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

1990

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

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SURVEY HIGHLIGHTS

This report describes the most significant and prevalent biotic and abiotic conditions that were detected and evaluated during extensive aerial and ground surveys conducted in the Northwestern Region of Ontario in 1990.

The forest tent caterpillar infestation continues to expand across the entire region, covering some 4,072,857 ha this season. This is almost double the total area infested in 1989, and the forecast is for further expansion in 1991. The area within which spruce budworm is causing moderate-to-severe defoliation of spruce-fir forest declined this season by some 457,000 ha, bringing the total to 2,747,824 ha. The southern portion of the infestation continues to decline whereas the northern edge is still advancing slowly outward. The decline in the south is due largely to the high level of whole-tree mortality in the spruce-fir stands throughout Fort Frances District and the south-central portion of Dryden District. The total area within which mortality was detected this season expanded to some 789,040 ha, an increase of 165,613 ha from last year. The greatest increase occurred in Kenora District. The jack pine budworm infestation all but collapsed this season. A total of 665 ha of moderate-to-severe defoliation was mapped in the northern portion of Red Lake District. However, trace numbers of larvae could still be detected throughout much of the 248,311 ha infested in 1989.

General surveys revealed that an average of 4.1% of the leaders in jack pine regeneration throughout the Region were damaged by the white pine weevil, and the eastern pine shoot borer was found attacking an additional 4.9% of the leaders in the areas examined.

Spruce needle rust had a very high incidence throughout the Region, but on average, caused <10% foliar damage. The western gall rust remains one of the major disease problems in jack pine regeneration; on average, 29.8% of the trees were affected. Hardwood foliar diseases were commonly encountered across the Region, occasionally causing >75% defoliation to balsam poplar or white birch. A current infection rate of 17% for Dutch elm disease was detected on the ornamental elms within the town of Fort Frances.

Special surveys included a re-evaluation of the three Acid Rain National Early Warning System plots in the Region, and monitoring of pest problems at the forest tree nursery at Dryden. A formal annual seed orchard survey was established and eight of the 19 orchards in the Region were evaluated. The gypsy moth pheromone trapping program at the provincial parks was conducted once again, and one or two adult males were captured at three of the nine parks.

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

Major Insects/Diseases

capble 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; and
(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 1990.

The authors would like to express their appreciation to personnel of the various Ontario Ministry of Natural Resources (OMNR) district and regional offices, to members of the woods industry and to various private individuals for their excellent cooperation during the 1990 field season.

R.J. Sajan
H. Brodersen

FRONTISPIECE

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INSECTS

Major Insects

Fall Cankerworm, *Alsophila pometaria* (Harr.)

For the third consecutive year, the fall cankerworm caused severe defoliation to ornamental Manitoba maple (*Acer negundo* L.) throughout the town of Sioux Lookout in Sioux Lookout District. Defoliation levels were often greater than 75%, with numerous trees sustaining 100% defoliation. For the second consecutive year, similar levels of defoliation were recorded at scattered locations on Manitoba maples in the town of Dryden, Dryden District. In 1990, severe defoliation occurred in the town of Kenora, Kenora District, and in Fort Frances, Fort Frances District.

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

Provincial Situation

For the second consecutive year, there was an increase in the total area of moderate-to-severe defoliation in the province caused by the spruce budworm. The annual defoliation mapping revealed a 540,810-ha increase over the 1989 level, bringing the provincial total to some 6,783,261 ha. The largest increases occurred in North Central Region, where some 4,026,230 ha of moderate-to-severe defoliation occurred, an increase of 991,653 ha. Thunder Bay District experienced the largest increase, almost doubling last year's estimated area and bringing the district total to 1,273,723 ha. In Northern Region some 6,392 ha were detected in Hearst District, the first defoliation in the Region in 4 years. In Northwestern Region, the total area infested declined for the third consecutive year, bringing the regional total to 2,747,824 ha, a decrease of some 457,235 ha. Red Lake District was the only district in this region in which an increase in the area affected was detected (Fig. 1).

Spruce budworm-induced whole-tree mortality continues to increase in the province. The total area within which mortality is occurring, primarily to balsam fir (*Abies balsamea* [L.] Mill.), increased by some 1,214,473 ha this season. This increase was confined to the North Central (1,048,860 ha) and Northwestern (165,613 ha) regions.

The Ontario Ministry of Natural Resources (OMNR) aerially sprayed some 49,627 ha of spruce-fir forest with the biological insecticide *Bacillus thuringiensis* (B.t.) in North Central Region. The majority of the spray operation was conducted in Nipigon District.

Northwestern Region

The total area of moderate-to-severe defoliation caused by this pest continued to decrease throughout the Region in 1990. Approximately 2,747,824 ha of defoliation, a decrease of some 457,235 ha, were detected.

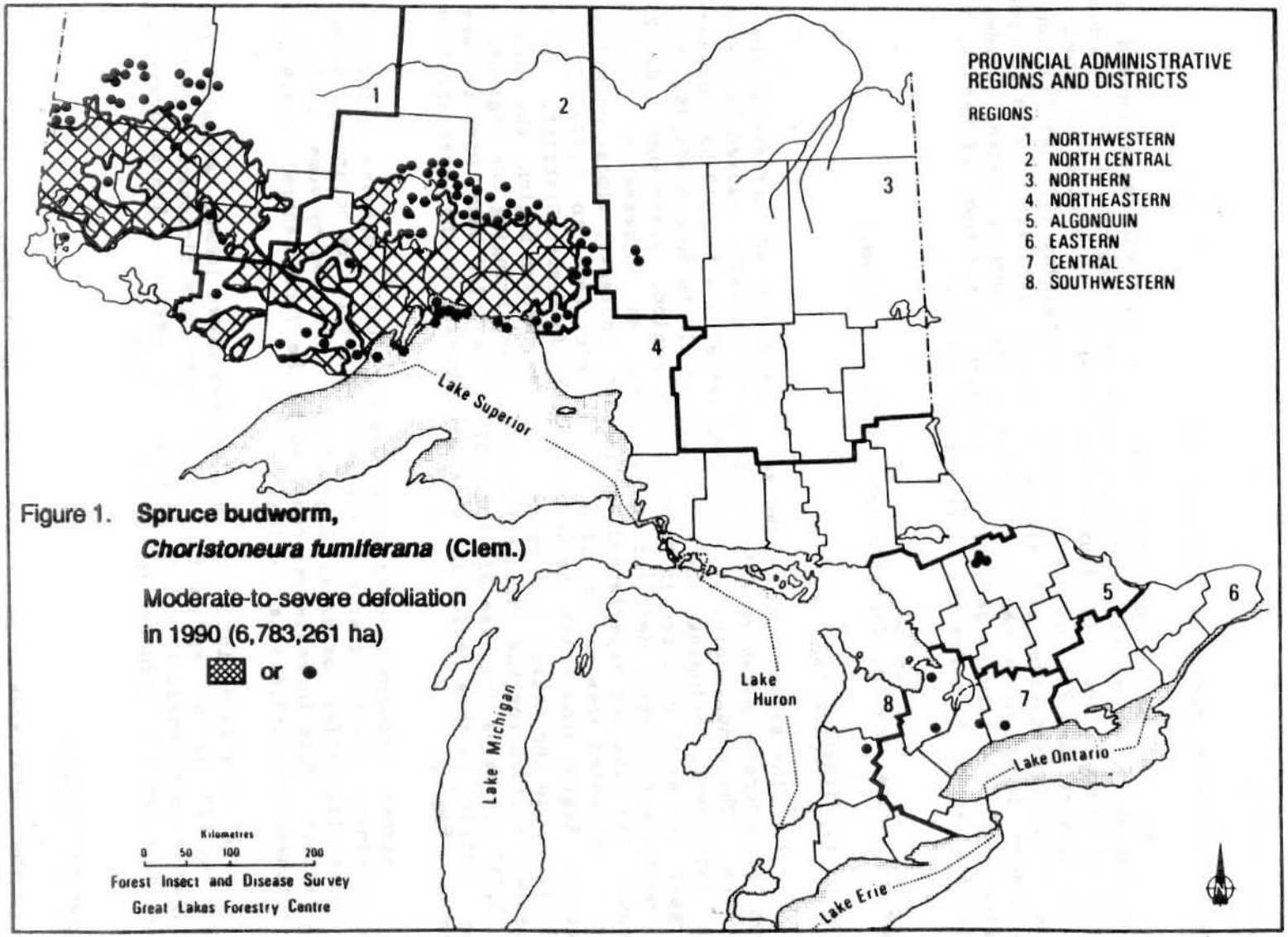

Figure 1. **Spruce budworm,**
***Choristoneura fumiferana* (Clem.)**

All districts, except for Red Lake, experienced the decrease. The largest areas of decline continue to be in the extreme southern portion of the Region, with the greatest decline in Fort Frances District. In 1990, only 6,720 ha of moderate-to-severe defoliation were mapped in Fort Frances District, a reduction of 192,364 ha from 1989. In the Dryden and Ignace districts, the total area of infestation decreased by approximately 105,000 ha. In Sioux Lookout District, the area of moderate-to-severe defoliation decreased by some 63,428 ha; in Kenora District, the decrease was 38,383 ha. Table 1 summarizes the total areas defoliated, by district, for 1989 and 1990.

Table 1. Total area of moderate-to-severe defoliation by the spruce budworm in the Northwestern Region of Ontario in 1989 and 1990, and the change for each district since 1989.

	Area of moderate-to-severe defoliation (ha)		
District	1989	1990	Change
Dryden	902,750	815,547	-87,203
Fort Frances	199,084	6,720	-192,364
Ignace	419,620	314,071	-105,549
Kenora	897,779	859,395	-38,384
Red Lake	199,054	228,747	+29,693
Sioux Lookout	586,772	523,344	-63,428
TOTAL	3,205,059	2,747,824	-457,235

In Red Lake District, a new infestation was detected in the Sydney, Longlegged and Red Lake areas, bringing the district total to 228,747 ha, an increase of some 29,693 ha. Newly infected areas were also seen in the Broadcast-Sunlight lakes area and the Bertha Lake area in Sioux Lookout District (Fig. 2).

Egg-mass sampling for the purpose of forecasting 1991 defoliation levels was completed at 120 locations across the Region. The locations and forecasts are listed in Appendix A1. Table 2 compares spruce budworm egg-mass densities per 9.29 m^2 of foliage from 1989 to 1990; 111 sites were compared, with 54 showing increases in egg-mass densities and an overall increase of 7% in the actual number of egg masses.

Spruce budworm-induced whole-tree mortality continues to increase throughout the Region. Since 1977, when mortality was first recorded (405 ha in Fort Frances District), the regional total has increased annually to the present figure of 789,040 ha (Fig. 3). In 1990 an increase of approximately 165,613 ha occurred across the Region. The largest area of increased mortality occurred in Kenora District, where a total of some 106,454 ha now exists,

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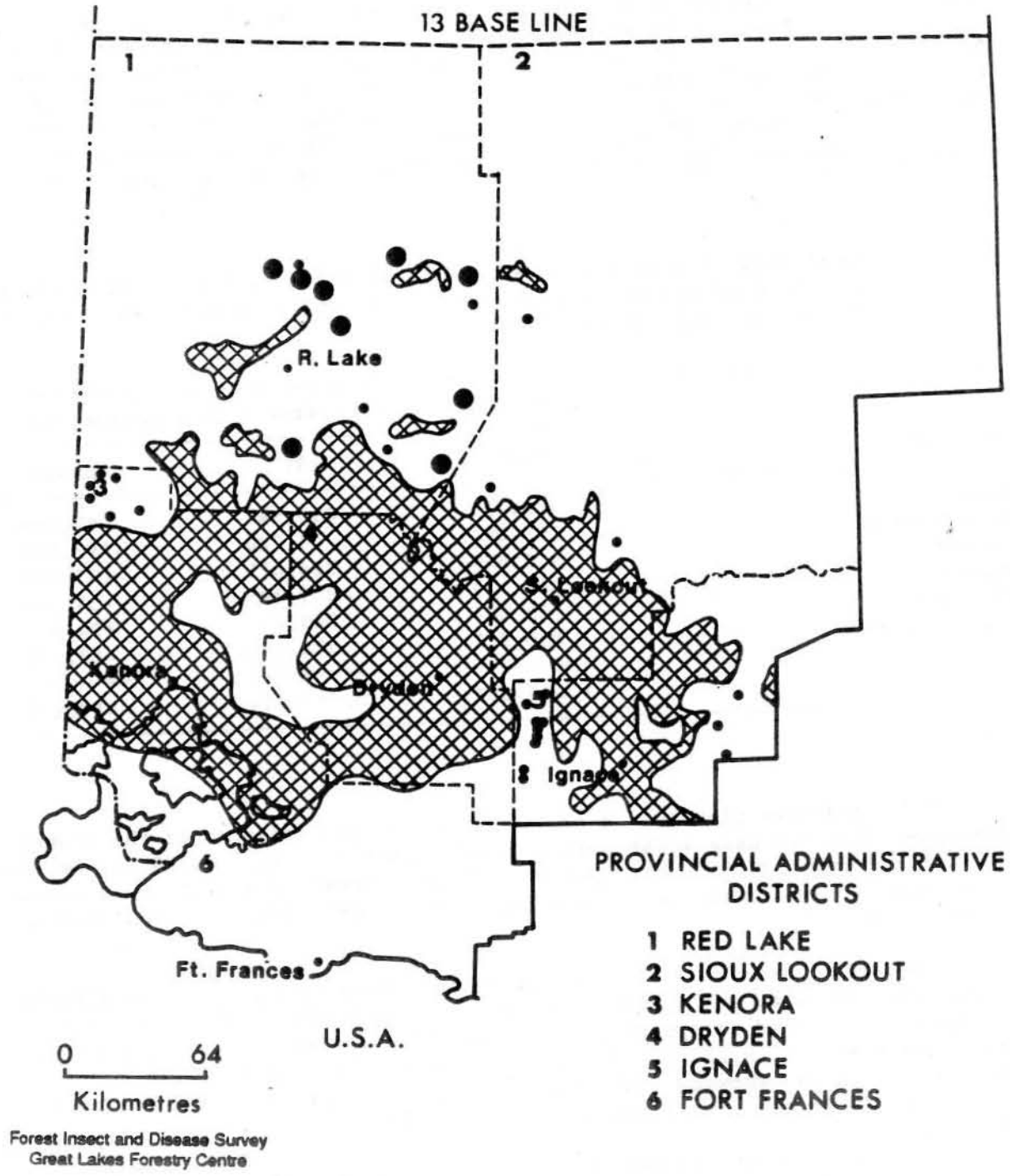

Figure 2. **Spruce budworm,**
***Choristoneura fumiferana* (Clem.)**

Areas within which moderate-to-severe defoliation occurred in 1990 ▨ or ●

Table 2. Comparison of spruce budworm egg-mass densities at 111 locations in the Northwestern Region of Ontario in 1989 and 1990.

District	No. of locations	No. of locations with increases	Average egg-mass density per 9.29 m^2		% change
			1989	1990	
Dryden	19	6	567.4	410.1	-28
Fort Frances	13	6	228.6	253.6	+11
Ignace	22	8	307.9	243.6	-21
Kenora	19	8	340.2	452.3	+33
Red Lake	19	13	294.5	484.8	+65
Sioux Lookout	19	13	272.2	332.5	+22
Over all	111	54	340.1	365.5	+7

up substantially from the 450 ha recorded in 1989. The damage was detected in the extreme northeastern corner of this district, northwest and southeast of the town of Kenora and north of Shoal Lake, west of Kenora. The Dryden and Ignace districts saw major increases in whole-tree mortality in 1990, totaling approximately 22,000 ha. The area of mortality in the Red Lake and Sioux Lookout districts totaled approximately 7,000 ha, and mortality in Fort Frances District, where the majority of the damage has been historically, increased by 350 ha, bringing the district total to 341,938 ha. The complete situation is presented for the last 2 years, by district, in Table 3.

In all, 18 mortality plots were tallied in the Region. At each location, 100 dominant or codominant trees were examined to determine their status. Fifteen of these plots had been surveyed in 1989. An overall average increase of 12.8% in the mortality rate was recorded in the plots measured in both years. The data from the 18 mortality plots for 1989 and 1990 are presented in Table 4.

Spruce budworm pheromone traps are set out annually in the Region as part of a continuing program to develop new survey methodology. Ten sites were trapped in 1990, with three traps at each site. The traps are set in place prior to the flight of the adult budworm moths and are retrieved in mid- to late August. All traps were recovered except for those at the Raleigh Lake site in Ignace District; at this location, two traps were destroyed by a bear. The overall average number of moths caught per trap at each location was 38.7. The largest numbers trapped were along Highway 17, east of Southworth Township in Dryden District, where the average was 127.7 moths per trap; the smallest numbers, averaging 11.0 moths per trap, were recorded along Highway 512 near the Fort Frances-Kenora district boundaries, in Fort Frances District.

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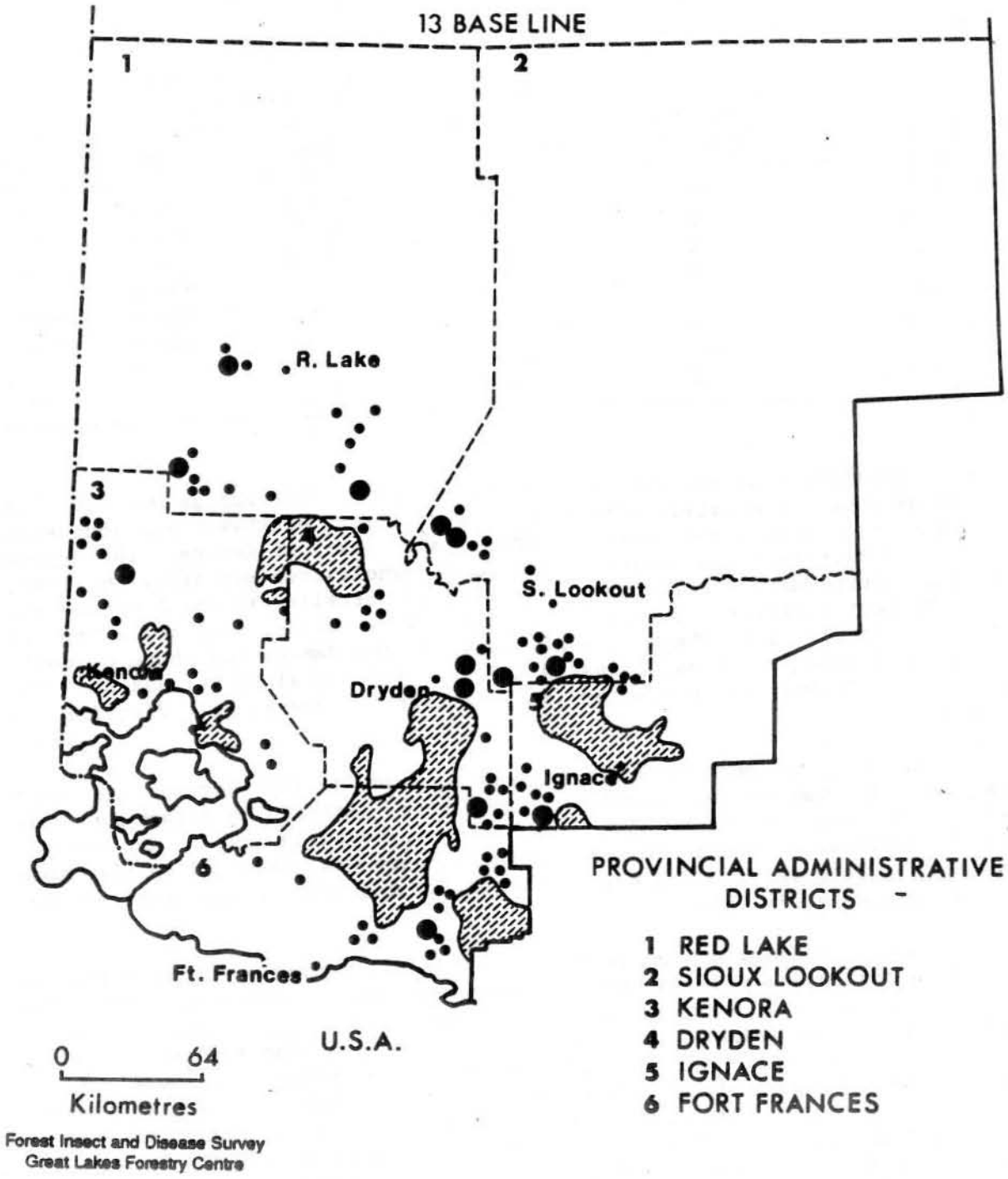

Figure 3. **Spruce budworm,**
***Choristoneura fumiferana* (Clem.)**

Areas within which balsam fir whole-tree and top mortality occurred in 1990.

▨ or ●

Table 3. Total area of spruce budworm-induced whole-tree mortality in the Northwestern Region of Ontario in 1989 and 1990, and the change since 1989.

District	Area of whole-tree mortality (ha)		
	1989	1990	Change
Fort Frances	341,588	341,938	+350
Dryden	165,854	188,129	+22,275
Ignace	103,840	127,268	+23,428
TOTAL	611,282	657,335	46,053

Table 4. Data collected from 18 spruce budworm mortality plots in the Northwestern Region of Ontario in 1989 and 1990 (counts based on an examination of 100 dominant and codominant trees at each location).

District (Location)	Tree species	Tree mortality (%)	
		1989	1990
Dryden District			
Ingall Lake	bF	56	66
Minnehaha Lake	bF	42	48
Portal Lake	bF	12	44
Aerobus Lake	bF	13	61
Thunder Lake	bF	2	5
Southworth Twp[a]	bF	-	23
Southworth Twp[a]	bS	-	3
Hwy 502	bS	-	13
Fort Frances District			
Strong Lake	bF	85	95
Ignace District			
Abamategwia Lake	bF	78	87
Dimple Lake	bF	73	82
Pluto Lake	bF	37	49
Revell Twp	bS	0	0
Isley Twp	bF	42	50
Dewan Twp	bF	3	4
Cecil Lake	bF	34	68
Kenora District			
Forge Twp	bF	54	63
Sioux Lookout District			
Ojibway Prov. Park	bF	1	1
Pickerel Twp	bF	0	1

[a] 79 balsam fir and 21 black spruce were sampled at this location.

In conjunction with the spruce budworm pheromone survey, overwintering second-instar larvae are also collected at the pheromone trap sites. This involves collection of a single branch from the mid- to upper crown of 10 trees at each site. Balsam fir was sampled at eight locations, and an average of 54.6 larvae per branch was found; black spruce (*Picea mariana* [Mill.] B.S.P.) was sampled at the remaining two locations, and an average of 15.7 larvae per branch was found. The largest numbers recovered from the balsam fir samples occurred along Highway 17, on the west side of Dewan Township in Ignace District, with an average of 95.5 larvae per branch. The smallest numbers of larvae were found along Highway 512 in Fort Frances District.

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

Populations of this budworm continue to decline across the area previously infested in the northern portion of the Region. Extensive aerial surveys, combined with ground surveys, revealed a total of 665 ha of moderate-to-severe defoliation in 1990, compared with some 248,311 ha in 1989. However, small numbers of the pest could still be readily found throughout much of last season's infested areas. At several locations in the northern end of Red Lake District, it was noted that an occasional single jack pine (*Pinus banksiana* Lamb.) tree could be moderately defoliated, sustaining some 50% defoliation, while adjacent trees appeared to be completely free of the insect.

The total area infested this season (Fig. 4) comprised three pockets. The largest was immediately east of Kirkness Lake in Red Lake District. At this location, 395 ha were moderately defoliated. The second pocket, 260 ha of moderate defoliation, also occurred in Red Lake District, east of Silcox Lake, south of the Berens River. The third pocket, only 10 ha in size, was detected north of Goodie Lake in Sioux Lookout District.

The single mortality plot in Red Lake District associated with this pest was re-evaluated this season, but there was no change from the level recorded in 1989; 10% of the trees were dead and 28% sustained varying amounts of top kill.

Egg-mass sampling for the purpose of forecasting defoliation levels in 1991 was conducted at 21 locations in the Region. The locations and results are listed in Appendix A2. Of the 21 locations sampled, 52% have a forecast of no infestation for the coming season; however, two (9.5%) are expected to sustain heavy defoliation, both of which are in Red Lake District: at Kirkness Lake, where moderate defoliation occurred in 1990, and at Offer Lake, approximately 40 km northeast of Trout Lake. Moderate defoliation is also forecast for the 10-ha pocket of damage at Goodie Lake in Sioux Lookout District.

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

Jack pine regeneration ranging from 0.8 to 5.5 m in height was examined at 21 locations in the Region for this shoot-boring insect. At all

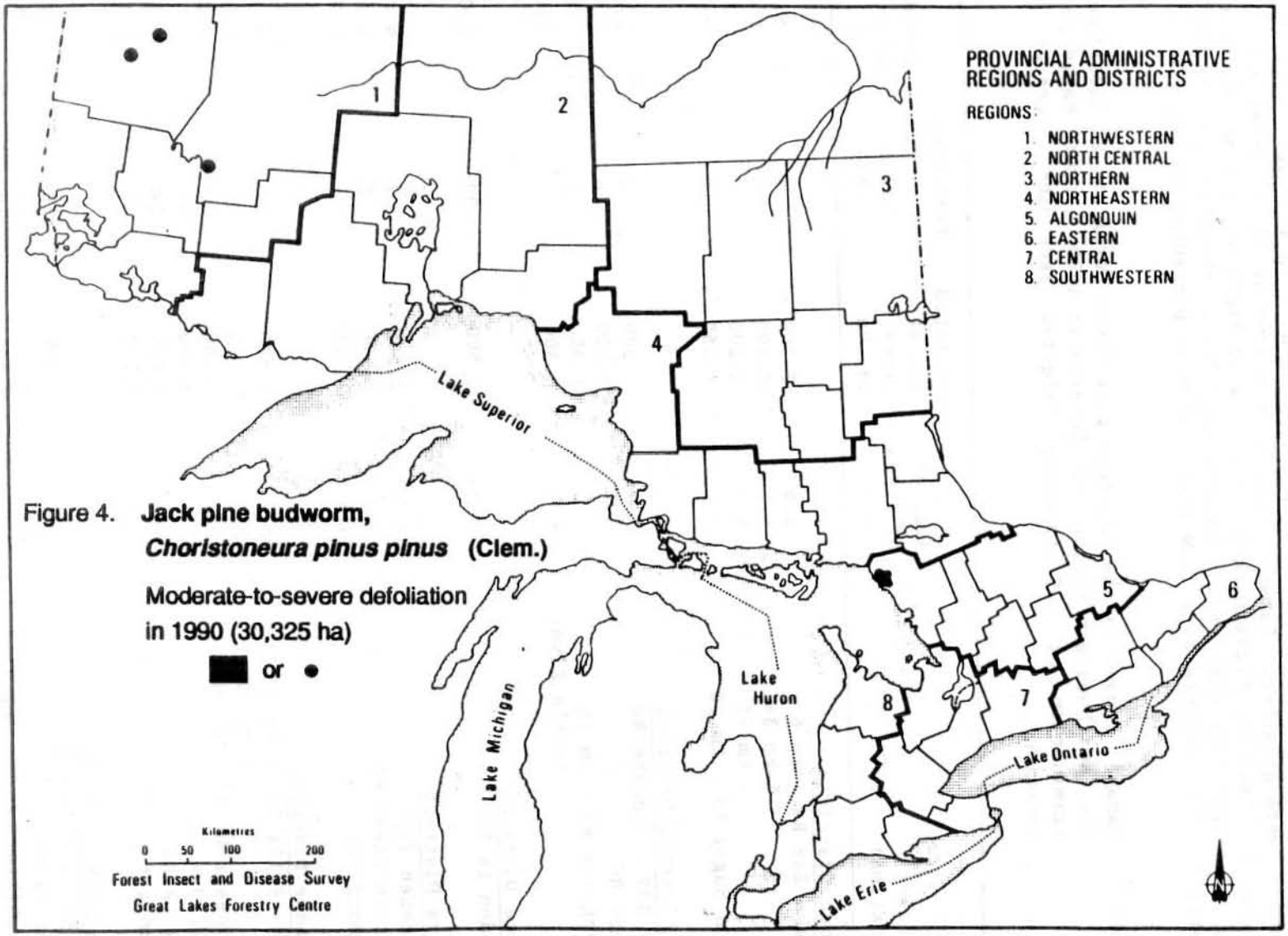

Figure 4. **Jack pine budworm,**
***Choristoneura pinus pinus* (Clem.)**

Moderate-to-severe defoliation
in 1990 (30,325 ha)
■ or ●

locations, only the main leader was evaluated. On average, 4.9% of the leaders were attacked. Damage ranged from lows of 0% at locations in the Dryden, Red Lake and Sioux Lookout districts to highs of 15.0 and 20.0% along the Overnight Lake Road and the Wegg Lake Road, respectively, in Red Lake District. The complete data from this survey is presented in Table 5.

Table 5. Damage caused by the eastern pine shoot borer at 21 locations in the Northwestern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected jack pine trees at each location).

District (Location)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area of stand (ha)	Leaders attacked (%)
Dryden District				
Snake Bay Rd - km 6	2.6	2,500	8	5.0
- km 34	5.5	10,000	1	0
- km 41	3.9	2,100	4	1.0
Eton Rugby Rd - km 38	3.0	1,550	10	7.0
Fort Frances District				
Hwy 502 - Kenozhe Rd	3.4	900	2	11.0
Mount Rd	1.4	5,200	6	1.0
Glengarry Rd - km 16	4.4	1,000	4	3.0
- Turtle River	3.5	1,300	1	2.0
Ignace District				
Sowden Lk Rd	1.9	3,500	20	1.0
Kenora District				
McMeeken Twp	3.5	2,500	2	9.0
English River Rd	3.5	2,200	2	9.0
Desmond Twp	3.0	4,100	4	6.0
Red Lake District				
Snake Falls Rd - km 8	2.7	3,500	20	2.0
- km 12	2.7	3,000	20	3.0
Nungesser Lk Rd - km 30	2.2	3,200	15	1.0
Pineridge Rd	2.3	3,000	20	0
Wegg Lk Rd	1.6	2,000	20	20.0
Overnight Lk Rd	1.5	3,200	20	15.0
Sioux Lookout District				
Hwy 516 - Mills Lk	2.6	4,000	20	3.0
Burma Lk Rd	0.8	3,000	15	3.0
Stanzhikimi Lk Rd - km 2	2.2	3,200	10	0

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Aerial surveys conducted throughout the Region revealed that the forest tent caterpilllar infestation continued to expand for the fifth consecutive year. In 1990, 4,072,857 ha were severely defoliated, compared with 2,180,118 ha in 1989. Moderate-to-severe defoliation, occurring primarily on trembling aspen (*Populus tremuloides* Michx.), was mapped in all six districts (Fig. 5).

The largest area of moderate-to-severe defoliation, some 1,080,680 ha, was in Fort Frances District, where damage was noted throughout the district. Dryden District sustained a total of 974,160 ha of defoliation, a substantial increase over the 564,902 ha recorded in 1989. Virtually all of the district was infested, with the exception of a strip two townships wide approximately 50 km long paralleling the southwestern district border.

Similar increases were detected in Ignace District, with the aerial survey revealing that three-quarters of the district was infested, from Savant Lake south to the Atikokan border. The total area affected was 577,960 ha, compared with 12,403 ha in 1989. Kenora District also experienced a substantial increase in the total area of moderate-to-severe defoliation, which expanded from 553,487 ha to some 965,400 ha. Most of the expansion occurred in the northern half of the district, extending as far north as the 7th base line.

Sioux Lookout District sustained a total of 436,703 ha of defoliation, a marked increase from the 450 ha reported last year. Most of the expansion occurred along the southern portion of the district and the northern shore of Lac Seul, westward to the Red Lake District border. Small, scattered infestations ranging in size from 5 to 50 ha were detected across the width of the district north of the main infestation, extending for approximately 25 km north of the 7th base line.

In Red Lake District, the defoliation occurred mainly in the extreme southern portion of the district adjacent to the Kenora District border, covering some 37,954 ha. However, small pockets were mapped as far north as the town of Red Lake. Table 6 summarizes the total area infested, by district, since the start of the current outbreak in 1987.

Egg-band counts utilized in forecasting the 1991 population levels were completed at 23 locations throughout the current infestation (Fig. 6). It appears that the infestation will persist, especially across the northern two-thirds of the infestation, and will expand further northward. A decrease in larval numbers and defoliation may occur across much of Fort Frances District. The complete forecast is presented in Table 7.

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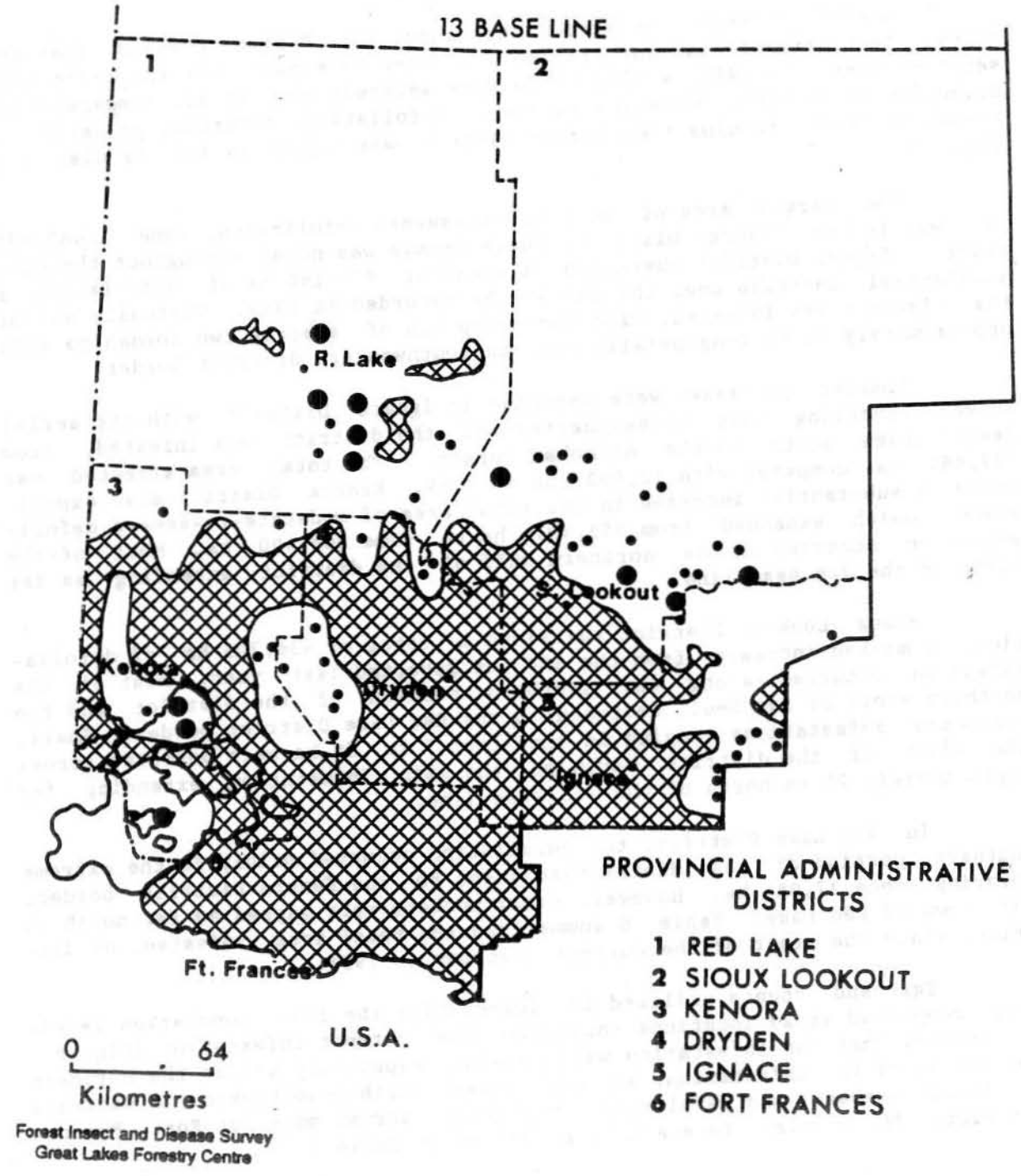

Figure 5. **Forest tent caterpillar, *Malacosoma disstria* (Hbn.)**

Areas within which moderate-to-severe defoliation occurred in 1990 ▨ or ●

Table 6. Area of moderate-to-severe defoliation caused by the forest tent caterpillar in the Northwestern Region of Ontario from 1987 to 1990.

District	Area of moderate-to-severe defoliation (ha)			
	1987	1988	1989	1990
Fort Frances	5,025	257,305	1,048,876	1,080,680
Kenora	0	15,070	553,487	965,400
Dryden	0	610	564,902	974,160
Ignace	0	0	12,403	577,960
Sioux Lookout	0	0	450	436,703
Red Lake	0	0	0	37,954
Total	5,025	272,985	2,180,118	4,072,857

Sawyer Beetles, *Monochamus* spp.

Damage by adult beetles feeding on the elongating shoots of mature and semimature jack pine and black spruce trees along the edge of cutovers is very common in the Region. In the Sioux Lookout and Red Lake districts, the residual trees at virtually every cutover have been damaged to some extent. Damage ranges from the occasional dead twig on one or two trees to death of most branches in a strip two or three trees wide along the entire edge of the cut. Severely affected trees are vulnerable to various secondary pests, such as bark beetles, and soon die.

Similar damage has been observed along the fringes of cuts in the eastern portion of Ignace District, the northern end of Fort Frances District, and the northeastern portion of Dryden District.

Jack Pine Sawfly, *Neodiprion pratti banksianae* Roh.

This sawfly was commonly detected on roadside or lakeshore trees across the northern half of the Region. At most locations, a single colony was detected causing 2 to 5% defoliation on the 10- to 15-m-tall jack pine.

In Red Lake District, scattered single colonies were found as far north as Kirkness and Silcox lakes. In Sioux Lookout District, single colonies were found on roadside trees at numerous locations along highways 72, 664 and 642. In Ignace District, this pest was easily detected on roadside trees along Highway 17 from the Revell River in the west to the English River in the east. Once again, the defoliation was minimal.

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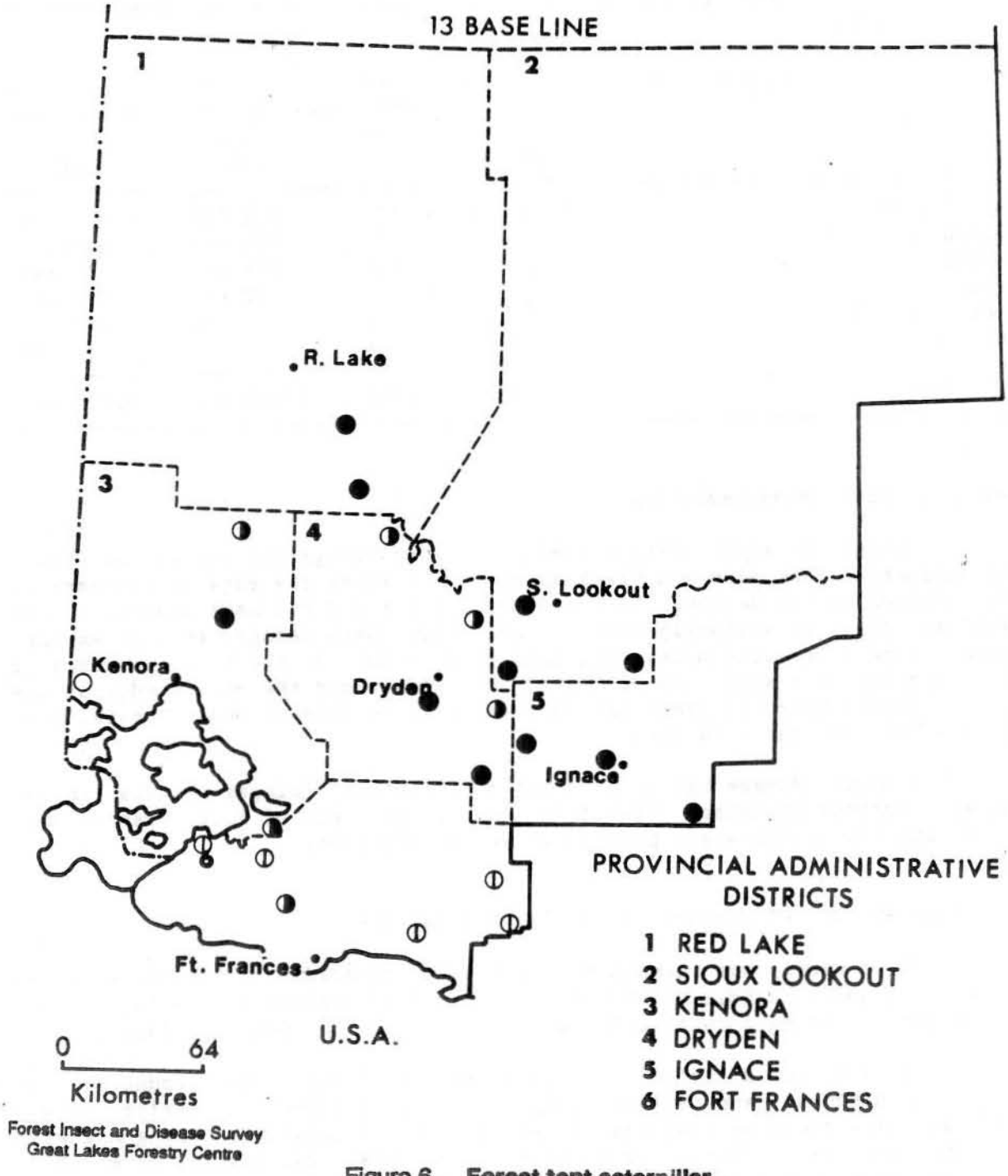

Figure 6. **Forest tent caterpillar, *Malacosoma disstria* (Hbn.)**

Location of egg-band counts in 1990 and defoliation forecasts for 1991.

severe. . . . . ● light. . . . . ◐
moderate. . . . ◑ nil. . . . . ○

Table 7. Forest tent caterpillar egg-band counts on trembling aspen at 23 locations in the Northwestern Region of Ontario in 1990 and infestation forecasts for 1991.

District (location)	Avg. DBH of sample trees (cm)	Avg. no. of egg bands per tree	Infestation forecast for 1991
Dryden District			
Dore Lake Rd	11.0	22	Severe
Hwy 105, Pickerel Creek	12.0	3	Moderate
Sunstrom Twp	13.0	4	Moderate
Borups Corners	10.0	3	Moderate
Snake Bay Rd	11.0	6	Severe
Fort Frances District			
Hwy 11 - Price Creek	10.0	1	Low
- Windy Lake	12.0	1	Low
Morson Seed Orchard	13.0	1	Low
Glengarry R	10.0	1	Low
Dance Hall Rd	13.0	3	Moderate
Caliper Twp	11.0	1	Low
Ignace District			
Hwy 17 - west of Ignace	12.0	24	Severe
- east of Basket Lake Rd	15.0	47	Severe
- Martin Siding	15.0	121	Severe
Kenora District			
Hwy 71 at 404 Rd	10.0	3	Moderate
Jones Rd at CNR	13.0	8	Severe
Hwy 17, Manitoba border	12.0	3	Moderate
Tide Lake	10.0	4	Moderate
Red Lake District			
Hwy 804	14.0	22	Severe
Pakwash Prov. Park	14.0	7	Severe
Sioux Lookout District			
Hwy 642, Umfreville	15.0	31	Severe
Hwy 664, Vermilion Lk	9.0	82	Severe
Big Sandy Lake	14.0	34	Severe

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

This leafminer was commonly encountered at trace-to-low (<24%) damage levels and varied incidence rates across the entire region from east to west and as far north as the southern half of Red Lake District.

Some significant exceptions occurred in Dryden District throughout Zealand and Brownridge townships along the Ghost Lake-Gullwing Lake roads. Here, foliar damage averaged 40 to 65% on 85% of the 4- to 6-m-tall aspen (*Populus* spp.) regeneration examined. Elsewhere in this district, low levels of foliar damage (from 10 to 20% at an incidence level of 95 to 100%) were recorded along the Snake Bay Road and along the Camp 12 Road in Breithaupt Township.

Severe browning of foliage on 5-m trembling aspen, primarily understory and fringe trees, was encountered frequently in the southern half of Ignace District. Foliar damage was usually in excess of 75% on the majority of the trees. Similar damage levels were recorded in a 6-km² area at Goodie Lake in Sioux Lookout District. Several kilometres of juvenile trees growing along the Suffel and Longlegged lakes roads in Red Lake District also sustained this severe level of damage.

Elsewhere in the Region, 5 to 10% foliar damage was observed at numerous locations, on a wide variety of age classes.

White Pine Weevil, *Pissodes strobi* (Peck)

Twenty-one jack pine regeneration areas across the Region were surveyed for this pest (Fig. 7). Standard 150-tree surveys revealed that an average of 3.7% of the leaders were attacked in the areas examined. Damage ranged from a low of 1% in parts of the Dryden and Sioux Lookout districts to a high of 11% along the Kenozhe Road in Fort Frances District. The complete results are presented in Table 8.

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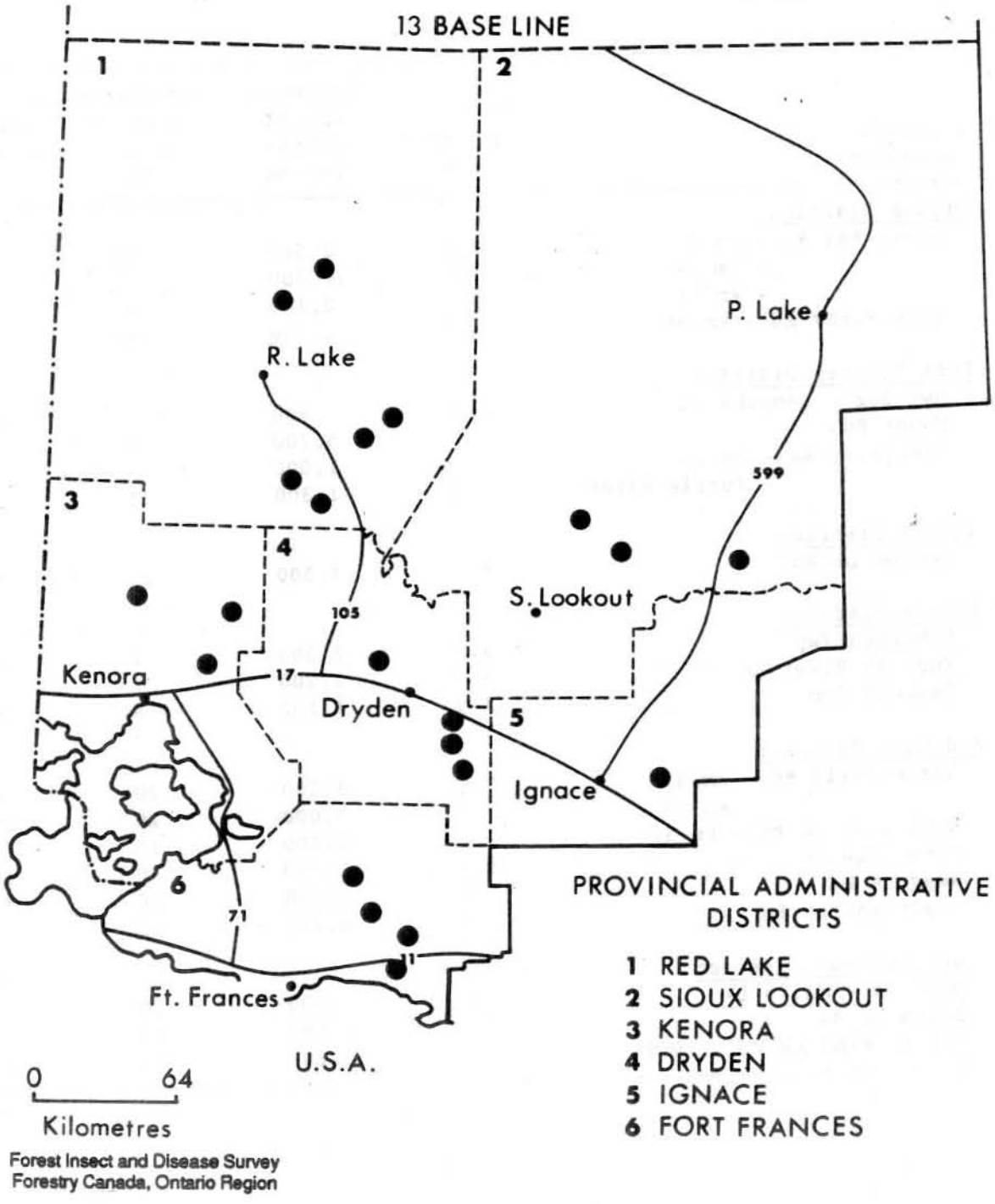

Figure 7. Locations at which surveys for the white pine weevil were carried out in 1990 ..... ●

Table 8. Damage caused by the white pine weevil at 21 locations in the Northwestern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected jack pine trees at each location).

District (Location)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area of stand (ha)	Leaders attacked (%)
Dryden District				
Snake Bay Rd - km 6	2.6	2,500	8	2.0
- km 34	5.5	10,000	1	2.0
- km 41	3.9	2,100	4	1.0
Eton-Rugby Rd - km 38	3.0	1,550	10	3.0
Fort Frances District				
Hwy 502 - Kenozhe Rd	3.4	900	2	11.0
Mount Rd	1.4	5,200	6	6.0
Glengarry Rd - km 16	4.4	1,000	4	3.0
- Turtle River	3.5	1,300	1	2.0
Ignace District				
Sowden Lk Rd	1.9	3,500	20	8.0
Kenora District				
McMeeken Twp	3.5	2,500	2	2.0
English River Rd	3.5	2,200	2	3.0
Desmond Twp	3.0	4,100	4	3.0
Red Lake District				
Snake Falls Rd - km 8	2.7	3,500	20	3.0
- km 12	2.7	3,000	20	2.0
Nungesser Lk Rd - km 30	2.2	3,200	15	2.0
Pineridge Rd	2.3	3,000	20	3.0
Wegg Lk Rd	1.6	2,000	20	5.0
Overnight Lk Rd	1.5	3,200	20	7.0
Sioux Lookout District				
Hwy 516 - Mills Lk	2.6	4,000	20	1.0
Burma Lk Rd	0.8	3,000	15	5.0
Stanzhikimi Lk Rd - km 2	2.2	3,200	10	3.0

Table 9. Other forest insects.

Insect	Host(s)	Remarks
Chionaspis pinifoliae (Fitch) Pine needle scale	wS	Large populations were detected on 3-m understory trees at an OMNR base in Drayton Twp, Sioux Lookout District.
Dioryctria abietivorella (Grt.) Fir coneworm	jP	Coneworms were collected in jack pine leaders killed by the white pine weevil along the Snake Bay Rd in Red Lake District and the Burma Lake Rd in Sioux Lookout District.
Malacosoma californicum pluviale (Dyar) Northern tent caterpillar	pCh	The caterpillar was common on roadside trees throughout the northern half of the Region, often causing 100% defoliation, especially in the Sioux Lookout and Red Lake districts.
Neodiprion maurus Roh. Pine sawfly	jP	Single colonies were detected on roadside regeneration, causing 3 to 4% defoliation at Mills and Stanzhikimi lakes in Sioux Lookout District.
Physokermes piceae (Schr.) Spruce bud scale	wS	Trace numbers were collected on three 4-m trees in Drayton Twp, Sioux Lookout District.
Pityophthorus sp. A bark beetle	jP	At the Luther Lake plantation, Kenora District, 4% of the 3.5-m trees averaged two dead shoots per tree.
Podapion gallicola Riley Pine gall weevil	rP	Trace populations were detected on a single 12-m tree in Drayton Twp, Sioux Lookout District.
Pseudexentera oregonana (Wlsm.) Early aspen leafcurler	tA	Small numbers of leafcurlers caused 5 to 10% defoliation throughout the Red Lake area of Red Lake District.

(cont'd)

Table 9. Other forest insects (concl.).

Insect	Host(s)	Remarks
Scolytus piceae (Swaine) Spruce bark beetle	bS	Small numbers were collected from a dying tree at the Goodie Lake black spruce seed orchard in Sioux Lookout District.
Xylotrechus sagittatus (Germ.) A wood borer	bS	A single larva was collected from a dying tree at the Ferguson black spruce seed orchard in Ignace District.
Zelleria haimbachi Bsk. Pine needle sheathminer	jP	Small numbers were collected on trees in various age classes at Goodie Lake, Sioux Lookout District, and at Aerofoil Lake in Red Lake District.

Major Diseases

Dutch Elm Disease, *Ceratocystis ulmi* (Buism.) C. Moreau

The incidence of this disease was evaluated on 100 roadside ornamental white elm (*Ulmus americana* L.) along Highway 11 on the western side of the town of Fort Frances in Fort Frances District. Tree height and DBH averaged 10 m and 30 cm, respectively. Almost one-third of the trees were dead or dying; 17% were currently infected and another 12% were recently killed. Throughout the town itself, valuable ornamentals continue to die as a result of this disease and the only current program to control its rate of spread is to cut down and remove dead trees.

Spruce Needle Rust, *Chrysomyxa ledi* (Alb. & Schwein.) de Bary var. *ledi*

This needle rust was commonly encountered at varying rates of infection, primarily on black spruce and to a lesser degree on white spruce (*Picea glauca* [Moench] Voss) and Colorado blue spruce (*Picea pungens* Engelm.) ornamentals throughout the entire Region. Although rates of infection varied from 2 to 100%, actual foliar damage averaged <10%, with few exceptions.

Notable exceptions were recorded along the Dixie Lake and Longlegged Lake roads in Red Lake District. South of Dixie Lake, a 15-ha 12-m stand sustained an infection rate of >90% on the current foliage, and at the junctions of Wegg Lake and the Longlegged Lake Road, 1.2-m fringe trees sustained an average infection rate of 40% on the new foliage. Moderate (25 to 75%) foliar damage levels on ornamental blue spruce were often encountered in many towns throughout Fort Frances District.

Additional data on this needle rust are found in the Annual Seed Orchard Survey section of this report.

Western Gall Rust, *Endocronartium harknessii* (J.P. Moore) Y. Hirats.

The western gall rust continues to be a significant problem in jack pine regeneration throughout much of the Region. Surveys conducted in young stands, averaging 2 to 4 m in height, revealed galls on 20% of all trees inspected. In addition, one-third of the affected trees were found to be severely affected, that is, with galls on the main stem or with >25% of all branches affected by one or more galls. Table 10 summarizes data collected on this rust at five locations in the Region in 1990.

General surveys revealed that there appears to be a lower incidence of both infected and severely affected trees in older regeneration areas where the trees have attained a height of 6 to 8 m. Surveys indicated an infection rate of 5 to 10%, with only 5% severely affected.

Table 10. Damage caused by the western gall rust in jack pine regeneration at five locations in the Northwestern Region of Ontario in 1990.

District (Location)	Avg. ht. of trees (m)	Estimated area affected (ha)	Total no. of trees examined	Trees affected (%)	Total no. of trees severely affected (%)
Sioux Lookout District					
Lomond Twp	2.0	10	150	31	12.4
Goodie Lake	3.0	10	150	22	6.2
Vermilion River Rd	3.0	15	100	37	8.1
Ignace District					
Sowden Lake Rd	4.0	15	100	36	2.8
Basket Lake Rd	3.5	10	100	23	9.2

Minor Diseases

Leaf Blight, *Septoria betulae-odoratae* Búbák & Vleúgel

This leaf-blight fungus was widespread at trace-to-low (2 to 10%) damage levels on young open-grown white birch (*Betula papyrifera* Marsh.) averaging 3 to 5 m tall throughout much of the Region. Typically, the lower branches of primarily fringe trees exhibited yellowed foliage by mid-August. A single location near Beauregard Lake in Red Lake District, comprising approximately 25 ha of scattered 4-m-tall white birch, was an exception, with defoliation levels of up to 60% on approximately 75% of the host trees.

Septoria Leaf Spot, *Mycosphaerella populicola* G.E. Thompson

This organism was once again encountered on balsam poplar (*Populus balsamifera* L.) throughout the entire Region. However, damage levels were in the trace-to-low (5 to 10%) category in most instances. This is a significant reduction from the high damage levels (>75%) reported in 1989.

Only a few locations at which significant damage occurred were encountered. These included areas along Highway 105 north of Ear Falls, where damage averaged 50 and 30% in the Chukuni and Bug River areas, respectively, in Red Lake District. At the Manion Lake seed orchard in Fort Frances District, 90% of the balsam poplar regeneration <2 m tall examined along the fringes of the orchard averaged 25 to 75% foliar damage.

Table 11. Other forest diseases.

Disease	Host(s)	Remarks
Armillaria ostoyae (Romagn.) Herink Armillaria root rot	jP	An infection rate of 0.7% was detected in a 15-ha regeneration area along the Burma Lake Rd, Sioux Lookout District.
Leptostroma spp. Needle cast	jP	Trace damage levels were detected on 2% of the 2.6-m trees in a planted area along the Snake Bay Rd, Dryden District.
Venturia macularis (Fr.) E. M|ller & v. Arx Shoot blight	tA	In a 5-ha cutover along the Burma Lake Rd, Sioux Lookout District, 75% of the shoots on the 1.8-m trees were affected. Elsewhere, this blight was commonly observed on aspen regeneration across the Region.

ABIOTIC DAMAGE

Blowdown

Several severe thunderstorms accompanied by strong winds occurred across the Region, causing varying degrees of damage to both forest and urban trees. In mid-June, one such storm caused scattered blowdown across a portion of the northern end of Fort Frances District. Broken-off and blown-down trees, primarily jack pine and poplar (*Populus* spp.), could be found for several kilometres along Highway 502 in the Scattergood Lake area. In Ignace District, two severe storms occurred in August. The first caused blowdown along Highway 17 in the vicinity of the Revell River. Although damage was light and scattered along 4 to 5 km of highway, pockets of black spruce approximately 0.5 ha in size were severely damaged, with more than half of the trees blown over or broken off. The second storm struck in late August and caused considerable blowdown of ornamentals within the town of Ignace. The storm also caused scattered damage in natural stands both north and east of the town.

In early September, a hailstorm in Red Lake District denuded young trembling aspen and white birch along a 0.5-km strip on the Dixie Lake Road near Genessee Lake and uprooted scattered, single trembling aspen in the area.

Drought

Foliar yellowing as a result of drought was evident by early August on white birch and pin cherry (*Prunus pensylvanica* L.f.) on rocky outcrops, especially throughout Kenora District.

FOREST HEALTH

Acid Rain National Early Warning System (ARNEWS)

The annual re-evaluation of the three ARNEWS plots in Northwestern Region confirmed the absence of any symptoms of damage due to airborne pollutants. A single plot is located in each of the Dryden, Fort Frances and Sioux Lookout districts. In addition to the annual evaluation, a 5-year reassesment of trees in and around the plot was also completed. This involved remeasurement of DBH, tree height and crown width and length. A foliar sample was also collected for chemical analyses and an increment core was taken from the various off-plot tree species at each site for growth analyses. A soil pit was dug at each location and soil profiles were recorded and soil samples taken. The following biotic and abiotic problems were encountered during the course of the evaluations at each of the plots:

The most frequently encountered pest at the Sandal Lake plot in Sioux Lookout District was the spruce budworm. Each black spruce sustained trace-to-low (<24%) levels of defoliation. Similar damage levels caused by this pest were recorded on the small balsam fir component of this stand. The jack pine sawfly was noted at trace (<5%) damage levels on two of the 10 off-plot jack pine trees. Spruce needle rust was noted at trace levels on 32% of the black spruce component. Small amounts of damage by the western gall rust were recorded on 2% of the jack pine. Finally, wind damage was detected on 36% of the black spruce, 17% of the jack pine and 50% of the balsam fir.

At the Mafeking Township plot in Dryden District, where the entire stand is jack pine, the jack pine sawfly was noted on 26% of the trees, causing trace foliar damage levels. Both the jack pine resin midge (*Chionopsis pinifoliae* [Fitch]) and the pine needle scale were detected at trace damage levels on 100% of the on- and off-plot trees. The western gall rust accounted for low levels of branch mortality on 63% of the trees and trace levels of wind damage were recorded on 18% of the trees examined.

The Dance Township plot in Fort Frances District had no discernable pests on the jack pine component, other than trace amounts of wind damage on 32% of the trees. The two white birch on the plot sustained severe (up to 75%) foliar damage from the birch leafminer (*Fenusa pusilla* [Lep.]) and the five trembling aspen in the plot were severely defoliated by the forest tent caterpillar.

SPECIAL SURVEYS

Annual Seed Orchard Survey

The summer of 1990 saw the inauguration of a new annual survey of the seed orchards across Northwestern Region. Eight seed orchards, comprising at least two species (black spruce, white spruce and jack pine), will be monitored to develop an inventory of insect and disease problems in seed orchards. This survey will be relocated annually so that a different set of seed orchards will be examined each year (Fig. 8). Each orchard will be surveyed twice during the year to improve the potential for spotting a problem that may not be present during the first visit. The following problems were detected during the first year's survey (Table 12):

The spruce budworm was present at various levels of incidence in all orchards, occurring on from 7.3 to 90.0% of the trees, often in association with the spruce coneworm (*Dioryctria reniculelloides* Mut. & Mun.). However, foliar damage was found only at trace-to-low (1.0 to 10.0%) levels in all instances. The white pine weevil, a leader-damaging pest, was detected at five of the eight orchards. The Manion Lake white spruce orchard had the highest population levels, with 4.6% of the trees affected. Tip blight (*Sphaeropsis sapinea* [Fr.] Dyko & B. Sutton), which is capable of causing whole-tree mortality, was encountered in only one of the eight orchards surveyed, the Skurband Lake black spruce orchard in Sioux Lookout District. The standard 150-tree evaluation conducted during the first visit in mid-June revealed that 18% of the trees were affected. Armillaria root rot was encountered in four of the eight orchards surveyed. The highest level of infection detected was at the Minnesabic black spruce orchard in Kenora District, where 6% of the trees were affected. Spruce needle rust was found at trace (0-3%) damage levels at half of the orchards surveyed. Frost damage was detected at a high incidence rate at five locations; however, foliar damage at all locations was <25%.

Other forest pests sought in this survey, but not encountered, were eastern dwarf mistletoe (*Arceuthobium pusillum* Peck), spruce broom rust (*Chrysomyxa arctostaphyli* Dietel), the white-spotted sawyer beetle (*Monochamus scutellatus* [Say]), the yellowheaded spruce sawfly (*Pikonema alaskensis* [Roh.]) and the spruce bud moth (*Zeiraphera canadensis* Mut. & Free.). The results of this survey are presented in Table 12.

A pest not included in the formal survey but that was encountered during the survey was the eastern spruce gall adelgid (*Adelges abietis* [L.]), which was found at very low population levels at the Ulster Lake black spruce orchard in Kenora District. Mechanical damage was recorded at low levels at three orchards, the Dawe white spruce orchard in Ignace District, the Beauregard black spruce orchard in Red Lake District and the Skurban Lake black spruce orchard in Sioux Lookout District. Damage at all sites was assesed as minimal (<1%).

Control programs for various pest problems were conducted by OMNR District personnel at several orchards during the 1990 field season. Malathion was applied effectively by hand sprayers at a rate of 2 mL of

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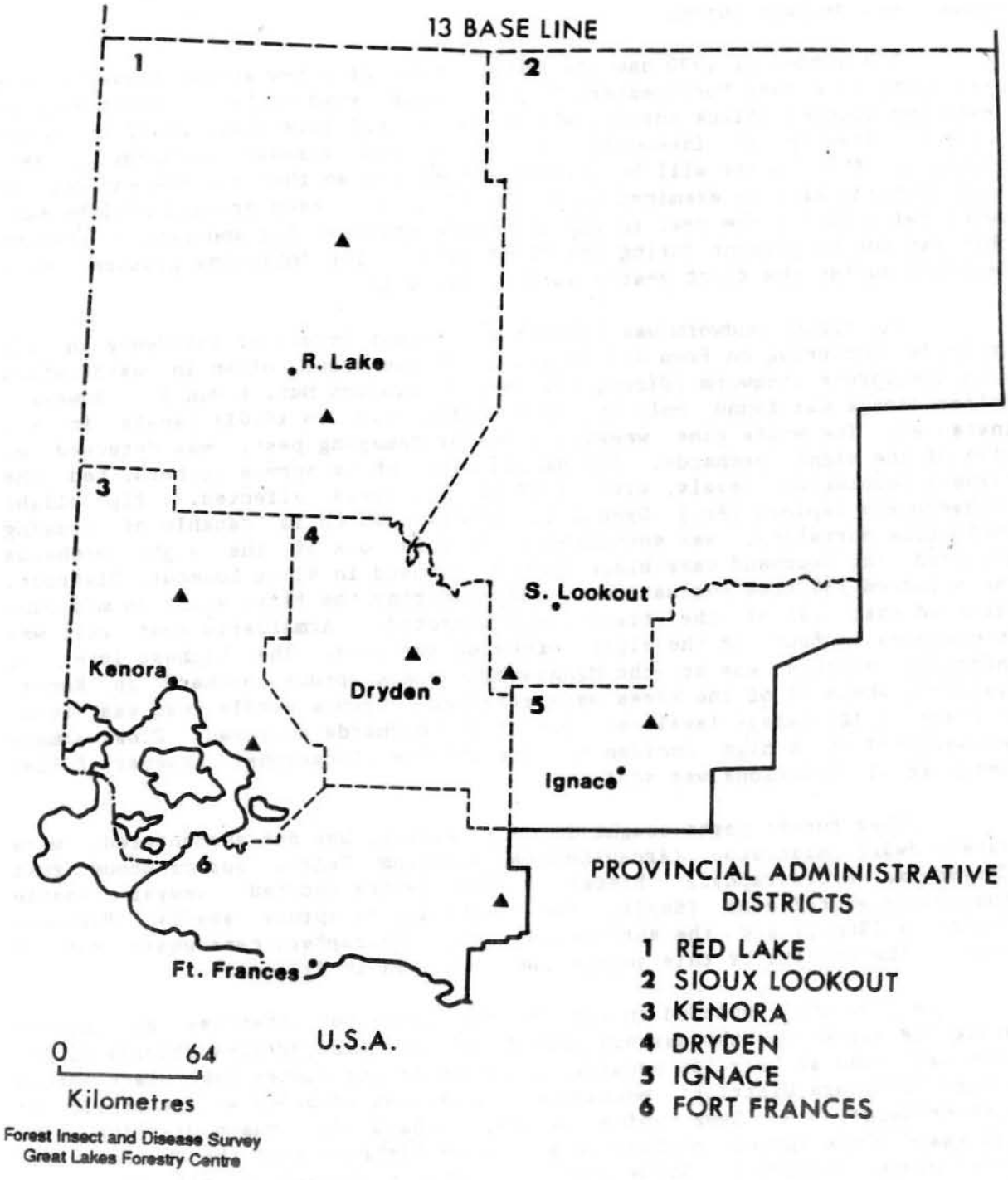

Figure 8. Location of annual seed orchard surveys conducted in 1990. . . . . ▲

Table 12a. Damage in four white spruce seed orchards in the Northwestern Region of Ontario in 1990 (results based on an examination of 150 randomly selected trees at each location).

	Dryden	Fort Frances	Ignace	Red Lake
	Glatz-Rugby	Manion Lake	Dawe	Bawlb Lake
Avg. ht. (m)	0.8	1.6	1.1	0.5
Area (ha)	4	8	11	8
Trees/ha	400	333	400	400
Spruce budworm				
Trees affected (%)	7.3	22.0	74.0	8.0
Spruce coneworm				
Trees affected (%)	0.0	0.0	0.0	0.0
Defoliation by budworm/coneworm (%)	1.4	3.0	10.0	1.0
Yellowheaded spruce sawfly				
Trees affected (%)	0.0	0.0	0.0	0.0
Monochamus sp.				
Trees affected (%)	0.0	0.0	0.0	0.0
White pine weevil				
Leaders affected (%)	0.0	4.6	1.2	0.0
Frost injury				
Trees affected (%)	52.6	44.6	84.7	82.0
Foliar damage (%)	6.9	7.7	15.0	25.0
Armillaria root rot				
Trees affected (%)	0.0	0.0	0.7	0.0
Needle rust				
Trees affected (%)	3.0	23.3	0.0	0.0
Foliar damage (%)	1.0	3.0	0.0	0.0
Tip blight				
Trees affected (%)	0.0	0.0	0.0	0.0
Cone rust				
Trees affected (%)	0.0	0.0	0.0	0.0

Table 12b. Damage in four black spruce seed orchards in the Northwestern Region of Ontario in 1990 (results based on an examination of 150 randomly selected trees at each location).

	Kenora		Red Lake	Sioux Lookout
	Minnesabic	Ulster	Beauregard	Skurban Lake
Avg. ht (m)	2.1	2.1	2.7	2.3
Area (ha)	5	5	5	5
Trees/ha	3,100	3,200	3,200	3,200
Spruce budworm				
Trees affected (%)	44.0	34.6	33.3	90.0
Spruce coneworm				
Trees affected (%)	0.0	0.0	0.0	0.0
Defoliation by budworm/coneworm (%)	1.0	-[a]	1.0	4.0
Yellowheaded spruce sawfly				
Trees affected (%)	0.0	0.0	0.0	0.0
Monochamus sp.				
Trees affected (%)	0.0	0.0	0.0	0.0
White pine weevil				
Leaders affected (%)	0.7	-[a]	2.0	2.6
Frost injury				
Trees affected (%)	0.0	0.0	84.0	0.0
Foliar damage (%)	0.0	0.0	84.0	0.0
Armillaria root rot				
Trees affected (%)	6.0	-[a]	0.7	0.7
Needle rust				
Trees affected (%)	5.3	-[a]	0.0	44.0
Foliar damage (%)	0.5	-[a]	0.0	1.0
Tip blight				
Trees affected (%)	0.0	0.0	0.0	18.0
Cone Rust				
Trees affected (%)	0.0	0.0	0.0	0.0

[a] No second visit occurred at this orchard because of road washouts.

active ingredient per litre of water at the 5th Creek jack pine orchard in Kenora District to control grasshoppers (Acrididae). Effective control was also carried out against the spruce budworm on white spruce using Malathion, applied at 2 mL per litre of water, Ambush 500EC, at 50 mL per litre of water, and B.t. at 4 mL per litre of water at the Glatz orchard in Dryden District. Leaders attacked by the white pine weevil were clipped by hand at Skurban Lake in Sioux Lookout District and at Manion Lake in Fort Frances District.

Tip blight was also controlled effectively by hand clipping at the Skurban Lake orchard in Sioux Lookout District. The orchard was clipped twice during the season, removing any branches that exhibited signs of infection. Removal of infected tissue before the fungus could mature and form fruiting bodies was a helpful control measure. As in 1989, any tree with more than half of its branches thought to be infected was removed completely. To date, 13% of the affected trees have been removed from the Skurban Lake orchard in an effort to control the spread of this disease. A further 9.8% of the affected trees have had one-third or less of the crown removed, and 11.3% have had one-half to three-quarters removed. During these 2 years, the remaining 65.9% of the affected trees have had one or more branches pruned as a result of suspected branch infections.

Additional Seed Orchard Surveys

In conjunction with the annual seed orchard survey, the remaining 11 orchards in the Region were also surveyed for any evidence of pest or other problems (Fig. 9). However, only a 500-tree summary estimate was conducted at each site, not a complete 150-tree evaluation. The information from this survey is presented in Table 13.

The spruce budworm was the most common and significant insect pest found during the survey. Eight orchards were infested, with the proportion of trees affected ranging from a low of 1.0% at Morson, in Fort Frances District, to a high of 98.0% at Aubrey, in Dryden District. However, the corresponding defoliation levels were low. The white pine weevil was detected at eight locations, ranging from a low of 0.8% leader damage at Melgund, in Dryden District, to a high of 24.0% at Vermeersch Lake, in Ignace District. The yellowheaded spruce sawfly was detected only at the Aubrey Township black spruce orchard, Dryden District, causing 60% defoliation of the new growth on 3.3% of the trees.

Tip blight was found affecting four orchards. The Goodie Lake North seed orchard in Sioux Lookout District was the most heavily infected orchard, with 23.8% of the trees affected. The orchard at Goodie Lake South in Sioux Lookout District sustained an infection rate of 6.0%, and in Ignace District the Ferguson orchard was found to have an infection rate of 1.6% and the Vermeersch orchard a 1.8% infection rate. Spruce needle rust was detected in six orchards, with an infection rate of 100% occurring in two of the Dryden District orchards; however, foliar damage at all locations averaged <2%. Armillaria root rot was found to be causing an average current mortality rate of only 0.4% at four of the 11 orchards, a significant reduction from the

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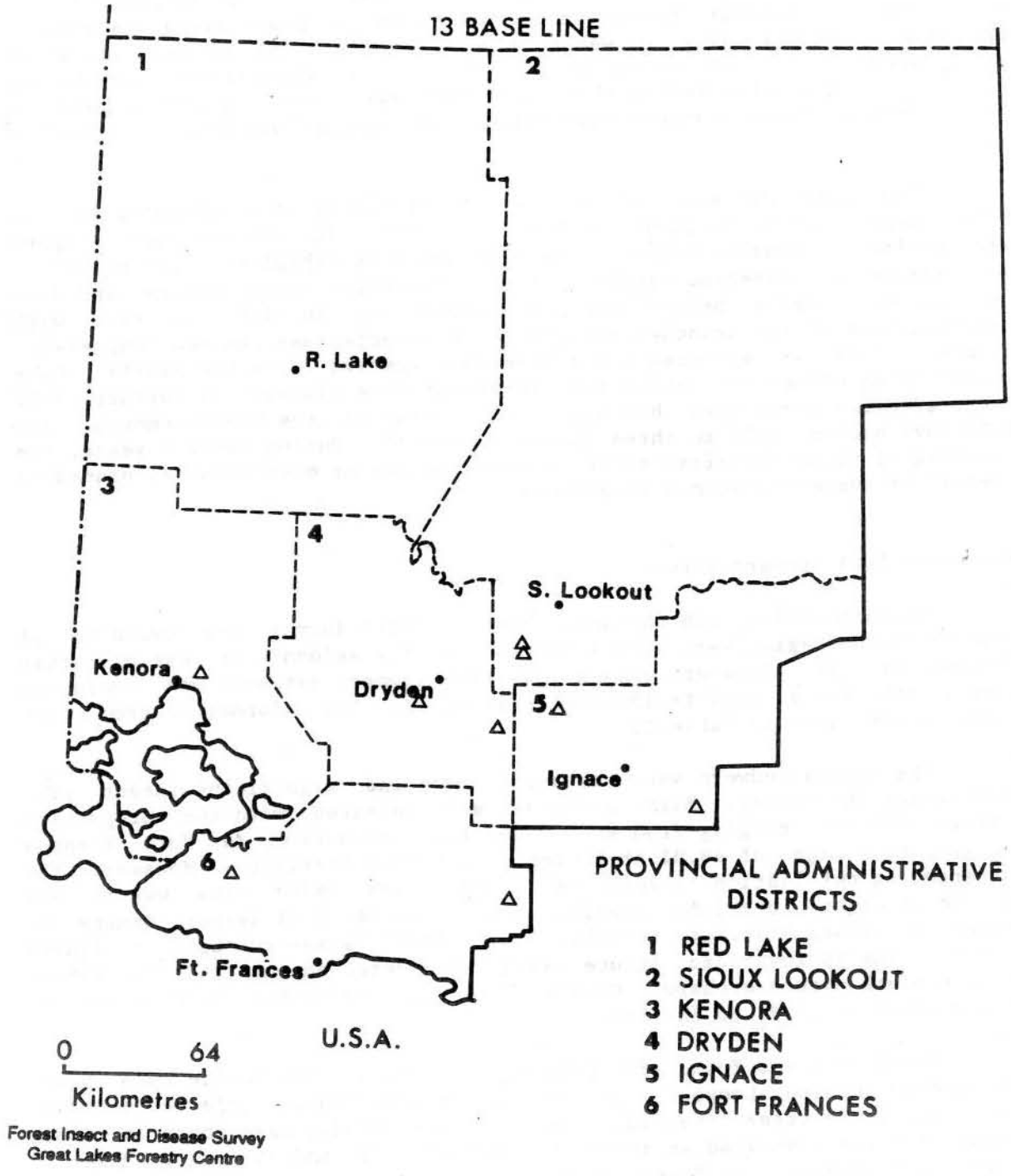

Figure 9. Location of additional seed orchard surveys conducted in 1990. . . . . Δ

Table 13a. Results of a seed orchard survey conducted at 11 locations in the Northwestern Region of Ontario in 1990 (counts based on an examination of 500 randomly selected trees at each location).

District (Location)	Tree species	Estimated stand area (ha)	Estimated no. of trees per ha	Avg. ht. of trees (m)	Spruce budworm		White pine weevil	Yellowheaded spruce sawfly	
					Trees affected (%)	Avg. defol. per tree (%)	Leaders attacked (%)	Trees affected (%)	Avg. defol. per tree (%)
Dryden District									
Aubrey	bS	3	625	1.7	82.0	10.0	1.3	3.3	60.0
Aubrey	wS	8	625	2.0	98.0	12.0	1.3	0.0	0.0
Melgund	bS	5	3,000	2.0	0.0	0.0	0.8	0.0	0.0
Fort Frances District									
Manion Lake	bS	5	3,200	2.0	0.0	0.0	2.0	0.0	0.0
Morson	bS	5	2,750	2.5	1.0	3.0	0.0	0.0	0.0
Morson	wS	8	270	1.0	0.0	0.0	0.0	0.0	0.0
Ignace District									
Ferguson	bS	10	3,200	2.2	7.2	1.0	12.0	0.0	0.0
Vermeersch	bS	10	3,000	2.3	54.6	1.0	24.0	0.0	0.0
Kenora District									
High Lake	wS	10	60	0.7	34.0	3.0	0.0	0.0	0.0
Sioux Lookout District									
Goodie Lake North	bS	5	3,000	2.5	29.4	2.0	1.4	0.0	0.0
Goodie Lake South	bS	5	3,000	2.3	24.2	1.6	2.2	0.0	0.0

Table 13b. Results of a seed orchard survey conducted at 11 locations in the Northwestern Region of Ontario in 1990 (counts based on an examination of 500 randomly selected trees at each location).

District (Location)	Tree species	Estimated stand area (ha)	Estimated no. of trees per ha	Avg. ht. of trees (m)	Tip blight		Armillaria root rot	Needle rust		Frost	
					Trees affected (%)	Avg. defol. per tree (%)	Trees affected (%)	Trees affected (%)	Avg. defol. per tree (%)	Trees affected (%)	Avg. defol. per tree (%)
Dryden District											
Aubrey	bS	3	625	1.7	0.0	0.0	0.0	100.0	1.0	48.0	3.0
Aubrey	wS	8	625	2.0	0.0	0.0	0.0	1.3	1.0	0.0	0.0
Melgund	bS	5	3,000	2.0	0.0	0.0	0.2	100.0	1.0	5.0	3.0
Fort Frances District											
Manion Lake	bS	5	3,200	2.0	0.0	0.0	0.0	36.0	5.0	49.0	5.0
Morson	bS	5	2,750	2.5	0.0	0.0	0.0	0.0	0.0	6.0	3.0
Morson	wS	8	270	1.0	0.0	0.0	0.0	1.0	1.0	49.0	5.0
Ignace District											
Ferguson	bS	10	3,200	2.2	1.6	6.0	0.4	0.0	0.0	0.0	0.0
Vermeersch	bS	10	3,000	2.3	1.8	2.0	0.6	0.0	0.0	0.0	0.0
Kenora District											
High Lake	wS	10	60	0.7	0.0	0.0	0.0	4.0	1.0	16.0	3.0
Sioux Lookout District											
Goodie Lk north	bS	5	3,000	2.5	23.8	2.0	0.0	0.0	0.0	0.0	0.0
Goodie Lk south	bS	5	3,000	2.3	6.0	1.0	4.0	0.0	0.0	0.0	0.0

levels recorded in 1989. Frost damage was found at six orchards, affecting an average of 28.8% of the trees and causing <4% foliar damage. Winter drying was found at three orchards, affecting an average of 1.9% of the trees and 8.0% of the foliage.

Control operations for the white pine weevil were conducted at the Sioux Lookout, Fort Frances and Ignace district orchards. Infested leaders were clipped and removed from the sites. Tip blight damage was also clipped by hand and removed from the orchards in the Sioux Lookout and Ignace districts. If the infection was confined to a single branch, the entire branch was removed, but if more than half of the tree was believed to be infected, then the entire tree was removed. In Sioux Lookout District, OMNR staff conducted two such sanitation operations during the growing season, the first in early June and the second in early September. This was a continuation of the 1989 program. At Goodie Lake North, 13.0% of the affected trees have been completely removed to date and an additional 26.7% have had three-quarters or less of their crowns removed. The remaining 60.3% of the affected trees have had one or more branches removed. At Goodie Lake South, 14.2% of the affected trees were removed entirely and 18.0% had three-quarters or less of the tops cut off. The remaining 67.8% of the affected trees have also been pruned to remove possible branch infections. In Ignace District, hand-clipping of affected trees was conducted in conjunction with the white pine weevil sanitation clipping in early July. No trees were considered to be heavily infected and had to be removed completely and fewer than 50 trees at each orchard were clipped because of suspected tip blight infection. Control of tip blight appears to have been successful in reducing the incidence and spread of the disease throughout the orchards. Subsequent visits will be required to monitor the complete effectiveness of this program.

Black Spruce Seed and Cone Pests

During the course of the annual seed orchard survey, 25 or more randomly selected green cones were taken from each orchard, when available, to determine the presence and identity of seed and cone pests. The complete list of pests recovered and the proportion of cones damaged by each pest is presented in Table 14. The following is a brief description of the pests encountered at the five orchards sampled.

The larvae of a coneworm (*Dioryctria* sp.) were found to have hollowed out and destroyed some developing cones. Larvae of the spruce cone maggot (*Lasiomma anthracinum* [Czerny]) were found tunnelling in a spiral fashion along the cone axis and causing considerable seed loss. Although damage by lepidopterous larvae is usually confined to the exterior of the cone, causing slight deformation, severe damage and partial or complete seed loss can occur. The spruce budworm, a commonly encountered pest in the orchards, is included in this order of insects, and the majority of the damage classified as lepidopterous may have been attributable to the budworm under these circumstances.

Table 14. Pests found damaging green cones at five seed orchards in the Northwestern Region of Ontario in 1990.

District (Location)	Tree species	No. of cones collected	Damaged cones (%)	Principle cause of cone damage and proportion attributed to each pest (%)	
Dryden District					
Glatz-Rugby	wS	30	16.6	Lepidoptera	80.1
				Lasiomma anthracinum	19.9
Fort Frances District					
Manion Lake	wS	28	100.0	*Lasiomma anthracinum*	89.3
				Dioryctria sp.	10.7
Kenora District					
Minnesabic Lake	bS	36	16.6	Lepidoptera	100.0
Red Lake District					
Beauregard Lake	bS	25	19.0	Lepidoptera	50.0
				Unknown	50.0
Sioux Lookout District					
Skurban Lake	bS	25	28.0	*Dioryctria* sp.	14.2
				Lepidoptera	85.8

Gypsy Moth Pheromone Traps

Pheromone traps were set out at 10 locations in the Region in 1990, nine of which were provincial parks; the tenth location was Minaki Lodge in Kenora District (Fig. 10). At all but one of the locations, two traps were set out in late June, prior to the flight of the adult male gypsy moth (*Lymantria dispar* [L]). At Blue Lake Provincial Park in Dryden Distict, the tenth location, 10 traps were set out because one male moth had been trapped at the park in 1989. This level of surveillance will determine if an infestation of this potentially harmful pest was building undetected in the park due to the heavy hardwood defoliation that is currently occurring as a result of the forest tent caterpillar infestation.

Four male moths were captured this season, two at Blue Lake Provincial Park and one each at Caliper Lake Provincial Park in Fort Frances District and Sioux Narrows Provincial Park in Kenora District. This is the highest total number of moths captured to date in the Region, and although these numbers do not imply that infestations are present, they do indicate a need for continued monitoring of the pest in the parks.

The results of the trapping program and the locations trapped are presented in Table 15.

NORTHWESTERN REGION

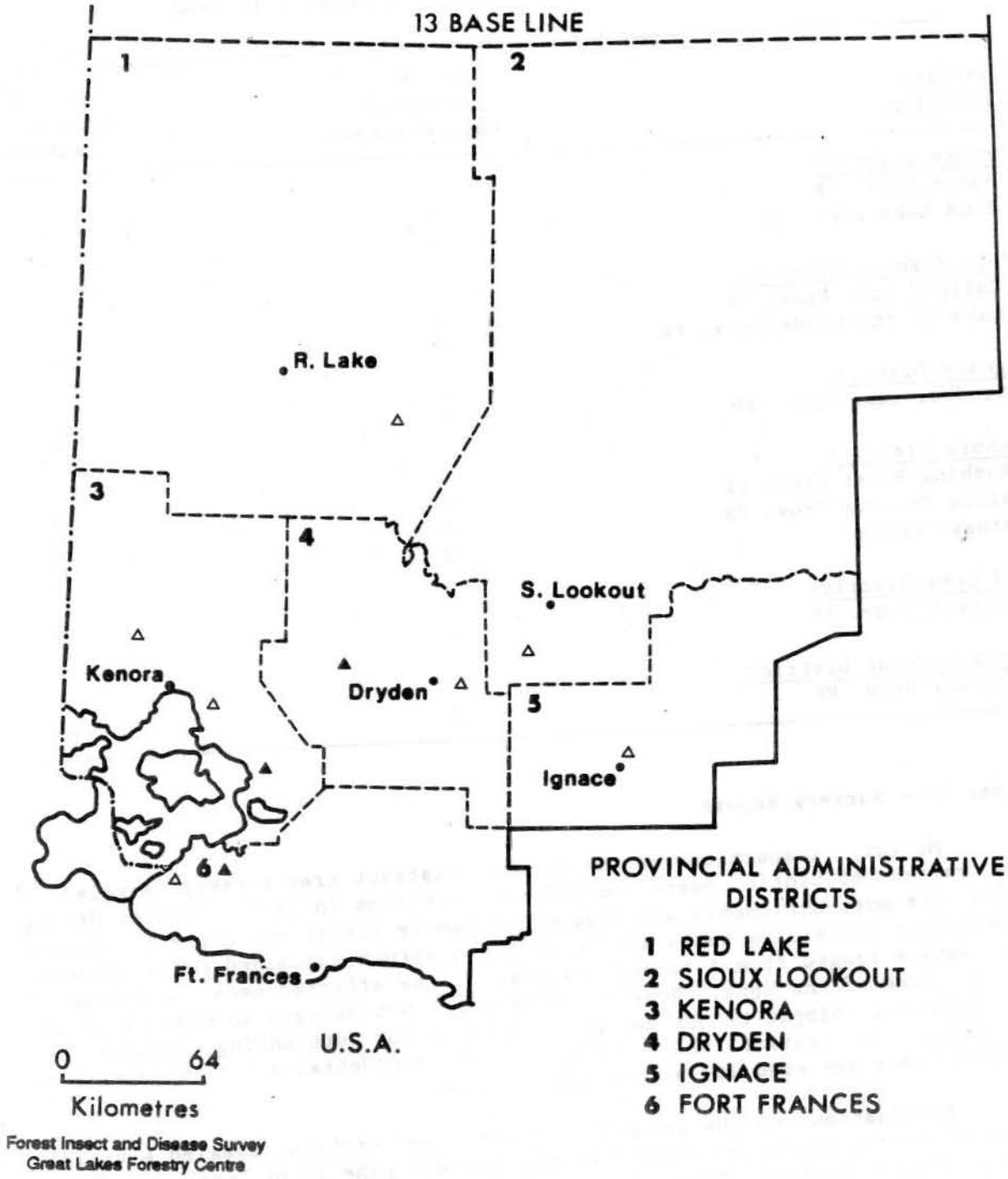

Figure 10. **Gypsy moth,**
***Lymantria dispar* (L.)**

Locations where pheromone traps were deployed in 1990.

Positive. . . . ▲
Negative. . . . △

Table 15. Results of the gypsy moth pheromone trapping program at 10 locations in the Northwestern Region of Ontario in 1990.

District (Location)	No. of pheromone traps deployed	No. of male moths captured
Dryden District		
Aaron Prov. Pk	2	0
Blue Lake Prov. Pk	10	2
Fort Frances District		
Caliper Lake Prov. Pk	2	1
Lake of the Woods Prov. Pk	2	0
Ignace District		
Sandbar Lake Prov. Pk	2	0
Kenora District		
Rushing River Prov. Pk	2	0
Sioux Narrows Prov. Pk	2	1
Minaki Lodge	2	0
Red Lake District		
Pakwash Prov. Pk	2	0
Sioux Lookout District		
Ojibway Prov. Pk	2	0

Forest Tree Nursery Report

Monthly inspections of the Dryden District tree nursery revealed a wide variety of biotic pests and abiotic problems in 1990. Winter drying caused the most noticeable and widespread damage across the nursery. Eleven compartments containing white spruce or black spruce sustained foliar damage. This damage ranged from 5 to 10% in most of the affected beds to a high of 45% in three of the beds. However, buds were not damaged in most cases and the stock was shipped to the various districts for outplanting. Winter drying damage to eastern white cedar (*Thuja occidentalis* L.) windbreak or hedgerow trees averaged 10% across the nursery.

Examinations of the nursery jack pine seed orchard revealed a variety of common forest pests, but only one, the eastern pine shoot borer, was found at significant levels. This insect damaged shoots on approximately 33% of the 4-m-tall jack pine stock over a 4-ha area. Other pests identified at trace incidence and damage levels in this seed orchard included the spruce budworm, the pine spittlebug (*Aphrophora cribrata* [Wlk.]), a jack pine sawfly (*Neodiprion* sp.), the northern pitch twig moth (*Petrova albicapitana* [Bsk.]) and Armillaria root rot.

Elsewhere in the nursery, a single stem canker caused by the sweet-fern blister rust (*Cronartium comptoniae* Arthur) was noted on a 0.7-m jack pine in the test stock area (T1). Several trays of black spruce seedlings germinated in the early spring in one of the nursery greenhouses were decimated by the gray mold fungus (*Botryotinia fuckeliana* [de Berg] Whetzel). Herbicide overspraying was found to have caused low-to-moderate (25-75%) levels of foliar damage to a group of young roadside green ash (*Fraxinus pensylvanica* var. *subintegerrima* [Vahl.] Fern.) ornamentals.

Climatic Data

Seasonal variations in the normal weather patterns have a direct effect on both biotic and abiotic conditions, as do sudden and extreme changes in weather. Monitoring daily weather conditions also permits an accurate predication of the emergence of overwintering larvae of some of the major forest pests. For these reasons, the FIDS Unit maintains daily and monthly averages of weather conditions for numerous locations across the province. Table 16 summarizes the weather data for 1990 provided by two Atmospheric Environment Service weather offices in Northwestern Region. The normals quoted were taken directly from the Canadian Climate Normals for Ontario, 1951-1980.

Table 16. Mean temperature and total precipitation at three locations in the Northwestern Region of Ontario in 1990.

Location	Month	Mean temperature (°C) Normal	Mean temperature (°C) Actual	Deviation from normal (°C)	Total precipitation (mm) Normal	Total precipitation (mm) Actual	Deviation from normal (mm)
Fort Frances Airport	Jan.	-16.9	-10.6	+5.5	30.6	19.0	-11.6
	Feb.	-13.1	-11.1	+2.0	22.7	25.2	+2.5
	March	-5.7	-2.8	+2.9	31.6	29.3	-2.3
	April	3.8	3.6	-0.2	48.5	47.7	-0.8
	May	11.0	9.5	+1.5	71.2	53.4	-17.8
	June	16.4	17.3	+0.9	101.7	159.8	+58.1
	July	19.2	18.9	-0.3	103.6	-50.3	-53.3
	Aug.	17.7	18.5	+0.8	82.6	74.6	-8.0
	Sept.	12.2	14.4	+2.2	83.8	48.6	-35.2
	Oct.	6.6	4.6	-2.0	50.9	47.0	-3.9
	Nov.	-3.2	-1.7	+1.5	36.8	16.4	-20.4
	Dec.	-12.4	-14.4	-2.0	31.8	48.6	+16.8
Sioux Lookout Airport	Jan.	-19.4	-13.7	+6.3	36.0	57.8	+21.8
	Feb.	-15.7	-15.2	+0.5	26.8	27.2	+0.4
	March	-8.3	-5.4	+2.9	35.0	31.8	-3.2
	April	1.4	1.5	+0.1	45.2	51.3	+6.1
	May	9.2	8.6	-0.6	65.8	48.5	-17.3
	June	15.2	15.9	+0.7	91.7	156.3	+64.6
	July	18.3	18.4	+0.1	93.7	89.5	-4.2
	Aug.	16.6	18.2	+1.6	88.3	66.6	-21.7
	Sept.	10.7	11.7	+1.0	81.6	51.4	-30.2
	Oct.	4.7	3.7	-1.0	64.9	46.3	-18.6
	Nov.	-5.3	-3.2	+2.1	49.9	47.3	-2.6
	Dec.	-15.1	-17.2	-2.1	33.7	48.1	+14.4
Kenora Airport	Jan.	-18.5	-11.7	+6.8	28.2	37.5	+9.3
	Feb.	-14.4	-13.8	+1.4	23.0	16.9	-6.1
	March	-7.1	-4.1	+3.0	30.1	40.3	+10.2
	April	2.7	2.5	-0.2	41.9	29.8	-12.1
	May	10.5	10.1	-0.4	57.3	32.5	-24.8
	June	16.1	16.8	+0.7	83.4	141.7	+58.3
	July	19.2	19.1	-0.1	91.8	64.4	-27.4
	Aug.	17.6	19.5	+1.9	85.9	23.5	-62.4
	Sept.	11.7	13.1	+1.4	69.2	49.4	-19.8
	Oct.	5.6	4.8	-0.8	40.7	17.8	-22.9
	Nov.	-4.6	-3.3	+1.3	40.4	21.9	-18.5
	Dec.	-14.1	-16.6	-2.5	31.2	28.2	-3.0

Table A-1. Northwestern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1990, and infestation forecasts for 1991.

Location	Host	Estimated defoliation in 1990 (%)	No. of egg masses per 9.29 m2 of foliage	Infestation forecasts for 1991[a]	Accumulated damage[b]
Dryden District (20 locations)					
Aerobus Lake	bF	53	347	S	2
Aubrey Twp	bF	48	105	M-S	1
Beaverhouse Lake	bF	72	191	M-S	3
Brownridge Twp	bF	25	166	M-S	2
Cedar Lake	bF	52	316	S	2
Cliff Lake	wS	38	905	S	1
Eagle Lake - E. side	bF	23	54	L-M	4
- Meridian Bay	bF	82	789	S	4
Forest Lake	bF	50	440	S	2
Ingall Lake	bF	37	445	S	2
Melgund Twp - SPA[c]	bS	8	58	M	0
Mutrie Twp - Eagle River	wS	49	763	S	2
Rugby Twp	bF	57	505	S	2
Southworth Twp	bF	13	330	S	2
Tadpole Lake	bF	58	224	M-S	5
Thaddeus Lake	bF	33	535	S	2
Tustin Twp	bF	13	11	L	1
Wapageisi Lake	bF	83	59	M-S	5
Washeibemaga Lake	bF	75	368	S	3
Zealand Twp - Aaron Prov. Pk	bF	49	1239	S	2
Fort Frances District (13 locations)					
Bear Pass	bF	8	426	S	0
Boffin Lake	bF	18	237	S	1
Carleton Lake	bF	26	125	M-S	3
Claxton Twp - Caliper Lake Prov. Pk	bF	62	1189	S	1
Entwine Lake	bF	33	103	M-S	1
Eric Lake	bF	13	161	M-S	1
Jackfish Lake	bF	23	371	S	2
Kaiarskons Lake	bF	46	451	S	3
Kawawia Lake	bF	7	23	L-M	9
Pipestone Lake	bF	43	126	M-S	7
Potts Twp	bF	13	85	M-S	0
Rainy Lake - Ash Bay	bF	6	0	0	1
Vickers Lake	bF	6	0	0	9

(cont'd)

Table A-1. Northwestern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1990, and infestation forecasts for 1991 (cont'd).

Location	Host	Estimated defoliation in 1990 (%)	No. of egg masses per 9.29 m² of foliage	Infestation forecasts for 1991[a]	Accumulated damage[b]
Ignace District (22 locations)					
Bark Lake	bF	83	38	L-M	3
Barrel Lake	bF	75	300	S	3
Basket Lake	bF	62	297	S	3
Bell Lake	bF	86	271	S	3
Bertrand Twp	bF	6	15	L-M	2
Campus Lake	bF	58	76	M-S	7
Cecil Lake	bF	74	57	M-S	4
Collins Lake	bF	84	203	M-S	3
Dewan Twp	bF	38	46	M	2
Hook Lake	bF	94	77	M-S	8
Indian Lake	bF	83	337	S	3
Kin Lake	bF	52	305	S	4
Kukukus Lake	bF	60	564	S	4
Phyllis Lake	bF	50	80	M-S	6
Sandbar Lake Prov. Pk - Stand 740	bF	47	78	M-S	2
Selwyn Lake	bF	71	861	S	3
Shikag Lake	bF	81	639	S	3
Smirch Lake	bF	24	252	S	6
Sturgeon Lake - Granite Bay	bF	93	513	S	2
- North Arm	bF	26	74	M-S	1
Tag Lake Road	bF	63	123	M-S	2
Vista Lake	bF	62	153	M-S	2
Kenora District (19 locations)					
Cameron Lake - Stand 265	bF	40	148	M-S	1
Chase Lake	bF	45	109	M-S	2
Cygnet Lake	wS	33	710	S	2
Dowswell Lake	bF	83	726	S	4
English River Rd - Stand 8	bF	28	628	S	1
Forgie Twp - Rush Bay Rd	bF	34	1,413	S	2
Lennan Lake	bF	74	255	S	2
Mayburn Rd - Stand 102	bF	19	27	L-M	1
Maynard Lake	bF	56	259	S	2
McGeorge Twp - Sioux Narrows	bF	27	1,087	S	0

(cont'd)

Table A-1. Northwestern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1990, and infestation forecasts for 1991 (cont'd).

Location	Host	Estimated defoliation in 1990 (%)	No. of egg masses per 9.29 m2 of foliage	Infestation forecasts for 1991[a]	Accumulated damage[b]
Kenora District (concl.) (19 locations)					
Paintpot Lake	bF	59	1,733	S	2
Pelican Twp - Pelican Pouch Lake	bF	20	353	S	2
Pellatt Twp - Sandy Lake	bF	18	227	S	1
Rowan Lake	bF	85	156	M-S	5
Rushing River Prov. Pk	bF	8	36	L-M	0
Sand Lake	bF	31	119	M-S	2
Snowshoe Lake	bF	23	435	S	2
Stephen Lake - Stand 220	bF	8	112	M-S	0
Toothpick Lake	bF	86	61	M-S	3
Red Lake District (23 locations)					
Baird Twp	bF	56	570	S	1
Bateman Twp - East Bay	bF	33	120	M-S	1
Beauregard Lake - Seed Orchard	bS	0	0	0	1
Birch Lake - South Bay	bF	79	478	S	2
Chukuni Lake Rd	bF	12	105	M-S	0
Conifer Lake	bF	59	893	S	3
Ear Falls	bF	37	345	S	2
Earngey Twp	bF	57	1,739	S	3
Flundra Lake	bF	78	108	M-S	2
Knott Twp	bF	75	438	S	3
Lac Seul - Farewell Bay	bF	78	478	S	2
Lietch Lake	bF	94	653	S	3
Longlegged Lake Rd	bF	86	482	S	3
McDonough Twp	bF	38	403	S	1
Murdock Lake	bF	18	299	S	1
Nungesser Road - Stand 67	bS	0	17	L-M	1
- Stand 75	bS	0	0	0	1
- Stand 76	bS	0	11	L-M	1
Pakwash Prov. Pk - Group Camping	bF	88	441	S	2
- Trailer Camp	bF	58	163	M-S	1
Sydney Lake	bF	89	647	S	4
Unexpected Lake	bF	36	529	S	2
Whitemud Lake	bF	83	321	S	5

(cont'd)

Table A-1. Northwestern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1990, and infestation forecasts for 1991 (concl.).

Location	Host	Estimated defoliation in 1990 (%)	No. of egg masses per 9.29 m² of foliage	Infestation forecasts for 1991[a]	Accumulated damage[b]
Sioux Lookout District (23 locations)					
Aerofoil Lake	bF	10	47	L-M	2
Big Sandy Lake	bF	93	850	S	3
Carling Lake	bF	4	9	L	1
Deception Lake	bF	88	234	S	2
Drayton Twp - Abram Lake	bF	69	309	S	3
Factor Twp	bF	79	343	S	2
Goodie Lake Seed Orchard					
- North	bS	3	17	L	1
- South	bS	3	0	0	1
Jacknife Lake	bF	45	458	S	3
Kimmewin Lake - Stand 410	bF	64	258	S	3
Lac Seul - Black Bay	bF	61	605	S	4
- Coons Bay	bF	84	157	M-S	2
- Merritt Bay	bF	38	144	M-S	2
- Whitefish Bay	bF	61	561	S	1
- Windigo Point	bF	53	917	S	3
Mascara Lake	bF	63	497	S	2
Ojibway Prov. Pk					
- Entrance	bF	84	363	S	3
- Terry Lake Trail	bF	41	719	S	4
Savant Lake - NE Arm	bF	3	12	L	1
Skurban Lake - Seed Orchard	bS	3	54	M	1
Sunlight Lake	bF	89	235	S	4
Wapesi Lake - Stand 470	bF	37	353	S	2
Wapesi River	bF	67	96	M-S	1

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

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

[c] SPA - Seed production area

Table A-2. Northwestern Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1990 and infestation forecasts for 1991 on jack pine.

Location	Estimated defoliation in 1990 (%)	No. of egg masses per 9.29 m² of foliage	Infestation forecasts for 1991[a]
Dryden District			
Mutrie Twp - Impact Plot	9	0	N
Redvers Twp - stand 51	40	0	N
Zealand Twp - tree nursery	6	0	N
Ignace District			
Kay Lake	6	0	N
McNevin Twp - Encamp Lake Rd	8	0	N
Kenora District			
Coyle Twp	4	1	L
Gundy Twp	23	0	N
Kirkup Twp	3	0	N
Redditt Twp	11	1	L
Red Lake District			
Agnew Twp - Perrigo Lake	23	0	N
Kirkness Lake - Stand 441	33	12	H
Madden Lake	51	4	M
Offer Lake	18	6	H
Pikangikum Lake	7	1	L
Silcox Lake	10	1	L
Wavell Lake	22	1	L
Sioux Lookout District			
Aerial Lake	8	0	N
Aerofoil Lake	5	0	N
Deaddog Lake	23	0	N
Goodie Lake	61	5	M
Papaonga Lake	25	1	L

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