted in northern Ontario in 1980 were assessed for effectiveness and the results are presented in Tables 18-28.

The objective of the protection spraying program in commercial forests in Ontario is to keep defoliation levels of the current year's growth below 50%. In terms of foliage protection the 1980 program was highly successful.

In Elliott Township, the various *B.t.* applications, as well as the *B.t.* plus Matacil application, resulted in excellent foliage protection and substantial decreases in budworm populations on both balsam fir and white spruce (Table 18). Very good results were also achieved from both the high-volume and double applications of Matacil. The experimental Permethrin treatments were somewhat disappointing. Population control was poor, and although foliage protection was good with the single application, results obtained with the double application were marginal. The reason for the difference between the single and double application is unknown.

A comparison of the sprayed and unsprayed areas in Elliott and Lamplugh townships showed that in the unsprayed areas balsam fir was in much worse condition, with tree mortality quite common. As well, the white spruce component was severely damaged, with occasional tree mortality.

The objective of protection spraying in high-value forests depends on the type of forest and management objective. Most of the high-value forests in the Northern Region are spruce seed production areas (SPAs), seed tree areas (STAs), or white spruce regeneration. In the SPAs and STAs, the objective is to minimize defoliation by the budworm and thereby preserve the general vigor and cone-producing potential of the trees. Likewise, in regenerated areas, the objective is to provide maximum protection of current growth and thereby enhance annual height growth.

The results of the single and double applications of Cygon in SPAs in Kapuskasing and Gogama districts were very poor (Tables 19 and 20). The chemical seemed to be totally ineffective for either foliage protection or population control. Generally the results in the SPAs and STAs treated with Orthene were much better (Tables 21, 22 and 23). Regardless of the dose, volume or number of applications, good-to-excellent foliage protection was provided by this insecticide. Population reduction due to treatment was more variable but generally quite good.

A ground spraying program was conducted by Kapuskasing District in the Bonner Tree Improvement Centre, independent of the aerial spraying program. A Rotomist sprayer was used to apply Orthene to various compartments of white spruce and black spruce, during the period 5 to 7 June. Results indicate clearly that this treatment provided better foliage protection than helicopter-applied Orthene (Tables 24 and 25).

In 1979, several compartments in the Bonner Centre were treated with spruce budworm NPV virus. These compartments were monitored in 1980 to determine the carry-over effect of the virus. The protection provided in 1980, in terms of foliage preservation, was very satisfactory (Tables 26 and 27). Defoliation of white spruce averaged 22%, and of black spruce only 8%.

The spruce coneworm, *Dioryctria reniculelloides*, an insect associated with spruce budworm, is reported to be an important occasional defoliator of white spruce and is destructive of cones. The average number of pre-spray larvae in spray areas in 1980 was 3.04 per 45 cm branch tip. This is lower than in 1979 when average pre-spray larval populations were about 7.6 larvae per 45 cm branch tip. For the third consecutive year the various treatments to control spruce budworm were also assessed for their effects on spruce coneworm populations. In addition to the coneworm, other associated species are found and are hard to distinguish from coneworm in early instars. Since the majority of associated insects are coneworms, all larvae were recorded in pre-spray samples. A summary of the effects of six treatments on these populations is given in Table 22. Comparisons of efficacy between treatments are difficult because of the low populations involved. However, in terms of population reduction those areas treated with *B.t.*, Orthene and Permethrin showed good results.

Proposed Aerial Spraying Operations for 1981: A total area of approximately 11 400 ha is proposed for protection spraying against spruce budworm damage in 1981. As in 1980, the majority of the spray operations will be carried out in the Northern Region with two smaller projects in the Algonquin and Central regions. Insecticides to be used include Orthene, Permethrin, Matacil, *B.t.* and virus.

In Kirkland Lake and Hearst districts about 8 432 ha of commercial forests are to be treated with various insecticides. Another 2 900 ha of high-value forests in eight districts are to be sprayed. These high-value locations include seed production areas, seed tree areas, plantations, nurseries and several new potential cone collection areas.

In the Algonquin Region about 600 ha of the deer yard in Spence Township will be protected again in 1981.