

GRANDMAISON - 1990 - 1

FOREST INSECT AND DISEASE  
CONDITIONS IN MANITOBA  
IN 1990

MIKE GRANDMAISON

FILE REPORT  
GRANDMAISON - 1990 - 1

FOREST INSECT AND DISEASE SURVEY  
FORESTRY CANADA  
MANITOBA DISTRICT OFFICE  
104 - 180 MAIN STREET  
WINNIPEG, MANITOBA  
R3C 1A6

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## Introduction

The Forest Insect and Disease Survey (FIDS) continued to monitor forest pest problems in the province of Manitoba during 1990. Mike Grandmaison (FIDS technician) operated from the Manitoba District Office in Winnipeg. Herb Cerezke (FIDS Head), Jan Volney (Project Leader) and Jim Emond (Chief FIDS Ranger), all from Northern Forestry Centre in Edmonton, provided functional assistance.

Pest detection involves a coordinated effort, including ground truthing and aerial surveys. These aerial surveys take place during critical periods when defoliation by a particular pest is most apparent. In 1990, a total of 8.5 hours of chartered aircraft time was provided by ForCan for aerial pest surveys (Figure 1). I wish to acknowledge Manitoba Forest Protection for conducting the aerial surveys.

In summary, the spruce budworm and forest tent caterpillar populations decreased considerably during 1990. The jack pine budworm remained at endemic levels.

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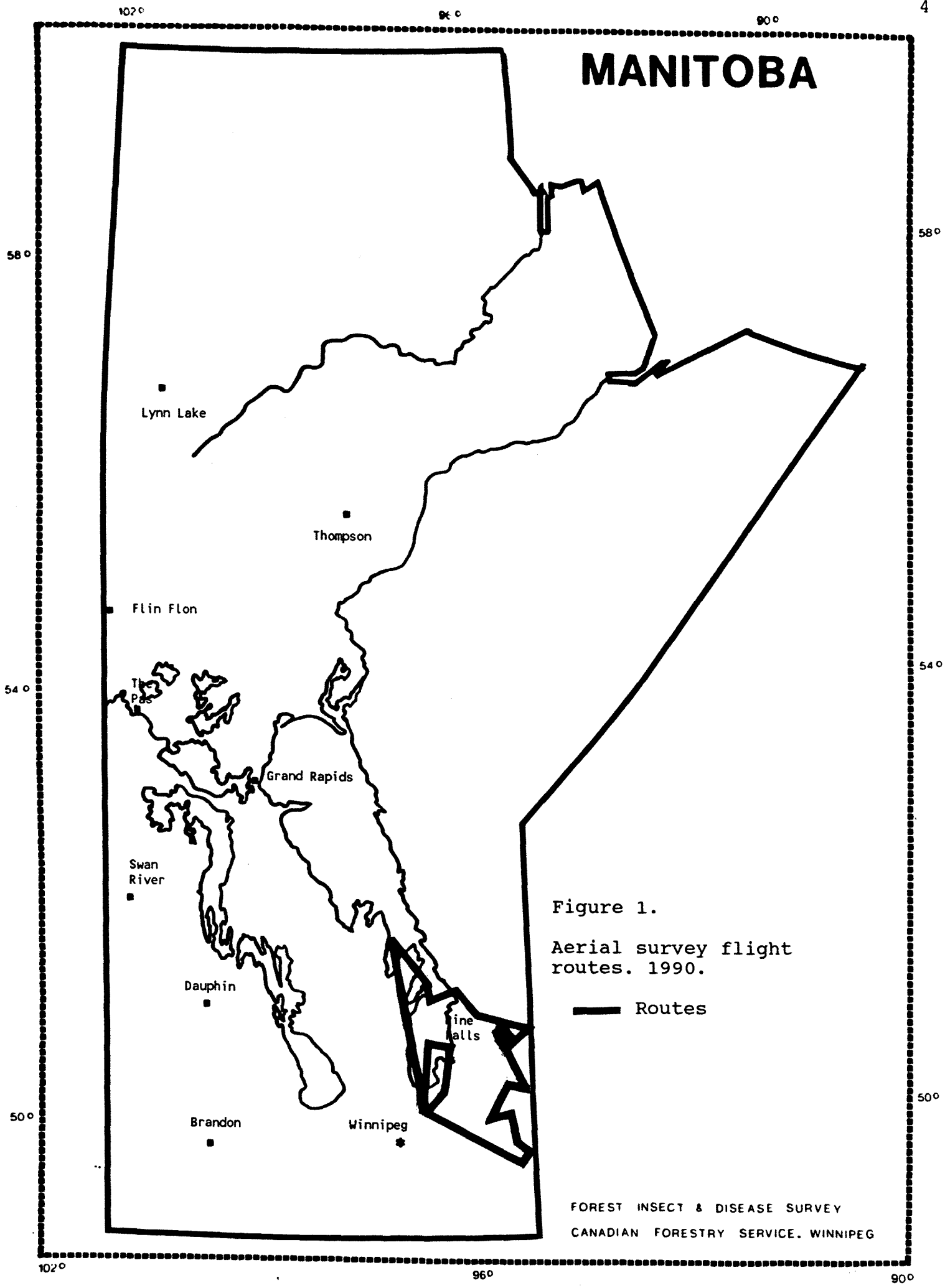


Figure 1.

Aerial survey flight routes. 1990.

— Routes

### Spruce Budworm

The spruce budworm, *Choristoneura fumiferana* (Clem.) defoliated some 18,985 ha of white spruce/balsam fir forests in 1990, about one third the area defoliated the previous year (Table 1). The infestation is at its lowest level in recent years.

Table 1. Areas of white spruce and balsam fir forests in Manitoba defoliated by the spruce budworm from 1982 to 1990.

Year	Area defoliated (ha)
1982	31,380
1983	40,500
1984	142,700
1985	77,500
1986	34,318
1987	15,540
1988	33,670
1989	58,016
1990	18,985

The infestation decreased markedly in every forest section of the province except in the Interlake Forest Section where nearly the same area as in the previous year was defoliated (9,220 ha). The infestation persisted in the Lake Winnipeg East Forest Section with 8,858 ha of forest defoliated; it also defoliated 907 ha of forest in the Pineland Forest Section (Figure 2). Table 2 summarizes the areas defoliated by Forest Management Unit and Forest Section. Detailed infestation data are compiled in Appendix 1. In general, actual defoliation levels echoed those predicted the previous fall through egg mass sampling.

A summary of 1990 defoliation levels, egg mass counts and defoliation predictions for 1991 appears in Table 3. Defoliation predictions for 1991 are based on egg mass counts. Although egg mass counts are somewhat lower or similar to last year's, a few exceptions are worth noting. Egg mass counts are higher in Spruce Woods Provincial Forest although predictions for 1991 remain in the moderate defoliation category. Numbers are also higher in Hecla Provincial Park (36) and Rocky Lake (12) where moderate and light defoliation levels respectively are expected for this coming season. Severe defoliation in Whiteshell Provincial Park and moderate defoliation in Wanipigow are predicted for 1991 although egg mass counts are lower than last year (218 and 77 respectively). In the Northwest Angle Provincial Forest, egg mass counts dropped from 25 to 0. Weather, parasites and diseases may alter these predicted levels for 1991.

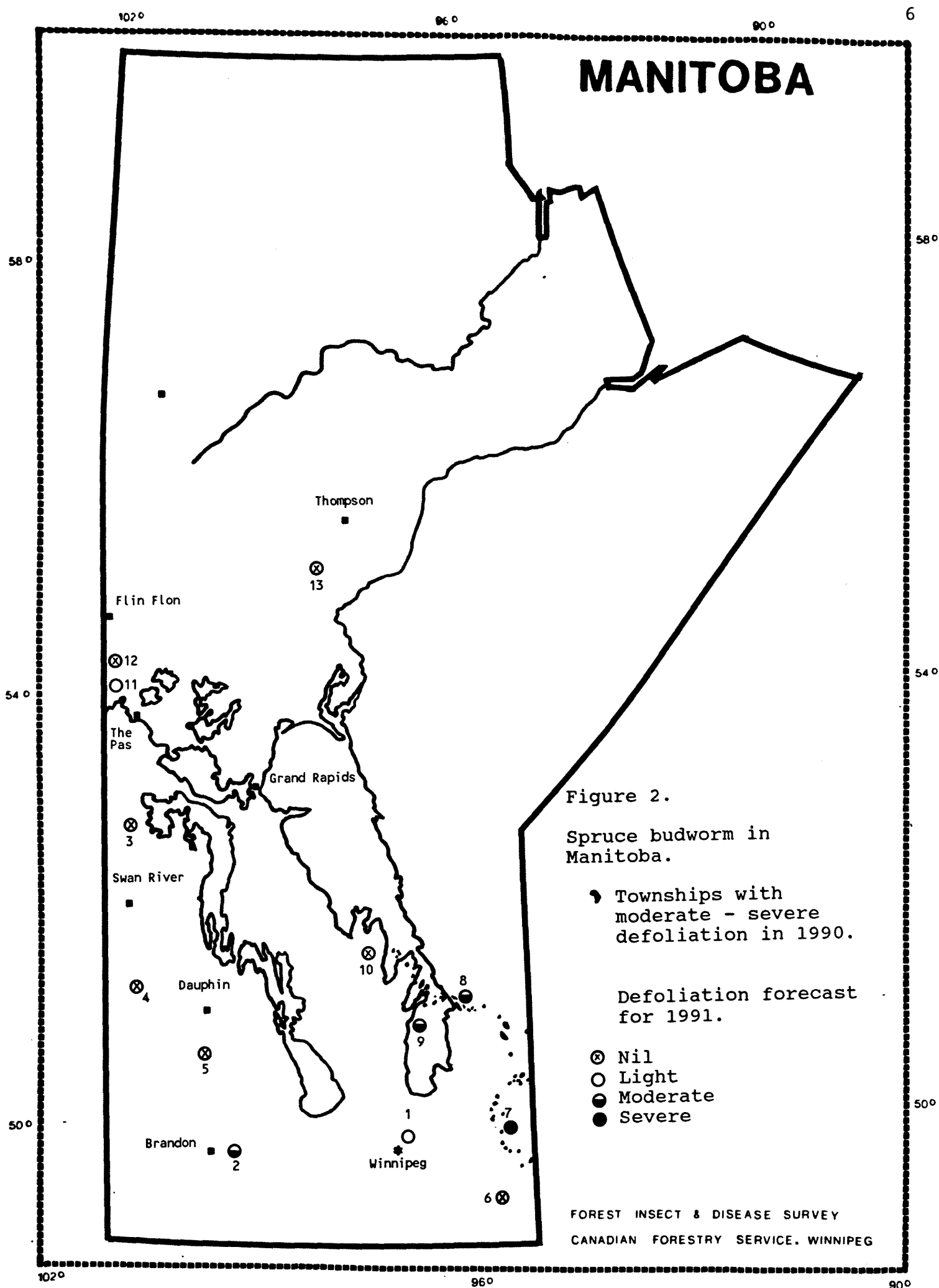


Table 2. Areas defoliated by the spruce budworm in Manitoba in 1990, summarized by Management Unit and Forest Section.

Forest Section	Management unit (MU)	Defoliated area (ha)	
		MU total	Section
Pineland	23	907	907
Lake Winnipeg East	30	1,412	8,858
	31	7,446	
Interlake	40	9,220	9,220
Manitoba (Total)			18,985

Pheromone-baited traps (non-saturating Multi-Pher) were deployed for the 6th consecutive year in 13 plot locations in Manitoba to test this technique as a survey monitoring tool. Three Multi-Pher traps were baited with a .03 % pheromone bait and positioned in a triangle, spaced 40 m apart. Results of pheromone trapping for 1990 are shown in Table 4. Male moth counts were generally lower or similar in 1990 to those of last year. Counts remain high in Spruce Woods Provincial Forest (322), Wanipigow (509) and Whiteshell Provincial Park (643). Table 5 summarizes pheromone data from 1985 to 1990.



Table 3. Summary of spruce budworm data in Manitoba: defoliation levels, egg mass counts in 1990, and defoliation forecasts for 1991.

Plot no.	Plot location	Forest management unit	Percent defoliation 1990	Defoliation level rating 1990	Number of egg masses/ 10m <sup>2</sup> foliage 1990	Defoliation predicted for 1991 <sup>a</sup>
1	Birds Hill Provincial Park	01	17	Light	11	Light
2	Spruce Woods Provincial Forest	04	25	Moderate	76	Moderate
3	Red Deer River	12	<1	Trace	0	Nil
4	Duck Mountain Provincial Park	13	2	Trace	0	Nil
5	Riding Mountain National Park	15	<1	Trace	0	Nil
6	Northwest Angle Provincial Forest	20	<1	Trace	0	Nil
7	Whiteshell Provincial Park	30	22	Moderate	218	Severe
8	Wanipigow	31	21	Moderate	77	Moderate
9	Hecla Provincial Park	40	9	Light	36	Moderate
10	Lake St. George	41	1	Trace	0	Nil
11	Rocky Lake	56	1	Trace	12	Light
12	Simonhouse	60	2	Trace	0	Nil
13	Pisew Falls	84	<1	Trace	0	Nil

<sup>a</sup> Based on egg mass density estimates

Table 4. Spruce budworm moth captures in Manitoba. 1990.

Plot no.	Plot location	Forest management unit	Number of male moths			
			Trap 1	Trap 2	Trap 3	Average
1	Birds Hill Provincial Park	01	86	141	-	114
2	Spruce Woods Provincial Forest	04	405	272	289	322
3	Red Deer River	12	58	59	54	57
4	Duck Mountain Provincial Park	13	8	3	12	8
5	Riding Mountain National Park	15	2	5	10	6
6	Northwest Angle Provincial Forest	20	12	4	10	9
7	Whiteshell Provincial Park	30	636	706	587	643
8	Wanipigow	31	518	590	420	509
9	Hecla Provincial Park	40	44	27	40	37
10	Lake St. George	41	6	5	7	6
11	Rocky Lake	56	38	32	78	49
12	Simonhouse	60	17	51	22	30
13	Pisew Falls	84	3	5	11	6

Table 5. Summary of spruce budworm moth captures per pheromone-baited trap in Manitoba from 1985 to 1989.

Plot no.	Plot location	Forest management unit	Average number of moths captured per trap					
			1985	1986	1987	1988	1989	1990
1	Birds Hill Provincial Park	01	2	279	128	40	328	114 <sub>b</sub>
2	Spruce Woods Provincial Forest	04	60	435	293	122	559	322
3	Red Deer River	12	25	16	9 <sup>a</sup>	2	52	57
4	Duck Mountain Provincial Park	13	1	13	1	3	8	8
5	Riding Mountain National Park	15	2	52	2 <sup>b</sup>	0	14	6
6	Northwest Angle Provincial Forest	20	- <sub>c</sub>	103	136	213	56	9
7	Whiteshell Provincial Park	30	335	3517	1326	612	774	643
8	Wanipigow	31	97	1585	456	431	659 <sup>a</sup>	509
9	Wallace Lake	31	26	375	- <sub>d</sub>	- <sub>d</sub>	- <sub>d</sub>	- <sub>d</sub>
10	Hecla Provincial Park	40	9	239	65 <sup>d</sup>	15 <sup>d</sup>	84 <sup>d</sup>	37 <sup>d</sup>
11	Lake St. George	41	1	77	9 <sup>b</sup>	6	9	6
12	Rocky Lake	56	5	66	9	2	41	49
13	Simonhouse	60	0	8	1 <sup>b</sup>	1	22	30
14	Pisew Falls	84	-	8	1	0	16	6

<sup>a</sup> Data from 1 of 3 traps.

<sup>b</sup> Data from 2 of 3 traps.

<sup>c</sup> No data collected at this site prior to 1986.

<sup>d</sup> Trapping was discontinued at Wallace Lake after 1986.

### Jack Pine Budworm

The jack pine budworm, *Choristoneura pinus* Free, did not cause any moderate to severe defoliation in the province again this year. The last outbreak spanned a period of six years, from 1982 to 1987 (Table 6). Results of egg mass sampling for selected locations in Manitoba are shown in Table 7.

Table 6. Areas of jack pine in Manitoba defoliated by the jack pine budworm from 1982 to 1990.

Year	Area defoliated (ha)
1982	46,000
1983	153,000
1984	761,000
1985	2,047,500
1986	132,000
1987	100
1988	0
1989	0
1990	0

Table 7. Jack pine budworm egg mass counts in 1990 and defoliation predictions for 1991 for selected Manitoba locations. <sup>a</sup>

Plot location	Forest management unit	Number of egg masses / plot	Defoliation predicted for 1991
Pineland	20	0.3	Light
Nopiming Provincial Park	31	0.7	Light
Devil's Lake	45	1.0	Light
Wicked Point	46	0.5	Light
The Pas	52	0.3	Light

<sup>a</sup> Manitoba Forest Protection data based on egg mass density estimates (egg masses / plot).

### Aspen Defoliators

Aspen defoliators were responsible for defoliating some 30,718 ha of aspen forests in 1990 (Figure 3). This represents a 90 % decrease in area defoliated from last year. The forest tent caterpillar, *Malacosoma disstria* Hbn., was the principal defoliator. Table 8 summarizes the area infested during the last ten year period.

Table 8. Areas of aspen forests in Manitoba defoliated by defoliators, mainly the forest tent caterpillar, during the outbreak years 1981 to 1990.

Year	Area defoliated (ha)
1981	100,000
1982	600,000
1983	600,000
1984	76,900
1985	19,500
1986	17,094
1987	4,403
1988	55,685
1989	325,045
1990	30,718

Defoliation in all forest sections of the province was considerably less in 1990 (Table 9). It was all but absent in the north with some defoliation noted in the Nelson River Forest Section (259 ha). It disappeared from the Saskatchewan River, Highrock and Hayes River forest sections. Defoliation was also noted in the Aspen Parkland (52 ha), Pineland (52 ha) and Lake Winnipeg East (414 ha) forest sections. However, defoliation persisted in the Interlake (13,883 ha) and Mountain (16,058 ha) forest sections but at much reduced levels. Most of the defoliation in the Mountain Forest Section was caused by the the large aspen tortrix, *Choristoneura conflictana* (Wlk.) which persisted in Riding Mountain National Park and Duck Mountain Provincial Park in 1990, defoliating some 15,540 ha. Defoliation by the tortrix was often patchy, ranging from light to moderate - severe. This pest was also present at low levels in a number of locations in Manitoba including Birds Hill Provincial Park, Reed Lake, Simonhouse, Flin Flon, Rocky Lake, Benito, Pelican Rapids, Porcupine Provincial Forest and Clearwater Provincial Park. Detailed infestation data are compiled in Appendix 2.

A forest tent caterpillar egg band survey to predict population levels for 1991 was conducted in cooperation with Forest Protection, Manitoba Natural Resources. Results indicate that moderate to severe defoliation of aspen may occur in only a few areas in the Interlake and Mountain forest sections in 1991 (Table 10).

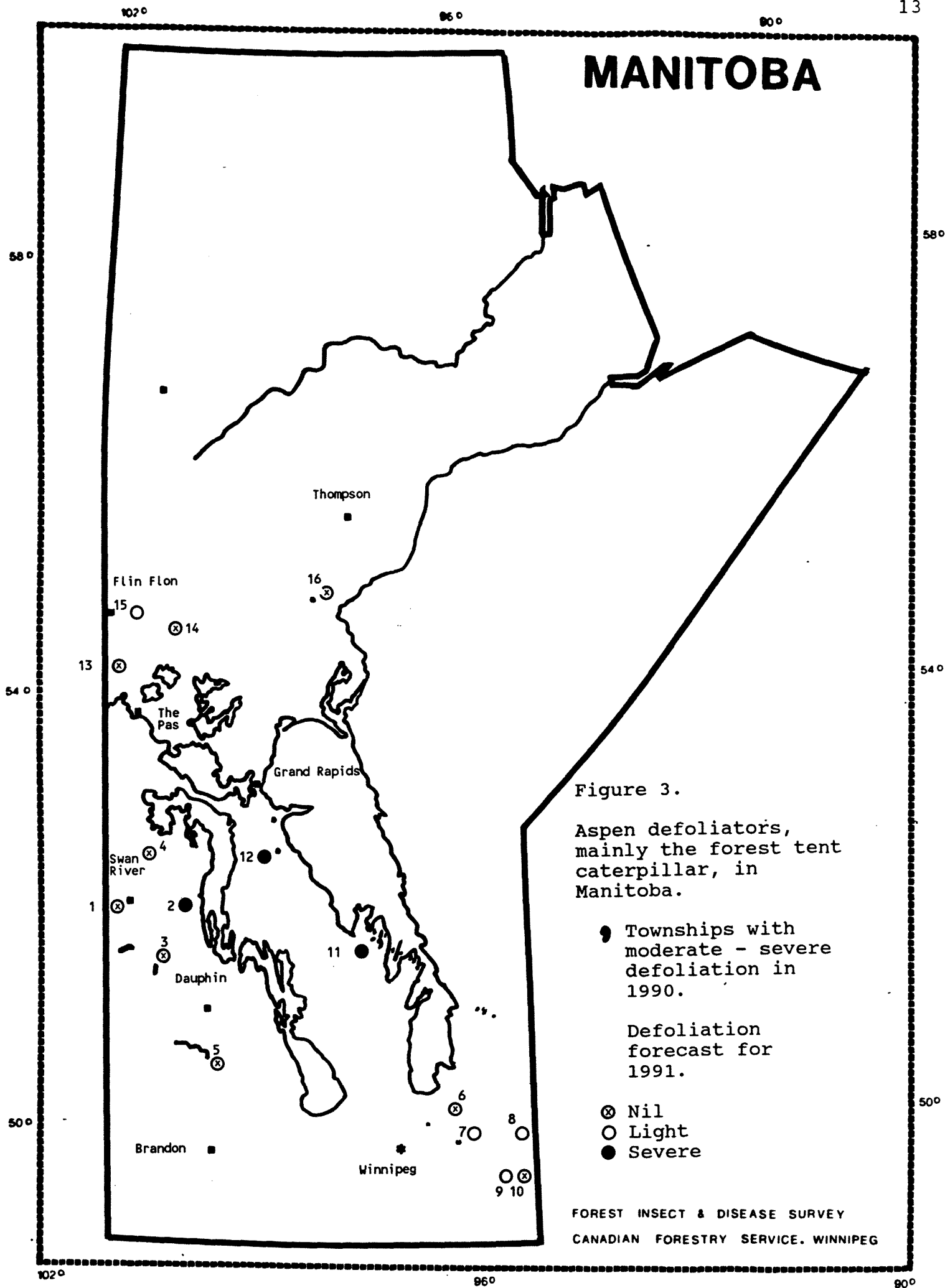


Table 9. Areas of aspen forests defoliated by defoliators, mainly the forest tent caterpillar, in Manitoba in 1990, summarized by Management unit and Forest section.

Forest section	Management unit (MU)	Defoliated area (ha)	
		MU	Section total
Aspen Parkland	01	52	52
Mountain	11	518	16,058
	13	6,216	
	15	9,324	
Pineland	20	52	52
Lake Winnipeg East	31	414	414
Interlake	40	4,973	13,883
	41	7,874	
	46	1,036	
Nelson River	83	259	259
Manitoba (Total)			30,718

Table 10. Forest tent caterpillar egg band survey results in Manitoba in 1990 and defoliation forecasts for 1991.

Location	Forest management unit	Average plot d.b.h. (cm)	Mean no. of egg bands/plot	Defoliation forecast for 1991	Source of information
1 Benito	11	4.3	0	Nil	ForCan
2 Camperville	11	9.7	16.3	Severe	ForCan
3 Duck Mountain Provincial Park	13	7.9	0	Nil	ForCan
4 Bellsite	14	7.3	0	Nil	ForCan
5 Riding Mountain National Park	15	9.0	0	Nil	ForCan
6 Lac Du Bonnet	23	8.6	0	Nil	M.N.R.
7 Pinawa	23	12.0	0.2	Light	M.N.R.
8 Big Whiteshell L.	30	7.5	2	Light	M.N.R.
9 Falcon Lake	30	8.4	0.7	Light	M.N.R.
10 West Hawk Lake	30	8.5	0	Nil	M.N.R.
11 St. Lakes	41	10.1	21.5	Severe	M.N.R.
12 Devil's Lake	45	7.9	15.7	Severe	ForCan
13 Rocky Lake	56	9.0	0	Nil	ForCan
14 Reed Lake	60	13.0	0	Nil	ForCan
15 Flin Flon	62	9.2	0.3	Light	ForCan
16 Jenpeg road	83	8.0	0	Nil	ForCan



### **Plantation Surveys**

Sixteen plantations were surveyed in the Pineland and Lake Winnipeg East forest sections. These plantations were selected from a priority list drafted by Forest Protection (M.N.R.) and account for a fraction of the plantation surveys carried out by their summer crews. Plantation data for the 1990 season are summarized in Table 11. An analysis of the plantation surveys to date will follow in a separate file report.

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### **Pest Assessment on Permanent Sample Plots**

A total of 30 plots were visited and assessed during the 1990 field season, bringing the total number of plots visited to 123 since the initiation of this project. This cooperative study with Manitoba Natural Resources was initiated to monitor insect and disease problems on a long term basis. This information could provide more accurate volume loss estimates as a result of impact by various pests. Plots visited in 1990 were located in Duck Mountain Provincial Park (MU 13), Sandilands (MU 20) and Belair (MU 23) Provincial Forests. Locations visited last year included Sandilands (MU 20) and Interlake Forest Sections (MU 41, 45 and 46). A computer program has been designed to facilitate data collection and generating reports.

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### **Gypsy Moth**

The gypsy moth, *Lymantria dispar* (Linnaeus), was found in Manitoba for the first time. A single male moth was identified from a pheromone-baited trap at the Lakeshore Campground in Falcon Lake, Whiteshell Provincial Park. A total of 206 traps were set out by Agriculture Canada, Plant Protection Division in Manitoba and an additional 28 traps were set out in northwestern Ontario. Moths were also captured across the border into Ontario including a single male moth in Quetico, Caliper and Sioux Narrows provincial parks and two moths in Blue Lake Provincial Park. The gypsy moth is potentially a serious defoliator if it becomes established in our region. It feeds on variety of hardwoods and conifers, but prefers oak, poplar and birch. In Canada, it is well established in Ontario, Quebec and the Maritimes.

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Table 11. Summary of Manitoba plantation data. 1990.

Planta- tion no.	MU	Year	Species	Area (ha)	No. of planted trees sampled	No. of volun- teer trees sampled	No. of plots	No. of trees/ plot	D.B.H. (cm)	Hei- ght (m)
11-84	20	1984	sP	6.4	9 sP	14 jP	2	20.5	2.2	1.7
17-82	20	1982	rP	46.1	109 rP	26 jP	15	9.0	<1.0	1.0
9-81	20	1981	rP	21.8	116 rP	29 jP	10	14.5	2.7	2.1
9-78	20	1978	rP	17.0	93 rP	4 jP	14	6.9	3.7	2.8
1-76	20	1976	sP	7.3	15 sP	3 tA	4	3.8	5.9	4.0
11-72	20	1972	wS	18.2	28 wS	82 tA	6	4.7	3.0	1.5
4-63	20	1963	rP	18.2	49 rP	6 tA	7	7.0	16.6	10.2
3-62	30	1962	wS	57.0	57 wS	147 other	10	5.7	3.7	3.0
9-60	20	1960	jP	32.4	58 jP	0	11	5.3	15.0	12.4
5-52	20	1952	rP	30.0	40 rP	24 jP	8	8.0	16.4	9.9
15-51	20	1951	jP	31.0	4 jP	4 rP	2	2.0	15.3	11.0
1-49	20	1949	rP	5.7	3 rP	15 tA	2	1.5	14.8	10.8
3-47	20	1947	sP	14.6	22 sP	3 jP	4	6.3	16.7	9.4
1-46	20	1946	rP	27.5	50 rP	17 jP	8	9.8	16.0	9.8
						11 sP				
2-46	20	1946	jP	8.9	11 jP	1 sP	2	6.0	8.7	7.5
1-45	20	1945	sP	5.7	29 sP	7 jP	2	18.0	18.3	10.5

## **Pest Conditions in Riding Mountain National Park**

In August, the annual pest survey was conducted. Dutch elm disease, *Ceratocystis ulmi* (Buism.), continued to be the major pest in the park. The disease is believed to be well established in the east-northeast section of the park and a substantial number of diseased trees were reported along the Wilson, Vermillion and Ochre rivers.

The large aspen tortrix, *Choristoneura conflictana* (Wlk.), continued to cause defoliation of trembling aspen (9,324 ha). Defoliation was not continuous, alternating with healthy, unaffected stands. Defoliation was most evident in the southern part of the park. It was also reported as far west as Whitewater Lake.

Defoliation by the spruce budworm was not detected again this year and the result of an egg mass survey indicates that defoliation is not expected in the coming year either. Pheromone-baited traps captured only 6 male spruce budworm moths.

Significant defoliation from the forest tent caterpillar is not expected in 1991 based upon an egg band survey conducted near Lake Audy.

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## **Acid Rain National Early Warning System**

Nineteen ninety marked the fifth year of the establishment of the Acid Rain National Early Warning System (ARNEWS) in Manitoba. Three of the four plots, situated in Whiteshell Provincial Park, Duck Mountain Provincial Park and Jenpeg, were monitored in early summer (the fourth plot burnt last summer). They were remeasured in the fall according to the schedule outlined in the manual. This involved mapping ingrowth trees, remeasuring and assessing plot and off plot trees, taking increment cores and foliage samples. Matt Fairbarns (NoFC) collected soil samples and conducted regeneration and ground vegetation surveys. Cores and foliage samples were sent to NoFC for measurement and analysis.

In addition, a fourth plot was established 16.2 km north of Leaf Rapids as a replacement for the Suwannee River plot which perished. Plot trees were mapped, measured for diameter, and off plot trees were sampled for foliage, increment cores and growth measurements. The remaining measurements will be taken next spring.

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### Special Surveys

A 25 year old spruce-aspen stand in the Duck Mountain Provincial Forest (Twp. 26, Rg. 25 & 26 W) was assessed for the presence and impact of the white pine weevil, *Pissodes strobi* (Peck). The white spruce was released from the aspen in 1987. J. P. De Franceschi (ForCan) requested the survey; Dr. Herb Cerezke conducted the survey with assistance from Linda Christianson (MNR), Joe De Franceschi, Norm Walker (ForCan) and myself. In general, the incidence of attack by the white pine weevil was light. However, most of the attacks had occurred in 1990, indicating that they had occurred post-treatment and probably in response to the treatment of aspen overstory removal. Survey results will be reported at some future date.

One white spruce plantation near Grandview (Twp. 26, Rg. 24W, Sect. 23) and two white spruce plantations in Turtle Mountain Provincial Forest (Twp. 1, Rg. 20W, Sect. 31) were also surveyed following a request by Norm Walker. Herb Cerezke, Norm Walker and I assessed all three decadent stands. The first plantation was planted in 1902 while the latter two were planted in 1912. Evidence of carpenter ants, *Camponotus* sp, was found in the base of a number of the Grandview plantation trees; these ants are believed to be secondary agents. Collections of the spruce beetle, *Dendroctonus rufipennis* (Kirby) and the Allegheny spruce beetle, *Dendroctonus punctatus* LeConte, were made in the Turtle Mountain plantations. In addition, two other bark beetle species were identified from these plantations: *Dryocoetes autographus* (Ratzeburg) and *Polygraphus rufipennis* (Kirby). Both of these latter species appear to have been reported in southwestern Manitoba before, but there is no indication in Bright (1976), "The Bark Beetles of Canada and Alaska", that the two *Dendroctonus* species had been reported there previously.

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### Other Important and Noteworthy Pests

A number of minor pests (Table 12) were encountered during the course of the field season. Although most of these did not cause extensive damage, they could potentially cause moderate to severe damage in localized areas.

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### Other Pest Surveys In Manitoba

Additional surveys or research activities relating to forest insect and disease conditions in Manitoba during 1990, carried out by agencies other than FIDS, are listed in Table 13.

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Table 12. Other important and noteworthy pest conditions in Manitoba, 1990.

Pest or condition	Host	Location	Remarks
Aphids	American elm	Winnipeg	Very common; public nuisance
Armilaria root rot <i>Armilaria</i> sp.	Jack pine	Plantation 9-60, 2-46 (Sandilands Provincial Forest	Occasional mortality
	Scots pine	Plantation 1-76, 11-84 (Sandilands Provincial Forest]	
Bronze birch borer <i>Agrilus anxius</i> Gory	Weeping birch	Riding Mountain National Park	A few trees around the administrative building were infected & removed
Browse	White spruce	Plantation 11-72 (Agassiz Provincial Forest)	Some leader mortality
	White spruce and balsam fir	Plantation 3-62 (Whiteshell Provincial Park)	Common with varying degrees of damage
	Red pine	PSP 110, Stand 151 (Belair Provincial Forest)	Common but light damage

Table 12. (continued)

Browse	Scots pine	Plantation 1-45 1-46 (Sandilands Provincial Forest) Plantation 1-76 (Sandilands Pro- vincial Forest)	Some leaders clipped  Light damage
	Jack pine	Plantation 9-78 and 5-52 (Sandi- lands Provincial Forest) Plantation 9-81 (Wampum)	Light damage  Common
Early aspen leaf curler <b>Pseudexentera oregonana</b> Wlshm.	Trembling aspen	Birds Hill P.P., Lundar, Ashern, Pine Falls	Light to moderate damage
Fall cankerworm <b>Alsophila pomataria</b> (Harris)	Variety of hardwoods	Winnipeg	Local light to moderate defoliation
False tinder conk <b>Phellinus tremulae</b> (Bond.) Bond & Boriss.	Trembling aspen	PSP 41, stand 176 (Duck Mountain P.P.) Plantation 3-62 (Whiteshell P.P.)	Light infection on mature trees
Frost damage	White spruce	Plantation 11-72 (Agassiz Provincial Forest)	Light damage to current shoots including terminals
Elm bark beetles <b>Scolytus multistriatus</b> (Marsham)	American elm	Winnipeg	A few European elm bark beetles found

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Table 12. (continued)

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Elm bark beetles <b>Hylurgopinus rufipes</b> (Eichhoff)	American elm	Winnipeg	Populations of the native elm bark beetle declined
Jack pine sawfly <b>Neodiprion pratti banksianae</b> Rohwer	Jack pine	Lester Beach	Caused light to moderate defoliation in localized area
Northern tent caterpillar <b>Malacosoma californicum</b> <b>pluviale</b> (Dyar)	Chokecherry	Nopiming Provincial Park	Localized moderate to severe damage
Oak mortality	Bur oak	Winnipeg and rural Manitoba	Possibly caused by drought
Pine needle scale <b>Chionaspis pinifoliae</b> (Fitch)	White spruce	Winnipeg, Spruce Woods P.F.	Light damage
Root collar weevil <b>Hylobius</b> sp.	Scots pine	Plantation 11-84 (Sandilands Pro- vincial Forest)	Light incidence
Sapsucker, yellow bellied	Scots pine	Plantation 1-45	Low incidence
Spring cankerworm <b>Paleacrita vernata</b> (Peck)	Variety of hardwoods	Winnipeg	Local light to moderate defoliation

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Table 12. (continued)

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Spruce gall aphid <b>Adelges lariciatus</b> (Patch)	White spruce	South of Duck Mountain Provincial Park, Whiteshell Provincial Park, Sandilands Provincial Forest Red Deer River	Common  Light incidence
Spruce needle rust <b>Chrysomyxa</b> sp.	Mostly on blue spruce; some on black and white spruce	Whiteshell Provincial Park	Light incidence
Slime flux	American elm	Winnipeg	Some sap leakage
Stem canker	Red and jack pine	Sandilands Provincial Forest	Associated with some mortality
Lodgepole terminal weevil <b>Pissodes terminalis</b> Hopping	Jack pine	Duck Mountain Provincial Park and Porcupine Provincial Forest	Common in areas regenerated after fire
Termites <b>Reticulitermes</b> sp.	Old foundations and new wood structures	City of Winnipeg (one city block in St. Boniface)	Light to moderate damage to nine houses

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Table 12. (continued)

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Tip dieback	Red pine	Sandilands Provincial Forest	Caused stunted and deformed trees.
Western gall rust <i>Endocronartium harknessii</i> (J.P. Moore) Y. Hiratsuka	Jack pine	Plantation 2-46, (Sandilands P.F.) Plantation 9-60 & 5-52. (Sandilands Provincial Forest) PSP 58, Stand 110, Duck Mountain P.P. PSP 18, Stand 234, PSP 15, Stand 236 (Belair Provincial Forest)	Branch galls common  Some main stem and branch infections  Branch galls common  Branch & main stem galls common
	Scots pine	Plantation 11-84 & 1-76 (Sandilands Provincial Forest)	Branch galls common with some main stem infections
White pine weevil <i>Pissodes strobi</i> (Peck)	White spruce	South of Duck Mountain Provin- cial Park West of Duck Mountain Provin- cial Park	Low incidence on 1990 formed leaders  High incidence with many cabbage trees
Winter kill	Jack pine (2-0 stock) Scots pine (1-0 stock) Ornamentals	Pineland Nursery	Winter injury and some mortality

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Table 13. Other pest surveys and research activities in Manitoba during 1990.

Pest	Study	Location	Study leader	Agency
Armillaria root rot Armillaria sp.	Monitoring and impact	FMU 20 23	Beaubien	M.N.R.
	Traplog study/Inoculation	FMU 20	Knowles	M.N.R.
Dutch elm disease Ceratokystis ulmi (Buism.) C. Moreau	Elm bark beetle contamination monitoring	Southern Manitoba	Pines	M.N.R.
	European elm bark beetle monitoring and pheromone	Southern Manitoba	Pines	M.N.R.
	European elm bark beetle monitoring and pheromone	Winnipeg	Gadawsky	City of Winnipeg
	Native elm bark beetle attractants	Winnipeg	—	S.U. of New York
	Native elm bark beetle control	Winnipeg	—	Private industry
	Native elm bark beetle monitoring and control	Winnipeg	Gadawsky	City of Winnipeg
	Surveillance and control of diseased elm trees	Manitoba	Knowles Matwee Platford Jansen, Pines	M.N.R. M.N.R. M.D.A. City of Winnipeg

Table 13. (continued).

Pest	Study	Location	Study leader	Agency
Dutch elm disease (continued)	Therapeutic elm tree injection trials	Winnipeg	Allen, Pines Swayze	City of Winnipeg
	Therapeutic elm tree pruning trials	Winnipeg	Allen, Pines Gadawsky	City of Winnipeg
Dwarf mistletoe <i>Arceuthobium</i> <i>americanum</i> Mutt. ex Engelm.	Research and impact	FMU 4 23 46 47 51 53 56	French Baker Knowles	U. of Minnesota Utah State University M.N.R.
	Sanitation	Manitoba	Regional Forestry Staff	M.N.R.
Fall cankerworm / <i>Alsophila pometaria</i> (Harr.) Spring cankerworm <i>Paleacrita vernata</i> (Peck)	Monitoring and control	Winnipeg	Gadawsky	City of Winnipeg
Gypsy moth <i>Lymantria dispar</i> (Linnaeus)	Pheromone trapping	Winnipeg Southeast Manitoba	Gadawsky Hicks	City of Winnipeg Agriculture Canada

Table 13. (continued).

Pest	Study	Location	Study leader	Agency
Pine stem cankers	Impact study and identification	FMU 20	Knowles Desrochers Skuba Reid	M.N.R. M.N.R. M.N.R. U. of M
Plantations	Pest detection surveys	FMU 13 14 20	Beaubien Christianson	M.N.R. M.N.R.
	White pine weevil	FMU 41	Beaubien Christianson	M.N.R. M.N.R.
Red pine tip dieback	Impact study and identification	FMU 20	Knowles Desrochers Skuba	M.N.R. M.N.R. M.N.R.
Spruce budworm <i>Choristoneura</i> <i>fumiferana</i> (Clem.)	Egg mass sampling	FMU 30 31 40	Knowles Khan Kelm	M.N.R. M.N.R. M.N.R.
	Larval counts	FMU 30 31 40	Knowles Khan Kelm	M.N.R. M.N.R. M.N.R.
	Auger shoot development assessment	FMU 30 31 40	Knowles Kelm	M.N.R. M.N.R.
Termites <i>Reticulitermes</i> sp.	Survey and control	Winnipeg (St. Boni- face)	Gadawsky	City of Winnipeg

Table 13. (continued)

Pest	Study	Location	Study leader	Agency
Western gall rust <i>Endocronartium</i> <i>harknessii</i> (J.P. Moore)	Resistance study in superior jack pine	FMU 01	Hiratsuka Klein Pines	ForCan ForCan M.N.R.
	Thinning study	FMU 13	Knowles Desrochers	M.N.R. M.N.R.

FMU - Forest management unit  
 ForCan - Forestry Canada  
 M.N.R. - Manitoba Natural Resources  
 M.D.A. - Manitoba Department of Agriculture  
 S.U. of N.Y. - State University of New York  
 U. of M. - University of Manitoba  
 U. of Minnesota - University of Minnesota

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## Appendices

### Appendix 1. Spruce budworm outbreak data for Manitoba, 1990.

FOREST SECTION	MU	TWP	RG	NS	MU	TWP	RG	NS
Pineland Forest Section	23	14	13E	.5	23	14	14E	.3
Lake Winnipeg East Forest Section	30	8	16E	1	30	9	17E	.7
	30	10	14E	.3	30	10	15E	.3
	30	10	16E	.3	30	11	14E	.8
	30	12	14E	.3	30	13	13E	.3
	30	14	13E	1.5	30	14	14E	.5
	31	15	13E	2	31	15	14E	.8
	31	16	13E	.3	31	16	14E	.3
	31	17	15E	1.5	31	17	16E	4
	31	17	17E	.3	31	18	15E	.3
	31	18	16E	3	31	20	15E	.2
	31	21	14E	.3	31	21	15E	.2
	31	22	14E	2	31	22	15E	.3
	31	22	17E	.1	31	23	14E	2
	31	23	15E	2.5	31	24	14E	.2
	31	25	9E	2.8	31	25	10E	4
	31	25	11E	.5	31	25	12E	.2
	31	26	9E	4				
Interlake Forest Section	40	25	6E	4.5	40	25	7E	4
	40	25	8E	1.5	40	26	6E	7
	40	26	7E	.5	40	26	8E	7
	40	27	5E	.1	40	27	6E	5.5
	40	28	2E	.5	40	28	5E	1
	40	28	6E	1	40	29	4E	.5
	40	29	5E	1	40	30	3E	.2
	40	30	4E	.3	40	31	3E	1

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FMU = Forest management unit

TWP = Township

RG = Range

NS = Number of sections with moderate to severe defoliation

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Appendix 2. Outbreak data of aspen defoliators in Manitoba, 1990.

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FOREST SECTION	MU	TWP	RG	NS	MU	TWP	RG	NS
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Aspen Parkland Forest Section	01	13	6E	.2				
Mountain Forest Section	11	26	24W	3	11	27	24W	4
	11	29	28W	4	11	30	26W	6
	11	30	27W	6	11	30	28W	1
	11	34	19W	2				
	15	19	17W	2	15	19	18W	8
	15	20	18W	3	15	20	19W	9
	15	20	20W	3	15	21	19W	1
	15	21	20W	5	15	21	21W	5
Pineland Forest Section	20	11	9E	.2				
Lake Winnipeg East Forest Section	31	24	13E	.2	31	25	11E	1.2
	31	25	12E	.2				
Interlake Forest Section	40	29	4E	1	40	30	2E	1
	40	30	3E	1	40	30	4E	8
	40	31	2E	3	40	31	3E	5
	40	31	4E	.2				
	41	31	1E	1	41	32	1E	13
	41	32	1W	.2	41	32	2E	.2
	41	33	1E	13	41	33	1W	1
	41	33	2E	2				
	46	41	10W	2	46	44	11W	2
Nelson River Forest Section	83	67	7W	1				

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