

**RESULTS OF FOREST INSECT  
AND DISEASE SURVEYS IN THE  
NORTHWEST REGION OF ONTARIO  
1993**

*Forest Districts: Dryden, Fort Frances,  
Geraldton, Kenora, Nipigon, Red Lake,  
Sioux Lookout, and Thunder Bay*

*W.D. Biggs, D.C. Constable,  
A.J. Keizer, and P.M. Bolan*

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## SURVEY HIGHLIGHTS

This report presents data collected in 1993 by the Forest Insect and Disease Survey (FIDS) unit on various insects, diseases, and abiotic damage in the Ontario Ministry of Natural Resources' (OMNR) Northwest Region. Additional information is included on biomonitoring plots currently being studied and on other special surveys.

There was one staff change within the region in 1993. David Constable replaced Hugh Evans at the Thunder Bay field headquarters. The FIDS ranger work areas from west to east are as follows: Paul Bolan is responsible for the Red Lake, Kenora, and western Fort Frances districts; Bill Biggs monitors the Sioux Lookout and Dryden districts; Dave Constable works the eastern half of the Fort Frances District, the Thunder Bay District, and that portion of the Nipigon District west of Lake Nipigon; and Alan Keizer is responsible for the remainder of the Nipigon District, Geraldton District, and the western Wawa District in the Northeast Region.

The eastern spruce budworm remains the most noteworthy insect found in the region. There were significant reductions in the area of moderate-to-severe defoliation in the Thunder Bay and Red Lake districts; however, there were some increases in the Dryden and Geraldton districts. The area within which moderate-to-severe defoliation occurred is still over 7 million ha. Infestations of two other major forest insects, the forest tent caterpillar and jack pine budworm, have collapsed this year. Showing some signs of resurgence were the large aspen tortrix, birch leaf miner, larger boxelder leafroller, and yellowheaded spruce sawfly.

The number of Acid Rain National Early Warning System (ARNEWS) plots was increased this year by five. There are now 11 of these biomonitoring sites scattered across the region. There was no formal seed orchard survey carried out in 1993, but some of the orchards and family tests are mentioned when discussing various pests. Special surveys were carried out to detect Scleroderris canker and a number of jack pine budworm and eastern spruce budworm study plots were established under projects funded by the Northern Forestry Program (NFP) of the Northern Ontario Development Agreement (NODA).

Insects and diseases described in this report are categorized as follows:

### **Major Insects / Diseases**

capable of causing serious 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 populations or for other reasons, did not cause serious damage this year.

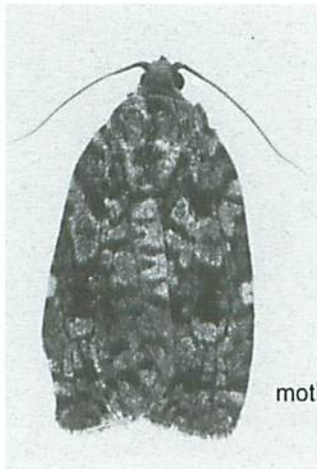
The cooperation and assistance provided by the OMNR and forest industry are gratefully acknowledged.

If further information is required about pest conditions in the Northwest Region, please contact one of the report authors or write to: Chief, Forest Insect and Disease Survey Unit, Canadian Forest Service – Ontario, P.O. Box 490, Sault Ste. Marie, Ontario, P6A 5M7.

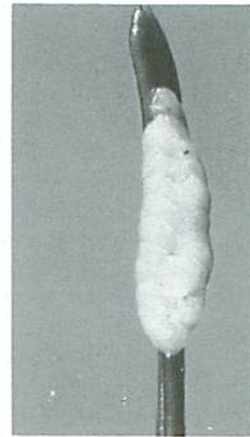
*W.D. Biggs  
D.C. Constable  
A.J. Keizer  
P.M. Bolan*



## FRONTISPIECE



moth



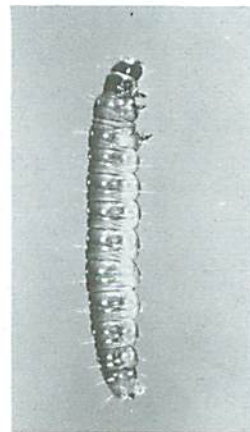
egg



bF mortality



pupa



larva

Life cycle of the eastern spruce budworm, *Choristoneura fumiferana* (Clem.) and insect caused mortality of balsam fir, *Abies balsamea* (L.) Mill.



Photo 1. A Manitoba maple, *Acer negundo* L. stripped of its foliage by the larger boxelder leafroller, *Archips negundana* (Dyar.)

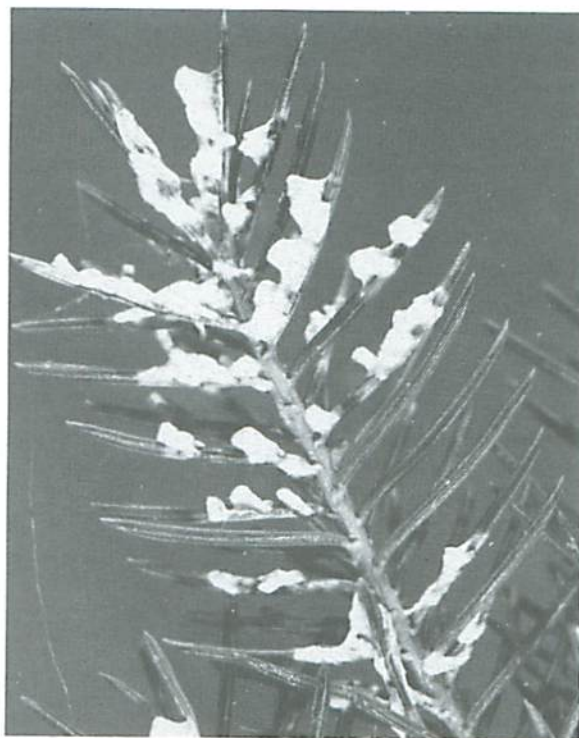


Photo 2. The rust parasite, *Fusarium avenaceum* (Fr. :Fr.) Sacc. on spruce needle rust, *Chrysomyxa* spp. on white spruce, *Picea glauca* (Moench) Voss needles.

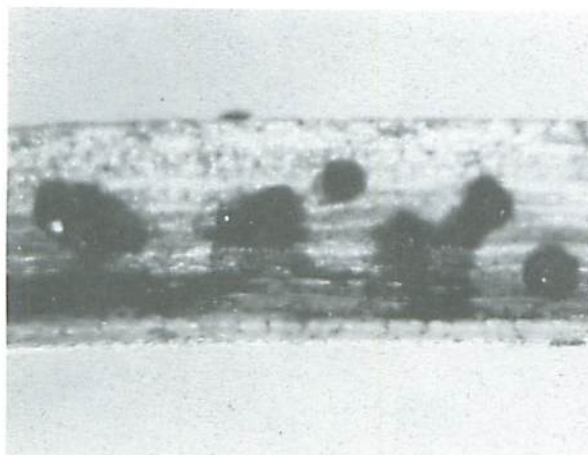


Photo 3. Fruiting structures of a needle blight of jack pine, *Hendersonia pinicola* Wehm.



Photo 4. Frost heave damage to bare root seedlings growing in a nursery bed.



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## INSECTS

### Major Insects

#### Larger Boxelder Leafroller, *Archips negundana* [Dyar]

Severely defoliated ornamental Manitoba maple (*Acer negundo* L.) trees were evident throughout the towns of Sioux Lookout, Ear Falls, Kenora, Fort Frances, Dryden, and Thunder Bay (see Photo 1). Defoliation estimates ranged from 10 to 100%.

This spring defoliator feeds on opening leaves while webbing them together with silk. Like most leafrollers, the larger boxelder is very wasteful and often leaves large amounts of remnant foliage entangled in the silk. These leaf remnants soon die and turn a pale colour. In severe instances attacked trees will exhibit a whitish appearance.

#### Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)

The large aspen tortrix, an early summer defoliator, generally attacks trembling aspen (*Populus tremuloides* Michx.); however, during severe outbreaks it will also consume the foliage of white birch (*Betula papyrifera* Marsh.) and balsam poplar (*Populus balsamifera* L.). Damaged trees usually re-foliate by mid-to-late summer.

Four small pockets of moderate defoliation (50%) were reported west of Lake Nipigon in the Nipigon District. These pockets of trembling aspen totaled 4,100 ha and were located in the Nazoteka Point area on Lake Nipigon, west of Gull Bay at Detour, and at Pangloss and Jackinnes lakes. No other areas of damage were detected from either ground or aerial surveys.

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

##### Provincial Situation

Population levels of eastern spruce budworm declined within Ontario in 1993. The total area of moderate-to-severe defoliation of balsam fir (*Abies balsamea* [L.] Mill.), white spruce (*Picea glauca* [Moench] Voss), and black spruce (*P. mariana* [Mill.] B.S.P.) mapped this year totaled 8,999,177 ha. Compared with the 9,595,762 ha recorded in 1992, this represents a reduction of 6% and is the first noticeable decline in the overall size of the outbreak in the past 5 years. The bulk of the defoliation occurred in north-western Ontario in a large area stretching from the Manitoba border east to the Hearst and Wawa districts in the Northeast Region (Fig.1, Table 1).

Aerial surveys disclosed a large increase in the area of visible tree mortality caused by spruce budworm. Throughout the province, 5,032,595 ha of dead balsam

fir and white spruce were mapped. This is up from the 3,943,442 ha recorded in 1992. Most of the increase occurred in the Northwest Region and in the Wawa and Hearst districts in the Northeast Region.

##### Northwest Region

There was a net reduction of 178,147 ha (2%) in the area of moderate-to-severe defoliation in the Northwest Region in 1993 (Fig.2, Table 2). The most noticeable decline occurred in the Thunder Bay District where a reduction of 387,980 ha was recorded. Much of this decline occurred in the southern part of the district, especially in the Arrow and Whitefish lakes area where only light defoliation was observed. A decline of 166,948 ha was also noted in the Red Lake District. Moderate-to-severe damage is now primarily located in a wide band from Wegg Lake northeast to Birch Lake. Other large infestations occurred in the vicinity of Sydney, Longlegged, Medicine Stone, Red, and Little Vermilion lakes. Slight declines were noted in the eastern Fort Frances District, especially north of the town of Atikokan in the vicinity of Upper Scotch and Gulliver lakes.

While increased areas of moderate-to-severe defoliation were mapped in the Dryden, Geraldton, Nipigon, and Sioux Lookout districts, most of the expansion was found in the first two of these districts. In the Geraldton District, pockets of damage were observed as far north as the 51<sup>st</sup> latitude in the Ogoki Lake area. The infestation boundary now runs from Ogoki Lake southeast to Clavet Township. Damage increased in the southern and central portions of the Dryden District. New areas of infestation were mapped from the Thaddeus Lake area south into Brownridge Township and in Wabigoon, Redvers, and Buller townships. In the Sioux Lookout District increased areas of moderate-to-severe damage were observed north of Lac Seul in the Wapese Lake area and east of Lac Seul from Tulley Lake east to Mask Lake. A notable expansion was identified in the northeast corner of the

**Table 1.** Total area of moderate-to-severe defoliation caused by the eastern spruce budworm in Ontario, 1991–1993.

Region	Area of moderate-to-severe defoliation (ha)		
	1991	1992	1993
Northwest	8,167,018	7,438,883	7,295,736
Northeast	887,010	2,090,080	1,650,677
Central	11,720	30,775	44,662
Southern	33	24	102
Total	9,065,781	9,595,762	8,991,177



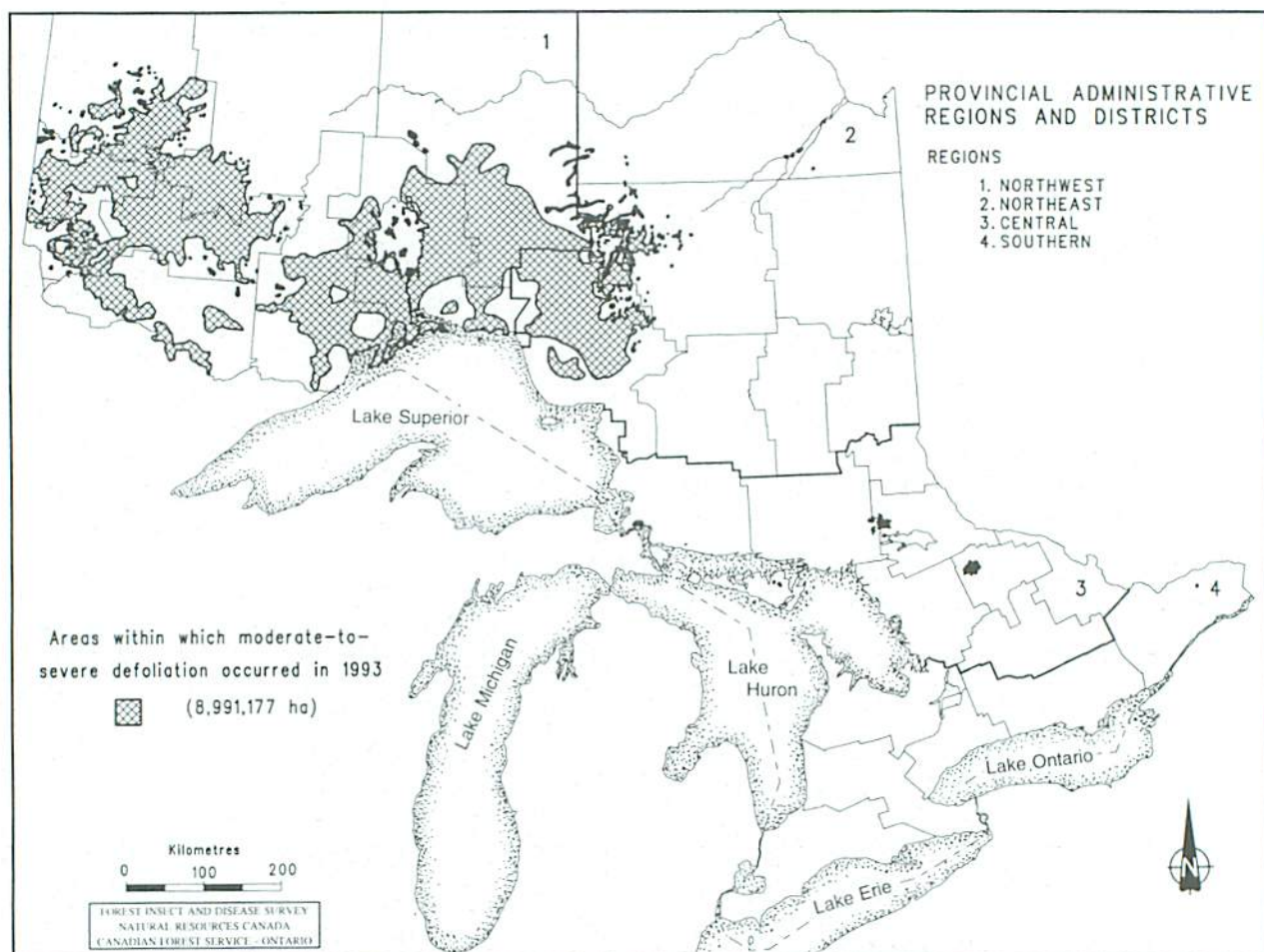


Figure 1. Eastern spruce budworm (*Choristoneura fumiferana* [Clem.]) defoliation.

Nipigon District, northeast of Lake Nipigon and extending to the Geraldton District boundary. However, a sizeable decline was found in the extreme southeast portion of the Nipigon District north from Lake Superior adjacent to the Wawa District boundary.

Balsam fir and white spruce mortality associated with spruce budworm continued to increase in all districts of the region (Table 3). This expansion was most noticeable in the Nipigon, Geraldton, and Kenora districts, with increases of 429,775 ha, 247,067 ha, and 208,980 ha, respectively (Fig.3). To follow the progression of mortality, monitoring plots were retallied in three districts. The results of these plots are summarized in Table 4.

To forecast population levels for 1994, egg-mass collections were carried out at 282 sample points (Appendix 1). It appears likely that the infestation will continue throughout most of the region in 1994; however, the intensity of feeding could be diminished as a result of widespread host mortality. A total of 47% of the sample points had accumulated damage ratings of four or higher (Appendix 1). A four rating indicates that

the stand is moribund or dying, with 80 to 100% total defoliation, or the crowns are grey in appearance with 50–150 cm of the top dead or bare.

Table 2. Total area of moderate-to-severe defoliation caused by the eastern spruce budworm in the Northwest Region of Ontario in 1992 and 1993.

District	Area of moderate-to-severe defoliation (ha)		
	1992	1993	Change (%)
Dryden	853,616	997,273	+14
Fort Frances	424,784	422,244	-0.6
Geraldton	1,138,621	1,296,783	+14
Kenora	867,632	850,187	-2
Nipigon	1,488,098	1,560,477	+5
Red Lake	805,912	638,964	-21
Sioux Lookout	533,554	556,122	+4
Thunder Bay	1,361,666	973,686	-28
Total	7,473,883	7,295,736	-2%

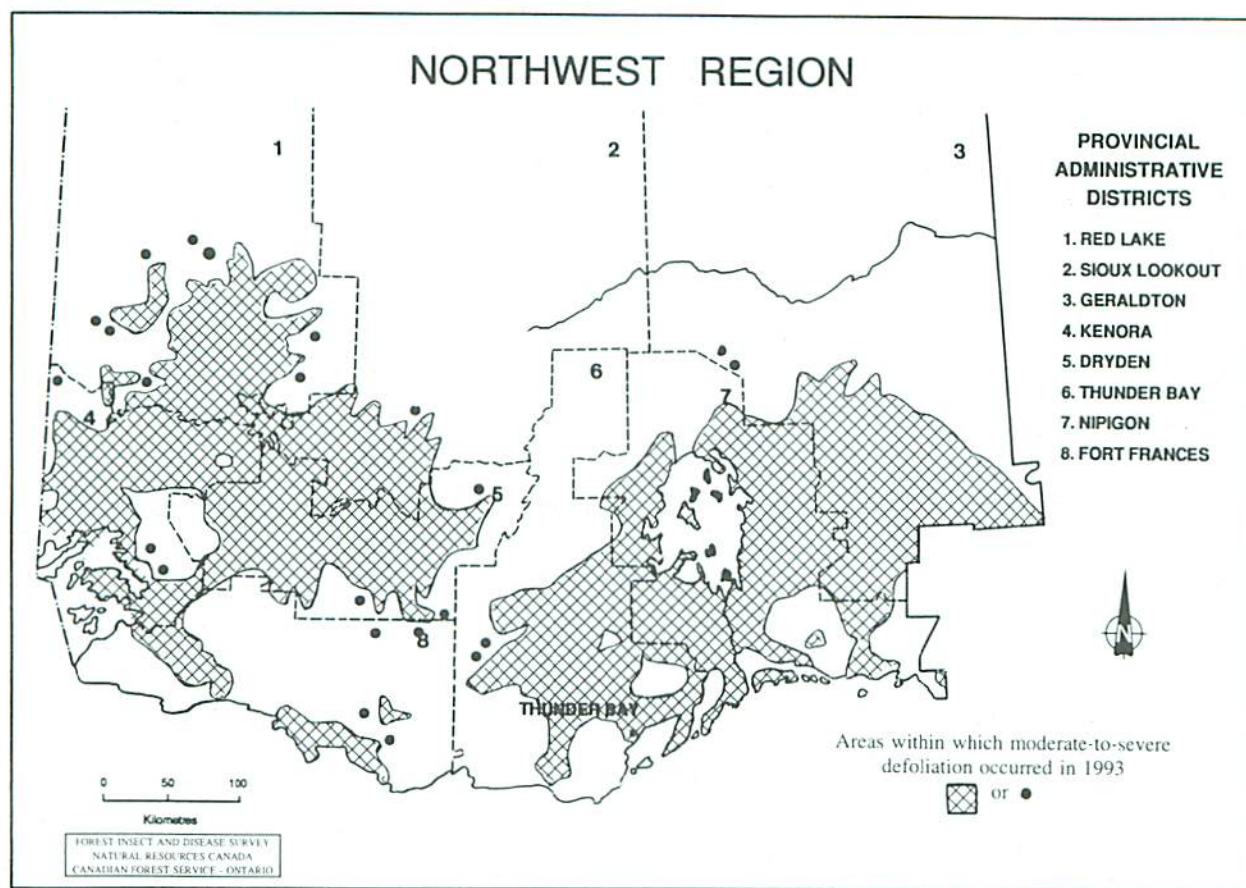


Figure 2. Eastern spruce budworm, *Choristoneura fumiferana* (Clem.).

**Table 3.** Total area of whole-tree top mortality associated with eastern spruce budworm in the Northwest Region of Ontario in 1992 and 1993.

District	Total area of mortality (ha)		Increase (ha)
	1992	1993	
Dryden	287,744	337,936	50,192
Fort Frances	1,219,405	1,251,605	32,200
Geraldton	64,018	311,085	247,067
Kenora	285,542	494,522	208,980
Nipigon	943,743	1,373,518	429,775
Red Lake	67,813	78,163	10,350
Sioux Lookout	38,066	47,916	9,850
Thunder Bay	754,240	761,700	7,460
Total	3,660,571	4,656,445	995,874

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

Egg-mass sampling conducted throughout the region (79 locations<sup>1</sup>) during the autumn of 1992 indicated a

age in the region during 1993. Egg-mass sampling completed this fall indicates budworm populations should remain at endemic levels in 1994 (see Appendix 2).

likelihood of continued decline in jack pine budworm populations for 1993. The 633 ha area of moderate-to-severe defoliation located in the Red Lake District during 1992 disappeared this year. Scattered jack pine (*Pinus banksiana* Lamb.) and Scots pine (*Pinus sylvestris* L.) in the Sioux Lookout golf course area sustained severe defoliation; however, this was the only report of budworm dam-

<sup>1</sup>Evans, H.J.; Biggs, W.D.; Keizer, A.J.; Bolan, P.M. 1993. Results of forest insect and disease surveys in the Northwest Region of Ontario, 1992. For. Can., Ont. Region, Sault Ste. Marie, Ont. Misc. Rep. 428. 37 p.



**Table 4.** Summary of tree mortality associated with eastern spruce budworm in the Northwest Region of Ontario. Results are based on ground checks for three districts for 1992 and 1993.

Location	Host <sup>a</sup>	Tree mortality (%)	
		1992	1993
<i>Geraldton District</i>			
Catlonite Road	bF	27	54
<i>Nipigon District</i>			
Adamson Township	bF	45	58
	wS	9	18
Black Sturgeon Lake	wS	50	68
Booth Township	bF	35	37
	wS	82	85
Camp 15	bF	29	29
Crombie Lake	bF	49	51
Kabitotikwia Lake	bF	70	82
	wS	24	24
Lett Township	bF	61	67
Lyon Township	bF	54	70
McIver Township	bF	90	92
	wS	18	18
McKirdy Lake	bF	80	90
Nipigon Township	bF	86	92
	wS	15	30
Postagoni Lake Road	bF	5	7
Purdom Township	bF	8	25
	wS	84	84
	wS	0	0
Shillabeer Creek	bF	67	Logged-over
Squawk Lake Road	bF	60	81
Squawk Lake Road	bF	43	56
Sump Lake	bF	53	63
Trapnarrows Lake Road	bF	62	87
Waweig Lake	bF	34	38
Windgohan Lake Road	bF	13	15
<i>Thunder Bay District</i>			
Cheeseman Lake	bF	79	81
	wS	12	8
Dog River	bF	8	11
Fallscamp Lake	bF	32	49
	wS	3	3
Jacques Township	bF	42	36
Mountain Lake	bF	88	not tallied
	wS	24	not tallied
Open (Lac des Mille Lacs)	bF	46	48
	wS	7	7
Sibley Township	bF	38	59
	wS	12	12
Sibley Township	bF	19	43

<sup>a</sup> bF = balsam fir, wS = white spruce.

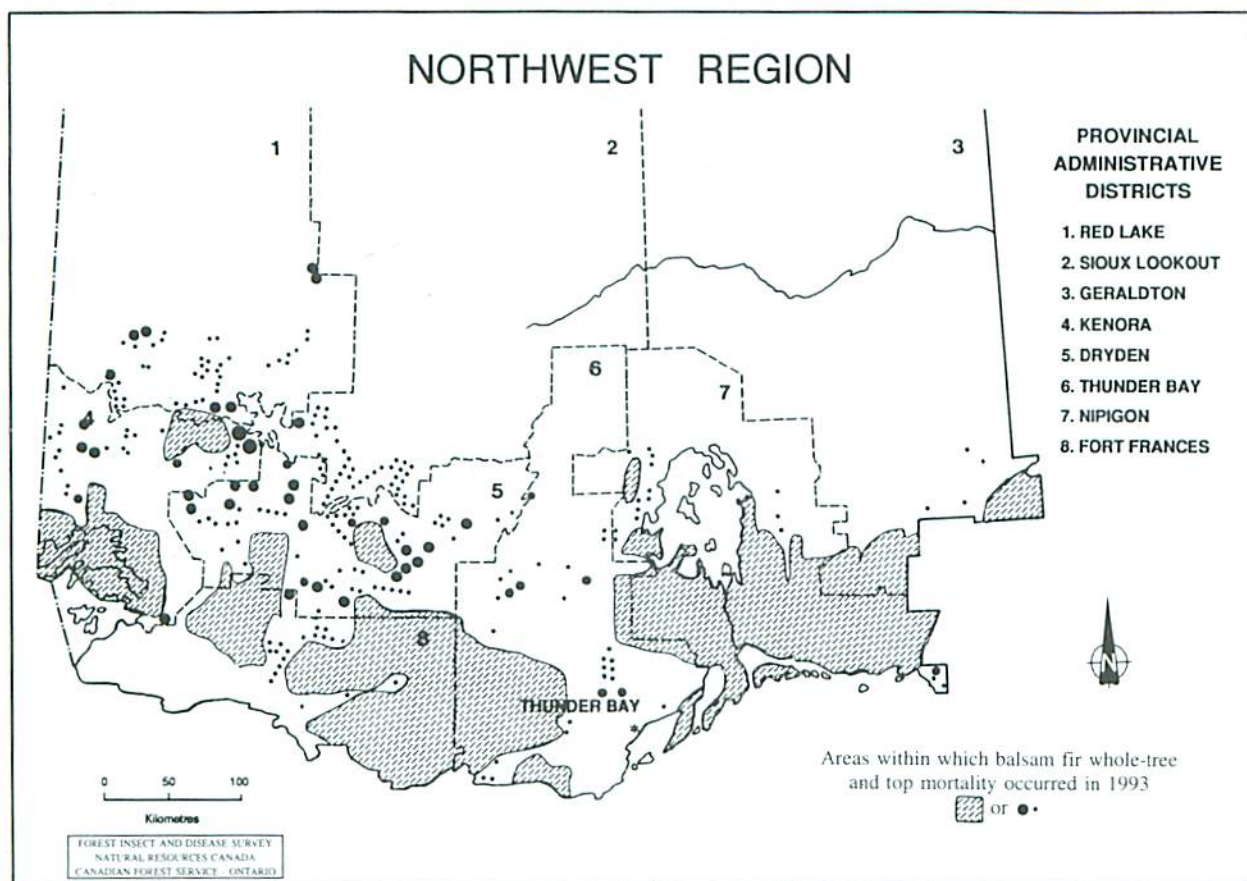


Figure 3. Eastern spruce budworm *Choristoneura fumiferana* (Clem.).

#### Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

A total of 17 areas were evaluated for the presence of eastern pine shoot borer during 1993. Population levels declined in 10 areas that had also been evaluated in 1992. The frequency with which tree leaders were attacked ranged from 0 to 29%, with the highest incidence occurring at the Fallscamp Lake Family Test, Thunder Bay District. Results of the areas evaluated are summarized in Table 5.

#### Birch Leafminer, *Fenusa pusilla* (Lep.)

Foliar browning of roadside and ornamental white birch trees was evident throughout scattered parts of the region. Population levels of the birch leafminer remained insignificant; however, in the Geraldton, Dryden, and Sioux Lookout districts increased occurrences were reported in the following areas: along Highway 584 north of the town of Geraldton, along Highways 502 and 601 near the town of Dryden, around the Dryden tree nursery, and along Highway 72 in the Sioux Lookout District. At all of these locations foliar damage levels ranged from 20 to 100%.

#### Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Hardwood defoliation reached epidemic levels in 1987 and increased annually until 1991. At that time an estimated 14.1 million hectares of forest were infested in northwestern Ontario. A 26% decrease (3,731,780 ha) in the area of moderate-to-severe defoliation occurred in 1992, reflecting increased levels of natural control factors. Egg-band counts taken in the fall of 1992 indicated a likely population decline in 1993. Indeed, during 1993 a total collapse of larval populations occurred throughout the region; consequently, no defoliation was recorded. For the most part, egg-bands inspected this spring contained unhatched eggs. This sudden collapse of high populations, typical of this pest's cyclic nature, usually occurs over a few years while governing influences (e.g., parasites and diseases) build and multiply. Environmental stress, such as cold winter temperatures, may further contribute to overwintering mortality of eggs.

Trembling aspen, the primary host of forest tent caterpillar, has begun showing the consequences of multiple years of severe defoliation. During aerial



surveys in the Geraldton District this summer, aspen stands containing elevated levels of branch dieback were evident, particularly in the southern half of the district. Mature and over-mature trees were also observed on the ground at scattered locations throughout the district. These exhibited varying levels of branch dieback including occasional whole-tree mortality.

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

This mid-summer defoliator, which attacks trembling aspen, was prevalent throughout the region during 1993. Primary hosts were young fringe and regeneration trees found along roadsides and in immature stands. Highest levels of damage were recorded in the following areas: along the Wintering Lake road in the vicinity of

Chorus Lake, Nipigon District and in the Margo Lake area east of the town of Longlac, Geraldton District. Across the remainder of the region reports of increased incidence and defoliation were numerous. Defoliation estimates ranged from 20 to 100% (commonly above 50%). Levels of damage have been increasing in most areas for the past two seasons.

**Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.)**

Elevated levels of defoliation caused by yellow-headed spruce sawfly were observed throughout most of the region during 1993 (Table 6). Heavy damage (average 60% defoliation) to both white and black spruce (up to 2 m in height) was evident in the Dryden District along Highway 17, from Ignace to Dryden, and

**Table 5.** Damage to jack pine caused by the eastern pine shoot borer in the Northwest Region of Ontario for 1992–1993. (Counts are based on an examination of a minimum of 150 trees at each location within the seven districts.)

Location	Area affected (ha)	Estimated number of trees/ha	Average height of trees (m)	Leaders attacked (%)	
				1992	1993
<i>Dryden District</i>					
Islet Lake	15	4,500	2.4	—	2.7
Sandbar Lake	20	4,000	2.8	6.0	6.0
Smock Lake Road	10	4,500	2.3	—	3.3
<i>Fort Frances District</i>					
Kenozhe Family Test	2.5	1,800	1.3	10.7	4.0
Sunny Lake Family Test	2.5	2,000	1.3	9.3	3.3
<i>Geraldton District</i>					
Highway 625, McQueston Township	25	3,500	3.5	—	0.0
<i>Kenora District</i>					
Dryberry Family Test	5	2,300	0.4	0.6	0.0
Kishquabik Family Test	5	2,300	0.5	0.6	2.7
<i>Nipigon District</i>					
Ledger Township	10	2,500	1.2	2.0	1.3
Ledger Township	1	1,000	5.5	2.0	1.3
Parks Lake	30	1,500	0.8	—	0.7
<i>Sioux Lookout District</i>					
Burma Lake Road	10.0	3,000	2.0	—	0.0
Stanzhikimi Lake Road	5.0	4,000	1.4	2.7	0.0
<i>Thunder Bay District</i>					
Bluebird Lake Family Test	5.0	2,500	1.6	26.0	0.0
Fallscamp Lake Family Test	5.0	2,500	1.7	39.3	28.6
Kakabeka Falls Seed Orchard	15.0	3,700	1.8	10.7	0.0
Raith Family Test	5.0	2,500	1.8	8.0	0.0

**Table 6.** Damage to spruce caused by the yellowheaded spruce sawfly in the Northwest Region of Ontario in 1993. (Counts are based on an examination of a minimum of 150 trees at each location within the five districts.)

Location	Host <sup>a</sup>	Area affected (ha)	Estimated number of trees/ha	Average height of trees (m)	Trees affected (%)	Foliar damage (%)
<i>Fort Frances District</i>						
Manion Lake Seed Orchard	bs	5	3,000	2.4	0	0
Morson Seed Orchard	bs	5	3,000	2.5	0	0
<i>Kenora District</i>						
Minnesabic Seed Orchard	bs	8	3,000	2.8	0	0
Ulster Lake Seed Orchard	bs	5	3,200	2.8	45	11
<i>Nipigon District</i>						
Jean Lake Seed Production Area	bs	1	2,000	5.8	0	0
McKirdy Seed Production Area	ws & bs	2	2,000	2.9	0	0
Syine Township	ws	3	100	5.0	10	25
<i>Thunder Bay District</i>						
Paiponge Township	bs	1	2,500	1.4	39	20
<i>Red Lake District</i>						
Bawlb Lake Seed Orchard	bs	6	3,000	0.6	0	0
Beauregard Seed Orchard	bs	5	3,000	2.7	0	0

<sup>a</sup> bs = black spruce, ws = white spruce.

at scattered points along Highway 72 in the Sioux Lookout District. Along the Vermilion River Road in the Sioux Lookout District, scattered black spruce regeneration (under 2 m) had defoliation levels reaching 80%. Black spruce windbreaks located between Thunder Lake and Dryden, Dryden District, exhibited average defoliation ranging from 50 to 80%. Total defoliation was noted on some individual 5-m-tall trees. Both black spruce and white spruce ornamentals (ranging in height from 1 to 4 m) were observed with defoliation levels ranging from 10 to 100% in the following towns: Fort Frances, Ear Falls, Sioux Lookout, Dryden, Wabigoon, Ignace, Dinorwic, Kakabeka Falls, Thunder Bay, Shabagua, Hurkett, Aitkokan, Nipigon, Geraldton, Terrace Bay, and Marathon. Increased levels of damage were also observed in the Thunder Bay District, particularly along Highway 11 and 17 between Kakabeka Falls and Shabagua.

#### White Pine Weevil, *Pissodes strobi* (Peck)

During 1993, surveys for white pine weevil were conducted at 29 locations in the Northwest Region (Table 7). Overall, damage was low in most young plantations. In the 15 jack pine plantations assessed (mean height 1.8 m), leader damage averaged 4% and ranged from 0 to 12%. The highest 'weevilled-leader' counts were found at Kenozle Lake, Fort Frances District with 12% and Ledger Township, Nipigon District with 10.7% of the trees sustaining leader damage. Twelve black spruce sites examined showed an average leader damage of 1.1%, with levels ranging from 0 to 4.7%. Three white spruce plantations were examined but only the Limestone Lake plantation contained leader damage. On this site 2.7% of the trees were affected.



**Table 7.** Damage caused by the white pine weevil in the Northwest Region of Ontario in 1993. (Counts are based on an examination of 150 randomly selected trees at each location within the seven districts.)

Location	Host <sup>a</sup>	Average height of trees (m)	Estimated number of trees/ha	Estimated area of stand (ha)	Leaders attacked (%)
<i>Dryden District</i>					
Islet Lake	jP	2.4	4,500	15	3
Sandbar Lake	jP	2.8	4,500	20	6
Smock Lake Road	jP	2.3	4,500	10	3
<i>Fort Frances District</i>					
Kenozle Lake Family Test	jP	1.3	1,800	3	12
Manion Seed Orchard	bS	2.4	3,000	5	0
Morson Seed Orchard	bS	2.5	3,000	5	0
Sunny Lake Family Test	jP	1.3	2,000	3	7
<i>Geraldton District</i>					
McQuestion Township	jP	1.5	3,000	25	<1
<i>Kenora District</i>					
Dryberry Family Test	jP	0.4	2,300	5	0
Kishqubik Family Test	jP	0.5	2,300	5	1
Minnesabic Seed Orchard	bS	2.8	3,000	8	0
Ulster Lake Seed Orchard	bS	2.8	3,200	5	<1
<i>Nipigon District</i>					
Jean Lake Seed Prod. Area	bS	5.8	2,000	1	0
Ledger Township	jP	5.5	1,000	10	1
Ledger Township	jP	1.2	2,500	10	11
Limestone Lake Road	wS	4.1	2,000	25	3
Limestone Lake Road	bS	4.6	1,800	25	5
McKirdy Seed Prod. Area	wS	2.9	2,000	2	0
Parks Lake	jP	0.8	1,500	30	0
Stirling Township	bS	4.5	2,500	5	0
Waweig Lake	jP	1.7	2,500	2	2
<i>Red Lake District</i>					
Bawlb Lake Seed Orchard	bS	0.6	3,000	6	1
Beauregard Seed Orchard	bS	2.7	3,000	5	<1
<i>Thunder Bay District</i>					
Bluebird Lake Family Test	jP	1.6	2,500	50	2
Falls Camp Lake Family Test	jP	1.7	2,500	5	7
Kakabeka Seed Orchard	jP	1.8	3,700	2	4
	wS	2.4	3,400	2	0
Paipoonge Township	bS	1.4	2,500	1	<1
Raith Seed Orchard	bS	0.9	2,500	10	2
Wolf River Plantation	bS	2.1	2,500	50	3

<sup>a</sup> bS = black spruce, jP = jack pine, wS = white spruce.

### Minor Insects

#### Jack Pine Resin Midge, *Cecidomyia resinicola* (O.S.)

High population levels of this tiny jack pine pest were evident in the Dryden and Sioux Lookout districts.

The heaviest damage was noted on 3- to 5-m roadside trees along the Highway 17 corridor from the English River to Ignace and in Stokes Township, Dryden District. In these areas most of the young jack pine growing on stand edges sustained 100% branch-tip

mortality. Similar damage levels were also observed along secondary roads throughout these same areas of the Dryden District; however, fewer trees were involved. High levels of twig mortality were recorded at many points in the Sioux Lookout District.

#### Jack Pine Tip Beetle,

*Conophthorus resinosae* Hopk.

Four plantations were examined for the presence of jack pine tip beetle in the Geraldton and Nipigon districts this season (Table 8). All damage encountered was to lateral shoots (i.e., no leader damage) and estimates ranged from 0 to 8.7% of the trees affected. The highest

**Table 8.** Damage to jack pine caused by the jack pine tip beetle in the Northwest Region of Ontario in 1993. (Counts are based on an examination of a minimum of 150 host trees at each location within the two districts.)

Location	Area affected (ha)	Estimated number of trees/ha	Average height of trees (m)	Number of shoots affected (%)
<i>Nipigon District</i>				
Ledger Township	10	3800	1.2	8.7
Ledger Township	1	1000	5.5	7.3
Parks Lake	30	1500	0.8	0.7
<i>Geraldton District</i>				
Highway 625	25	3000	1.5	0.0

incidence of damage occurred at a 10-ha plantation of 1.2 m trees in Ledger Township, Nipigon District.

#### Other Forest Insects

A number of other pests were encountered during the course of regular surveys. Information on these pests is provided in Table 9.

**Table 9.** Other forest insects.

Insects	Host(s) <sup>a</sup>	Remarks
<i>Acantholyda erythrocephala</i> (L.) Pine false webworm	rP	In Paipoonge Township, Thunder Bay District, 31% of trees averaging 2.8-m-tall had defoliation levels ranging from 5 to 70%.
<i>Archips cerasivorana</i> (Fitch) Uglynest caterpillar	cCH	This insect was commonly observed at several points along Rosslyn Road, Paipoonge Township, Thunder Bay District.
<i>Chrysomela interrupta</i> F. An alder leaf beetle	bPo	Average 80% foliar damage occurred at various points throughout the Geraldton and Nipigon districts.
<i>Hemichroa crocea</i> (Geoff.) Striped alder sawfly	wB	Three 10-m trees were 60% stripped of foliage by high numbers of this sawfly at the Geraldton Air Base, Geraldton District.
<i>Micurapteryx salicifoliella</i> (Cham.) Willow leafminer	W	Moderate-to-severe defoliation was commonly observed throughout the region.
<i>Monochamus</i> spp. Sawyer beetles	jP, bS	Feeding by adults has resulted in varying degrees of tree mortality along roads and cutover edges in the Nungesser and North roads area, Red Lake District.
<i>Neodiprion pratti banksianae</i> Roh. Jack pine sawfly	jP	Defoliation levels from 10 to 20% were found at Big Sawbill Lake on 4-m-tall trees and single colonies were observed at Eva and French lakes, Fort Frances District.

(cont'd)



**Table 9.** Other forest insects (concl.).

Insects	Host(s) <sup>a</sup>	Remarks
<i>Neodiprion virginianus</i> complex Redheaded jack pine sawfly	jP	Average defoliation levels of 10% were observed on 4-m trees at several points along the Graham Road, Thunder Bay District. Similar damage was noted on 5-m trees along the Sturgeon River Road, Nipigon District.
<i>Petrova albicapitana</i> (Bsk.) Northern pitch twig moth	jP	Insect damage was present on 9% of 1.5-m-tall trees at the Kakabeka Falls Seed Orchard and 6% of 1.6-m-tall trees at the Falls Lake Family Test, Thunder Bay District.
<i>Phyllonorycter nipigon</i> (Free.) Balsam poplar leafblotch miner	bPo	Moderate-to-severe damage ranging from 10 to 100% was present for the second year throughout the entire region.
<i>Pristiphora geniculata</i> (Htg.) Mountain-ash sawfly	aMo	Scattered colonies caused defoliation levels ranging from 10 to 100% along Highway 11 from Shebandowan to Quetico Provincial Park, Thunder Bay District.
<i>Rhyacionia adana</i> Heinr. Pine tip moth	jP	At the Hambleton Seed Production Area, Geraldton District, the 1-m-tall trees sustained bud damage.
<i>Tomostethus multicinctus</i> (Roh.) Brownheaded ash sawfly	bAs	Moderate population levels of this insect were observed in Middle Falls Provincial Park, Thunder Bay District, resulting in 10% defoliation on 12-m-tall trees.

<sup>a</sup> aMo = American mountain-ash, bAs = black ash, bPo = balsam poplar, bS = black spruce, cCH = choke cherry, jP = jack pine, rP = red pine, W = willow, wB = white birch.

## TREE DISEASES

### Major Diseases

#### Armillaria root rot, *Armillaria ostoyae* (Romagn.) Herink

A total of 33 plantations throughout the region were evaluated to detect current mortality caused by this fungus. The disease was identified in thirteen (39%) of the plantations and mortality levels ranged from 0.7 to 7.3%. The highest mortality level occurred at the Bluebird Lake Family Test Site where 7.3% of the 1.6-m-tall trees were affected. In all plantations examined, tree heights were under 4.5 m and averaged 2.3 m (Table 10).

#### Spruce Needle Rust, *Chrysomyxa ledicola* Lagerh. and *C. ledi* (Alb. & Schein.) de Bary var. *ledi*

Foliar damage resulting from spruce needle rust was again evident throughout most of the region in both black spruce and white spruce stands during 1993 (Table 11). Of the 12 locations examined for this disease, 2 were negative and 10 contained infection levels ranging from 2 to 90%. The highest incidence encountered was near Boxer Lake, Nipigon District, where foliar damage to a 25-ha area of lowland black spruce averaged 90% on 100% of the 2-m-tall trees.

A new rust parasite, *Fusarium avenaceum* (Fr.:Fr.) Sacc. was discovered this year at three locations in the Nipigon District. Trace levels were found at Neys and Rossport provincial parks on both white spruce and black spruce. At the Boxer Lake location the rust disease on approximately 5% of the infected black spruce trees sustained heavy attack. This parasite colonizes the rust pustules and appears as a white cottony substance on the host needles (see Photo 2).

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

Western gall rust causes the formation of round galls on the lateral branches and main stems of pine. The disease can kill small trees; in older stands trees with stem infections may develop decay and are easily broken by the wind. The rust spreads from pine to pine, which can make it more of a problem in young infected plantations. In the Northwest Region the commercial species most affected by this pest is jack pine. To assess damage caused by this disease a total of 32 locations were evaluated across the region. Positive results were obtained in 15 stands with incidence levels ranging from 0.7 to 40% (Table 12).

**Table 10.** Summary of damage caused by *Armillaria* root rot in the Northwest Region of Ontario in 1993. (Counts are based on an examination of 150 randomly selected trees at each location within the eight districts.)

Location	Host <sup>a</sup>	Average height of trees (m)	Density (trees/ha)	Estimated area affected (ha)	Current mortality (%)
<i>Dryden District</i>					
Block 9, Smock Lake Road	jP	2.3	4,500	10	1.3
Hwy 622, Islet Lake	jP	2.4	4,500	15	0.7
Hwy 622, Sandbar Lake	jP	2.8	4,500	20	2.0
<i>Fort Frances District</i>					
Kenochelle Family Test	jP	1.3	2,000	3	0.0
Manion Seed Orchard	bS	2.4	3,000	5	0.0
Morson Seed Orchard	bS	2.5	3,000	5	0.0
Sunny Lake Family Test	jP	1.3	1,800	3	0.0
<i>Geraldton District</i>					
Cecile Township	jP	3.5	3,500	10	0.0
Flanders Road	bS	0.9	3,000	10	0.0
Flanders Road	wS	1.9	3,000	10	0.0
Highway 625	jP	1.5	3,000	25	0.0
Hillsport Road South	wS	1.9	5,000	15	0.0
Stirling Township	bS	4.5	2,500	2	0.0
Twist Road	wS	2.0	1,000	20	0.0
<i>Kenora District</i>					
Dryberry Family Test	jP	0.4	2,300	5	0.0
Kisquabik Family Test	jP	0.5	2,300	5	0.0
Minnesabic Seed Orchard	bS	2.8	3,000	8	0.0
Ulster Lake Seed Orchard	bS	2.8	3,200	5	0.0
<i>Nipigon District</i>					
Jean Lake Seed Prod. Area	bS	5.8	6,000	1	0.0
Ledger Township	jP	6.0	2,500	4	0.4
Ledger Township	jP	1.5	3,000	3	1.2
McKiroy Seed Prod. Area	wS	2.9	1,000	2	0.0
Parks Lake	jP	0.8	1,500	30	3.3
<i>Red Lake District</i>					
Bawlb Lake Seed Orchard	bS	0.6	3,000	6	0.0
Beauregard Seed Orchard	bS	2.7	3,000	5	0.0
<i>Sioux Lookout</i>					
Burma Lake Road	jP	2.0	3,000	10	0.7
Stanzhikimi Road	jP	1.4	4,000	5	0.7
<i>Thunder Bay District</i>					
Bluebird Family Test	jP	1.6	2,500	5	7.3
Fallscamp Lake Family Test	jP	1.7	2,500	5	2.6
Kakabeka Falls Seed Orchard	jP	1.8	3,700	15	0.0
Paipoonge Township <sup>b</sup>	bS	2.4	2,000	1	1.3
Raith Family Test	bS	0.7	2,500	10	2.0
Raith Family Test	jP	1.8	2,500	5	2.6

<sup>a</sup> bS = black spruce, jP = jack pine, wS = white spruce.

<sup>b</sup> plantation owned by Canadian Pacific Forest Products Limited.



**Table 11.** Summary of foliar damage caused by spruce needle rusts in the Northwest Region of Ontario in 1993. (Counts are based on an examination of 150 randomly selected trees at each location within the three districts.)

Location	Host <sup>a</sup>	Estimated area affected (ha)	Average height of trees (m)	Density (trees per ha)	Average number of trees affected (%)	Average foliar damage (%)
<i>Nipigon District</i>						
Boxer Lake	bS	25	2.0	3,000	100	90
Coldwell Township	bS	1	5.0	100	80	80
Jean Lake Seed Production Area	bS	1	5.8	600	0	0
Lahontan Township	wS	1	4.0	50	100	25
Lahontan Township	bS	1	2.0	150	100	50
McKirdy Lake Seed Production Area	wS	2	2.9	1,000	0	0
Neys Provincial Park	wS & bS	5	3.0	500	90	50
Parks Lake	bS	10	0.5	800	100	20
Syine Township	wS	3	5.0	100	50	50
<i>Red Lake District</i>						
Nungesser Road	bS	6	1.3	1,000	76	40
<i>Thunder Bay District</i>						
Wolf River	bS	5	2.1	2,500	33	2
Raith Seed Orchard	bS	5	0.9	2,500	35	2

<sup>a</sup> bS = black spruce, wS = white spruce.

#### **Scleroderris Canker, *Gremmeniella abietina* (Lagerb.) M. Morelet**

As part of an ongoing survey of forest diseases, 23 conifer stands were examined for the presence of scleroderris canker. The stands, ranging in size from 1.0 to 60.0 ha, consisted of 15 jack pine, 7 red pine (*Pinus resinosa* Ait.), and 1 white spruce, with an average height of 3.6 m. Only two of the plantations had positive infections of the North American race of the fungus. These results differed little from those of 1992 when five plantations had single tree infections. The heaviest damage in 1993 was found on jack pine in Vivian Township, Nipigon District, where five (3.3%) of the trees had branch infections (Table 13). Branch infections were also observed on one tree in a red pine plantation and on a single ornamental jack pine at Neys Provincial Park in Coldwell Township, Nipigon District.

#### **Minor Diseases**

##### **Pine Needle Rust, *Coleosporium asterum* (Dietel) Syd. & P. Syd.**

A survey in Rowell Township, Dryden District of a 2-ha plantation of 2.0-m-tall jack pine disclosed numerous trees with 5 to 10% affected foliage. In the Kemuel Lake area of the Fort Frances District, 18% of

the 1.4-m-tall jack pine sustained an average foliar damage level of 1.6%. Elsewhere, infection levels of 10% were observed on 100% of the 3.5-m jack pine host at Shebandowan, Thunder Bay District.

##### **Tar Spot Needle Cast, *Davisomycella ampla* (Davis) Darter**

Surveys in the region during 1993 disclosed varying levels of tar spot needle cast. The highest level of damage was encountered in Vivian Township, Nipigon District. At this location 25.3% of the 5.3-m-tall jack pine in a 60-ha plantation sustained average foliar damage levels of 20%.

At the 5-ha Fallscamp Lake Jack Pine Family Test, Thunder Bay District, 8.6% of the 1.6-m host sustained foliar damage levels averaging 2%.

Infection levels on last years' foliage ranged from 10 to 20% on young jack pine (2.0 to 5.0 m in height) in the Goodie, Kathlyn, and Stanzhikimi lakes area, Sioux Lookout District and in the Centrefire and Williams lakes area, Dryden District.

##### **A Needle Blight Of Jack Pine, *Hendersonia pinicola* Wehm.**

During mid-August, aerial surveys detected unusual color patterns throughout a 200-ha even-aged jack pine

**Table 12.** Damage caused by the western gall rust in jack pine stands in the Northwest Region of Ontario in 1993.

District (Locations)	Average height of trees (m)	Number of trees per ha	Area affected (ha)	Trees affected (%)	Trees severely affected (%)
<i>Dryden District</i>					
Basket Lake Camp Road	8.9	2,000	58	23.0	2.0
Bradshaw Township	23.4	900	5	2.0	12.0
Hodgson Township	22.5	800	95	0.0	0.0
Ilsley Township	7.1	2,500	118	34.0	12.0
Mameigwess Lake Road	9.7	1,500	22	26.0	26.0
McNevin Township	24.3	750	38	0.0	0.0
Revell River	16.5	1,000	31	2.0	0.0
Suzanne Lake	10.3	1,500	146	40.0	16.0
Turtle River	19.9	900	10	0.0	0.0
<i>Fort Frances District</i>					
Kenozhe Family Test	1.3	1,800	2.5	1.3	1.3
Sunny Lake Family Test	1.3	2,000	2.5	3.3	3.3
<i>Geraldton District</i>					
Lukinto Lake	6.0	1,500	10.0	7.4	1.0
McQueston Township	7.6	900	20.0	0.0	0.0
<i>Thunder Bay District</i>					
Bluebird Family Test	1.6	2,500	5.0	12.0	2.0
Fallscamp Lake Family Test	1.7	2,500	5.0	7.3	2.0
Kakabeka Seed Orchard	1.8	3,700	15.0	0.0	0.0
Pace Lake, Hwy 527	1.5	2,500	10.0	5.3	0.7
Raith Family Test	1.8	2,500	5.0	6.0	0.0
Rossmore Creek – Hagey Township	1.4	2,500	15.0	0.0	0.0
<i>Kenora District</i>					
Dryberry Family Test	0.4	2,300	5.0	0.0	0.0
Kishquabik Family Test	0.5	2,300	5.0	0.0	0.0
<i>Nipigon District</i>					
Ledger Township	1.5	4,000	2.0	3.8	1.2
Ledger Township	6.0	3,000	1.0	1.4	0.0
<i>Sioux Lookout District</i>					
Big Sandy Lake	21.6	900	8.0	2.0	0.0
Drayton Township	9.1	2,500	14.0	0.0	0.0
Elbow Lake Road	6.2	2,500	83.0	0.0	0.0
Hwy 516 – Wrong Lake	20.4	900	170.0	0.0	0.0
Hwy 642, Wyatt Lake Road	16.5	1,000	43.0	0.0	0.0
Lomond Township	8.6	2,500	21.0	0.0	0.0
McAree Township	22.3	900	26.0	0.0	0.0
Moose Lake Road	16.6	1,000	160.0	2.0	0.0
Parrot Lake	17.3	9,000	81.0	2.0	0.0

flat along Highway 643 in the Geraldton District. This stand of 16-m-tall trees, located between the towns of Aroland and Nakina, displayed a brown/grey discoloration over large patchy areas. All ages and sizes were affected, particularly along the stand edges, with up to

100% of the current foliage damaged by this needle-inhabiting fungus. Grey necrotic areas appeared in the centre or tip of the needles caused the remainder of the needle to turn a reddish-brown color (*see* Photo 3). Approximately 25% of the trees were affected, with an



**Table 13.** Damage caused by *Scleroderris* canker in the Northwest Region of Ontario in 1993. (Counts are based on an examination of 150 randomly selected trees at each location within the six districts.)

District (Location)	Host <sup>a</sup>	Average height of trees (m)	Number of trees per ha	Area affected (ha)	Trees affected (%)
<i>Fort Frances District</i>					
Kenozhe Family Test	jP	1.3	1,800	2.5	0.0
Morson Township	jP	0.8	500	2.0	0.0
Sunny Lake Family Test	jP	1.3	2,000	2.5	0.0
<i>Geraldton District</i>					
Lukinto Lake	jP	6.0	1,500	10.0	0.0
Margo Lake	rP	10.0	600	2.0	0.0
Margo Lake	wS	0.7	10,000	2.0	0.0
McQueston Township	jP	8.0	900	5.0	0.0
<i>Kenora District</i>					
Dryberry Family Test	jP	0.4	2,300	5.0	0.0
Kishquabik Family Test	jP	0.5	2,300	5.0	0.0
Minnesabic Lake	rP	2.0	500	2.0	0.0
Work Township	rP	2.0	500	2.0	0.0
<i>Nipigon District</i>					
Coldwell Township	rP	7.0	500	3.0	0.7
Eva Township	jP	20.0	700	2.0	0.0
Ledger Township	jP	6.0	3,000	1.0	0.0
Ledger Township	jP	1.5	4,000	2.0	0.0
Vivian Township	jP	5.5	4,000	60.0	3.3
<i>Sioux Lookout District</i>					
Goodie Lake	rP	1.0	500	2.0	0.0
Goodie Lake	jP	1.4	500	2.0	0.0
Lomond Township	rP	1.8	500	1.0	0.0
<i>Thunder Bay District</i>					
Athelstane Lake	jP	1.4	2,500	10.0	0.0
Bluebird Family Test	jP	1.7	2,500	5.0	0.0
Devon Township	rP	0.9	1,110	10.0	0.0
Rossmere Creek	jP	1.4	2,000	10.0	0.0

<sup>a</sup> jP = jack pine, rP = red pine, wS = white spruce

average foliar damage level of 50%. Successive attacks to new needles could reduce diameter and height growth or even kill younger trees.

**Septoria Leaf Spot, *Mycosphaerella populicola* G.E.Thomps. and *Linospora* Leaf Blight, *Linospora tetraspora* G.E. Thomps.**

Increased evidence of these diseases was noted throughout the Geraldton, Nipigon, Sioux Lookout, Thunder Bay, Fort Frances, and Kenora districts during 1993. Severe foliar browning occurred in balsam poplar

hosts of all sizes, usually in small pockets (<1 ha) and frequently along exposed roadsides. In the Geraldton and Nipigon districts some pockets reached 10 to 15 ha in size. In the Thunder Bay District numerous host trees were found to have sustained foliar damage levels ranging from 80 to 100%. Most of the damage in the Fort Frances District occurred in the western portions from Crozier Township in the east to Blue Township in the west, and north into Gundy and Jaffray townships, Kenora District. Heavy infections caused premature leaf fall to begin in early September.

**Diplodia Tip Blight, *Sphaeropsis sapinea* (Fr.) Dyko & B.Sutton**

For the second consecutive year, surveys have detected an increase in the incidence of this disease in the southern portion of the Fort Frances District.

In Quetico Provincial Park a 15-m red pine at the French Lake campground and a 10-m red pine along the Nym Lake Airbase Road sustained foliar damage averaging 75 and 20%, respectively.

East of the town of Fort Frances in the vicinity of Reef Point and Windy Point, Rainy Lake, the number of

infected red pine continued to rise. Foliar damage ranging from 10 to 70% was encountered on scattered host trees. As reported in 1992, red pine stressed by this pathogen continue to be attacked by the pine engraver beetle (*Ips pini* [Say]) and as a result a low level of mortality is occurring.

**Other Forest Insects**

Various other diseases were encountered during the course of regular surveys. Information on these is provided in Table 14.

**Table 14.** Other forest diseases.

Disease	Host <sup>a</sup>	Remarks
<i>Apiosporina collinsii</i> (Schwein.) Höhn. Witches'-broom	Service berry	High levels of infection occurred on 80% of the trees at Middle Falls Provincial Park, Pardee Township, Thunder Bay District.
<i>Ciborinia whetzellii</i> (Seaver) Seaver Ink spot of aspen	tA	This disease caused 80% foliar damage in a 0.5-ha area of 8- to 10-m-tall trees at one location in McTavish Township, Thunder Bay District.
<i>Cronartium comandrae</i> Peck Comandra blister rust	jP	Infection levels of 2.6 and 3.3% occurred at the Falls Lake Family Test and Kakabeka Seed Orchard, Thunder Bay District, respectively. Tree height averaged 1.4 m at both sites.
<i>Gymnosporangium cornutum</i> Arthur ex Kern Gall rust	aMo	In the Nipigon District, 90% of the host trees from Marathon to Terrace Bay had 50 to 90% foliar damage. In Nipigon Township the incidence of infection was 100% with an average of 25% foliar damage.
<i>Leucostoma kunzei</i> (Fr.:Fr.) Cytospora canker	bF	A 5-ha balsam fir stand near Raynor Lake, Geraldton District, contained stem cankers on 10% of the trees.
<i>Lophodermella concolor</i> (Dearn.) Darker A needle cast	jP	Approximately 25% of scattered host trees were affected by this needle cast at Obatanga Provincial Park, Wawa District.
<i>Marssonina betulae</i> (Lib.) Magn. Marssonina leaf spot	wB	Small stands of mature trees had 50 to 75% affected foliage in the Terrace Bay – Schreiber area of the Nipigon District and along the Catlonite Road in the Geraldton District.
<i>Ophiostoma ulmi</i> (Buisman) Nannf. Dutch elm disease	wE	Mortality levels of 2 and 4% were recorded in mature and overmature ornamentals in the towns of Fort Frances and Kenora, respectively. One infested tree was also found in Vickers Park in the city of Thunder Bay. At a farm near Oxdrift in Eton Township, Dryden District, four 15-m trees were dead. An additional five showed symptoms of the disease.
<i>Venturia macularis</i> (Fr.:Fr.) E. Müll. & Arx Shoot blight	tA	Infection levels of 100% were observed on aspen regeneration throughout many areas in the region.

<sup>a</sup> aMo = mountain ash, bF = balsam fir, jP = jack pine, tA = trembling aspen, wB = white birch, wE = white elm.



## ABIOTIC DAMAGE

### Frost Damage

Foliar damage averaging 2% was encountered on 28.6% of the 3.3-m-tall white spruce at the 5-ha O'Connor Seed Orchard, Thunder Bay District. Higher damage levels were recorded on 15-m black ash (*Fraxinus nigra* Marsh.) at Middle Falls Provincial Park, Thunder Bay District. Scattered trees sustained defoliation levels averaging 10%.

### Hail Damage

Heavy hail storm damage was observed at one location in the Thunder Bay District. When this phenomenon occurs, and the hail stones are large enough, they literally rip the foliage off the stems and/or kill the shoots by removing the bark from the twig. Balsam fir in the area along Highway 527 between Mott and Keelor lakes sustained the heaviest damage with defoliation levels of 75% recorded on all age classes. Scattered white spruce were also damaged, but to a lesser extent.

### Winter Browning

Winter browning damage results when the foliage of young trees is exposed to sunny, windy days during late winter. Because the roots are still frozen there is no flow of moisture to the needles. If exposed to the above conditions long enough, the needles will dry out and eventually turn brown. This type of damage was observed on 64% of the 2.1-m black spruce at the OMNR black spruce breeding orchard in Paipoonge Township, Thunder Bay District. Foliar damage levels averaging 36% were recorded on the previous years' foliage. Winter browning was not observed elsewhere in the region.

## FOREST HEALTH

### Acid Rain National Early Warning System (ARNEWS)

In 1993 the number of ARNEWS plots in Ontario increased from 27 to 38 in an effort to broaden coverage across the province and increase the sample size for major tree species. In the Northwest Region five new plots were established in semimature stands. These included: trembling aspen stands in Hutchinson Township, Fort Frances District and along the Caribou Falls Road in the Kenora District; white birch stands near the towns of Schreiber and Ear Falls in the Nipigon and Red Lake districts, respectively; and a jack pine stand on the Pine Road in the Dryden District. There are now 11 plots scattered across the Northwest Region (Fig.4).

In addition to annual data collection on previously established plots, it was necessary to obtain more detailed information on the new plots. The exact location of all trees within the 10- by 40-m plot boundary was recorded. As well, the physical condition of individual trees and the overall stand was noted. Tree parameters assessed included vertical and horizontal characteristics of the crown, position of each tree in the canopy, diameter, and tree form. The length of any dead tops and the vertical length of the tree's live crown were also recorded.

No specific symptoms of damage caused by airborne pollutants were observed in 1993. However, varying levels of damage caused by a wide range of insect and disease pests were found in all plots. Eastern spruce budworm was present on most white spruce in Wiggins Township, Nipigon District. Defoliation levels ranged from 5 to 45%. Most black spruce experienced damage in the 1 to 5% range in Wiggins Township, Nipigon District and in Fowler Township, Thunder Bay District. All of the white birch in the Red Lake District plot and the Wiggins Township and Schreiber plots in the Nipigon District were 100% affected by birch leafminer, but only at trace levels. Aspen leafblotch miner was present on all the trembling aspen at trace levels in Hutchinson Township, Fort Frances District. The most common disease found was western gall rust. Branch infection levels of 39 and 8% were present in Mafeking Township and Pine Road, respectively, in the Dryden District. Of all jack pine at Margo Lake, Geraldton District, 70% had branch galls. At the Caribou Falls Road plot in Kenora District 23% of the trembling aspen had tinder fungus (*Phellinus* spp.) fruiting and one tree had a main stem infection of Hypoxylon canker (*Hypoxylon mammatum* [Wahlenb.] P.Karst.). Marssonina leaf spot affected all 22 white birch on the Schreiber plot in Nipigon District. Damage levels ranged from 1 to 5%.

As part of the forest monitoring program for airborne pollution damage, these plots will be checked again in 1994.

## SPECIAL SURVEYS

### Gypsy moth, *Lymantria dispar* (L.)

Throughout the region in 1993 two deltoide-type traps were deployed at each of 23 locations in an effort to capture male gypsy moth adults. At two sites where moths were caught last year a more intensive trapping was carried out by placing a total of ten traps at these locations<sup>2</sup>. No adults were retrieved from traps during 1993.

<sup>2</sup>Evans, H.J.; Biggs, W.D.; Keizer, A.J.; Bolan, P.M. 1993. Results of forest insect and disease surveys in the Northwest Region of Ontario, 1992. For. Can., Ont. Region, Sault Ste. Marie, Ont. Misc. Rep. 428. 37 p.



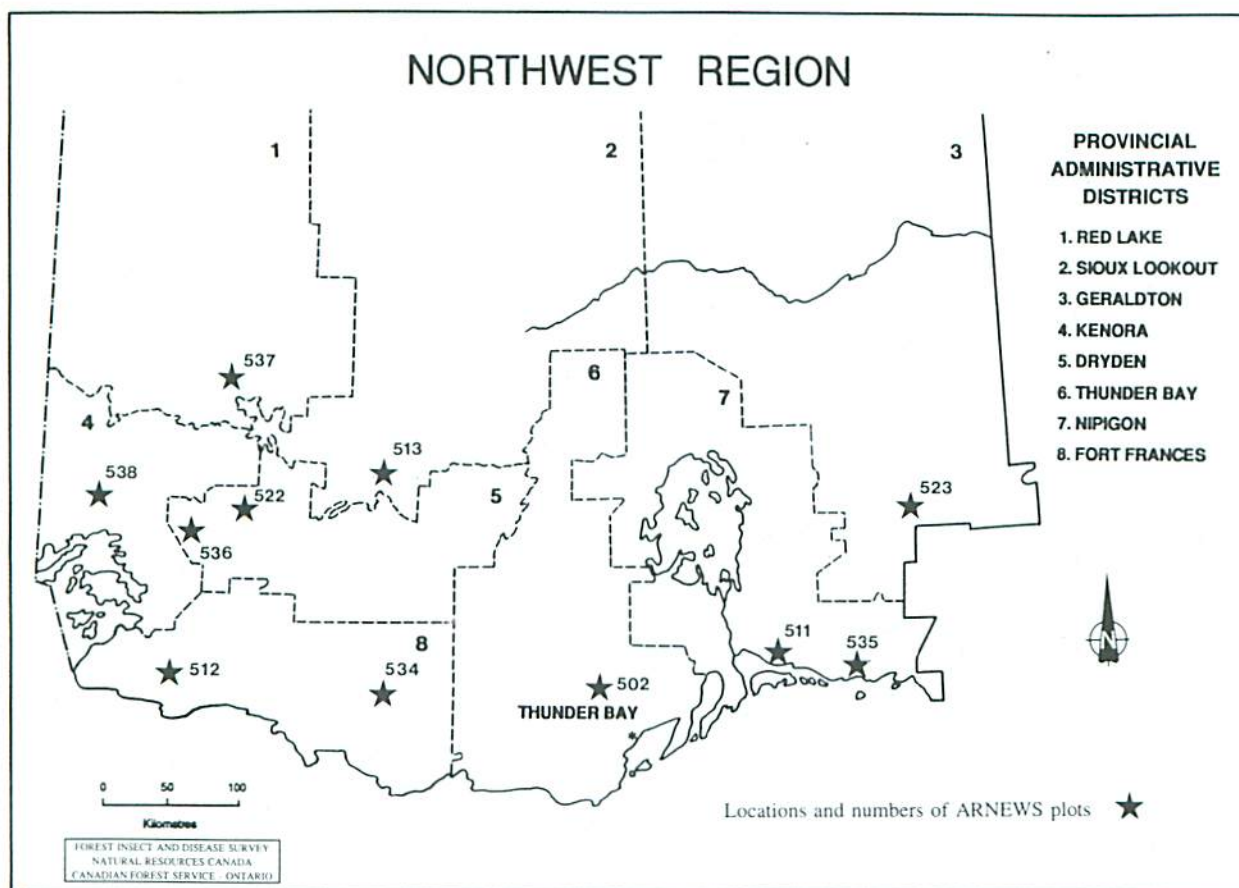


Figure 4. Locations of ARNEWS plots.

### Forest Tree Nursery Report

During the 1993 field season very little pest-related damage was found at the Dryden Forest Tree Nursery in the Dryden District. The most significant damage resulted from frost heaving of bare root seedlings in two of the nursery compartments.

Frost heaving is a phenomenon that results from repeated freezing and thawing of the soil surface. This causes seedlings to lift out of the ground (*see* Photo 4) and topple over, exposes their roots, and often results in mortality. The damage tends to occur in patches and is more common in wet, fine-textured soils that are devoid of snow cover during periods of cold weather. Small first year seedlings and newly established transplants are most susceptible.

Frost heaving was present in compartment C-7. On average, 60% of the 2+0 red pine were lost in scattered areas across 40% of this compartment. Similar damage levels were also found on GT+1.5 white spruce comprising approximately 15% of compartment W-1.

This type of damage can be prevented by using thick mulches to insulate seedbeds and by keeping the seedbed well drained. Seedling growth schedules should encourage root development on small first year seedlings and root wrenching or pruning should be scheduled to allow adequate time for new root formation before the end of the growing season.

During a visit to the nursery in late July, a trace level of damage caused by the yellowheaded spruce sawfly was found. Four 2+0 white spruce growing along the edge of compartment C-3 were stripped of their foliage.

### NORTHERN ONTARIO DEVELOPMENT AGREEMENT (NODA)

With the signing of the Northern Ontario Development Agreement (NODA) in November of 1991, the Northern Forestry Program (NFP) was provided with \$50 million over a 4-year period for economic development in forestry in northern Ontario.



The NFP is a joint venture between the Ontario Ministry of Natural Resources (OMNR) and the Canadian Forest Service. Emphasis will focus on obtaining information to develop better tools and ultimately result in better decisions in the management of Ontario forests for economic, social, and environmental prosperity.

### Projects

Development of an Eastern Spruce Budworm Hazard Rating System for the Forests of Northern Ontario  
NFP Project No. 4210

Studies have shown that the variable nature of conifer stands also means they differ in their vulnerability to attack by the eastern spruce budworm and, therefore, require different management actions. To effectively manage these stands one must be able to predict what will ultimately happen to each type of stand under attack. The goal of this project is to provide forest managers with a spruce budworm hazard rating system that will assist them in assessment of the susceptibility and vulnerability of different stand types. One hundred and eight study plots were established across the Northwest Region to help gather the information required to meet this goal.

Stand selection for the study plots was based on three stand variables: balsam fir/white spruce composition, balsam fir age, and site class. Attempts were made to install study plots in stands with balsam fir/white spruce compositions from 10 to 30%, 31 to 60%, and over 60% in all the various site classes (X to 4). Balsam fir was broken down into three age groups: 20 to 40 years, 41 to 60 years, and over 60 years. A total of 27 plots was required to cover all of the above variables. Personnel from the OMNR and various forest industries played a significant role in helping FIDS staff find suitable stands in which to establish the plots.

These plots will also be used as sample locations for conducting egg-mass counts to forecast eastern spruce budworm populations. Therefore, it was important to have good distribution across the region (Fig.5). Where possible the plots will be used for pheromone trapping and second instar larval ( $L_2$ ) sampling. This is a co-operative study, started in 1983 with Dr. C.J. Sanders, to monitor spruce budworm populations and to determine correlations between moth catches and over-wintering  $L_2$ . Impact on the various host species in the plots is monitored by recording the tree health and defoliation levels.

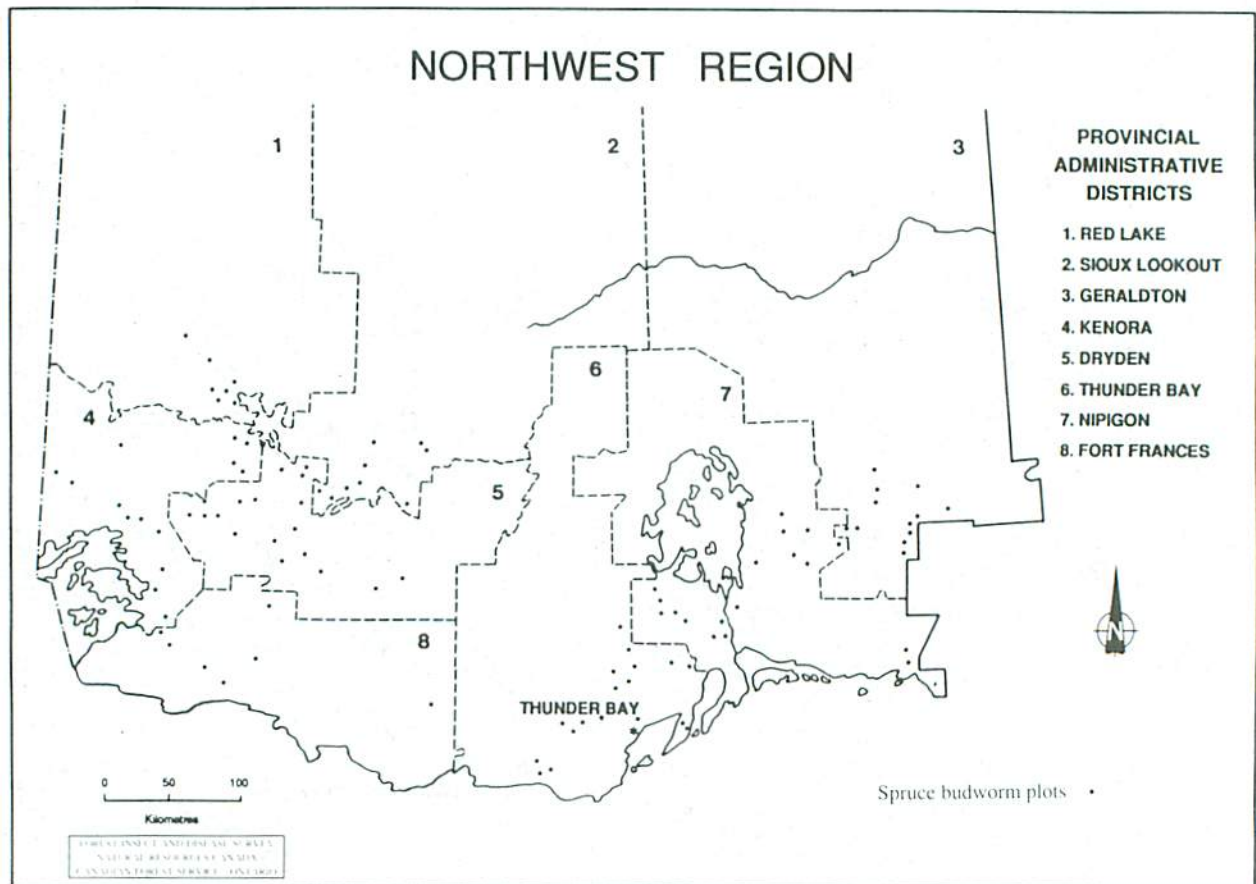


Figure 5. Locations of eastern spruce budworm NFP plots.

Management Guidelines for Jack Pine Budworm  
NFP Project No. 4033

The goal of this project is very similar to the one described for the eastern spruce budworm. Over the next several years information will be gathered on jack pine budworm and its resulting impact on Ontario's forest land. A set of guidelines will be produced to serve as a jack pine management tool. This will enable forest managers to predict such things as growth loss, top kill, and whole-tree mortality in relation to various tree and stand characteristics.

Work on this project was started in 1992 with the installation of 54 plots in the western half of the Northwest Region. Because jack pine budworm does not cause significant impact in a range of conifer species, as does its close relative the eastern spruce budworm, host stands were pure or nearly pure jack pine. Site class coverage was from X to 3; age breakdown was 1 to 40 years, 41 to 80 years, and over 80 years. Some natural regeneration or young plantations were included. Attempts were made to locate the plots in stands currently infested by jack pine budworm or in ones that had a history of being infested during the mid-1980's.

The final round of plots was installed in 1993. This brings the regional total to 89, with a district breakdown as follows: Dryden – 18, Fort Frances – 15, Kenora – 14, Red Lake – 24, and Sioux Lookout – 18 (Fig.6). When choosing these plots it was felt that very young stands were too small; therefore, a minimum height requirement was set at 5 metres. Because prolific flowering on jack pine may have a positive affect on insect populations, a survey was carried out in June to assess the amount of male flowers on plot trees.

In late August each plot was sampled for egg-mass and  $L_2$  densities. Some plots will be used for additional studies by CFS researchers; Dr. C.J. Sanders and Dr. V.G. Nealis will examine pheromone trap development and jack pine budworm sampling techniques, respectively.

Impact Assessment of *Scleroderris* Canker in Ontario  
NFP Project No. 4034

The objective of this project was to obtain better information on the distribution and damage caused by European and North American races of *Scleroderris* canker (*Gremmeniella abietina* [Lagerb.] M. Morelet) on red pine plantations in Ontario.

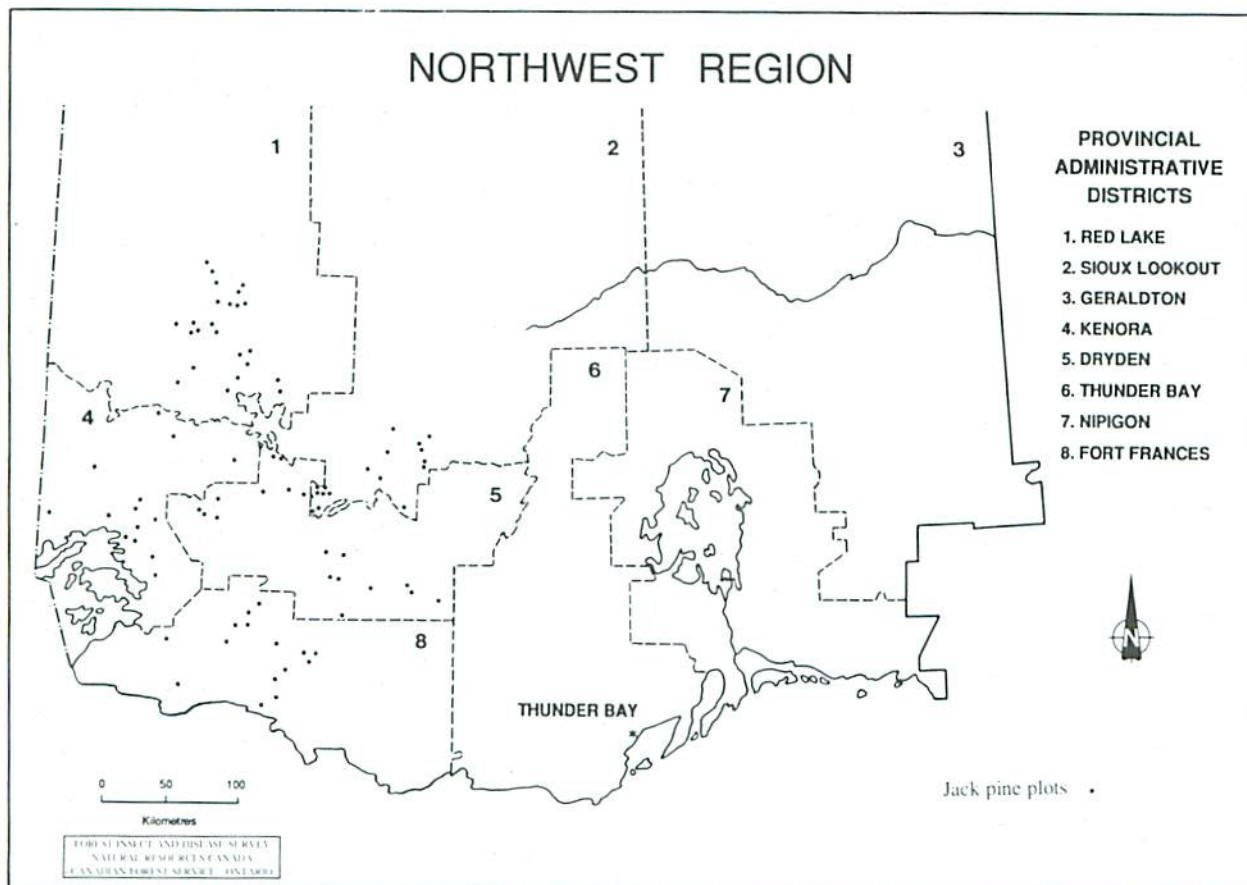


Figure 6. Locations of jack pine budworm NFP plots.



The North American race of this fungus is found in the Northwest Region. Jack pine is the main host but red pine is also infected. During the first half of June 1993, one week was set aside to conduct surveys across the region. A total of 22 sites was checked; 15 of these were jack pine stands and 7 were red pine stands. Survey results showed that *Scleroderris* was not a problem in 1993. (See the *Tree Disease* section of this report for a more detailed description of the annual FIDS work carried out on this disease.)

## Climatic Data

Abiotic damage most commonly results from extremes in weather; for example, frosts or low precipitation levels that cause drought stress. Climate also has an important effect on the development of insect and disease problems. Table 15 lists the mean monthly temperatures and total precipitation for 1993 at five locations in the Northwest Region, as recorded by the Atmospheric Environment Service. Deviations from the 30-year average values are also reported.

**Table 15.** Climatic data from five weather stations in the Northwest Region of Ontario in 1993.

Location	Month	Mean temperature (C°)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal	Actual		Normal	Actual	
Fort Frances Airport	January	-15.2	-16.9	+1.7	28.0	30.6	-8
	February	-12.7	-13.1	+0.4	3.0	22.7	-87
	March	-3.6	-5.7	+2.1	5.0	31.6	-84
	April	3.2	2.5	+0.7	47.6	50.7	-6
	May	10.4	8.8	+1.6	98.0	73.3	+34
	June	14.7	14.0	+0.7	75.5	76.6	-1
	July	17.8	17.6	+0.2	174.5	75.4	+131
	August	18.2	16.4	+1.8	140.0	83.1	+68
	September	9.2	11.1	-1.9	68.8	89.1	-20
	October	3.2	5.7	-2.5	16.5	54.8	-70
	November	-5.4	-2.6	-2.8	32.0	52.9	-40
	December	-9.6	-11.1	+1.5	12.0	41.1	-71
Geraldton Airport	January	-17.6	-20.0	+2.4	17.6	38.2	-54
	February	-18.8	-17.9	-0.9	5.2	33.3	-84
	March	-8.2	-11.0	+2.8	18.4	38.2	-52
	April	-0.8	-0.5	-0.3	61.2	43.3	+41
	May	7.4	7.7	-0.3	97.6	63.2	+54
	June	13.8	13.5	+0.3	53.4	91.9	-42
	July	16.7	16.3	+0.4	136.6	81.6	+67
	August	17.1	14.6	+2.5	78.0	66.8	+17
	September	7.0	9.3	-2.3	136.6	75.6	+81
	October	0.5	3.9	-3.4	58.4	64.6	-10
	November	-8.0	-5.5	-2.5	16.2	61.5	-74
	December	-13.7	-15.4	+1.7	22.8	38.8	-41
Kenora Airport	January	-16.0	-18.5	+2.5	16.2	28.2	-43
	February	-13.7	-14.4	+0.7	3.4	23.0	-85
	March	-9.4	-7.1	-2.3	11.1	30.1	-63
	April	3.5	2.7	+0.8	38.2	41.9	-9
	May	10.6	10.5	+0.1	48.9	57.3	-15
	June	15.2	16.1	-1.1	87.8	83.4	+5
	July	17.6	19.2	-1.8	259.4	91.8	+183
	August	17.7	17.6	+0.1	116.5	85.9	+36
	September	9.1	11.7	-2.6	51.5	69.2	-26
	October	2.0	5.6	-3.6	55.1	40.7	+35
	November	-6.2	-5.5	-0.7	15.5	61.5	-75
	December	-12.2	-15.4	+3.2	14.8	38.8	-62

(cont'd)

**Table 15.** Climatic data from five weather stations in the Northwest Region of Ontario in 1993 (concl.).

Location	Month	Mean temperature (C°)		Deviation from normal (°C)	Total precipitation (mm)		Deviation from normal (mm)
		Normal	Actual		Normal	Actual	
Sioux Lookout Airport	January	-17.2	-19.4	+2.2	16.6	36.0	-54
	February	-15.3	-15.7	-0.4	4.9	26.8	-82
	March	-4.8	-8.3	+3.5	18.5	35.0	-47
	April	2.0	1.4	+0.6	35.2	45.2	-22
	May	9.8	9.2	+0.6	51.8	65.8	-21
	June	14.7	15.2	-0.5	94.8	91.7	+3
	July	17.7	18.3	-0.6	104.2	93.7	+11
	August	17.5	16.6	+0.9	186.4	88.3	+111
	September	7.7	10.7	-3.0	136.2	81.6	+67
	October	1.5	4.7	-3.2	54.6	64.9	-16
	November	-7.8	-5.5	-2.3	21.3	61.5	-65
	December	-12.9	-15.4	+2.5	14.0	38.8	-64
Thunder Bay Airport	January	-14.1	-15.4	+1.3	20.3	40.9	-50
	February	-12.6	-13.0	+0.4	3.6	28.3	-87
	March	-5.1	-6.3	+1.2	13.4	45.0	-70
	April	1.6	2.5	-0.9	72.0	50.7	+43
	May	8.3	8.8	-0.5	99.8	73.3	+36
	June	12.8	14.0	1.2	56.2	76.6	-27
	July	16.8	17.6	-0.8	224.0	75.4	+297
	August	17.8	16.4	+1.4	61.1	83.1	-26
	September	8.6	11.1	-2.5	39.3	89.1	-56
	October	2.7	5.7	-3.0	32.5	54.8	-41
	November	-4.7	-2.6	-2.1	47.0	52.9	-11
	December	-10.2	-11.1	+0.9	18.8	41.1	-54



**Appendix 1.** Northwest Region – Spruce Budworm. (Summary of defoliation estimates and egg-mass counts in 1993, and infestation forecasts for 1994).

Location	Host <sup>a</sup>	Estimated defoliation in 1993 (%)	Number of egg masses per 9.29 m <sup>2</sup> of foliage	Infestation forecasts for 1994 <sup>b</sup>	Accumulated damages <sup>c</sup>
<i>Dryden District (40 locations)</i>					
Barrel Lake	bF	60	211	S	2
Beaverhouse Lake	bF	74	202	M-S	8
*Bridges Township – stand 83	bF	80	250	S	5
*Coronary Lake	bF	84	64	M	3
*Docker Township – stand 110	bS	2	19	L-M	0
*Dore Lake – stand 483	bF	95	122	M-S	4
Eagle Lake – west side	bF	100	300	S	8
*Emmons Lake	bF	66	166	M-S	2
	wS	54	791	S	1
*Forest Lake – stand 22	bF	85	245	S	3
*Hlsley Township	bF	52	0	N	1
	bS	4	0	N	0
Ingall Lake	bF	98	307	S	6
Kukukus Lake	bF	50	204	M-S	1
*Langton Township	bS	11	26	L-M	1
*Little Indian Lake	bF	44	43	L-M	7
*Mafeking Township	bF	98	64	M-S	7
	wS	88	347	S	3
*McIlraith Township – stand 10	bF	38	72	M-S	3
	bS	2	77	M-S	1
Mickle Lake	bF	23	0	N	1
*North Road	bF	82	146	M-S	4
*Rugby Township	bF	97	20	L-M	3
	wS	98	122	M-S	3
Sandbar Lake Provincial Park – stand 740	bF	99	275	S	7
*Sandy Point Road	bF	99	163	M-S	5
	bS	67	329	S	2
*Satterly Township	bF	92	189	M-S	4
	bS	28	221	M-S	1
Shikag Lake	bF	58	140	M-S	3
Smirch Lake	bF	13	0	N	1
*Southworth Township	bF	98	175	M-S	6
Sturgeon Lake – Granite Bay	bF	40	157	M-S	3
– North Arm	bF	85	65	M-S	2
Tag Lake Road	bF	92	65	M-S	4
*Temple Township	bF	93	205	M-S	7
	wS	85	151	M-S	3
*Vaughan Lake	bF	92	95	M-S	7
	bS	4	68	M	1
Zealand Township – Aaron Provincial Park	bF	98	489	S	3
<i>Fort Frances District (27 locations)</i>					
Agnes Lake	bF	87	1183	S	8
Basswood Lake – Prairie Portage	bF	52	854	S	5
Bear Pass	bF	61	287	S	1
*Big Sawbill Lake	bF	79	294	S	6
Boffin Lake	bF	88	172	M-S	2
Burton Lake	bF	8	47	M	–
Cache Bay	bF	0	0	N	1
*Claxton Township	bF	95	427	S	3
Eric Lake	bF	5	25	L-M	0
*French Lake	bF	50	0	N	8

(cont'd)

**Appendix 1.** Northwest Region – Spruce Budworm. (Summary of defoliation estimates and egg-mass counts in 1993, and infestation forecasts for 1994) (cont'd).

Location	Host <sup>a</sup>	Estimated defoliation in 1993 (%)	Number of egg masses per 9.29 m <sup>2</sup> of foliage	Infestation forecasts for 1994 <sup>b</sup>	Accumulated damage <sup>c</sup>
<i>Fort Frances District (27 locations) (concl.)</i>					
Irene Lake	bF	68	108	M-S	5
Jackfish Lake	bF	63	720	S	2
Kawawia Lake	bF	36	52	L-M	1
*Lake Hope	bF	79	289	S	1
Lerome Lake	bF	82	610	S	7
*Menary Township – stand 84	bF	60	991	S	1
Old Man Lake	bF	2	31	L-M	7
Oriana Lake	bF	68	24	L-M	8
Pipestone Lake	bF	4	0	N	1
Poohbah Lake	bF	28	168	M-S	8
*Preacher Lake	bF	18	34	L-M	6
	wS	40	79	M-S	6
Sand Point	bF	29	126	M-S	5
Shoal Lake	bF	89	410	S	2
Tuck Lake	bF	78	649	S	8
Vickers Lake	bF	22	23	L-M	1
*Watten Township – stand 158	bF	100	596	S	2
<i>Geraldton District (52 locations)</i>					
Ashmore Township	bF	95	133	M-S	3
	wS	88	170	M-S	3
	bS	80	32	L-M	2
Ashmore Township	bF	92	99	M-S	3
Bain Township	bF	59	86	M-S	2
*Bikerace Lake	bF	91	91	M-S	4
	wS	50	98	M-S	3
	bS	13	55	M-S	1
*Burrows Lake – north	bF	94	107	M-S	2
	wS	95	275	S	2
*Burrows Lake – south	bF	90	123	M-S	2
	wS	68	488	S	2
Burrows Lake – Plantation	wS	22	12	L-M	0
*Caramat Road – Highway 11	bF	94	168	M-S	3
– 2.8 km south of Highway 11	bF	26	37	L-M	3
*Catlonite Road – Spider Lake	bF	90	155	M-S	5
	wS	56	189	M-S	5
Clavet Township	bF	42	0	N	2
*Daley Township	bF	48	113	M-S	2
	wS	58	106	M-S	2
	bS	8	0	N	1
Danford Township	bF	11	0	N	3
*Errington Township	bF	92	160	M-S	2
	wS	82	128	M-S	2
	bS	16	45	L-M	1
Esnagami Lake	bF	2	33	L-M	6
Fernow Lake – plot 1(91)	bF	68	53	M-S	3
Florrie Road – north	wS	60	271	S	2
– south	wS	38	57	M-S	2
Flynne Creek – north	wS	3	0	N	0
– south	wS	5	0	N	3
Goldfield Road – Kenogamisis River	bF	61	90	M-S	3
– Wig Lake	bF	90	58	M	2

(cont'd)



**Appendix 1.** Northwest Region – Spruce Budworm. (Summary of defoliation estimates and egg-mass counts in 1993, and infestation forecasts for 1994) (cont'd).

Location	Hosta	Estimated defoliation in 1993 (%)	Number of egg masses per 9.29 m <sup>2</sup> of foliage	Infestation forecasts for 1994b	Accumulated damages <sup>c</sup>
<i>Geraldton District (52 locations) (concl.)</i>					
Goodwin Township	bF	42	360	S	3
Kimberly – Clark SPA <sup>d</sup>	wS	6	9	L	1
Klotz Lake Provincial Park	bF	15	73	M–S	3
Long Lake – west side	wS	92	105	M–S	3
Meta Lake	wS	4	17	L–M	3
Mistake Creek	wS	2	0	N	0
Nakina Township	bF	88	218	S	3
*Nakina Township	bF	34	67	M	2
	wS	35	53	L–M	2
	bS	4	0	N	1
*Nibs Lake	bF	52	22	L–M	2
	wS	21	82	M–S	1
Oly Lake	wS	58	381	S	3
*Raynar Lake	bF	80	68	M–S	3
	wS	45	139	M–S	3
*Suicide Lake	bF	74	6	L	4
	wS	88	25	L–M	3
Wababimiga Lake	bF	79	163	M–S	1
Wintering Lake	wS	31	433	S	2
<i>Kenora District (45 locations)</i>					
*Aerobus Lake Road	bF	91	46	L–M	2
	bS	48	461	S	1
*April Lake	bF	82	92	M–S	2
*Cliff Lake	bF	95	242	S	2
	wS	77	913	S	2
Conifer Lake Road – stand 348	wS	19	255	S	5
Deer Lake Road	bF	34	292	M–S	1
	bS	7	73	M–S	1
Forgie Township – Rush Bay Road	bF	8	0	N	8
*Forgie Township – stand 355	bF	10	0	N	8
	wS	15	155	M–S	5
*Godson Township – stand 451	bF	96	708	S	6
*Gundy Lake Road – stand 28	bF	9	0	N	7
*Haycock Township – stand 384	bF	40	306	S	6
*Kirkup Township – stand 167	wS	64	833	S	8
Lennan Lake	bF	88	120	M–S	5
Maynard Lake – stand 44	bF	90	386	S	6
	wS	73	1208	S	2
McCallum Point Road	bF	22	0	N	8
McGeorge Township – Sioux Narrows	bF	22	89	M–S	1
*McMeekin Township – stand 412	bS	49	97	M–S	1
*Melick Township – stand 205	bF	95	528	S	5
	wS	89	598	S	4
Oak Lake – stand 238	bF	95	305	S	3
	wS	89	557	S	2
Ord Lake – stand 122	bF	79	482	S	6
	wS	75	570	S	2
Pelican Township – Pelican Pouch Lake	bF	58	90	M–S	6
Pellatt Township – Sandy Lake	bF	90	167	M–S	1
Sand Lake	bF	85	958	S	5

(cont'd)

**Appendix 1.** Northwest Region – Spruce Budworm. (Summary of defoliation estimates and egg-mass counts in 1993, and infestation forecasts for 1994) (cont'd).

Location	Host <sup>a</sup>	Estimated defoliation in 1993 (%)	Number of egg masses per 9.29 m <sup>2</sup> of foliage	Infestation forecasts for 1994 <sup>b</sup>	Accumulated damages <sup>c</sup>
<i>Kenora District (45 locations) (concl.)</i>					
Scenic Lake – stand 16	wS	82	1939	S	2
	bS	25	455	S	1
Separation Lake – stand 8	bF	81	389	S	6
	wS	75	2196	S	5
Snowshoe Lake	bF	25	18	L-M	5
Stephen Lake – stand 220	bF	67	69	M-S	5
Tide Road – stand 117	bF	79	429	S	5
	bS	11	406	S	1
– stand 372	wS	81	769	S	5
*Trail Lake – stand 127	bF	85	165	M-S	6
	bS	30	275	S	1
Umfreville Lake	bF	17	1053	S	6
Unexpected Lake – stand 60	bF	73	334	S	3
	wS	82	1694	S	2
*Willingdon Township – stand 156	bF	95	848	S	3
<i>Nipigon District (62 locations)</i>					
Altitude Lake	bF	31	236	S	2
Big Duck Lake	bF	18	14	L	1
*Black Sturgeon Lake	bF	91	170	M-S	4
	wS	88	718	S	4
*Booth Township	bF	95	27	L-M	7
Camp 75 Road	bF	95	186	M-S	4
Caragana Lake	wS	86	109	M-S	5
Catlonite Road – km 46.7	bF	56	112	M-S	7
Central Lake	bF	87	13	L	4
*Church Township	bF	95	57	M-S	–
*Coldwell Township	wS	3	0	N	1
Cornish Lake	bF	66	37	L-M	3
*Eskanonwatin Lake	wS	36	327	S	6
Foxtrap Lake	bF	95	72	M-S	6
Frank Lake	bF	82	188	M-S	2
*Grain Township	bF	92	55	M	5
Greenhedge Lake	bF	59	58	M	3
Hwy 527 – Gull River	bF	78	474	S	5
– Waweig Lake	bF	95	66	M-S	5
*John Ahl Road	bF	70	18	L-M	2
	wS	70	14	L-M	2
	bS	7	70	M-S	1
*John Creek	bF	93	43	L-M	5
Kabitotikwia Lake	bF	91	225	S	6
Kilkenny Township – Lake Nipigon					
Provincial Park	bF	87	36	L-M	2
Killala Lake	bF	77	232	S	3
Killraine Township – Rainbow Falls Park	bF	3	0	N	2
Kirby Township	bF	18	54	M	4
*Legault Township – Highway 11	bF	95	458	S	3
	bS	56	55	M	3
*Legault Township – Kinghorn Road	bF	95	0	N	3
	wS	80	0	N	3
Limestone Lake – north	wS	95	318	S	1
– south	wS	72	562	S	1

(cont'd)



**Appendix 1.** Northwest Region – Spruce Budworm. (Summary of defoliation estimates and egg-mass counts in 1993, and infestation forecasts for 1994) (cont'd).

Location	Host <sup>a</sup>	Estimated defoliation in 1993 (%)	Number of egg masses per 9.29 m <sup>2</sup> of foliage	Infestation forecasts for 1994 <sup>b</sup>	Accumulated damages <sup>c</sup>
<i>Nipigon District</i> (62 locations) (concl.)					
Limestone Lake – hydro line	wS	8	0	N	0
McKirdy SPA <sup>d</sup>	wS	34	86	M–S	1
McMaster Township – block 15	bF	85	343	S	3
*Nonwatin River	bF	95	88	M–S	5
	bS	15	118	M–S	5
North Lamaune Lake	bF	9	12	L	3
Onaman Lake – south	bF	68	161	M–S	2
Onaman River	bF	83	214	S	1
Oskawe Lake	bF	95	29	L–M	5
*Parent Township	bF	53	67	M–S	5
	wS	56	159	M–S	4
	bS	2	13	L	2
Parks Lake	bF	95	74	M–S	4
*Pic Township – Black River	bS	0	14	L–M	1
*Polly Lake	wS	95	125	M–S	4
	bS	7	322	S	1
Shillabeer Creek	bF	90	281	S	8
*South Beatty Lake	bF	88	43	L–M	4
	wS	83	0	N	3
Summers Township	bF	95	0	N	4
Sump Lake	bF	43	167	M–S	8
Syine Township	wS	49	0	N	5
*Twit Lake	bF	82	17	L–M	5
Tyrol Lake – north	wS	26	41	L–M	4
– south	wS	94	150	M–S	6
Upper Roslyn Lake	bF	88	155	M–S	6
Vein Lake	bF	78	70	M–S	3
Wiggins Township	bF	54	24	L–M	3
<i>Red Lake District</i> (22 locations)					
Aerofoil Lake	bF	78	427	S	5
*Baird Township – stand 162	bF	95	231	M–S	2
Bateman Township – East Bay	bF	35	154	M–S	1
Birch Lake – South Bay	bF	96	219	M–S	5
Chukuni Lake Road	bF	89	401	S	3
Confederation Lake	bF	57	299	S	5
*Detector Lake – stand 251	bF	96	184	M–S	8
Flundra Lake	bF	91	425	S	2
*Goldpine Road – stand 734	bF	92	735	S	3
*Goose Lake – stand 169	bF	78	396	S	5
Lac Seul – Farewell Bay	bF	78	625	S	5
	bS	21	100	M–S	1
McDonough Township	bF	65	185	M–S	3
Pakwash Provincial Park	bF	96	464	S	5
*Sandy Creek – stand 202	wS	65	879	S	2
Skinner Township – Narrow Lake	bF	95	325	S	6
*Snake Falls Road – stand 38	bF	95	370	S	3
	wS	89	886	S	2
Wegg Lake – stand 348	bF	91	167	M–S	7
	wS	91	627	S	5
*Wenesaaga Lake – stand 252	bF	95	393	S	2
Whitemud Lake	bF	84	294	S	5

(cont'd)

**Appendix 1.** Northwest Region – Spruce Budworm. (Summary of defoliation estimates and egg-mass counts in 1993, and infestation forecasts for 1994) (cont'd).

Location	Host <sup>a</sup>	Estimated defoliation in 1993 (%)	Number of egg masses per 9.29 m <sup>2</sup> of foliage	Infestation forecasts for 1994 <sup>b</sup>	Accumulated damage <sup>c</sup>
<i>Sioux Lookout District (22 locations)</i>					
*Burma Lake Road	bF	94	113	M-S	3
	bS	18	0	N	1
Carling Lake	bF	16	28	L-M	2
*Deception Lake	bF	100	294	S	3
*Drayton Township – stand 234	bF	87	48	M	3
	wS	59	366	S	3
*Factor Township – stand 209	bF	95	55	M	3
*Foley Lake – stand 287	bF	92	1093	S	3
Kimmewin Lake – stand 410	bF	95	243	S	3
Lac Seul – Black Bay	bF	81	569	S	3
– Coons Bay	bF	82	162	M-S	2
– Whitefish Bay	bF	91	116	M-S	3
– Windigo Point	bF	82	248	S	3
*Lomond Township	bF	81	343	S	3
	wS	17	458	S	2
	bS	20	201	M-S	
Maskara Lake	bF	97	208	M-S	3
*Moose Lake Road	bF	98	89	M-S	3
Ojibway Provincial Park – Terry Lake Trail	bF	93	515	S	3
*Pickerel Township	bF	83	112	M-S	4
Savant Lake – NE Arm	bF	96	213	S	1
Wapesi Lake – stand 470	bF	82	158	M-S	3
<i>Thunder Bay District (62 locations)</i>					
Aldina Township – impact plot, stand 19	bF	33	84	M-S	8
*Blackwell Township	bF	72	153	M-S	6
	bS	20	19	L-M	6
Buck Lake	bF	75	346	S	4
Burchell Lake – stand 125	bF	18	9	L	–
*Buzzer Lake Road	bF	95	874	S	3
Cheeseman Lake – km 130	bF	57	17	L-M	8
Conacher Township – stand 459	bF	43	86	M-S	8
*Conacher Township	bF	38	91	M-S	8
	bS	8	36	L-M	2
Crayfish Lake	bF	5	9	L	7
*Decourcey Lake	bF	82	81	M-S	4
Devon Township	bF	73	212	S	6
*Dog Lake – stand 60	bF	28	97	M-S	3
*Forbes Township – Flett	bF	80	59	M	2
*Fowler Township	bF	62	0	N	2
	bS	10	0	N	2
Gorham Township – Hazelwood	bF	47	106	M-S	2
*Gorham Township – stand 99	bF	56	25	L-M	3
	wS	58	174	M-S	3
Greenwater Lake – S.E.	bF	0	0	N	–
– Shelter Island	bF	0	12	L-M	+
Greenwood Lake	bF	0	0	N	–
Grew River	bF	91	124	M-S	4
Hagey Township – Highway 586	bF	6	0	N	+
Haines Township – Postans	bF	5	20	L-M	1
Harmon Lake	bF	52	69	M-S	6
*Hicks Lake	bF	44	24	L-M	2

(cont'd)



**Appendix 1.** Northwest Region – Spruce Budworm. (Summary of defoliation estimates and egg-mass counts in 1993, and infestation forecasts for 1994) (concl.).

Location	Host <sup>a</sup>	Estimated defoliation in 1993 (%)	Number of egg masses per 9.29 m <sup>2</sup> of foliage	Infestation forecasts for 1994 <sup>b</sup>	Accumulated damage <sup>c</sup>
<i>Thunder Bay District (62 locations) (concl.)</i>					
Hood Lake	bF	0	12	L	–
Hoof Lake	bF	25	11	L	–
*Joeboy Lake	bF	91	102	M–S	8
Kekekuab Lake	bF	2	39	L–M	–
Lac Des Mille Lacs – Bolton Bay	bF	22	53	L–M	7
– Honkonen Narrows	bF	22	38	L–M	8
*Laverendrye Park	bF	32	143	M–S	7
Lismore Township	bF	45	85	M–S	5
Matawin Road – Tree Seed Orchard	wS	5	34	L–M	1
McGinnis Lake	bF	0	0	N	–
*Michener Township	bF	89	218	S	4
*Milkshake Lake	bF	41	94	M–S	4
	wS	34	916	S	4
Moss Lake	bF	0	0	N	–
Mountain Lake	bF	58	27	L–M	7
*Mountain Lake Road – stand 205	bF	36	66	M–S	7
Mug Lake	bF	82	244	S	4
O'Connor Township – SPA <sup>d</sup>	wS	5	43	L–M	1
Plummes Lake	bF	0	30	L–M	–
*Sandstone Lake	bF	13	20	L	1
Selwyn Lake	bF	18	51	L–M	5
Shebandowan Lake	bF	20	39	L–M	–
Sleeping Giant Provincial Park	bF	83	322	S	–
*Soper Township	bF	79	248	S	4
	bS	28	585	S	3
Squeers Lake	bF	10	10	L	–
*Walkingshaw Lake	bF	33	140	M–S	5
	bS	11	86	M–S	5
Wawang Lake	bF	37	48	L–M	3
Weaver Lake	bF	53	495	S	6
*Wolf River Road – km 28	bF	95	200	M–S	5
Wolf Lake – plantation north	wS	30	258	S	1
– plantation south	wS	51	486	S	1
*Wolf Lake – stand 56	bF	51	131	M–S	3

\* SBW NODA IMPACT PLOT.

<sup>a</sup> bF = balsam fir, wS = white spruce.

<sup>b</sup> S = severe, M = moderate, L = light, N = nil.

<sup>c</sup> 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.

<sup>d</sup> SPA – Seed Production Area.

**Appendix 2.** Northwest Region – Jack Pine Budworm. (Summary of defoliation estimates and egg-mass counts in 1993 and infestation forecasts for 1994 on jack pine. Unless indicated otherwise, sampling was done on jack pine budworm NODA plots.)

Location	Estimated defoliation in 1993 (%)	Total number of egg- masses on six – 61 cm branch tips	Infestation forecasts for 1994 <sup>a</sup>
<i>Dryden District</i> (20 locations)			
Bailey Lake – stand 208	0	0	N
+Basket Lake – stand 519	0	0	N
Bradshaw Township – stand 200	0	1	L
+Bradshaw Township – stand 212	0	0	N
+Centrefire Lake – stand 28	0	0	N
Hodgson Township – stand 370	0	0	N
+Hlsley Township – stand 333	0	0	N
Lac Seul – Williams Bay – stand 89	0	0	N
+ – Route Bay – stand 128	0	0	N
Little Metionga Lake – stand 362 <sup>b</sup>	0	0	N
Mafeking Township – stand 66	0	0	N
McNevin Township – stand 364	0	0	N
Mutrie Township – stand 311	0	0	N
Pipio Lake <sup>b</sup>	0	1	L
Revell River – stand 398	0	0	N
Rowell Township – stand 100	0	0	N
Suzanne Lake – stand 323	0	0	N
Turtle River – stand 19	0	0	N
Wabigoon Township – stand 350	0	0	N
– stand 362	0	0	N
<i>Fort Frances District</i> (15 locations)			
+Caliper Lake – stand 167	0	0	N
Dawn Road – stand 229	0	0	N
Eltrut Lake – stand 183	1	0	N
– stand 249	0	2	L
Fishhawk Road – stand 43	0	0	N
Gallow Lake – stand 131	0	0	N
+Heathcliffe Lake – stand 232	0	0	N
+Hillyer Creek – stand 224	0	0	N
Lake Despaire	0	0	N
Prince Road	0	0	N
Rawlinson Creek – stand 30	0	0	N
Rawlinson Creek – stand 119	0	0	N
Skull Lake – stand 110	2	0	N
Straw Lake – stand 519	0	0	N
Triple Road – stand 134	0	0	N
<i>Kenora District</i> (14 locations)			
April Lake – stand 134	0	0	N
Blindfold Creek – stand 344	1	0	N
Coyle Township – stand 245	0	0	N
Devonshire Township – stand 503	0	0	N
Ewart Township – stand 319	1	0	N
Graphic Lake	1	0	N
+John Lake – stand 119	0	0	N
MacNicol Township – stand 108		0	N
+Mark Lake – stand 103	0	0	N
Rabbit Lake	0	1	L
Snook Lake	0	0	N
Stokes Lake	0	0	N
Tide Road – stand 645	0	0	N
Wabigoon Lake – stand 32	0	0	N

(cont'd)



**Appendix 2.** Northwest Region – Jack Pine Budworm. (Summary of defoliation estimates and egg-mass counts in 1993 and infestation forecasts for 1994 on jack pine. Unless indicated otherwise, sampling was done on jack pine budworm NODA plots.)

Location	Estimated defoliation in 1993 (%)	Total number of egg- masses on six – 61 cm branch tips	Infestation forecasts for 1994 <sup>a</sup>
<i>Red Lake District (24 locations)</i>			
+Bateman Township – stand 31	0	0	N
+ – stand 34	0	1	L
+Coli Lake – stand 224	0	0	N
Conifer Lake	0	0	N
Ear Falls	0	0	N
+Emarton Lake	0	0	N
+Flundra Lake	0	0	N
+Gleave Lake	0	0	N
+Graves Township – stand 514	0	0	N
McDonough Township – stand 401	1	0	N
– stand 402	1	1	L
– stand 403	0	0	N
+McKenzie Bay Road – km 10.2	0	0	N
+McKenzie Bay Road – km 11.4	0	0	N
North Road – stand 132	0	1	L
Nungesser Road – km 30 – stand 271	0	N	
– km 36 – stand 1503	0	N	
– km 75 – stand 4070	0	N	
Nungesser River – stand 240	0	0	N
Overnight Road – stand 404	0	0	N
Sidace Lake Road – stand 230	0	0	N
+ – stand 254	0	0	N
Wenesaga Lake	2	0	N
Zimring Road – stand 100	1	0	N
<i>Sioux Lookout District (17 locations)</i>			
+Drayton Township – stand 200	0	0	N
+Elbow Lake Road – stand 251	0	0	N
Goodie Lake – stand 49	0	0	N
Goodie Lake – stand 80	0	0	N
+Goodie Lake – stand 83	0	0	N
+Goodie Lake – stand 108	0	0	N
Goodie Lake – stand 245	0	1	L
McAree Township – stand 57	0	0	N
McAree Township – stand 65	0	0	N
Moose Lake Road – stand 99	0	0	N
Moose Lake Road – stand 116	0	0	N
– stand 122	0	0	N
Porrett Lake – stand 259	0	0	N
Stanzhikimi Lake Road – stand 26	0	0	N
+ – stand 230	0	0	N
Wrong Road – stand 266	0	0	N
Wyatt Lake Road – stand 195	0	0	N

<sup>a</sup> N = nil, L = light, M = moderate, H = heavy

<sup>b</sup> not a Jack Pine Budworm NFP Plot

+Immature jack pine stand