RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTHWESTERN REGION OF ONTARIO

1989

(FOREST DISTRICTS: RED LAKE, SIOUX LOOKOUT, KENORA, DRYDEN, IGNACE AND FORT FRANCES)

R. J. SAJAN and H. BRODERSEN

FORESTRY CANADA

ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

1989

MISCELLANEOUS REPORT NO. 95

Catalogue No. Fo29-8/95E
ISBN 0-662-17931-5
ISSN 0832-7130

Copies of this publication are available at no charge from:

Communications Services
Forestry Canada
Ontario Region
Great Lakes Forestry Centre
P.O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

Microfiches of this publication may be purchased from:

Micro Media Inc.
Place du Portage
165, Hotel-de-Ville
Hull, Quebec
J8X 3X2

SURVEY HIGHLIGHTS

This report describes the most significant and most prevalent forest pest problems encountered and evaluated during extensive ground and aerial surveys conducted in the Northwestern Region of Ontario in 1989.

There was a marked increase in the area of moderate-to-severe defoliation caused by the forest tent caterpillar. The total area defoliated throughout the Fort Frances, Kenora and Dryden districts was approximately 2,180,118 ha. A decrease in the total area of infestation caused by the spruce budworm was documented. This area of moderate-to-severe defoliation currently stands at approximately 3,205,059 ha, a decrease of 184,726 ha from 1988. This infestation, however, is still expanding and moving northward in the region, even as it collapses in the southern portions. The decline is a result of the large area of whole-tree mortality and subsequent lack of host trees in the Fort Frances and Ignace districts. The total area of whole-tree mortality across the region to date is estimated to be 624,947 ha. Defoliation by the jack pine budworm continues to decline, as evidenced by the 66% reduction in the area of infestation mapped this year. The current infestation in the northern portion of Red Lake District covers approximately 248,311 ha.

Poplar leaf rusts caused severe discoloration and premature leaf drop on balsam poplar across the region, especially in the northern half. Diplodia tip blight was found damaging 4-25% of all trees examined in three black spruce seed orchards in Sioux Lookout District and one in Ignace District. Damage varied from dead branch tips to whole-tree mortality. This is the first time this pathogen has been recorded damaging black spruce in Ontario.

Black spruce was the target species for both the high-value plantation survey and the cone and seed pest survey in 1989. The three Acid Rain National Early Warning System (ARNEWS) plots were retallied, as were all five pinewood nematode plots. A summary of pest problems encountered at the Dryden Forest Station is included in this report.

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

Major Insects/Diseases

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

Minor Insects/Diseases

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

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

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

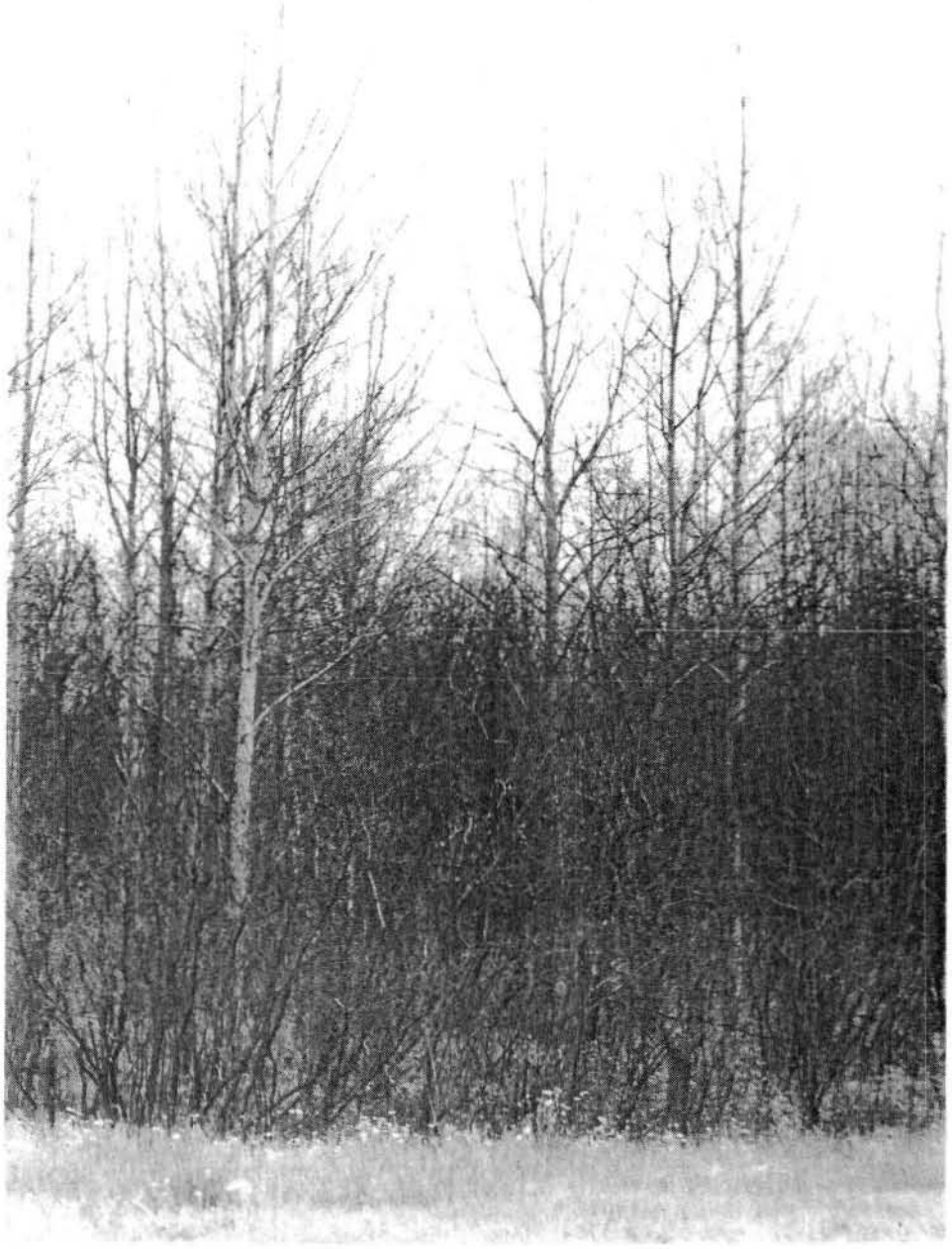
(2) those that are capable of causing serious damage but, because of low population levels or for other reasons, did not cause serious damage in 1989.

The authors would like to express their appreciation to personnel of the various Ontario Ministry of Natural Resources (OMNR) district offices, to members of the woods industry and to various private individuals for their excellent cooperation during the 1989 field season.

R.J. Sajan

H. Brodersen

Frontispiece



Trembling aspen (*Populus tremuloides* Michx.) defoliated by the forest tent caterpillar, *Malacosoma disstria* Hbn.

TABLE OF CONTENTS

(cont'd)

TABLE OF CONTENTS (cont'd)

INSECTS

Major Insects

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Ontario Situation

Spruce budworm, *Choristoneura fumiferana* (Clem.), populations have been declining for the past several years in northern Ontario. However, in 1989 the trend was reversed when an increase of some 1,000,000 ha of moderate-to-severe defoliation was recorded, bringing the provincial total to approximately 6,239,636 ha. The total area of moderate-to-severe defoliation is confined to two regions, the North Central with 3,034,577 ha and the Northwestern with 3,205,059 ha. In the North Central Region, a small decrease occurred in the Atikokan District; however, major increases were recorded in Thunder Bay, Nipigon, Terrace Bay and Geraldton districts. In the Northwestern Region, decreases occurred in the Ignace, Dryden, Fort Frances and Red Lake districts, and increases in Sioux Lookout and Kenora districts (Fig. 1).

An upward trend in spruce budworm populations was noted across much of the remainder of northern Ontario and in four locations in southern Ontario. However, population levels throughout these areas were low, except in single white spruce (*Picea glauca* [Moench] Voss) plantations in the Huronia and Wingham districts, where moderate levels were recorded.

The Ontario Ministry of Natural Resources (OMNR) aerially sprayed some 30,516 ha of spruce-fir forest in the Thunder Bay and Nipigon districts. The biological insecticide *Bacillus thuringiensis* (*B.t.*) was applied to minimize defoliation in commercial spruce-fir stands, in a provincial park and in several plantations.

Northwestern Ontario Situation

The total area of moderate-to-severe defoliation caused by this pest in the region decreased in 1989 by some 184,726 ha to a total of 3,205,059 ha (Fig. 2). Reductions occurred in the southwestern portion of Ignace District, in the southern half of Fort Frances and Red Lake districts, and in the extreme southwestern corner of Dryden District. The total area defoliated, together with changes since 1988 (listed by district), can be found in Table 1. Except in Red Lake District, the reductions were caused by severe defoliation in previous years, which resulted in whole-tree mortality over large tracts of forested land. This high level of mortality has virtually eliminated host species preferred by budworm. In Red Lake District, the reduction was due to large wildfires in 1988 and 1989.

Increases in the area infested were detected in both Sioux Lookout and Kenora districts. The expansion occurred along the leading northern edge of the infestation in both districts. As well, the in-

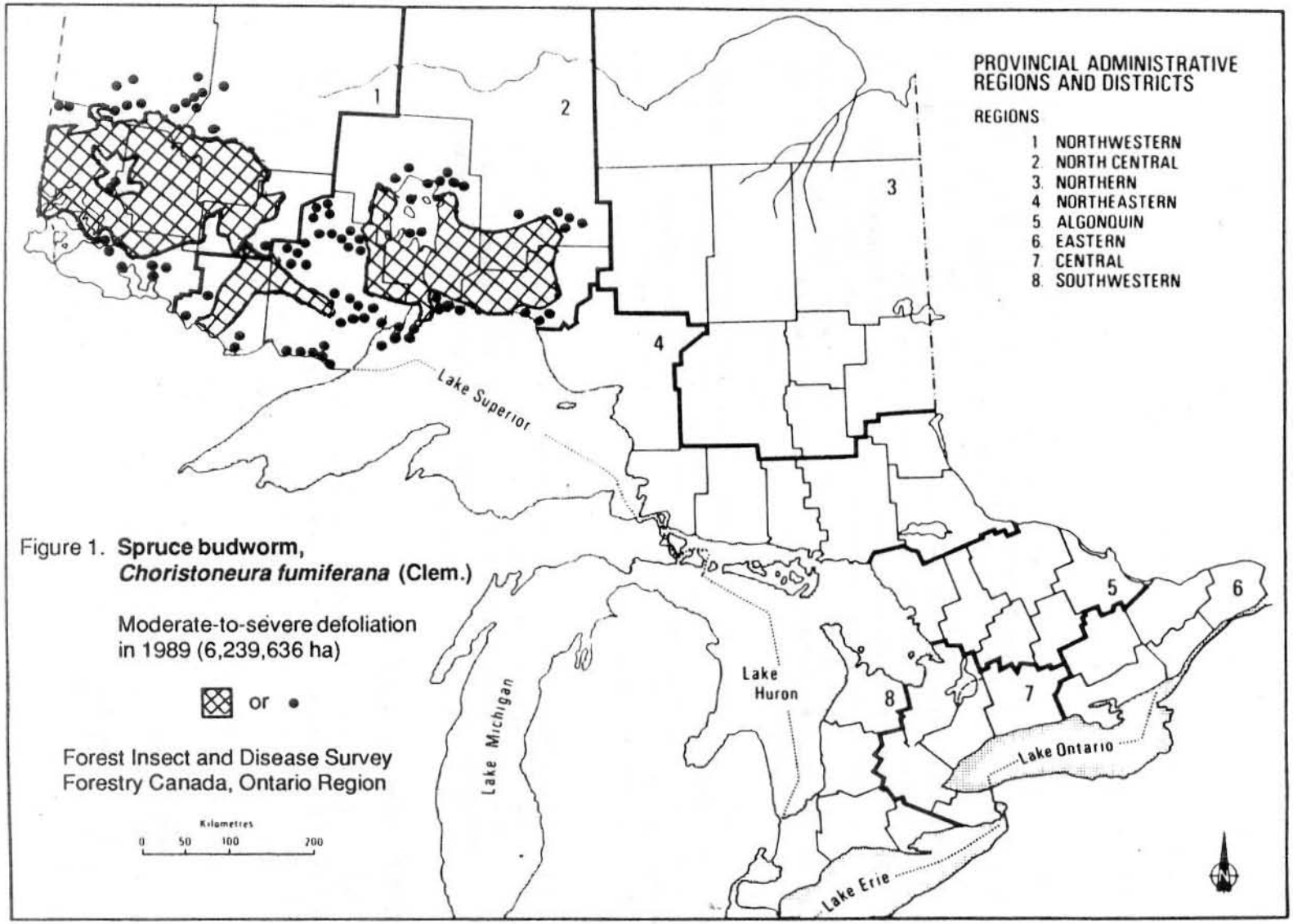
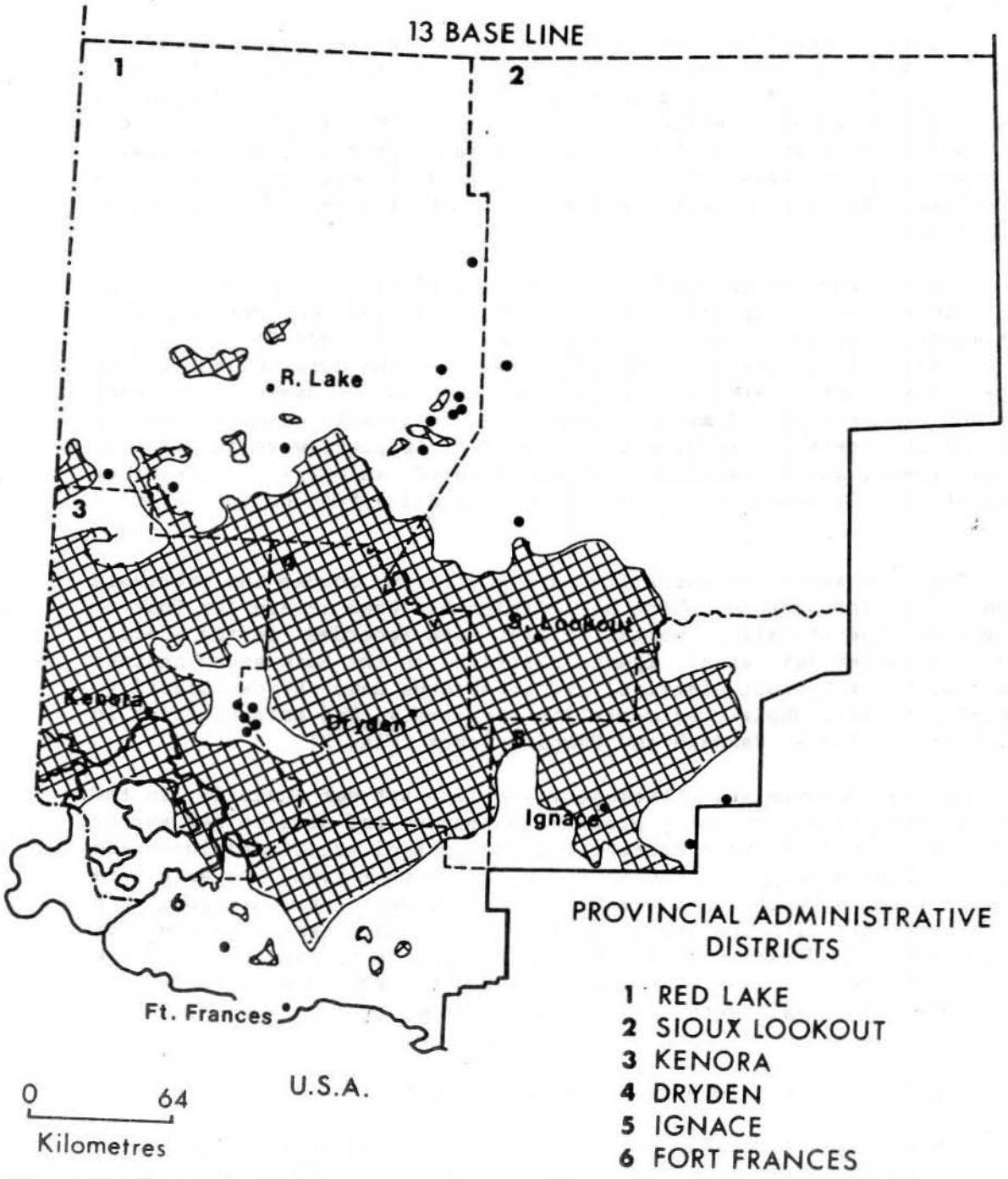


Figure 1. **Spruce budworm,**
***Choristoneura fumiferana* (Clem.)**

NORTHWESTERN REGION



Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Figure 2. **Spruce budworm, *Choristoneura fumiferana* (Clem.)**
Areas within which moderate-to-severe defoliation occurred in 1989
⊠ or •

festation intensified in many areas across this northern band that were previously mapped as moderately (25-75%) defoliated, and in 1989 were classified as severely (>75%) defoliated.

Egg-mass sampling for the purpose of forecasting defoliation levels in 1990 was conducted at 129 locations in the region. The locations and results are listed in Appendix Table A1. Table 2 compares spruce budworm egg-mass densities in 1988 and 1989. In all, 129 locations were sampled in 1989, 116 of which were sampled in 1988. Comparisons revealed a decrease of 3% in the density of egg masses per 9.29 m^2 of foliage; however, severe defoliation is still forecasted for 83% of the locations.

Spruce budworm-induced whole-tree mortality has occurred in the region since 1977. In 1989, an additional 138,935 ha were aerially sketch-mapped, bringing the regional total to some 624,947 ha within which mortality is occurring. Table 3 summarizes the data collected from 18 mortality plots scattered throughout the area of damage. At each site, 100 dominant or codominant trees were physically examined and the health of the trees was recorded. Ten of the 18 plots were in place in previous years, and comparison of these revealed an overall increase of approximately 20% (range 6 to 43%) in the mortality rate on the selected sites.

The new areas of mortality are scattered across the northern portion of the infestation, where defoliation has been severe for four or five years. Specifically, mortality has been recorded in the Cecil, Kukukus and Basket lake areas, Ignace District, in the Amik and Minnitaki lake areas, Sioux Lookout District, and at Aerobus Lake, Dryden District. For the first time, whole-tree mortality occurred in Red Lake District in the vicinity of Bruce, Pakwash and Camping lakes (Fig. 3).

Spruce budworm sex pheromone traps are set out annually in the region as part of a continuing program to improve and develop new survey methodology. In 1989 two different formulations of artificial lure were tested at 12 sites with the nonsaturating Multi-pher trap. At each site three traps baited with the standard PVC lure were set out along with three traps baited with the new Biolure. The two different trap clusters were at least 100 m apart. An attempt is being made to calibrate the new Biolure with the PVC lure. On the average the PVC lure attracted 3.5 times as many adult male moths as did the Biolure.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

There was a marked decrease in the total area within which moderate-to-severe defoliation of jack pine (*Pinus banksiana* Lamb.) occurred in 1989. The infested area declined by some 66% to approximately 248,311 ha. A large proportion of the decline was due to wildfires in August of 1988 and in the early summer of 1989 east of Pikangikum Lake and north of the Berens River in the Red Lake District.

NORTHWESTERN REGION

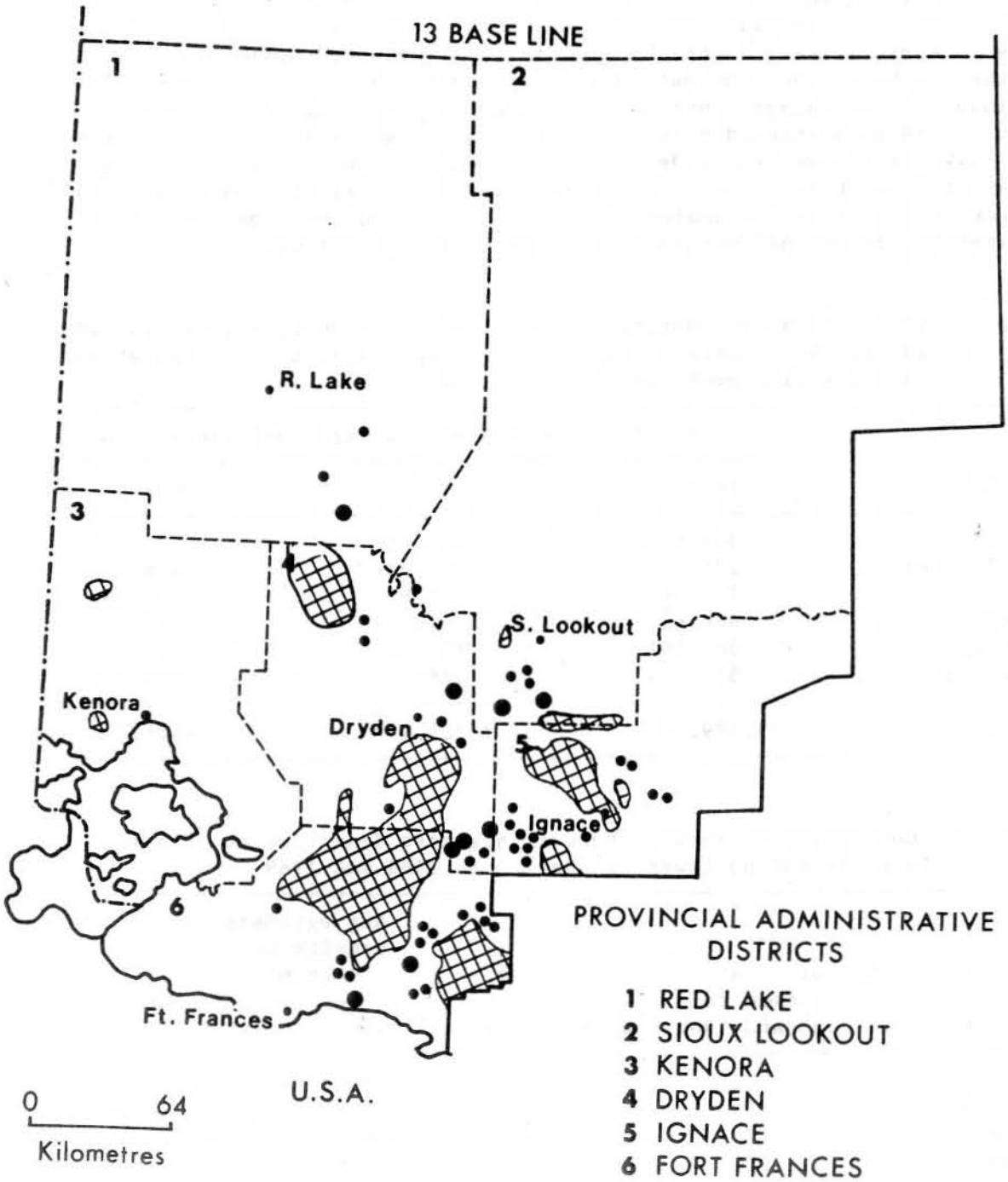


Figure 3. **Spruce budworm, *Choristoneura fumiferana* (Clem.)**
Areas within which whole-tree mortality occurred in 1989
or

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

The largest area of damage (165,716 ha) occurred for the sixth consecutive year in the northern reaches of Red Lake District. This large pocket extended south from the Berens River to Nungesser Lake and from Goose Lake westward to Kirkness Lake (Fig. 4). A second large pocket, approximately 37,682 ha in size, was detected north of Lac Seul on the Red Lake-Sioux Lookout district boundary at Aerofoil Lake. The remainder of the damage consisted of 10 pockets ranging in size from 170 ha to 12,039 ha scattered between the two larger areas and extending from Gull Lake on the western side of Sioux Lookout District to the western shore of Trout Lake in Red Lake District. The total area defoliated in Red Lake District was estimated to be 212,265 ha and the remainder of the infestation, 36,046 ha, occurred in Sioux Lookout District.

Table 1. Total area of moderate-to-severe defoliation by spruce budworm in the Northwestern Region in 1988 and 1989, and the change in each district over the previous year

	Area of moderate-to-severe defoliation (ha)		
District	1988	1989	Change
Dryden	907,685	902,750	-4,935
Fort Frances	275,817	199,084	-76,733
Ignace	512,961	419,620	-93,341
Kenora	886,627	897,779	+11,152
Red Lake	266,361	199,054	-67,307
Sioux Lookout	504,334	586,772	+46,438
Total	3,389,785	3,205,059	-184,726

Table 2. Comparison of spruce budworm egg-mass densities at 116 locations in the Northwestern Region in 1988 and 1989

District	No. of locations common to 1988 and 1989	No. of locations with increases	Avg egg-mass density per 9.29 m²		Change (%)
			1988	1989	
Dryden	20	9	431.4	542.9	+26
Fort Frances	16	11	123.8	195.9	+58
Ignace	17	7	275.6	257.9	-6
Kenora	22	11	378.8	348.7	-8
Red Lake	21	8	460.3	326.5	-29
Sioux Lookout	20	8	327.0	286.4	-12
Over all	116	54	343.4	333.0	-3

NORTHWESTERN REGION

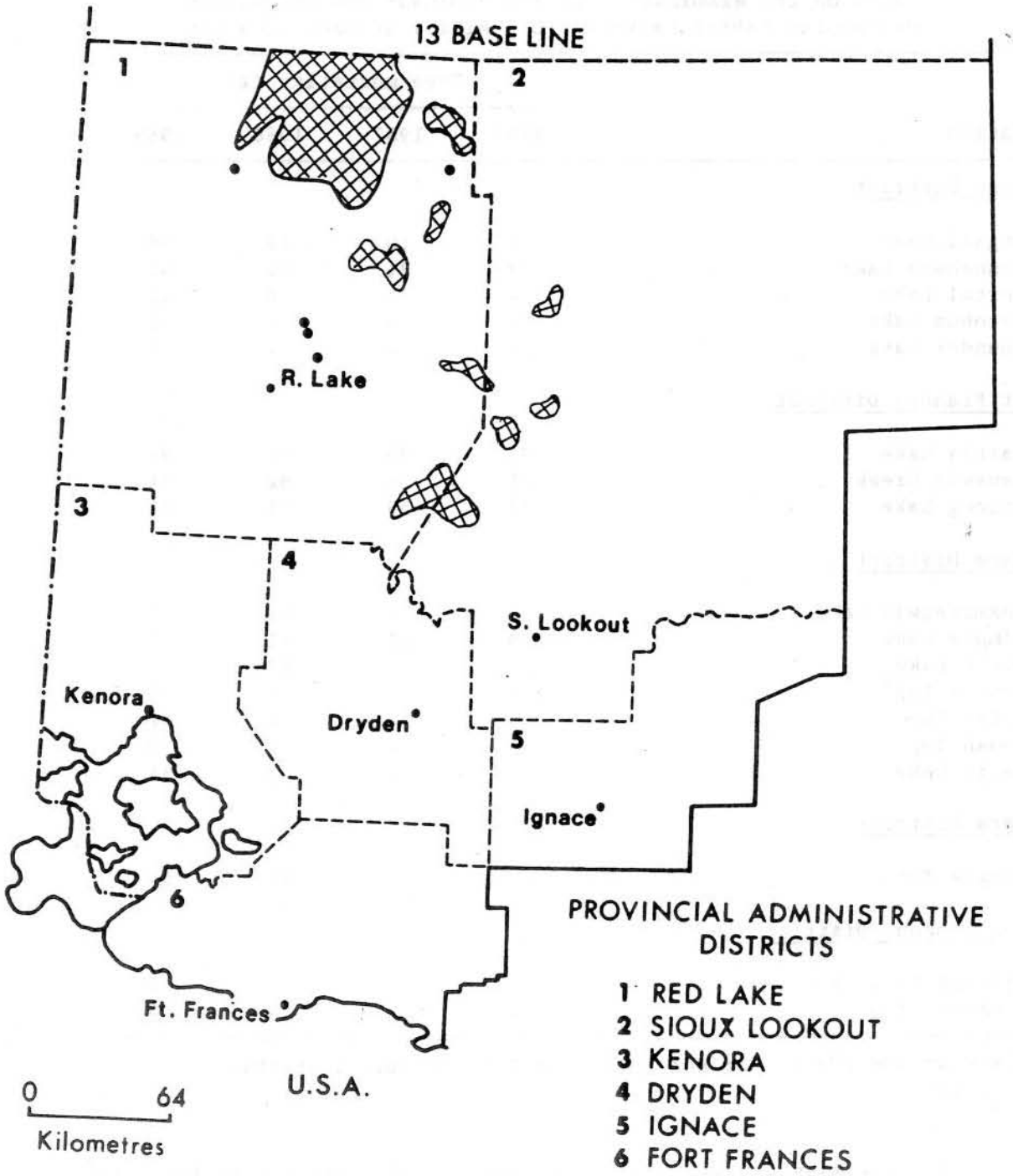


Figure 4. **Jack pine budworm, *Choristoneura pinus pinus* Free.** Areas within which moderate-to-severe defoliation occurred in 1989 ⊠ or •

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Table 3. Summary of data collected from 18 spruce budworm mortality plots in the Northwestern Region from 1986 to 1989 (counts based on the examination of 100 dominant and codominant balsam fir (*Abies balsamea* [L.] Mill.) at each location)

Location	Tree mortality (%)			
	1986	1987	1988	1989
Dryden District				
Ingall Lake	6	10	13	56
Minnehaha Lake	13	31	33	42
Portal Lake	-	-	6	12
Aerobus Lake	-	-	-	13
Thunder Lake	-	-	-	2
Fort Frances District				
Harris Lake	49	55	66	94
Kawawia Creek	25	79	82	94
Strong Lake	52	59	71	85
Ignace District				
Abamategwia Lake	-	-	51	78
Dimple Lake	8	25	41	73
Pluto Lake	-	-	17	37
Revell Twp[a]	-	-	0	0
Isley Twp	-	-	-	42
Dewan Twp	-	-	-	0
Cecil Lake	-	-	-	34
Kenora District				
Forgie Twp	-	-	37	54
Sioux Lookout District				
Ojibway Prov. Pk	-	-	-	1
Pickerel Twp	-	-	-	0

[a] black spruce (*Picea mariana* [Mill.] B.S.P.) examined at this location

An egg-mass survey for the purpose of forecasting the next season's defoliation levels was conducted at 50 locations in the region. The locations and results of this survey are listed in Appendix Table A2. Table 4 compares the egg-mass densities in 1988 and 1989. A total of 43 locations, of which 29 were in Red Lake and Sioux Lookout districts, were common to the two years and could be compared. There was a marked de-

crease in the number of egg masses per 61-cm branch tip. Over all, moderate levels of defoliation are forecasted for Red Lake District and light levels for Sioux Lookout District.

Whole-tree mortality and dead, bare tops of jack pine were observed throughout most of the areas of infestation in Red Lake and Sioux Lookout districts. It was estimated that fewer than 10% of the tree in these areas were damaged. A 100-tree count was completed at the location that appeared to be the most heavily damaged, north of Stormer Lake on the Nungesser Lake Road in Red Lake District. It was determined that 62% of the trees were alive, 28% had dead, bare tops and 10% were completely dead. In 1988, the same area was checked and revealed slightly lower damage figures: 21% had dead, bare tops and 9% were dead. In the Norway Lake area of Kenora District, a similar plot was retallied in an area free of defoliation by this pest for two consecutive years. The tally revealed no change from 1988 in the number of living trees; however, three of the nine trees that had dead tops have now died, bringing the total number of dead trees to 18.

Table 4. Comparison of jack pine budworm egg-mass densities at 43 locations in the Northwestern Region in 1988 and 1989.

District	No. of locations common to 1988 and 1989	No. of locations with increases	Avg egg-mass density per 61-cm branch tip		Change (%)
			1988	1989	
Dryden	6	0	1.3	0.0	-1
Fort Frances	2	0	1.0	0.0	-1
Ignace	2	0	0.0	0.0	0
Kenora	4	0	0.5	0.0	-1
Red Lake	19	1	12.0	3.8	-68
Sioux Lookout	10	2	6.6	1.2	-82
Overall	43	3	7.2	2.0	-72

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Aerial surveys conducted throughout the region revealed that the forest tent caterpillar infestation of 1988 (reported at 272,985 ha) had expanded to encompass 2,180,118 ha in 1989. Defoliation at moderate-to-severe levels was mapped in four districts (Fig. 5), exclusively on trembling aspen (*Populus tremuloides* Michx.).

The largest area of moderate-to-severe defoliation mapped was in Fort Frances District (1,048,876 ha), where virtually the entire trembling aspen component was attacked.

NORTHWESTERN REGION

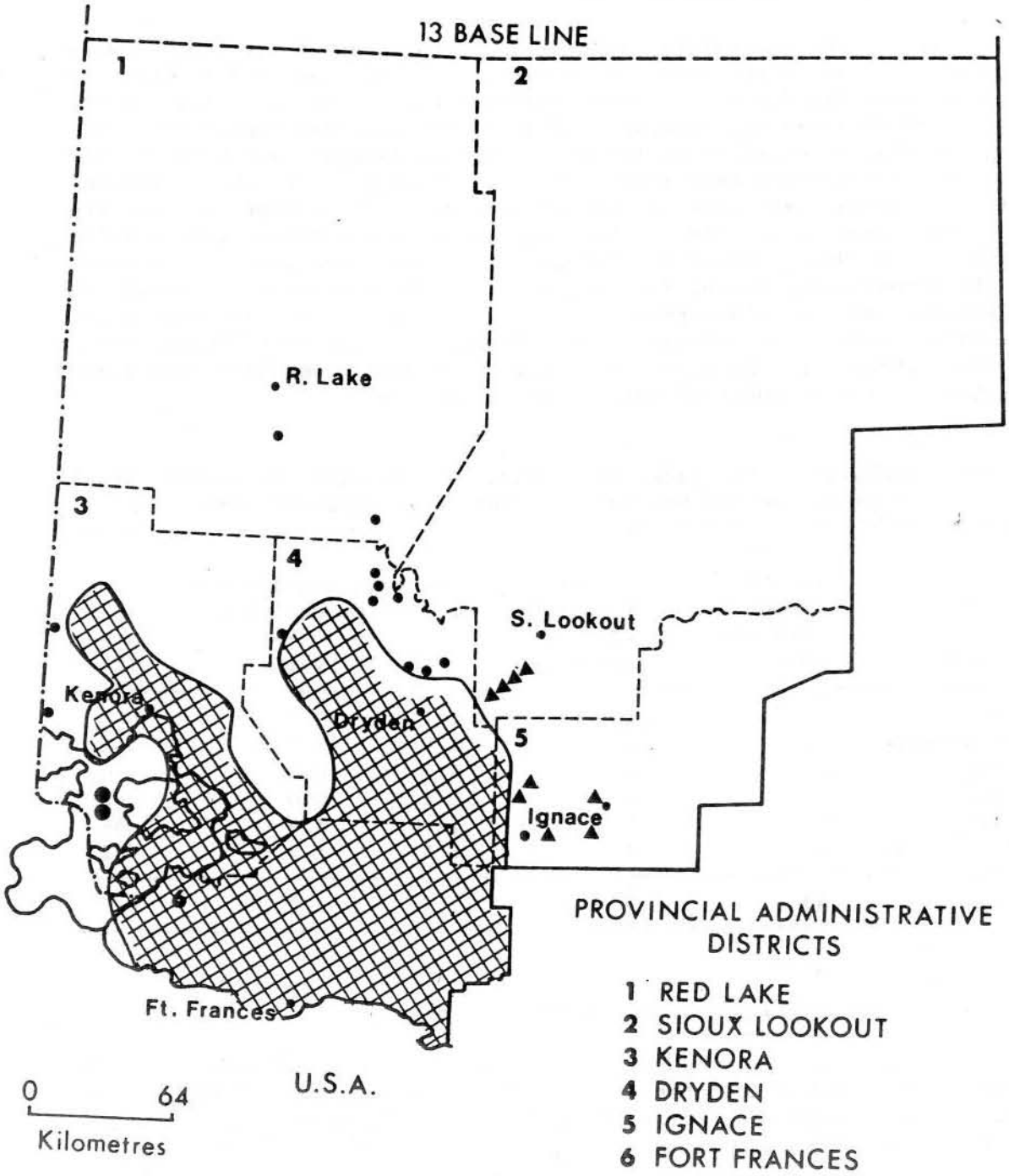


Figure 5. **Forest tent caterpillar, *Malacosoma disstria* Hbn.** Areas within which defoliation occurred in 1989

Moderate-to-severe .... ⊠ or ● ●
Light ..... ▲

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Surveys across Dryden District disclosed a total of 564,902 ha of moderate-to-severe defoliation (up dramatically from 610 ha in the previous year). This infestation was located largely in the southern half of the district, with a northerly extension terminating at Cliff Lake. A few scattered pockets of severe defoliation (>75%) were noted as far north as Perrault Falls.

Significant increases in the area of moderate-to-severe defoliation were also noted in Kenora District. The total area affected was 533,487 ha (up from 15,070 ha in 1988). Across the district, defoliation was aerially mapped in a wide swath running roughly northwest from Nestor Falls in the south to Umfreville Lake in the north. Falcon Island on Lake of the Woods had the only significant pocket of moderate-to-severe (26-75%) defoliation outside of the main infestation.

A narrow band of moderate-to-severe defoliation totalling 12,403 ha was mapped along the western border of Ignace District. This infestation extended from Borups Corners on Highway 17 south to Stormy and Bending lakes. Small numbers of larvae with accompanying low levels of defoliation (6-25%) were discovered at numerous widely scattered locations across the balance of this district.

Low defoliation levels were documented along Highway 72 and in the town of Sioux Lookout in Sioux Lookout District. Similar defoliation levels were noted in the town of Red Lake and along Highway 804 in Red Lake District.

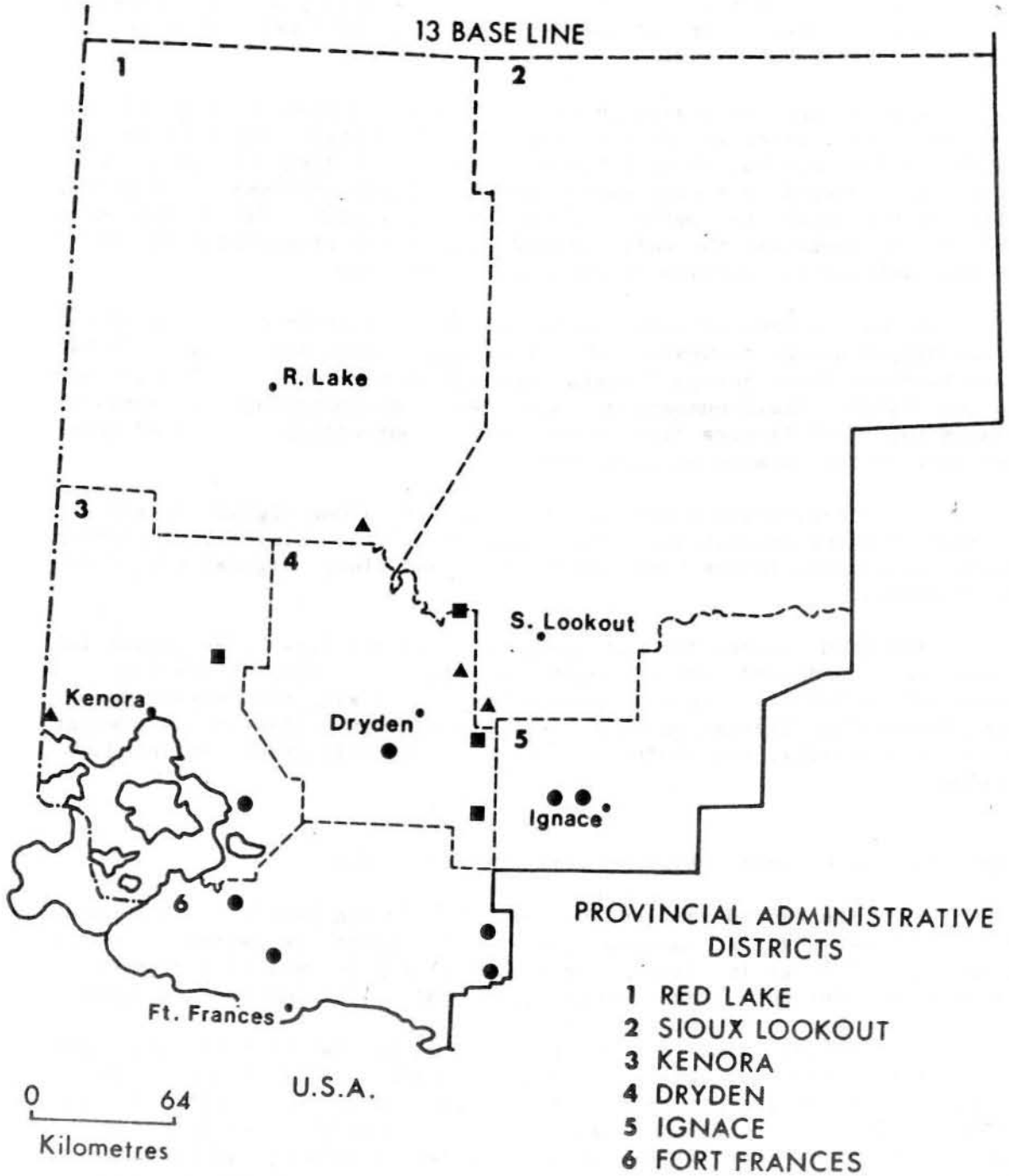
Egg-band counts for the purpose of forecasting 1990 population levels were conducted at 16 locations (Fig. 6). This information is summarized in Table 5. On the basis of this forecast, the current forest tent caterpillar infestation will likely persist into 1990 at its present level of intensity, and there is a distinct possibility of continued expansion.

Aspen Leafblotch Miner, *Phyllonorycter ontario* (Free.)

For the second consecutive year, population levels of this aspen pest have been high at numerous places throughout the region. Severe browning of foliage in late July and early August was most evident on roadside or understory trees, where often >75% of the leaves were mined.

The largest area of damage occurred on mature trembling aspen north of the town of Ignace, along the Paguchi Lake road, in Ignace District. The entire crowns of the 18-m-tall aspen were affected from Sandbox Lake north to Paguchi Lake. Along the Basket Lake Road, 5- to 7-m-tall roadside trees were similarly affected between Highway 17 and the Canadian Pacific Railroad tracks. Heavy defoliation was noted on 5- to 10-m-tall trees in the Encamp-Savoy lakes area at the east end of Ignace District. In Sioux Lookout and Red Lake districts, heavy foliar damage was encountered on roadside regeneration in numerous widely scattered areas (Fig. 7).

NORTHWESTERN REGION



Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Figure 6. **Forest tent caterpillar, *Malacosoma disstria* Hbn.**
Location of egg-band counts and defoliation forecasts for 1990

Severe ..... ●
Moderate ..... ■
Light ..... ▲

Table 5. Summary of forest tent caterpillar egg-band counts on trembling aspen at 16 locations in the Northwestern Region of Ontario in 1989 and infestation forecasts for 1990

Location	Avg DBH of sample trees (cm)	No. of egg bands	Infestation forecast for 1990
Dryden District			
Dore Lake Road	15	>10[a]	severe
McIlraith Twp	17	3	light
Melgund Twp	15	8	moderate
Pickerel Creek Hwy 105	15	1	light
Snake Bay Road	14	6	moderate
Fort Frances District			
Bennett Twp	15	>10	severe
Caliper Twp	17	>10	severe
Dance Twp	15	>10	severe
Petite Lake	17	>10	severe
Ignace District			
Pinafore Lake	15	>10	severe
Hwy 17 West of Ignace	14	>10	severe
Kenora District			
Indian Reserve No. 32	17	>10	severe
John Lake - Jones Road	17	8	moderate
Hwy 17 - Manitoba border	15	1	light
Red Lake District			
Hwy 105	15	3	light
Sioux Lookout District			
Hwy 72 - Big Sand Lake	18	>10	severe

[a] >10 implies that sufficient egg bands are present to ensure severe defoliation.

Low (5-15%) levels of damage were detected once again on roadside regeneration in the Centrefire Lake area, at Borups Corner and along the Snake Bay Road in Dryden District. Similar levels were recorded at the east end of Fort Frances District along the Crill Road and at Mills Creek in Bennett Township.

NORTHWESTERN REGION

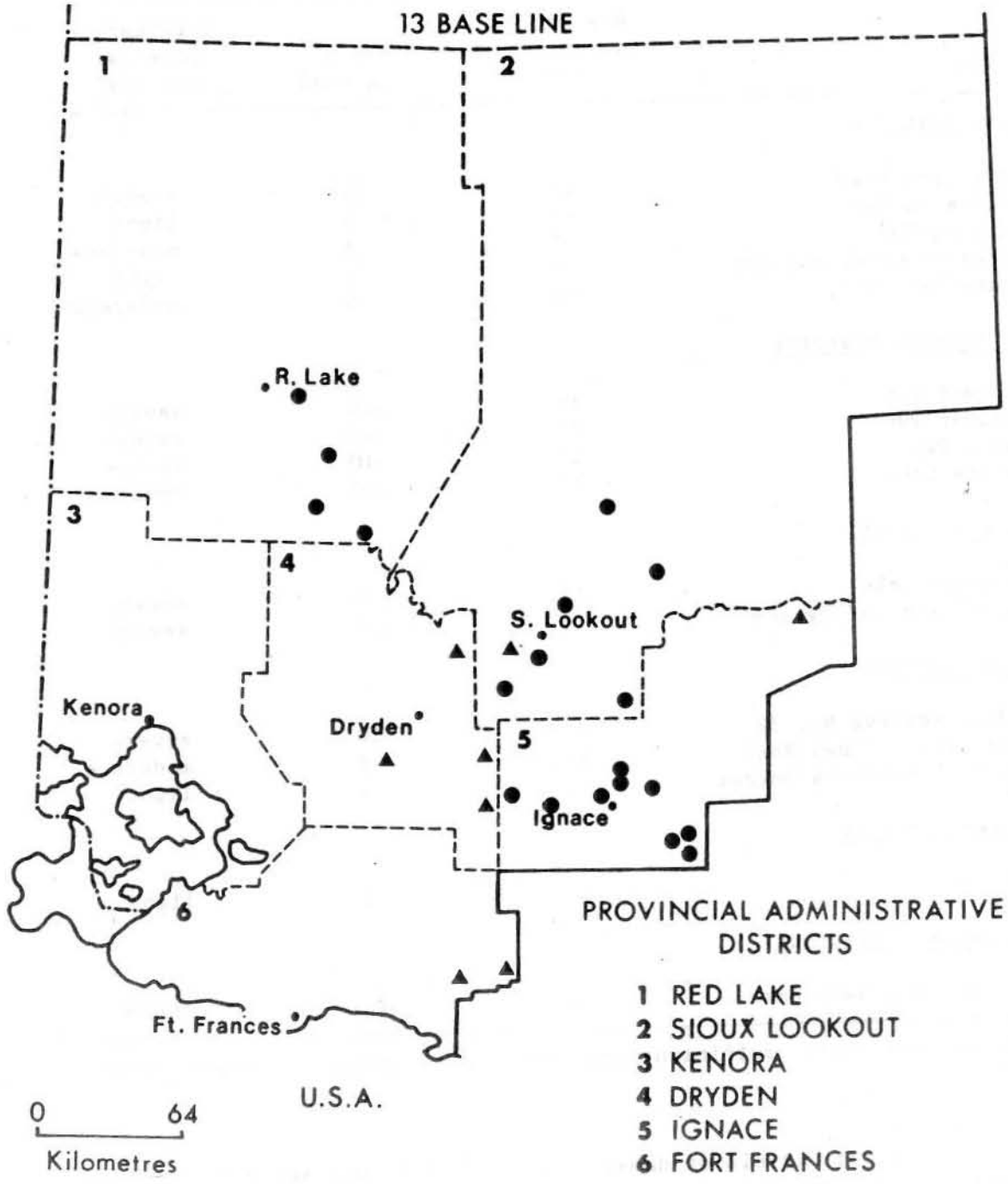


Figure 7. **Aspen leafblotch miner, *Phyllonorycter ontario* (Free.)** Areas within which defoliation occurred in 1989

Light ..... ▲
Moderate-to-severe ..... ●

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

White Pine Weevil, *Pissodes strobi* (Peck)

As was the case in 1988, only small numbers of trees were reported to have been attacked at locations surveyed across the region (Table 6).

The percentage of leaders damaged at all locations remained low (≤4%); however, there was a significant increase in the percentage of sites examined that sustained damage. A total of 80% of all sites examined in 1989 suffered some level of weevil damage in comparison with 42% reported across the region in 1988.

Simply stated, the damage level at a given site was low, but the number of sites attacked rose significantly across much of the region.

Table 6. Summary of damage caused by the white pine weevil at 15 locations in the Northwestern Region of Ontario in 1989 (counts based on the examination of 150 randomly selected jack pine trees at each location)

Location	Avg ht of trees (m)	Density (trees/ha)	Estimated area affected (ha)	Leaders attacked in 1989 (%)
Dryden District				
Snake Bay Rd, km 6	2.1	2,500	8	3
Snake Bay Rd, km 34	5.0	10,000	1	1
Snake Bay Rd, km 41	3.5	2,100	4	1
Eton Rugby Rd, km 26	2.5	1,450	9	1
Eton Rugby Rd, km 38	2.5	1,550	10	0
Fort Frances District				
Hwy 502 - Kenozhe Rd	3.0	900	2	4
Mount Rd	0.9	5,200	6	3
Manion Creek	3.0	3,900	3	1
Glengarry Rd, km 6	4.0	1,000	4	0
Kenora District				
Graphic Lake, Work Twp	2.5	1,330	2	2
Ulster Lake, Work Twp	1.9	7,500	3	1
McMeeken Twp	3.0	2,500	2	1
English River Rd	3.0	2,200	2	1
Desmond Twp	2.5	4,100	4	0
Red Lake District				
Dixie Lake Rd	2.6	5,000	15	1

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

The 1,000,000-ha infestation of this aspen pest that was reported in Red Lake District in 1988 nearly collapsed. In 1989, only 22,655 ha of moderate-to-severe defoliation, consisting of three large areas and nine scattered, smaller pockets, were aerially sketch-mapped. The largest, some 7,120 ha, was recorded along the north shore of Murdock Lake. A 5,800-ha area was mapped across the northern end of Red Lake and the third area, 5,000 ha in size, was at the northern end of Little Vermilion Lake. The remaining areas, ranging in size from 220 to 1,560 ha, were scattered from Camping Lake in the south to Hornblendite Lake in the north (Fig. 8).

Defoliation levels of 10 to 20% were recorded along the Dixie Lake and Bruce Lake roads in Red Lake District. Similar levels were recorded in the area between Hudson and Vermilion Lake, in the vicinity of the town of Sioux Lookout and at Kathlyn Lake, all in the Sioux Lookout District.

Minor Insects

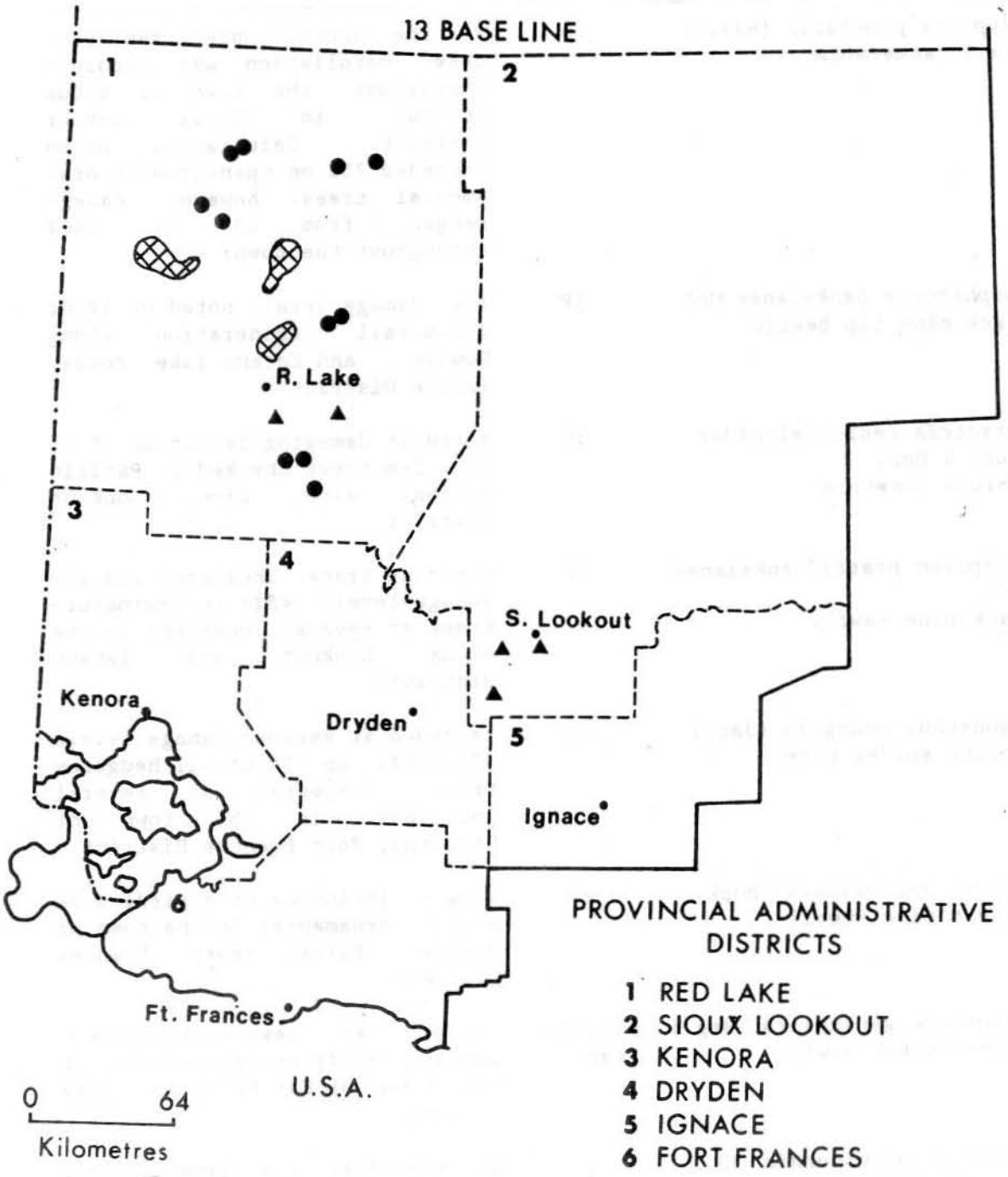
Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

New shoot damage attributed to this pest was monitored on jack pine regeneration (2-3 m tall) at eight randomly chosen locations across Fort Frances and Kenora districts. Both incidence and damage were low at all locations as is shown in Table 7.

Table 7. Summary of shoot damage at eight locations in the Northwestern Region in 1989 (counts based on the examination of 100 randomly selected jack pine trees at each location).

Location	Avg ht of trees (m)	Density (trees/ha)	Estimated area affected (ha)	Leaders attacked in 1989 (%)
Fort Frances District				
Mount Rd	0.9	5,200	6	0
Manion Creek	3.0	3,900	3	0
Glengarry Rd	4.0	1,000	4	0
Kenora District				
Ulster Lake	1.9	7,500	2.5	1
McMeeken Twp	3.0	2,500	2	0
English River Rd	3.0	2,200	2	1
Desmond Twp	2.5	4,100	4	2
Ignace District				
Furniss Twp	3.5	3,000	7	1

NORTHWESTERN REGION



Forest Insect and Disease Survey
Forestry Canada, Ontario Region

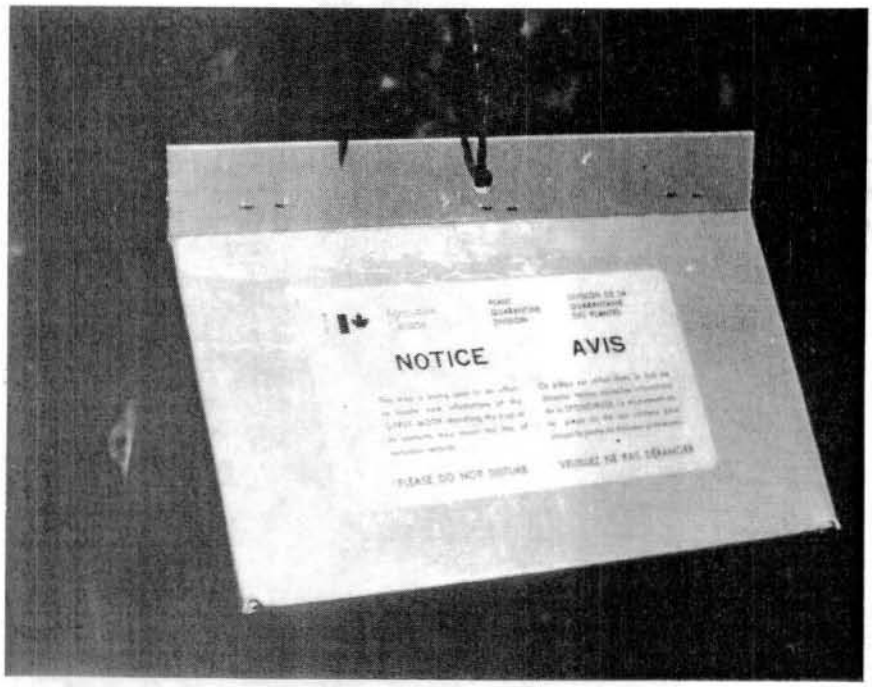
Figure 8. **Early aspen leafcurler, *Pseudexentera oregonana* (Wlsm.)**
Areas within which defoliation occurred in 1989

Light ..... ▲
Moderate-to-severe ... ⊠ or ●

Table 8. Other forest insects

Insect	Host(s)	Remarks
Alsophila pometaria (Harr.) Fall cankerworm	mM	For the second consecutive year heavy defoliation was recorded throughout the town of Sioux Lookout in Sioux Lookout District. Defoliation often exceeded 75% on open-growing ornamental trees; however, damage ranged from 10% to 100% throughout the town.
Conophthorus banksianae McP. Jack pine tip beetle	jP	low damage levels noted on 1% of 3.5-m-tall regeneration along Sowden and Encamp lake roads, Ignace District
Dioryctria reniculelloides Mut. & Mun. Spruce coneworm	bS	noted at damaging levels on 7% of all 2-m trees checked at Pacific progeny site, Sioux Lookout District
Neodiprion pratti banksianae Roh. Jack pine sawfly	jP	noted at trace incidence and low damage levels (<5%) on semimature trees at several locations in the Sioux Lookout and Ignace districts
Oligonychus ununguis (Jac.) Spruce spider mite	wS	recorded at various damage levels (25-100%) on 25% of all hedgerow trees inspected at several locations in the town of Stratton, Fort Frances District
Pissodes approximatus Hopk. Northern pine weevil	wP	single incidence of a girdled 3-m-tall ornamental in the town of Nestor Falls, Fort Frances District
Pristophora geniculata (Htg.) Mountain-ash sawfly	mountain ash	noted at severe defoliation levels (>75%) on ornamentals in the towns of Ear Falls and Sioux Lookout
Toumeyella parvicornis (Ckll.) Pine tortoise scale	jP	documented at low damage levels (<10%) on scattered individuals at various locations in Ignace and Red Lake districts

Mortality of balsam fir (*Abies balsamea* [L.] Mill.) caused by the spruce budworm, *Choristoneura fumiferana* (Clem.)



Gypsy moth pheromone trap

Diplodia tip blight, *Septoria betulae-odoratae* Bubák & Vleugal, on black spruce (*Picea mariana* [Mill.] B.S.P.)

Frost damage on young, open-grown white spruce (*Picea glauca* [Moench] Voss) tree. Note dead, drooping tips.

TREE DISEASES

Major Diseases

Balsam Poplar Leaf Diseases, *Mycosphaerella populicola* G.E. Thompson, *M. populorum* G.E. Thompson, and *Linospora tetraspora* G.E. Thompson

For the third consecutive year, balsam poplar (*Populus balsamifera* L.) trees were severely affected by one or more of these leaf diseases. Host trees of all age classes were affected, with defoliation levels often exceeding 75%. The heaviest damage occurred throughout Red Lake and Sioux Lookout districts and in the southeastern portion of Ignace District, wherever the host species occurred.

In the southern portion of the region, the incidence level of leaf diseases was high; however, the level of damage was usually <25%. Leaf drop in all areas was evident by late August, and in the areas most severely affected entire stands were denuded by mid-September.

Leaf Blight, *Septoria betulae-odoratae* Bubák & Vleugel

White birch (*Betula papyrifera* Marsh.) growing on dry gravel sites along the Nungesser and Dixie Lake roads in Red Lake District were affected by this leaf blight. Approximately 35% of the crowns of this 2- to 4-m-tall natural regeneration were discolored or experienced premature leaf drop. Similar damage levels were encountered on 8- to 10-m-tall trees south of Encamp Lake in Ignace District.

Lower levels of damage, usually 5-10%, were observed along the Basket Lake road in Ignace District, and along Highway 72 and the Marchington Lake road in Sioux Lookout District.

Minor Diseases

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

The native race of this fungus was recovered from 1- to 2-m-tall natural regeneration on an old fire site along Highway 599 south of Lake St. Joseph in Sioux Lookout District. Low damage levels were noted on 2% of the 50 trees examined.

Table 9. Other forest diseases

Disease	Host(s)	Remarks
Ciborinia whetzelii (Seaver) Seaver Ink spot of aspen	tA	moderate foliar damage (30%) noted on all 1- to 2-m-tall regeneration surveyed at a single location on Hwy 105, Red Lake District
Venturia macularis (Fr.) E. Müller & v. Arx Shoot blight	tA	shoot damage in excess of 80% noted on regeneration south of Encamp Lake in Ignace District and at a single location along Hwy 105, Red Lake District

ABIOTIC DAMAGE

Drought

Drought damage became evident at several locations across the work area by late July or early August. It was noted exclusively on shallow soils overlying high rocky sites. Pin cherry (*Prunus pensylvanica* L.f.) and white birch were the most frequently damaged hosts.

Two large areas of drought damage were noted at the western end of Ignace District. The first, approximately 2 km², was centered in the southwestern corner of Basket Lake. The second, in which trembling aspen appeared to be the primary host damaged, was approximately 1 km², and was situated immediately south of Oval Lake.

Severe desiccation (>75%) of 1- to 2-m-tall white birch and pin cherry was evident on rock outcrops bordering Highway 71 south from its intersection with Highway 17 as far down as the town of Sioux Narrows in Kenora District.

Winter Drying

Red pine (*Pinus resinosa* Ait.) ornamentals scattered across the eastern portion of the town of Kenora sustained low-to-moderate levels (25%-75%) of foliar desiccation. An urban survey revealed that 85% of all ornamentals (in all age classes) sustained some degree of foliar damage.

No doubt the lack of rain (25.2 mm less than average) experienced throughout the month of September, 1988 predisposed many red pines to winter drying.

SPECIAL SURVEYS

Black Spruce Plantations

The 1989 high-value plantation survey was conducted in 12 randomly selected black spruce plantations or stands. At each location a standard 150-tree evaluation was conducted in mid-June and again in late July for specific insects and diseases. Tables 10(a) and (b) summarize the data collected during this survey. (See also Fig. 9.)

During the first visit, spruce budworm was encountered at eight of the sites, infesting an average of 84% of the trees (range 47% to 100%). The spruce coneworm was recorded at only one site on 7% of the trees. Frost damage was detected at four sites on an average of 79% of the trees, causing 4% mortality of new shoots. Eastern dwarf mistletoe, *Arceuthobium pusillum* Peck, and spruce broom rust, *Chrysomyxa arctostaphyla* Diet., were included in this survey but were not detected at any of the sites.

During the second visit, total defoliation caused by spruce budworm and spruce coneworm was recorded. Damage averaged 10% (range of 1-60%) on the trees affected. The highest level, 60%, was recorded in a seed production area on 6.9-m-tall trees in McAree Township, Sioux Lookout District. Damage to elongating shoots caused by the whitespotted sawyer, *Monochamus scutellatus* (Say), was found at one location in Red Lake District, where 4% of the 0.8-m-tall trees sustained 1% damage. The white pine weevil was detected at five sites, attacking an average of 7% (range of 1-19%) of the leaders at each site. Armillaria root rot was detected at low levels (1-2%) at four locations. The Spruce needle rust (*Chrysomyxa ledi* [Alb. & Schwein] de Bary var. *ledicola* [Peck] Lagerh.) was detected at four locations as well; the incidence level ranged from a low of 1% (causing 1% defoliation) in Zealand Township, Dryden District to a high of 94% (causing 10% defoliation) in Furniss Township, Ignace District. An average of 1% current mortality was noted at four locations, all of it caused by Armillaria root rot, and stand openings were recorded at five of the 12 sites examined.

The yellowheaded spruce sawfly, *Pikonema alaskensis* (Roh.), was searched for but not detected during this second visit.

This was the fourth time that black spruce was the target species in the high-value plantation survey. The results of this year's survey are very similar to those of the two preceding years. The same pests, causing approximately the same levels of damage, were detected during each survey. In 1983 the yellowheaded spruce sawfly was also found at seven of the locations, where it was causing approximately 5% defoliation. In 1980 no insect damage was recorded at any of the 12 sites; Armillaria root rot was found at only two locations causing trace damage (<1%), and needle rust was found at one site affecting 12% of the trees. Low levels of frost damage were recorded at three locations.

NORTHWESTERN REGION

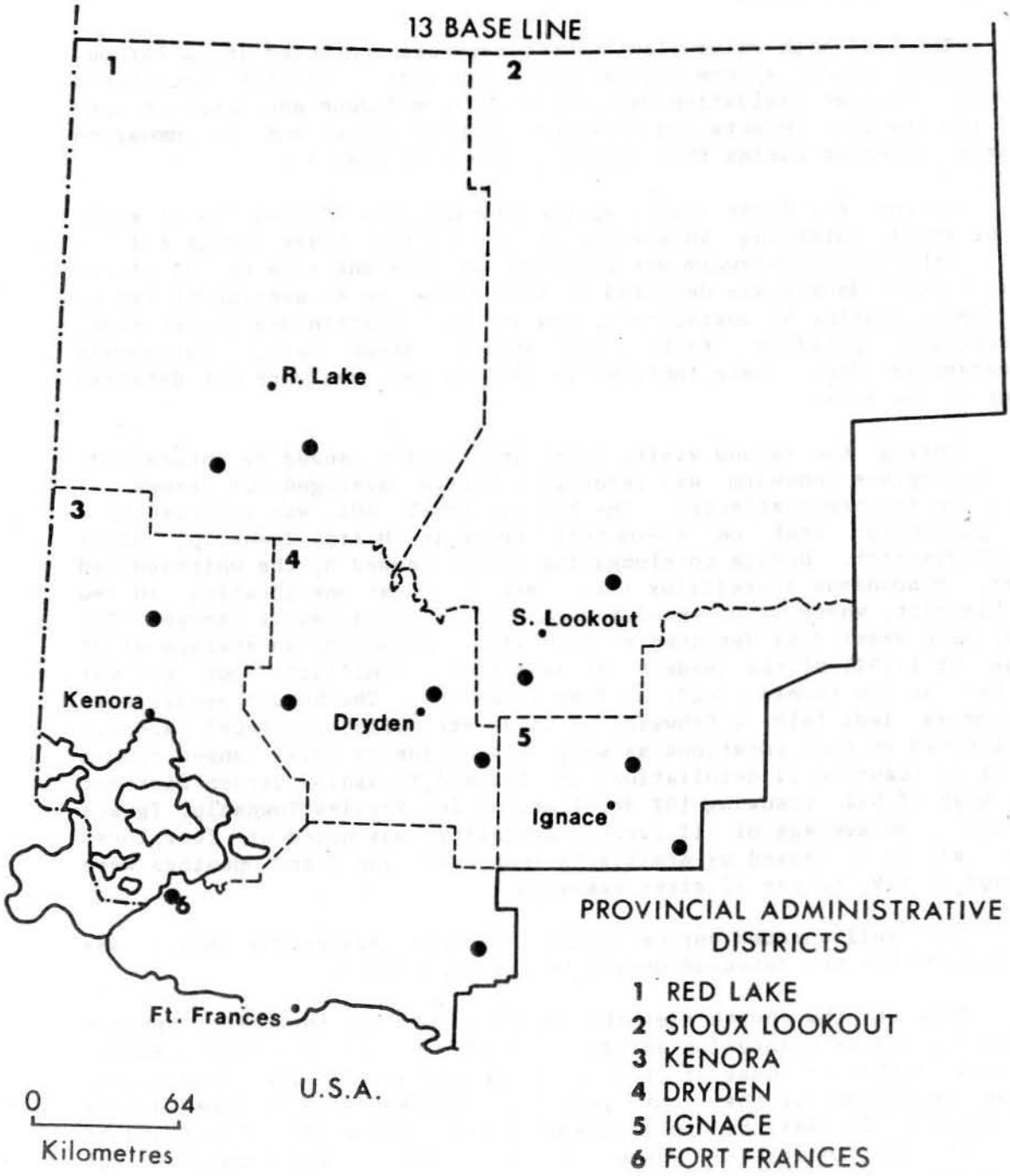


Figure 9. **Black Spruce Plantation Survey**
Location of areas examined in 1989 ..... ●

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Table 10(a). Summary of the results of a black spruce plantation survey conducted at 12 randomly selected locations in the Northwestern Region in 1989 (counts based on the examination of 150 trees at each location).

District (Location)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Spruce budworm	Spruce coneworm	Defoliation by spruce budworm and spruce coneworm (%)	White spotted sawyer		White pine weevil
				Infested trees (%)	Infested trees (%)		Infested trees (%)	Avg defoliation per tree (%)	Leaders attacked (%)
Dryden District									
Melgund Twp	5	3,000	1.9	0	0	0	0	0	6
Zealand Twp	15	1,600	13.0	90	0	10	0	0	0
Docker Twp	7	1,700	16.5	75	0	6	0	0	0
Fort Frances District									
Morson Twp	5	2,750	1.6	0	0	0	0	0	0
Manion Lake	5	3,200	1.7	0	0	0	0	0	6
Ignace District									
Hwy 599	10	1,200	1.5	98	0	1	0	0	1
Furniss Twp	10	4,000	2.0	47	0	1	0	0	19
Kenora District									
Minnesabik Lake	5	3,100	2.1	0	0	0	0	0	0
Red Lake District									
Hwy 105	7	1,100	5.0	100	0	4	0	0	0
Longlegged Lake Rd	20	2,000	0.8	91	0	1	4	1	0
Sioux Lookout District									
Pacific Lake	12	1,200	1.4	74	7	1	0	0	2
Hwy 72	10	2,200	6.9	100	0	60	0	0	0

Table 10(b). Summary of the results of a black spruce plantation survey conducted at 12 randomly selected locations in the Northwestern Region in 1989 (counts based on the examination of 150 trees at each location)

District (Location)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Frost		Armillaria root rot	Spruce needle rust		Current mortality (%)	Total no. of stand openings
				Trees affected (%)	Foliar damage (%)	Trees affected (%)	Trees affected (%)	Foliar damage (%)		
Dryden District										
Melgund Twp	5	3,000	1.9	0	0	0	0	0	0	0
Zealand Twp	15	1,600	13.0	0	0	2	1	1	2	0
Docker Twp	7	1,700	16.5	0	0	0	0	0	0	0
Fort Frances District										
Morson Twp	5	2,750	1.6	0	0	0	0	0	0	0
Manion Lake	5	3,200	1.7	0	0	0	0	0	0	0
Ignace District										
Hwy 599	10	1,200	1.5	97	2	1	91	1	1	9
Furnias Twp	10	4,000	2.0	98	2	1	94	10	1	1
Kenora District										
Minnesabik Lake	5	3,100	2.1	0	0	1	0	0	1	0
Red Lake District										
Hwy 105	7	1,100	5.0	100	10	0	0	0	0	7
Longlegged Lake Rd	20	2,000	0.8	0	0	0	0	0	0	7
Sioux Lookout District										
Pacific Lake	12	1,200	1.4	21	2	0	51	1	0	3
Hwy 72	10	2,200	6.9	0	0	0	0	0	0	0

Jack Pine Plots

The year 1982 marked the beginning of an annual jack pine survey at four locations in the region. The purpose of the survey was to monitor the incidence of forest pests and the subsequent commercial value of the 1,000 plot trees. To date, these plots have been monitored annually except in 1986 and 1987. When the plots were retallied in 1988 not all of the original plot trees could be located; therefore, "new" trees were measured as replacements. The number of replacement trees varied from plot to plot, i.e., in the Ignace District plot, 3% of the trees were replaced, in the Sioux Lookout District plot, 5% were replaced and in the Kenora District plot, 29% were replaced. The Dryden District plot could not be located at all because the numbered tags had been removed from the trees; therefore, 250 "new" trees were measured. This should be kept in mind when one compares the annual incidence of pests and, especially, mortality on the plots.

Throughout the survey the plot trees were evaluated on the basis of whether or not each could be considered a future crop tree. Trees were considered to be culls if the main stem was distorted more than 5 cm, if it was multiple-leadered or if it was severely galled. In 1989 it was concluded that 2.8% of the trees in the Dryden District plot were culls, as were 9.9% in the Kenora District plot, 12.4% in the Sioux Lookout District plot and 32.9% in the Ignace District plot. Except in the Kenora District plot, the majority of trees were culled because of damage attributed to the western gall rust.

Tables 11(a) and (b) summarize the major pests monitored in the surveys since 1982 on each of the four plots. The white pine weevil, eastern pine shoot borer and jack pine tip beetle have caused trace-to-low levels of damage during the 6-year study, whereas the western gall rust has caused low-to-moderate levels and the tar spot needle cast has caused low levels of damage. Armillaria root rot has caused low levels of damage on only two of the plots.

Sweetfern blister rust, *Cronartium comptoniae* Arthur, was detected on 14% of the tree boles in the Ignace District plot.

Table 11(a). Summary of the incidence of insect-caused damage noted in a survey conducted in sample plots in four natural jack pine stands in the Northwestern Region from 1982 to 1985 and from 1988 to 1989 (counts based on the examination of 250 trees at each location).

Location (Twp)	Estimated area of stand (ha)	Estimated no. of trees per ha	Year	Avg ht of trees (m)	White pine weevil: Trees affected (%)	Eastern pine shoot borer: Leaders attacked (%)	Jack pine tip beetle: Leaders attacked (%)	Norther pitch twig moth: Trees infested (%)	Jack pine budworm: Trees infested (%)
Dryden District									
Aubrey Twp	150	7,000	1982	1.0	0.0	4.0	2.0	6.0	0.0
			1983	1.8	0.4	1.2	0.0	2.4	0.0
			1984	2.2	0.4	2.4	0.0	0.0	0.0
			1985	2.6	1.2	3.2	0.0	0.0	4.0
			1988	3.4	0.0	3.7	0.4	0.0	8.8
			1989	5.0	0.8	1.6	0.0	0.0	0.0
Ignace District									
Furniss Twp	875	7,500	1982	1.0	0.8	3.6	0.0	5.2	0.0
			1983	1.7	4.0	2.8	0.8	0.4	0.0
			1984	2.1	6.8	1.2	2.8	0.0	0.0
			1985	2.5	5.6	0.0	0.0	0.0	0.0
			1988	3.8	0.4	3.2	2.4	0.0	35.2
			1989	4.5	0.8	0.0	0.0	0.0	0.0
Kenora District									
Broderick Twp	3,600	8,000	1982	0.9	0.0	1.2	0.8	0.4	0.0
			1983	1.7	0.0	4.0	0.0	0.4	0.0
			1984	2.2	4.8	0.0	0.0	0.0	0.0
			1985	2.4	0.8	0.0	0.0	0.0	0.0
			1988	3.6	0.4	1.6	0.0	0.0	4.0
			1989	4.0	0.0	2.4	0.0	0.0	0.0

(cont'd)

Table 11(a). Summary of the incidence of insect-caused damage noted in a survey conducted in sample plots in four natural jack pine stands in the Northwestern Region from 1982 to 1985 and from 1988 to 1989 (counts based on the examination of 250 trees at each location) (concl.).

Location (Twp)	Estimated area of stand (ha)	Estimated no. of trees per ha	Year	Avg ht of trees (m)	White pine weevil: Trees affected (%)	Eastern pine shoot borer: Leaders attacked (%)	Jack pine tip beetle: Leaders attacked (%)	Norther pitch twig moth: Trees infested (%)	Jack pine budworm: Trees infested (%)
Sioux Lookout District									
Vermilion River	100	3,000	1982	1.0	0.0	8.8	2.4	18.0	0.0
			1983	1.4	1.3	5.6	1.2	0.4	0.0
			1984	2.2	0.8	2.0	3.2	0.8	0.0
			1985	2.9	4.4	1.2	0.0	0.0	0.0
			1988	5.3	0.0	1.3	0.0	0.0	53.2
			1989	6.0	0.0	0.0	0.0	0.0	0.0

Table 11(b). Summary of the incidence of disease-caused damage noted in a survey conducted in sample plots in four natural jack pine stands in the Northwestern Region from 1982 to 1985 and from 1988 to 1989 (counts based on the examination of 250 trees at each location).

Location (Twp)	Estimated area of stand (ha)	Estimated no. of trees per ha	Year	Avg ht of trees (m)	Armillaria root rot — Trees affected (%)	Pine needle rust — Trees affected (%)	Tar spot needle cast — Trees affected (%)	Western gall rust — Trees affected (%)	Scleroderris canker — Trees affected (%)	Mortality (%)
Dryden District										
Aubrey Twp	150	7,000	1982	1.0	0.0	3.3	0.0	19.2	0.0	0.0
			1983	1.8	0.0	0.0	44.0	14.8	0.0	0.4
			1984	2.2	0.0	0.0	0.0	0.0	0.0	0.0
			1985	2.6	0.0	0.0	11.2	2.0	0.0	1.6
			1988	3.4	0.0	12.8	2.4	18.4	0.0	0.0
			1989	5.0	0.0	0.0	0.0	6.4	0.0	0.0
Ignace District										
Furniss Twp	875	7,500	1982	1.0	0.0	1.6	0.0	10.9	0.0	0.0
			1983	1.7	0.0	0.0	0.8	9.6	0.0	0.4
			1984	2.1	0.0	3.6	36.0	0.0	0.0	1.2
			1985	2.5	0.0	0.0	12.6	0.6	0.0	1.2
			1988	3.8	0.0	0.0	70.4	38.4	0.0	0.0
			1989	4.5	0.0	0.0	12.6	20.3	0.0	1.6
Kenora District										
Broderick Twp	3,600	8,000	1982	0.9	0.0	0.0	0.0	3.2	0.0	0.0
			1983	1.7	0.0	0.0	0.0	1.8	0.0	0.0
			1984	2.2	0.4	0.0	0.0	0.0	0.0	0.4
			1985	2.4	0.8	0.0	0.0	0.4	0.0	0.8
			1988	3.6	0.0	1.6	0.0	3.6	0.0	0.0
			1989	4.0	0.0	0.0	0.0	0.0	0.0	4.0

(cont'd)

Table 11(b). Summary of the incidence of disease-caused damage noted in a survey conducted in sample plots in four natural jack pine stands in the Northwestern Region from 1982 to 1985 and from 1988 to 1989 (counts based on the examination of 250 trees at each location) (concl.)

Location (Twp)	Estimated area of stand (ha)	Estimated no. of trees per ha	Year	Avg ht of trees (m)	Armillaria root rot — Trees affected (%)	Pine needle rust — Trees affected (%)	Tar spot needle cast — Trees affected (%)	Western gall rust — Trees affected (%)	Scleroderris canker — Trees affected (%)	Mortality (%)
Sioux Lookout District										
Vermilion River	100	3,000	1982	1.0	0.8	0.0	0.0	13.2	0.0	0.8
			1983	1.4	0.8	0.0	0.0	12.0	0.0	0.8
			1984	2.2	0.0	0.0	0.0	11.2	0.0	0.8
			1985	2.9	0.0	0.0	4.0	17.2	0.0	1.2
			1988	5.3	0.0	0.0	7.6	40.0	0.0	0.0
			1989	6.0	0.0	0.0	4.0	21.6	0.0	0.0

Black Spruce Seed Orchards and Progeny Test Sites

Surveys were conducted at the 11 black spruce seedling seed orchards for any evidence of insect or disease problems. Each orchard was visited at least twice during the 1989 field season (Fig. 10).

The white pine weevil was detected in nine of the orchards, where an average of 4.7% of the main leaders (range 1-9%) were affected. Spruce budworm was found in six orchards infesting an average of 13.5% of the trees (range 5-90%) and causing only 1% defoliation. Spruce budworm will feed heavily on the flowers of black spruce each spring, causing heavy losses in seed production. Should the current spruce budworm infestation persist in the region, this pest may have a major impact on seed production in the orchards. Complete data for all major pest problems noted are presented in Table 12.

The spruce bark beetle, *Scolytus piceae* (Swaine), was found infesting trees that were dying or had already died as a result of infection by Armillaria root rot or Diplodia tip blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton, at both Goodie Lake North and Goodie Lake South orchards in Sioux Lookout District and Vermeersch Lake orchard in Ignace District. A wood borer, *Monochamus* sp., was also found in several dying trees at both of the Goodie Lake orchards.

Armillaria root rot was found killing 1% of the trees at seven orchards and frost damage occurred on an average of 58% of the trees at three orchards, causing 1-2% defoliation. Diplodia tip blight was found causing serious damage in the three orchards in Sioux Lookout District and at one in Ignace District. At Goodie Lake North, 26% of the trees were affected; in 80% of them, >50% of the main stem was killed. At Goodie Lake South, 4% of the trees were affected, and 93% of them were >75% dead. Similarly, at Skurban Lake, 4% of the trees were affected, and 75% of these trees sustained >50% top kill. At the Vermeersch orchard in Ignace District, 5% of the trees were affected, and 75% sustained >50% damage.

A control program was initiated in September by OMNR at the four infected orchards, and where it was apparent that damage had been caused by this blight, the damaged portion was removed, and burnt. Any trees with >50% foliar damage were removed as heavy pruning would have caused the 2.0-m-tall trees to die. The Armillaria root rot control operations continued as well, with two different treatments being tried. Any dead or dying tree was removed and the remaining trees in the clusters were treated with either the fungicide Captan at a formulation rate of 2.22 g per L of water and an application rate of 9 L of solution per tree, or a Bordeaux mixture of 537 g of lime and 537 g of copper sulfate. This mixture was either applied in a granular form or dissolved in 9 L of water. Similar treatments for Armillaria root rot were conducted in the Minnesabie and Ulster lakes seed production areas on young black spruce trees. At the Minnesabie site, Captan was used exclusively whereas the Ulster Lake site received separate treatments of both Captan and Bordeaux mixtures. Captan was the only compound used to treat trees infected with

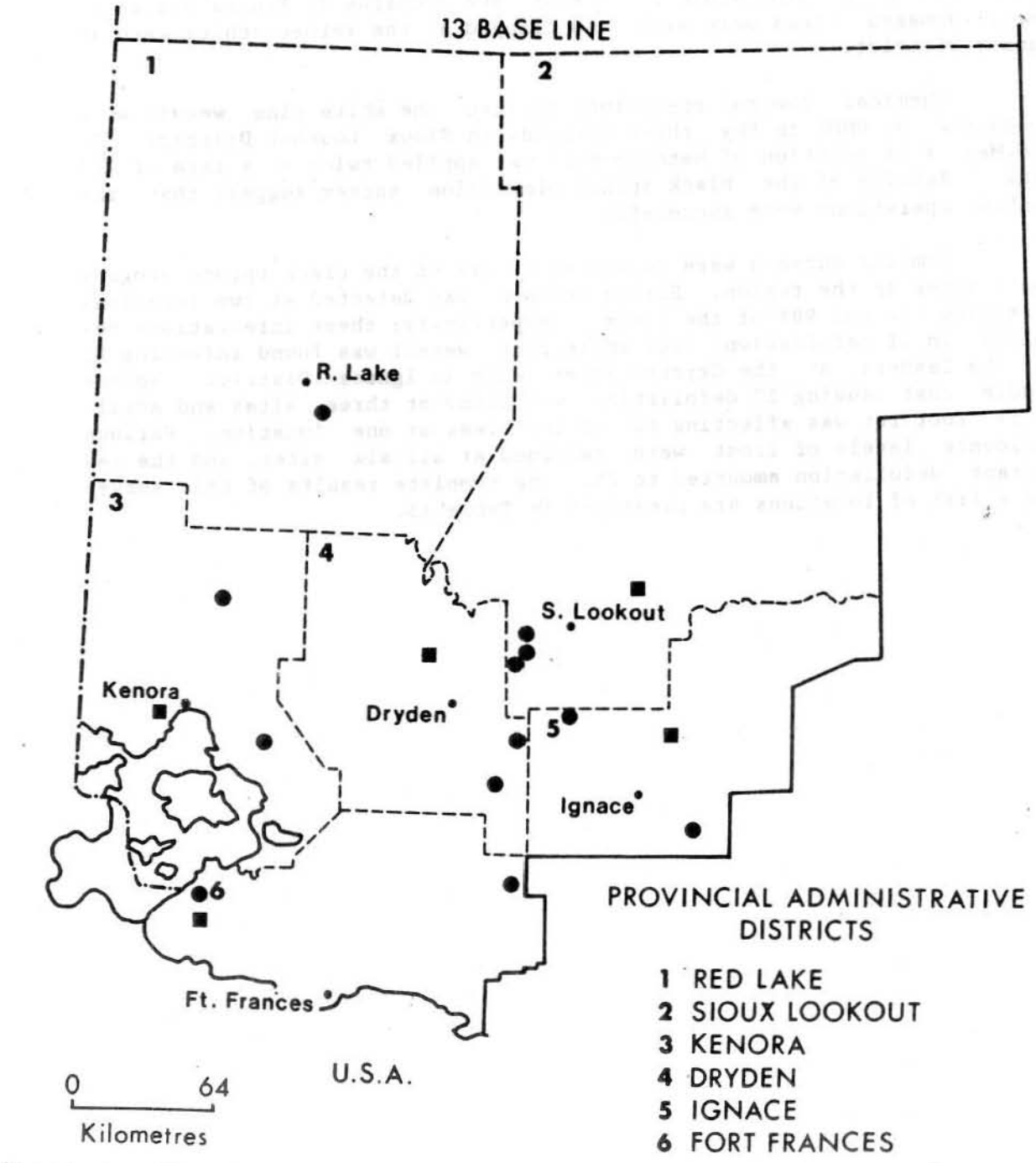


Figure 10. Location of tree improvement sites at which pest surveys were conducted in 1989

Seed orchard ..... ●
Progeny test ..... ■

Armillaria at the Melgund Township orchard in Dryden District. Damage caused by the white pine weevil (1-6%) was controlled by hand clipping at the Manion Lake and Morson Township seed orchards in Fort Frances District and at the Minnesabie and Ulster lake orchards in Kenora District. Weevil-damaged trees were also hand clipped at the Vermeersch orchard in Ignace District.

Chemical control operations against the white pine weevil were conducted by OMNR in the three orchards in Sioux Lookout District. In mid-May a 2% solution of Methoxychlor was applied twice at a rate of 165 L/ha. Results of the black spruce plantation survey suggest that the control operations were successful.

Similar surveys were conducted at six of the black spruce progeny test sites in the region. Spruce budworm was detected at two locations infesting 74 and 98% of the trees, respectively; these infestations resulted in 1% defoliation. The white pine weevil was found infesting 1% of the leaders at the Crystal River site in Ignace District. Spruce needle rust causing 1% defoliation was found at three sites and Armillaria root rot was affecting 1% of the trees at one location. Various incidence levels of frost were recorded at all six sites, and the resultant defoliation amounted to 2%. The complete results of this survey and a list of locations are presented in Table 13.

Table 12. Results of surveys conducted at the 11 black spruce seedling orchards in the Northwestern Region in 1989 (counts based on the examination of 150 or 500 randomly selected trees at each location)

District (Orchard)	Spruce budworm		White pine weevil	Armillaria root rot	Diplodia tip blight		Frost	
	Trees affected (%)	Defoliation (%)	Leaders attacked (%)	Trees affected (%)	Trees affected (%)	>50% of trees affected (%)	Trees affected (%)	Defoliation (%)
Dryden District								
Melgund	0	0	6	0	0	0	0	0
Fort Frances District								
Manion	0	0	6	0	0	0	6	1
Morson	0	0	4	0	0	0	0	0
Ignace District								
Ferguson	47	1	19	1	0	0	98	2
Vermeersch	10	1	3	1	5	75	70	1
Kenora District								
Minnesabik	0	0	0	1	0	0	0	0
Ulster	0	0	0	0	0	0	0	0
Red Lake District								
Beauregard	90	1	1	0	0	0	0	0
Sioux Lookout District								
Goodie Lake North	5	1	1	1	26	80	0	0
Goodie Lake South	5	1	1	1	4	93	0	0
Skurban	5	1	2	1	4	75	0	0

Table 13. Results of surveys conducted at six black spruce progeny test sites in the Northwestern Region in 1989 (counts based on the examination of 150 randomly selected trees at each site)

District Progeny site	Spruce budworm		White pine weevil	Spruce needle rust		Frost		Armillaria root rot
	Trees affected (%)	Defoliation (%)	Leaders attacked (%)	Trees affected (%)	Defoliation (%)	Trees affected (%)	Defoliation (%)	Trees affected (%)
Dryden District								
Rugby Twp	0	0	0	0	0	56	2	0
Fort Frances District								
Kawawia Cr.	0	0	0	0	0	11	2	0
Tovell Twp	0	0	0	2	1	19	2	0
Ignace District								
Crystal River	98	1	1	93	1	97	2	1
Kenora District								
Sandy Lake	0	0	0	0	0	10	2	0
Sioux Lookout District								
Pacific Lake	74	1	0	51	1	21	2	0

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

The five pinewood nematode plots that were established in the region in 1988 were retallied in 1989. Each site was selected because the pinewood nematode had been recovered there in the past from dead or dying trees. Dead and dying trees that were considered to show evidence of nematode damage were marked for identification purposes, as were 25 adjoining trees that appeared to be healthy and free of this pest. The dying and healthy trees were to be monitored to detect any outward spread of the nematodes.

Current mortality was recorded in 1989 in two of the plots; however, it was not attributed to the pinewood nematode. In the Sioux Lookout District plot the single balsam fir that died succumbed to defoliation by the spruce budworm. This plot is located where budworm damage has been severe for three years and the effect of the budworm is becoming very evident throughout the stands in the area. In the Ignace District plot, the single dead jack pine tree recorded was killed as a result of the severe wind storm experienced in the district in June of 1988.

One tree showing symptoms of damage caused by the pinewood nematode was sampled at each of the Dryden and Fort Frances district plots. Positive samples of the "r" form of this nematode were collected at these sites in 1988 and although nematodes were recovered in 1989, insufficient numbers were retrieved for the form to be identified.

No damage was recorded in 1989 in the remaining plot in Red Lake District.

Gypsy Moth Pheromone Traps

In all, nine provincial parks were surveyed across the region for the presence of adult male gypsy moths. Two traps were set out at separate locations in each park. Minaki Lodge was once again included in the annual survey. With the single exception of Blue Lake Provincial Park, Dryden District, where a single moth was recovered, all other locations proved negative for gypsy moth.

Black Spruce Seed and Cone Pests

Black spruce was the species chosen for the 1989 survey. In all, 100 green cones were collected at four different sites (two lowland and two upland) during the last week of June. Cones were collected from a minimum of three trees at a given location and were taken from a representative cross-section of the entire cone-bearing portion of the crown. Cones were submitted to Forestry Canada, Ontario Region in Sault Ste. Marie for dissection and pest identification. The results of this survey

are detailed in Table 14. Cones from upland sites were selected from seed production areas, while lowland cones were retrieved from natural stands. A brief description of the pests encountered follows the table.

Table 14. Summary of black spruce seed and cone damage at four locations in the Northwestern Region of Ontario in 1989 (100 cones examined at each site)

Location	Damaged cones (%)	Seed loss within damaged cones (%)	Principal cause of seed loss and proportion of cones attacked (%)	
Fort Frances District				
Spohn Twp[a]	27	32	*Dasineura rachiphaga*	66
			Lepidoptera	22
			Unknown	7
			Lasiomma anthracinum	5
Morson Twp[b]	8	52	Lepidoptera	63
			Lasiomma anthracinum	12
			Unknown	25
Sioux Lookout District				
Goodie Lake North[a]	28	38	Lepidoptera	64
			Unknown	25
			Lasiomma anthracinum	4
			Coleotechnites atrupictella	4
			Endopiza piceana	3
Hwy 516 and Vermilion Rd[b]	87	72	Lepidoptera	78
			Dioryctria sp.	9
			Dioryctria reniculelloides	3
			Dasineura rachiphaga	6
			Unknown	4

[a] upland site

[b] lowland site

Coleotechnites atrupictella (Dietz), spruce micro moth - This insect is usually found mining needles or buds but has been found in cones as well.

Dasineura rachiphaga Tripp, spruce cone axis midge - Larvae girdle the cone axis tissues, causing seeds to be underdeveloped and cones to fall early.

Dioryctria sp. and *Dioryctria reniculelloides* Mut. & Mun., spruce coneworms - These are significant forest pests, the larvae of which hollow out developing cones.

Endopiza piceana (Free.), spruce micro moth - Larvae of this pest are known to bore at various feeding sites, including flowers, shoots and cones.

Lasiomma anthracinum (Czerny), spruce cone maggot - Larvae of this pest tunnel in a spiral along the cone axis, causing significant seed loss.

Lepidopterous larvae - Although damage is usually confined to the exterior of the cone, causing slight deformation, it can be severe in some cases.

Acid Rain National Early Warning System

The three plots located in the Northwestern Region were all re-examined in 1989 for symptoms of damage from airborne pollutants. To date, no such symptoms are evident in any of the plots. However, surveys did reveal several other pest problems.

At the Sandle Lake plot north of Sioux Lookout significant damage caused by spruce budworm and wind was documented on black spruce. Approximately 73% of all the trees examined sustained widely varying levels of defoliation caused by spruce budworm (1-75%). Specifically, 20% of the trees sustained trace-to-low levels of defoliation (0-5%), another 51% sustained low-to-moderate defoliation (6-25%) and the balance of the damaged trees (2%) sustained severe levels of defoliation (>75%).

Damage due to wind shear and sustained high winds on this plot is summarized as follows:

(i) trees that were completely blown over (4.5%)

(ii) whipping of new shoots with subsequent breakage and desiccation, which affected 39% of the trees and caused an average shoot loss of 10-20%

(iii) mechanical damage to 5.7% of the stand (either damage caused by the action of trees falling against one another or damage to the branches and boles of the trees).

Another type of damage (noted for its potential as a fungal entrance court) was sapsucker feeding, which was found on three trees. Also, spruce needle rust was noted at trace-to-low foliar damage levels on 19% of the trees. Stem cankers (of unconfirmed origin) were noted on 4.3% of the survey sample.

The survey conducted at the Dance Township plot in Fort Frances District disclosed no significant pest problems in the jack pine component; however, branch infections of hypoxylon canker, *Hypoxylon mammatum* (Wahlenb.) J. Miller, were noted on a single trembling aspen.

Of the jack pine trees examined in the Mafeking Township plot in Dryden District, 19% sustained low levels (<5%) of crown damage caused by the western gall rust.

These plots will continue to be monitored in the foreseeable future.

Forest Tree Nursery Report

Throughout the field season, monthly inspections were conducted in the compartments of the Dryden nursery. The eastern pine shoot borer was found damaging small numbers of shoots on 10% of the jack pine component in compartments S3, S4 and S5 in the seed orchard portion of the nursery. In compartment C3, small numbers (<5%) of a needletier belonging to the tortricid family were found damaging the new shoots of 2-0 jack pine seedlings at low levels (<5%). Finally, gray mould, *Botryotinia fuckeliana* (de Bary) Whetzel, was recovered from damaged black spruce seedlings in compartments C11 and C12; approximately 5% of all seedlings were infected.

Climatic Data

Seasonal variations in the normal weather patterns have a direct effect on both biotic and abiotic conditions. Sudden and extreme changes in weather have a significant effect on forest pest problems. Monitoring daily weather conditions permits the accurate prediction of the emergence of overwintering larvae. For these reasons, FIDS Unit staff maintain daily and monthly averages of weather conditions on file for numerous locations across the province. Table 15 summarizes the weather data for 1989 (January to December) provided by two Atmospheric Environment Service weather offices in the Northwestern Region. The normals quoted were taken directly from the Canadian Climate Normals for Ontario, 1951-1980.

Table 15. Summary of mean temperature and total precipitation at three locations in the North-western Region in 1989

Location	Month	Mean temperature (°C)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal	Actual		Normal	Actual	
Fort Frances Airport	January	-16.9	-13.6	+3.3	30.6	81.0	+50.4
	February	-13.1	-18.2	-5.1	22.7	16.0	-6.7
	March	-5.7	-9.0	-3.3	31.6	19.0	-12.6
	April	3.8	2.2	-1.6	48.5	4.6	-43.9
	May	11.0	12.0	+1.0	71.2	49.0	-22.2
	June	16.4	15.6	-0.8	101.7	176.9	+75.2
	July	19.2	20.8	+1.6	103.6	65.7	-37.9
	August	17.7	18.5	+0.8	82.6	116.0	+33.4
	September	12.2	12.9	+0.7	83.8	51.7	-32.1
	October	6.6	6.1	-0.5	50.9	22.9	-28.0
	November	-3.2	-3.2	0.0	36.8	52.0	+15.2
	December	-12.4	-13.0	-0.7	31.8	46.0	+14.2
Kenora Airport	January	-18.5	-14.6	+3.9	28.2	41.9	+13.7
	February	-14.4	-18.9	-4.5	23.0	10.3	-12.7
	March	-7.1	-9.1	-2.0	30.1	41.2	+11.1
	April	2.7	1.5	-1.2	41.9	20.8	-21.1
	May	10.5	13.2	+2.7	57.3	91.0	+33.7
	June	16.1	16.4	+0.3	83.4	252.2	+168.8
	July	19.2	21.9	+2.7	91.8	53.4	-38.4
	August	17.6	24.0	+6.4	85.9	135.4	+49.5
	September	11.6	13.5	+1.9	69.2	25.1	-44.1
	October	5.6	6.2	+0.6	40.7	37.4	-3.3
	November	-4.6	-7.8	-3.2	40.4	27.0	-13.4
	December	-14.1	-19.5	-5.4	31.2	23.8	-7.4
Sioux Lookout Airport	January	-19.4	-15.4	+4.0	36.0	40.4	+4.4
	February	-15.7	-14.6	+1.1	26.8	16.0	-10.8
	March	-8.3	-11.1	-2.8	35.0	43.7	+8.7
	April	1.4	0.0	-1.4	45.2	21.6	-23.6
	May	9.2	11.6	+2.4	65.8	53.0	-12.8
	June	15.2	15.3	+0.1	91.7	121.2	+29.5
	July	18.3	20.8	+2.5	93.7	35.6	-58.1
	August	16.6	18.2	+1.6	88.3	42.0	-46.3
	September	10.7	13.3	+2.6	81.6	16.2	-65.4
	October	4.7	5.2	+0.5	64.9	24.4	-40.5
	November	-5.3	-8.8	-3.5	49.9	50.7	+0.8
	December	-15.1	-21.3	-6.2	33.7	24.5	-9.2

APPENDICES

Table A1. Northwestern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1989, and infestation forecasts for 1990.

Location	Host	Estimated defoliation in 1989 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1990[a]	Accumulated damage[b]
Dryden District (22 locations)					
Aerobus Lake	bF	78	336	S	3
Aubrey Twp	bF	63	347	S	3
Beaverhouse Lake	bF	88	233	M-S	3
Brownridge Twp	bF	73	442	S	3
Cedar Lake	bF	95	428	S	3
Cliff Lake	wS	9	106	M-S	1
Dore Lake	bS	9	250	S	0
Eagle Lake - E. side	bF	75	608	S	4
- Meridian Bay	bF	92	473	S	3
Forest Lake	bF	90	586	S	2
Ingall Lake	bF	80	925	S	3
Kekekwa Lake	bF	95	78	M-S	8
Melgund Twp - Seed Production Area	bS	5	39	L-M	0
Mutrie Twp - Eagle River	wS	67	2027	S	2
Rugby Twp	bF	85	916	S	3
Southworth Twp	bF	36	82	M-S	2
Tadpole Lake	bF	91	315	S	4
Thaddeus Lake	bF	82	1693	S	3
Tustin Twp	bF	71	38	L-M	3
Wapageisi Lake	bF	87	101	M-S	5
Washeibemaga Lake	bF	43	195	M-S	3
Zealand Twp - Aaron Prov. Pk	bF	78	929	S	3
Fort Frances District (16 locations)					
Bear Pass	bF	7	152	M-S	2
Big Sawbill Lake	bF	11	57	M-S	2
Boffin Lake	bF	5	0	0	1
Carleton Lake	bF	18	138	M-S	2
Claxton Twp - Caliper Lake Prov. Pk	bF	33	794	S	2
Entwine Lake	bF	5	0	0	2
Eric Lake	bF	28	365	S	2
Jackfish Lake	bF	13	534	S	2
Kaiarskons Lake	bF	49	139	M-S	3
Kawawia Lake	bF	52	248	S	9

(cont'd)

Table A1. Northwestern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1989, and infestation forecasts for 1990 (cont'd).

Location	Host	Estimated defoliation in 1989 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1990[a]	Accumulated damage[b]
Fort Frances District (cont'd) (16 locations)					
Manion Lake Rd					
- Hillyer Creek	bF	6	105	M-S	9
- near Seed Orchard	bF	5	0	0	8
Pipestone Lake	bF	67	388	S	7
Potts Twp	bF	9	75	M-S	0
Rainy Lake					
- Ash Bay	bF	9	101	M-S	1
Vickers Lake	bF	11	38	L-M	9
Ignace District (24 locations)					
Bark Lake	bF	95	300	S	3
Barrel Lake	bF	93	309	S	5
Basket Lake	bF	95	73	M-S	4
Bell Lake	bF	93	339	S	2
Bertrand Twp	bF	9	42	L-M	1
Campus Lake	bF	47	118	M-S	4
Cecil Lake	bF	81	203	M-S	2
Collins Lake	bF	67	1030	S	2
Dewan Twp	bF	82	230	M-S	3
Hook Lake	bF	62	1178	S	4
Ilsley Twp - Raleigh Lake	bF	95	196	M-S	3
Indian Lake	bF	80	529	S	2
Kin Lake	bF	95	368	S	2
Kukukus Lake	bF	77	361	S	3
Microwave Tower Rd - Impact Plot	bS	12	26	L-M	1
Phyllis Lake	bF	72	292	S	3
Sandbar Lake Prov. Pk					
- Stand 740	bF	63	129	M-S	3
Selwyn Lake	bF	88	184	M-S	3
Shikag Lake	bF	55	213	M-S	2
Smirch Lake	bF	42	82	M-S	4
Sturgeon Lake - Granite Bay	bF	72	557	S	2
- North Arm	bF	5	43	L-M	0
Taga Lake Road	bF	81	57	M	2
Vista Lake	bF	14	136	M-S	1

(cont'd)

Table A1. Northwestern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1989, and infestation forecasts for 1990 (cont'd).

Location	Host	Estimated defoliation in 1989 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1990[a]	Accumulated damage[b]
Kenora District (22 locations)					
Cameron Lake - Stand 265	bF	85	102	M-S	2
Chase Lake	bF	68	419	S	3
Cygnet Lake	wS	70	1043	S	2
Dowswell Lake	bF	96	330	S	2
English River Rd - Stand 8	bF	59	202	M-S	3
Forgie Twp - Rush Bay Rd	bF	78	209	M-S	2
Godson Twp	bF	58	382	S	2
Lennan Lake	bF	82	474	S	2
Mayburn Rd - Stand 102	bF	92	717	S	4
Maynard Lake	bF	90	417	S	3
McGeorge Twp - Sioux Narrows	bF	36	225	M-S	2
Paintpot Lake	bF	94	196	M-S	2
Pelican Pouch Lake	bF	29	145	M-S	2
Pellatt Twp - Sandy Lake	bF	54	542	S	2
Rowan Lake	bF	63	267	S	4
Rushing River Prov. Pk	bF	53	211	S	1
Sand Lake	bF	69	164	M-S	3
Snowshoe Lake	bF	94	408	S	2
Stephen Lake - Stand 220	bF	66	317	S	2
Tetu Lake	bF	32	312	S	3
Toothpick Lake	bF	81	76	M-S	3
Umfreville Lake - Tourist Bay	bF	93	514	S	3
Red Lake District (22 locations)					
Baird Twp	bF	94	141	M-S	2
Bateman Twp - East Bay	bF	42	15	L-M	1
Birch Lake - South Bay	bF	82	283	S	2
Bowerman Twp	bF	92	174	M-S	2
Chukuni Lake Rd	bF	93	450	S	2
Conifer Lake	bF	93	108	M-S	1
Ear Falls	bF	94	55	M	3
Earngey Twp	bF	93	268	S	3
Flundra Lake	bF	91	218	M-S	2
Knott Twp	bF	86	229	M-S	2
Lac Seul - Farewell Bay	bF	44	86	M-S	1

(cont'd)

Table A1. Northwestern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1989, and infestation forecasts for 1990 (cont'd).

Location	Host	Estimated defoliation in 1989 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1990[a]	Accumulated damage[b]
Red Lake District (cont'd) (22 locations)					
Lietch Lake	bF	64	331	S	3
Longlegged Lake Rd	bF	39	0	O	2
McDonough Twp	bF	48	253	S	2
Murdock Lake	bF	92	389	S	2
Musclow Lake	bF	89	697	S	2
Pakwash Lake	bF	94	721	S	2
Pakwash Prov. Pk - Group Camping	bF	93	761	S	2
- Trailer Camp	bF	94	529	S	2
Sydney Lake	bF	93	611	S	4
Unexpected Lake	bF	78	271	S	2
Whitemud Lake	bF	72	598	S	2
Sioux Lookout District (23 locations)					
Aerofoil Lake	bF	8	34	L-M	1
Carling Lake	bF	7	0	O	0
Deception Lake	bF	68	596	S	2
Drayton Twp - Abram Lake	bF	40	343	S	2
Factor Twp	bF	93	98	M-S	3
Jacknife Lake - Stand 131	bF	45	92	M-S	2
Kimmewin Lake - Stand 410	bF	41	254	S	2
Lac Seul - Black Bay	bF	64	744	S	2
- Coons Bay	bF	7	30	L-M	2
- Merritt Bay	bF	58	995	S	2
- Whitefish Bay	bF	51	309	S	2
- Windigo Point	bF	87	149	M-S	2
Mascara Lake	bF	51	639	S	2
McAree Twp - Sandybeach Lake	bF	89	270	S	3
Ojibway Prov. Pk					
- Entrance	bF	68	137	M-S	2
- Terry Lake Trail	bF	93	213	M-S	2
Pickerel Twp - Impact Plot	bF	93	164	M-S	3
	wS	92	422	S	3
	bS	52	854	S	1

(cont'd)

Table A1. Northwestern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1989, and infestation forecasts for 1990 (concl.).

Location	Host	Estimated defoliation in 1989 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1990[a]	Accumulated damage[b]
Sioux Lookout District (concl.) (23 locations)					
Savant Lake - NE Arm	bF	6	0	0	0
Sunlight Lake	bF	79	198	M-S	2
Wapesi Lake - Stand 470	bF	25	90	M-S	1
Wapesi River	bF	63	250	S	2

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

[b] Accumulated Damage

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, 50-150 cm of top dead or bare
5	<25% of stand dead
6	25% to 50% of stand dead
7	50% to 70% of stand dead
8	>70% of stand dead
9	<25% of stand dead, no significant (0-25%) defoliation for several years
+	25% to 50% of stand dead, no significant defoliation for several years
-	51% to 70% of stand dead, no significant defoliation for several years

Table A2. Northwestern Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1989 and infestation forecasts for 1990 on jack pine.

Location	Estimated defoliation 1989 (%)	Total no. of egg masses on six 61-cm branch tips	Infestation forecasts for 1990[a]
Dryden District (6 locations)			
Breithaupt Twp - Bailey Lake	5	0	N
Eagle Lake - Niven Bay, Stand 85	5	0	N
Mutrie Twp - Impact Plot	5	0	N
Redvers Twp - Stand 51	5	0	N
Smellie Twp	5	0	N
Zealand Twp - Tree nursery	5	0	N
Fort Frances District (2 locations)			
Claxton Twp	5	0	N
Manion Lake	6	0	N
Ignace District (6 locations)			
Corman Twp	5	0	N
Furniss Twp	5	0	N
Kay Lake	13	0	N
McNevin Twp - Encamp Lake Rd	5	0	N
McNevin Twp - Check Plot	0	0	N
Shaw Lake	10	0	N
Kenora District (5 locations)			
Coyle Twp	5	0	N
Devonshire Twp - Stand 491	5	0	N
Gundy Twp	5	0	N
Kirkup Twp	4	0	N
Redditt Twp	5	0	N

(cont'd)

Table A2. Northwestern Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1989 and infestation forecasts for 1990 on jack pine (concl.).

Location	Estimated defoliation 1989 (%)	Total no. of egg masses on six 61-cm branch tips	Infestation forecasts for 1990[a]
Red Lake District (20 locations)			
Agnew Twp - Perrigo Lake	17	4	M
Baird Twp	23	0	N
Bateman Twp	12	0	N
Berens Lake	18	0	N
Bigshell Lake	12	1	L
Cairns Lake	5	0	N
Celt Lake	10	0	N
Goose Lake	72	2	L
Guernsey Lake	14	5	M
Kirkness Lake - Stand 441	20	3	M
Little Trout Lake	8	1	L
Longlegged Lake	8	0	N
Madden Lake	58	11	H
Offer Lake	40	24	H
Pikangikum Lake	14	2	L
Pringle Lake	16	1	L
Shabu Lake	19	3	M
Silcox Lake	42	5	M
Trout Lake - SW side	13	4	M
Wavell Lake	26	7	H
Sioux Lookout District (11 locations)			
Aerial Lake	8	0	N
Aerofoil Lake	12	1	L
Amik Lake	0	0	N
Deaddog Lake	18	2	L
Kapikik Lake	40	1	L
Lac Seul - Coones Bay	8	0	N
Meen Lake	17	3	M
Papaonga Lake	8	0	N
Root Lake - Stand 646	22	2	L
Upturnedroot Lake	16	1	L
Whitestone Lake	16	2	L

[a] N = nil, L = light, M = moderate, H = heavy