1997 Forest Pest Management Forum

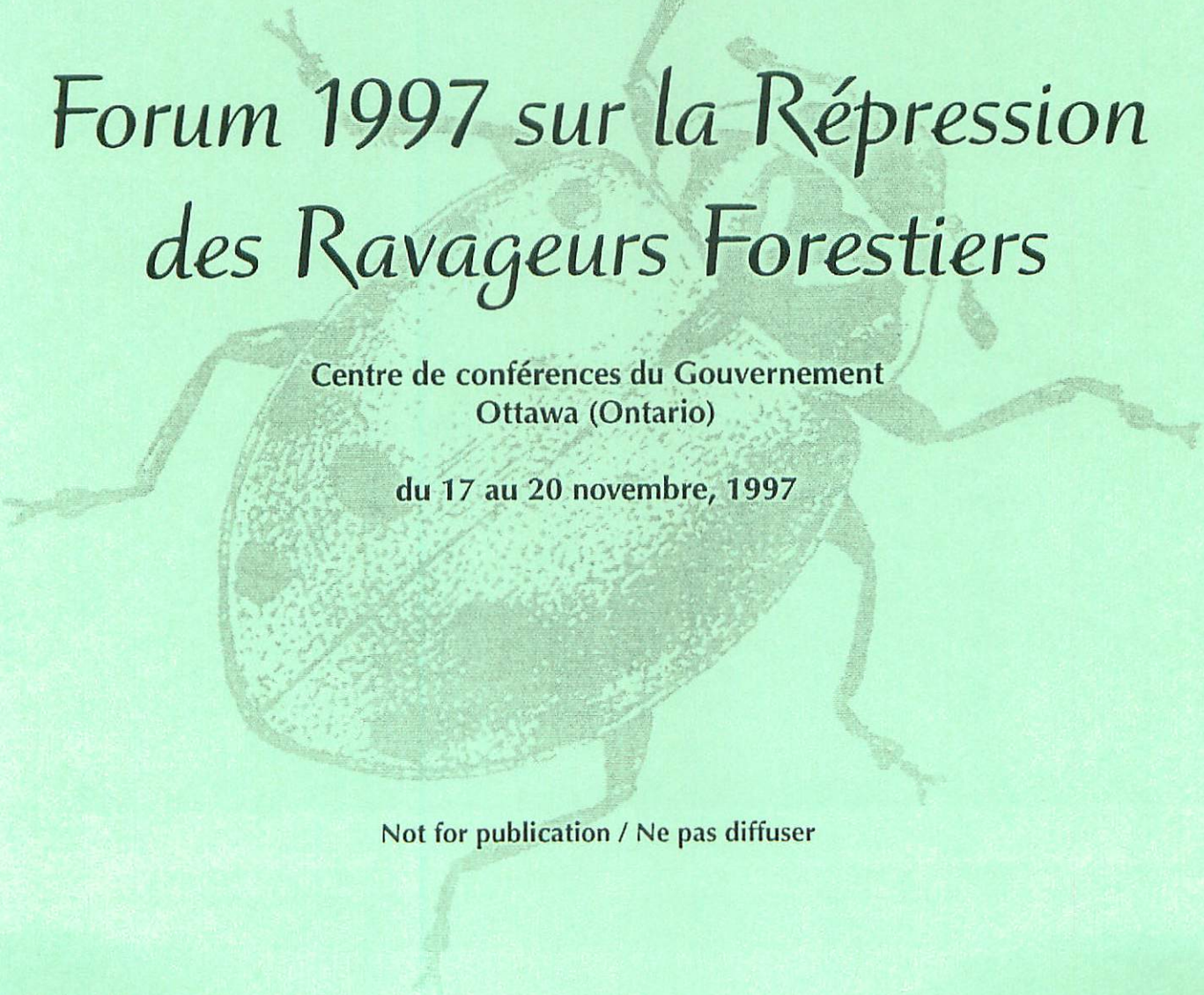
Government Conference Centre
Ottawa, Ontario

November 17–20, 1997

Forum 1997 sur la Répression des Ravageurs Forestiers

Centre de conférences du Gouvernement
Ottawa (Ontario)

du 17 au 20 novembre, 1997



Not for publication / Ne pas diffuser

Natural Resources Canada
Canadian Forest Service
Ressources naturelles Canada
Service canadien des forêts

Canada

1997 Forest Pest Management Forum

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The Forest Pest Control Forum is held under the aegis of Natural Resources Canada, Canadian Forest Service, to provide the opportunity for representatives of provincial and federal governments and private agencies to review and discuss forest pest control operations in Canada and related research.

Le colloque sur la répression des ravageurs forestiers se déroule sous l'égide de Ressources naturelles Canada, Service canadien des forêts, dans le but de donner l'opportunité aux représentants des gouvernements fédéral et provinciaux ainsi qu'aux organismes privés de passer en revue et de discuter les activités relatives à la répression des ravageurs forestiers, de même que la recherche connexe.

Rodney Smith
Natural Resources Canada/Ressources naturelles Canada
Canadian Forest Service/Service canadien des forets
Sault Ste. Marie, Ontario/Sault Ste-Marie (Ontario)
April 1998/avril 1998

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LIST OF ATTENDEES
LISTE DES PERSONNES PRÉSENTES

Abbott Laboratories Ltd

Stephen Nicholson

Alberta Land and Forest Service

Hideji Ono
Derek MacFarlane

Atmospheric Environment Service

Bob Mickle

Bioforest Technologies

Craig Howard
Joseph Meating

BIO-SAG FNC

Marie-France Lamarche

British Columbia Ministry of Forests

Russ Cozens

Canadian Food Inspection Agency

J. L. M. Dawson
Erhard Dobesberger
Robert J. Favrin
Doreen Watler

Canadian Forest Service

Eric Allen
Jean Berube
Anne-Christine Bonfils
Errol Caldwell
David Gray

Richard Hamelin
Blair Helson
Harry Hirvonen
Steve Holmes
Anthony Hopkin
Gordon Howse
Lee Humble
David Kennington
Ed Kettela
Gaston Laflamme
Len Lanteigne
Robert Lavallée
Bill Leduc
Chris Lucarotti
Barry Lyons
Ken Mallett
Ben Moody
Dan Ostaff
Jacques Régnière
Simon Shimoun
Rodney Smith
Tom Sterner
Graham Thurston
Kees van Frankenhuyzen
Rick West
David Winston

Canadian Institute of Forestry

Roxanne Comeau

Corner Brook Pulp and Paper

George van Dusen

Forest Protection Ltd.

Peter Amirault
David Davies

Forintek Canada Corp.

Dian-Qing Yang

Health Canada, Pest Management Regulatory Agency

Terry Caunter
Karen McCullagh
Wendy Sexsmith

J. D. Irving Ltd.

Blake Brunsdon

Manitoba Ministry of Natural Resources

Richard Westwood

Ministère des Ressources Naturelles de Québec

Michel Auger
Clément Bordeleau
Jean Cabana
Roger Touchette

Monsanto

Guy Paquette

New Brunswick Department of Natural Resources

Nelson Carter
G. Koniski

Nova Scotia Department of Natural Resources

Eric Georgeson

Ontario Ministry of Natural Resources

Harri Liljalehto
Taylor Scarr

Rohm and Haas Canada Inc

Al McFadden

Spray Efficacy Research Group

H.J. (Bud) Irving

Société de Protection des Forêts contre les Insectes et Maladies (SOPFIM)

Jacques Dugal
Alain Dupont
Denise Moranville
Patrick Therrien

United States Forest Service
Melvyn Weiss

Université Laval

Pierre Gagné

Final Program

1997

FOREST PEST

MANAGEMENT

FORUM

SUSSEX ROOM

GOVERNMENT CONFERENCE CENTRE

OTTAWA, ONTARIO

NOVEMBER 17-20, 1997

Natural Resources Canada | Ressources naturelles Canada
Canadian Forest Service | Service canadien des forêts

All meetings in Sussex Room except
Forest Pathology Working Group meeting in Room 513
Posters and coffee in Sussex Lounge and on view Tuesday and Wednesday, November 18-19

MONDAY, NOVEMBER 17

0830-1700	**Meeting of the Forest Protection Technology Committee** ***Chair - Gordon Howse*** ***Sussex Room***	
1530-1700	**Meeting of the Forest Pathology Working Group** ***Chair - Richard Hamelin*** ***Rm 513***	
1900-2100	**Meeting of the Spray Efficacy Research Group (SERG)** ***Chair - Bud Irving*** ***Sussex Room***	

TUESDAY, NOVEMBER 18

FOREST PEST STATUS AND OPERATIONAL/EXPERIMENTAL TRIALS

Chair - Tom Sterner ***Sussex Room***

0830-0900	**Forum Welcoming Remarks**	
0900-0930	Newfoundland	-------
0930-1000	Nova Scotia	Eric Georgeson
1000-1030	***Coffee/Posters***	
1030-1100	New Brunswick	Nelson Carter
1100-1130	Quebec	Clément Bordeleau
1130-1200	Quebec, SOPFIM	Denise Moranville
1200-1300	***Lunch***	
1300-1345	Plant Quarantine Issues	Canadian Food Inspection Agency
1345-1415	Ontario	Taylor Scarr/Gordon Howse
1415-1445	Manitoba	Richard Westwood
1445-1500	***Coffee/Posters***	
1500-1530	Alberta	Hideji Ono
1530-1600	British Columbia	Russ Cozens
1600-1630	U.S. Forest Service	Melvyn Weiss
1630-1700	What is an Acceptable Insecticide?	Taylor Scarr
1700-1730	**Tabling of issues** raised at the Forest Pest Management Forum (Resolution of issues 1600, Wed. Nov. 19)	Richard Westwood
1700-1900	**Meeting of the Forest Pest Management Forum Steering Committee (closed)**	

WEDNESDAY, NOVEMBER 19

GENERAL SCIENCE PRESENTATIONS

Chair - Taylor Scarr, Sussex Room

0830-0900	Proposal for the Establishment of a Resource Bank of Baculoviruses - the "Baculobank"	Chris Lucarotti
0900-0920	Validation and Use of Cooke's Bt Efficacy Model as a Decision Support Tool for Management of SBW Populations	Jacques Régnière
0920-0940	Abbott Deposit Assessment Method for Detection and Quantification of Bt Toxin Proteins on Foliage	Kees van Frankenhuyzen
0940-1000	Spatial Analysis of the SBW Data of Quebec	David Gray
1000-1030	***Coffee/Posters***	
1030-1050	Use of Snow Mould to Control Calamagrostis Canadensis	Ken Mallett
1050-1110	Development of a Microbial Control Strategy for Management of Dwarf Mistletoe	Simon Shimoun
1110-1130	Diversity of Sapstaining Fungi in Canadian Sawmills	Dian-Qing Yang
1130-1200	Forest Health Technology Organization in the US Forest Service	Mel Weiss

MEETING OF FOREST PEST MANAGEMENT CAUCUS
(open to all Forum participants)

Chair - Richard Westwood, Sussex Room

1300-1630

Update of Mimic and Release registration status
Update of wood preservative registration status
Petition for minor registration of Goal for forest nurseries
IPM budworm initiative - planned meeting for pesticide registration
NAFTA meeting report
Good laboratory practices - implementation for pesticide registration
Appointment of minor use coordinator
Appointment of representative to Federal/Provincial Committee

WEDNESDAY, NOVEMBER 19
(Cont'd)

RESOLUTION OF ISSUES

1630-1700	Resolution of Issues Raised at the Forest Pest Management Forum	Richard Westwood

THURSDAY, NOVEMBER 20

Chair - Errol Caldwell, Sussex Room

0900-1600 **Meeting of the CFS Forest Pest Management Methods Network**
(Closed, CFS staff only)

Programme

FORUM 1997

SUR LA

RÉPRESSION DES

RAVAGEURS FORESTIERS

SALLE SUSSEX

CENTRE DE CONFÉRENCES DU GOUVERNEMENT

OTTAWA (ONTARIO)

DU 17 AU 20 NOVEMBRE 1997

Ressources naturelles Canada | Natural Resources Canada

Service canadien des forêts | Canadian Forest Service

Toutes les réunions se tiendront dans las salle Sussex, sauf celle du Groupe de travail sur la pathologie forestière, qui se déroulera dans la salle 513. Les affiches et le café se trouveront dans le salon Sussex les mardi et mercredi 18 et 19 novembre.

LE LUNDI 17 NOVEMBRE

8 h 30 - 17 h **Réunion du Comité sur la technologie de protection des forêts**
Président - Gordon Howse, salle Sussex

15 h 30 - 17 h **Réunion du Groupe de travail sur la pathologie forestière**
Président - Richard Hamelin, salle 513

19 h - 21 h **Réunion du Groupe de recherche sur l'efficacité des pulvérisations (SERG)**
Président - Bud Irving, salle Sussex

LE MARDI 18 NOVEMBRE

ÉTAT DES RAVAGEURS FORESTIERS ET SOMMAIRES OPÉRATIONNELS ET EXPÉRIMENTAUX

Président - Tom Sterner, salle Sussex

8 h 30 - 9 h	**Allocution d'ouverture du Forum**	
9 h - 9 h 30	Terre-Neuve	-----
9 h 30 - 10 h	Nouvelle-Écosse	Eric Georgeson
10 h - 10 h 30	***Pause café et affiches***	
10 h 30 - 11 h	Nouveau-Brunswick	Nelson Carter
11 h - 11 h 30	Québec	Clément Bordeleau
11 h 30 - 12 h	Québec, SOPFIM	Denise Moranville
12 h - 13 h	***Déjeuner***	
13 h - 13 h 45	Quarantine phytosanitaire	Agence canadienne d'inspection des aliments
13 h 45 - 14 h 15	Ontario	Taylor Scarr/Gordon Howse
14 h 15 - 14 h 45	Manitoba	Richard Westwood
14 h 45 - 15 h	***Pause café et affiches***	
15 h - 15 h 30	Alberta	Hideji Ono
15 h 30 - 16 h	Colombie-Britannique	Russ Cozens
16 h - 16 h 30	U.S. Forest Service	Melvyn Weiss
16 h 30 - 17 h	Qu'est-ce qu'un insecticide acceptable?	Taylor Scarr
17 h - 17 h 30	**Présentation des enjeux** ressortis du Forum sur la répression des ravageurs forestiers (Résolution des problèmes à 16 h, le mercr. 19 nov.)	

17 h -19 h	**Réunion du Comité d'organisation du Forum sur la répression des ravageurs forestiers (à huis clos)**	

LE MERCREDI 19 NOVEMBRE

EXPOSÉS SCIENTIFIQUES GÉNÉRAUX

Président - Taylor Scarr, salle Sussex

8 h 30 - 9 h	Proposition relative à l'établissement d'une réserve de baculovirus - la «baculobanque»	Chris Lucarotti
9 h - 9 h 20	Validation et utilisation du modèle de Cooke relatif à l'efficacité de B.t. comme outil d'aide à la décision pour la répression des populations de TBE	Jacques Régnière
9 h 20 - 9 h 40	Méthode d'Abbott d'évaluation des dépôts comme moyen de détection et de quantification des protéines de la toxine B.t. sur les feuilles	Kees van Frankenhuyzen
9 h 40 - 10 h	Analyse spatiale des données du Québec concernant la tordeuse des bourgeons de l'épinette noire	David Gray
10 h - 10 h 30	**Pause café et affiches**	
10 h 30 - 10 h 50	Utilisation de la moisissure des neiges dans la lutte contre le calamagrostide du Canada	Ken Mallett
10 h 50 - 11 h 10	Élaboration d'une stratégie de lutte microbienne pour la gestion du faux-gui	Simon Shimoun
11 h 10 - 11 h 30	Diversité de la tache de sève trouvée dans les scieries du Canada	Dian-Qing Yang
11 h 30 - 12 h	Organisation relative à la technologie sanitaire forestière au sein du US Forest Service	Mel Weiss

RÉUNION DU CAUCUS SUR LA RÉPRESSION DES RAVAGEURS FORESTIERS

(ouverte à tous les participants)

Président - Richard Westwood, salle Sussex

13 h -16 h 30	Mise à jour concernant la situation de l'homologation de *Mimic* et de *Release* Mise à jour concernant la situation de l'homologation des produits de préservation du bois

Pétition visant l'homologation de l'emploi limité de *Goal* dans les pépinières forestières
Projet de lutte intégrée lié à la tordeuse des bourgeons - réunion prévue concernant l'homologation des pesticides
Compte rendu de la réunion sur l'ALENA
Bonnes pratiques en laboratoire - mise en oeuvre en matière d'homologation des pesticides
Nomination d'un coordonnateur du programme des pesticides à emploi limité
Nomination d'un représentant au Comité fédéral-provincial

LE MERCREDI 19 NOVEMBRE
(suite)

RÉSOLUTION DES PROBLÈMES

16 h 30 - 17 h	Résolution des problèmes ressortis du Forum sur la répression des ravageurs forestiers	Richard Westwood

LE JEUDI 20 NOVEMBRE

Président - Errol Caldwell, salle Sussex

9 h - 16 h	**Réunion des membres du Réseau du SCF sur les méthodes de lutte contre les ravageurs forestiers** (à huis clos; réservée au personnel du SCF)

FOREST PEST STATUS AND OPERATIONAL/EXPERIMENTAL TRIALS

SITUATION DES RAVAGEURS FORESTIERS ET TESTS OPÉRATIONNELS/EXPÉRIMENTAUX

Status of Some Forest Pests in Nova Scotia

E. Georgeson
Nova Scotia Department of Natural Resources
Integrated Pest Management Section
Shubenacadie, Nova Scotia

Severe drought in 1997 caused heavy forest defoliation in Nova Scotia, and insect populations increased, except for forest tent caterpillar, satin moth and spring canker worm. No defoliation by spruce budworm was found, but pheromone traps caught moths for the first time in 3 years.

Larval populations of the eastern blackheaded budworm appear to be increasing, and defoliation by this insect was easily detected from ground observations.

The spruce beetle population continues to expand in distribution and density across the province. A major aerial survey is expected to be completed in the fall of 1998. Approximately 8,000 - 10,000 ha of mainly mature white spruce have been severely affected.

Defoliation by the balsam fir sawfly totalled 27,000 ha. Approximately 300 ha of balsam fir were treated with *B.t.k.* against the hemlock looper. Larval survival in the treated areas was reduced by 67% over all. The looper population seems to be collapsing on Cape Breton Island, but there is considerable activity on the mainland, and a further *B.t.k.* treatment program may be carried out in 1998.

Defoliation by whitemarked tussock moth increased from 0 in 1996 to 202,751 ha in 1997, with heavy damage to balsam fir over about 18,000 ha. A provincewide egg-mass count was to be completed by the end of November 1997. Joint studies are under way with the Canadian Forest Service to develop better prediction monitoring tools for this insect.

Abiotic problems associated with dry weather became more common in 1997. These ranged from massive hail and wind damage to drought damage.

STATUS OF SOME FOREST PESTS IN NOVA SCOTIA PREPARED FOR THE 1997 FOREST PEST MANAGEMENT FORUM NOVEMBER, 1997 OTTAWA

Eric Georgeson, Provincial Entomologist
Nova Scotia Department of Natural Resources
Integrated Pest Management Section
PO Box 130 Shubenacadie, N.S. B0N 2H0

PLEASE NOTE:

This is only a preliminary report since data is still being analysed and assembled at the time of writing. For a more finished report please contact me at the following address sometime early in 1998 for the annual report.

Eric Georgeson, Provincial Entomologist
Nova Scotia Department of Natural Resources
Integrated Pest Management Section
P.O. Box 130 Shubenacadie, N.S. B0N 2H0
Phone: (902) 758-2232
Fax: (902) 758-3210

FOREST PEST MANAGEMENT FORUM 1996

LIST OF FIGURES

Fig. 1: Location of Spruce Budworm Pheromone and L-2 Sample Points in NS - 1997

Fig. 2: Blackheaded Budworm Larvae Collection Location in Victoria Co., NS in 1997

Fig. 3: Location of Spruce Stands with High Mortality Caused by Spruce Beetles

Fig. 4: Hail damage in Cape Breton

Fig. 5: Balsam Fir Sawfly Infestation

Fig. 6: Hemlock Looper Protection Programs 1997

Fig. 7: Hemlock Looper Defoliation in NS in 1997

Fig. 8: White Marked Tussock Moth Defoliation in NS in 1997

Fig. 9: Whitemarked Tussock Moth Egg Mass Survey to Date

Fig. 10: 10 Top Reasons to Become an Entomologist

Introduction:

Integrated Pest Management (IPM) is a section within the Forest Protection Subdivision of the Nova Scotia Department of Natural Resources. The main responsibilities of this section are to:

a) identify, monitor, and assess insect populations and forest disease conditions in Nova Scotia (primarily forest pests).

b) organizes and conduct the vegetation management spray operation on Crown Land and control of noxious weeds in Provincial Parks.

c) we also recommend management strategies and carry out forest insect and disease education project and displays.

There are also various research projects and surveys that we are involved in with the Federal Government and private industry.

Integrated Pest Management plans, organizes and conducts the vegetation management spray operation on Crown Land and control of noxious weed in Provincial Parks.

Integrated Pest Management has offices and labs in Shubenacadie. The lab is otherwise know as the insectary or the Bughouse. Five permanent staff members and varying numbers of casual staff carry out the duties of the section.

General Overview:

The winter of 1996-1997 was a repeat of the last two winters, being mild with little snow. The spring started out cool and wet but by the end of May the weather turned hot and dry. The drought of 1997, was the worst in several decades for this province. Forest defoliation in general did very well and populations increased. Exceptions would be forest tent, satin moth, and spring canker worm which were very hard to find and only a few reports coming into the Insectary. Abiotic forest and tree problems associated with drought weather conditions became more common, everything from single trees to several thousand hectares of forest were effected by abiotic factors that ranged from massive hail damage and wind damage to drought damage.

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

IPM conducted an aerial survey to determine the extent of defoliation caused by the spruce budworm. No defoliation was found in 1997. A province wide pheromone trap system was set up with 130 traps. Moths were found in traps. This is the first time in three (3) years that spruce budworm has been found.

The annual L-2 survey has been delayed due to the need to do the whitemarked tussock moth egg mass survey. It now is underway with 65 sample points being collected province wide. There is concern that with the drought there will be a large flower cup on spruce and fir trees next year. If this happens it could 'kickstart' the budworm population in this province once again. The placement of pheromone traps and L-2 points is shown in Figure 1.

Eastern Blackheaded Budworm, *Acleris variana (Fern):*

Larval populations of this insect appear to be increasing again this year, particularly in the Marianna Road/Norman Fire Tower area of the Cape Breton Highlands. Defoliation caused by this insect was easily detected from ground observations, with the larva still present in its feeding chamber. This insect was also observed in low numbers in the Creignish Mountain area of Inverness County, Cape Breton (Figure 2).

Spruce Beetle, *Dendroctonus rufipennis:*

The beetle population continues to expand in distribution and density across the Province. The most active areas of expansion appears to be in the North Mountain and Digby Neck area of western Nova Scotia and lowland Cape Breton where white spruce occurs. We were unable to complete the major aerial survey for 1997, but will try to complete this survey in the fall of 1998. It is estimated that 8,000 to 10,000 hectares of mainly mature white spruce are affected suffering mortality (Figure 3).

***Hail Damage*:**

An area of 2,300 hectares of hardwood defoliation/discolouration was mapped in early September 1997. This defoliation resulted from a severe hail storm which damaged tolerant and intolerant hardwoods and left characteristic elliptical shaped wounds on the twigs and small branches. A southeasterly track can be inferred by examining the aspect of the damage in relationship to the elevation contours (Figure 4).

***Balsam Fir Sawfly,* *Neodiprion abietis*:**

A large area of balsam fir sawfly (BFS) defoliation in balsam fir occurred in coastal eastern Halifax County and western Guysborough County. Gross area of defoliation was mapped at 26,739 hectares of low, 189 hectares of moderate and 272 hectares of severe defoliation for a total of 27,200 hectares. Severe defoliation and some mortality occurred in recently thinned balsam fir stands (Figure 5).

A previous outbreak of BFS occurred further east at New Harbour in 1995, and totalled 234 hectares of moderate to severe defoliation. This outbreak collapsed in 1996.

This problem is increasing and is starting to have an impact on stand management in these areas.

***Hemlock Looper**, Lambdina f. Fiscellaria (Guen.):*

There was a small hemlock looper control program in Cape Breton in 1997. Approximately 300 hectares of balsam fir were aerially treated with Bacillus Thuringensis Kurstaki (Btk). The area was divided up into 5 treatment blocks based on high and extreme hemlock looper populations levels (Figure 6).

A double application of the Btk formulation, Foray 48B, was applied aerially at 2.4 litres/hectare. The separation time between application was approximately one week.

The spray aircraft used was a Bell 206 helicopter with four micronair AV 4000 units attached to the boom. The navigational system used was a combination of GPS and a guidance Nova Scotia Department of Natural Resources Hughes 500 helicopter.

The treatment program was a success. Biocide application was timed to knock down the larvae at the critical time in its development, resulting in good foliage protection. Compared to 1996, the weather for 1997 was very cooperative resulting in only a few lost spray sessions. Reduction of larval survival in the treated areas ranged from 0 to 96% and the overall reduction in larval survival was 67%.

For current foliage growth the results saved ranged 0 to 87.5%. The overall current foliage saved was 50.1%.

There was a population crash occurring at the time of the post spray survey and this caused a lot of population fluctuation in the calculations.

The hemlock looper population in Cape Breton seems to be collapsing with only 1,000 hectares of visible defoliation (Figure 7). There are indications, however, that the mainland situation is different with numerous reports of high hemlock looper moth activity along the northern part of the mainland. The data from the province wide pheromone trap system has not yet been analysed. The 1997, province wide hemlock looper egg survey is still underway and we are expecting to process 500 points. This will give us a good idea of the "areas at risk."

Depending on the hemlock looper egg survey and what is found, another possible treatment program using Btk on the looper could occur in 1998.

***Whitemarked Tussock Moth**, Orgyia leucostigma (J.E. Smith):*

There has been a rapid population buildup of this insect in the province. Areas showing any level of defoliation went from zero in 1996, to 202,751 hectares in 1997 (Figure 8). Severe defoliation occurred in over 18,194 hectares causing heavy damage to all balsam fir trees in this area.

A province wide egg mass count will be completed by the end of November, with over 15,000 trees sampled. The results so far show a large area with moderate and high egg mass numbers (Figure 9). However, until the final survey results are mapped the total area at risk will not be known but it is estimated to be around 400,000 hectares.

A number of joint studies are underway with the Canadian Forestry Service for the development of better prediction monitoring tools for this insect.

Also, attempting to get a user requested minor use label extension (URMULE) for use of Foray 48B against this insect.

An experimental block of 50 hectares was set up on Crown Land to test the effectiveness of a double application of Foray 48B against late instar whitemarked tussock moth. The product was aerially applied at the rate of 4.0 litres or 50 BIU/hectare. The spray aircraft used was a Hugh 269 helicopter fitted with four micronair AV 4,000 units.

It was too late to attempt to save any foliage in the trial area but the trial did show that the Btk worked very well on the whitemarked tussock moth. The reduction of survival in the treated area was 93.0%.

Figure 1

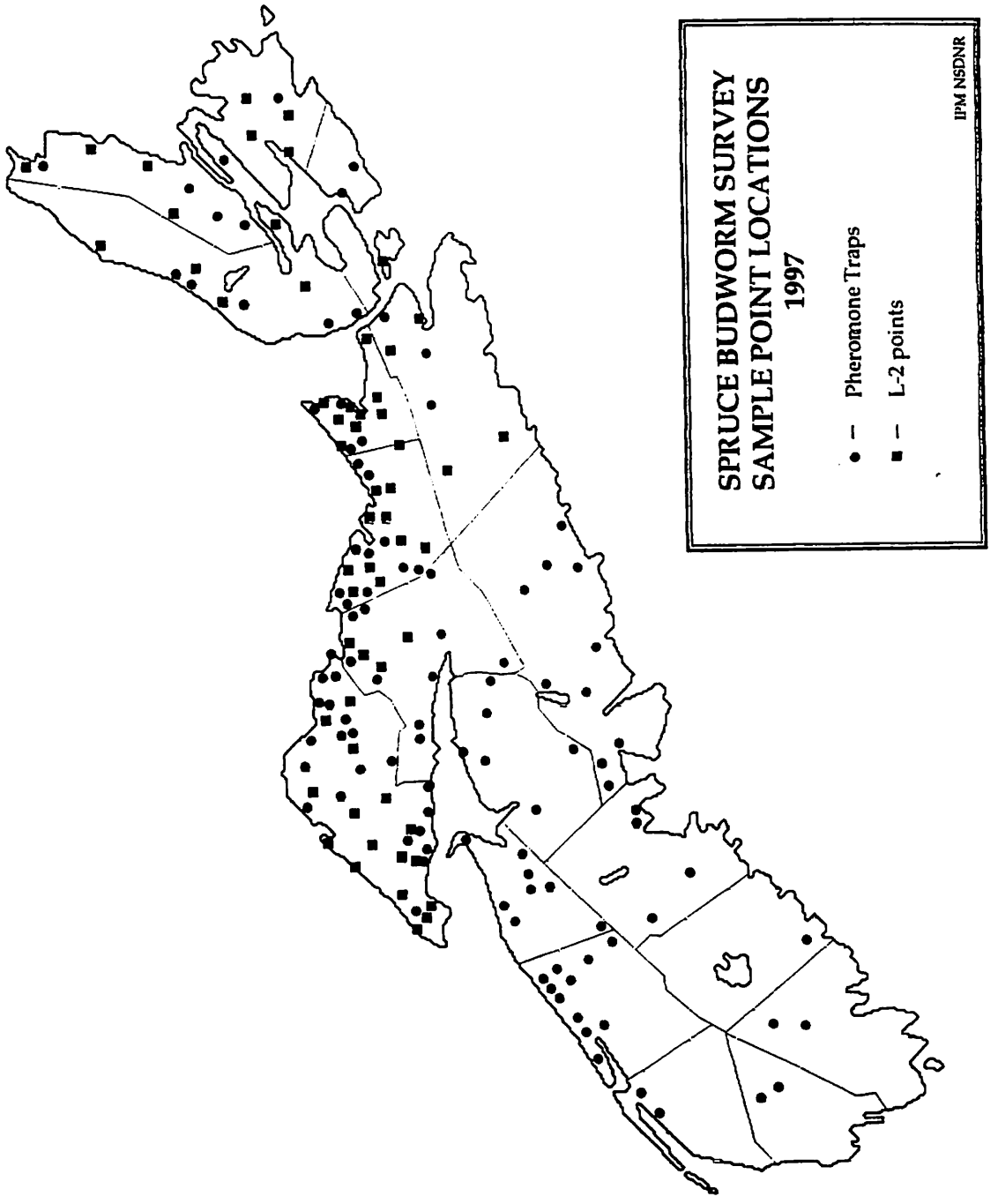

SPRUCE BUDWORM SURVEY
SAMPLE POINT LOCATIONS
1997
Pheromone Traps
L-2 points
IPM NSDNR

Figure 2

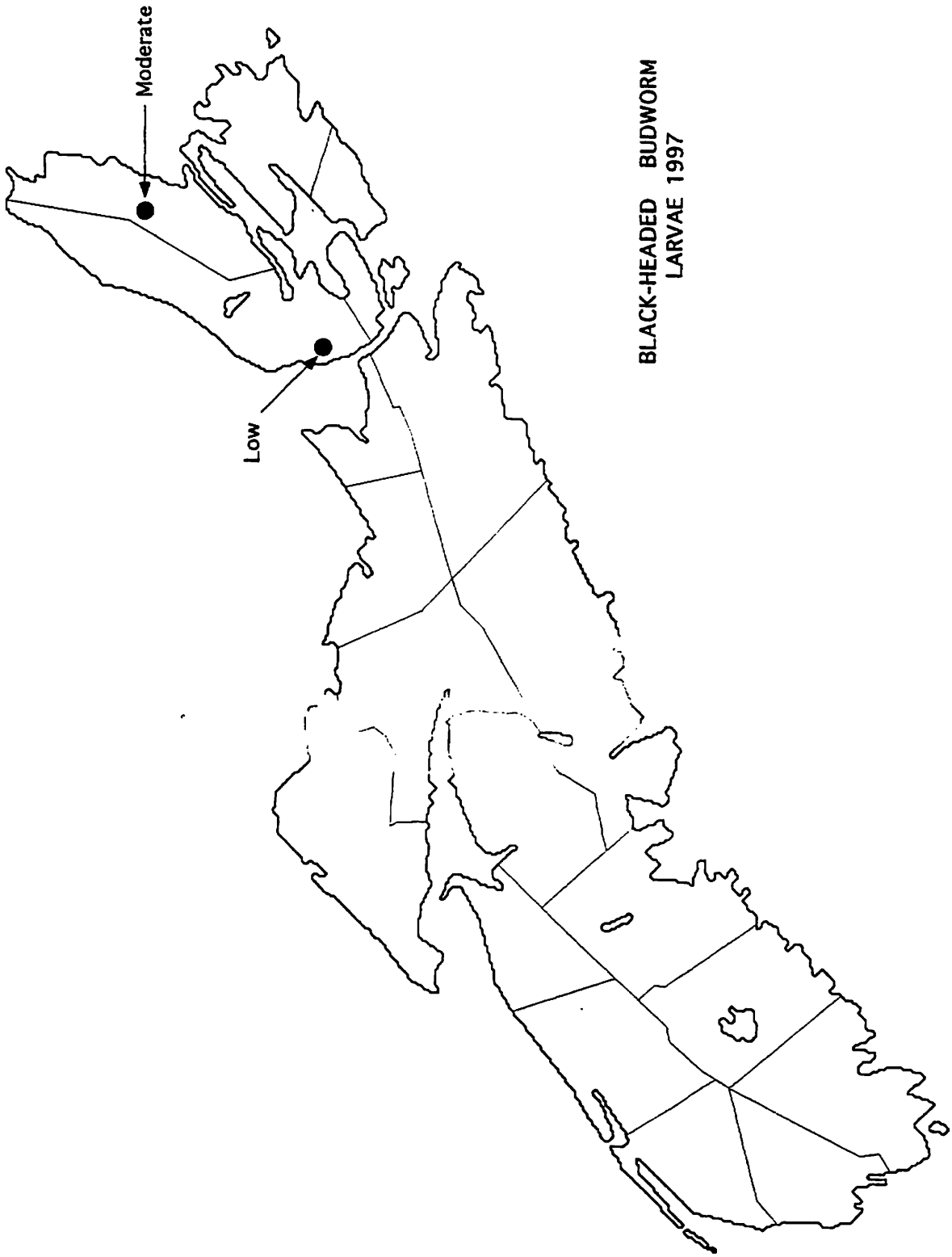


Figure 3

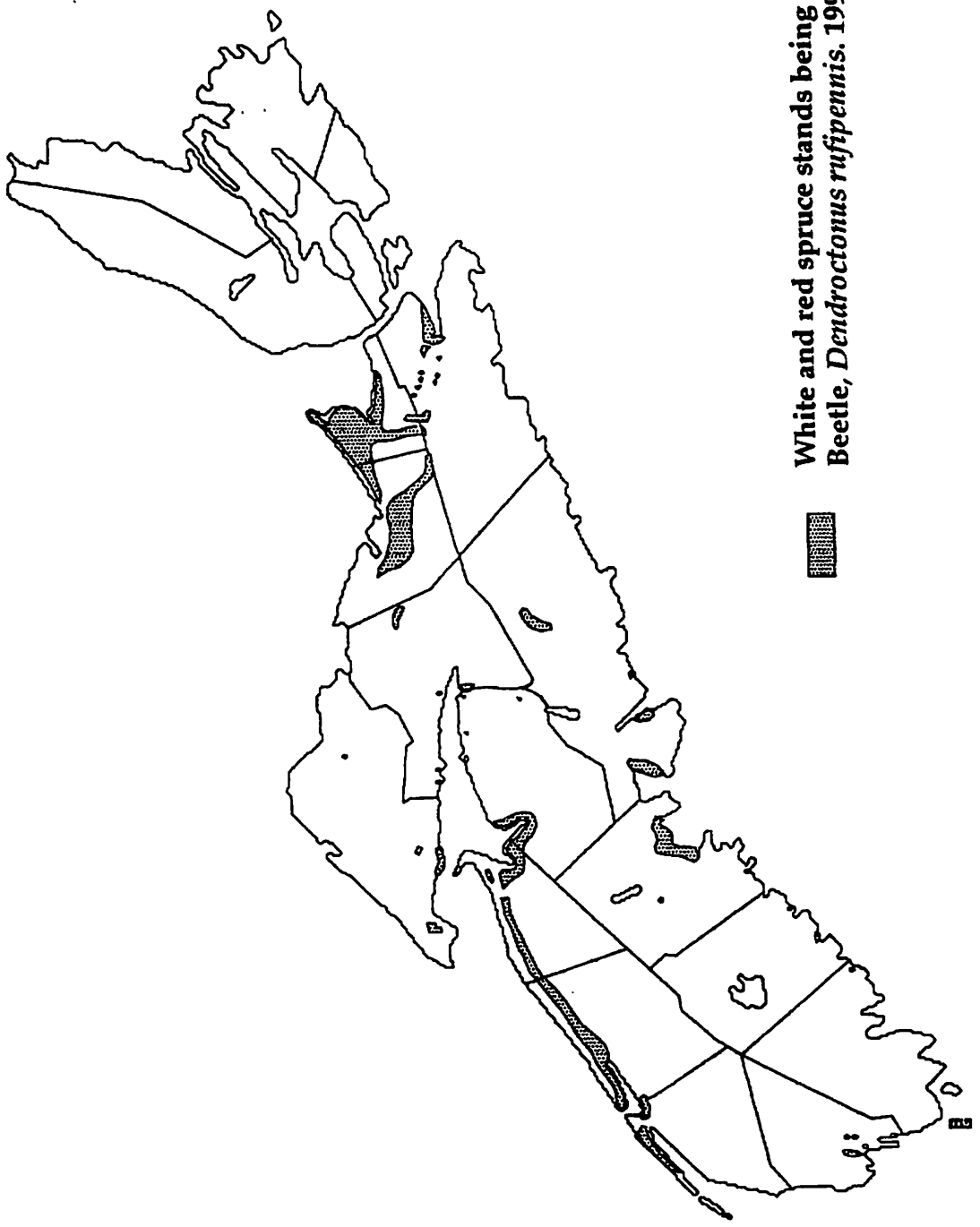
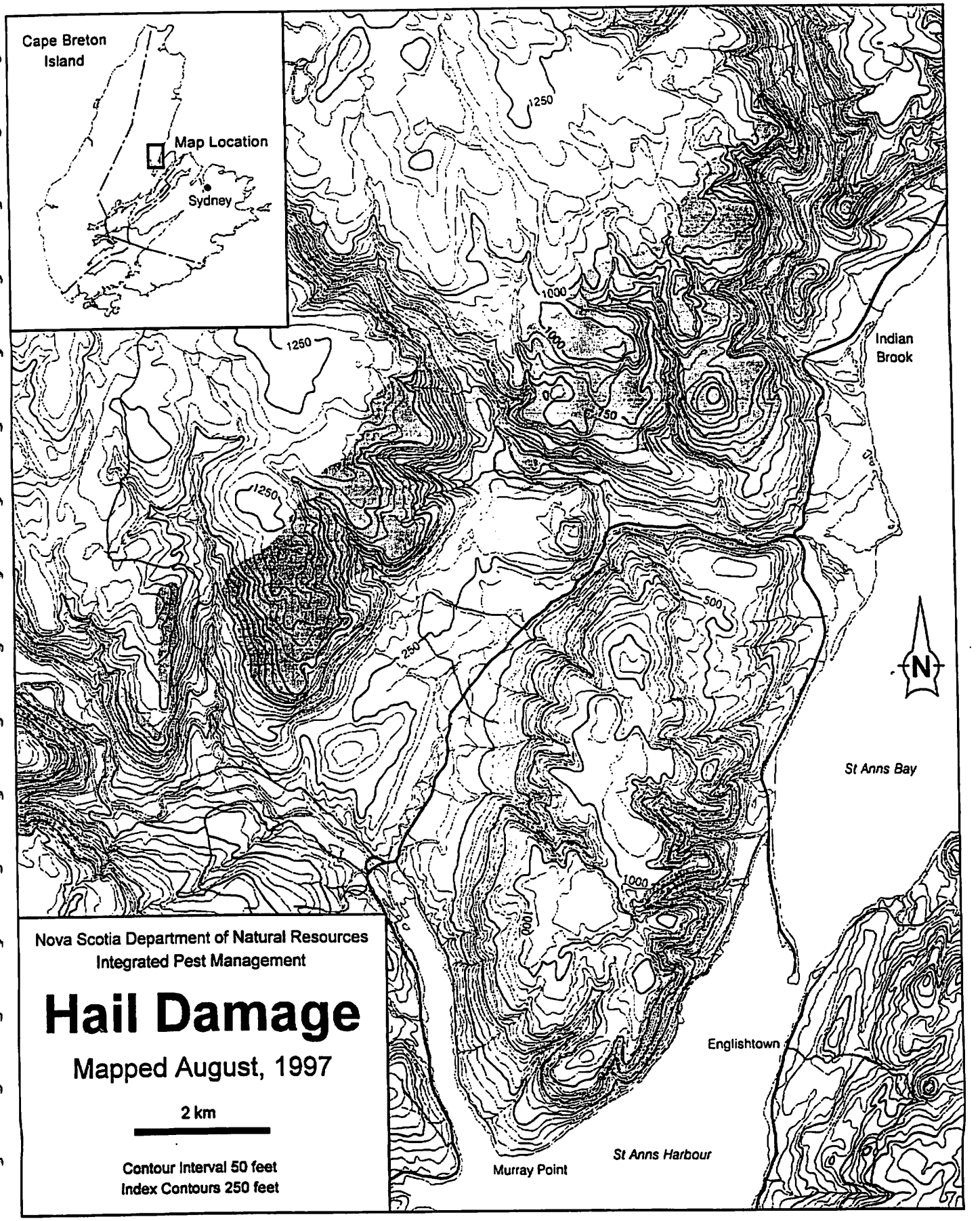

White and red spruce stands being attacked by Spruce Beetle, *Dendroctonus rufipennis*. 1997

Figure 4


Cape Breton Island
Map Location
Sydney
1250
1000
750
500
250
Indian Brook
St Anns Bay
N
Englishtown
St Anns Harbour
Murray Point
Nova Scotia Department of Natural Resources
Integrated Pest Management
Hail Damage
Mapped August, 1997
2 km
Contour Interval 50 feet
Index Contours 250 feet

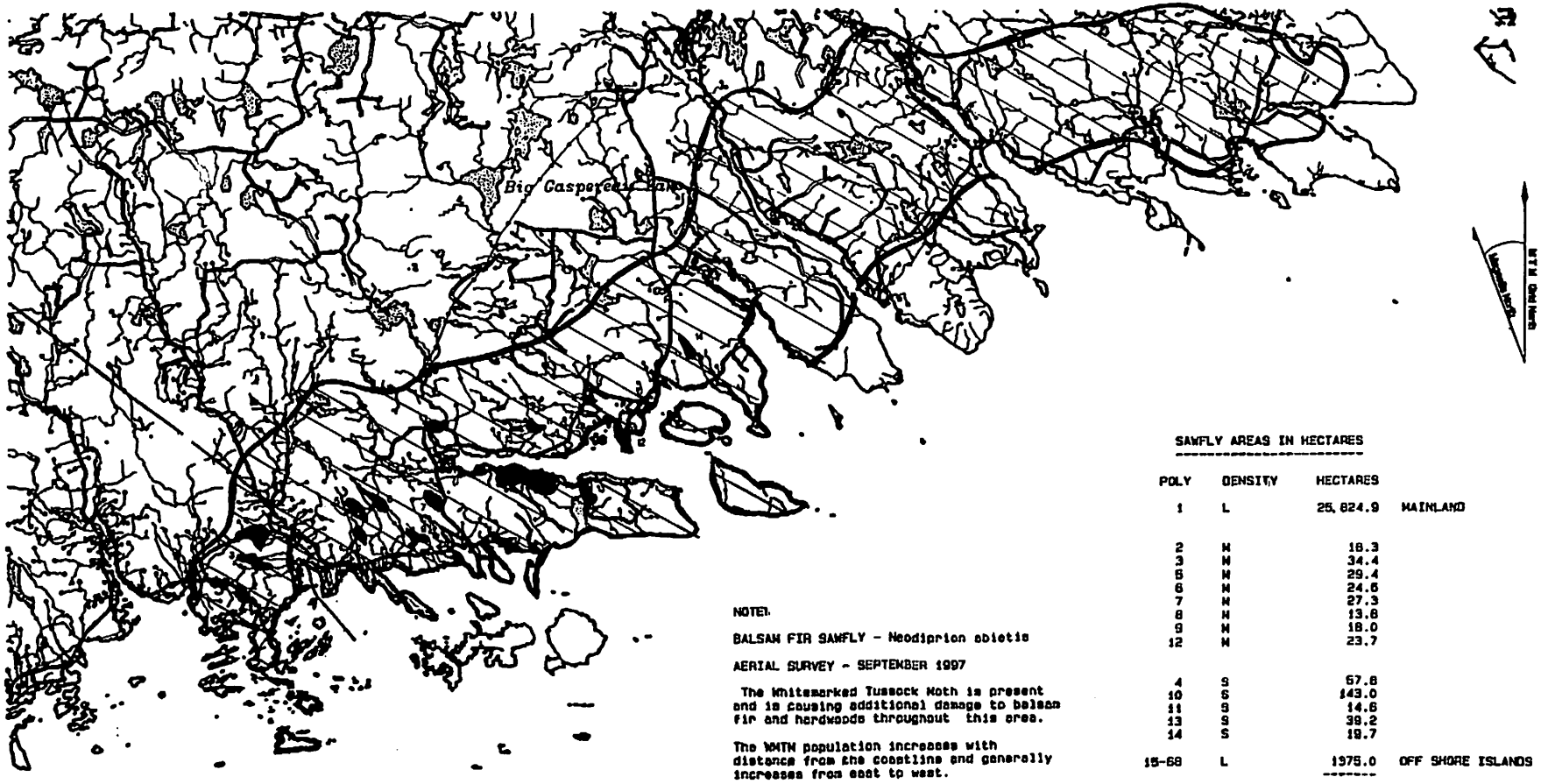
DEPT. OF NATURAL RESOURCES – INTEGRATED PEST MANAGEMENT

BALSAM FIR SAWFLY DEFOLIATION, HALIFAX & GUYSBOROUGH CO.

SCALE 1 : 250,000 2 CM = 5 KILOMETER

Late
Low Defoliation
Moderate Defoliation
Severe Defoliation

NOVA SCOTIA
Department of Natural Resources
Forestry Branch GIS
October 27, 1997



NOTE:

BALSAM FIR SAWFLY – Neodiprion abietis

AERIAL SURVEY – SEPTEMBER 1997

The Whitemarked Tussock Moth is present and is causing additional damage to balsam fir and hardwoods throughout this area.

The WMTM population increases with distance from the coastline and generally increases from east to west.

SAWFLY AREAS IN HECTARES

POLY	DENSITY	HECTARES	
1	L	25,824.9	MAINLAND
2	M	18.3	
3	M	34.4	
5	M	29.4	
6	M	24.6	
7	M	27.3	
8	M	13.8	
9	M	18.0	
12	M	23.7	
4	S	57.8	
10	S	143.0	
11	S	14.6	
13	S	39.2	
14	S	19.7	
15-68	L	1975.0	OFF SHORE ISLANDS
		27,200	TOTAL HECTARES

sawfly250.eps

Figure 5

Figure 6

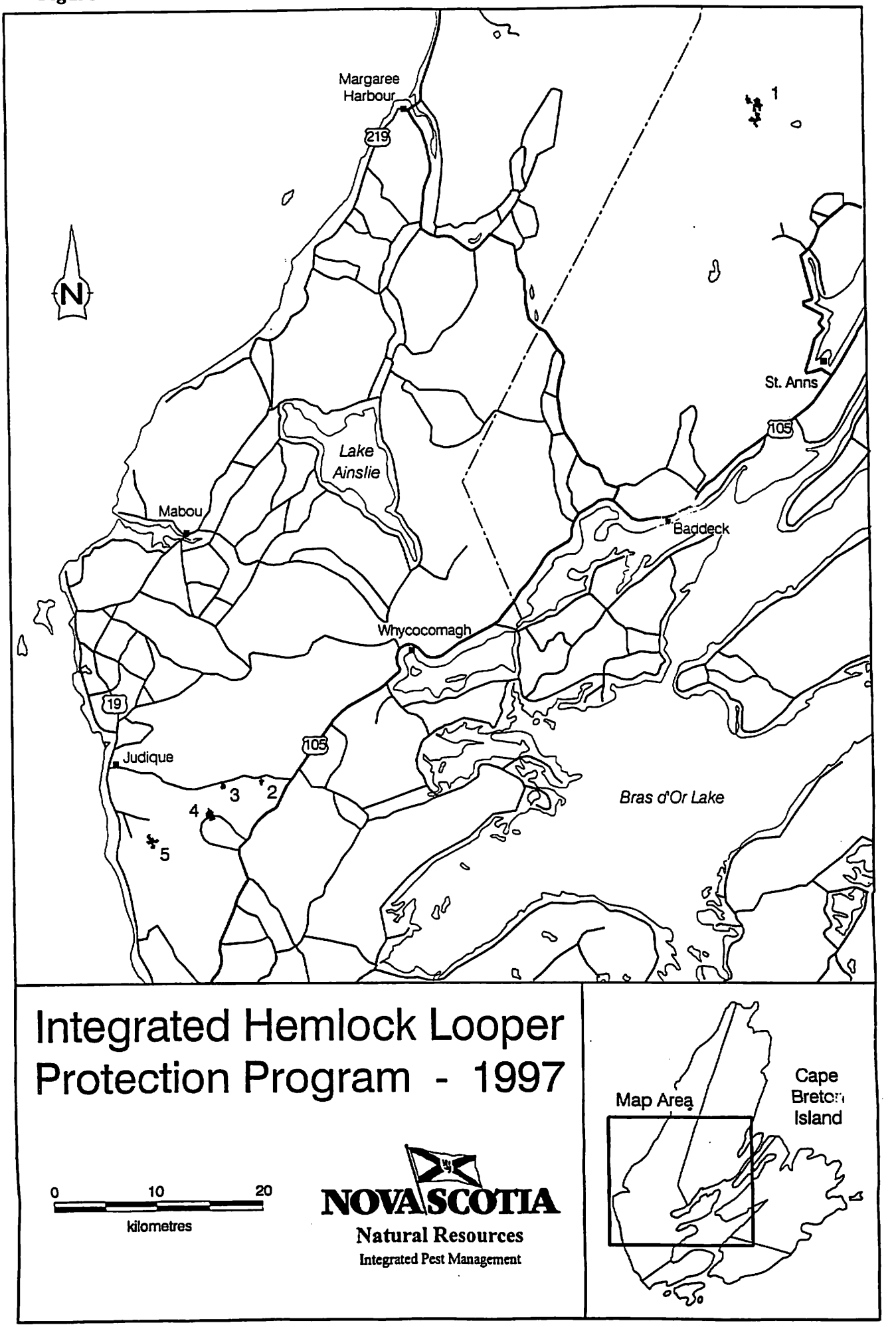
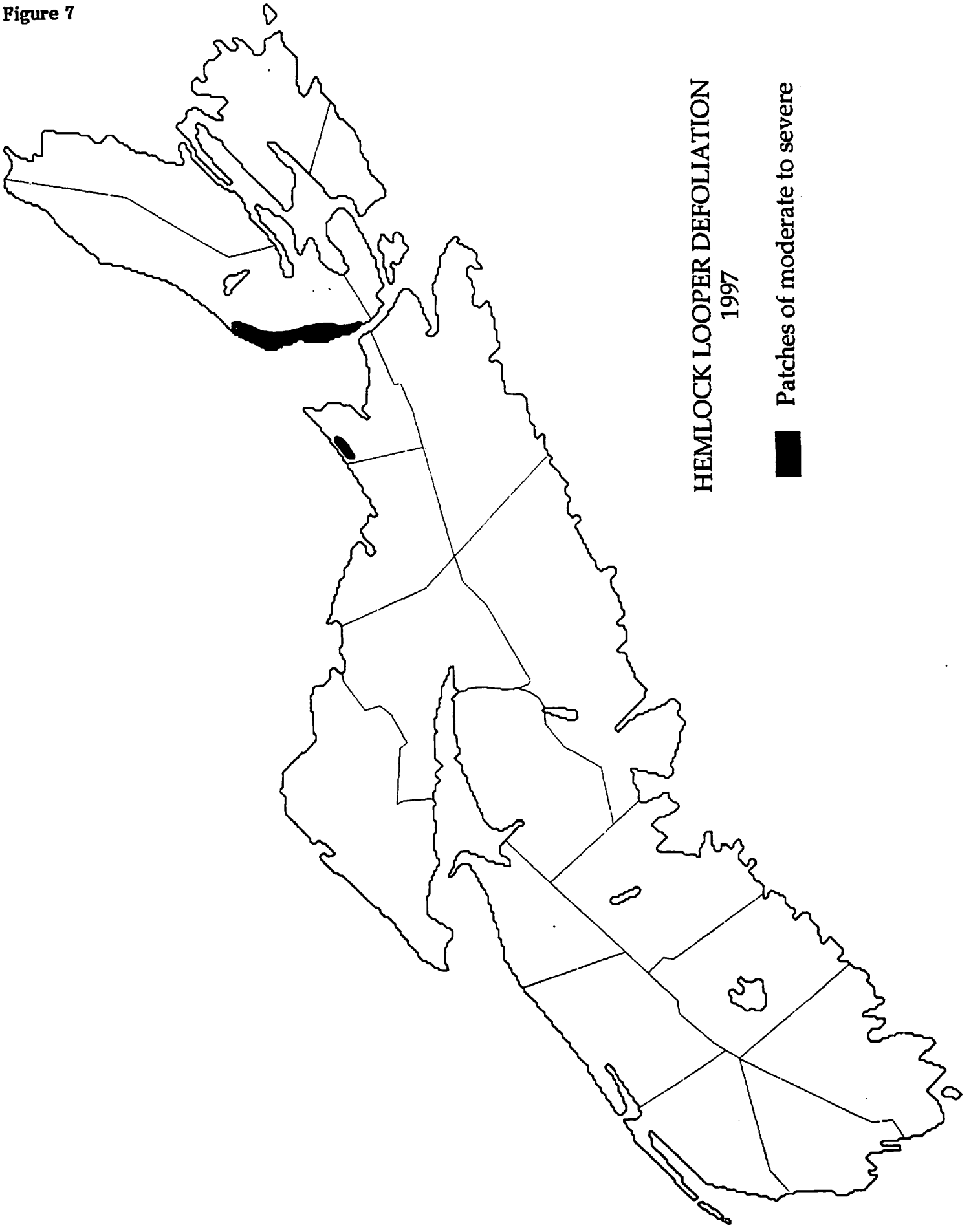
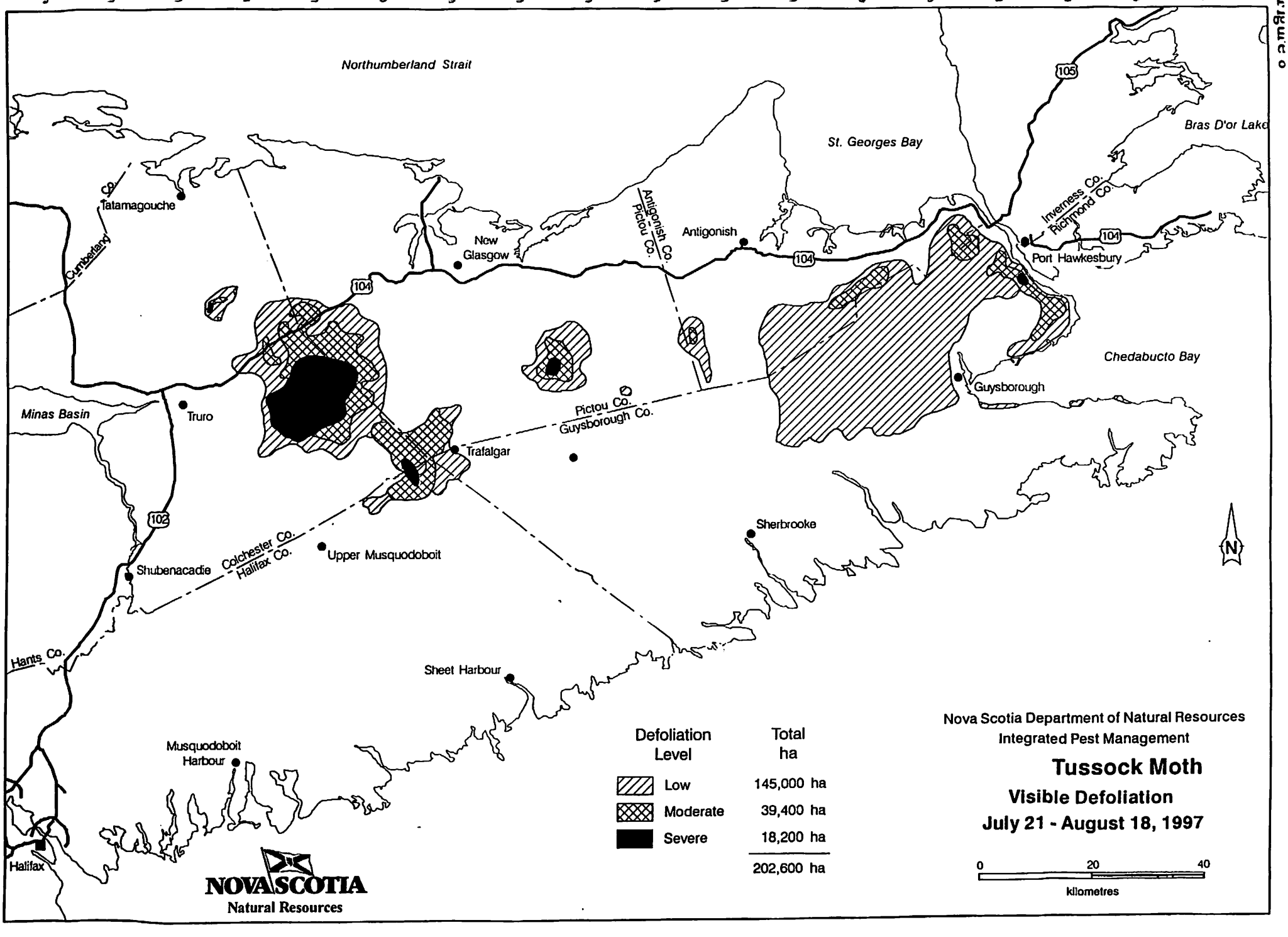
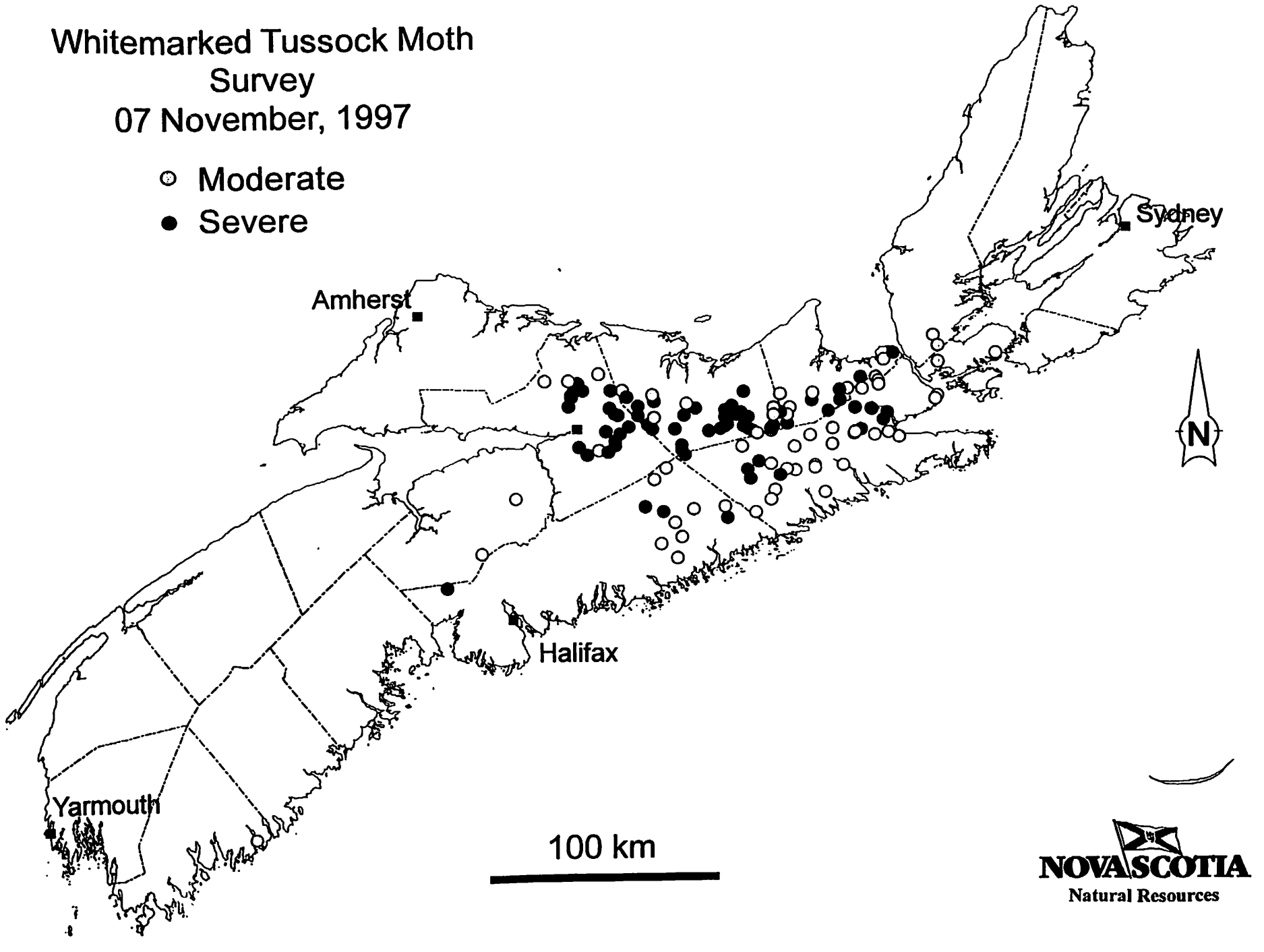

Margaree Harbour
219
1
N
St. Anns
105
Lake Ainslie
Mabou
Baddeck
Whycocomagh
19
105
Judique
3
2
4
5
Bras d'Or Lake
Integrated Hemlock Looper Protection Program - 1997
0
10
20
kilometres
NOVA SCOTIA
Natural Resources
Integrated Pest Management
Map Area
Cape Breton Island

Figure 7


HEMLOCK LOOPER DEFOLIATION
1997
Patches of moderate to severe


Northumberland Strait
St. Georges Bay
Bras D'or Lake
Chedabucto Bay
Minas Basin
Cumberland Co.
Tatamagouche
New Glasgow
Antigonish Co.
Pictou Co.
Antigonish
Inverness Co.
Richmond Co.
Port Hawkesbury
Guysborough
Truro
Pictou Co.
Guysborough Co.
Trafalgar
Sherbrooke
Colchester Co.
Halifax Co.
Upper Musquodoboit
Shubenacadie
Hants Co.
Sheet Harbour
Musquodoboit Harbour
Halifax
105
104
102
N
Defoliation Level
Total ha
Low 145,000 ha
Moderate 39,400 ha
Severe 18,200 ha
202,600 ha
Nova Scotia Department of Natural Resources
Integrated Pest Management
Tussock Moth
Visible Defoliation
July 21 - August 18, 1997
0 20 40
kilometres
NOVA SCOTIA
Natural Resources


Whitemarked Tussock Moth
Survey
07 November, 1997
Moderate
Severe
Amherst
Sydney
Halifax
Yarmouth
N
100 km
NOVA SCOTIA
Natural Resources

10 TOP REASONS TO BECOME AN ENTOMOLOGIST

1. Consort with maggots, weevils, fleas, locusts, fellow entomologists, and other vermin.
2. Big Bucks!
3. Only about a billion species to worry about.
4. Travel to distant, foreign lands, collect strange, exotic and beautiful new species, and kill them.
5. Realize your secret ambition to become Lord of the Flies.
6. Get interviewed during plagues, crop failures, pestilence, and other fun events.
7. Great shot at the Nobel Prize.
8. Lots of interesting cross-species ideas for mating strategies.
9. Claim that, "It's vital research, Dear," when your spouse catches you grinding flies in the kitchen blender.
10. Might have to work for a living otherwise.

Forest Pest Status Report for New Brunswick in 1997

N. Carter, H. Hartling, D. Lavigne and W. Patterson
Department of Natural Resources and Energy
Fredericton, New Brunswick

Because spruce budworm populations were low and defoliation was not anticipated anywhere in New Brunswick in 1997, no aerial surveys for damage were conducted this year. DNRE placed pheromone traps in 152 plots across the province. Trap catches were negative in 73%, and the remaining 27% had 1-10 moths per trap. J.D. Irving maintains its own trapping network, and its trap catches were low as well.

Pheromone traps were also set for the hemlock looper. Moths caught in DNRE traps did not reflect populations significant enough to cause damage in 1998. Data are not yet available from J.D. Irving Ltd. traps.

Populations of balsam fir sawfly, which caused significant defoliation in 1996, have declined in southern New Brunswick. At South Oromocto Lake, a study was conducted to assess egg distribution throughout the tree crown and egg parasitism, and to develop damage forecast curves. Information is only partially analyzed. The chalcid egg parasite *Cirrospilus* sp. was abundant at various sites in southern New Brunswick in 1996 and 1997.

Surveys were conducted around the province to determine whether more plantations were affected by the yellowheaded sawfly than in 1996. In the southeast, plantations were generally in better condition than in 1996 because of less feeding by the sawfly. The insect was present in 34 plantations in north-central New Brunswick where it had not previously been detected.

Because of the tussock moth outbreak in Nova Scotia where approx. 200,000 ha were defoliated in 1997, all fir and spruce branches collected during DNRE's spruce budworm fall survey were checked for tussock moth, but none have been found to date.

A provincewide survey was conducted to examine the incidence of larch pests. Of 298 stands sampled, 129 had larch beetle, 46 had larch sawfly and 5 had both. Nine stands had larch casebearer.

As cone production was limited in 1997, seed orchard monitoring focused on insects and diseases attacking the non-reproductive tissues of trees. Dofoliators caused little damage. Spruce budworm numbers remain low in all spruce orchards.

Egg sampling for spruce cone maggot *(Strobilomyia neathracina)* was done in the spring in a black spruce stand at Kingsclear. Combined egg counts for these 2 pests were significantly high to justify control measures to protect the seed crop for harvest in 1997.

Les ravageurs forestiers au Nouveau-Brunswick : état de la situation en 1996

N. Carter

Comme les populations de la tordeuse des bourgeons de l'épinette étaient faibles et qu'aucune défoliation n'était prévue nulle part dans la province en 1997, aucun relevé aérien des dommages n'a été réalisé cette année. Le personnel du MRNE a installé des pièges à phéromone dans 152 parcelles réparties dans diverses régions de la province. Aucune capture n'a été enregistrée dans 73 % des pièges; dans tous les autres pièges, le nombre de prises a varié entre 1 et 10. J.D. Irving Ltd., qui possède son propre réseau de piégeage, a également signalé des nombres de prises faibles.

Des pièges à phéromone ont également été déployés contre l'arpenteuse de la pruche. À la lumière des faibles nombres de prises enregistrés, le MRNE n'anticipe pas de défoliation importante en 1998. J.D. Irving Ltd. n'a pas encore communiqué ses résultats de piégeage.

Les populations du diprion du sapin, à l'origine d'une défoliation importante en 1996, ont décliné dans le sud du Nouveau-Brunswick. Au lac Soth Oromocto, une étude visant à déterminer la répartition des masses d'oeufs au niveau de la cime des arbres et les taux de parasitisme des oeufs et à élaborer des courbes prévisionnelles des dommages a été réalisée. L'analyse des résultats obtenus dans le cadre de ces travaux n'est pas encore terminée. Le chalcidien parasite des oeufs *Cirrospilus* sp. était abondant en divers endroits du sud de la province en 1996 et en 1997.

Des relevés ont été effectués en plusieurs points de la province afin de déterminer si le nombre de plantations infestées par le diprion du sapin s'était accru par rapport à l'année précédente. Dans le sud-est de la province, les plantations semblaient en meilleur état qu'en 1996, les taux de défoliation par le diprion y étant moins élevés. Dans le centre-nord de la province, jusque-là exempt du diprion, la présence du ravageur a été détectée dans 34 % des plantations inspectées.

Comme la chenille à houppes a défolié près de 200 000 ha en Nouvelle-Écosse en 1997, le personnel du MNRE a inspecté toutes les branches de sapin et d'épinette recueillies dans le cadre du relevé automnal de la tordeuse des bourgeons de l'épinette afin d'y déceler la présence éventuelle du ravageur. Aucune chenille à houppes n'a cependant été découverte.

Un inventaire visant à déterminer les taux d'infestation des peuplements de mélèze par divers ravageurs a été réalisé à l'échelle de la province. Parmi les 298 peuplements visités, 129 étaient infestés par le dendroctone du mélèze, 46, par la tenthrède du mélèze et 5, par ces deux ravageurs. La présence du porte-case du mélèze a été détectée dans 9 de ces peuplements.

La production de cônes étant limitée en 1997, la surveillance dans les vergers à graines a été centrée sur les insectes et les maladies touchant les tissus non reproducteurs des arbres. Les défoliateurs ont causé peu de dommages. Les effectifs de la tordeuse des bourgeons de l'épinette sont demeurés faibles dans tous les vergers d'épinette.

Un échantillonnage des oeufs de la mouche granivore de l'épinette (*Strobylomyia neathracina*) a été réalisé au printemps dans un peuplement d'épinette noire, à Kingsclear. Les résultats des dénombrements des oeufs de ces deux ravageurs étaient suffisamment élevés pour justifier l'application de mesures de lutte en vue de protéger la récolte de semence de 1997.

FOREST PEST STATUS REPORT FOR NEW BRUNSWICK IN 1997

(Prepared for the Forest Pest Management Forum, held in Ottawa, Nov. 17-20, 1997)

N. Carter, L. Hartling, D. Lavigne and W. Patterson,
Dept. Natural Resources & Energy, P.O. Box 6000, Fredericton, N.B., E3B 5H1

INSECT PESTS OF SOFTWOODS

SPRUCE BUDWORM (*Choristoneura fumiferana* (Clem.))

Based on the fall 1996 forecast survey, spruce budworm populations were so low that defoliation was not anticipated anywhere in New Brunswick in 1997. Nonetheless, a request was sent to all forest companies and regional DNRE personnel to report any feeding damage they might have seen whether travelling by ground or air, so they could be further assessed. No reports of defoliation were received and hence an aerial survey was not conducted. Except for 4 000 ha in 1995, no defoliation has been recorded in the Province since 1992. The last control program on Crown land was in 1993, and on J.D. Irving (JDI) freehold land in 1995.

L2 Survey: A total of 317 plots, uniformly distributed throughout the Province were sampled for overwintering spruce budworm larvae (L2). Laboratory processing revealed that overwintering populations were virtually undetectable (i.e. only 2 plots had a single larva/3 branches). Supplementary sampling was done by JDI on its freehold limits in northwestern New Brunswick (i.e. 43 plots at Black Brook and 23 at Deersdale). Only a single larva was found in one plot at Black Brook, consistent with the provincial survey. No defoliation is forecast for any part of the Province in 1998.

Pheromone Trapping: DNRE placed budworm pheromone traps at 152 plots (in about half the operational L2 plots) distributed uniformly throughout the Province. Of the traps placed out, 148 were successfully retrieved. Trap catches were negative at 73% of the plots; and, of the remaining 23% the highest trap catch was only 6 moths. Locations with positive trap catches were found throughout the Province, though 80% of them occurred in the northern half. Moths counts in 1997 were even lower than 1996 when (based on 99 retrieved traps) 53% of the plots had negative catches, 41% had 1 to 10 moths/trap, and 3% had 11 to 20 moths/trap.

In addition, JDI maintains its own budworm trapping network on its freehold limits in northwestern and southeastern New Brunswick. Trap catches (25) in the northwest were very low ranging from 0 to 28 moths/trap: 3 were negative; 18 had 1 to 10 moths/trap; 2 had 11 to 20 moths/trap; and 2 had >20 moths/trap (Carole LeBlanc, pers. comm., JDI). Likewise, trap catch from 6 counties in the southeast (Sussex District) were very low to undetectable. Samples from this area were submitted by the company to DNRE for processing. Of 25 traps placed at 24 locations the only "noteworthy" counts came from 2 traps in the company's seed orchard (i.e. 6[illegible] and 83 moths/trap); 19 were negative; 3 had <3 moths/trap; and one had 13 moths/trap. According to past experience in this seed orchard, moth counts of this magnitude were believed to still represent only insignificant overwintering (L2) populations. This was confirmed in subsequent samples submitted by JDI for assessment (4 plots, 0 larvae found).

Like the results from the L2 survey, results from the pheromone traps do not indicate any significant populations of spruce budworm anywhere in the Province for 1998.

HEMLOCK LOOPER (*Lambdina fiscellaria fiscellaria* Gn.)

Populations of hemlock looper have remained below damaging thresholds in New Brunswick since the last defoliation reported from DNRE's aerial survey in 1992. In 1996, a pheromone trapping survey again confirmed low populations and hence no damage was anticipated in 1997. None was detected. Nonetheless, there were concerns whether populations might be increasing, especially in the northern part of the Province, because an outbreak was forecast to occur in Quebec in 1997 on the Gaspé Peninsula.

Pheromone Trapping: DNRE placed hemlock looper pheromone traps at 103 plots distributed uniformly throughout the Province, and all were retrieved. Traps were collected in late October (20-29), and some incidental moth activity was detected at a few locations at the time. All except one trap had positive catches, ranging from 0 to 790 moths/trap (mean = 155 moths/trap). In addition, due to their concern about the situation on the Gaspé, DNRE's Region 5 placed out another 15 traps (1 lost) in the northwest. Results were similar to the provincial survey.

In addition, JDI maintains its own hemlock looper trapping network on its own freehold limits in northwestern (data not available) and southeastern New Brunswick. In the southeast, traps were placed at 27 locations. Two traps were found on the ground ("shot" out of the trees) and had no moths in them. The other 25 traps were all positive with catches ranging from 18 to 549 moths/trap (mean = 163 moths/trap). Whereas this represents an apparent 3-fold increase in their average trap catch from 1996 (mean = 55 moths/trap), it is not certain that the difference is due to a real increase in populations, or the fact that the lure used in 1997 was from a different source than that used in 1996. The latter is also true for the DNRE data.

Given the potency of the lure and past experience, and experience in other jurisdictions where counts of thousands of moths/trap are encountered, it is believed that the numbers of moths from the various pheromone trapping surveys do not reflect populations of hemlock looper significant enough to cause damage in New Brunswick in 1998.

JACK PINE BUDWORM (*Choristoneura pinus pinus* Free.)

This insect periodically reaches severe outbreak status in Ontario, frequently resulting in substantial control programs. In New Brunswick, jack pine represents about 10.1 million m^3 of the volume of the Province's natural forests. It is also a major species used in reforestation programs now existing on some 80 000 ha, or about 25% of the planted area in the Province. Consequently, a major outbreak of this insect could put significant values at risk.

The last reported outbreak of jack pine budworm in New Brunswick occurred in 1983, mostly in western Kent County and southern Northumberland County, with scattered pockets detected elsewhere. Defoliation was aerially detected throughout a 200 000 ha area in which some 35 000 ha of jack pine forests were present. That fall, a survey was conducted by DNRE to determine what conditions would be like for 1984 in the event control action was required. The survey indicated that populations were not likely to cause significant defoliation, and it was recommended that control was not necessary. The forecast was correct as there was no defoliation detected in 1984.

Pheromone Trapping: From 1984 to 1994 (except 1993), FIDS and DNRE Regional staff placed out jack pine budworm pheromone traps to monitor annual changes. Trap catches have never reached levels that indicated significant population increases. In 1997, DNRE placed out 46 traps at a number of selected plantations and natural stands around the Province. None collected any moths, confirming once again that populations of jack pine budworm continue to be extremely low in the Province (though there has been some question of lure blend/strength).

YELLOWHEADED SPRUCE SAWFLY (*Pikonema alaskensis* (Roh.))

No operational controls were applied against yellowheaded spruce sawfly in 1997. Several follow-up studies were conducted by various agencies based on work done in the past two years; and surveys were conducted to determine whether more plantations were affected than last year.

In the southeast, infested plantations were assessed and found to be generally in better condition due to less feeding this year. Two years ago (fall of 1995), 37 plantations on Crown land were deemed to have significant sawfly attack, and by the fall of 1996 that number had decreased to 24. In the fall of 1997, the number of affected plantations dropped again to 18, of which only one had severe damage. The others had light damage on roadside trees and/or scattered trees throughout the plantation, thus indicating that populations have not yet totally collapsed in these areas. Damage on six JDI plantations also appears to have subsided.

In north-central New Brunswick, a total of 113 plantations on Crown land were assessed in 1997. Yellowheaded spruce sawfly larvae and damage were detected at 23 (20%) of these; and typical damage was detected at 62 (55%). Only 3 (2.6%), however, are considered moderately to heavily damaged at present and the level of infestation is primarily light in the rest. Overall observations are as follows:

28 had no evidence of larvae or damage.
8 had larvae detected but no current damage, though two had evidence of previous damage.
15 had both larvae and current damage detected.
30 had no larvae or current damage detected, but four had previous damage detected.
32 had no larvae detected, but current damage was detected.

The primary objective of the survey was detection, to determine whether yellowheaded spruce sawfly was present. A more intensive survey would have been conducted had damage warranted. The presence or absence of larvae could have been a result of: timing of observations (summer or fall); relative population levels present; and the amount of time "searching". These plantations will be monitored in 1998.

BALSAM FIR SAWFLY (*Neodiprion abietis* (Harr.))

In 1996, populations of balsam fir sawfly caused visible defoliation to fir in some local areas in southwestern New Brunswick especially near South Oromocto Lake and in the Lake George/Lake Utopia area. In 1997, populations declined and no defoliation was detected during a roadside survey conducted in these areas and throughout the southern and southwestern part of the Province. This insect typically causes periodic short-term outbreaks that can cause growth

loss and mortality in young to middle-aged balsam fir trees, especially in low-density or thinned stands. Significant areas are reportedly being attacked in Nova Scotia and Newfoundland.

At South Oromocto Lake, a study was conducted to assess: egg distribution throughout the tree crown; egg parasitism; pupal parasitism; and to develop damage forecast curves (eggs v subsequent damage) should populations persist. Defoliation assessments were made before and after larval feeding, but the significant population decline in the plot resulted in limiting the range over which a damage forecast curve could be examined.

There did not appear to be any relationship between egg density and height of branches off the ground; nor any relationship between crown level and egg density within a given tree. There was a weak to non-existent relationship between egg counts and defoliation, probably reflecting the collapse of the population at the study site.

An egg parasite, *Cirrospilus sp.* (Eulophidae:Eulophinae), was found to be quite abundant at various sites in southern New Brunswick in 1996 and 1997. Actual determination of the species could not be made by the taxonomic unit in Ottawa. The Canadian National Collection contains only 8 of 24 possible Nearctic species, but specimens like those submitted by DNRE were not among them.

At the South Oromocto Lake site, 526 eggs from 56 branches from 3 crown levels on 25 trees were found to have an overall parasitism rate of 26%. At the same site, 36 sawfly cocoons were collected for potential parasites. Hymenoptera parasites emerged, or were dissected from 10 cocoons (28%). From 7 of these, multiple emergence of the parasite *Mesopolobus verditer* (Pteromalidae: Pteromalinae) occurred (mean = 13.6; median = 12). From 1 cocoon, an Ichneumonid (Ichneumonidae: Cryptinae) emerged; and upon dissection, 2 cocoons were found to each contain a live larva of an undetermined species of Hymenoptera.

LARCH PESTS

During the summer, while doing the aerial survey to assess hardwood defoliation in southeastern and southcentral New Brunswick, larch trees were noticed showing symptoms of stress. Affected areas were mostly scattered trees to small stands, perhaps a hectare or less in size. GIS maps of all the larch stands in the Province were produced, and a Province-wide ground survey of selected stands was subsequently conducted to determine what pests were present, as well as the percent of trees damaged. Of 298 stands examined: 129 (43%) had eastern larch beetle (*Dendroctonus simplex* Lec.); 46 (15%) had larch sawfly (*Pristiphora erichsonii* (Htg.); and 5 (2%) had both larch beetle and larch sawfly. Larch casebearer (*Coleophora laricella* (Hbn.)) was found in nine stands also.

Larch beetle was found predominantly in larch stands east of Fredericton ranging as far south as the Bay of Fundy and as far north as the Bay of Chaleur. In contrast, larch sawfly damage was limited to areas west of Fredericton with sawfly detected in larch stands as far south as St. Stephen and as far north as Grand Falls. The majority of stands with larch casebearer were found east of Bathurst, in northern New Brunswick.

SPRUCE BEETLE (*Dendroctonus rufipennis* (Kby.))

The spruce beetle can be an insidious pest of white spruce. In New Brunswick, it is routinely noted in aerial surveys but to-date has not resulted in significant areas of attack. In some instances, however, clusters of attacked trees are often apparent in strips along rivers and streams. Damage "appeared" to be slightly more noticeable in the northern part of the Province in 1997, though this was not quantified. Significant tree mortality is being reported by authorities in Nova Scotia.

BALSAM TWIG APHID (*Mindarus abietinus* Koch)

In the course of conducting the operational spruce budworm overwintering larval survey, all fir branches are examined and the presence of twig aphid is recorded. Since these samples come from sites generally well-distributed around the Province (though fir plots are less dense in the east and southeast) they provide a general overview of how twig aphid populations are changing. Results in 1996, when compared with data from the previous 12 years, had suggested that twig aphid populations might increase in 1997. That supposition was correct as the percent of positive samples increased across all Regions of the Province by 10% to 21%. It is possible that populations could increase again in 1998, and although this is not a major concern to the forest industry, Christmas tree growers will need to carefully monitor their plantations in the spring to determine whether they will need to apply control.

BALSAM GALL MIDGE (*Paradiplosis tumifex* Gagne)

As noted for balsam twig aphid, branch samples taken to survey overwintering spruce budworm larvae are also examined for the presence of balsam gall midge. Results in 1996, when compared with the previous 12 years data had suggested that gall midge populations were also on the increase. Data from 1997 confirm that an increase did occur throughout each Region of the Province, with the greatest increases apparent in Region 2 (2% up to 52%) and Region 4 (3% up to 48%). It is possible that populations could increase again in 1998, and although this is not a major concern to the forest industry, Christmas tree growers will need to carefully monitor their plantations in the spring to determine whether they will need to apply control.

WHITEMARKED TUSSOCK MOTH (*Orgyia leucostigma* (J.E. Smith))

Populations of whitemarked tussock moth have occasionally reached significant levels in the Maritimes as far back as 1946. The last major outbreak to cause moderate to severe defoliation in New Brunswick occurred in 1975 (25 000 ha) and 1976 (206 400 ha) in the southeast. In 1997 in Nova Scotia, an outbreak over 202 600 ha occurred and resulted in tree mortality, and the conduct of salvage operations by at least two forest companies. The proximity and severity of that outbreak prompted DNRE to examine all 951 fir and spruce branches, collected from the 317 plots during the spruce budworm fall L2 survey, for the presence of tussock moth life stages prior to processing.

Due to the timing of L2 sampling (Sept. and Oct.), if any evidence of tussock moth were present, it is possible that only cocoons could have been found on some samples while others could have both empty cocoons and eggs, or empty larval or pupal skins. It is also possible that the budworm L2 branch samples might not represent the most efficient method of detecting tussock moth egg masses. No cocoons or egg masses were found. Nevertheless, it is felt that if significant populations were present, some cocoons or egg masses would have been detected. In response to concerns expressed from several forest companies and Regional DNRE foresters, information sessions were planned for Regional and Forest Extension staff and forest companies; as well as a small survey for egg masses or other life stages in southeastern New Brunswick.

DISEASES OF SOFTWOODS

EUROPEAN LARCH CANKER (*Lachnellula willkommii* (Htg.))

Surveys conducted by the CFS in New Brunswick in 1997 confirmed the presence of this disease at two locations (K. Harrison, CFS, pers. comm.). One of these fell within the Quarantine Zone already regulated under the federal Plant Protection Act, administered by the CFIA, and the other fell just outside the quarantine border. Whether this finding will result in any changes to the regulated area remains to be determined by CFIA.

EUROPEAN SCLERODERRIS CANKER (*Gremmeniella abietina* (Lagerb.) Morelet)

The story of Scleroderris canker in New Brunswick goes back to the mid-1970s when samples obtained from a number of pine plantations were identified as being the non-North American/or European strain based on identification procedures in use at the time. Concern stemmed from the fact that whereas the North American strain generally only infected and/or killed very young trees or branches below 2 metres on the trunk, the European strain is capable of killing seedlings and trees up to pole-size or larger. It was also thought that species of fir (*Abies* spp.), larch (*Larix* spp.), spruce (*Picea* spp.), and Douglas fir (*Pseudotsuga* spp.) were at risk; but that concern has now been dropped. Red pine (*Pinus resinosa* Ait.), Scots pine (*P. sylvestris* L.) and exotic pines (*Pinus* spp.) are most at risk. Additionally, current thinking is that the threat of spread is mostly, if not entirely, on infected nursery seedlings; and consequently, quarantine regulations to prevent the spread of this disease are under re-evaluation by CFIA.

In the last year or two, cultures (maintained by the CFS) from the suspect sites were re-assessed using newer technology. This re-assessment concluded that **only one** of the original 12 suspect sites **is or ever was**, positive for European Scleroderris within the Province (K. Harrison, CFS, pers. comm.). This is an old Scots pine Christmas tree plantation on private property in Region 5 in northwestern New Brunswick about 15-20 km east of Edmundston. What actions will result from this new information remain to be determined by CFIA (who are responsible for quarantine measures under the federal Plant Protection Act).

INSECT PESTS OF HARDWOODS

FOREST TENT CATERPILLAR (*Malacosoma disstria* Hbn.)

The outbreak of forest tent caterpillar essentially terminated in 1996, although in some areas increases of satin moth populations made the separation of feeding damage impossible. No damage attributable to forest tent caterpillar was noted in 1997, and very few reports of its presence were received. As forest tent caterpillar outbreaks generally occur about 10-years apart, it is anticipated that the threat of attack by this insect is unlikely for the next several years.

SATIN MOTH (*Leucoma salicis* (L.))

Populations of satin moth appeared on the rise in 1996 and caused defoliation in many areas in conjunction with the declining populations of forest tent caterpillar. In 1997, an aerial survey was conducted (July 21 and 22), and although defoliation was noticed it appeared that the survey was "late" as damaged tress had begun to re-foliate. Consequently, a map of damage was not attempted. In general, defoliation appeared to be very much similar to 1996 with no significant expansion detected, though PDOs in Regions 2, 3, and 4 expressed the view that perhaps damage had intensified. One new small patch was aerially detected in Region 1, about 30-km west of Bathurst.

GREENSTRIPED MAPLEWORM (*Dryocampa rubicunda rubicunda* (F.))

In mid-August, reports were received from a bass fisherman who noted that maples were being defoliated for several kilometres along the Oromocto River between Geary and Fredericton Junction. Based on the description given, the insect responsible was most likely the greenstriped mapleworm.

GYPSY MOTH (*Lymantria dispar* (L.))

Survey activities in 1997 focused on the detection of gypsy moth life stages along the leading edge of infested areas, as well as early detection of life stages in uninfested areas of the Province. These activities included studies to examine overwinter survival of gypsy moth egg-masses, pheromone trapping, and a fall life stage/egg-mass survey. In addition, a new gypsy moth parasitoid was introduced into southwestern New Brunswick in a small-scale trial.

Overwinter Survival: Periods of very low temperatures and the absence of snow cover are factors that negatively affect the overwinter survival of gypsy moth egg-masses. In 1997, a total of 60 egg-masses were collected from four sites to determine overwinter survival and associated studies (e.g. presence of egg parasitoids).

Overall, overwinter survival expressed as the percent of egg-masses with hatch, and percent of eggs hatched from all egg-masses, was lower than the high rate observed in 1996, but greater than the rates recorded in the previous three years (Table 1). When expressed as the percent of eggs hatched from only those egg-masses with hatch, survival was similar to 1994.

Average egg-mass length, width, area, and number of eggs/egg-mass were generally similar to those recorded back to 1993, thus indicating no specific change in the apparent general health of gypsy moth populations over the five-year period according to these parameters. No gypsy moth egg parasitoids were observed in 1997.

Table 1. Comparison of mean gypsy moth egg mass size and overwinter survival at selected sites in New Brunswick from 1993 to 1997.

CATEGORY	YEAR				
	1993	1994	1995	1996	1997
% egg masses with hatch	39.7	42.7	47.7	90.4	71.7
% eggs hatched from egg masses with hatch	16.8	66.6	83.4	77.5	68.3
% of eggs hatched from all egg masses	7.8	28.5	31.8	70.1	49.0
average no. eggs/egg mass	502	501	513	528	583
average egg mass length (cm)	3.4	3.0	3.4	3.2	3.4
average egg mass width (cm)	1.8	1.8	2.0	1.6	1.6
average egg mass area (sq cm)	6.1	5.4	7.0	5.4	5.5

Leading Edge Survey: For this survey, DNRE placed 212 pheromone traps (1 lost) every 5-km along roads radiating away from known positive gypsy moth sites to a distance of 20 km, and CFIA placed 133 traps (6 lost) at varying distances along roadways bordering parishes currently in the Quarantine Zone regulated by them under the federal Plant Protection Act. As in 1996, trap catches were generally highest at known positive sites and decreased with distance away from these baseline traps. Sites with high catches away from known sites were identified for fall life stage/egg mass searches.

Early Detection Survey: This survey was conducted in areas beyond the leading edge by DNRE (103 traps out, 7 lost), CFIA (100 traps out, 1 lost), and Parks Canada (41 traps out, 3 lost) in cooperation with CFS-Atlantic. Trapping locations included parks, tourist areas, towns/villages, sawmills, importing nurseries, and other high risk areas of potential introduction. Results indicated that large areas of the Province remain uninfested with 97% of the sampled locations having negative or very low trap catches (<3 moths/trap). Similar to 1996, one trap placed near a hardwood importing sawmill in the Woodstock area had a trap catch >20 moths/trap. This site was also targeted for fall life-stage/egg-mass searches (see following).

Fall Life-stage/Egg-mass Survey: A total of 262 locations were examined by DNRE in search of gypsy egg masses or evidence of other life stages (e.g. larval or pupal skins). Locations sampled were predominantly within the leading edge, using sites with higher pheromone trap catches to identify areas requiring higher sampling intensity. Also sampled were locations previously known to have life stages detected, but negative within the last several years (e.g. Forest City and Buctouche). Finally, locations with high early detection trap catches, such as the Woodstock site, were also searched.

Of all locations searched: 31 had new egg-masses; 39 had only old egg-masses or other life-stages; and 192 were negative. Only two new positive sites were detected, i.e. Woodstock (two new egg masses) and the Millidgeville Ferry Road (one pupal case). Both are outside areas currently regulated by CFIA. Despite being new finds, there was no evidence of reproducing populations (i.e. no new egg masses). Forest City and Buctouche were again negative.

Overall, gypsy moth population levels in known areas appear to have decreased based on a comparison of 1996 and 1997 egg-mass survey results. No new egg-masses were found in 28 of the 52 locations with new egg-masses in 1996. At 17 locations, although new egg-masses were found in 1997, the number of new egg-masses/person-hour searching decreased from 1996 levels. Only 11 locations had higher numbers of new egg-masses, and there was no increase in the number of new egg-masses found in 19 locations. Pooled results for the 77 locations searched in both years indicate an overall reduction of 67.4% in the total number of new egg-masses found per person-hour searching in 1997.

The above results indicate that gypsy moth populations are not only lower within known areas, but there has been no (or very little) spread or establishment of gypsy moth populations within the leading edge.

Parasitoid Release Trial

Ceranthia samarensis is a tachinid fly parasitoid that is highly specific to gypsy moth. First discovered in Europe, this insect was successfully introduced over a five-year period into two sites in southwestern Ontario[1]. Unlike other introduced parasitoids which attack gypsy moth at outbreak levels, *C. samarensis* attacks gypsy moth larvae at endemic or low population levels. Since populations of gypsy moth are so low in New Brunswick, this parasitoid could be a good addition to natural biological controls already present in the Province.

In 1997, a small trial was conducted in southwestern New Brunswick. The release was done with the permission of Georgia Pacific Corporation on their freehold land, and was conducted by DNRE with the cooperation of CFS researchers at Laurentian and Sault Ste. Marie. The goal for 1997 was to make an initial small-scale release and look for evidence of successful attack and parasitism. The long-term goal is permanent establishment of this beneficial parasitoid in New Brunswick to aid in the natural control of the spread of gypsy moth as well as the prevention of outbreaks; but that will likely require continued releases for several years.

The release site was located along the St. Croix River at Mohannes and was ironically the same site where gypsy moth life stages were first found in 1981 after a 40-year absence. Subsequent to that discovery, the trees were cut and the material chipped on site. This is also the site where CFS - Atlantic released the egg parasitoid *Anastatus japonicus* Ashmead in 1983. The site is now regenerating with a good component of red oak 3-4 m in height originating from cut stumps. One clump of red oak with approximately 15 stems was selected and a 6-7 m buffer cleared around the clump. In the spring, a survey found a few gypsy moth egg-masses within a few hundred metres of the site, though none was found directly on the site itself.

[1] Nealis, V.G. and F.W. Quednau. 1996. Proceedings of the Ent. Soc. of Ont. 127:11-20.

Populations were therefore augmented by placing ~25 000 second and third instar larvae on the foliage and stems of the red oak in the selected clump at the time of leaf-flushing. The larvae were allowed to feed for 2-3 days, after which time some defoliation was evident. *Ceranthia* females use the chemical odour given off by the damaged foliage as a queue for searching for gypsy moth larvae which they then attack.

On June 5, ~150 mated female flies (reared at the CFS - Laurentian Forest Centre) were transported to Fredericton from Quebec City. The next morning, they were brought to the site and ~130 were released (~20 had died before release) under trees within the selected clump. Daily temperatures were very high (30°C range) during the period, and could have negatively affected the survival of *Ceranthia* adults after release as they are vulnerable to temperatures over 25°C. Observations of gypsy moth larvae at the release site revealed no characteristic scarring typical evidence of attack by this paraasitoid.

Drop trays, covering 80-85% of the area under the crowns of trees in the selected clump, were placed on the ground to collect any *Ceranthia* fly maggots that emerged from hosts and dropped to the ground to pupate. Subsequent examination of the soil in these trays found 7 dipterous puparia which were submitted for identification. None, however, was determined to be *Ceranthia* and therefore there was no evidence of successful attack or parasitism. Plans for follow-up activities in 1998 depend on the availability of more parasitoids for release.

DISEASES OF HARDWOODS

BUTTERNUT CANKER (*Sirococcus clavigignenti-juglandacearum* Nair, Kosticha & Kuntz)

According to the CFS (K. Harrison, CFS, pers comm.), this fungal pathogen was confirmed present for the first time in New Brunswick this past summer. One site is located about 12-km north of Woodstock and another four sites close together about 12-km beyond that, near Stickney (Carleton County), in the western part of the Province about 20-km north of Woodstock. These sites are about 25-35 km from Houlton, Me. where the disease has previously been found by Maine authorities. Another distant "suspect" site has also been located in the Province and will be monitored (by CFS) for determination in 1998. The implications of these findings are unclear at this time (e.g. the possibility of eradication or establishment of quarantine regulations by CFIA). This disease has caused grave concern in the United States as indicated in the following excerpts from Ostry *et al.* (1994)[1]:

"Butternut (*Juglans cinerea*) is being killed throughout its range in North America ... Butternut is valued for its wood for furniture, panelling, speciality products, carving and nut production. It is also an important source of wildlife mast and significantly contributes to the biodiversity of forest stands. Butternut is not a common tree anywhere within its range. ...

"The number of butternut trees have been dramatically reduced and it is listed under Category 2 on the list of endangered and threatened plants. This implies there is some evidence of vulnerability, but not enough data supporting listing at this time."

[1] Ostry, M.E., Miekle, M.E. and D.D. Skilling. 1994. Butternut - Strategies for managing a threatened tree. USDA. For. Serv., NEFES Gen. Tech. Rep. NC-165.

SEED ORCHARD MONITORING PROGRAM

This was the 10th year of monitoring (by DNRE's Forest Pest Management Section) of pests in seed orchards operated by DNRE. Cone production was quite limited in 1997. Since no cones were seen in first-generation orchards of white spruce and larch at Queensbury, nor in first-generation orchards of white and black spruce at Pokiok, monitoring efforts focussed on insects and disease which attack the non-reproductive tissues of the trees. At Kingsclear, where a small cone crop was produced in a second-generation black spruce stand and two second-generation jack pine stands, monitoring included assessments of both non-reproductive and reproductive tissues (flowers and cones).

Defoliators caused little damage in 1997. Feeding by the yellowheaded spruce sawfly was responsible for damaging only a few black spruce trees at Pokiok; whereas, populations appeared to have totally collapsed in the Queensbury white spruce. Some webspinning sawfly (*Acantholyda erythrocephala* (L.)) activity was seen in a small second-generation jack pine stand, but little damage resulted. Spruce budworm numbers remain low to undetectable in all spruce orchards.

Egg sampling for spruce cone maggot (*Strobilomyia neathracina* Mich.) and spruce seed moth (*Cydia strobilella* L.) were conducted in the spring, in the second-generation black spruce stand at Kingsclear. Since adults of spruce seed moth had been detected in spring (1997) using a single pheromone trap, it was decided to conduct an assessment of seed moth egg densities in conjunction with a pre-planned cone maggot egg survey. Conelet dissections indicated the combined egg count from these two cone pests was significantly high enough to justify control measures to protect the seed crop for harvest in 1997. An efficacy assessment later in the summer indicated trees treated with the insecticide dimethoate suffered no cone damage, whereas unprotected trees experienced damage to 12% of the cone crop. It is noteworthy that prior to 1997, spruce seed moth populations had only been detected in DNRE's **white** spruce seed orchards, never in **black** spruce orchards.

Gypsy Moth Activities in New Brunswick - 1997

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Survey activities in 1997 focused on the detection of gypsy moth life stages along the leading edge of infested areas, as well as the early detection of gypsy moth life stages in uninfested areas of the province. These activities included pheromone trapping and a fall life stage/egg-mass survey. In addition, work was done to examine overwintering survival of gypsy moth egg masses and to introduce a new gypsy moth parasitoid, the European tachinid fly (*Ceranthia samarensis*) [Vili]) in southwestern New Brunswick. Various federal and provincial cooperators were involved in the surveys.

Activités entreprises contre la spongieuse au Nouveau-Brunswick en 1997

N. Carter

Les relevés effectués en 1997 avaient pour principal objectif de détecter la présence éventuelle de la spongieuse le long de la ligne de front des secteurs infestés et de signaler le plus rapidement possible son apparition éventuelle dans les secteurs encore non infestés de la province. Les relevés ont été réalisés par piégeage (pièges à phéromone) et par dénombrement des masses d'oeufs. On a également déterminé les taux de survie des masses d'oeufs en hiver et procédé à des lâchers d'un nouveau parasitoïde de la spongieuse originaire d'Europe, le *Ceranthia samarensis* (Vili), dans le sud-ouest du Nouveau-Brunswick. Divers chercheurs des gouvernements fédéral et provincial ont participé aux relevés.

Gypsy Moth Activities In New Brunswick – 1997

(Prepared for the Forest Pest Management Forum, held in Ottawa, Nov. 17-20, 1997)

Overview

Survey activities in 1997 focused on the detection of gypsy moth life stages along the leading edge of infested areas, as well as the early detection of gypsy moth life stages in uninfested areas of the Province. These activities included pheromone trapping and a fall life stage/egg-mass survey. In addition, work was done to: 1) examine overwintering survival of gypsy moth egg-masses, and 2) introduce a new gypsy moth parasitoid (European tachinid fly, *Ceranthia samarensis* (Vili.)) in southwestern New Brunswick. Various federal and provincial co-operators were involved in the surveys and trial as follows:

Overwintering Survival	-	N.B. Dept. of Natural Resources and Energy (DNRE)
Pheromone Trapping - Surveys		Canadian Food Inspection Agency (CFIA) Canadian Forest Service – Atlantic/Parks Canada (CFS – Atlantic/Parks Canada)
Life Stage/egg-mass Survey	-	DNRE/CFIA
Parasitoid Trial	-	DNRE Canadian Forest Service – Laurentian Forestry Centre Canadian Forest Service – Great Lakes Forestry Centre Georgia Pacific

Overwintering Survival

Periods of freezing temperatures and the absence of snow cover are thought to be factors affecting the overwintering survival of gypsy moth egg-masses. In 1997, a total of 60 egg-masses were collected from four sites. Egg-masses were reared at room temperature with newly-emerged larvae left for a period of 30 days and subsequently removed and counted to record the number of eggs per egg-mass with hatch. Unhatched eggs were left for another 60 days to allow egg parasite adults, if present, to emerge. At the end of this period, all unhatched eggs per egg-mass were recorded.

Overall, overwintering survival expressed as the percent of egg-masses with hatch and percent of eggs hatched (from all egg-masses) was lower than the high rates observed in 1996, but greater than the rates recorded for 1993, 1994, and 1995 (Table 1). Overwintering survival expressed as the percent of eggs hatched (from only those egg-masses with hatch) was similar to that seen in 1994. These results indicate that hatching rates per egg-mass were similar between these two years, however, a greater percent of egg-masses had egg hatch in 1997 versus 1993, 1994, and 1995.

Average egg-mass length, width, area and number of eggs/egg-mass were similar indicating little, if any, change in the general health of gypsy moth populations over the 1993 to 1997 period. No gypsy moth egg parasite adults were observed in 1997.

Table 1. Comparison of mean gypsy moth egg-mass size and overwintering survival at selected sites in New Brunswick from 1993 to 1997.

Category	Year				
	1993	1994	1995	1996	1997
% of egg- masses with hatch	39.7%	42.7%	47.7%	90.4%	71.67%
% of eggs hatched from egg-masses with hatch	16.8%	66.6%	83.4%	77.5%	68.3%
% of eggs hatched from all egg-masses	7.8%	28.5%	31.8%	70.1%	49.0%
Avg. no. eggs/egg-mass	502	501	513	528	583
Avg. egg-mass length (cm)	3.4	3.0	3.4	3.2	3.4
Avg. egg-mass width (cm)	1.8	1.8	2.0	1.6	1.6
Avg. egg-mass area (sq cm)	6.1	5.4	7.0	5.4	5.5

Pheromone Trapping Surveys

Trapping in 1997 included a leading edge survey and early detection survey. In the leading edge survey, DNRE placed traps every 5-km along roads radiating away from known[1] gypsy moth sites to a distance of 20-km. In addition, CFIA placed traps along roadways bordering currently regulated parishes. A total of 345 traps were placed (Table 2) with trap catch results shown in Figure 1 and Table 3. As in 1996, trap catches were generally highest at known sites and decreased proportionally with distance from these baseline traps. Sites with high captures away from known sites were later targeted for fall life stage/egg-mass searches.

The early detection survey was conducted in areas of the Province beyond the leading edge. Trapping locations included parks, tourist areas, towns/villages, sawmills, importing nurseries and other high risk areas of potential introduction. A total of 244 traps were placed (Table 1) with trap catch results shown in Figure 2 and Table 2. Results indicate that large areas of the Province remain uninfested with 97% of the locations sampled having negative or very low trap catches (<3 moths/trap). As in 1996, one trap placed near a hardwood importing sawmill in the Woodstock area had a trap catch >20 moths/trap. This site was also targeted for fall life-stage/egg-mass searches.

[1] Sites previously detected with gypsy moth life stages other than male moths.

Table 2. Gypsy moth pheromone traps placed, collected and missing by agency and trapping survey – New Brunswick, 1997.

Co-operating Agency	Trapping Survey	Number of Traps Placed	Number of Traps Collected	Number of Traps Missing
CFIA	Early Detection	100	99	1
	Leading Edge	133	127	6
	Totals:	233	226	7
CFS – Atlantic/ Parks Canada	Early Detection	41	38	3
	Leading Edge	0	0	0
	Totals:	41	38	3
DNRE	Early Detection	103	96	7
	Leading Edge	212	211	1
	Totals:	315	307	8
Combined (All Agencies)	Early Detection	244	233	11
	Leading Edge	345	338	7
	Overall Totals:	589	571	18

Table 3. Summary of gypsy moth pheromone trap catches by agency and trapping survey.

Co-operating Agency	Trapping Survey	Trap Catch Ranges (Number of male moths/trap)						Total Male	Mean/ Trap
		0	1-2	3-5	6-10	11-20	>20		
CFIA	Early Detection (n = 99)	76	17	5	0	0	1	73	0.74
		76.8	*17.2*	*5.0*	*0.0*	*0.0*	*1.0*	-	-
	Leading Edge (n = 127)	23	34	32	30	8	0	500	3.94
		18.1	*26.8*	*25.2*	*23.6*	*6.3*	*0.0*	-	-
CFS/Parks Canada	Early Detection (n = 38)	36	2	0	0	0	0	3	0.08
		94.7	*5.3*	*0.0*	*0.0*	*0.0*	*0.0*	-	-
DNRE	Early Detection (n = 96)	81	14	1	0	0	0	19	0.20
		84.4	*14.6*	*1.0*	*0.0*	*0.0*	*0.0*	-	-
	Leading Edge (n = 211)	49	56	39	22	19	23	1314	6.23
		23.2	*26.5*	*18.5*	*10.4*	*9.0*	*10.9*	-	-
Combined (all agencies)	Early Detection (n = 233)	193	33	6	0	0	1	95	0.41
		82.8	*14.2*	*2.6*	*0.0*	*0.0*	*0.4*	-	-
	Leading Edge (n = 338)	72	90	71	52	27	23	1814	5.37
		21.3	*26.6*	*21.0*	*15.4*	*8.0*	*6.8*	-	-

[1] Percentages shown in italics.

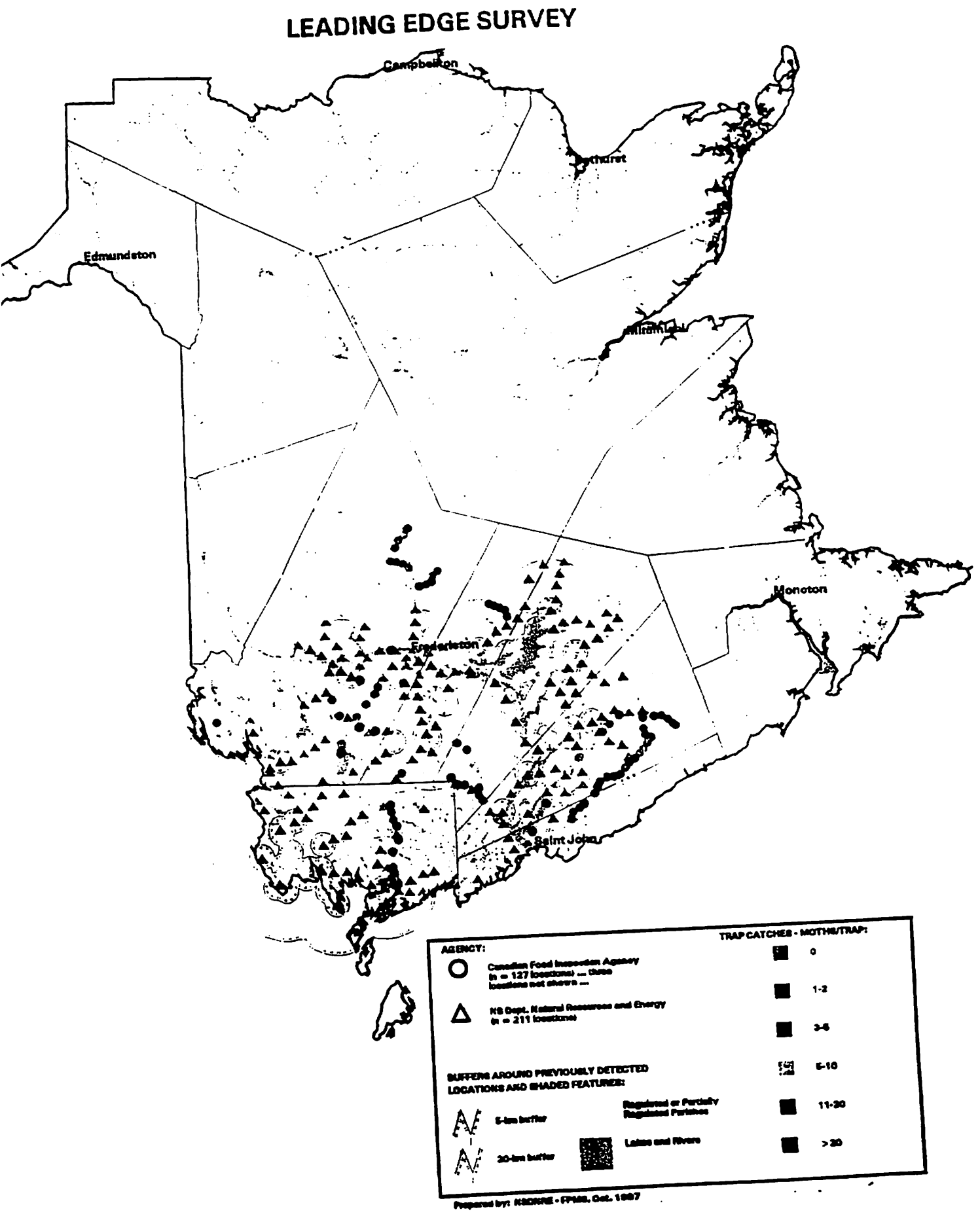

Figure 1. Location of gypsy moth pheromone traps, Leading Edge Survey – New Brunswick, 1997.

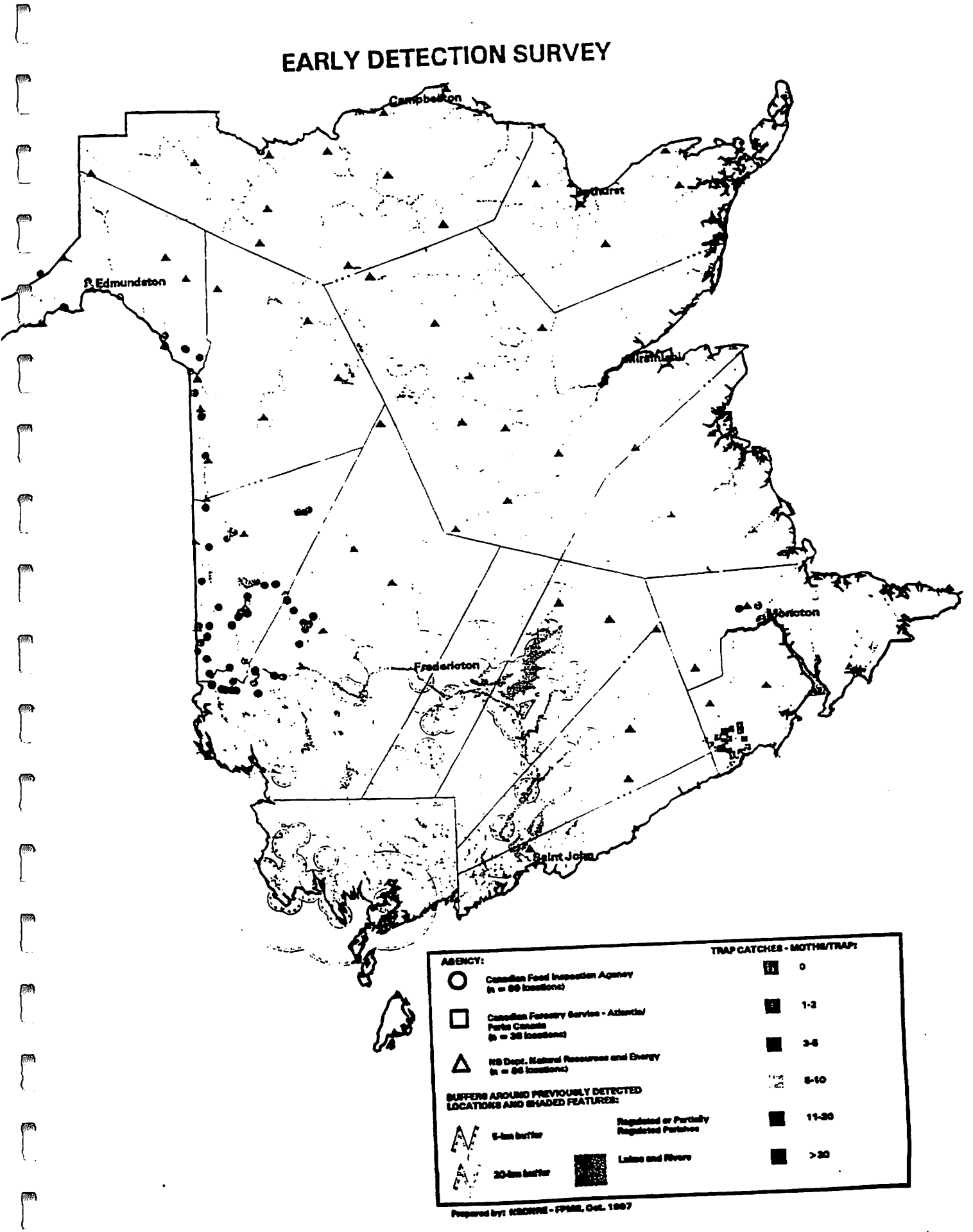

Figure 2. Location of gypsy moth pheromone traps, Early Detection Survey – New Brunswick, 1997.

Fall Life-stage/Egg-mass Survey (DNRE data only)

Fall life-stage/egg-mass surveys were conducted at 262 locations. Locations sampled were predominantly within the leading edge with pheromone trap catches (i.e. higher catches) used to identify areas requiring a higher sampling intensity. Locations identified with positive life stages, but negative within the last several years were also sampled (eg. Forest City, Buctouche). Locations with high early detection trap catches (such as the Woodstock site) were also searched for life stages.

Of the 262 sites or locations searched, 31 had new egg-masses, 39 had only old egg-masses or other life-stages, and 192 were negative (Figure 3). Only two new positive sites were detected, Woodstock and the Millidgeville Ferry Road. Both are outside currently regulated areas. Despite being new finds, at both sites there was no evidence of reproducing populations (i.e. Woodstock – no old egg-masses; Ferry Road – no new egg-masses).

Overall, gypsy moth population levels in known areas appear to have decreased based on a comparison of 1996 and 1997 egg-mass survey results. No new egg-masses were found in 28 of the 52 locations found with new egg-masses in 1996. In 17 of these locations, although new egg-masses were found in 1997, the number of new egg-masses/person-hour searching decreased from 1996 levels. Only 11 locations had higher numbers of new egg-masses, and there was no increase in the number of new egg-masses found in 19 locations. Pooled results for the 77 locations searched in 1996 and 1997 indicate an overall reduction of 67.4% in the total number of new egg-masses found between these two years.

The above results indicate that gypsy moth populations are not only lower within known areas, but it appears that there has been no or very little spread and establishment of gypsy moth populations within the leading edge.

Parasitoid (*C. samarensis*) Trial

C. samarensis is a tachinid fly parasitoid that is highly specific to gypsy moth. First discovered in Europe, this insect was successfully introduced over a five-year period into two sites in southwestern Ontario. Unlike other introduced parasitoids which attack gypsy moth at outbreak levels, *C. samarensis* has been credited with the capacity of controlling gypsy moth at endemic or low population levels. In 1997, a small trial was conducted in southwestern N.B. involving the release of this parasitoid. The goal for 1997 was to provide evidence of successful attack and parasitism by this insect. The long-term goal is evidence of permanent establishment of this beneficial parasitoid.

Permission was obtained from Georgia Pacific to conduct the trial on land owned by them along the St. Croix River in Mohannes. Ironically this site was the same site where gypsy moth life stages were first found in 1981 after a 40-year absence. Subsequent to this discovery, the site was cut and material chipped on site. The site is now regenerating with a good component of red oak 3-4 m in height originating from cut stumps. One clump of red oak with approximately 15 stems was selected and a 6-7 m buffer cleared around the clump. Although gypsy moth egg-masses were present within the area, populations were insufficient for the trial.

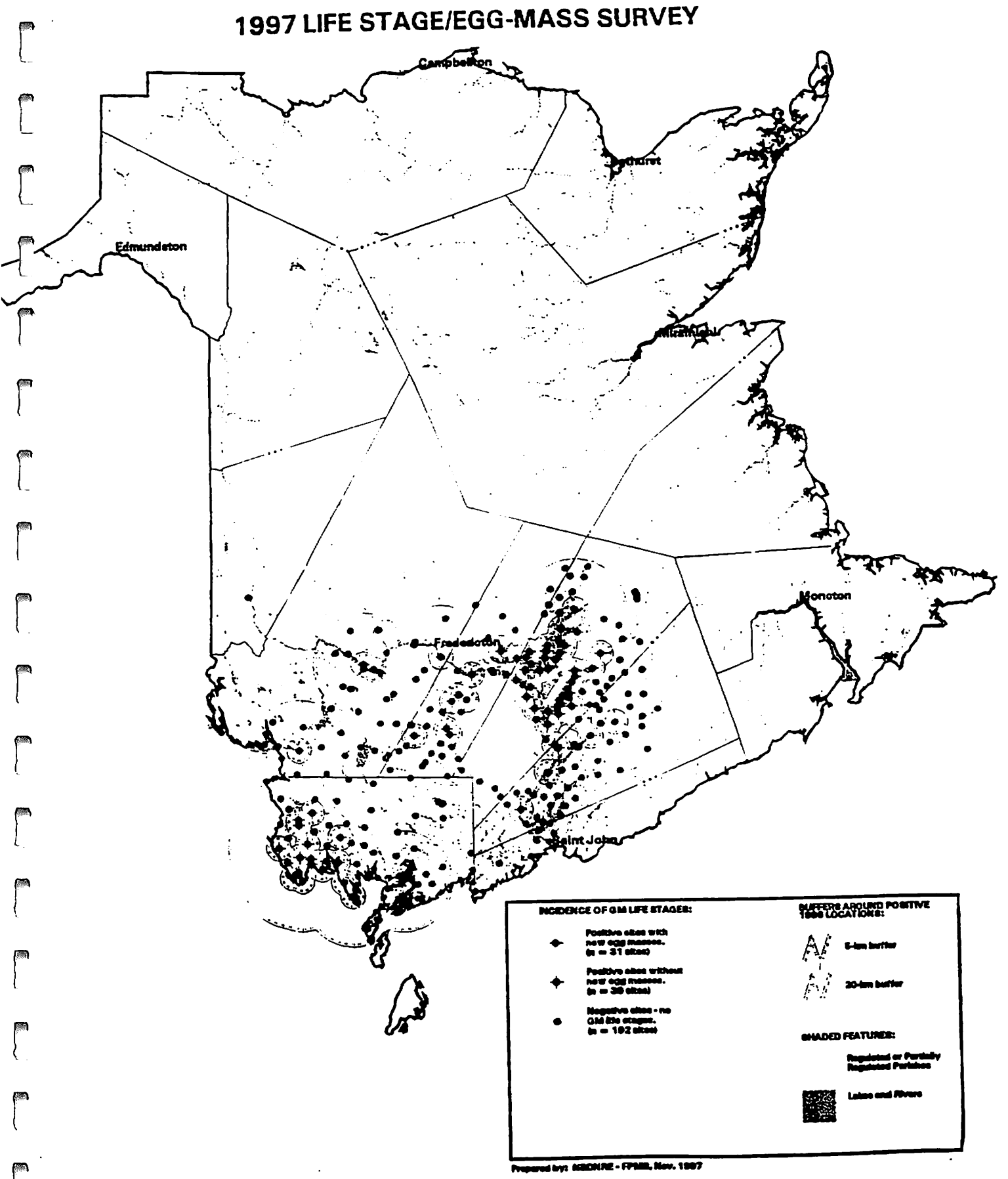

Figure 3. Locations sampled in the fall of 1997 for gypsy moth egg-masses or life stages other than male moths —New Brunswick.

Populations were therefore augmented by placing approximately 25 000 2nd and 3rd instar larvae on the foliage and stems of the red oak in the selected clump. This was timed to correspond with leaf-flushing. The larvae were allowed to feed for 2-3 days, after which time some defoliation and damage was evident. *Ceranthia* females use the chemical signature given off from the damaged foliage as a queue for searching for gypsy moth larvae.

Gravid female flies, reared and mated at the Canadian Forest Service-Laurentian Forest Centre, were subsequently released (free release) under trees within the selected clump. Unfortunately only a small number of flies (ca. 130) were released. Subsequent observations of larvae revealed no characteristic scarring or evidence of attack. Drop trays, covering 80-85% of the area under the crowns of trees in the selected clump, were placed on the ground to collect any *Ceranthia* fly maggots emerging from hosts and dropping to the ground to pupate.

Subsequent examination of these trays found no *Ceranthia* puparia and therefore no evidence of attack and successful parasitism. Plans for follow-up in 1998 have not yet been developed.

Sommaire du Relevé des Insectes et des Maladies des Arbres au Québec en 1997

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Les dégâts causés par les principaux insectes défoliateurs des résineux n'ont pas connu de progression importante en 1997. Les superficies défoliées par la tordeuse des bourgeons de l'épinette sont comparables à celles enregistrées l'année dernière alors que l'infestation de l'arpenteuse de la pruche n'a pas causé les défoliations anticipées. Les populations de la tordeuse du pin gris ont poursuivi leur régression dans le seul foyer qui avait persisté en 1996. Les dégâts causés par le porte-case du mélèze ont toutefois augmenté considérablement cette année. Le porte-case du bouleau a été le principal problème entomologique détecté dans les forêts feuillues. Le charançon du pin blanc et la tenthrède à tête jaune de l'épinette demeurent les ravageurs qui causent le plus de dommages dans les plantations.

Les principaux faits marquants de l'année sont:

. le maintien de l'infestation de tordeuses des bourgeons de l'épinette dans la région de l'Outaouais;

. la chute spectaculaire des populations d'arpenteuses de la pruche dans plusieurs secteurs du nord-est de la région de la Gaspésie-Îles-de-la-Madeleine;

. la poursuite de la régression des populations de tordeuses du pin gris dans la région de l'Outaouais;

. les dégâts causés par le porte-case du mélèze dans plusieurs régions du Québec;

. le maintien à un niveau endémique des populations de spongieuses dans la presque totalité de son aire de distribution dans la province;

.. les défoliations encore importantes causées par le porte-case du bouleau dans les régions du Saguenay-Lac-Saint-Jean, de la Côte-Nord et de la Gaspésie-Îles-de-la-Madeleine;

. la chute des populations de la noctuelle décolorée dans l'ensemble des secteurs infestés en 1996;

. la diminution des dégâts causés par la tenthrède à tête jaune de l'épinette dans le centre et dans l'est du Québec.

Sommaire du Relevé des Insectes et des Maladies des Arbres au Québec en 1997

(Survey of Forest Insects and Diseases in Quebec in 1997)

Clément Bordeleau

In coniferous forests, there was no significant increase in 1997 of damage caused by the principal defoliating insects. The size of the areas defoliated by spruce budworm was comparable to 1996, while hemlock looper infestation did not cause the anticipated damage. Jack pine budworm populations continued to regress at the sole site of infestation that had persisted in 1996. However damage caused by larch casebearer increased considerably this year. In deciduous forests, the main insect problem was the birch casebearer. At plantations, the white pine weevil and the yellowheaded spruce sawfly continued to cause the most damage.

Here are the year's highlights:

- continuation of the spruce budworm infestation in the Outaouais region
- spectacular drop in hemlock looper populations in several areas in the northeastern part of the Gaspé - Magdalen Islands region
- continued regression of jack pine budworm populations in the Outaouais region
- damage by larch casebearer in several regions of Quebec
- maintenance at endemic levels of gypsy moth populations, throughout nearly its entire range in the province
- continued significant defoliation by birch casebearer in several regions of the province: Saguenay - Lac-Saint-Jean, North Shore, and Gaspé - Magdalen Islands
- drop in populations of aspen twoleaf tier in all areas infested in 1996
- reduced damage by yellowheaded spruce sawfly in central and eastern Quebec.

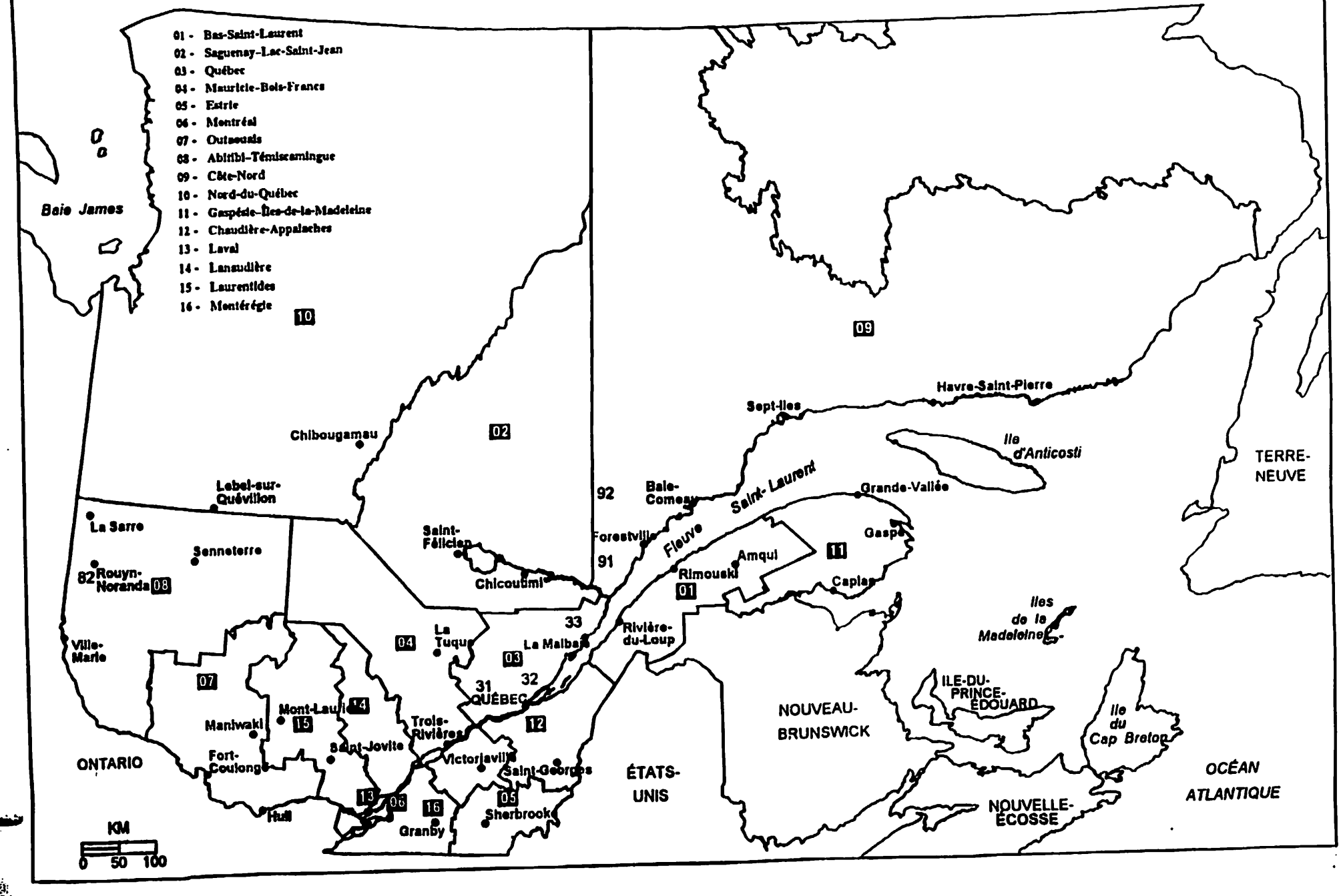
SOMMAIRE DU RELEVÉ DES INSECTES ET DES MALADIES DES ARBRES AU QUÉBEC EN 1997

PAR
CLÉMENT BORDELEAU

DIRECTION DE LA CONSERVATION DES FORÊTS
MINISTÈRE DES RESSOURCES NATURELLES DU QUÉBEC

Rapport préparé pour le Forum sur la répression des ravageurs forestiers, Ottawa, du 17 au 20 novembre 1997

LES RÉGIONS ADMINISTRATIVES DU QUÉBEC



TORDEUSE DES BOURGEONS DE L'ÉPINETTE
Choristoneura fumiferana (Clem.)

INFESTATION

L'infestation de tordeuses relevée depuis 1992 dans la région de l'Outaouais n'a pas connu de progression en 1997. L'épidémie demeure localisée au sud de cette région ainsi que dans le foyer détecté en 1995 dans la région de la Mauricie–Bois-Francs. Dans la région de l'Outaouais, les dégâts sont demeurés principalement circonscrits à l'intérieur du périmètre délimité par les localités de Fort-Coulonge, Kazabazua et Gatineau. Les aires infestées sont comparables à celles relevées l'année dernière, tant en étendue qu'en intensité; seules quelques variations locales ont été observées. L'infestation a également peu progressé dans le foyer localisé près de Drummondville dans la région de la Mauricie–Bois-Francs; les dégâts enregistrés dans ce secteur sont revenus, après une légère baisse observée en 1996, au même niveau qu'en 1995. Aucune défoliation n'a été relevée ailleurs dans la province. La superficie totale infestée au Québec en 1997 couvre 5 162 hectares, comparativement à 5 234 hectares en 1996. Les dégâts se sont avérés modérés ou graves sur près de 85 % de la superficie défoliée.

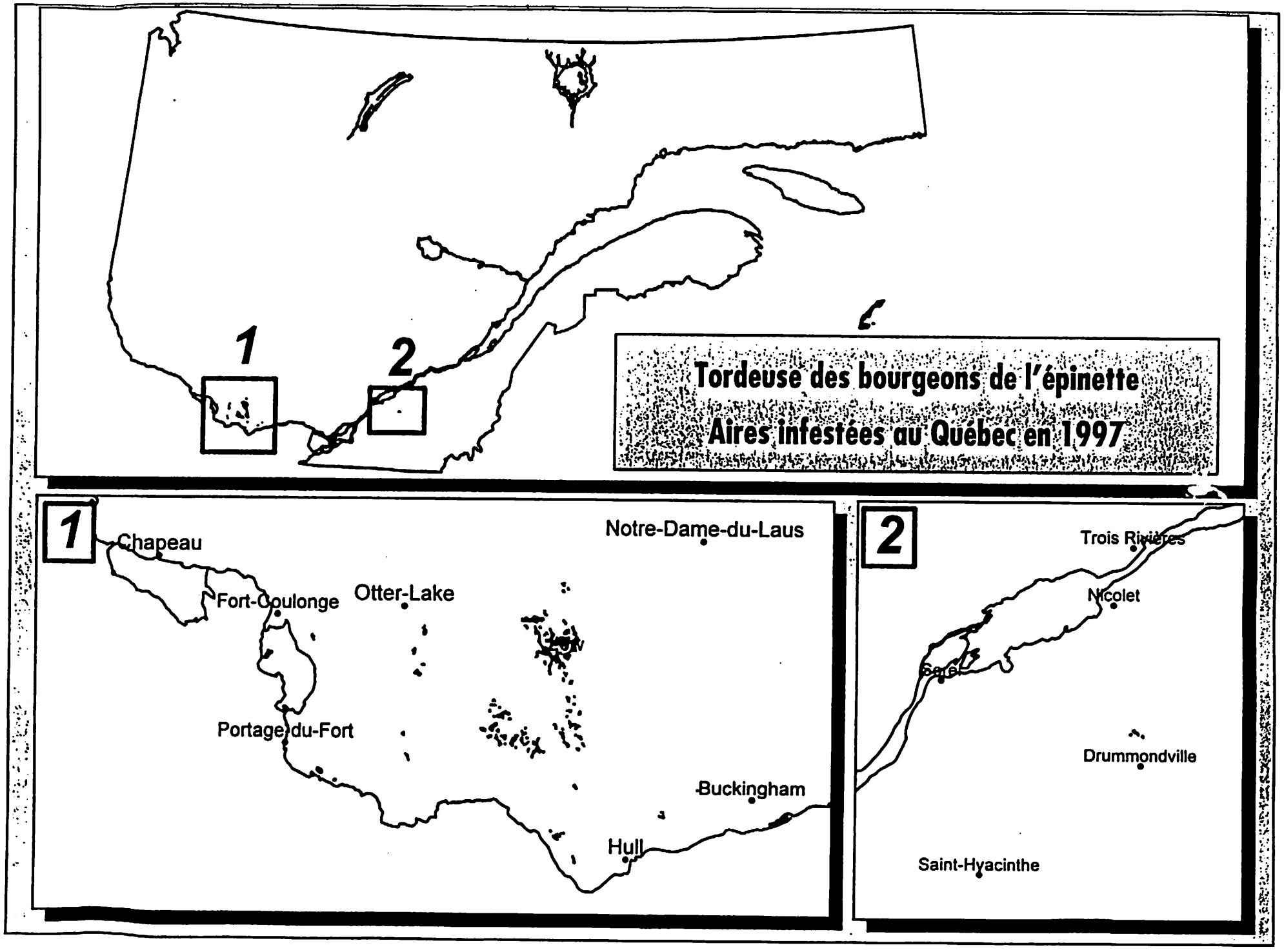
Tableau 1 - Superficies (ha) affectées par la tordeuse des bourgeons de l'épinette au Québec en 1997

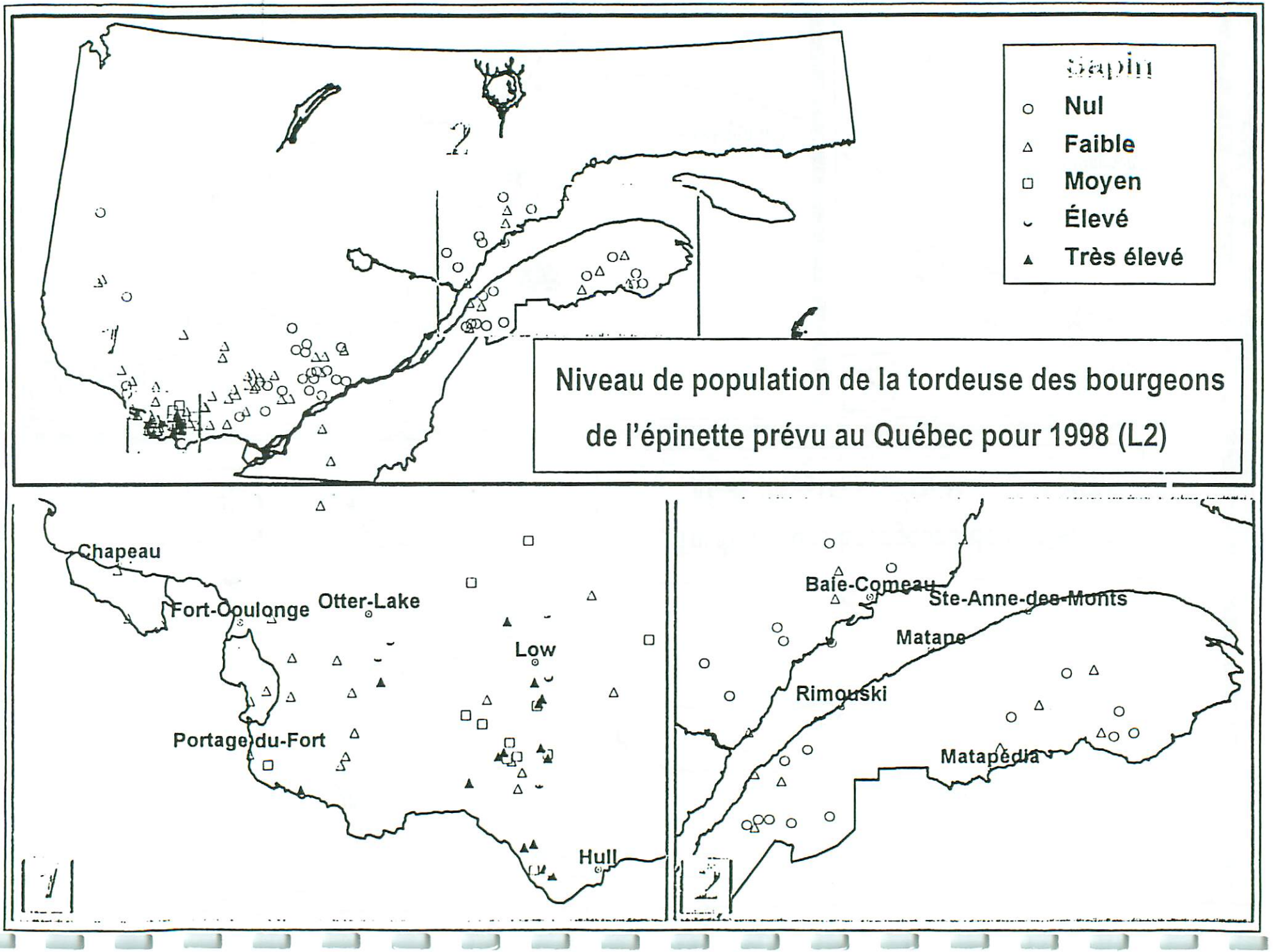
Régions administratives	Niveaux de défoliation			Total
	Léger	Modéré	Grave	
Outaouais	771 (638)*	779 (784)	3 522 (3 778)	5 072 (5 200)
Mauricie–Bois-Francs	29 (25)	36 (9)	25 (0)	90 (34)
Grand total	800 (663)	815 (793)	3 547 (3 778)	5 162 (5 234)

* ( ) = Superficies affectées en 1996

PRÉVISIONS POUR 1998

L'inventaire des larves en hibernation (L2) a été réalisé dans quelque 280 sites répartis dans toute la province. Les résultats ne sont actuellement disponibles que pour environ 50 % des sites. Ils indiquent que la situation en 1998 devrait être relativement semblable à celle de cette année. Des populations de tordeuses ont été relevées dans toutes les régions de la province, mais les défoliations demeureront circonscrites sensiblement dans le même périmètre qu'en 1997. L'infestation ne devrait progresser que très légèrement au nord et à l'est de la zone infestée cette année. Aucune expansion majeure de l'infestation n'est anticipée à date pour l'an prochain. Les dégâts continueront d'être importants dans la région de l'Outaouais, particulièrement dans le bassin de la rivière Gatineau.


1
2
Tordeuse des bourgeons de l'épinette
Aires infestées au Québec en 1997
1
Chapeau
Notre-Dame-du-Laus
Fort-Coulonge
Otter-Lake
Portage-du-Fort
Buckingham
Hull
2
Trois Rivières
Nicolet
Sorel
Drummondville
Saint-Hyacinthe


Sapin
Nul
Faible
Moyen
Élevé
Très élevé
Niveau de population de la tordeuse des bourgeons de l'épinette prévu au Québec pour 1998 (L2)
Chapeau
Fort-Coulonge
Otter-Lake
Low
Portage-du-Fort
Hull
Baie-Comeau
Ste-Anne-des-Monts
Matane
Rimouski
Matapédia

ARPENTEUSE DE LA PRUCHE
Lambdina fiscellaria (Guen.)

INFESTATION

L'épidémie de l'arpenteuse de la pruche qui était prévue dans la région de la Gaspésie–Îles-de-la-Madeleine n'a pas connu l'envergure anticipée. La relevé des œufs effectué à l'automne 1996 indiquait que quelque 130 000 hectares de sapinières vulnérables à l'insecte pourraient y être fortement infestés en 1997. Les dégâts enregistrés l'été dernier n'ont finalement couvert qu'une superficie d'environ 12 700 hectares localisés principalement au nord-est de la péninsule gaspésienne. Une chute des populations attribuable à un parasite des œufs, *Telenomus* sp., est survenue au cours du printemps. L'importance de ce parasite dans les populations peut être probablement attribuable au printemps tardif qui a retardé l'éclosion des œufs. Bien que la progression ait été moins importante que celle attendue, les superficies défoliées ont toutefois augmenté par rapport à 1996 (7 848 ha). Une progression a été notée dans le parc national de Forillon et sur les terrains privés de l'est de la péninsule. Des dégâts ont été également relevés dans les bassins des rivières York, Saint-Jean, Darmouth et Mont-Louis, ainsi que près des Monts Barry. Une mortalité d'arbres variant de 5 % à 25 % a aussi été observée sur près de 2 000 hectares. Celle-ci fut enregistrée dans des secteurs qui ont été défoliés pour une deuxième année consécutive. Une proportion importante de cette mortalité s'est produite dans de vieux peuplements situés sur des pentes fortes.

Des infestations locales ont été encore signalées sur au-delà de 700 hectares au sud-ouest de l'Île d'Anticosti. L'épidémie a cependant chuté dans la majorité des foyers rapportés au cours des dernières années, alors qu'un nouveau secteur localisé au sud-est de la rivière Jupiter était infesté. Aucun dégât n'a été relevé cette année dans le foyer qui avait été rapporté l'année dernière au nord de Natashquan dans la région de la Côte-Nord. Les aires totales infestées par l'arpenteuse au Québec en 1997 couvrent quelque 13 400 hectares, comparativement à 8 900 hectares en 1996.

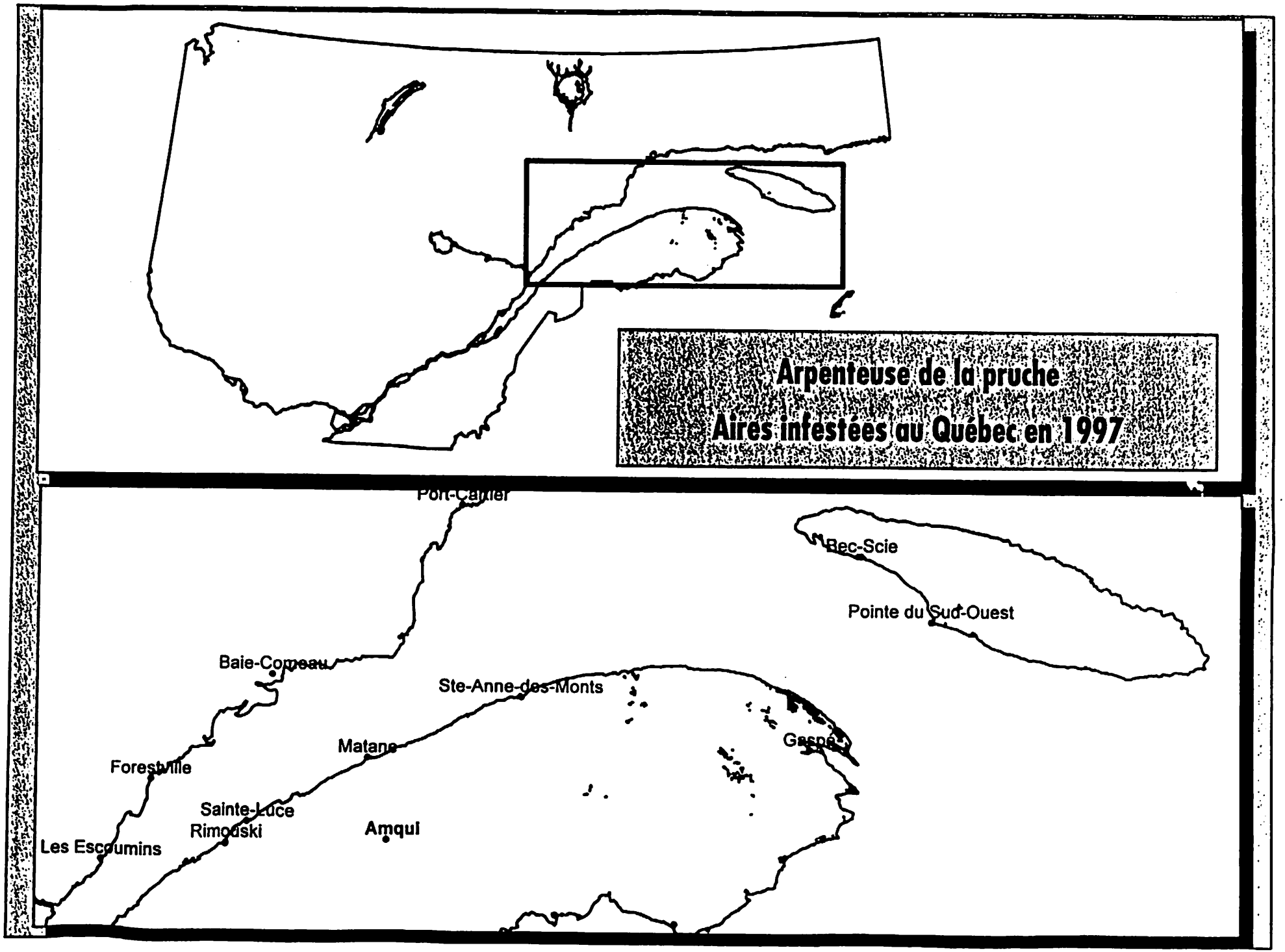
Tableau 2 - Superficies (ha) affectées par l'arpenteuse de la pruche au Québec en 1997

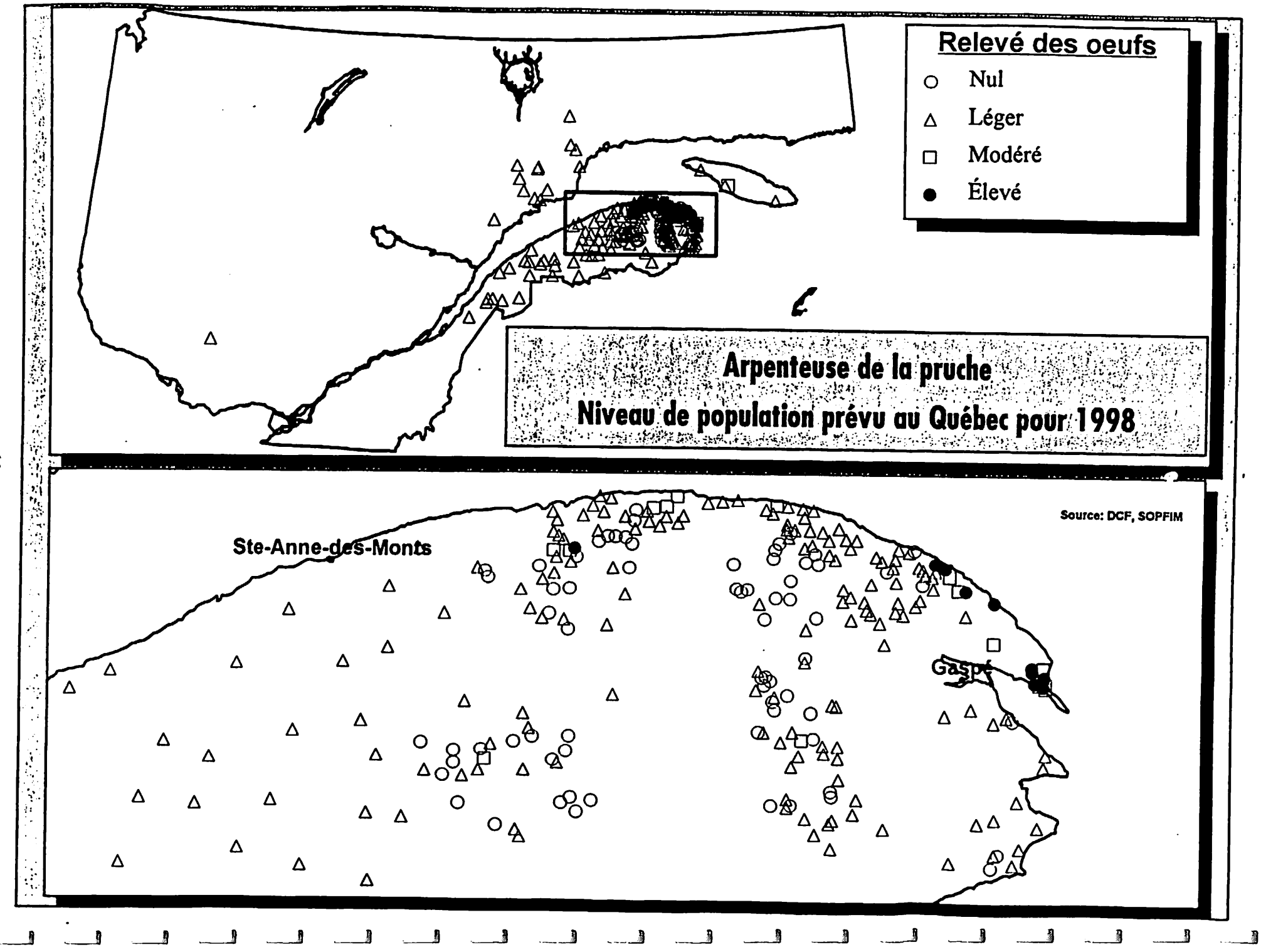
Régions administratives	Niveaux de défoliation			Total
	Léger	Modéré	Grave	
Bas-Saint-Laurent	0 (0)*	0 (32)	0 (0)	0 (32)
Côte-Nord	0 (20)	480 (279)	237 (760)	717 (1 059)
Gaspésie–Îles-de-la-Madeleine	747 (1 730)	6 769 (4 071)	5 152 (2 047)	12 668 (7 848)
Grand total	747 (1 750)	7 249 (4 382)	5 389 (2 807)	13 385 (8 939)

* ( ) = Superficies affectées en 1996

PRÉVISIONS 1998

Un relevé des œufs a été effectué à l'automne dans les régions de l'est du Québec. Quelque 350 sites ont été échantillonnés, dont près de 200 par la SOPFIM dans la péninsule gaspésienne. Les résultats partiels de ces relevés montrent que les populations d'oeufs d'arpenteuses sont généralement à un niveau faible, à l'exception d'une étroite bande de territoire localisée sur le versant nord de la péninsule gaspésienne et s'étendant d'Anse-à-Valleau au parc national de Forillon. Ce territoire a été défolié gravement en 1997 et pourrait être encore infesté l'an prochain. Des populations de niveau modéré n'ont été relevées que dans quelques autres secteurs restreints de la Gaspésie. Aucune infestation majeure n'est prévue sur l'Île d'Anticosti; les dégâts devraient demeurer circonscrits dans quelques foyers localisés au sud de l'île.


Arpenteuse de la pruche
Aires infestées au Québec en 1997
Port-Cartier
Bec-Scie
Pointe du Sud-Ouest
Baie-Comeau
Ste-Anne-des-Monts
Matane
Gaspé
Forestville
Sainte-Luce
Rimouski
Amqui
Les Escoumins


Relevé des oeufs
Nul
Léger
Modéré
Élevé
Arpenteuse de la pruche
Niveau de population prévu au Québec pour 1998
Source: DCF, SOPFIM
Ste-Anne-des-Monts
Gaspé

TORDEUSE DU PIN GRIS
Choristoneura pinus Free.

INFESTATION

Les populations de la tordeuse du pin gris ont poursuivi leur régression dans le seul foyer qui était encore actif en 1996 dans la région de l'Outaouais. Les dégâts qui y ont été enregistrés cette année ont été très faibles. Aucune défoliation n'a été relevée ailleurs dans la province.

Tableau 3 - Superficies (ha) affectées par la tordeuse du pin gris au Québec en 1997

Région administrative	Niveaux de défoliation			Total
	Léger	Modéré	Élevé	
Outaouais	0 (228)*	0 (84)	0 (0)	0 (312)

* ( ) = Superficies affectées en 1996

SPONGIEUSE
Lymantria dispar (L.)

INFESTATION

Les populations de la spongieuse ont continué à se maintenir à un niveau endémique dans la presque totalité de son aire de distribution au Québec. Des défoliations légères n'ont été enregistrées que dans quelques foyers de faibles superficies localisés dans les régions de la Montérégie, de l'Outaouais et de la Mauricie–Bois-Francs. Les dégâts causés par l'insecte ont été négligeables au cours des cinq dernières années.

LIVRÉE DES FORÊTS
Malacosoma disstria Hbn.

INFESTATION

La livrée des forêts n'a pas causé de dégâts importants au Québec en 1997. Les quelques foyers d'infestation rapportés en 1996 dans la région de la Mauricie–Bois-Francs ont tous périclité cette année. La présence de l'insecte a été cependant signalée plus fréquemment dans la région de l'Abitibi-Témiscamingue; les défoliations y ont été toutefois peu apparentes.

TORDEUSE DU TREMBLE
Choristoneura conflictana (Wlk.)

INFESTATION

Les populations de la tordeuse du tremble ont connu une baisse marquée au cours des dernières années. Les dégâts causés par l'insecte ont été peu importants en 1997. Seules les infestations locales rapportées l'année dernière dans la région de l'Estrie se sont maintenues. Des défoliations ont été relevées dans quatre foyers couvrant quelque 270 hectares.

NOCTUELLE DÉCOLORÉE
Enargia decolor (Wlk.)

INFESTATION

La régression des populations de la noctuelle décolorée amorcée en 1996 dans les régions de l'Abitibi-Témiscamingue, de Lanaudière et de la Mauricie–Bois-Francs s'est poursuivie en 1997. L'ensemble des foyers d'infestation ont connu un déclin marqué cette année. Des défoliations mineures n'ont été relevées qu'au sud de la région de l'Abitibi-Témiscamingue.

PORTE-CASE DU BOULEAU
Coleophora serratella (L.)

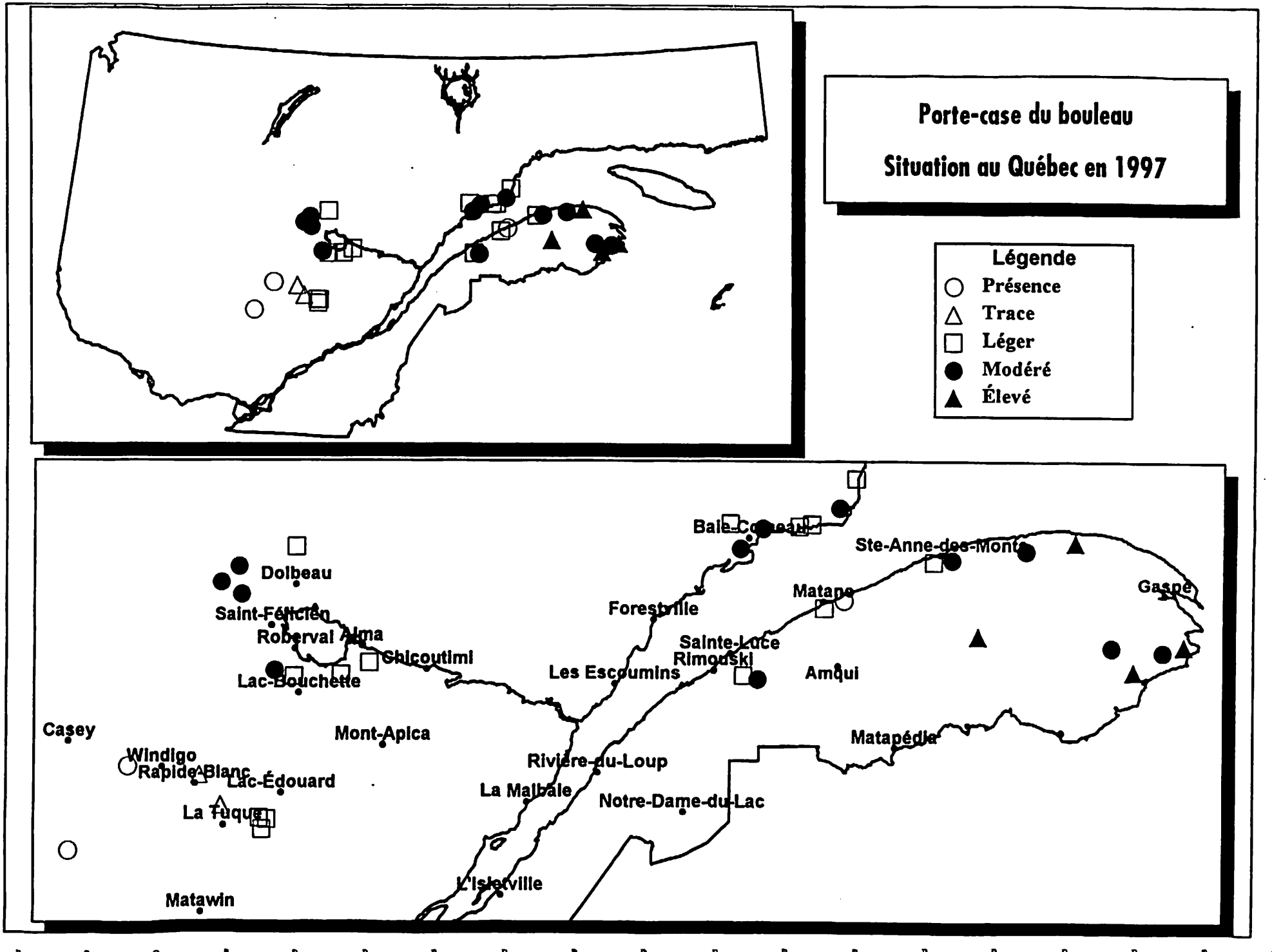
INFESTATION

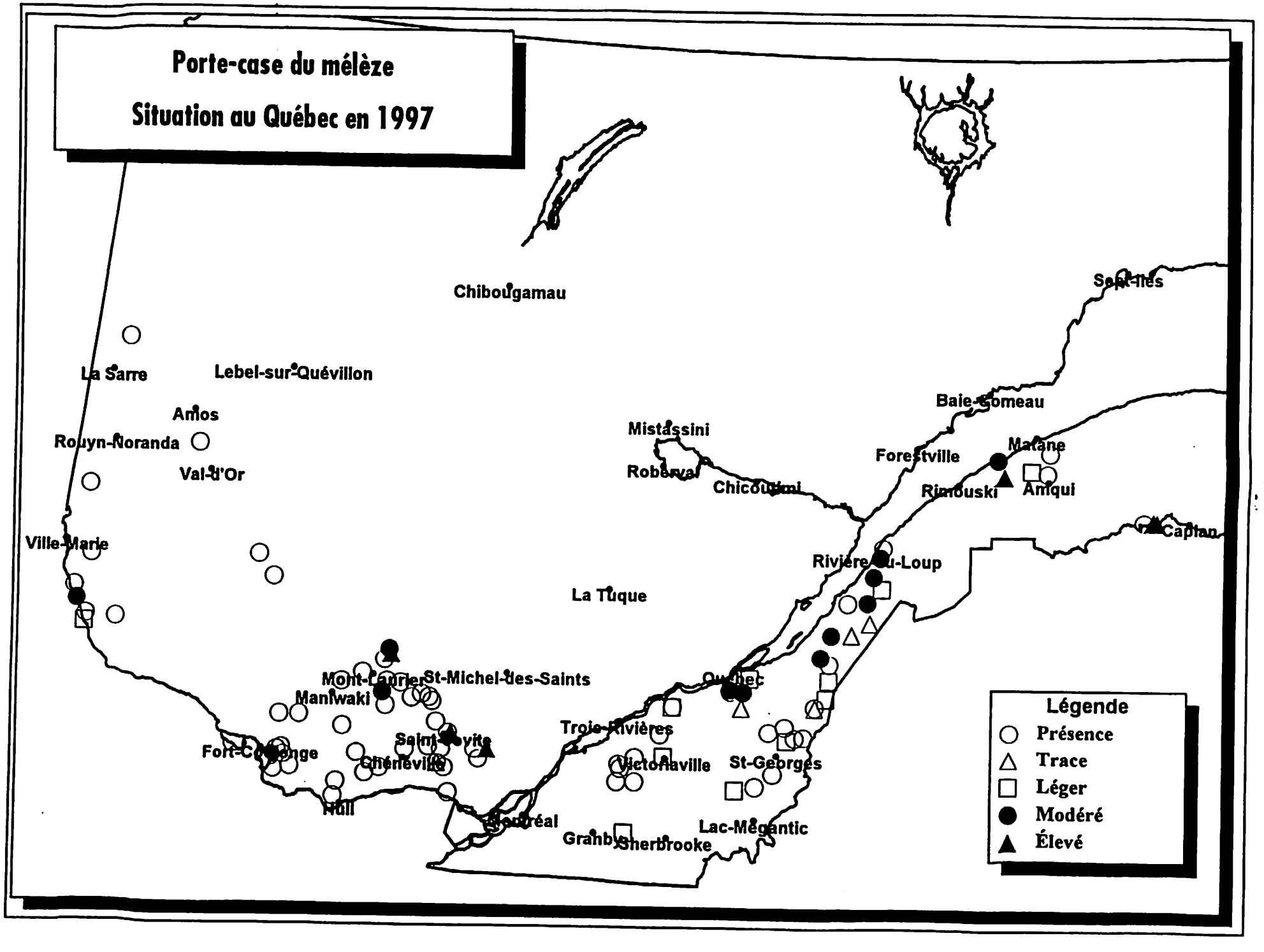
Le porte-case du bouleau a causé, pour une troisième année consécutive, des défoliations au centre et à l'est du Québec. Malgré une baisse marquée des dégâts en 1997, l'insecte persiste sur plusieurs territoires. Des défoliations modérées à élevées ont été relevées localement dans les régions de la Gaspésie–Îles-de-la-Madeleine et du Bas-Saint-Laurent et de la Côte-Nord. Dans l'ensemble de ces régions, la distribution des superficies défoliées est devenue plus irrégulière et les dégâts sont souvent confinés sur des arbres isolés et localisés en bordure de routes.

PORTE-CASE DU MÉLÈZE
Coleophora laricella (Hbn.)

INFESTATION

Le porte-case du mélèze a été signalé d'une manière importante dans plusieurs régions du Québec. Il a causé des défoliations modérées à graves dans plusieurs secteurs des régions de l'Abitibi-Témiscamingue, de l'Outaouais et des Laurentides. La présence de l'insecte a été détectée dans toutes les régions situées au sud du fleuve Saint-Laurent; des dégâts légers à modérés ont été, entre autres, relevés dans les régions de Chaudière-Appalaches et du Bas-Saint-Laurent, alors qu'une mélèzaie d'une trentaine d'hectares a été gravement défoliée dans la région de la Gaspésie–Îles-de-la-Madeleine.


Porte-case du bouleau
Situation au Québec en 1997
Légende
Présence
Trace
Léger
Modéré
Élevé
Baie-Comeau
Ste-Anne-des-Monts
Gaspé
Matane
Forestville
Sainte-Luce
Rimouski
Amqui
Les Escoumins
Dolbeau
Saint-Félicien
Roberval
Alma
Chicoutimi
Lac-Bouchette
Casey
Windigo
Rapide-Blanc
Lac-Édouard
La Tuque
Mont-Apica
Rivière-du-Loup
La Malbaie
Notre-Dame-du-Lac
Matapédia
L'Isletville
Matawin


Porte-case du mélèze
Situation au Québec en 1997
Chibougamau
La Sarre
Lebel-sur-Quévillon
Amos
Rouyn-Noranda
Val-d'Or
Ville-Marie
La Tuque
Mistassini
Roberval
Chicoutimi
Sept-Îles
Baie-Comeau
Forestville
Matane
Rimouski
Amqui
Rivière-du-Loup
Mont-Laurier
St-Michel-des-Saints
Maniwaki
Saint-Sauveur
Chénéville
Fort-Coulonge
Hull
Montréal
Granby
Sherbrooke
Trois-Rivières
Victoriaville
Québec
St-Georges
Lac-Mégantic
Légende
Présence
Trace
Léger
Modéré
Élevé

PLANTATIONS

TENTHRÈDE À TÊTE JAUNE DE L'ÉPINETTE
Pikonema alaskensis (Roch.)

Des défoliations importantes ont été encore relevées localement cette année dans les plantations d'épinettes des régions de Québec, de Chaudière-Appalaches, du Bas-Saint-Laurent et de la Gaspésie–Îles-de-la-Madeleine. Les dégâts causés par l'insecte ont été généralement moins intenses qu'en 1996. Ils demeurent circonscrits dans quelques plantations. Un relevé aérien, qui a été conduit au cours des deux dernières années dans les secteurs les plus à risque, montrent que les superficies infestées et l'intensité des dégâts ont généralement diminué en 1997, sauf dans la région de Chaudière-Appalaches où la gravité des dégâts a augmenté par rapport à 1996. La mortalité d'arbres a été observée localement mais elle demeure faible et limitée sur de très petites superficies des plantations affectées.

CHARANÇON DU PIN BLANC
Pissodes strobi (Peck)

Le charançon du pin blanc est présent dans toutes les régions du Québec. La situation est généralement demeurée stable en 1997 à l'échelle de la province. La proportion de plantations d'épinettes atteintes par l'insecte dans le réseau de surveillance est semblable à celle de l'année dernière (26 %), alors que le nombre de plantations de pins affectées est en légère progression par rapport à 1996 (18 %). Le taux d'arbres atteints n'a cependant pas évolué.

CHANCRE SCLÉRODERRIEN
Gremmeniella abietina (Lagerberg)

La présence de la maladie du chancre scléroderrien a été enregistrée plus fréquemment dans la province en 1997. Le nombre de plantations infectées ainsi que le taux d'arbres atteints ont augmenté. Les progressions les plus marquées ont été observées dans les régions de l'Outaouais, du Saguenay–Lac-Saint-Jean, de la Mauricie–Bois-Francs et de la Côte-Nord. Les fortes accumulations de neige enregistrées à l'hiver 1996-1997 semble avoir favorisé la progression de la maladie.

ROUILLE VÉSICULEUSE DU PIN BLANC

Cronartium ribicola J.C. Fish

La maladie de la rouille vésiculeuse du pin blanc a continué de progresser dans les plantations de pins blancs du réseau de surveillance. Les progressions ont été observées plus particulièrement dans les régions de l'Abitibi-Témiscamingue et de l'Outaouais. La maladie est presque omniprésente dans l'ensemble des plantations surveillées dans la province.

CB/nf

1997-11-14

Forest Protection Program against Hemlock Looper in Eastern Quebec - 1997

A. Dupont
Forestry Branch
Société de Protection des Forêts contre les Insectes et Maladies

In 1997, SOPFIM planned to conduct aerial spraying operations against the hemlock looper in eastern Quebec. The program was intended to protect 62,822 ha of mature balsam fir forest located on Crown lands (94%) and private woodlots (6%) in the Gaspé region.

An aerial damage survey was conducted by QMNR in 1996. In the Gaspé region, 7,848 ha of balsam fir forests were defoliated. Overwintering eggs were sampled at 215 locations to forecast larval populations and defoliation for 1997. A forest protection program was prepared on the basis of this information, with *B.t.* to be sprayed over 62,822 ha.

In June, an egg survey was done to identify the causes of high mortality (30-100%) in the infested area. Two parasitoid species were identified, *Trichogramma* sp. and *Telenomus* sp., which were responsible for 64% of total mortality.

SOPFIM and QMNR have established a 300-plot network to forecast subsequent hemlock looper population levels.

Programme de protection des forêts contre l'arpenteuse de la pruche dans l'est du Québec - 1997

A. Dupont

En 1997, la SOPFIM envisageait d'effectuer des pulvérisations aériennes contre l'arpenteuse de la pruche dans la région de Gaspé afin de protéger 62 822 ha de peuplements de sapin baumier mature situés sur des terres publiques (94 %) et des boisés privés (6 %).

Le MRNQ a réalisé un inventaire aérien des dommages en 1996. Au total, 7 848 ha de sapin baumier ont été défoliés dans la région de Gaspé. On a également procédé à un dénombrement des oeufs en hibernation dans 215 secteurs afin de prévoir l'ampleur des effectifs larvaires et des défoliations en 1997. Les informations recueillies ont permis d'élaborer un programme de protection des forêts prévoyant l'application de B.t. sur 62 822 ha.

En juin, on a effectué un dénombrement des oeufs en vue de déterminer les causes des forts taux de mortalité (30 à 100 %) enregistrés dans la région infestée. Les parasitoïdes *Trichogramma* sp. et *Telenomus* sp. étaient à eux seuls responsables de 64 % de la mortalité observée.

La SOPFIM et le MRNQ ont établi un réseau de 300 parcelles de surveillance afin de prévoir les fluctuations des populations de l'arpenteuse la pruche au cours des années à venir.

FOREST PROTECTION PROGRAM AGAINST HEMLOCK LOOPER IN EASTERN QUEBEC - 1997

Alain Dupont, F.E., M.Sc.
Forestry Branch
SOPFIM

In 1997, SOPFIM planned to conduct aerial spraying operations against the hemlock looper (*Lambdina fiscellaria fiscellaria* Guen.) in Eastern Quebec. The program was intended to protect 62 822 hectares of mature balsam fir forest, located on Crown lands (94 %) and private woodlots (6 %) in the Gaspé region.

Previous defoliation and population forecast

An aerial damage survey was conducted by the Quebec Ministry of Natural Resources (QMNR) in 1996. In the Gaspé region, the total area of balsam fir forests defoliated was 7 848 hectares (fig. 1).

Table 1. Areas of defoliation caused by the hemlock looper in Eastern Quebec in 1996 (Source QMNR).

REGION	DEFOLIATION LEVEL			TOTAL
	LIGHT (1 - 35 %)	MODERATE (36 - 70 %)	SEVERE (71 - 100 %)	(Ha)
GASPÉ	1730	4071	2047	7848

Overwintering eggs were sampled at 215 locations in late October to forecast larval population levels and subsequent defoliation for 1997 (fig. 2). A forest protection program as been prepared on the basis of this information, in order to protect a total of 9 millions of cubic meters.

Figure 1

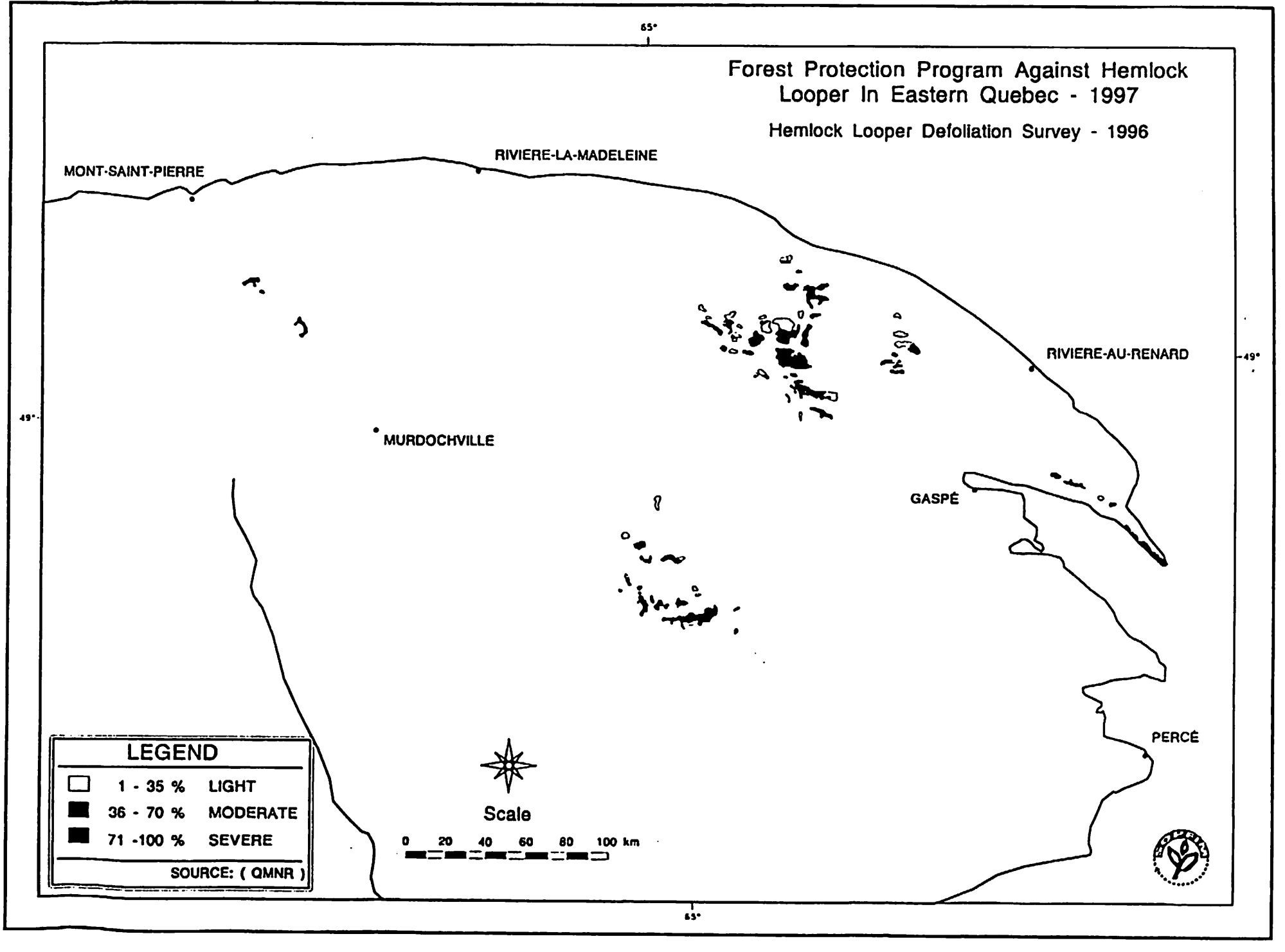

Forest Protection Program Against Hemlock Looper In Eastern Quebec - 1997
Hemlock Looper Defoliation Survey - 1996
65°
MONT-SAINT-PIERRE
RIVIERE-LA-MADELEINE
RIVIERE-AU-RENARD
49°
MURDOCHVILLE
GASPÉ
PERCÉ
LEGEND
1 - 35 % LIGHT
36 - 70 % MODERATE
71 -100 % SEVERE
SOURCE: (QMNR)
Scale
0 20 40 60 80 100 km

Table 2. Hemlock looper egg survey (eggs/100 cm branch) in Gaspé region in 1996 (Source SOPFIM and QMNR).

	NIL (0)	LIGHT (1 - 4)	MODERATE (5 - 9)	HIGH (10 - 19)	EXTREME (20 +)
INFESTED AREA	8 %	23 %	17 %	16 %	36 %
PLANNED SPRAY BLOCKS	0 %	6 %	23 %	29 %	42 %

In the planned protection program, the average population was 31 eggs/100 cm branch and 22 % of the sampled trees have shown a population level greater than 40 eggs per 100 cm branch.

Planned protection program

The planned protection program was prepared following the egg survey results in vulnerable stands moderately to severely infested by the hemlock looper. The biological insecticide *Bacillus thuringiensis* (B.t.) will be spray over 62 822 hectares distributed into 55 blocks (fig. 3).

Table 3. Planned protection program against the hemlock looper in Eastern Quebec in 1997 by treatment.

TREATMENT	AREA (Ha)	AREA (%)
1 X 30 BIU	10 485	17
2 X 30 BIU	52 237	83
	62 822	

Figure 2

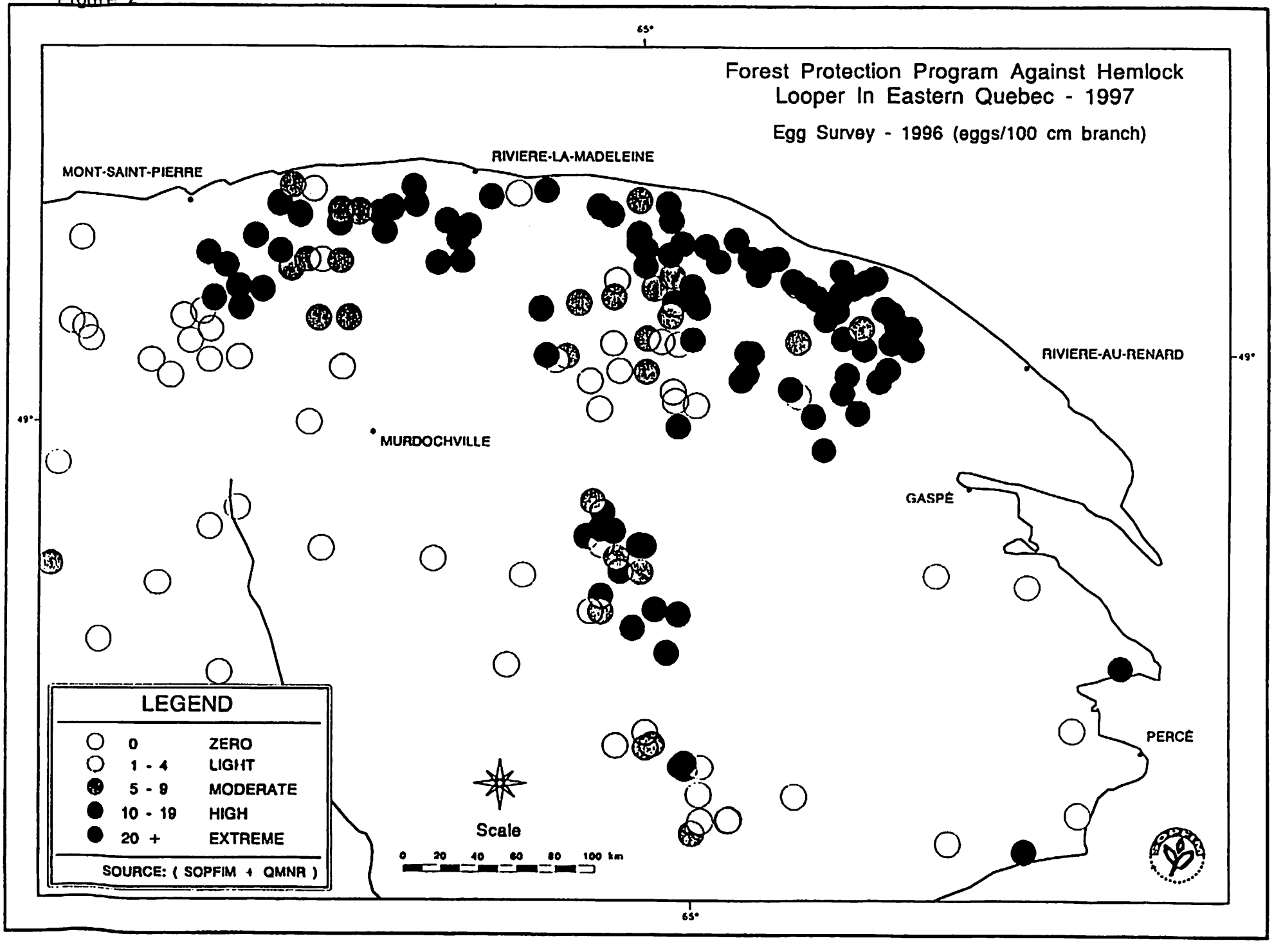

Forest Protection Program Against Hemlock Looper In Eastern Quebec - 1997
Egg Survey - 1996 (eggs/100 cm branch)
65°
MONT-SAINT-PIERRE
RIVIERE-LA-MADELEINE
RIVIERE-AU-RENARD
49°
MURDOCHVILLE
GASPÉ
PERCÉ
LEGEND
0 ZERO
1 - 4 LIGHT
5 - 9 MODERATE
10 - 19 HIGH
20 + EXTREME
SOURCE: (SOPFIM + QMNR)
Scale
0 20 40 60 80 100 km

Figure 3

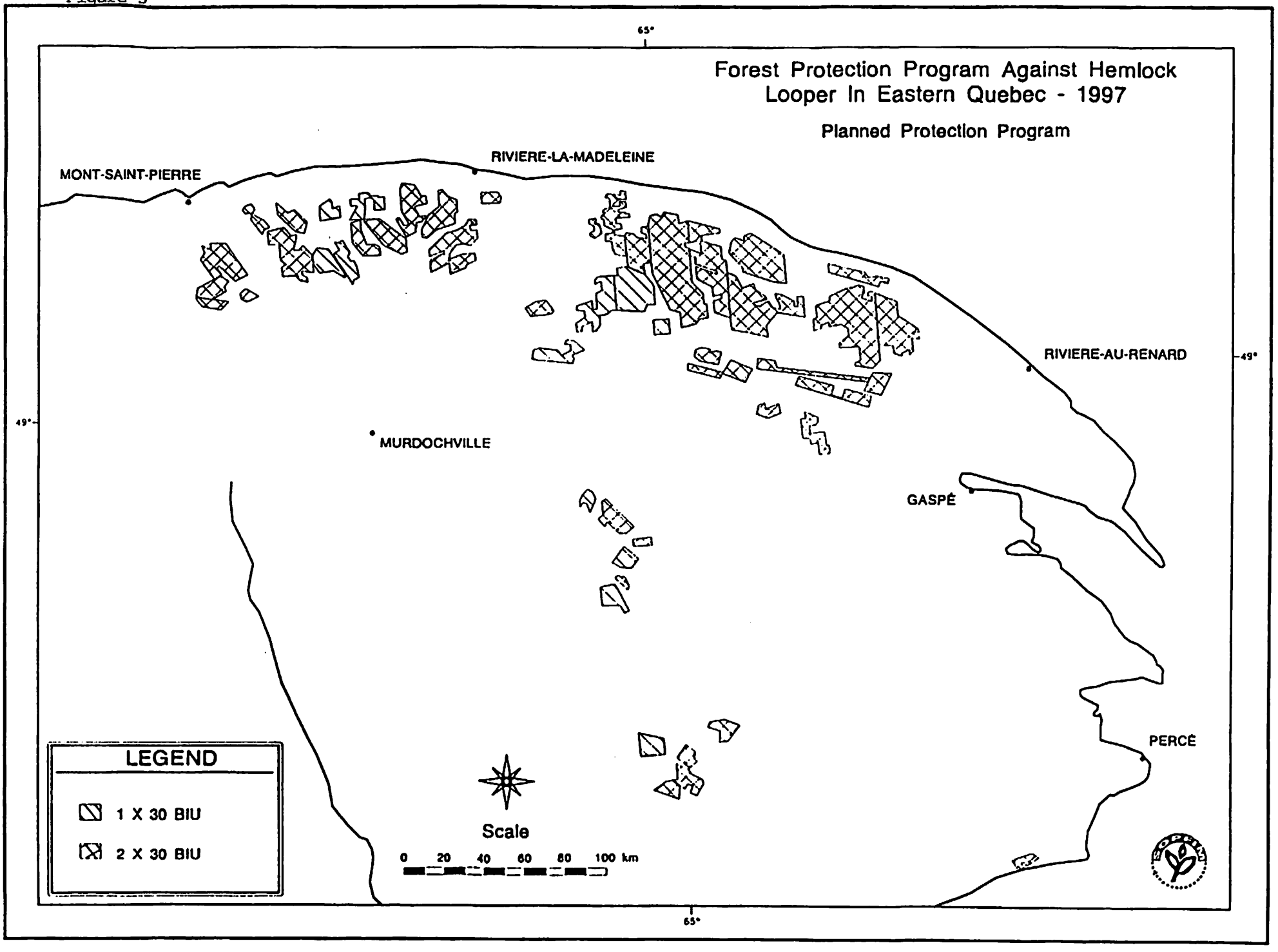

Forest Protection Program Against Hemlock Looper In Eastern Quebec - 1997
Planned Protection Program
65°
MONT-SAINT-PIERRE
RIVIERE-LA-MADELEINE
RIVIERE-AU-RENARD
49°
MURDOCHVILLE
GASPÉ
PERCÉ
LEGEND
1 X 30 BIU
2 X 30 BIU
Scale
0 20 40 60 80 100 km

Table 4. Planned protection program against hemlock looper in Eastern Quebec in 1997 by product.

PRODUCT	VOLUME (L/Ha)	AREA (Ha)	AREA (%)
Dipel 176	1,77	9 567	8
Foray 76B	1,50	27 908	24
Foray 48B	2,37	77 684	68
		115 159	

- Total Area to protect = 62 822 Ha
- Total Area to spray = 115 159 Ha (double and single applications)

Aircraft and spray parameters

The different products will be applied using nine (9) M-18 Dromader and three (3) Bull Trush. The following spray parameters have been defined :

M-18 Dromader

- Spray speed : 193 Km/h
- Flying height : 15 m.
- Swath : 50 m.
- Atomiser type : 8 micronair AU-5000
- Atomiser speed : 6000-7000 RPM

Bull Trush

- Spray speed : 217 Km/h
- Flying height : 15 m.
- Swath : 50 m.
- Atomiser type : 8 micronair AU-4000 or AU-5000
- Atomiser speed : 6000-7000 RPM

Protection program realized

In spite of very high egg counts in the planned spray blocks, only seven blocks showed significant larval population levels and were sprayed. The insects did not show up and no defoliation was observed in other planned blocks (fig. 4). However, the treated area was about 8 % of the planned protection program.

Table 5. Protection program carried out against the hemlock looper in Eastern Quebec in 1997.

BLOCK	TREATMENT	PRODUCT	AREA (Ha)
G - 74	2 X 30 BIU	Foray 48B	825
G - 75	1 X 30 BIU	Foray 48B	2498
G - 95	2 X 30 BIU	Foray 48B	327
H - 51	2 X 30 BIU	Foray 48B	926
H - 52	2 X 30 BIU	Foray 48B	236
H - 54	2 X 30 BIU	Foray 48B	130
M - 05	2 X 30 BIU	Foray 76B	397
			5339

Egg mortality assessment

In June, an egg survey was done in order to identify the cause(s) of high mortality levels encountered all over the infested area. All the samples (6740 eggs) were reared in the laboratory and the percentage of unhatched eggs was calculated for each of the 89 plots (fig. 5). The mortality levels ranged from 30 to 100 % and overall only 20 % of the eggs produced young larvaes.

Figure 4

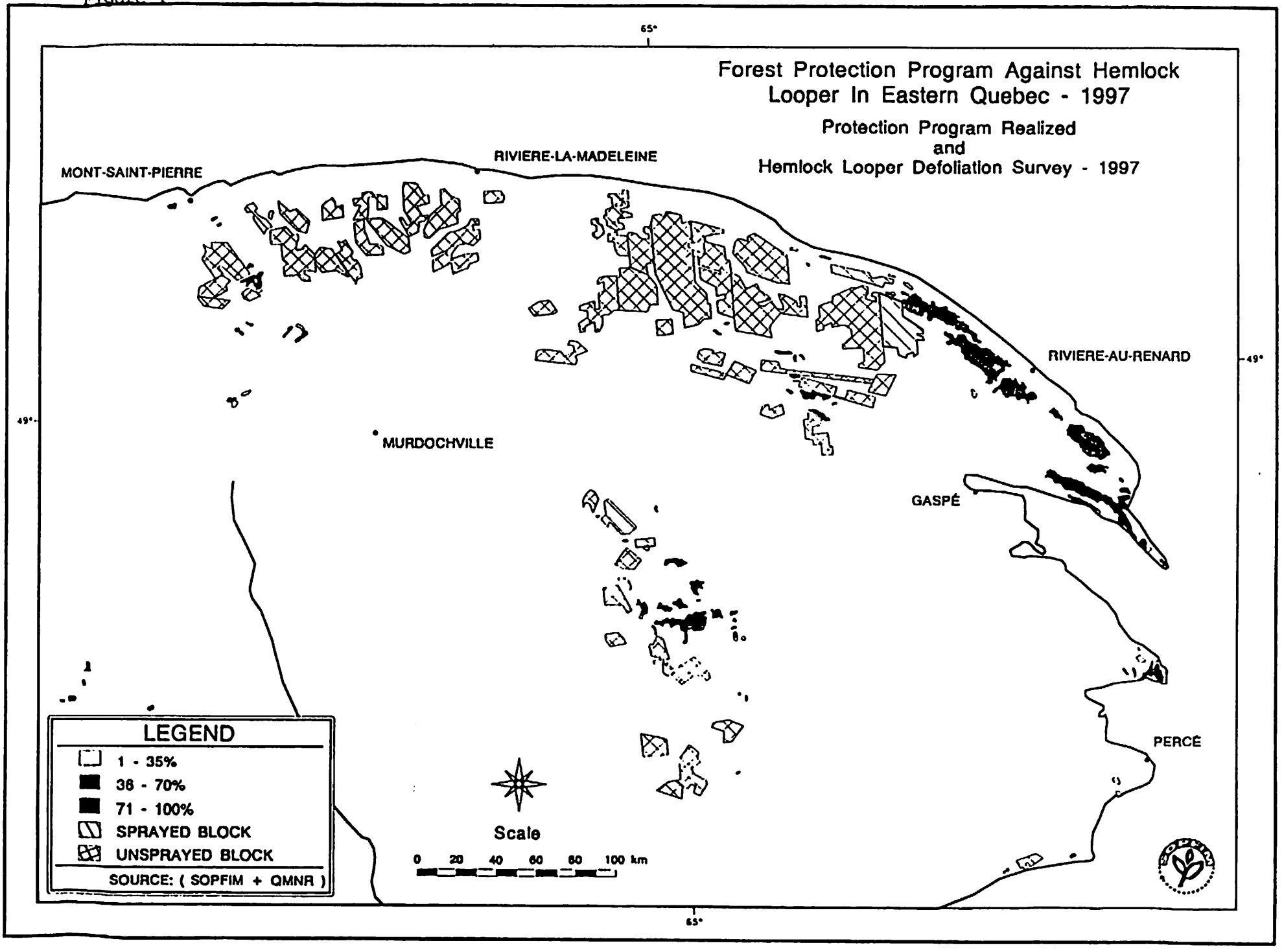

Forest Protection Program Against Hemlock Looper In Eastern Quebec - 1997
Protection Program Realized
and
Hemlock Looper Defoliation Survey - 1997
65°
MONT-SAINT-PIERRE
RIVIERE-LA-MADELEINE
RIVIERE-AU-RENARD
49°
MURDOCHVILLE
GASPÉ
PERCÉ
LEGEND
1 - 35%
36 - 70%
71 - 100%
SPRAYED BLOCK
UNSPRAYED BLOCK
SOURCE: (SOPFIM + QMNR)
Scale
0 20 40 60 80 100 km

Table 6. Egg mortality assessment on hemlock looper populations in Eastern Quebec in 1997 (Source SOPFIM and QMNR).

HEMLOCK LOOPER EGG MORTALITY CLASSES / PLOT				
< 61 %	61 - 70 %	71 - 80 %	81 - 90 %	91 - 100 %
6 %	8 %	29 %	37 %	20 %

Two parasitoïd species have been identified, *Trichogramma* sp. and *Telenomus* sp., which are responsible for 64 % of the total mortality. Unknown mortality causes have been observed on 16 % of the egg samples.

Table 7. Egg mortality factors on hemlock looper populations in Eastern Quebec in 1997.

HATCHED EGGS	PARASITED EGGS *Telenomus sp.*	PARASITED EGGS *Trichogramma sp.*	UNHATCHED EGGS Unknown causes
20 %	56 %	8 %	16 %

N = 2962 eggs

The QMNR carried out four (4) successive egg surveys in three (3) different sites, in order to know when *Telenomus sp.* attacked the hemlock looper. The following results show some evidence of a high activity level during the spring period. One hundred (100) eggs were collected by site and survey, for a total of 1200 eggs.

Figure 5

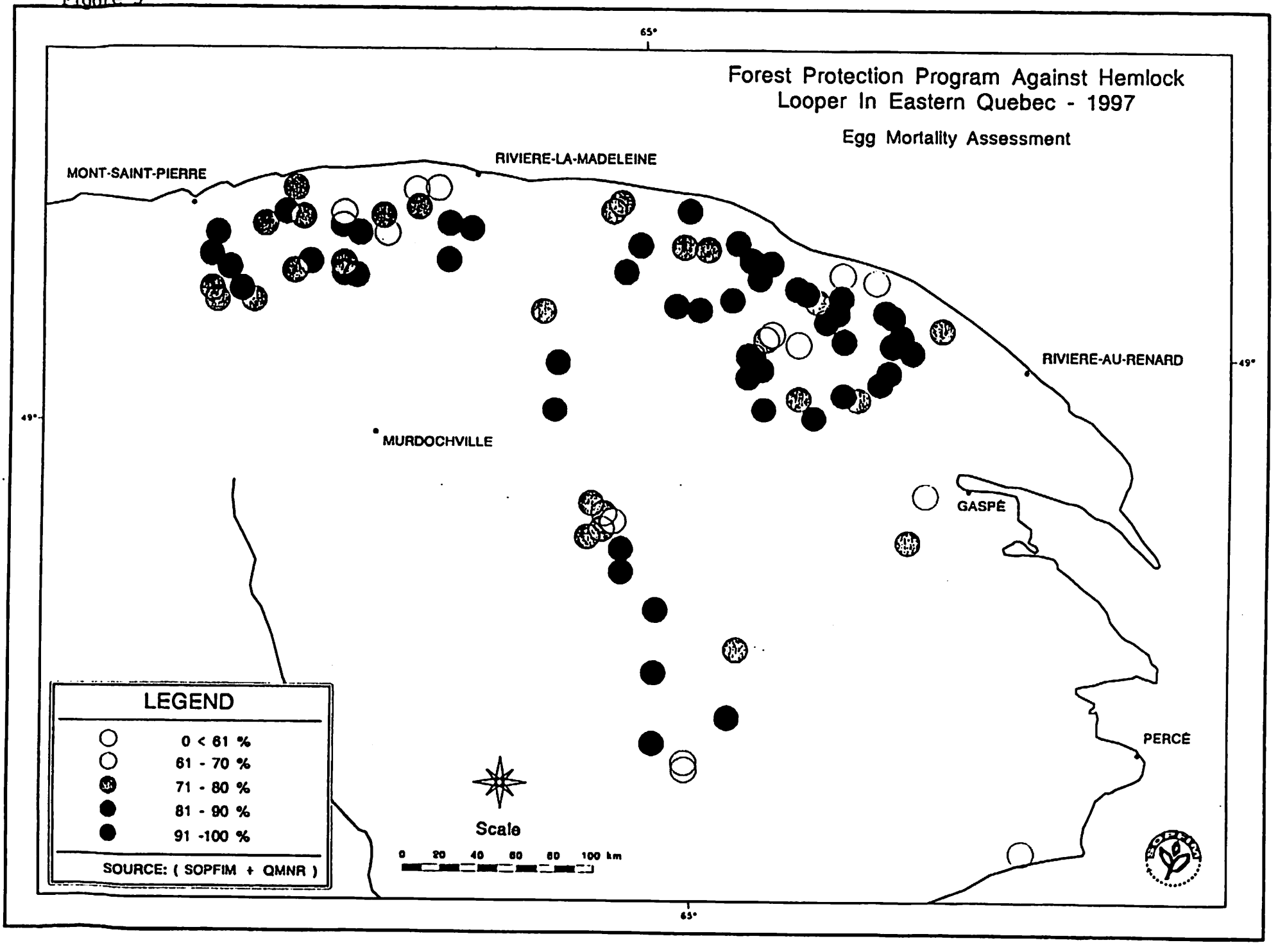

Forest Protection Program Against Hemlock Looper In Eastern Quebec - 1997
Egg Mortality Assessment
65°
49°
MONT-SAINT-PIERRE
RIVIERE-LA-MADELEINE
RIVIERE-AU-RENARD
MURDOCHVILLE
GASPÉ
PERCÉ
LEGEND
0 < 61 %
61 - 70 %
71 - 80 %
81 - 90 %
91 -100 %
SOURCE: (SOPFIM + QMNR)
Scale
0 20 40 60 80 100 km

Table 8. Hemlock looper egg surveys for hatching and parasitism assessment in Eastern Quebec in 1997 (Adapted from QMNR).

	LAC SIROIS			RIV. ST-JEAN			LAC BLANCHET		
	HAT. (%)	PAR. (%)	OTH. (%)	HAT. (%)	PAR. (%)	OTH. (%)	HAT. (%)	PAR. (%)	OTH. (%)
SURVEY # 1 (May 27-29)	80	0	20	30	43	27	44	26	30
SURVEY # 2 (June 3-4)	34	46	20	6	84	10	23	45	32
SURVEY # 3 (June 10-11)	12	64	24	6	82	12	15	58	27
SURVEY # 4 (June 17-18)	2	80	18	0	65	35	5	63	32

HAT. = Hatched eggs
PAR. = Parasited eggs
OTH. = Other mortality causes

Forecasts 1998

SOPFIM and the QMNR have established a 300 plot network in order to forecast hemlock looper population levels. Four different kinds of surveys have been done since August 1997 in all locations :

- Pupae survey with 5 pupae shelters/site ;
- Adult survey using 1 pheromone trap/site ;
- Egg survey with 10 egg traps/site (foam band) ;
- Egg survey involving 5 branches/site.

SOPFIM's *B.t.* Experimental field trials against Eastern Spruce Budworm in Western Quebec -1997

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Forestry Branch
Société de Protection des Forêts contre les Insectes et Maladies
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and

E. Bauce
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Québec, Québec

For three years, SOPFIM has been conducting experimental field spraying against the eastern spruce budworm in western Quebec. These trials, using *B.t.*, are intended to test and improve spray techniques, treatments and new tools in order to achieve protection targets at the lowest possible cost.

Overwintering budworm populations were evaluated throughout the infested area in western Quebec. Light-to-moderate defoliation was found in 96% of the treated area, with only 1% showing severe defoliation; 54% of the untreated area was severely defoliated.

Except for controls, all treatments achieved the protection target. Where budworm populations were higher, better protection was obtained by increasing both dosage and number of applications. Untreated blocks were severely defoliated. Final defoliation results indicate no difference after a 5- or 10-day delay between applications, providing more operational latitude.

All trials helped to establish some limits to *B.t.* efficacy. In certain cases, the greatest efficacy was not achieved with the highest dosage. On the basis of the results obtained, and in conjunction with laboratory experiments on variables that can influence efficacy, prescription charts can be improved, allowing selection of different *B.t.* utilization strategies on the basis of different parameters.

Compte rendu des pulvérisations expérimentales de *B.t.* effectuées par la SOPFIM contre la tordeuse des bourgeons de l'épinette dans l'ouest du Québec en 1997

D. Moranville, A. Dupont et E. Bauce

Depuis trois ans, la SOPFIM effectue des pulvérisations expérimentales de B.t. contre la tordeuse des bourgeons de l'épinette dans l'ouest du Québec. Dans le cadre de ces essais, elle s'emploie à évaluer et à améliorer les méthodes de pulvérisation et les traitement et à mettre au point de nouveaux outils en vue d'atteindre à un moindre coût les objectifs de protection qu'elle s'est fixés.

L'ampleur des populations hibernantes de la tordeuse des bourgeons de l'épinette a été évaluée dans tous les secteurs infestés de l'ouest du Québec. Des défoliations légères à modérées ont été signalées sur 96 % de la zone traitée. Seulement 1 % de la zone traitée a été gravement défolié, comparativement à 54 % du secteur non traité.

À l'exception des traitements témoins, tous les traitements ont permis d'atteindre les objectifs de protection visés. Contre les populations de forte densité, les meilleurs résultats ont été obtenus en augmentant les doses et le nombre de pulvérisations. Les parcelles non traitées ont été gravement défoliées. Une comparaison des derniers résultats de défoliation n'a révélé aucune différence d'efficacité entre les pulvérisations effectuées à 5 jour d'intervalle et celles réalisées à tous les 10 jours. Ces résultats laissent entrevoir une plus grande latitude quant à l'application des traitements.

Tous les essais ont contribué à mettre en lumière certaines limites du B.t. Dans certains cas, les meilleurs résultats n'ont pas été obtenus avec les plus fortes doses. Les résultats enregistrés dans le cadre de ces essais et d'un certain nombre d'expériences en laboratoire visant à déterminer l'incidence de certaines variables sur l'efficacité des traitements révèlent qu'il est possible d'améliorer les grilles de dosage et d'orienter la sélection d'une méthode d'application du B.t. en tenant compte de divers paramètres.

SOPFIM'S[1] *B.t.* EXPERIMENTAL FIELD TRIALS AGAINST EASTERN SPRUCE BUDWORM IN WESTERN QUEBEC - 1997

Presented at the 25th annual Forest Pest Control Forum in Ottawa by :
Denise Moranville, F. Eng., Forestry branch, SOPFIM

Contributors : Alain Dupont, F. Eng., M. Sc., Forestry Branch SOPFIM
Eric Bauce, F. Eng., Ph.D., Laval University

Context

For 3 years, SOPFIM has been conducting experimental field spray against eastern spruce budworm (SBW) in Western Quebec. These trials, using *Bacillus thuringiensis (B.t.)* are held to test and improve spray techniques, treatments and new tools in order to achieve protection target, at lowest cost.

Objectives

The main objective of these experiments is to improve SOPFIM's treatment chart, by collecting efficacy data while testing various treatments against SBW. In order to adjust protection strategies, other objectives are followed as getting better knowledge of *B.t.* lethal and sublethal effects on SBW behavior, interaction between food quality and *B.t.* effects on SBW, and *B.t.* effects on parasitoids biodiversity. Part of these experiments are still ongoing (laboratory works). Only results of field efficacy are presented in this report.

Study area

Overwintering SBW populations (L2) were evaluated throughout the infested area in Western Quebec, more specifically in the experimental zones followed since 1995.

Based on L2, stand conditions and cumulative defoliation, a total of thirty blocks (24 for treatments, six for controls) were selected (figure 1). All blocks were located on private woodlots and contained balsam fir stands mixed with hardwoods.

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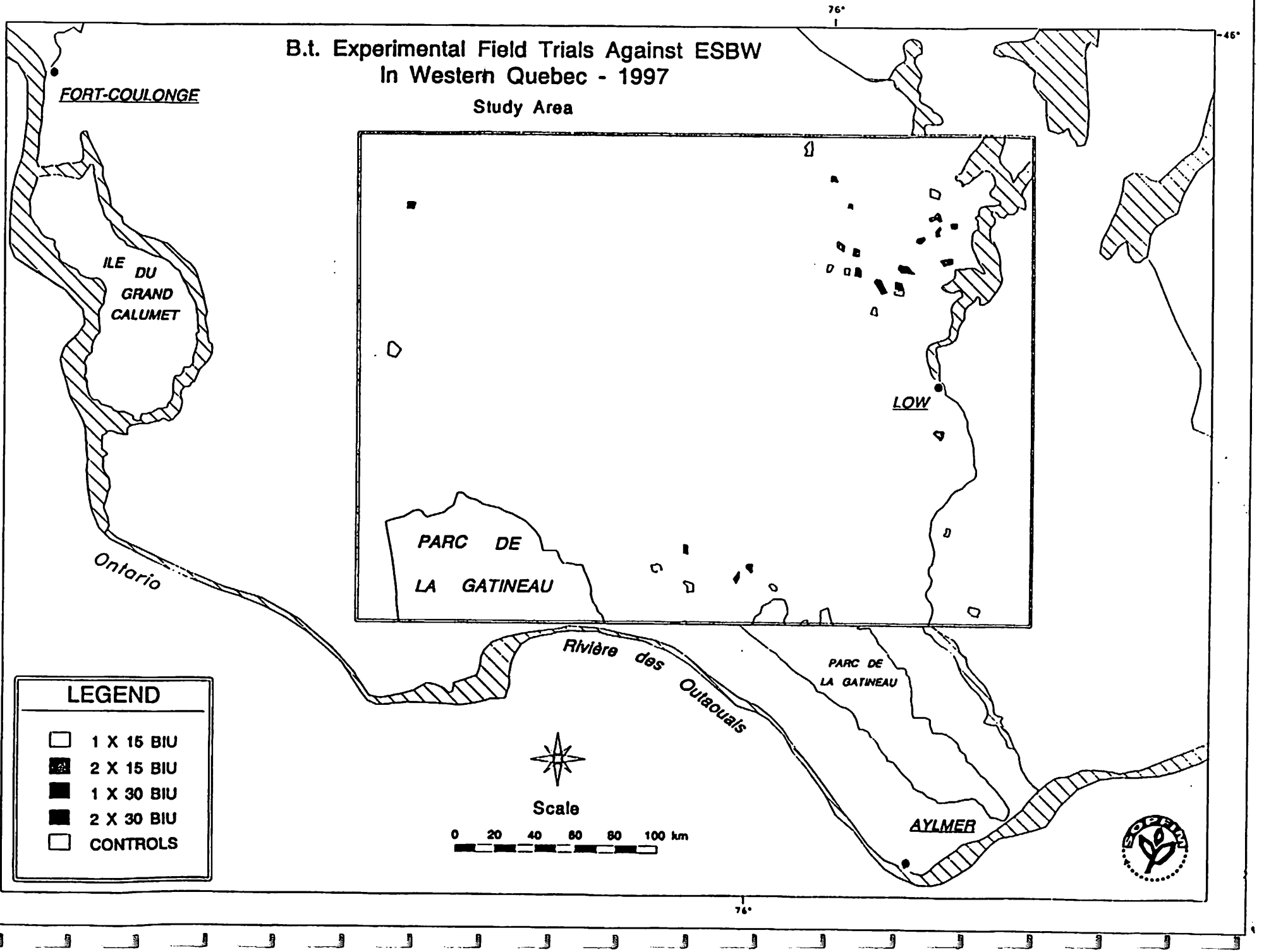
(1) Société de protection des forêts contre les insectes et maladies

Figure 1


B.t. Experimental Field Trials Against ESBW
In Western Quebec - 1997
Study Area
76°
45°
FORT-COULONGE
ILE DU GRAND CALUMET
LOW
PARC DE LA GATINEAU
Ontario
Rivière des Outaouais
PARC DE LA GATINEAU
AYLMER
LEGEND
1 X 15 BIU
2 X 15 BIU
1 X 30 BIU
2 X 30 BIU
CONTROLS
Scale
0 20 40 60 80 100 km
76°

Treatments

Table 1 describes treatments tested in 1997. Each treatment was replicated six times, on six different blocks. Parameters like volume and product did not vary during trials. A M-18 Dromader, equipped with 8 Micronair® AU-5000 rotary atomizers delivered insecticide, using a 50 m. swath width. Navigation was supported by D-GPS (SOFTNAV®).

Table 1 : Treatments description

Treatments (BIU/ha)	Products	Volume (l/ha)	Replicates	Area (ha)
1 X 15	Foray 48B	2,37	6	97
2 X 15	Foray 48B	2,37	6	109
1 X 30	Foray 48B	2,37	6	106
2 X 30	Foray 48B	2.37	6	101
Controls	---	---	6	154
			30	567

Spray timing and pre-spray situation

Insect and host developments were evaluated on a regular basis in order to begin treatments at optimal time. At spray time (table 2), shoot and larvae index were respectivelly 4.5 and 4.3. Average population was 15 larvae per branch. Data show that pre-spray defoliation and larval population were not different among treatments even if variability between blocks was observed.

Table 2 : Pre-spray situation

Treatments (BIU/ha)	SDI	LDI	Lar./br	Current defoliation (%)*	Cumulative defoliation (%)
1 X 15	4,5	4,2	16	13	32
2 X 15	4,3	4,5	15	11	26
1 X 30	4,6	4,4	19	18	24
2 x 30	4,6	4,1	11	7	23
Controls	4,6	4,3	18	(32)	29
Average	4,5	4,3	15	12	26

* Post-spray 5 days

Assessments

Sampling scheme for efficacy is showed at table 3. In order to evaluate defoliation, mortality and field efficacy, four sampling periods were established (pre, post 5, post 15 and final post).

Table 3 : Sampling scheme

Treatments (BIU/ha)	Nb blocks (replicates)	Sampled trees/block	Nb sampled trees/period				Total
			Pre-spray	Post-spray (5 days)	Post-spray (15 days)	Post-spray (pupae)	
1 X 15	6	16	96	96	96	96	384
2 X 15	6	16	96	96	96	96	384
1 X 30	6	16	96	96	96	96	384
2 x 30	6	16	96	96	96	96	384
Controls	6	16	96	96	96	96	384
Total	30	80	480	480	480	480	1 920

RESULTS AND DISCUSSION

Aerial defoliation assessment

Annual aerial survey conducted by the QMNR was used to map defoliation in treated and non treated areas. The results (Table 4) indicate that 96 % of the treated area support light to moderate defoliations (86 % light, 8 % moderate -). Only 1 % of the treated zone shows severe defoliation while 54 % of the non-treated area is severely defoliated.

Table 4 : Current defoliation assessment (aerial survey)

Treatments (BIU/ha)	Current defoliation classes			
	Light (1 - 35%)	Moderate (-) (36 - 49 %)	Moderate (+) (50 - 69 %)	Severe (70 - 100 %)
1 X 15	73 %	11 %	11 %	5 %
2 X 15	97 %	3 %	0 %	0 %
1 X 30	73 %	19 %	8 %	0 %
2 X 30	100 %	0 %	0 %	0 %
Treated (413 ha)	86 %	8 %	5 %	1 %
Controls (154 ha)	9 %	37 %		54 %

Source QMNR

Field efficacy

Tables 5 and 6 show 1997 current defoliations per treatment for two differents SBW populations averages.

Results from table 5 demonstrate that, except for controls, all treatments achieved protection target ($\leq$ 50 % current defoliation). At same dosage per hectare (15 BIU or 30 BIU), no significative difference between 1 and 2 applications in term of final defoliation

has been observed. There is also no difference in foliage protection between 2 x 15 BIU/ha and 1 x 30 BIU/ha. Same level of protection is obtained.

Table 5 : 1997 - Current defoliation per treatment (average pop. = 15 l/br.)

Treatments (BIU/ha)	Post 5 %	Post 15 %	Post final %
1 X 15	13	25	33 b
2 X 15	13	19	29 bc
1 x 30	11	20	21 c
2 x 30	11	17	22 c
Controls	29	57	57 a

In higher SBW populations, better protection was obtained by increasing both number of applications and dosage (Table 6). In that case however, 1 x 15 BIU was not sufficient to protect 50 % of current foliage. Even if 2 x 15 BIU and 1 x 30 BIU treatements werent significativelly different, both prescriptions barely reached protection target. Best results (20 % final current defoliation) were obtained using 2 x 30 BIU. In comparision, non-treated blocks were severely defoliated (99 %).

Table 6 : 1997 - Current defoliation per treatment (average pop. 30 l/br.)

Treatments (BIU/ha)	Post 5 %	Post 15 %	Post final %
1 X 15	25	55	73 b
2 X 15	24	32	50 c
1 x 30	25	45	50 c
2 x 30	14	19	20 d
Controls	85	97	99 a

Additional efficacy informations from 1996 trials are shown at table 7. Used against high SBW levels, prescriptions tested (30 vs 50 BIU) showed that no protection gain is obtained by increasing dosage. In that case, the second application of *B.t.* was more efficient. 1996 trials also supplied informations on optimal time period between applications. Final defoliation results indicate that no difference is observed after either a 5 or 10 day delay between applications, giving more operational latitude.

Table 7 : 1996 - Current defoliation per treatment (average pop 33 l/br.)

Treatments (BIU/ha)	Post 5 %	Post 10 %	Post 20 %	Post final %
1 x 50	20	18	38	43 b
2 x 30 (5 days)*	20	18	23	27 c
2 x 30 (10 days)	16	16	18	25 c
2 X 50 (5 days)	21	18	20	26 c
Controls	41	64	75	75 a

* Time period between applications

CONCLUSION

All these experimental field trials help to establish some limits to *B.t.* efficacy. In certain conditions, highest efficacy is not reached with highest dosage. That seems to be the case in a very high SBW population context where spraying two times instead of one is more efficient.

Supported by laboratory experiments on variables that can influence efficacy (food quality, SBW behavior *B.t.*, lethal and sublethal effects), these results will improve prescription chart, allowing different B.t. utilization strategies to be selected on a various parameter basis (dosage, application, volume, timing).

ACKNOWLEDGEMENT

SOPFIM would like to thank all research partners for their precious collaboration, specially Jacques Régnière (CFS - Quebec), Eric Bauce (Laval University), Kees van Frankenhuyzen (CFS - Sault Ste-Marie) and Pierre Therrien (QMNR).

Canadian Food Inspection Agency Report to the 1997 Forest Pest Management Forum

M. Dawson and R. Favrin
Canadian Food Inspection Agency
Nepean, Ontario

The Canadian Food Inspection Agency (CFIA) began operations on April 1, 1997, bringing together all federally mandated food inspection, animal health and plant protection activities in one organization. Its programs and services will support food safety and quarantine security, and its staff will work with provincial and municipal authorities to create an efficient and streamlined national food inspection service. The CFIA is developing a business plan, after having consulted with industry, consumers, federal partners, other governments and its own staff. Imports, domestic programs and exports are high-priority items.

Two significant gypsy moth hot spots were found on Vancouver Island in 1997, with 225 moths (all of the North American genotype) being analyzed. The CFIA has amended its policies for Dutch elm disease (DED) and larch canker, and is consulting with stakeholders to amend policies for other forest pests.

Following interception of potential quarantine pests on wood packing and crating materials with imported cargo from Asia, Europe and South America, the CFIA and the Canadian Forest Service (CFS) conducted a survey. They intercepted numerous quarantine and potential quarantine pests, particularly in British Columbia, from a variety of commodities. Canadian Plant Protection officials are working with their counterparts in the United States and Mexico to harmonize regulations and draft a North American Plant Protection Organization (NAPPO) standard for crating and packing materials used in international trade.

Proposed quarantine forest pest surveys for 1998 for pine shoot beetle, exotic bark beetles, gypsy moth, Scleroderris canker, larch canker, DED and balsam woolly aphid are summarized.

Rapport de l'Agence canadienne d'inspection des aliments présenté lors du Forum de répression des ravageurs forestiers de 1997

M. Dawson et R. Favrin
Agence canadienne d'inspection des aliments
Nepean (Ontario)

L'Agence canadienne d'inspection des aliments (ACIA) a débuté ses opérations le 1er avril 1997. Le gouvernement fédéral a ainsi regroupé en une seule organisation tous les services d'inspection des aliments et de protection de la santé animale et des végétaux dont il avait la responsabilité. Ses programmes et ses services viendront appuyer les initiatives visant à garantir l'innocuité des aliments et l'efficacité des mesures de quarantaine, et son personnel travaillera en étroite collaboration avec les autorités provinciales et municipales afin de mettre en place à l'échelle du pays un service d'inspection des aliments efficace et rationalisé. L'Agence est en train d'élaborer un plan d'activités, après avoir consulté l'industrie, des associations de consommateurs, des partenaires fédéraux, d'autres gouvernements et son propre personnel. Elle entend accorder la priorité aux importations, aux programmes des échanges intérieurs et aux exportations.

En ce qui a trait à la spongieuse, deux points chauds ont été découverts en 1997. Deux cent vingt-cinq spécimens (tous du génotype nord-américain) provenant de ces endroits ont été analysés. L'ACIA a modifié ses politiques concernant la maladie hollandaise de l'orme et le chancre du mélèze et a amorcé une ronde de consultations avec des partenaires en vue de modifier ses politiques s'appliquant à d'autres ravageurs forestiers.

À la suite d'une série d'interceptions de ravageurs potentiellement justiciables de quarantaine dans du bois d'emballage et de fardage utilisé pour protéger des marchandises provenant d'Asie, d'Europe et d'Amérique du sud, l'ACIA et le Service canadien des forêts (SCF) ont effectué un relevé. Un grand nombre de ravageurs justiciables de quarantaine ou susceptibles de l'être ont été découverts dans diverses marchandises, en particulier en Colombie-Britannique. Les fonctionnaires canadiens chargés de la protection des végétaux s'emploient avec leurs homologues américains et mexicains à harmoniser la réglementation et à élaborer un projet de norme de l'Organisation nord-américaine pour la protection des plantes visant les matériaux d'emballage et de fardage utilisés dans le commerce international.

Les relevés prévus en 1998 pour le grand hylésine des pins, des scolytes exotiques, la spongieuse, le chancre sclérodermien, le chancre du mélèze, la maladie hollandaise de l'orme et le puceron lanigère du sapin sont présentés brièvement.

Canadian Food Inspection Agency
Report to the
1997 Forest Pest Management Forum

Ottawa, Ontario
November 18, 1997

presented by Marcel Dawson & Rob Favrin

1. Organizational Changes

On April 1, 1997 the Canadian Food Inspection Agency (CFIA) opened for business, with Dr. Art Olson as CEO, and for the first time brought together all federally mandated food inspection and animal health and plant protection activities into one federal organization. The CFIA amalgamated inspection services from three government departments, Health, Fisheries and Agriculture and was given a mandate to create more effective and efficient systems responsive to the rapidly changing environment and emerging pressures faced on a national and international scale. Its programs and services will support food safety and quarantine security, and will not impede industry's competitiveness in the marketplace. The agency was given authority to work with provincial and municipal authorities in order to create an efficient and streamlined national Canadian Food Inspection Service.

The legislation providing authority for the New Agency was passed by the Canadian Parliament on February 12, 1997 and was promulgated into law on July 1, 1997. The new Agency still reports to Parliament through the Minister of Agriculture.

The development of the business plan is the major activity currently underway in the Agency and was preceded by many consultations with industry, consumers, Agency staff, federal partners and other governments during the early summer. Results of consultations are currently being analyzed and incorporated into the first business plan which will be presented to the Minister of Agriculture this autumn. The proposed mission for the Canadian Food Inspection Agency is:

The Canadian Food Inspection Agency, through a competent and qualified workforce, delivers inspection and related services for consumers and industry that contribute to safe and wholesome food supply and facilitates trade in food animal and plant products.

The Canadian food inspection and quarantine service must integrate many pieces of legislation inherited by the CFIA, many program policies and procedures, and operational delivery. Harmonization, increased efficiency and cost-effectiveness will be goals.

The program begun two years ago in the Plant Protection Division to realign resources on a risk- and

science-based approach has been accelerated. The highest priority from a risk point of view is imports, followed by domestic programs and export. Increasingly for exports, industry accreditation or certification programs are supported as alternative mechanisms of service delivery. The agency role is changing to that of developing standards, training if needed and monitoring programs to ensure delivery at the required standard. Examples include accreditation or certification programs under development for a number of commodities, including softwood lumber for export.

2. Gypsy Moth Finds on Vancouver Island:

Nothing new to report from the east. There were two significant hot spots in British Columbia this year on Vancouver Island, (Esquimalt & Langford) from which a total of 225 moths have been analysed, in addition to several egg masses which were observed on the garry oak in the vicinity. All moths analysed this year have been of North American genotype. Agency staff in British Columbia are in the process of consulting with provincial government and BC forest industry representatives and local residents to determine an appropriate course of action for the Vancouver Island sites.

3. Domestic Regulations (Plant Quarantine Pests):

CFIA has recently amended its policies for Dutch elm disease and larch canker, and is currently in the process of consulting with stakeholders to amend policies in regards to other forest pests of quarantine significance, ie., gypsy moth, pine shoot beetle, scleroderris canker, in order to ensure that Canadian plant protection policies up to date and consistent with international standards.

The following criteria are deemed important in the policy review: 1) policies must be science based and economically sound, 2) Import and domestic regulations must be harmonized and 3) Where possible, policies must incorporate industry compliance with a CFIA developed standard with auditing by the agency. An example of this type of program which is being explored is the registration of processing facilities to allow the movement of logs with bark attached from regulated areas of the U.S. or Canada to facilities within a pest free area within Canada under compliance with CFIA's bark containment and disposal standard.

4. Crating & Pallet Inspection:

Following interceptions of potential quarantine pests on wood packing and crating materials with imported cargo from temperate areas of Asia, Europe and South America., a survey was conducted in 1997 by Canadian Food Inspection Agency (CFIA) and Canadian Forest Service (CFS) staff, targeting the crating of commodities which in themselves did not pose a risk. Delivery varied across the country. Most interceptions were made in British Columbia, which reflects the level of resources put into the survey.

Numerous quarantine and potential quarantine pests were intercepted in wooden packing and crating materials, including *Anoplophora glabripennis*, *A. chinensis*, *Monochamus alternatus*, *Orthotomicus*

angulatus, *Ips* spp., and a *Lymantriid* pupa. Interceptions were made from a variety of commodities including: wooden wire and cable spools from China and Korea, wooden crating with granite tiles from India, wooden boxes with metal valves from Italy, and wooden pallets with ceramic tiles from Brazil. Non-traditional pathways for the movement of live wood boring insects, and other insects; i.e., Asian gypsy moth, have been identified.

Canadian Plant Protection officials are working with their counterparts from the United States and Mexico to harmonize regulations in an attempt to prevent the introduction of quarantine pests from wooden articles and packing material into North America. This includes the drafting of a North American Plant Protection Organization (NAPPO) standard which proposes to restrict the use of wood as crating and packing materials in international trade, and would require all wooden crating, pallets, and other packing materials to be either kiln dried, processed or treated in a manner approved by the United States, Canada and Mexico. Although the proposed NAPPO standard was recently given support by representatives from the three countries, it is not likely that this standard could be implemented before 1999, given the time required for consultations in enacting new regulations in the U.S. In the meantime, CFIA is exploring other options, eg., increased inspection levels for foreign dunnage and wooden packing materials at major ports beginning in 1998.

5. PROPOSED QUARANTINE FOREST PEST SURVEYS - 1998:

a) **Pine Shoot Beetle (*Tomicus piniperda*):** New finds in the Upper Peninsula of Michigan and a corresponding expansion of the quarantine in that area, will impact wood importers in Northern Ontario. The USDA still considers PSB a pest of quarantine significance (as do the states that do not have it) and have indicated that the quarantine will remain in place. Therefore we will require an increase in survey activity northern Ontario to maintain our claim of pest freedom. Alternately, we would have to relax our quarantine and risk having restrictions placed on Ontario by the non-infested areas of Canada and the US. For 1998, we will be required to conduct extensive surveys in the vicinity of Sault Ste. Marie and along the northern shore of Lake Huron.

b) **Exotic Bark Beetles:** As described above, interception records in both Canada and the United States show that many pests of wood and living trees, such as bark beetles (e.g. *Ips typographus*, *Tomicus piniperda*) and borers (e.g. *Anoplophora* spp.), can be associated with dunnage and various types of crating material used to support and stabilize cargo during shipping. The wood used for this purpose is often of low quality and may be in many forms, such as, lumber, logs and crating. CFIA plans to continue surveillance activities related to this issue in 1998. This will be approached in two ways: 1) a Lindgren trapping survey near all the major Canadian ports (BC ON, PQ, Atl.), and 2) a national import inspection program of commodities typically associated with heavy wooden crating (steel pipe, marble, heavy machinery etc). The trapping program was initiated in 1995 in BC as a pilot and was continued 1996 and 1997. To date, CFS-BC Region has assisted in sample identification and some of the field work.

c) **Gypsy Moth (*Lymantria dispar*):**
i) **North American Race.** In an effort to harmonize import and domestic policies, a new Directive governing domestic spread of gypsy moth is expected to be developed in 1998. In Nova Scotia and New Brunswick, surveys in 1998 are required to monitor population expansion and to detect new infestations beyond regulated areas. In Ontario, there was a collapse in the NAGM population with defoliation dropping to near zero in 1997. In Quebec, there has not been a significant change in the NAGM population distribution for a number of years. Therefore, with no expected changes to the quarantine zones, delimitation surveys in Ontario and Quebec are not seen as a priority for 1998. Detection surveys should be continued in all other provinces (NF, PE, MB, SK, BC) with all moth captures subjected to DNA analysis. Most regions have well established cooperative networks for gypsy moth trapping. In some cases, CFS is the lead agency, in others it is CFIA, and most have a high degree of provincial involvement.
ii) **Asian Race.** Apart from the moths caught outside of the infested provinces, a systematic DNA analysis of gypsy moth captures has not been conducted since 1995. It is proposed that AGM surveillance expand to include infested provinces by way of a limited port survey parallel to the USDA AGM Port Survey. Finds of Lymantriid life stages during last year's dunnage/crating inspection also reinforce the importance of surveillance for this pest. Operationally, the survey would be relatively simple to implement. A small number of traps would be placed within a 5-10 km radius of selected port areas during the peak flight period. In a number of areas this could be combined with Exotic Bark Beetle trapping surveys. All moths outside of infested provinces will continue to be subjected to DNA analysis.

d) **Scleroderris Canker (*Gremmeniella abietina*):** A new policy directive on this disease is being sent out for consultation during the fall of 1997. The directive affects the movement of living *Pinus* plants, including nursery stock and forest tree seedlings from areas where the European race occurs. Surveys should be directed toward monitoring disease spread beyond the proposed regulated townships in Ontario and any significant expansions to the known distribution of the European race in Quebec. In the Atlantic, surveys would include monitoring spread to areas other than the Avalon Peninsula in Newfoundland and the single infested site in New Brunswick.

e) **Larch Canker (*Lachnellula willkommii*):** A new Directive (D-97-10) was signed in 1997 governing the import and movement of *Larix* and *Pseudolarix* in Canada. Detection surveys are required to monitor the spread beyond the regulated areas described in D-97-10, with particular emphasis on P.E.I., where this is viewed as a priority.

f) **Dutch Elm Disease (*Ophiostoma ulmi*):** An interim policy governing domestic movement of this pest was drafted in 1997 (D-97-07). This policy will be updated in 1998 to include importation, which will require up-to-date survey information. Monitoring of disease spread and new vector finds will be required in uninfested areas.

g) **Balsam Woolly Adelgid (*Adelges piceae*):** Federal regulations are in place to support quarantines in B.C. In the past couple of years there have been pest finds beyond the quarantine area. Continued monitoring of any population expansion will be required for 1998.

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The 1997 field program consists of monitoring forest health plots, introduced pests and major forest disturbances. This bulletin is produced jointly by the Forest Health Monitoring Unit of Natural Resources Canada, Canadian Forest Service, Sault Ste. Marie, with assistance from the Ontario Ministry of Natural Resources to conduct an expanded field survey beyond that which could be undertaken solely under the national Forest Health Network. The information in this bulletin reflects monitoring, aerial surveys and other activities from late May to mid-September.

Temperatures were cooler than normal in April and May, and biological development (vegetation, insects, etc.) was delayed. June was warmer than normal and phenology was more or less back to normal by July.

On the basis of aerial surveys, spruce budworm (*Choristoneura fumiferana* [Clem.]), jack pine budworm (*Choristoneura pinus pinus* Free.) and gypsy moth (*Lymantria dispar* [L.]) appear to have declined this year. Forest tent caterpillar (*Malacosoma disstria* Hbn.) infestations more than doubled in extent in 1997. Further details on these and other pests follow.

Principaux ravageurs forestiers en Ontario - État de la situation en 1997

G. Howse et T. Scarr

En 1997, les activités sur le terrain ont consisté à surveiller le réseau de parcelles indicatrices de l'état de santé des forêts et à suivre l'évolution des populations des ravageurs introduits et des principales perturbations en milieu forestier. Le présent rapport est publié conjointement par la Forest Health Monitoring Unit de Ressources naturelles Canada, Service canadien des forêts, Sault Ste. Marie, et le ministère des Richesses naturelles de l'Ontario. L'objectif visé est d'accroître la portée du relevé par rapport à celle qu'il aurait s'il était réalisé séparément dans le cadre du réseau national de surveillance de l'état des forêts. Les informations présentées dans ce rapport sont le reflet des activités de surveillance, des relevés aériens et des autres initiatives menées à bien depuis la fin de mai jusqu'au milieu de septembre.

Les températures anormalement fraîches enregistrées en avril et en mai ont retardé le développement et la croissance de la végétation et des insectes. En revanche, le mois de juin a été plus chaud que la normale, si bien que le retard observé au début de la saison de végétation s'était estompé en juillet.

Les relevés aériens ont révélé que les populations de la tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana* [Clem.]), de la tordeuse du pin gris (*C, p. pinus* Free.) et de la spongieuse (*Lymantria dispar* [L.]) ont décliné en 1997. En revanche, la superficie infestée par la livrée des forêts (*Malacosoma disstria* Hbn.) a plus que doublé. Des données plus détaillées sur ces insectes et sur d'autres ravageurs sont présentées dans le rapport.

STATUS OF IMPORTANT FOREST PESTS IN ONTARIO IN 1997

by

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Report prepared for the 25th Annual Forest Pest Management Forum, Ottawa, November 18-20,

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STATUS OF IMPORTANT FOREST PESTS IN ONTARIO IN 1997

OVERVIEW

The 1997 field program consists of monitoring forest health plots, introduced pests and major forest disturbances. This bulletin is produced jointly by the Forest Health Monitoring Unit of Natural Resources Canada, Canadian Forest Service, Sault Ste. Marie, with assistance from the Ontario Ministry of Natural Resources to conduct an expanded field survey from what could be undertaken solely under the national Forest Health Network. The information in this bulletin reflects monitoring, aerial surveys and other activities from late May to mid September.

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Based on aerial surveys, spruce budworm (*Choristoneura fumiferana* Clem.) jack pine budworm (*Choristoneura pinus pinus* Free.) and gypsy moth (*Lymantria dispar* [L.]) declined this year. Forest tent caterpillar (*Malacosoma disstria* Hbn.) infestations more than doubled in extent in 1997. Further details on these and other pests follow.

FOREST INSECTS

EASTERN SPRUCE BUDWORM (*Choristoneura fumiferana* Clem.)

The extent of moderate-to-severe defoliation caused by spruce budworm declined in 1997 to 135,051 ha compared to 435,931 ha in 1996 (Table 1) (Fig. 1). This is the fifth consecutive year of decline from its most recent peak of 9,595,762 ha in 1992. At the peak of the outbreak (1967-1997), spruce budworm defoliated a maximum of 18,850,000 ha in 1980 in Ontario.

Declines occurred in the following districts: Dryden, Fort Frances, Kenora, Nipigon, Sioux Lookout, Thunder Bay, Chapleau, Sault Ste. Marie, Wawa, Algonquin, Parry Sound and Pembroke. The largest declines were in Thunder Bay and Wawa districts. Increase occurred, although small in most cases, in Red Lake, Hearst, North Bay, Sudbury, Kemptville and Peterborough districts.

Table 1: Gross area of moderate-to-severe defoliation caused by the eastern spruce budworm in Ontario 1994-1997.

Region / District	Area (ha)			
	1994	1995	1996	1997
Northwest				
Dryden	507 430	601 490	4 695	0
Fort Frances	506 878	373 401	43 004	26 765
Kenora	571 555	513 141	12 725	11 032
Nipigon	355 699	95 569	60 164	15 507
Red Lake	559 847	392 031	3 964	4 018
Sioux Lookout	367 437	576 055	6 138	16
Thunder Bay	1 004 558	521 802	117 971	3 420
	3 873 404	3 073 489	248 661	60 758
Northeast				
Chapleau	0	2 695	31 433	0
Hearst	42 245	53 413	3 334	3 520
North Bay	27 995	28 269	26 116	33 758
Sault Ste. Marie	915	2 713	3 194	0
Sudbury	22 640	26 371	22 501	26 306
Wawa	241 340	221 446	81 136	0
	335 135	334 907	167 714	63 584
Southcentral				
Algonquin	57 405	33 692	10 234	0
Aurora	0	7	0	8
Bancroft	0	1 828	0	0
Cambridge	20	0	0	0
Kemptville	570	5 638	4 880	6 870
Midhurst	97	97	0	0
Parry Sound	0	0	438	0
Pembroke	0	645	2 826	3 447
Peterborough	0	815	178	384
	58 092	42 722	19 556	10 709
TOTAL	4 266 631	3 451 118	435 931	135 051

In northwestern Ontario, the largest pockets of defoliation were mapped between Tetu Lake and the Ontario/Manitoba border, south of Lount Lake and on the west side of Perrault Lake in the Kenora District. In the Red Lake District, the largest infestations were at Pineneedle Lake and south of Little Trout Lake. Smaller defoliated areas were observed in both districts including six islands on Lake of the Woods. In the Fort Frances District, most of the defoliation was mapped northwest of the town of Fort Frances located between Stanjikoming Bay and Northwest Bay of Rainy Lake. In the Thunder Bay District, there are only a few small pockets of defoliation remaining in Devon, Scoble and Gorham townships and near Whitelilley and Retto lakes just west of Highway 527. In the Nipigon District, the largest pocket of defoliation was mapped on the Black Bay Peninsula with numerous, small, scattered pockets elsewhere in the district.

In northeastern Ontario, infestations in the Dubreuilville area in Wawa District, Biscotasing in the Chapleau District and the Sault Ste. Marie District collapsed in 1997. A pocket of defoliation occurred again in Rogers Township in Hearst District. The infestation near the village of Warren on Highway 17 which straddles the Sudbury-North Bay District boundary expanded to 60,000 ha in 1997 compared to 48,600 ha in 1996.

In southern Ontario, infestations in the northwest corner of Algonquin Park District collapsed in 1997. In the Pembroke District, pockets of defoliation were mapped in Stafford and Westmeath townships, southeast of the city of Pembroke and around the town of Renfrew. Pockets of defoliation were mapped in the Amprior-Almonte-Kanata area in Kemptville District. These latter infestations increased in 1997 compared to 1996. Several small pockets of defoliation were mapped in the Larose Forest, east of Ottawa in Clarence and Cambridge townships, Kemptville District. A pocket of severe defoliation persisted at Balsam Lake Provincial Park, Peterborough District and in a small white spruce (*Picea glauca* [Moench] Voss) plantation near Claremont in Aurora District.

The total area of spruce budworm caused tree mortality increased by 145,553 ha in 1997 (Fig.2)to a total of 8,464,763 ha. The largest increases occurred in Fort Frances, Kenora, Nipigon, Red Lake, Sioux Lookout and Thunder Bay districts. Mortality was mapped in North Bay, Kemptville, Pembroke and Peterborough districts for the first time.

JACK PINE BUDWORM (*Choristoneura pinus pinus* Free.)

Jack pine budworm populations collapsed in 1997 and defoliation was not mapped. In 1996, defoliation totalled some 103,851 ha and was mapped in Parry Sound (55,289 ha), Sudbury (20,238 ha), North Bay (19,397 ha), Algonquin (4,365 ha), Pembroke (3,317 ha), Timmins (723 ha) and Chapleau (522 ha).

FOREST TENT CATERPILLAR *(Malacosoma disstria* Hbn.)

Forest tent caterpillar infestations more than doubled in extent with 1,780,301 ha being mapped in 1997, compared to 854,269 ha in 1996 (Table 2) (Fig. 3). Most of the defoliation occurred in Cochrane, Hearst, Timmins, Kirkland Lake and Wawa districts. New infestations were also detected in Dryden, Kenora and Red Lake districts in northwestern Ontario. Infestations in Mountain and Cumberland townships in Kemptville District in southeastern Ontario collapsed in 1997.

LARGE ASPEN TORTRIX *Choristoneura conflictana* (Wlk.)

Large aspen tortrix infestations more than tripled in size in 1997 as 160,144 ha of defoliation was mapped compared to 50,461 ha in 1996 (Table 3) (Fig. 4). This outbreak is located in Nipigon and Thunder Bay districts along the Nipigon River, Black Bay, Nipigon Bay, Sibley and Black Bay peninsulas and St. Ignace Island. Defoliation was also found on the Garden River First Nation, Sault Ste. Marie District.

ASPEN TWOLEAF TIER *Enargia decolor* (Wlk.)

Populations of this aspen defoliator declined by 81% based on the area of moderate to severe defoliation mapped in 1997. a total of 744,705 ha of defoliation was mapped in 1997 compared to 3,900,196 ha in 1996 (Table 4) (Fig. 5). The largest infestation was located in the western part of the Hearst District and extends into the adjacent Wawa District. Defoliated stands were located in the vicinity of Wig, Steel, Ara, Tennant, Marshall and Castor lakes of the Nipigon District and near Caribou Lake, north of Armstrong in the Thunder Bay District. There were also small patches of moderate defoliation between Massey and Espanola in Sudbury District.

ASPEN SERPENTINE LEAFMINER *(Phyllocnistis populiella* Cham.)

This insect damaged a total of 189,983 ha of aspen forest in 1997 (Fig. 6). Most of the damage (187,188) ha) was in the vicinity of Kagianagami, Abamasagi and Junior lakes in the Nipigon District with a small area of damage (2,865 ha) in the adjacent part of Thunder Bay District.

In 1996, a total of 5, 970 ha of host stands were severely mined in Nipigon District and in 1995, 88,740 ha were damaged in Nipigon and Sioux Lookout districts.

PINE FALSE WEBWORM *Acantholyda Erythrocephala* (L.)

Populations of this insect expanded in 1997, particulary in the Ganaraska Forest Area where 1,368 ha of red pine and white pine including plantations up to 12 metres in height and large overstory white pine were severely defoliated in Hope-Cavan townships in Peterborough District and Clark Township in Aurora District (Fig. 7).

Table 2: Gross Area of moderate to severe defoliation caused by the forest tent caterpillar in Ontario 1994-1997.

Region / District	Area (ha)			
	1994	1995	1996	1997
Northwest				
Dryden	0	0	0	9 639
Kenora	0	0	0	273
Red Lake	0	0	0	987
	0	0	0	10 899
Northeast				
Chapleau	0	0	2 953	0
Cochrane	116 720	165 988	512 022	1 102 202
Hearst	49 340	72 329	255 094	432 841
Kirkland Lake	0	0	1 881	42 683
Timmins	0	3 470	80 693	190 388
Wawa	0	0	0	1, 288
	166 060	241 787	852 643	1 769 402
Southcentral				
Kemptville	0	1 338	1 626	0
	0	1 338	1 626	0
TOTAL	166 060	243 125	854 269	1 780 301

A total of 167 ha of defoliation was mapped near Craighurst in Oro, Medonte, Flos and Vespra townships in Midhurst District. Large mature white pine, old Scots pine and red pine plantations of all heights were severely defoliated. Up to 60% tree mortality has occurred to older, near pole size red pine in the older infested plantations.

Elsewhere, severe defoliation was mapped south of Cobden in Ross Township, Pembroke District. The 5 ha, 4 metre tall red pine plantation was affected as well as nearby mature white pine. Severe defoliation was also found south of Sprucedale in the Parry Sound District and north of Bird Creek, Monteagle Township, Bancroft District. Defoliated trees were also found in the City of Sault Ste. Marie and near Espanola, Sudbury District.

Table 3. Gross area of moderate to severe defoliation caused by the large aspen tortrix in Ontario, 1994-1997.

Region / District	Area (ha)			
	1994	1995	1996	1997
Northwest				
Nipigon	1 905	900	32 824	92 519
Thunder Bay	0	0	17 637	67 595
	1 905	900	50 461	160 114

Table 4. Gross area of moderate to severe defoliation by the aspen twoleaf tier in Ontario, 1995-1997.

Region / District	Area (ha)		
	1995	1996	1997
Northwest			
Nipigon	0	0	64 530
Thunder Bay	0	0	5 132
	0	0	69 662
Northeast			
Chapleau	925 202	342 543	0
Hearst	0	496 768	632 263
Kirkland Lake	926 977	9 018	0
North Bay	797 685	397 248	0
Sault Ste. Marie	109	16 044	0
Sudbury	385 548	803 559	0
Timmins	1 156 323	25 973	0
Wawa	0	1 339 176	42 780
	4 191 844	3 430 329	675 043
Southcentral			
Algonquin	416 724	298 105	0
Bancroft	62 298	8 238	0
Parry Sound	39 587	32 640	0
Pembroke	92 512	130 884	0
	611 121	469 867	0
	4 802 965	3 900 196	744 705

OAK LEAF SHREDDER *Acleris semipurpurana* (Kft.)

In 1997, approximately 525 ha of red oak forest was moderately defoliated near Lafontaine in Tiny Township, Midhurst District and Christian Island in Nottawasaga Bay (Fig. 7). Some gypsy moth was observed in the area and may have contributed to the defoliation.

This insect also caused about 40% defoliation (1 ha) within the City of Sault Ste. Marie and 60% defoliation (10 ha) on High Island, Gordon Lake, Gordon Township, Sault Ste. Marie District.

GYPSY MOTH *Lymantria dispar* (L.)

Gypsy moth populations which had declined to 7,214 ha in 1996 declined to almost zero based on moderate to severe defoliation in 1997. After six years, 1991-1996, the infestation located in and around the City of Sudbury collapsed. A small pocket of defoliation, 5 ha, was detected along Cedar Creek, west of Kingsville, Aylmer District (Fig. 7) in the same area where 919 ha of defoliation was mapped in 1996. Aerial surveys detected three small pockets of moderate defoliation on inaccessible shorelines of Red Horse Lake and Donaldson Bay on Charleston Lake north of Charleston Lake Provincial Park, Kemptville District. Ground checks to confirm whether gypsy moth was responsible or not will be carried out. very low populations of gypsy moth larvae were found in many parts of southern Ontario and in the vicinity of Sudbury. Many dead larvae were encountered and samples were submitted to the laboratory for diagnosis.

Pheromone trapping was carried out in Northern Ontario parks and campgrounds in 1997. Fifty six locations were trapped. Moths were caught in North Bay, Sudbury, Sault Ste. Marie, Kirkland Lake, Chapleau and Wawa districts. Single moths were caught at Nakina, Nipigon District and Blue Lake provincial Park, Dryden District.

LARCH CASEBEARER *Coleophora laricella* (Hbn.)

Larch casebearer caused moderate or severe defoliation to larch stands through the southern part of the Sault Ste. Marie, Sudbury, North Bay districts and throughout the southcentral Region wherever there are concentrations of larch.

SNOW DAMAGE

Heavy, wet snow in the late fall or early winter of 1996-97 caused damage to primarily jack pine throughout a total area of some 1,291,079 ha in the Chapleau, Sault Ste. marie and Sudbury districts in the Northeast Region and Dryden, Kenora and Red Lake districts in the Northwest Region (Table 5) (Fig. 8). Young jack pine trees in Moncrieff Township, Sudbury District, and in Invergarry and Vrooman townships, Timmins District were snow damaged also.

Heavy wet snow accumulated in tree tops and subsequently laid trees flat, bent them over or broke branches or main stems. Species affected were jack pine, red pine, willow, white birch, trembling aspen and alder.

Table 5: Area within which snow damage was mapped in Ontario, July, 1997.

Region District	Area (ha)
Northwest	
Dryden	24 014
Kenora	103 821
Red Lake	72 380
	200 215
Northeast	
Chapleau	495 048
Sault Ste. Marie	436 687
Sudbury	159 129
	1 090 864
TOTAL	1 291 079

HAIL DAMAGE

A hail storm that occurred near the end of July 1996, was probably responsible for some Dryden (13,339 ha) districts (Fig. 9).

Most of the damage mapped was in the Fairchild and Savant lakes area in Sioux Lookout District and extended south into the Dryden District to the north end of Sturgeon Lake.

Hail damage was also reported from Rogers Township, Hearst District (area not yet determined) and from Assignick Township, Manitoulin Island, Sudbury District, where 5 ha of eastern white cedar was severely damaged.

DROUGHT

Warm, dry weather in June and July 1997 resulted in drought damage. A total of 1,460,769 ha were mapped throughout the province (Fig.10). In the Northwest Region, the extent of damage in ha by district was mapped as follows: Dryden - 110,026 ; Fort Frances - 601,124; Kenora - 109,294 ; Nipigon - 9,918 ; Red Lake - 26,163 ; Sioux Lookout - 64,404 and Thunder Bay - 49, 289. The regional total is 970, 218 ha.

In the Northeast Region: Chapleau - 6,407 ; North Bay - 4,377 ; Sault Ste. Marie - 363,260 ; Sudbury - 487 and Wawa - 13,521. The regional total is 388,052 ha.

In the South Central Region: Algonquin - 14,424 ; Bancroft - 48,133 ; Midhurst - 398 ; Parry Sound - 15,321 and Pembroke - 24,223. The regional total is 102,499 ha.

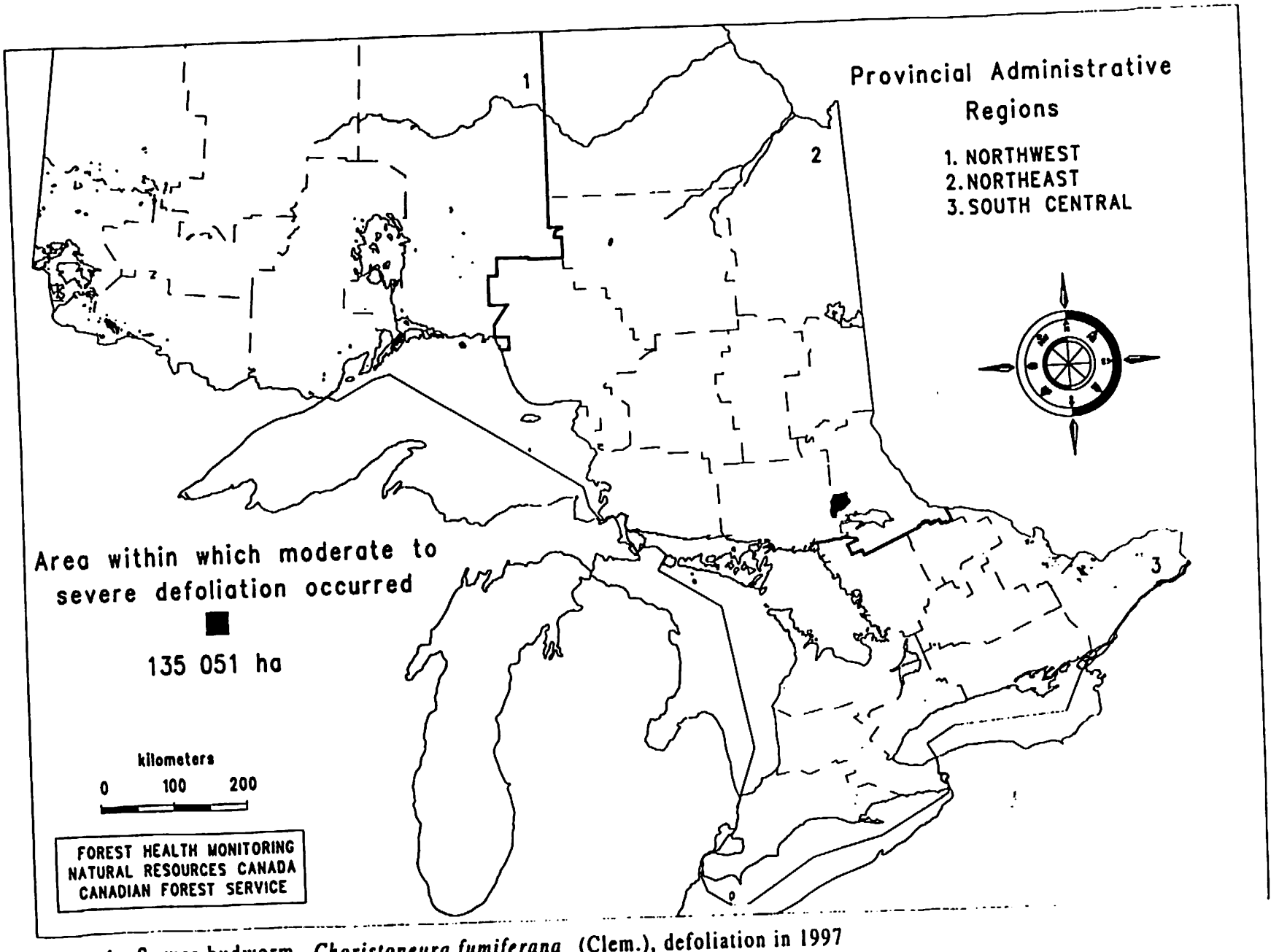

Figure 1. Spruce budworm, *Choristoneura fumiferana* (Clem.), defoliation in 1997

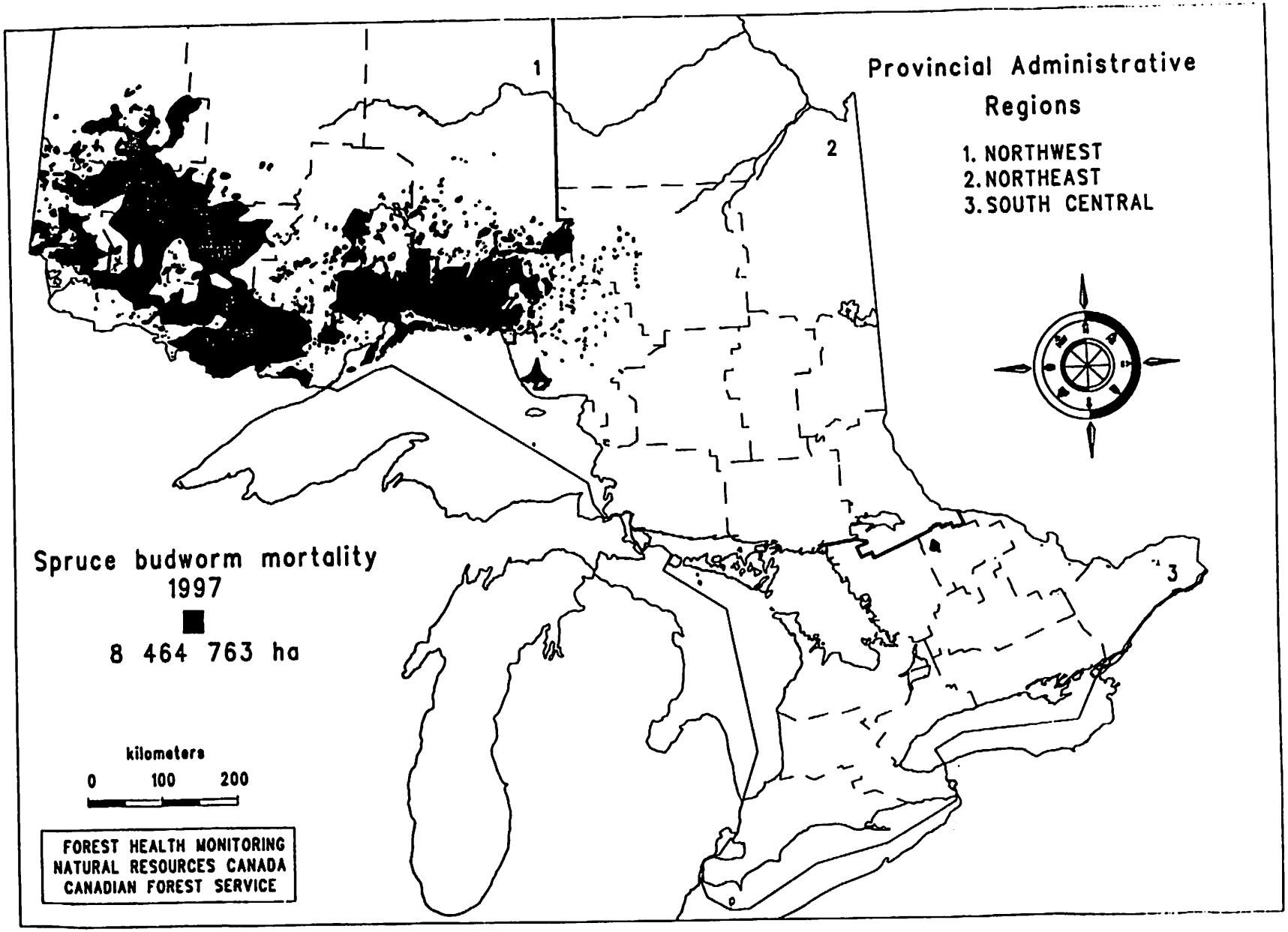

Figure 2. Spruce budworm, *Choristoneura fumiferana* (Clem.), mortality in 1997.

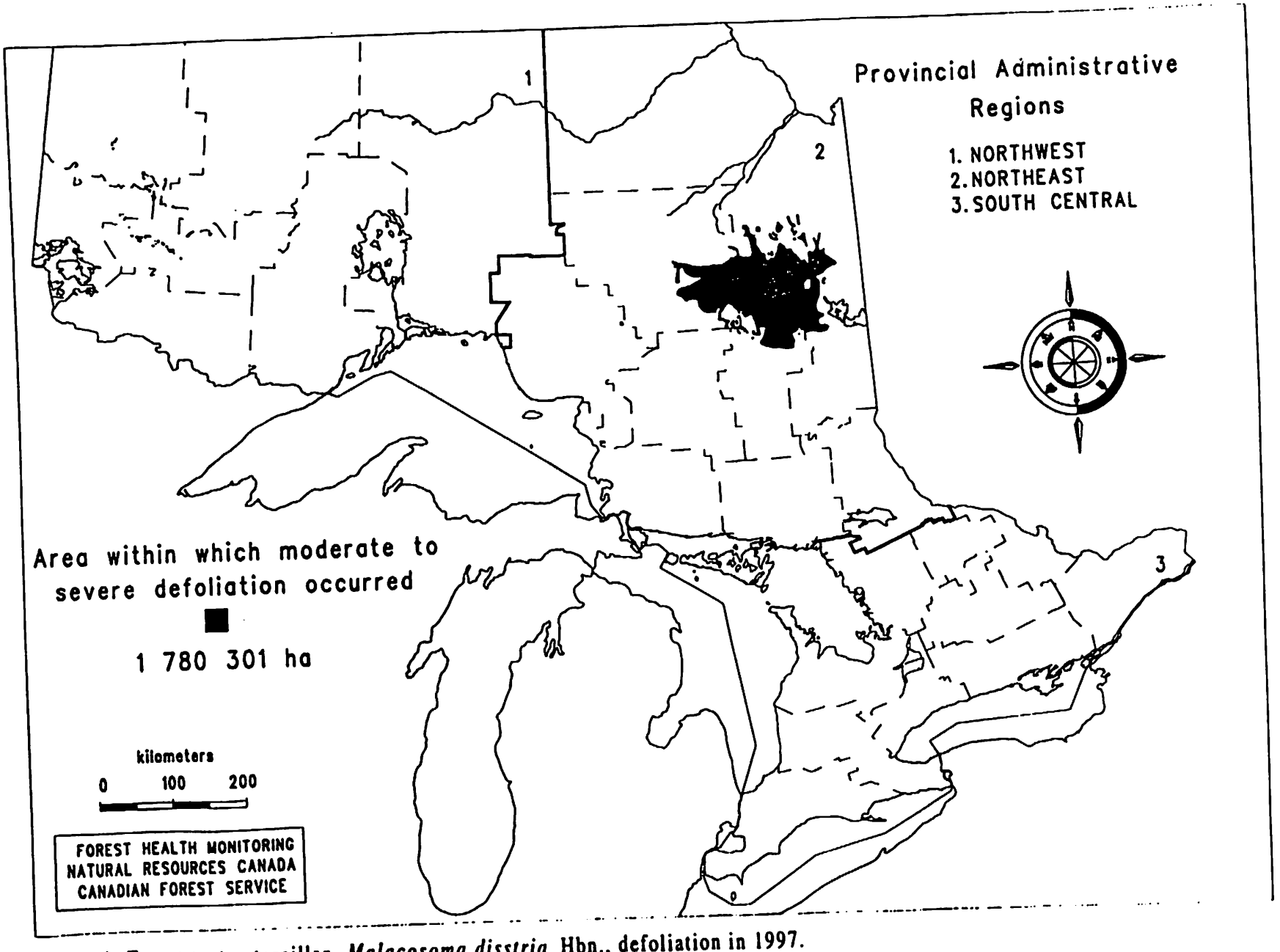

Figure 3. Forest tent caterpillar, *Malacosoma disstria* Hbn., defoliation in 1997.

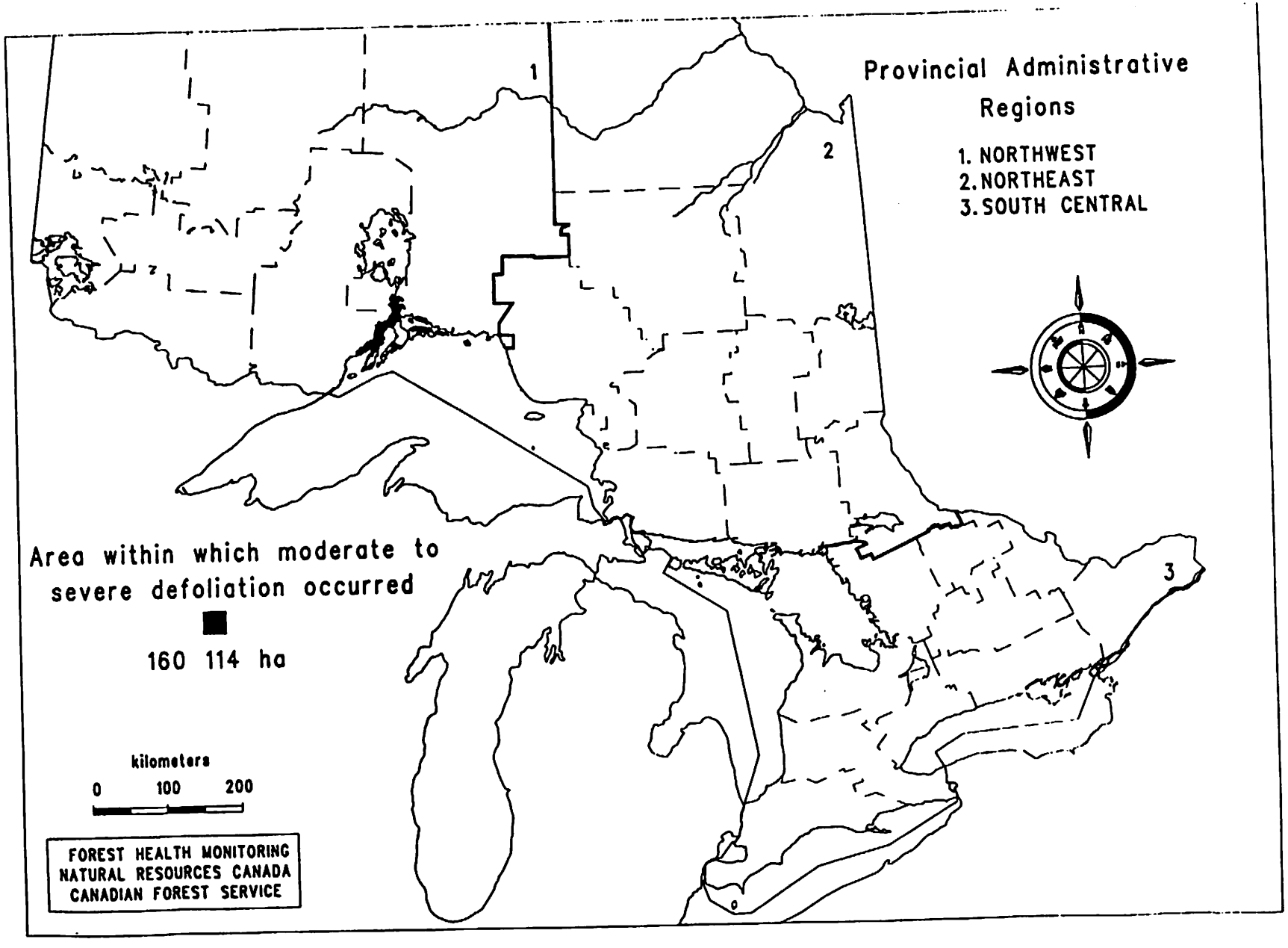

Figure 4. Large aspen tortrix, *Choristoneura conflictana* (Wlk.), defoliation in 1997

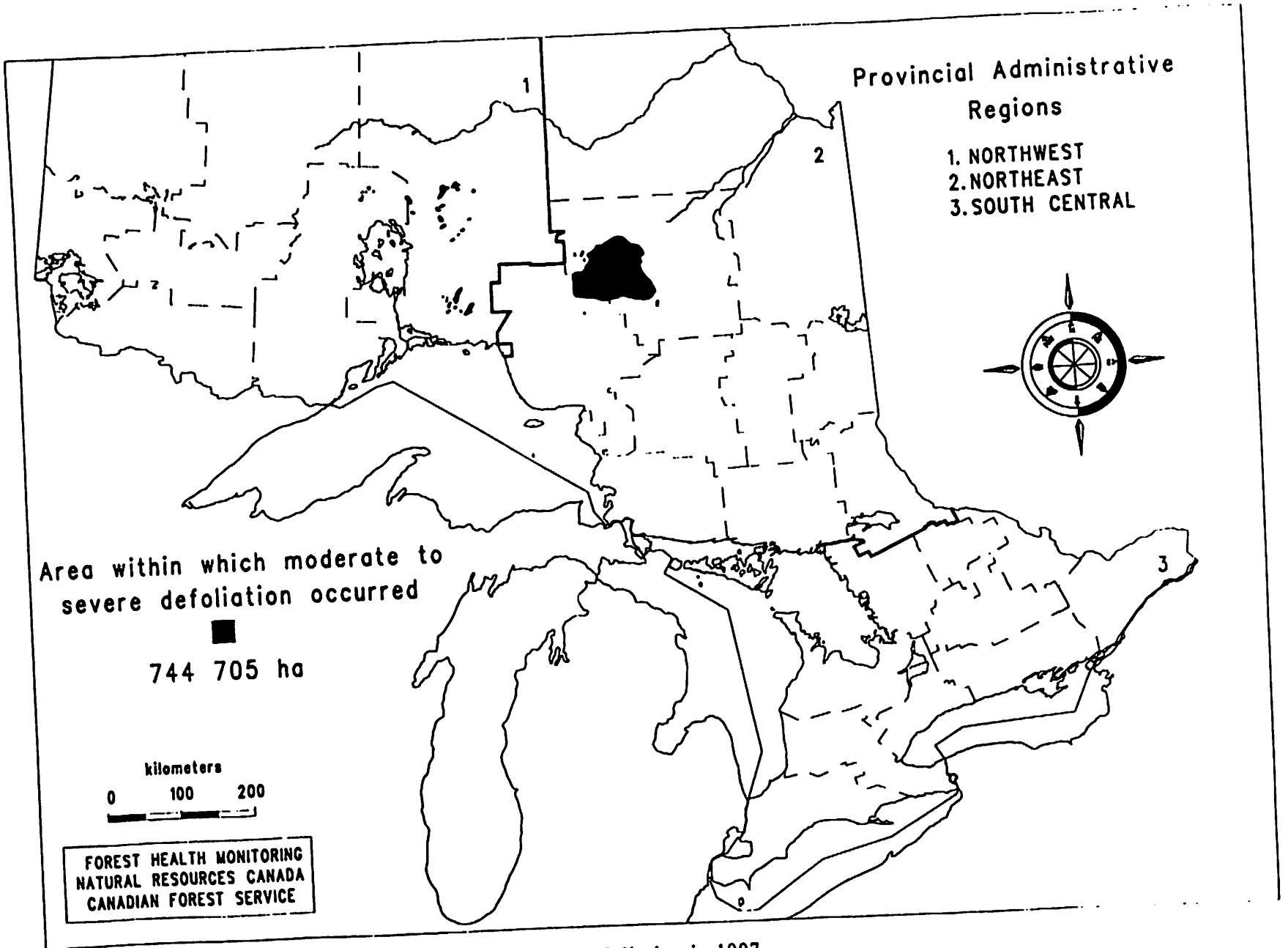

Figure 5. Aspen two leaf tier, *Enargia decolor* (Wlk.), defoliation in 1997

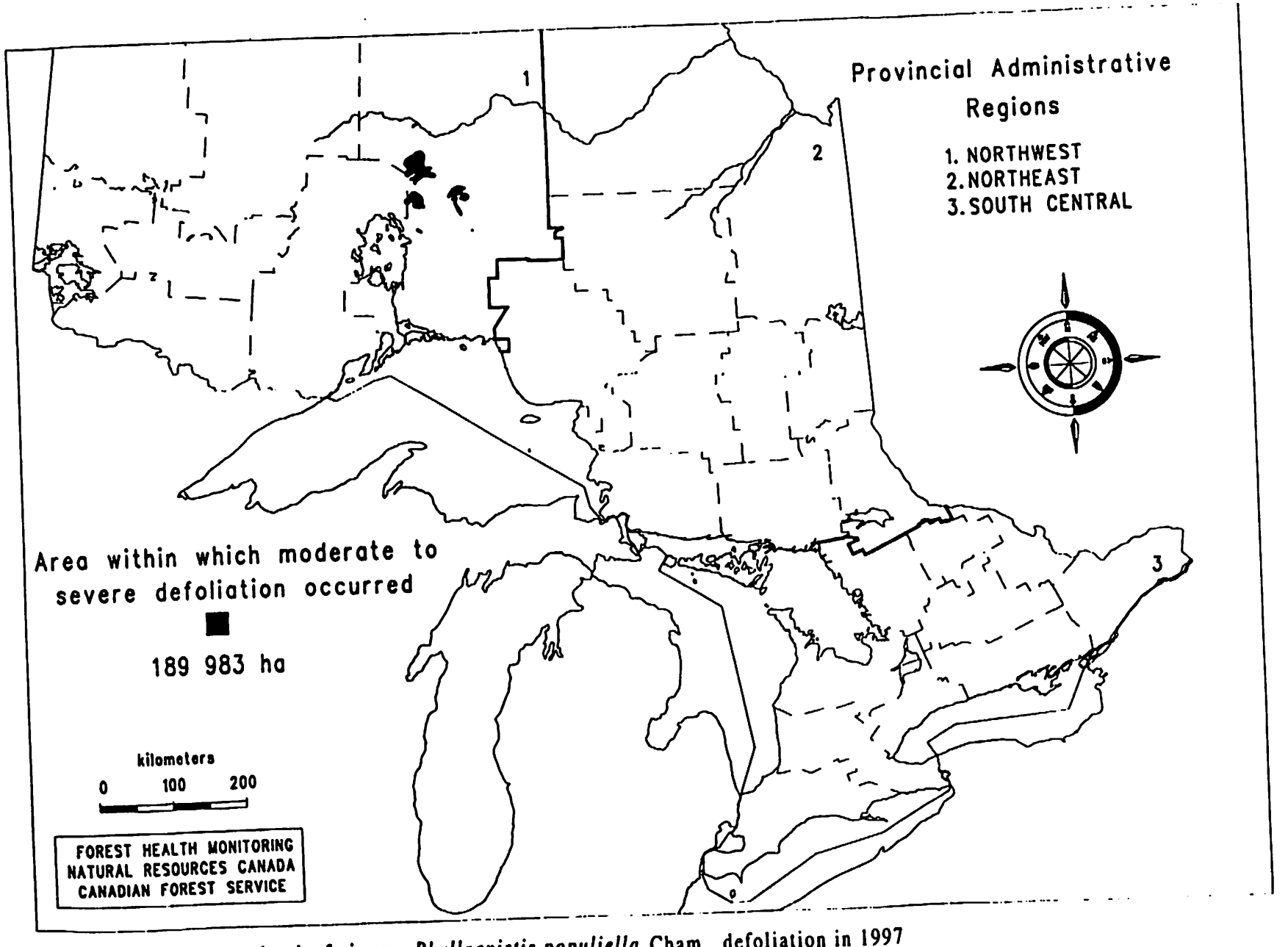

Figure 6. Aspen serpentine leafminer, *Phyllocnistis populiella* Cham., defoliation in 1997

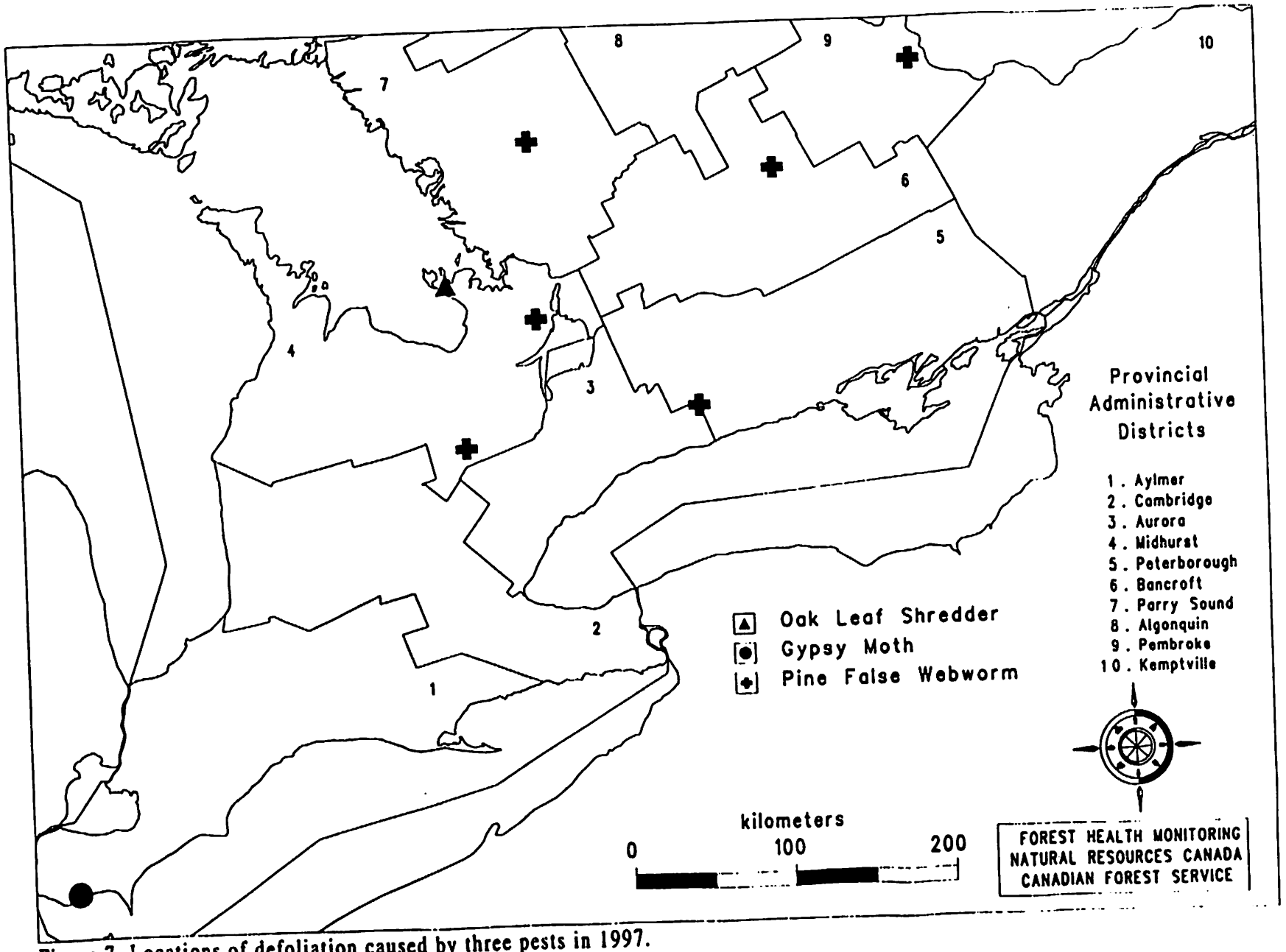

Figure 7. Locations of defoliation caused by three pests in 1997.

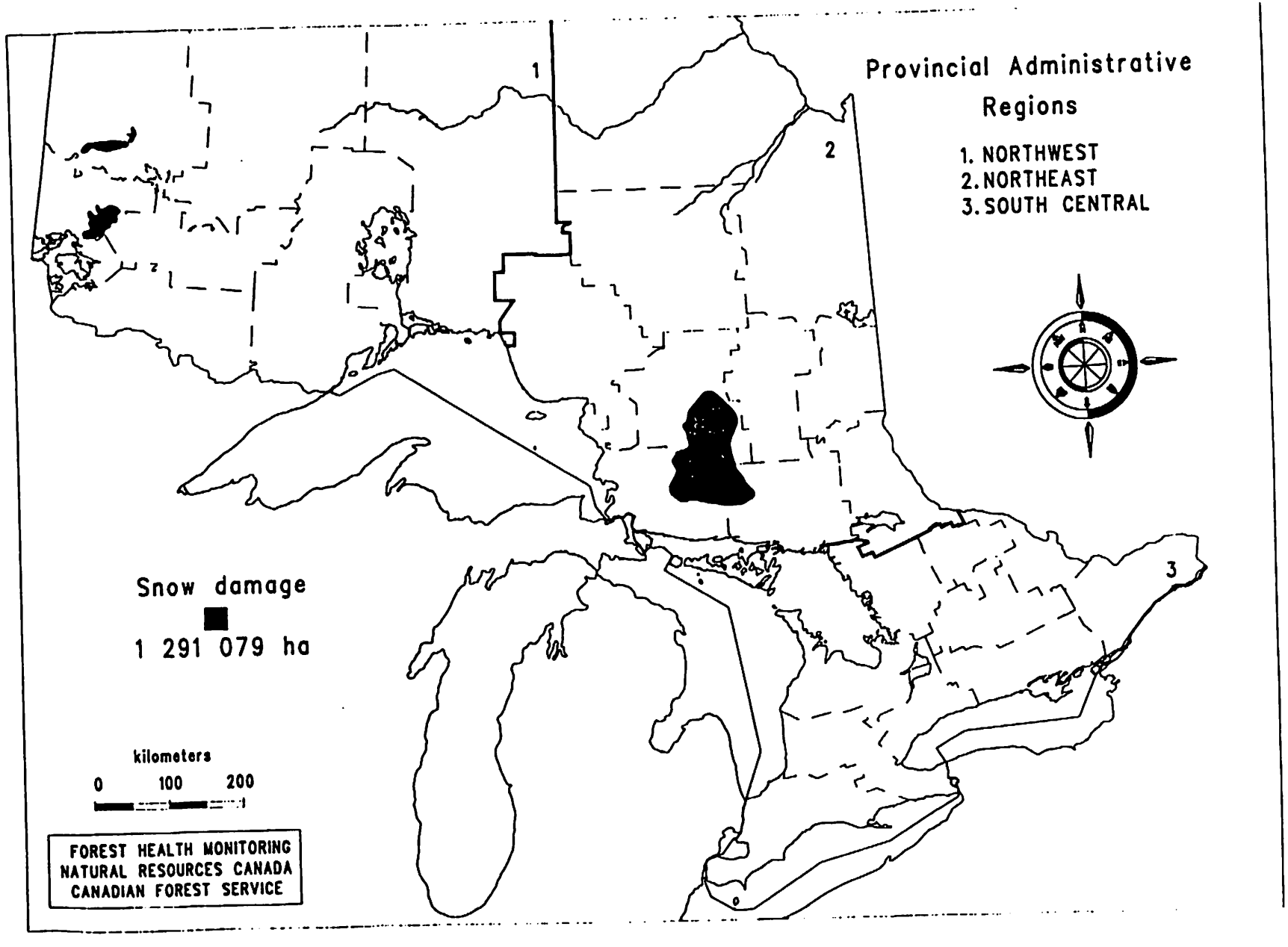

Figure 8. Snow damage in 1997.

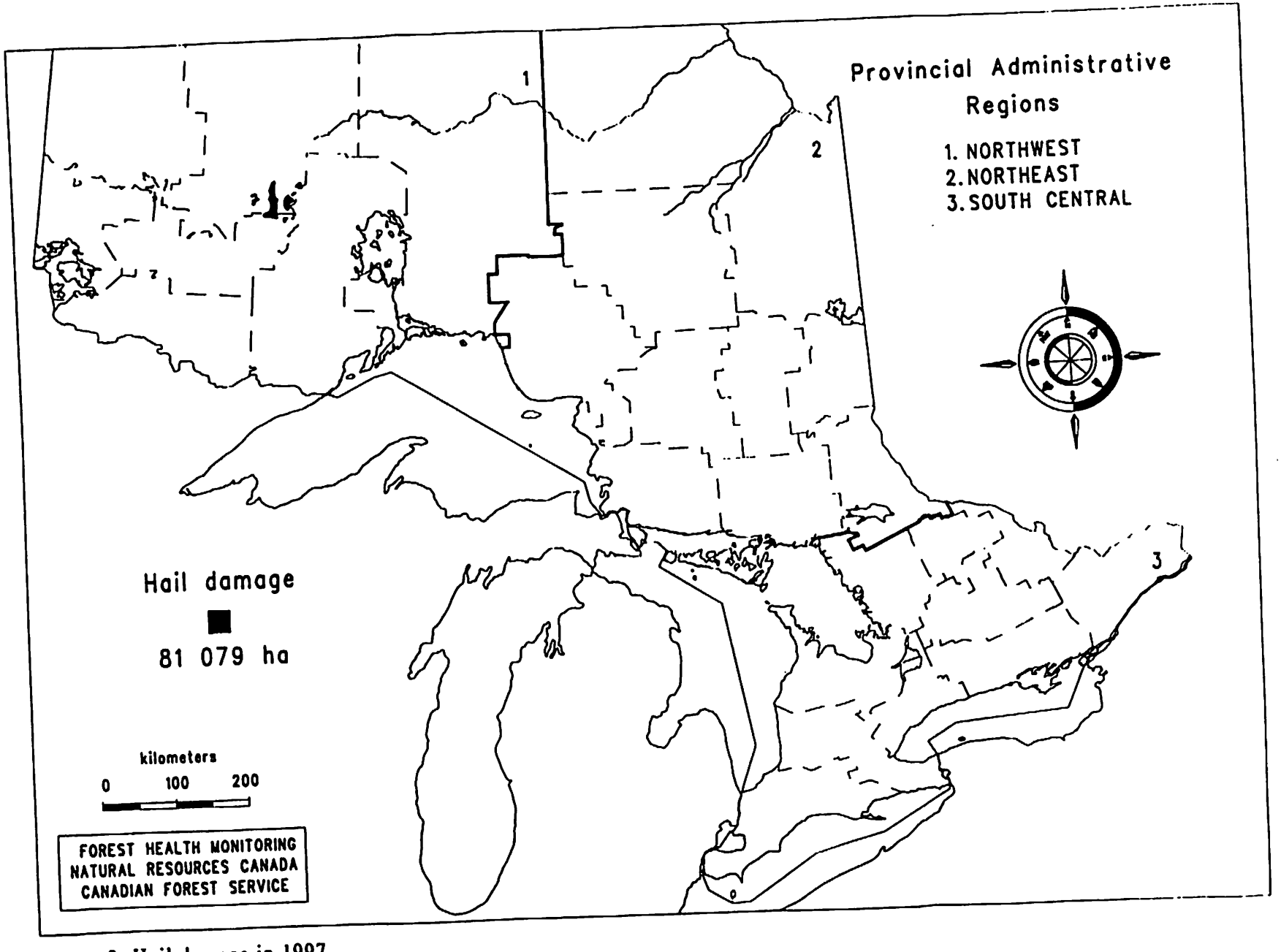

Figure 9. Hail damage in 1997.

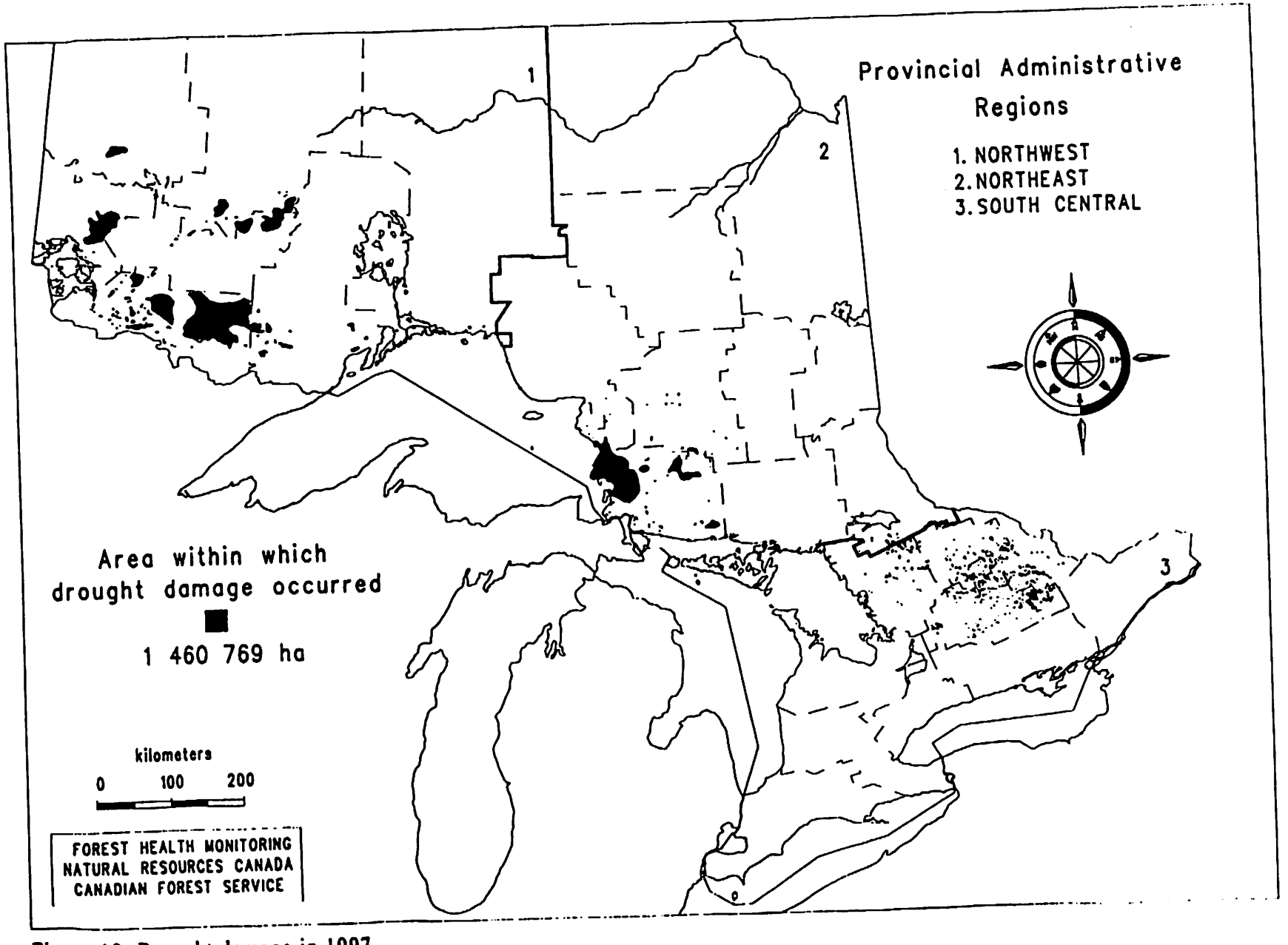

Figure 10. Drought damage in 1997.

Forest Pests in Manitoba - 1997

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The 1997 spray project against spruce budworm was very successful. The population reduction due to insecticide treatment ranged from 66 to 86%. Jack pine budworm populations have remained at endemic levels in Manitoba's jack pine forests. Pheromone traps, which have been used to monitor populations of both insects, appear to have potential as a predictive tool for defoliation.

Three age classes of trembling aspen stands were surveyed for decay due to heart rot, for volume loss to Hypoxylon canker and for the incidence of butt rot and attack by the poplar wood borer.

During the 1997 provincial survey for Dutch elm disease (DED), 5,378 rural elms were marked for removal, and 6,737 more were so designated in the city of Winnipeg. River areas continue to have high levels of DED.

The incorporation of forest health measurements into regeneration surveys became fully operational in 1997 and included lands managed by both the province and industry.

Free to Grow (FTG) surveys were tested for accuracy on forested lands managed by the province. The long-term effect of aerial application of herbicides on competition and on conifer species is being monitored on vegetation plots in treated and untreated areas of plantations.

Les ravageurs forestiers au Manitoba en 1997

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Le programme de pulvérisation entrepris en 1997 contre la tordeuse des bourgeons de l'épinette a donné de très bons résultats. Les réductions induites par les traitements insecticides ont oscillé entre 66 et 86 %. Les populations de la tordeuse du pin gris sont demeurées au seuil endémique dans les pinèdes grises de la province. Les pièges à phéromone utilisés pour la surveillance des populations de ces deux ravageurs semblent présenter un potentiel intéressant comme outils de prévision des taux de défoliation à venir.

Une surveillance visant à déterminer les taux de carie dus à la carie du coeur, les pertes de volumes imputables au chancre hypoxylonien ainsi que les taux de carie de la souche et d'attaque par la saperde du peuplier a été exercée dans des peuplements de peuplier faux-tremble de trois classes d'âge.

Durant le relevé de la maladie hollandaise de l'orme effectué à l'échelle de la province en 1997, 5 378 ormes ont été marqués à des fins d'élimination en régions rurales, et 6 737 autres dans la ville de Winnipeg. L'incidence de la maladie demeure élevée dans les secteurs riverains.

En 1997, des évaluations de l'état de santé des forêts ont été effectuées de façon systématique dans le cadre des relevés sur la régénération. Ces évaluations ont visé des terres gérées par la province et par l'industrie.

La fiabilité des relevés de végétation spontanée a été vérifiée dans des terres boisées gérées par la province. Enfin, des chercheurs s'emploient actuellement à déterminer les effets à long terme des applications aériennes d'herbicides sur la compétition et sur la composition en résineux dans des parcelles établies dans des plantations traitées et non traitées.

FOREST PESTS IN MANITOBA - 1997

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Spruce Budworm Management

In 1997 the spruce budworm, *Choristoneura fumiferana,* infestation in Manitoba was approximately 90,520 ha. Approximately 80,480 ha of spruce/fir forests were moderate to severely defoliated in the Lake Winnipeg East area, Nopiming, Whiteshell and Hecla Island Provincial Parks, and Grindstone Peninsula. The infestation in the Duck Mountain Provincial Forest was approximately 5,583 ha. In northwestern Manitoba approximately 1,853 ha were defoliated in the Namew Lake area. A new outbreak of approximately 2,636 ha was discovered in the Spruce Woods area of southwestern Manitoba.

Based on defoliation predictions derived from the 1996 egg mass surveys an operational budworm suppression program was implemented in 1997 in the Pine Falls Paper Co. Forest Management License Area (FMLA), in Duck Mountain Provincial Forest within the Louisiana Pacific Inc. FMLA and in the Namew Lake area within the Tolko Manitoba Inc. FMLA.

The biosynthetic insecticide, Mimic 240 LV (tebufenozide) flowable was aerially applied to 13,225 ha (Figure 1). The spray project was carried out at five locations (Figure 1). The treatment areas were Hay Bay (2,075 ha) and Coppermine Bay (2,550 ha) in the Pine Falls Paper Co. FMLA; 850 ha west of Falcon Lake in the Northwest Angle Provincial Forest; 3,868 ha in Duck Mountain Provincial Forest in the Louisiana Pacific FMLA and 3,750 ha in the Namew Lake area in the Tolko Manitoba FMLA. With the exception of 1,650 ha in the Duck Mountain area which received a double application, all spray blocks received a single application of tebufenozide 70 grams active ingredient (a.i.) per ha. The product was applied with water providing an application volume of 2.0 litres per ha (290 ml Mimic® and 1,710 ml water). The total spray area, single and double application combined was 14,875 ha. The product was applied by three Air Tractor 401 fixed-wing aircraft each equipped with eight AU 5000 Micronair rotary atomizers. The insecticide applications were carried from June 11 to 17, 1997.

The Coppermine, Hay Bay and Falcon Lake spray blocks were opened on June 11, 1997. The Namew Lake block was opened June 13, 1997 and the Duck Mountain spray block was opened June 15, 1997. Spray block openings coincided with shoot development index 4.0 to 4.5 (Auger's Class) for white spruce and peak 4th to 5th instar spruce budworm larval development.

Pre and post spray larval and defoliation surveys were carried out to determine application timing and spray efficacy. Average pre spray budworm larval numbers per 45 cm branch sample ranged from 5 at Falcon Lake to 50 at Coppermine Bay . Each plot consisted of five dominant or codominant white spruce or balsam fir trees. Sampling consisted of the removal of two 45 cm branch tips at mid-crown per tree to assess larval mortality, defoliation and egg mass densities.

The 1997 spray project was very successful. The population reduction due to insecticide treatment (corrected mortality using Abbott's formula) ranged from 66% at Falcon Lake to 86% at Coppermine Bay (Table 1).

Table 1: Spruce Budworm - percent reduction in larval numbers

Location	Treatment	Pre Spray[1] Larvae	Post Spray[1] Larvae	Larval Mortality	Corrected Mortality
Falcon Lake	Mimic 70 a.i./ha	5	0.4	83%	66%
Falcon Lake	Untreated	12	5	50%	
Coppermine	Mimic 70 a.i./ha	50	6	87%	77%
Coppermine	Untreated	15	8	45%	
Hay Bay	Mimic 70 a.i./ha	37	2	92%	86%
Hay Bay	Untreated	15	8	45%	
Namew Lake	Mimic 70 a.i./ha	23	4	85%	n/a[2]
Duck Mt.	Mimic 2x 70 a.i./ha	9	1	86%	74%
Duck Mt.	Untreated	2	1	47%	

[1.] Number of larvae per 45 cm branch. [2.] Not available due to unreliable untreated plot data.

Table 2: Spruce Budworm - 1997 defoliation and predictions for 1998

Location	Treatment	1997 Defoliation[1]	Egg Masses per 10m²	1998 Prediction
Falcon Lake	Mimic - 70 g a.i./ha	31%	3	Light
Falcon Lake	Untreated	39%	49	Moderate
Coppermine	Mimic - 70 g a.i./ha	38%	132	Moderate
Coppermine	Untreated	54%	286	Severe
Hay Bay	Mimic - 70 g a.i./ha	27%	104	Moderate
Hay Bay	Untreated	54%	286	Severe
Namew Lake	Mimic - 70 g a.i./ha	64%	124	Moderate
Namew Lake	Untreated	35%	118	Moderate
Duck Mt.	Mimic - 2x 70 g a.i./ha	26%	23	Light
Duck Mt.	Untreated	7%	29	Light

[1]Defoliation classes: Light: Up to 35% defoliation of current shoots. Based on <40 or less egg masses per 10 m² of branch area.
Moderate: 35% to 70% defoliation of current shoots. Based on 40 to 185 egg masses per 10 m² of branch area.
Severe: Greater than 70% defoliation of current shoots and possible feeding on old foliage. Based on >185 egg masses per 10 m² of branch area.

Egg mass surveys to predict 1998 defoliation and defoliation assessments were done during the month of August. Moderate defoliation is predicted in the Coppermine, Hay Bay and Namew Lake spray blocks. Light defoliation is predicted within the Duck Mountain and Falcon Lake spray blocks (Table 2).

Spruce Budworm Pheromone Trapping

Within an area to the east of Lake Winnipeg and northeast of the Winnipeg River there is approximately 14,000 ha of budworm vulnerable forest stand types. In 1993 the spruce budworm population in this area was at endemic or pre outbreak levels. In order to monitor low density budworm populations in this area, pheromone traps were placed at 29 locations over a three year period (1994 to 1996 inclusive). The Manitoba Model Forest partially funded this project.

Three Multi-Pher® insect traps containing spruce budworm pheromone (PVC lure containing 0.3% by weight of a 95:5 blend of (E)- and (Z)-11-tetradecenal) were placed 40 m apart at each plot location in either a straight or triangular configuration. White spruce or balsam fir branch samples were collected from to assess defoliation and egg mass densities. Moth captures were compared to subsequent defoliation using the moths per trap versus the risk of severe defoliation in a relationship as follows:

Average moths/trap	Risk of severe defoliation
< 500	Low
500-2000	Moderate
2000+	High

In the plots where the moth capture predicted the risk of severe defoliation to be low, 65% experienced light defoliation, 22% moderate defoliation and 13% severe defoliation the following year. In the plots where the moth capture predicted the risk of severe defoliation to be moderate, 19% experienced light defoliation, 61% moderate defoliation and 19% severe defoliation. The risk of severe defoliation could not be compared to subsequent defoliation as none of the plots averaged 2,000 or more moths per trap.

A similar comparison was made between egg mass densities and subsequent defoliation according to the following relationship:

Egg Mass Density	Defoliation Prediction
<40 egg masses/10m^2 of foliage	Light
40 to 185 egg masses/10m^2 of foliage	Moderate
>185 egg masses/10m^2 of foliage	Severe

The comparison of egg mass densities to subsequent defoliation yielded similar results to that of the moth capture by pheromone traps and subsequent defoliation. In the plots where light

defoliation was predicted, 57% experienced light defoliation, 40% moderate defoliation and 3% severe defoliation. In the plots where moderate defoliation was predicted, 27% experienced light defoliation, 53% moderate defoliation and 20% severe defoliation.

Statistical analysis (contingency table) indicated that the two defoliation prediction methods (moth capture and egg mass densities) were not significantly different in their ability to predict the following year's defoliation at $p \leq 0.05$. These results indicate that pheromone traps have the potential to be used as a predictive tool for spruce budworm defoliation. Pheromone trapping is less labour intensive than egg mass surveys and may be a useful alternative in certain situations.

Jack Pine Budworm

Populations of jack pine budworm, *Choristoneura pinus*, in Manitoba, have continued to remain at endemic levels throughout Manitoba's jack pine (*Pinus banksiana*) forests. Adult jack pine budworm males have been monitored with pheromone baited traps since 1985. This trapping method is being evaluated as an early warning method for outbreaks and a supplemental technique to branch collecting and egg mass prediction of population levels.

Twelve locations across Manitoba are being monitored with pheromone traps. Since 1989, two trap types, Pherocon 1C and Multipher, have been field tested for capture efficiency using a 0.03 microgram concentration of pheromone lure.

Preliminary analysis indicates the Pherocon trap to be more effective in attracting adult male moths during endemic population levels. In 1997, the total number of male moths increased considerably across the province (Figure 2). The two most southerly locations, Shilo and Sandilands, had the largest gain in moth captures.

Since 1986, there had been no visible defoliation observed at the 12 trapping locations. This year, light defoliation was observed in some stands. Branch assessment for defoliation, egg masses, and pollen cone buds is progressing. Pollen cone buds can reliably estimate the level of male flowering that will occur the following spring. Jack pine budworm larvae feed on the pollen cones before consuming the new spring foliage.

Growth measurements (height, dbh and height of live crown) and core samples were taken from 1,056 jack pine trees on 163 permanent sample plots. The core samples will be analysed to determine growth suppression resulting from the most recent jack pine budworm outbreak. Both the growth and core sample date will be utilized in the jack pine budworm decision support system project (JPBWDSS).

Aspen Decay Survey

In recent years trembling aspen has gained in importance as a commercial species. There has been a perception that the aspen resource suffers substantial volume loss due to heart rot

caused by *Phellinus tremulla*, a common wood decay fungus. Cull factors for aspen, originally developed for the saw log industry, range from 20% to 40% in the Manitoba forest inventory. With aspen utilization for other products increasing, a damage appraisal survey was initiated in 1990 to determine if these cull factors are appropriate when aspen is used for manufacturing composite board products (oriented strand board, particle board and paper board). The survey will eventually include all forest management units (FMU) in Manitoba in which aspen has the potential to be commercially important. The survey has been completed in southeastern Manitoba in FMU's 20 and 23 and in FMU's 10 and 13 in western Manitoba. During the 1997 field season the survey continued in FMU's 11 and 12.

Trembling aspen stands in the immature class (approximately 30 to 49 years), mature class (50 to 70 years) and overmature class (71+ years) were included in the survey. Sample plots were randomly placed in the various stand types with each plot consisting of nine sample trees. Sample trees were felled and sectioned into one metre bolts. Stem decay tracings made in the field were digitized into a computerized format and assessed for volume loss. In addition to assessing decay, the volume loss to Hypoxylon canker and the incidence of butt rot and poplar wood borer attack were assessed. The results by FMU are as follows:

Table 3: Advanced Decay

Maturity	Southeast FMU 20	Southeast FMU 23	Western FMU 10	Western FMU 13
Immature (30 to 49 years)	1.0%	3.6%	2.1%	2.0%
Mature (50 to 70 years)	3.8%	4.0%	4.5%	7.0%
Overmature (71+ years)	6.7%	12.1%	4.0%	7.2%

Table 4: Incidence of Poplar Woodborer

Maturity	Southeast FMU 20	Southeast FMU 23	Western FMU 10	Western FMU 13
Immature (30 to 49 years)	37.7%	35.9%	13.6%	7.4%
Mature (50 to 70 years)	38.3%	54.9%	12.1%	29.4%
Overmature (71+ years)	44.4%	62.9%	19.4%	26.8%

Table 5: Incidence of Butt Rot

Maturity	Southeast FMU 20	Southeast FMU 23	Western FMU 10	Western FMU 13
Immature (30 to 49 years)	24%	37%	37%	36%
Mature (50 to 70 years)	44%	49%	58%	44%
Overmature (71+ years)	54%	65%	69%	51%

Table 6: Volume Loss to Hypoxylon Canker

Southeast FMU 20	Southeast FMU 23	Western FMU 10	Western FMU 13
6.9%	10.2%	2.0%	3.6%

Dutch Elm Disease 1997/98

The objective of the Dutch Elm Disease (DED) program in Manitoba is to manage the loss of high value urban trees at less than 3% annually. The DED program uses an integrated approach to minimize the effects of DED on Manitoba's urban forests.

The annual DED surveillance program ran for approximately three months during the summer of 1997. This survey program encompassed 28 cost sharing communities as well as 5 buffer zone municipalities around selected towns and cities including the City of Winnipeg. The province is responsible for the survey of diseased and dead elm trees within all cost sharing agreement communities. The province is also responsible for removal of infected elms from all cost sharing communities except those of Brandon and Swan River. The Province of Manitoba and the communities cost share DED management aspects such as sanitation pruning, basal spraying with chlorpyrifos, replacement planting, site specific inventory, general tree care and education and training courses approved by the Province. The City of Winnipeg, which has no cost sharing agreement with the Province, operates its own Dutch Elm Disease program with the assistance of a grant from the Provincial government.

The range of Dutch Elm Disease extends across southern and central regions of the province from the Manitoba-Ontario border into Saskatchewan and northward to the Saskatchewan River. The disease now extends throughout the entire range of American elm in Manitoba.

During the 1997 provincial survey, 5,378 elms were marked for removal. Of this total, 73 consisted of firewood piles, 691 trees were diagnosed as having DED and the remainder were classified as hazards i.e. decadent to the point that they were capable of supporting elm bark beetle breeding activity. In the City of Winnipeg, 6,737 were slated for removal, 4,875 of which were diagnosed as having DED and the remaining classified as hazards. In addition, the City of Winnipeg issued 192 firewood notices. Other major urban centres with disease included Brandon, Portage la Prairie, Morden, Winkler, Dauphin, Steinbach and Selkirk.

River areas continue to have high levels of DED, especially along the Red and Assiniboine Rivers. The Boyne River near Carman and the Souris River in southwestern Manitoba remain extensively infected. In the western and northwestern portions of the province major the Swan, Red Deer, Carrot and Saskatchewan Rivers plus numerous smaller rivers are heavily infested.

From April 1, 1996 to March 31, 1997 the Provincial DED Sanitation crews removed 8,454 diseased and hazard elms; the City of Winnipeg removed approximately 6,931 in 1996 and the City of Brandon removed 233.

The major vector of Dutch Elm Disease in Manitoba is the native elm bark beetle (*Hylurgopinus rufipes*). The more aggressive smaller European elm bark beetle (*Scolytus multistriatus*), has been found in small numbers in the City of Winnipeg, since 1975. Eight pheromone trapping locations were established across southern Manitoba, from 1982-1995, to monitor the population and distribution of *S. multistriatus*. Two specimens were captured in rural Manitoba in 1989.

The City of Winnipeg continued a DED management research study in 1997 which is examining a variety of intensive survey and removal strategies in combination with fungicide injections and using community involvement. Results are pending.

Regeneration Performance Assessment - Pest Impact Plot Survey

From 1986 to 1988, the Silviculture Section of the Manitoba Forestry Branch located Regeneration Performance Assessment (RPA) plots in recently established plantations of the major tree species. Plots are maintained by species and differentiated by planting technique and site preparation method. Forest Health and Ecology section began a survey regime in 1990, within the Silvicultural RPA plots, to periodically assess the seedlings for pest damage and occurrence and relate this incidence to tree growth and vigour. The seedlings are assessed every three years until age 21.

In 1997, a third pest assessment was conducted on the 1988 permanent silvicultural RPA plots. These included 4 plantations or 48 plots with white spruce or jack pine. Data entry and analysis is ongoing. Needlecast was a prominent problem on both tree species this year.

White Pine Weevil Monitoring

Two white spruce family test plantations in the Western Region have had a low population of white pine weevil since 1994. Pruning of the terminals and a methoxychlor application were previously conducted in these high-value plantations. In the spring of 1997, baited sticky stovepipe traps were utilized to mass trap adult weevils in these two plantations. Capturing the adults, upon emergence, could reduce the number of trees attacked by the weevil. Data is now being compiled to determine whether this method was effective and to provide further control recommendations.

1997 Integrated Forest Renewal Program Pest Survey

Regeneration Survey

The incorporation of forest health measurements into regeneration surveys became fully operational in 1997 and included areas managed by forest companies (FMLA's) as well as forest lands directly managed by the province. The forest health survey method included only unacceptable codes ie. renders a tree not countable (Table 7). Additional acceptable codes designed to pick up a greater number of damaging pests were discontinued after two years of testing indicated minimal success. Detecting pest symptoms using acceptable codes (trees included in counts as damage is less severe) at age seven were not easily picked up by surveyors as symptoms are not well developed. In order to make the forest health component operational, the provincial field supervisors, who are responsible for the implementation of these surveys, were intensively trained prior to the start of the survey year. An improvement this year was the development of plasticized field survey cards using scanned colour photos of each forest health code.

In 1997, the Provincial regeneration surveys covered 3,436 ha (126 stands). The following list of criteria was provided to the regeneration crew supervisors to select stands for forest health follow up check:

a) Dwarf Mistletoe - any level of occurrence (L - light, M - moderate, S- severe)
b) Moderate or Severe intensity for any one Forest Health code.
c) Combinations - of any 2 codes (L,M or S) for all Softwood Species;
for Hardwood Species : Dead (M or S); Browse (M or S); and Vigour (M or S).
d) Mapping of dwarf mistletoe infections (residuals and/or edge infections).

Nine stands covering 255 ha, were selected for forest health follow up (eight provincially managed stands; one Tolko company stand). Follow up surveys for Pinefalls Paper Company will occur in the spring of 1998. One mixed jack pine/black spruce stand (Tolko-northwest region) was checked for jack pine dwarf mistletoe *(Arceuthobium americanum)* edge infections and poor stocking. Provincially managed lands had follow up visits to four stands in the western region which indicated light spruce dwarf mistletoe *(Arceuthobium pusillum)* in one black spruce stand, and moderate to severe browse damage to trembling aspen, white birch and balsam poplar in three planted black spruce stands. Damage to the hardwood component in these stands may impact Louisiana Pacific in the future. Dwarf mistletoe on black spruce was checked in two stands in the southeast region. One stand had significant edge infection in one portion of the stand and the other stand was found to be misidentified (rust broom). In the northwest region, two stands were checked for dwarf mistletoe infection. Due to the potential impact of mistletoe these stands were planted to an alternate tree species not susceptible to the disease.

Table 7: Regeneration Survey Forest Health Unacceptable Damage Codes

Pest/Damage & Host	Signs and Symptoms	Causes
D - Dead all species	foliage missing,red or chlorotic, main stem broken, etc.	unknown cause
G - Galls Jack Pine - Do not use on hardwoods	globose gall, orange spores in May-June; only one gall is on the main stem OR 5+ galls on the branches	western gall rust
DM - Dwarf Mistletoe Jack Pine, Spruces. Map & Comment on Data Sheets if DM is on Residuals or Bordering Trees	broom is formed on one or more branches or localized swellings & aerial shoots on young trees	parasitic plant
L - Lean all species	greater than 45 degree angle from base of tree (root collar). Base of tree must be inside of plot	can indicate root collar weevils, improper planting,snow damage
C - Chlorosis all species	all foliage is yellow or grey green	can indicate flooding, nutrient deficiency, root collar weevil, western gall rust, root collar girdling, armillaria, etc. Can occur in pockets with dead and dying trees
V - Poor Vigour all species	tree has extreme foliage loss, very suppressed or very stunted or with multiple damages	extreme competition (grass, shrubs), flooding, repeated frost damage
BR - Browse all species	feeding/clipping damage to 2/3rds of crown	rabbits, mice, voles, deer, moose

Free to Grow Survey

Free to Grow (FTG) surveys were tested for accuracy on forested lands directly managed by the Province in 1997. The FTG survey will become operational in the near future in areas managed by forest companies. As with the regeneration survey, only unacceptable forest health codes are targeted (Table 8). Trees falling into these categories are considered unacceptable and as such are not included in the tree counts. Seventy-three stands (2,303 ha) were surveyed in 1997. Two year's forest health data collection have proved very beneficial at locating problem stands. A total of 25 stands (1,154 ha) were followed up for forest health concerns across the province in 1997.

Thirteen stands were surveyed in the southeast region of the province and ten stands were highlighted by the provincial free to grow survey as containing pest problems. Follow up visits in the southeast region found armillaria root disease *(Armillaria ostayae)* causing light impact in two jack pine stands and moderate impact in one red pine stand; western gall rust *(Endocronartium harknessii)* in one jack pine stand occurring at low levels; and eastern dwarf mistletoe causing

moderate to severe impact in three black spruce stands. Two surveyed stands, each indicating light pest occurrence, were used as control checks and found to accurately reflect low pest levels.

Five of 12 surveyed stands were revisited in the Eastern region of the province. Two stands acted as control checks and were found to accurately reflect the data collected. Dwarf mistletoe was investigated in one white spruce stand (misidentified rust broom) and one black spruce stand (present but low impact). One mixed white spruce/trembling aspen stand was revisited to check numerous light codes. The trembling aspen in one portion of the stand was found to have a high incidence of hypoxylon canker *(Hypoxylon mammatum)*. Several of the mixed spruce/aspen stands in this region were found to have high shrub competition resulting in less than adequate survival of spruce along with inadequate numbers of aspen due to previous herbicide treatments.

Three of 16 surveyed stands were revisited in the central region of the province for high incidence of white pine weevil *(Pissodes strobi)*. One of the three stands is understocked leaving it very open growing which may result in increased weevil activity.

In the Northwest region of the province 27 stands were surveyed and nine had indications of pest problems. These included six stands with dwarf mistletoe recorded or mapped. Only one stand was significantly affected. The visits showed excellent sanitation of mistletoe infected sites and the use of alternate host species to prevent spread of the disease. Other problems included armillaria and warren root collar weevil *(Hylobius warreni)* mortality scattered throughout with some pockets forming in mixed jack pine/black spruce stands. These stands tended to be very heavily stocked and can likely withstand the losses.

No returns were conducted in the northeast or western areas as the data indicated low pest levels. Considerable progress was made in 1997 towards the development of decision making tools which will be implemented at several levels. The end product, which may take several years to become operational, includes the development of:

1. A key to determine which stands require a follow up survey (in progress).

2. Forest Health Follow up Guidelines which provides the on site observer with a step by step standardized approach of general questions which provide the basis for determining the forest health severity index on the site (completed).

3. Forest health severity index which will be linked eventually by stand using the forestry branch DARTS (depletion and renewal tracking system). Stands which have had follow up forest health visits will be given an overall pest severity rating (low = pest awareness, moderate = exercise caution when doing stand tending or in setting harvest year, severe = expected volume will be significantly reduced by rotation age) which will provide the forest manager with a visual tool to aid in future decision making. (Data is formatted to allow downloading of this into DARTS as the programming becomes available).

4. A more detailed pest management decision making guide for each of the FTG pests will be developed by a forest health team. Managers will eventually be able to have management recommendations based on the pest and it's severity level. (under development)

Table 8: Unacceptable Health Codes - Free to Grow Survey

Pest/Damage & Host	Sample tree is unacceptable if:	Signs and symptoms
Dwarf mistletoe - DM Jack pine Black spruce White spruce	Any visible infection	Witches broom Branch or stem swelling Aerial shoots - greenish yellow, up to 10 cm in length on jack pine and green to brown up to 3 cm on spruce Basal cups remaining from dead aerial shoots
Stem canker - SC Jack pine Red pine	Any main stem infection	Flattened often twisted dead area under bark up to 2 m in length Bark absent from canker, wood visible
Armillaria root rot - AR All conifers	Any root disease symptoms	Basal resinosis Chlorosis Thinning crown Stunted shoot growth Distress cones White mycelial fans under bark at root collar Mushrooms at base of tree
Tip dieback - TD Red pine	Any infection	Dead shoots Loss of main stem dominance Low height to dbh ratio Prolific adventitious budding
Western gall rust - G Jack pine Scots pine	Main stem gall Branch gall within 10 cm of main stem Multiple laterals infected (5+ branch galls)	Perennial globose galls on stem or branch Orange yellow spores on surface of galls in May to June
Root collar weevils - RCW Jack & Scots pine White & Black spruce	Any evidence of root collar attack	Basal resinosis Chlorosis Larval girdling beneath bark at root collar Creamy white, legless larvae with reddish brown head under bark at root collar

Table 8: cont'd

Pest/Damage & Host	Sample tree is unacceptable if:	Signs and Symptoms
White pine weevil - WPW White spruce Black spruce Jack pine*	Two or more attacks with dead terminal or laterals of 3 years growth or more *Only record in General Forest Health box (not in plot data) for jack & white pine.	Adult feeding punctures in one year old growth on main stem White legless larvae with light brown head feeding in cambium Shepherds crook and browning of terminal late in the growing season
Lean - L All conifers	Lean greater than 45°	J shaped roots Leaning from snow loading or wind (Ensure tree base is located inside the plot)
Girdling - GIR All conifers	> 75% of circumference of bole or > one third of tree height	Stem debarking including cambium Includes yellow belly sapsucker damage
Browsing - BR All conifers	Extensive repeated browsing throughout crown of tree	Buds and shoots clipped off Adventitious budding Loss of main stem dominance
Defoliators - F All conifers	50% or more of foliage absent or dead with terminal buds on leader and laterals dead or absent	Branch dieback Top kill
Hypoxylon Canker - HC Trembling aspen	Any main stem infection	Orange-yellow discolouration of bark Conidial blisters Sexual fruiting bodies (perithecia)
Poor Vigor - V All conifers	Trees which are not vigorous, very suppressed or stunted. This category is only chosen if tree does not fit other unacceptable categories.	Thin crown, stunted shoot growth, dead shoots, low height, chlorotic foliage. Causes include extreme competition, flooding, repeated frost, etc.
Dead - D All conifers	Unknown cause of death.	Foliage on entire crown dead or missing

Forest health data will be entered on GIS to provide baseline data. The immediate goal is to provide the Regional Offices with summarized forest health data as part of the regular regeneration survey. Long term goals include determining whether problems are of a repeated

nature; linked to certain geographic locations, stand type, or forestry practice; and to use data to direct research needs including ways to reduce impact on future volume losses. The most cost effective method is to identify and prevent inherited problems from the preceding stand from affecting new stands (pre-harvest prescriptions), and to recommend modification in reforestation and stand tending activities to minimize pest impact.

Pest Specific Assessments

In 1994 a pre-harvest assessment conducted in an overmature, site class 2 jack pine stand in the Sandilands Provincial Forest found the percentage area infected by Armillaria root rot (*Armillaria* sp.) to be 74.5%. Comparisons between the performance of planted stock and natural regeneration will be conducted in stumped plots versus non-stumped plots. The coordinates of the seedlings, stumps (removed or left), and trap stakes (to trap armillaria occurrence) were plotted spatially to provide a visual tool over time. The study will determine whether stumping improves survival and whether there is any differences in natural regeneration or planted stock survival.

On site discussions were held in September, 1997 in the southeast area of the eastern region. Included in the discussions were the silviculture forester, forest health staff and the regional technicians. The free to grow surveys conducted in 1996 and 1997 are proving very beneficial at locating problem stands. Four black spruce stands with considerable eastern dwarf mistletoe infection *(Arceuthobium pusillum)* have been located by the FTG survey. The stands had been harvested approximately 13 years earlier. Often the residual trees left as a seed source were heavily infected with dwarf mistletoe. We suspect the problem is larger as this survey is a slice in time and these harvesting practices have been occurring before and after this time frame. Time was spent educating the regional staff on the spread of this disease in black spruce as they were much more familiar with *Arceuthobium americanum* which occurs in jack pine. As a team, decisions were made to change logging practices in infected stands and in formulating methods to clean up existing problem areas.

An intensive survey was conducted on two of these sites recording mistletoe infections along parallel lines spaced 25 meters apart. This survey will locate infection centres on a map to aid in the clean up of the sites. Data will be run through the jack pine dwarf mistletoe loss simulator model (after it is modified) to provide accurate volume loss figure.

Vegetation Management Efficacy Program

The long term effect of aerial herbicide application on competition and conifer species can be monitored through the establishment of vegetation plots within treated and untreated areas of plantations. Plots are instituted prior to treatment and measured for trees, shrubs, herbs and available browse to ungulates. Changes in vegetation and tree measurements are conducted at one, three, and five years after treatment.

In 1997, one-year assessments were conducted in two jack pine plantations which had been treated with glyphosate in the Eastern Region. Data entry and analysis will occur this winter. One-year assessments were also conducted in a large white spruce plantation in the Interlake. This plantation had three different herbicide applications in 1996 and eight large circular plots were established per treatment. Measurements were conducted on all tagged trees and surviving hardwoods. Data entry and analysis will occur this winter.

Vegetation Management - Herbicide Useage summary.

Table 9: 1997 Herbicide application summary in Manitoba.

USER	Purpose	Method	Product	Rate l/ha	Area treated (ha.)
MNR Forestry	Release	Basal bark/ Back pack	Triclopyr	N/A	15
MNR Forestry	Release	Ground/ Brackie	Vision	3.0	232
MNR Forestry	Release	Ground/ Boom and nozzle	Vision	5.0	125
MNR Forestry	Release	Ground/ Brackie	Vision	5.0	60
MNR Forestry	Site Preparation	Ground/ Brackie	Velpar	9.0	80
MNR Forestry	Site Preparation	Power Disk Trencher	Velpar	9.0	175
MNR Forestry	Release	Aerial/ Fixed wing	Vision	5.0	814
Tolco Manitoba	Release	Aerial/ Fixed wing	Vision	5.0	854
Pine Falls Paper Co.	Site Preparation	Ground/ Boom and nozzle	Vision	2.5	388
Pine Falls Paper Co.	Release	Aerial/ Rotary wing	Vision	4.0	48
Pine Falls Paper Co.	Release	Aerial/ Rotary wing	Vision	5.0	145
Total					2,936

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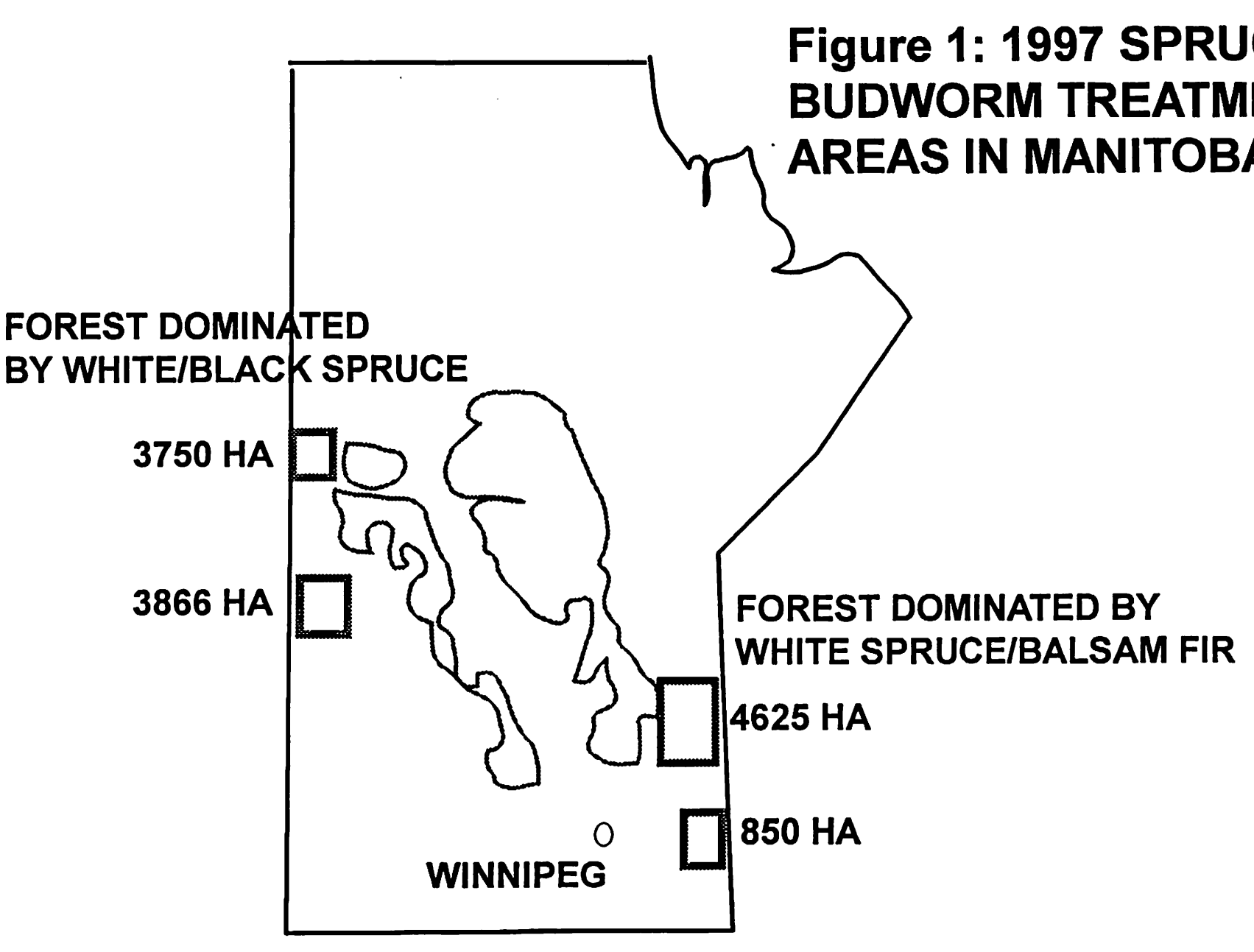
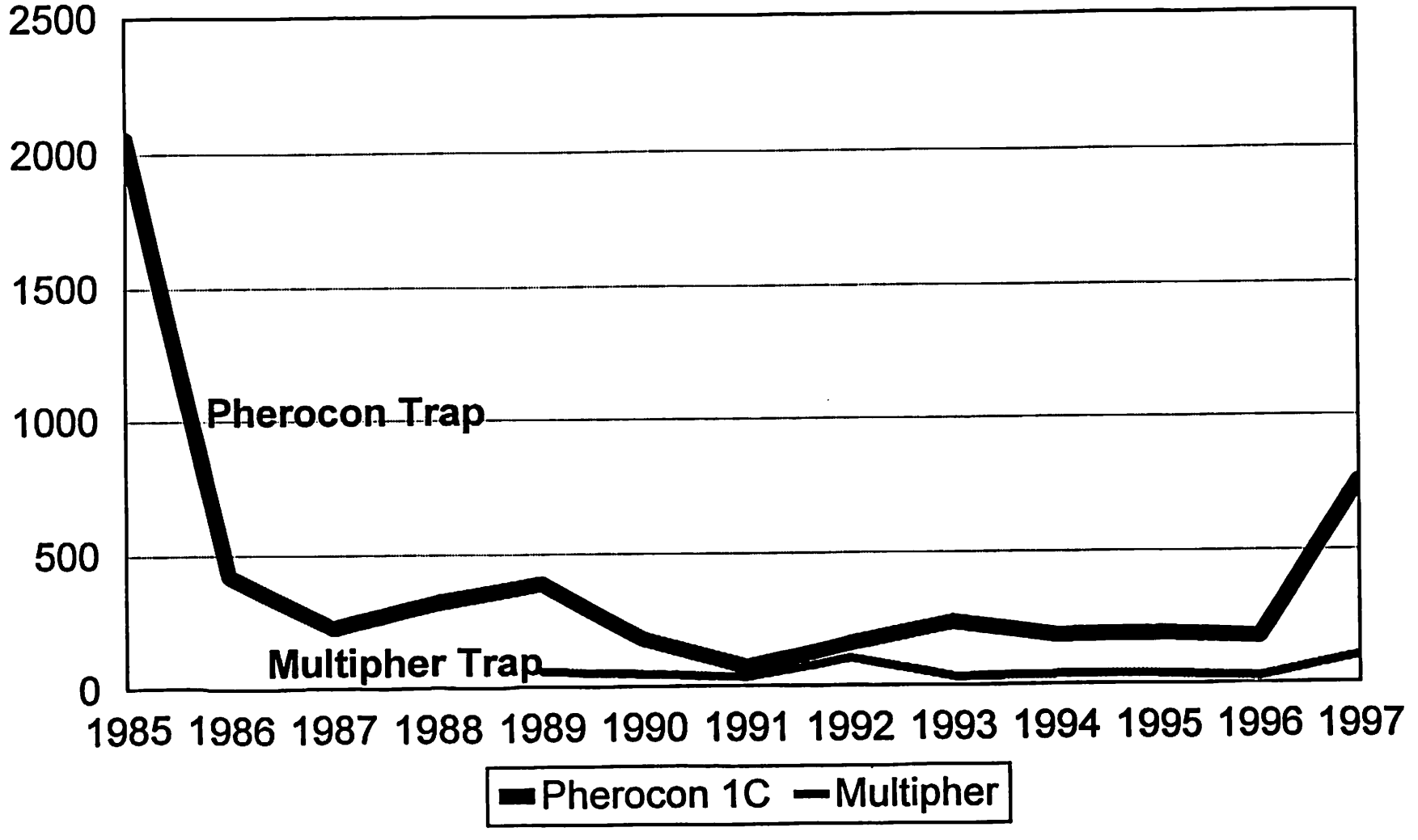


Figure 1: 1997 SPRUCE BUDWORM TREATMENT AREAS IN MANITOBA
FOREST DOMINATED BY WHITE/BLACK SPRUCE
3750 HA
3866 HA
FOREST DOMINATED BY WHITE SPRUCE/BALSAM FIR
4625 HA
850 HA
WINNIPEG

Figure 2: Total male jack pine budworm moths caught in the two trap types since 1985.



Important Forest Pest Conditions, Pest Management Operations and Field Experiments in Alberta

H. Ono *(1)*, **C. Kominek** *(1)*, **M. Maximchuk** *(1)*, **S. Ranasinghe** *(1)*, **R. Stronach** *(1)*, **J. Feddes-Calpas** *(2)* **and C. Saunders** *(3)*

No major new pest outbreaks were reported in Alberta in 1997. Spruce budworm defoliation within the province's forest management area was at its lowest level in 10 years, although there were localized increases. Moth catches in pheromone-baited traps indicated that the risk of new budwork outbreaks was low in most areas. On the basis of the results of second-instar larval surveys, budworm defoliation in most stands sprayed in 1997 and in many sprayed before 1997 is expected to be nil to light in 1998. A resurgence of budworm is expected in few previously sprayed areas. Most unsprayed stands should have moderate or severe defoliation in 1998.

Aerial spraying with *B.t.k.* was carried out over 20,068 ha to protect trees by reducing the current budworm populations to levels that would limit next year's defoliation to less than 35%. All plots sprayed twice and 75% of the plots sprayed once are expected to have nil-to-light defoliation in 1998. Mimic 240LV (Rohm and Haas Canada, Inc.) was aerially sprayed in a large-scale field trial to determine its efficacy in budworm control. All sprayed plots are expected to have nil-to-light defoliation in 1998. There was no apparent difference in budworm control between plots sprayed once and those sprayed twice.

Female forest tent caterpillar sex pheromone proved effective in trapping male moths at relatively low population densities in Alberta. Of three trap types used, the Delta trap appeared to be the most effective in trapping moths at low population densities.

An aerial survey carried out in 1997 revealed no mountain pine beetle infestations. However, relatively high numbers of beetles found in sample plots in the Foothills District containing pheromone-baited trees are causing concern about a possible increase in the beetle population.

Spruce beetle populations in the province remained at endemic levels in 1997. Forest tent caterpillar defoliation dropped to its lowest level since 1992. There were localized outbreaks of other aspen defoliators, notably aspen leaf roller in northwestern Alberta. Satin moth infestations continued to spread in and around Edmonton.

Dutch elm disease has not been detected in the province, although one of the vector species has been trapped repeatedly in suburban areas.

(1) Alberta Land and Forest Service, Edmonton, Alberta

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Le point sur les principaux ravageurs forestiers et les campagnes de lutte entreprises contre les ravageurs, ainsi que sur les essais de terrain réalisés en Alberta en 1997

H. Ono, S. Ranasinghe, C. Kominek, M. Maximchuk, R. Stronach, J. Feder-Calpas et C. Saunders

Aucune nouvelle infestation majeure n'a été signalée en Alberta en 1997. La défoliation par la tordeuse des bourgeons de l'épinette dans la zone de gestion forestière provinciale a atteint son plus bas niveau depuis 10 ans, malgré quelques augmentations localisées. Les nombres de prises dans les pièges à phéromone indiquent que le risque de nouvelles infestations par la tordeuse est faible dans la plupart des régions. À la lumière des résultats des dénombrements des chenilles du deuxième stade, la défoliation dans la plupart des peuplements traités en 1997 et dans de nombreux peuplements traités avant 1997 devrait être nulle ou faible en 1998. Une augmentation des populations est prévue dans quelques régions déjà traitées antérieurement. En 1998, la plupart des peuplements non traités risquent d'être défoliés modérément ou gravement.

Plus de 20 068 ha ont fait l'objet d'un traitement aérien au B.t.k.. L'objectif était de protéger les arbres en abaissant les populations de la tordeuse de manière telle que la défoliation soit inférieure à 35 % en 1998. Dans toutes les parcelles traitées à deux reprises et dans 75 % de celles ayant fait l'objet d'une seule pulvérisation, on prévoyait des taux de défoliation nuls à légers en 1998.

L'efficacité du Mimic 240LV (Rohm and Haas Canada Ltd.) contre la tordeuse des bourgeons de l'épinette a été évaluée dans le cadre d'un essai de pulvérisation aérienne à grande échelle. Dans toutes les parcelles traitées, on prévoyait des taux de défoliation nuls à légers en 1998. Aucune différence apparente liée à la mortalité larvaire n'a été relevée entre les parcelles ayant fait l'objet d'un traitement unique et celles traitées à deux reprises.

En présence de populations de densité relativement faible, la phéromone sexuelle émise par la femelle de la livrée des forêts s'est révélée relativement efficace pour le piégeage des mâles. Parmi les trois types de piège utilisés, c'est le piège Delta qui s'est révélé le plus efficace en présence de populations de faible densité.

Aucune infestation par le dendroctone du pin ponderosa n'a été détectée dans le cadre d'un relevé aérien effectué en 1997. Toutefois, les nombres relativement élevés de scolytes récupérés sur les arbres appâtés avec des phéromones dans les parcelles d'échantillonnage établies dans le District des Foothills laissent présager une hausse des populations.

Les populations du dendroctone de l'épinette sont demeurées au seuil endémique en 1997. La défoliation par la livrée des forêts a atteint son plus bas niveau depuis 1992. Des infestations localisées par d'autres défoliateurs du peuplier faux-tremble ont été signalées, en particulier par l'enrouleuse hâtive du tremble dans le nord-ouest de la province. Les infestations par le papillon satiné ont continué de s'étendre à Edmonton et dans les secteurs avoisinants.

La maladie hollandaise de l'orme n'a pas été détectée dans la province, bien qu'une des espèces vectrices ait été piégées à maintes reprises dans des banlieues.

1997 Forest Pest Management Forum

Important Forest Pest Conditions, Pest Management Operations, and Field Experiments in Alberta

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November 1997
OTTAWA

1.0 INTRODUCTION

This is the final report on forest pest conditions, pest management operations and field tests carried out in Alberta during 1997. It contains details on important forest pests for which current data are available.

Overall, Alberta's forests remained relatively healthy during 1997. This may be attributed to two consecutive years of above-average precipitation in the province. This year, an unusually cool, wet spring delayed the emergence of insect pests in the province, which may have further contributed to their decline. The major forest pest outbreaks continued to decline in 1997, with one new major outbreak reported.

In 1997, the responsibility for forest weed management was transferred to the Forest Health Branch in Forest Protection Division. Until this year, forest weed management was handled by the Forest Management Division. To better reflect this new mandate, and to emphasise the proactive approach in managing the health of forests, the name of the Forest Insect and Disease Management Branch was changed to Forest Health Branch.

This report contains information provided by a number of agencies (see listing on cover). In addition, Forest Health Technicians from the Northern Forestry Centre, Canadian Forest Service helped with pest surveys carried out this year. Forest industry (High Level Forest Products and Millar Western Industries) participated in the second instar budworm survey, and budworm moth survey using pheromone traps.

2.0 FOREST PEST CONDITIONS IN 1997 AND PREDICTIONS FOR 1998

2.1 Eastern Spruce Budworm, *Choristoneura fumiferana* (Clemens)

2.1.1 Budworm Defoliation in 1997

As predicted in 1996, the extent of the area defoliated by spruce budworm in the Northwest Boreal Region was reduced even further in 1997. Following aerial surveys, the extent of budworm defoliation was estimated at 33 146 ha, its lowest level in 10 years. This is a 64% reduction in defoliated area compared to the defoliated area observed in 1996. Almost all the stands sprayed with *Bacillus thuringiensis* var. *kurstaki* (Btk) in 1996 had no visible budworm defoliation in 1997. There was about a 20% drop in the defoliated area of unsprayed stands as well, possibly indicating a natural decline of budworm outbreak in some areas. However, the moderate budworm defoliation found in 1996 over 771 ha in the John D'or Prairie area increased to 2037 ha of severe defoliation in 1997. There was also a budworm resurgence in one area sprayed twice before. Budworm defoliation in Crown land in the Mackenzie District was severe and remained relatively unchanged from the1996 figure of 2564 ha. In addition, an estimated 5976 ha in the Paddle Prairie Metis Settlement were severely defoliated; this area was not sprayed in 1996 (Figure 1).

The budworm-defoliated area in the Northeast Boreal Region was aerially surveyed in July 1997, and moderate to severe defoliation was observed along the Athabasca and House Rivers. The extent of budworm defoliation, excluding the area north of Fort Chipewyan, was estimated at 16 910 ha. Defoliation was severe in 561 ha and moderate in 16 349 ha (Figure 1).

The extent of budworm outbreak in Wood Buffalo National Park increased considerably during 1997. Aerial surveys carried out by Forest Health Technicians of the Northern Forestry Centre, Canadian Forest Service (CFS), detected budworm-defoliated areas in the park, mainly along the Peace River (Figure 1). The extent of this defoliation is estimated to be 134 707 ha. Spruce budworm defoliation in Cypress Hills Provincial Park was light and therefore not surveyed in 1997 (Les Weekes, pers. Comm.).

2.1.2 Predictions for 1998 Based on Pheromone Trap Catches

Multi-Pher I® traps (Le Groupe Biocontrole, Quebec) baited with female budworm sex pheromone lures were used to monitor spruce budworm populations in several forest stands provincewide. These stands had no signs of budworm defoliation currently, but had a high potential of being defoliated in the near future. The procedure for deploying these traps is described in the "Spruce Budworm Sampling Manual" (Kominek and Ranasinghe 1996).

Altogether, 129 monitoring plots were established across the province. The moth catches in three plots were high; i.e., over 2000 moths per trap, indicating a high probability of severe defoliation (over 70%) in 1998. Two of these plots were located in the Northwest Boreal Region and the other was in the Northeast Boreal Region. The moth catches in 25 other plots were moderate; i.e., 500-2000 moths per trap, indicating a high probability of moderate defoliation

Aerial surveys were conducted through the cooperative efforts of CFS and LFS.

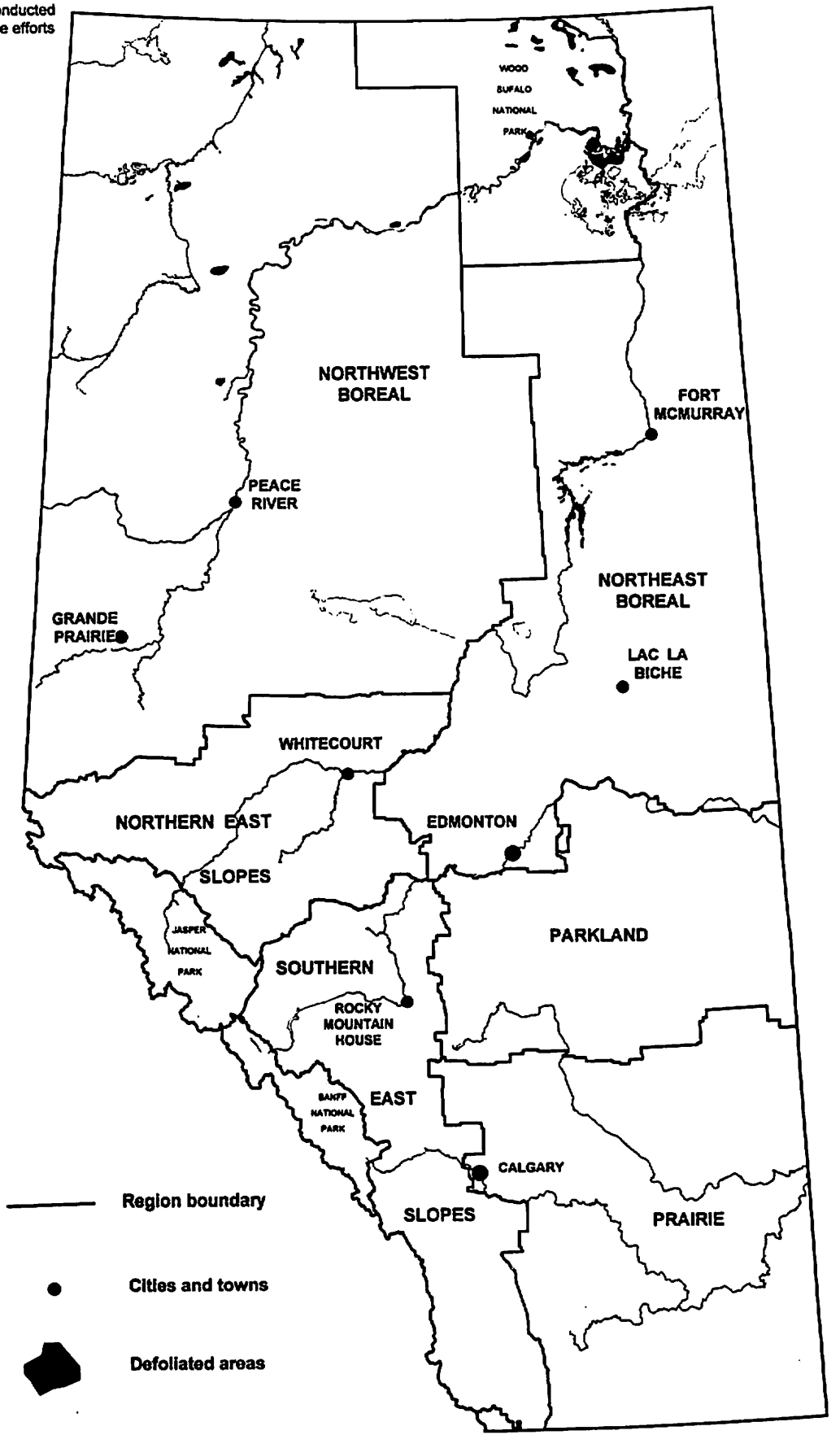

Figure 1. Spruce budworm defoliation in Alberta, 1997.

(35%-70%) in 1998. Twenty-two of these plots were located in the Northwest Boreal Region and the other three were located in the Northeast Boreal Region. Another 96 plots that were located across the province, including the Northern East and Southern East Slopes Regions, had average trap catches below 500 moths indicating a high probability of light defoliation (less than 35%) in 1998. One plot in the Southern East Slopes Region had no moth catch indicating a high probability of nil defoliation in 1998. In four other plots, the traps were either missing or damaged by bears (Figure 2).

According to the above results, no new spruce budworm outbreaks are expected in the Northern East Slopes and Southern East Slopes Regions in 1998. Two of the three sites with high moth counts were followed up with second instar larval (L2) surveys. The L2 counts confirmed the prediction for severe defoliation at one site in the Northwest Boreal Region, but predicted only moderate defoliation for the site in the Northeast Boreal Region. Twenty-two out of the 25 sites where moderate defoliation is predicted for 1998, were followed up with L2 surveys. The L2 counts confirmed moderate defoliation at 7 sites; however, based on L2 counts, severe defoliation is predicted for 10 sites and light defoliation is predicted for the remaining 5 sites, in 1998.

2.1.3 Predictions for 1998 Based on L2 Surveys

Second instar (L2) surveys were carried out in those areas that have had spruce budworm defoliation during the current outbreak and in the vicinity of these areas, to predict the level of defoliation expected in 1998. In the Northwest Boreal Region, 169 plots were established, and results of the survey predict a drastic reduction in the area expected to be defoliated by budworm in 1998. In the Upper Hay District, almost all the stands sprayed in 1997 are predicted to have nil to light defoliation in 1998. However, moderate to severe defoliation is expected in 1998 in previously sprayed areas along the Chinchaga River and Sousa Creek, and in John D'or Prairie. The unsprayed areas in the northeast portion of this District will continue to have severe budworm defoliation in 1998. In the Mackenzie District, the results of the L2 survey predict moderate to severe defoliation in 1998 in currently defoliated areas. In the Paddle Prairie Metis Settlement, the unsprayed areas are expected to be moderately to severely defoliated in 1998 (Figure 3).

In the Northeast Boreal Region, the L2 counts predict moderate to severe defoliation in some previously sprayed areas along the Athabasca and House rivers and near the Algar River. Nil to light defoliation is expected in the other areas surveyed in this Region (Figure 4).

2.2 Mountain Pine Beetle, *Dendroctonus ponderosae* Hopkins

2.2.1 Aerial Survey

No mountain pine beetle infestations were detected during an aerial survey carried out jointly by the Land and Forest Service (LFS), Canadian Forest Service (CFS) and Parks Canada. The area surveyed covered mainly the river valleys in the foothills of southwestern Alberta bordering B.C.

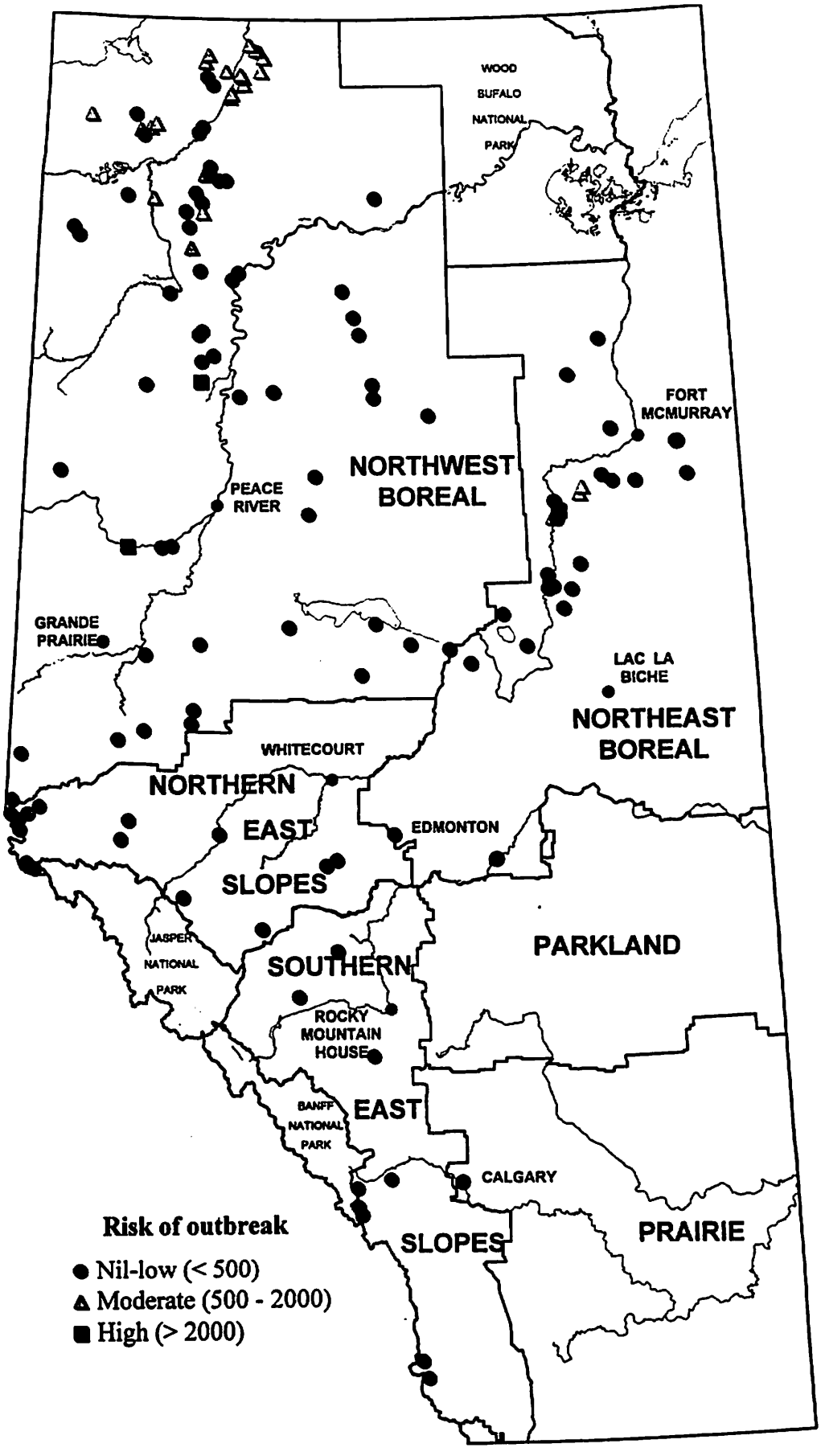

Figure 2. Spruce budworm moth catches in pheromone-baited traps in Alberta, 1997.

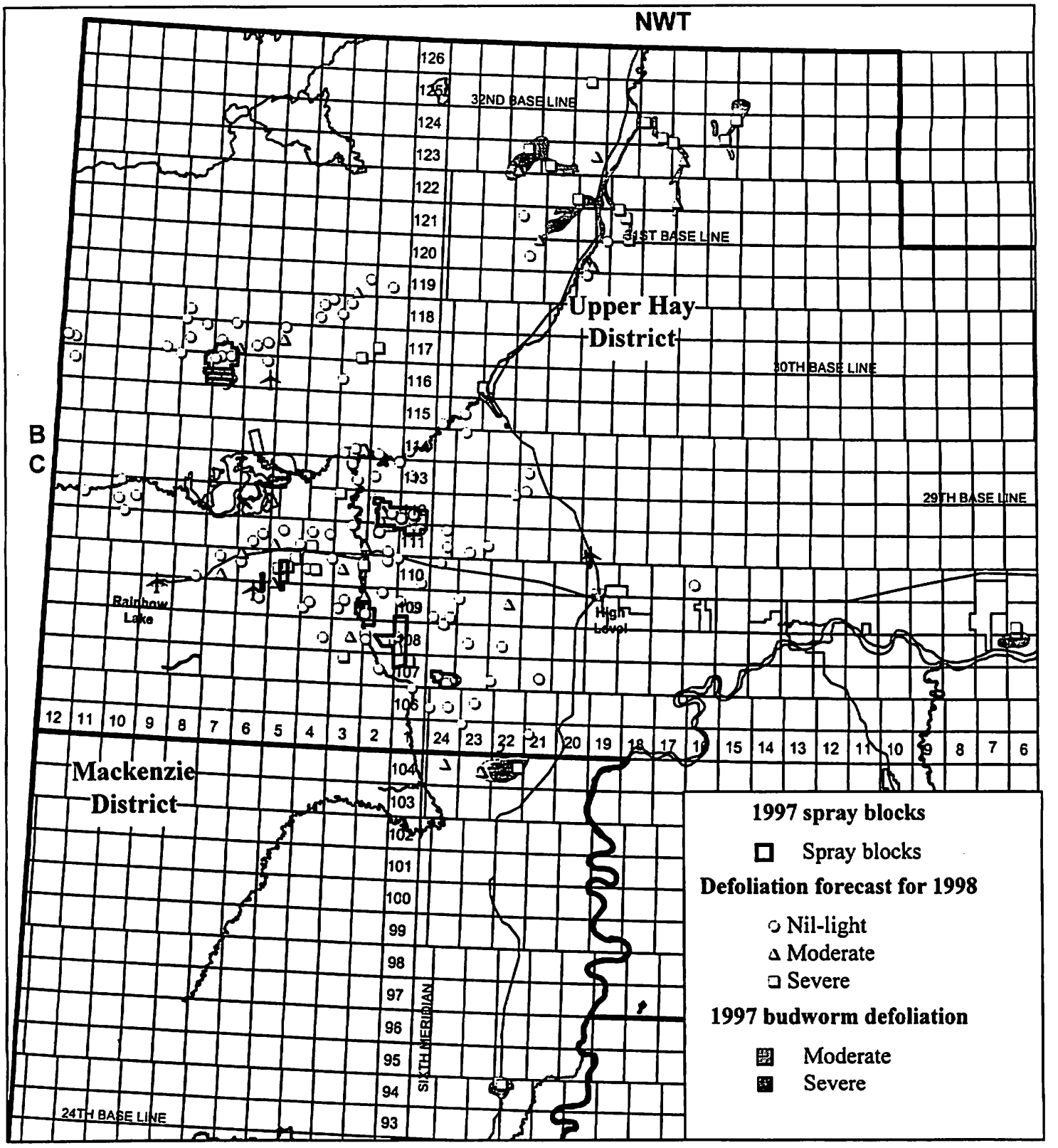

Figure 3. Spruce budworm defoliation forecast for 1998 based on second instar counts, Northwest Boreal Region, Alberta.

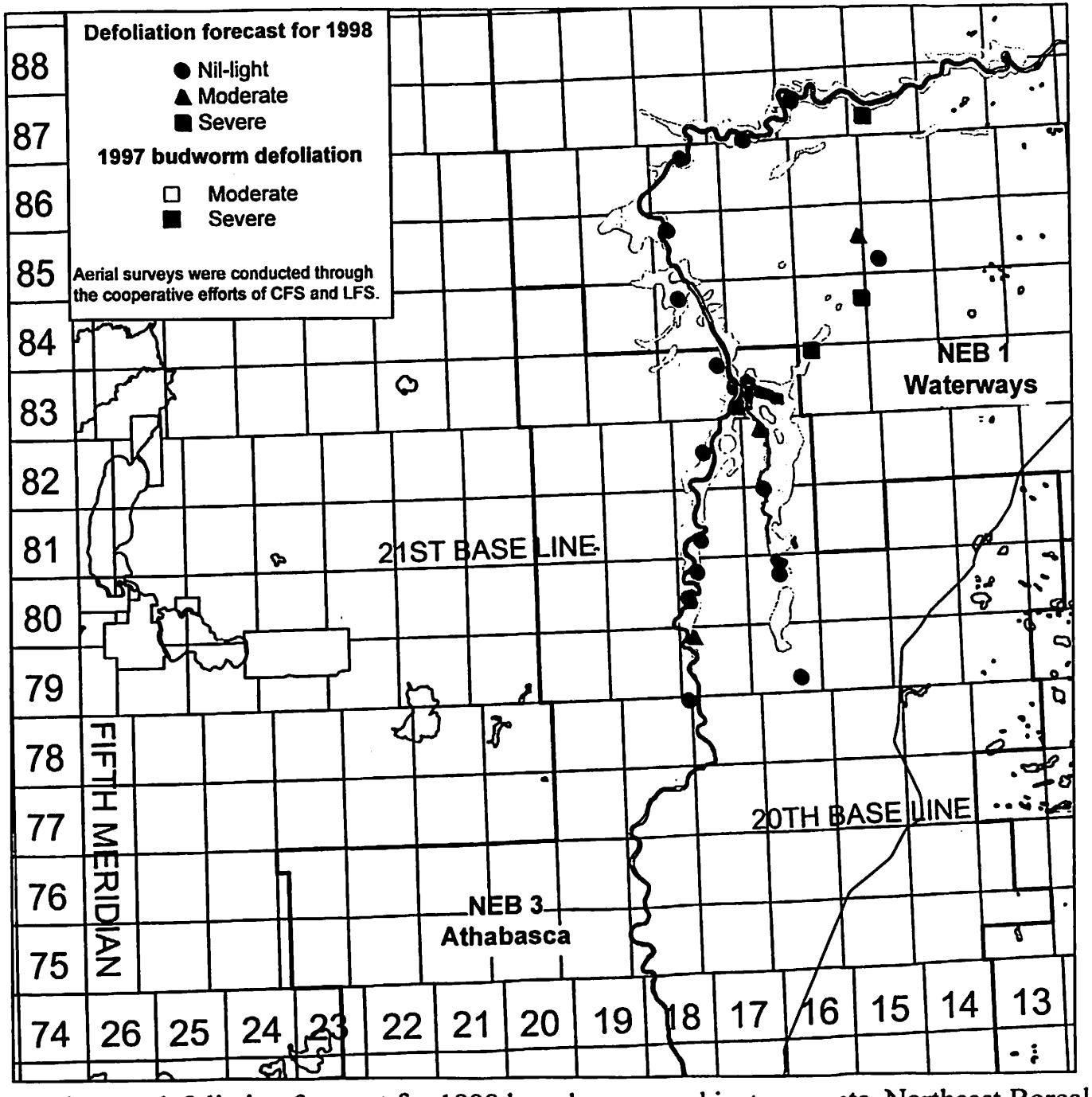

Figure 4. Spruce budworm defoliation forecast for 1998 based on second instar counts, Northeast Boreal Region, Alberta.

2.2.2 Survey with Pheromones

In southwestern Alberta, lodegpole pine stands with a high risk of becoming infested with mountain pine beetles were monitored for beetle activity. A two-component aggregation pheromone bait (Phero Tech Inc., B.C.) was used. The procedure for deploying these pheromone baits is described in "Mountain Pine Beetle Pheromone Sampling Manual 1997" (Kominek and Ono 1997).

Fifty-six plots were established in the Southern and Northern East Slopes Regions in 1997. In the Northern East Slopes Region, 10 out of 17 plots located close to B.C. border in the Foothills District had beetle hits ranging from 2-60 per tree. The beetle hits in this District are of concern because no beetle infestations have been reported this year from the corresponding B.C. side of the border. The potential for a mountain pine beetle outbreak in this District will be closely monitored in 1998. In the Yellowhead District of this Region, none of the three plots had any beetle hits. In the Southern East Slopes Region, 3 out of 20 plots in the Crowsnest District had beetle hits ranging from 1-6 per tree. There was only one beetle hit in 10 plots located in the Bow District and none in six plots located in the Clearwater District (Figure 5). In the Southern East Slopes Region, the potential for a beetle infestation in 1998 appears to be minimal. Trees with successful beetle hits will either be debarked or burned before the next spring.

2.3 Spruce Beetle, *Dendroctonus rufipennis* (Kirby)

No spruce beetle infestations were detected within the forested area monitored by the LFS in 1997.

In the Mackenzie District, Northwest Boreal Region, spruce beetle populations were monitored in six spruce stands at high risk of being infested by the beetle. At each monitoring site, two Lindgren funnel traps baited with the three component lure (Phero Tech Inc., B.C.) were used. The traps were set-up in mid-May before the peak beetle flight period. Trap catches were used to calculate a beetle index; i.e., average number of beetles in a trap per trapping day. This beetle index showed endemic level (0-0.31) beetle populations in these stands in 1997. It is noteworthy that all six sites had substantial catches of predatory checker beetles in the traps.

2.4 Forest Tent Caterpillar, *Malacosoma disstria* Hubner

The declining trend of forest tent caterpillar defoliation in Alberta continued with a drastic reduction in the defoliated area during 1997. Tent caterpillar defoliation within the forested area was aerially surveyed jointly by the Canadian Forest Service Forest Health Technicians, and Land and Forest Service field personnel.

The extent of forest tent caterpillar defoliation in 1997 is the lowest on record during the past five years. In the Northwest Boreal Region, forest tent caterpillar defoliation was observed over an area of 28 518 ha. Within this area, 3454 ha had severe defoliation, 1379 ha had moderate to severe defoliation, 2969 ha had moderate defoliation, 562 ha had light to moderate defoliation, and 20 154 ha had light defoliation. In the Northeast Boreal Region, forest tent caterpillar defoliation was observed over an area of 17 346 ha. Within this area, 447 ha had

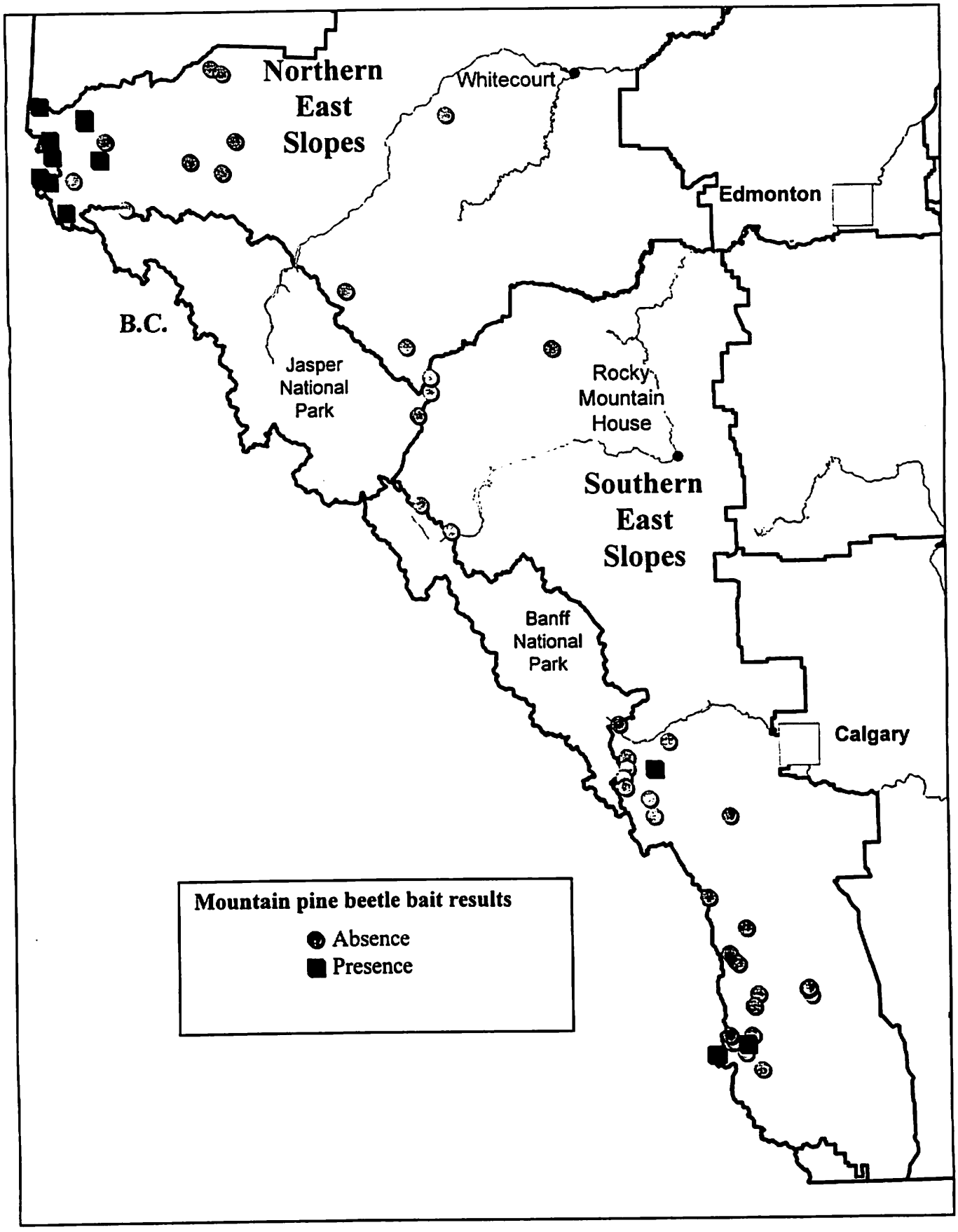

Figure 5. Mountain pine beetle monitoring with pheromone-baited trees in Alberta, 1997.

moderate defoliation, 429 ha had light to moderate defoliation, and 16 470 ha had light defoliation (Figure 6).

2.5 Other Aspen Defoliators

2.5.1 Satin Moth, *Leucoma salicis* (Linnaeus)

Thirty-six new infestations of satin moth were detected in Edmotnon and surrounding communities 1997. Seven were in wild balsam poplar stands (*Populus balsamifera)* demonstrating the moth's adaptability to native poplars in Alberta. This pest, first detected in Edmonton in 1994, has since been reported from the surrounding communities of Sherwood Park and St. Albert. This indicates the ability of this insect to successfully overwinter and spread beyond Edmonton.

In the City of Edmonton, there was no recurrence of satin moth at 114 infested sites sprayed with Ambush (permethrin) in 1995. The City is investigating the possibility of introducing parasitoids - two braconid wasp species - to control this pest.

2.5.2 Large Aspen Tortrix, *Choristoneura conflictana* (Walker)

Aspen stands defoliated by large aspen tortrix have been found west of Hines Creek in northwestern Alberta. No estimate of the extent of this defoliation is available.

2.5.3 Aspen Leaf Roller, *Pseudexentera oregonana* (Walsingham)

The outbreaks of aspen leaf roller are normally localised. Defoliation caused by this pest was observed over an area of 51 852 ha in the Northwest Boreal Region. Defoliation was severe on 29 433 ha, moderate to severe on 14 144 ha, moderate on 5446 ha and light on 2829 ha (Figure 6).

2.6 Dutch Elm Disease (DED)

This disease has not been detected to date in Alberta. However, the smaller European elm bark beetle (SEEBB), *Scolytus multistriatus* - one of the vector species - has been found in Alberta on a recurring basis. Beetles have been trapped every year from 1994 to 1997 in Calgary, and from 1995 to 1997 in Edmonton and St. Albert. In Vauxhall, beetles were trapped in 1996, but not since that time.

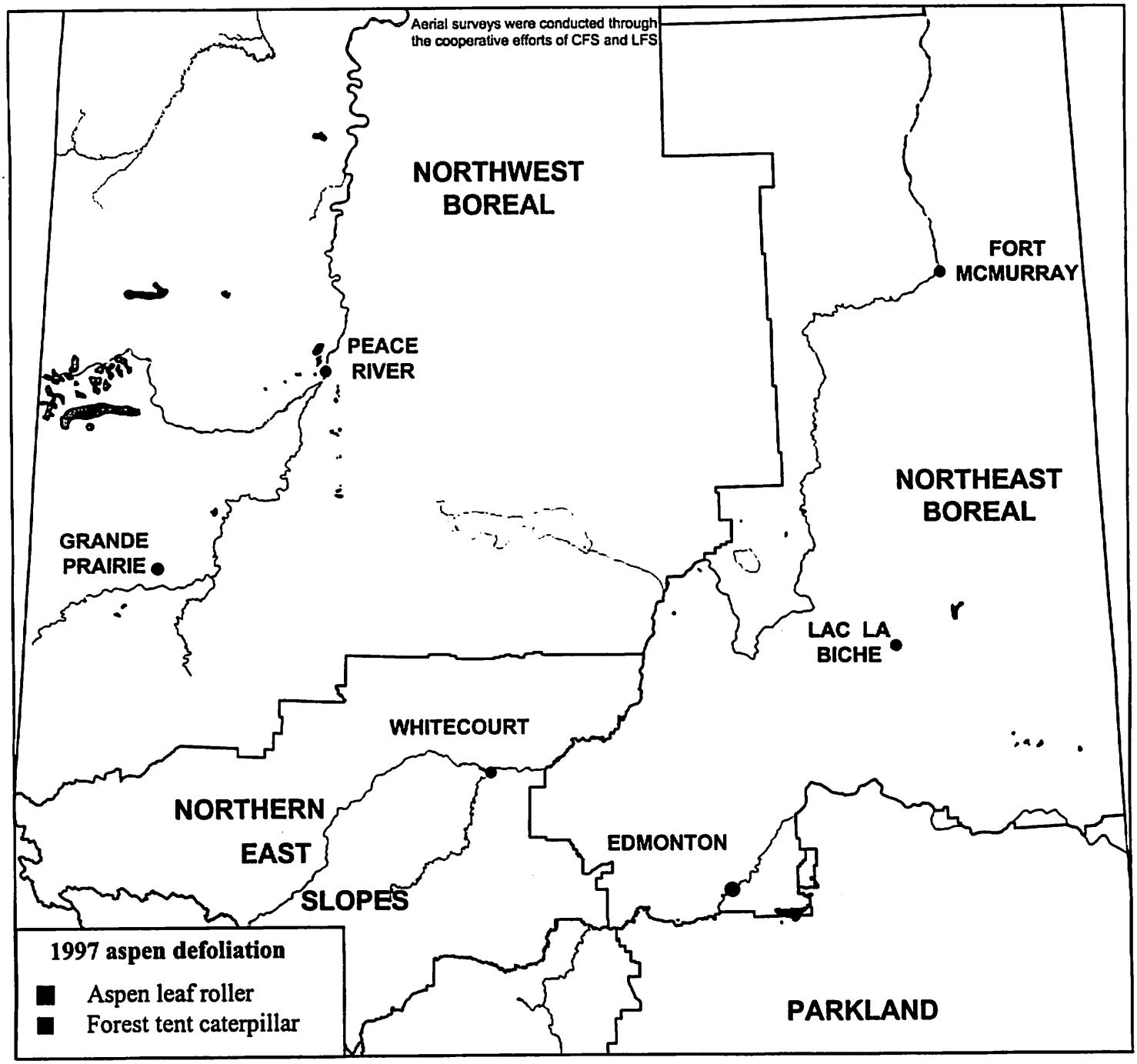

Figure 6. Forest tent caterpillar and aspen leaf roller defoliation in Alberta, 1997.

During 1997, approximately 400 sticky traps baited with SEEBB pheromone lures were set-up throughout the province. In Calgary, one SEEBB was trapped at one location in May and 30 SEEBB were found in traps in August through September. In Edmonton, one SEEBB was trapped at each of four locations in August through September. No SEEBB were found in the other sticky traps.

In 1997, the Society to Prevent Dutch Elm Disease (STOPDED), a non-profit organisation to protect and preserve Alberta's elm trees from DED, received funding from Human Resource Development Canada. This funding is being used to recruit personnel who will conduct inventories, record the conditions and size of elm trees, and increase the overall public awareness of DED in Alberta. In addition, all municipalities with elm trees are being encouraged to develop programs to prevent DED.

2.7 Other Diseases and Damaging Agents

In 1997, aspen leaf spot diseases were common throughout northern Alberta, and Spruce needle rusts were widespread in northeast Alberta. Red belt occurrence was above average in the eastern slopes of the Rockies in southwestern Alberta. In the Southern East Slopes Region, unusually cool spring temperatures killed many aspen buds, causing the failure of first flush.

3.0 PEST MANAGEMENT OPERATIONS

In the Northwest Boreal Region, Thuricide 48LV® (Novartis Crop Protection (Canada) Inc.) was aerially sprayed to manage the spruce budworm outbreak in the Upper Hay District. The objective of this spraying was to keep the trees alive by reducing the budworm populations to a level that would limit any future defoliation to less than 35%. These forest stands were sprayed because they were expected to either be moderately or severely defoliated by spruce budworm in 1997, based on second instar (L2) sampling carried out in 1996.

Budworm, and spruce bud development in relation to degree-days were monitored leading up to spraying. This was carried out to determine when the peaks of spray-targeted stages occurred (i.e., peaks of fifth instar, and buds with needles flaring). Due to unseasonably cool weather, budworms did not reach the targeted stage until June 15, i.e., about 10 days behind their normal occurrence. Spraying was completed by June 21, at which time the budworms had reached the peak of their sixth instar.

A prespray sampling was carried out a few days before spraying to confirm the abundance of budworms in the stands slated for spraying.

Altogether, 20 068 ha were sprayed with 65 242 L of Thuricide 48LV. The first spraying was carried out when budworms were at the peak of fifth instar. Of the sprayed area, 12 715 ha were sprayed twice and 7353 ha were sprayed once. Undiluted pesticide was sprayed at a volume of 2.0 L/ha (25.4 BIU/ha) by using spray aircraft equipped with Micronair AU4000® atomizer nozzles (Micronair Ltd., England) and a Satloc Forestar® Differential Global Positioning System (Satloc Inc., USA). The technical details of this project are given in Appendix I.

In the fall, an L2 survey was carried out to determine the effectiveness of aerial spraying in reducing the budworm populations. The results of this survey showed effective budworm control in the sprayed blocks compared to the unsprayed check stands. Budworm defoliation in 1998 is expected to be nil to light (below 35%) in all the 14 plots located in stands sprayed twice with Thuricide. Nil to light defoliation is expected in 1998 in 3 out of 4 plots located in stands sprayed once; the other plot is expected to have severe defoliation. In comparison, nil to light defoliation is expected in 1998 in 24% of the 25 plots located in unsprayed check stands that had 1996 L2 population levels comparable to those in sprayed plots; another 28% are expected to have moderate defoliation and the remaining 48% of the plots are expected to have severe defoliation in 1998 (Figure 7).

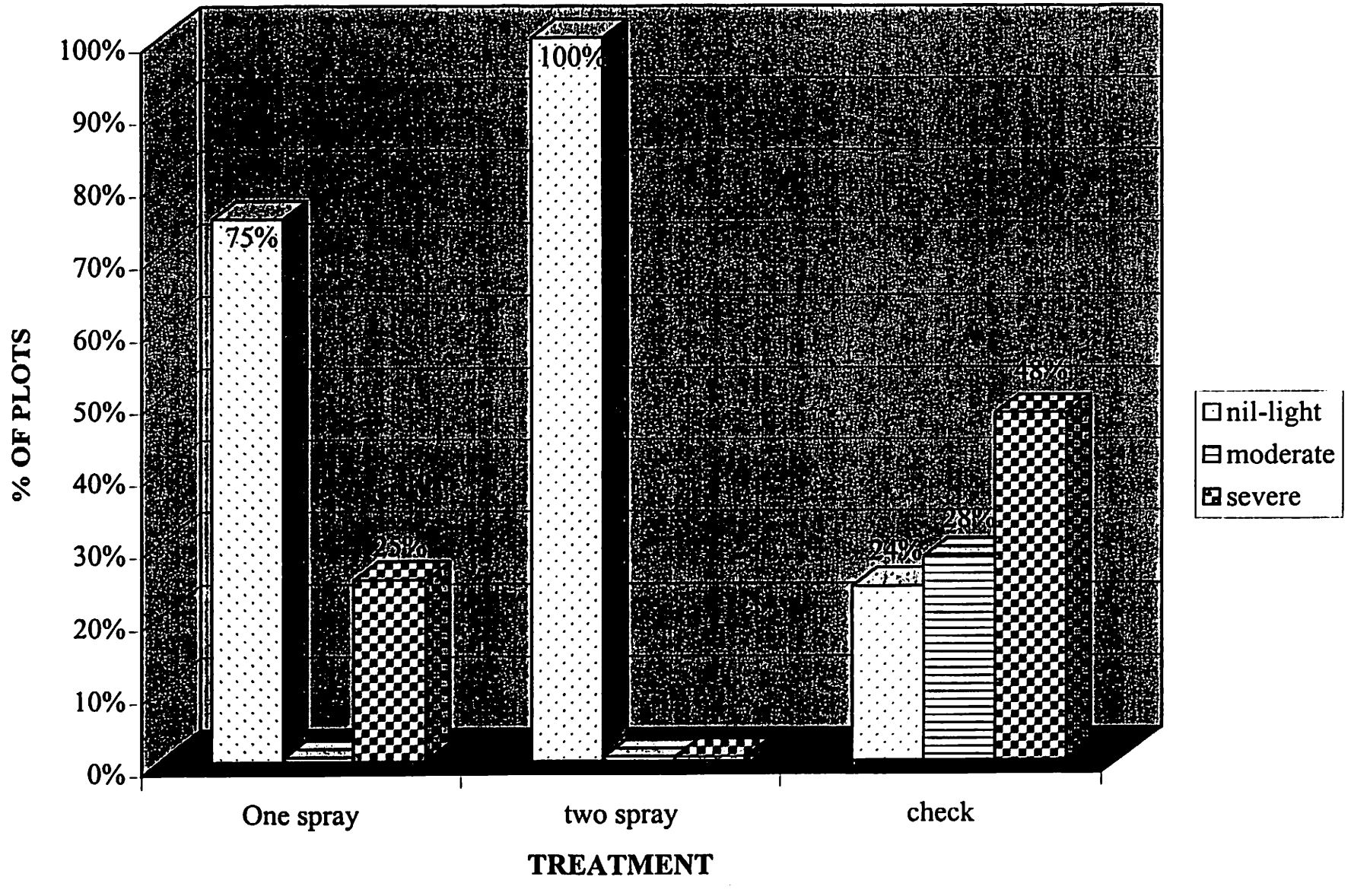

Figure 7. Aerial spraying to manage spruce budworm in Alberta, 1997: Percent of Thuricide-sprayed vs. unsprayed check plots expected in each defoliation category in 1998.

4.0 FIELD TRIALS

4.1 Field Trial on Mimic

Mimic 240LV ®(Rohm and Haas Canada, Inc.) was aerially sprayed in a large-scale field trial to find its efficacy and field use to control eastern spruce budworm outbreaks in northern Alberta. It was sprayed at a dose of 70 grams a.i. /ha (290 mL of pesticide mixed with 1710 mL of water). Mimic was sprayed once on 857 ha; it was sprayed twice, with five days between the two sprayings, on another 755 ha. A fixed-wing spray aircraft (AT 502), equipped with eight Micronair AU4000® atomizer nozzles and a Satloc Forestar Differential Global Positioning System, was used for spraying. The technical details of these sprayings are given in Appendix I.

A prespray sampling survey carried out in early June confirmed the high budworm populations predicted from the 1996 L2 counts in the spray blocks. The first spraying was carried out when the budworms were at the peak of fifth instar.

A second instar larval (L2) survey was carried out in the fall to determine the effectiveness of these sprayings. The results showed an excellent reduction in budworm populations in the sprayed plots. All six sprayed plots are expected to have nil to light defoliation in 1998. Thus, Mimic 240LV brought about excellent spruce budworm control in this field trial. There appears to be no difference in budworm control between the two plots sprayed once versus the four plots sprayed twice. In comparison, only 24% of the 25 unsprayed check plots located in stands with comparable budworm populations are expected to have nil-light defoliation in 1998 (Figure 8).

The effectiveness of single spray may be attributed to the relatively long persistence of Mimic after spraying. If this holds true, it might be possible to control budworms with one application of Mimic.

4.2 Field Testing of Forest Tent Caterpillar Pheromone

4.2.1 Introduction

In the summer of 1997, a field trial was carried out in the Northwest and Northeast Boreal Regions to:

a) test the efficacy of forest tent caterpillar sex pheromone in monitoring moth populations in Alberta;
b) compare the efficacy of three pheromone trap types in monitoring forest tent caterpillar moth populations.

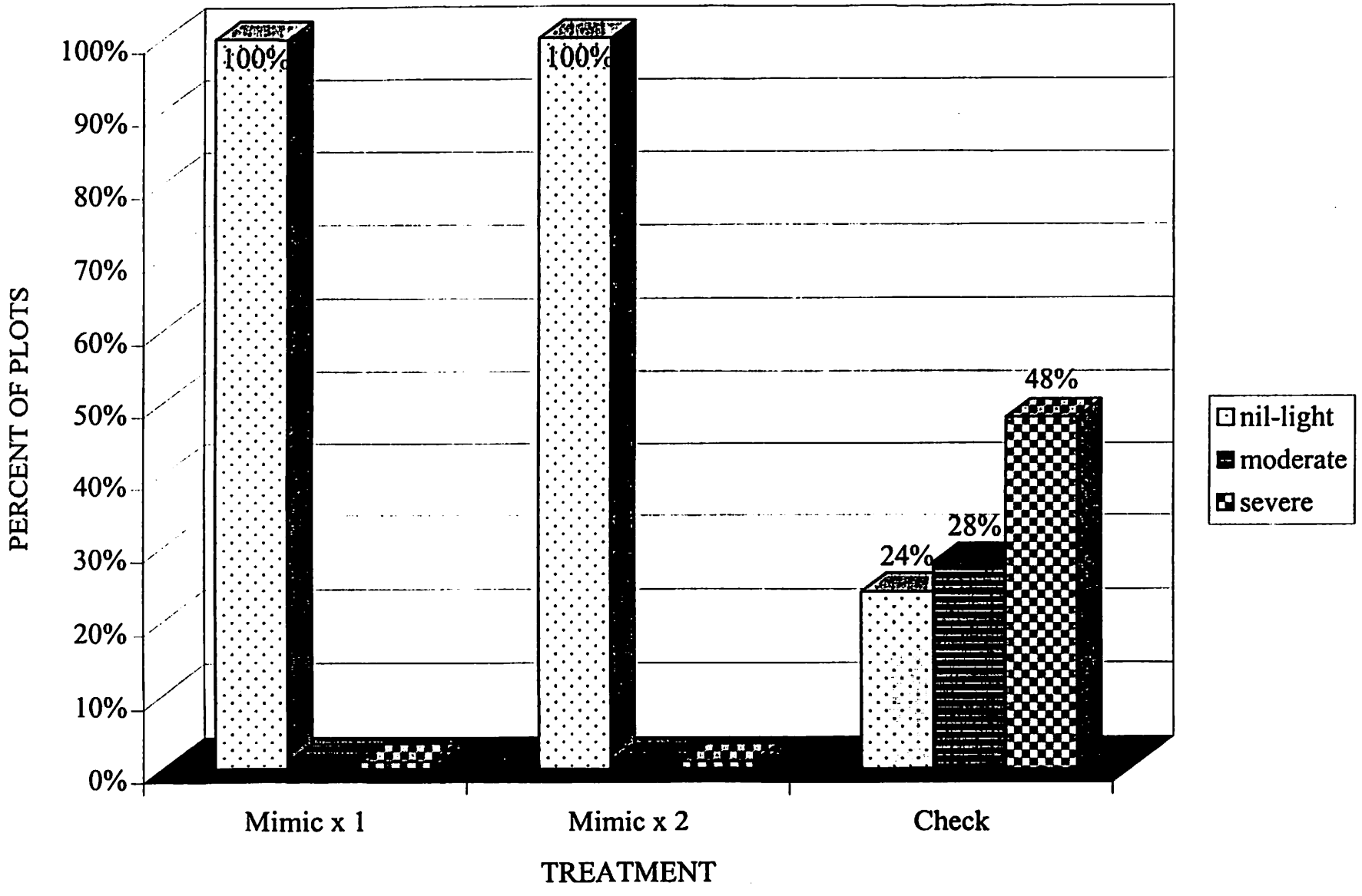

Figure 8. Field trial on Mimic 240LV in Alberta, 1997: Percent of sprayed vs. unsprayed check plots expected in each defoliation category in 1998.

4.2.2 Materials and Methods

In the Northwest Boreal Region, fifteen sites were selected for this study; five of these sites had light defoliation (below 30%), five sites had moderate defoliation (30% to 70%), and five sites had severe defoliation (over 70%) in 1996. In the Northeast Boreal Region, five sites were selected; all five sites had moderate defoliation in 1996. Three types of pheromone traps - Multi-Pher I® (Le Groupe Biocontrole, Quebec), Pherocon II® (Great Lakes IPM Inc., USA), and Delta® (Phero Tech Inc., B.C.) - were used. Two pheromone-baited traps and one unbaited (check) trap belonging to each type, were used at each site (i.e., nine traps altogether per site). The forest tent caterpillar pheromone was supplied by the Research and Productivity Council, Fredericton, N.B.

Traps were set-up in mid- to late June when forest tent caterpillars were in their late instars. Traps were placed randomly in a zigzag pattern so that no two traps were closer than 40 m to each other. In late July, once moth flight was over, the traps were collected and moth catch in each was recorded.

4.2.3 Results and Discussion

Forest tent caterpillar populations across the province collapsed except in small pockets. Thus the trap sites had either nil or light defoliation in 1997.

The results of this trial are summarised in Table 1. Although the moth catches in traps were relatively low, a significantly higher number of moths per trap was found in the baited-traps, compared to the number found in the unbaited traps (Wilcoxon Signed-Rank Test for paired data: sum of ranks at 95% level). Thus the tent caterpillar sex pheromone appears to be effective in attracting moths at low population levels.

Delta traps had significantly higher trap catches than either the Multi-Pher I or Pherocon II traps (Wilcoxon Signed-Rank Test: sum of ranks at 95% level). There was no significant difference between trap catches in Multi-Pher I and Pherocon II traps. Thus out of the three trap types, Delta traps are superior for monitoring forest tent caterpillar moth populations at low levels. Delta traps are also relatively cheaper and easier to set-up. However, unlike the Multi-Pher I traps, Delta traps are not reusable. Under high population levels, Delta traps can get saturated quickly with moths due to their limited sticky surface area, which make them low volume traps.

5.0 OTHER PROGRAMS

5.1 Regional Integrated Pest Management Groups

Integrated pest management groups were set up in each Region to foster collaboration between LFS and the forest industry in managing forest health issues. Each group has representatives from local forest companies, as well as LFS districts, regions and provincial headquarters.

5.1.1 IPM Monitoring Plots

The integrated pest management group in the Northwest Boreal Region is planning to set up a series of monitoring plots to collect data on the impact pests have on forest sustainability. This project is being implemented in collaboration with the Northern Forestry Centre, Canadian Forest Service. Activities planned include an assessment of current permanent sample plot systems used by the participating agencies, designing appropriate tools for monitoring and sampling important forest pests, and an assessment of aerial detection methods. Manuals will be prepared on the aerial and ground assessment of pest conditions, and on the analysis of data collected from plots. Currently seven forest companies are involved in this project. The cost of this three-year project will be borne equally by these companies and LFS.

5.2 Spruce Budworm Decision Support System

The Land and Forest Service has initiated a project to develop a decision support system (DSS) to manage spruce budworm in Alberta. This project involves the Canadian Forest Service (Dr. David Maclean and Dr. Jan Volney) and High Level Forest Products (HLFP), whose Forest Management Area (FMA) is affected by the current budworm outbreak. The main objective is to adapt the DSS developed by Dr. Maclean for New Brunswick to the conditions found in Alberta. The feasibility of extending this system to cover other major forest pests in Alberta will also be considered. The cost of the project will be borne equally by LFS and HLFP.

5.3 Videos on Major Forest Pests

The Forest Health Branch is planning to produce a series of videos on major forest pests and their management in Alberta. These videos are aimed at educating LFS staff, forest industry personnel and the general public. The first video in this series is on Armillaria root rot. It has already been produced and will be available for distribution soon. The second video, on lodgepole pine dwarf mistletoe, is currently in production. Plans are being made to produce a video on aerial spraying to manage spruce budworm infestations in Alberta. A comprehensive booklet on the subject will accompany each video.

6.0 REFERENCES

Kominek, C.; Ono, H. 1997. Mountain pine beetle pheromone sampling. Alberta Environmental Protection, Forest Insect and Disease Management Branch. 8 p.

Kominek, C.; Ranasinghe, S. 1996. Spruce budworm sampling manual. Alberta Environmental Protection, Forest Insect and Disease Management Branch.

Table 1. Moth catches in traps baited with forest tent caterpillar sex pheromones and in check traps without baits in Alberta, 1997.

NORTHWEST BOREAL REGION						
SITE NO.	DELTA TRAPS		MULTI PHER I TRAPS		PHEROCON II TRAPS	
	BAITED*	CHECK	BAITED*	CHECK	BAITED*	CHECK
1	2.0	1.0	0	0	1.0	0
2	1.0	0	0	0	0	0
3	0.5	0	0	0	0	0
4	2.5	0	0.5	0	0	0
5	0.5	0	0	0	0	0
6	14.5	0	3.5	1.0	0.5	23.0
7	4.0	0	0	0	4.0	0
8	8.0	1.0	1.0	0	9.0	1.0
9	4.5	3.0	1.5	0	3.5	1.0
10	3.5	0	0.5	0	13.5	10.0
11	1.0	0	0	0	1.0	0
12	0	0	0	0	0	0
13	14.5	21.0	3.0	1.0	14.0	3.0
14	0	0	0	0	0	0
15	0.5	0	0	0	0	0
NORTHEAST BOREAL REGION						
1	5	0	4.5	0	1.5	0
2	8.5	0	0.5	1.0	5.0	0
3	1.0	1.0	0	1.0	1.0	0
4	0.5	0	0	0	0	0
5	0	0	0	0	0	0

* Average catch in two traps per site

Appendix I. Technical Details of Aerial Spraying to Manage Spruce Budworm in Alberta, 1997.

Insecticides

I. Thuricide 48LV®

- Active ingredient: *Bacillus thuringiensis* var. *kurstaki*
- Formulation: water-based
- Additions: none
- Dilutions: none
- PCPA NO. 17980
- Micro-contaminants: nil
- Potency: Guaranteed: 10 600 iu/mg (12.7 BIU/L)
  Observed:
  Sample 1 10 065 ± 450
  Sample 2 10 272 ± 1098
  Sample 3 12 165 ± 385
  Sample 4 13 981 ± 1129
- Supplier: Novartis Crop Protection Inc. (Canada)

II. Mimic 240LV®

- Active ingredient: Tebufenozide
- Formulation: water-based
- Additions: water, canola oil, glycerol, alkylaryl polyether alcohol
- Dilutions: 0.290 L Mimic : 1.310 L water
- PCPA NO. 24502
- Supplier: Rohm and Haas Canada Inc.

Aircraft Air Tractor 502B (Spray) each with Satloc® Forestar GPS guidance system
Cessna 210 (pointer)

Spraying Nozzle system: Micronair AU4000® with flowmeter
Nozzles per aircraft: eight
Blade angle: 43° when temperature <15 °C and RH > 75%
47° when temperature > 15 °C and RH <75%
VRU setting: 11
Spray speed: 225 km/h
Atomizer rotation speed: 7000 rpm
Flow rate per nozzle: 8.43 L per minute
VMD 95-110 microns
Swath width: 90 m
Rate of spraying: 2.0 L/ha

Period of spraying: June 12-21, 1997

Area sprayed:	Thuricide:	Sprayed once:	7 353 ha
		Sprayed twice:	12 715 ha
		Total	20 068 ha (65 242 L)
	Mimic:	Sprayed once:	927 *ha
		Sprayed twice:	755 ha
		Total	1682 ha (4934 L)

* Includes 70 ha sprayed with rinsate

Spray weather parameters

Temperature	5-30 °C
Relative humidity	over 30%
Wind	under 15 km/h
Precipitation	none within six hours

Forest Pest Conditions in British Columbia - 1997

R. Cozens
Forest Practices Branch
British Columbia Ministry of Forests
Victoria, British Columbia

The province of British Columbia encompasses some 95 million hectares, of which 45 million are under forest management. Our allowable annual cut is about 70 million cubic metres, which is harvested from about 220,000 ha annually.

The Forest Practices Code, which sets out the processes by which Crown forests will be managed in British Columbia, came into full effect in July 1997 after a 2-year period of "substantial compliance". Forest health is an important part of the Code.

Provincial aerial overview surveys were not conducted this year, our first year of "life after FIDS". However, our district and regional staff routinely conduct operational surveys of bark beetle activity so that harvesting can be planned as a control strategy.

Bark beetles continue to be of concern, infesting some 255,000 ha in the province. In comparison with 1996 levels, mountain pine beetle has increased, spruce beetle and western balsam bark beetle have remained constant, and Douglas-fir beetle has declined. Western spruce budworm activity has increased from 1996 levels, while that of all other defoliators has decreased. European gypsy moth has been detected in the vicinity of Victoria.

We expect to develop and conduct a provincial aerial overview survey for 1998. Bark beetle management operations will continue, primarily through priority harvesting. A modest western spruce budworm spray program is in the planning stages.

Ravageurs forestiers en Colombie-Britannique - la situation en 1997

R. Cozens

Le territoire de la Colombie-Britannique couvre quelque 95 millions d'hectares, dont 45 millions font l'objet d'un aménagement forestier. Les quotas annuels de coupe s'élèvent à 70 millions de m^3. L'exploitation forestière touche environ 220 000 ha chaque année.

Le code de pratiques forestières, qui précise les mécanismes régissant l'aménagement des terres publiques en Colombie-Britannique, est officiellement en vigueur depuis juillet 1997, après deux années de « respect en substance ». L'état des forêts est un des volets importants du code.

Aucun relevé aérien n'a été effectué à l'échelle de la province cette année, la première depuis l'achèvement du RIMA. Toutefois, le personnel des bureaux de district et des bureaux régionaux surveille régulièrement l'activité des scolytes afin d'orienter les pratiques d'exploitation en conséquence.

Les scolytes continuent de causer des problèmes sur quelque 255 000 ha dans la province. Comparativement à 1996, les effectifs du dendroctone du pin ponderosa ont augmenté, tandis que ceux du dendroctone de l'épinette et du scolyte du sapin de l'Ouest sont demeurés stables et ceux du dendroctone du douglas ont décliné. L'activité de la tordeuse occidentale de l'épinette s'est intensifiée par rapport à 1996, mais celle de tous les autres défoliateurs a diminué. La présence de la race européenne de la spongieuse a été détectée dans la région de Victoria.

Un relevé aérien à l'échelle de la province est prévu pour 1998. La lutte contre les scolytes, fondée principalement sur des coupes prioritaires, se poursuivra en 1998. Un programme de pulvérisation restreinte contre la tordeuse occidentale de l'épinette est en cours de planification.

Forest Pest Conditions in British Columbia - 1997

Report to the 1997 Forest Pest Management Forum

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18 November, 1997
Ottawa, Ontario

A BC Backgrounder:

To put what is to follow into context, some statistics may be helpful:

- the total area of BC is about 95 million hectares; about 45 million hectares is under forest management, either under tree farm licences (managed by industry) or under timber supply areas (managed by the Forest Service)
- 95% of the forest land in BC is owned by the Crown
- total allowable annual cut is about 70 million m^3, from about 220 000 hectares annually
- average MAI is 2.5 m^3 per hectare (range <1 m^3 to >15 m^3)
- administratively, there are 6 regional offices and 41 district offices throughout BC; each region has forest entomology and forest pathology expertise; most districts have forest health professionals or technicians on staff; at headquarters there are 6 professional staff that work totally or partly in forest health.

Change Prevails:

- The Forest Practices Code came into full effect in July 1997, after a two year "substantial compliance" period. The Forest Practices Code, and its associated regulations, sets out the processes by which Crown forests will be managed in BC. Forest health is an important part of the Code. As can be expected with new legislation, there is a substantial number of amendments to the *Act* as well as regulation revisions, to make the package more workable.

- Forest Renewal BC, a Crown corporation recently established with the purpose of enhancing BC's forest resource, will not be funding the Forest Health Program in BC after March 1998. The Forest Service is in the process of rationalizing a budget of about $10 million for forest health from base funding.

- 1997 was our first year of "life without FIDS". Our district and regional staff concentrate on operational surveys . . . mapping of bark beetle activity so that harvesting operations can be used as a control tactic. We did not do any "FIDS-type" aerial overview surveys and thus have lost a second year of valuable historical data.

Forest Pest Conditions:

Generally, in the absence of consistent overview surveys:

- mountain pine beetle has increased from last years 56 000 hectares
- spruce beetle has remained more-or-less unchanged from last years 77 000 hectares
- Douglas-fir beetle occurrence has continued to decline
- western balsam bark beetle has remained more-or-less static at last years estimate of about 132 000 hectares
- white pine weevil (on spruce) incidence has continued to increase as more plantations become susceptible and as we become more vigilant in looking for signs of activity
- western spruce budworm has increased from 1996 levels; about 10 000 hectares of budworm in the Kamloops and Cariboo regions were sprayed
- Douglas-fir tussock moth has declined to undetectable levels
- gypsy moth (European) egg masses have been identified in the Esquimalt / Langford area of Victoria
- green striped forest looper near the Nass River (north west BC) has collapsed, where some 20 000 hectares had been infested in 1996

Expectations for 1998:

- that funding will be assured to maintain our current forest health programmes
- bark beetle management, primarily through priority harvesting, will continue throughout the province
- that "FIDS type" aerial overview surveys and reports will be implemented on a province-wide basis
- that up to20 000 hectares of western spruce budworm in the Kamloops and Cariboo may be treated with Bt, and possibly other insecticides
- that a control option for 700 hectares of gypsy moth (European) in will be chosen and implemented

Status of Major Forest Insects and Diseases in the United States

M. Weiss, T. Hofacker and R. Fowler
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USDA Forest Service
Washington, District of Columbia

Defoliation by the gypsy moth totalled 20,000 ha, the lowest since 1960. The Slow-the-Spread (S-T-S) pilot project begun in 1992 shows that the advance of gypsy moth can be slowed by 60%. If funds are available, we plan to implement S-T-S along the entire leading edge beginning in 1999. Two specimens of the Asian strain of the gypsy moth were trapped in the Seattle area, and the Animal and Plant Health Inspection Service (APHIS) and the State of Washington are considering future action.

Defoliation by the spruce budworm occurred in Michigan, Minnesota and Arkansas, totalling 172 ha. Defoliation by the western spruce budworm totalled 121,000 ha, the lowest ever recorded. Douglas-fir tussock moth activity was low over all, but population increases that began in California in 1996 continued.

Mountain pine beetle activity was reported on 142,000 ha, a near-record low. The spruce beetle outbreak in south-central Arkansas continued, covering a total of 320,000 ha. Southern pine beetle damage continued to decrease, but the trend may be reversing, as beetle activity rises.

Dwarf mistletoes, root diseases and rusts continued to have significant effects in many areas. Pitch canker first found in California in 1986 has now been recorded in 17 coastal and adjacent inland counties and has caused significant loss of Monterey pine in some areas. Butternut canker has been found from Maine to Georgia and west to Wisconsin, killing an estimated 70% of the butternut in North Carolina and Virginia. In Wisconsin, 27% of the butternut trees are dead, and most of the remaining trees are infected.

APHIS and the State of New York started a project to eradicate the Asian long-horned beetle infestations in Brooklyn and Amityville. To date, over 1,200 infested trees have been found and destroyed.

Insectes et maladies des arbres forestiers d'importance économique aux États-Unis État de la situation en 1997

M. Weiss, T. Hofacker et R. Fowler

La défoliation par la spongieuse a atteint son plus bas niveau depuis 1960, la superficie touchée s'élevant à seulement 20 000 ha. Le projet pilote entrepris en 1992 en vue de freiner la propagation de la spongieuse (*Slow-the-Spread pilot project*) a démontré qu'il est possible de ralentir de 60 % la progression du ravageur. Si les fonds nécessaires continuent de nous être accordés, nous projetons d'étendre le projet à toute la ligne de front de la zone infestée par la spongieuse en 1999. Deux spécimens de la race asiatique ont été capturés dans la région de Seattle, et le *Animal and Plant Health Inspection Service* (APHIS) et l'État de Washington envisagent de prendre des mesures additionnelles afin de prévenir toute propagation du ravageur dans la région.

La tordeuse des bourgeons de l'épinette a défolié 172 ha au Michigan, au Minnesota et en Arkansas. Pour sa part, la défoliation par la tordeuse occidentale de l'épinette a atteint un plancher historique avec 121 000 ha. L'activité de la chenille à houppes était également faible dans toutes les régions, mais l'augmentation des populations qui s'est amorcée en Californie en 1996 s'est poursuivie.

Le dendroctone du pin ponderosa a causé des dommages sur 142 000 ha. Ce niveau d'activité s'approche du plus faible seuil jamais enregistré. L'infestation par le dendroctone de l'épinette s'est poursuivie sur 320 000 ha dans le centre-sud de l'Arkansas. L'ampleur des dommages causés par le dendroctone méridional du pin a continué de baisser, mais cette tendance pourrait s'inverser si l'activité du ravageur s'intensifie.

Les faux-guis, les maladies des racines et les rouilles ont continué de causer des dégâts importants dans de nombreuses régions. Le chancre fusarien, dont la présence a été signalée pour la première fois en Californie en 1986 et depuis dans 17 comtés côtiers et intérieurs adjacents, a infligé des dégâts considérables au pin de Monterey. Le chancre du noyer cendré, dont la présence a été détectée depuis le Maine jusqu'en Georgie et, vers l'ouest, jusqu'au Wisconsin, a détruit environ 70 % des noyers en Caroline du Nord et en Virginie. Au Wisconsin, 27 % des noyers sont morts, et la majorité des arbres survivants sont infestés.

L'APHIS et l'État de New York ont lancé conjointement un projet visant à enrayer les infestations causées par un cérambycide originaire d'Asie à Brooklyn et à Amityville. À ce jour, plus de 1 200 arbres infestés ont été découverts et détruits.

FOREST INSECT AND DISEASE CONDITIONS IN THE UNITED STATES, 1997

Summary

In the Eastern United States, gypsy moth and southern pine beetle activity declined from 1996 to 1997. Spruce budworm defoliation was extremely low and was of little consequence; the area defoliated by the gypsy moth decreased to the lowest level since 1960; the southern pine beetle epidemic in parts of the South continued to recede; the area infested by European pine shoot beetle continued to increase. Browntail moth populations continued to cause concern in Maine and Massachusetts. In the West, western spruce budworm defoliation and mountain pine beetle activity remained at low levels. To date, no "Asian" gypsy moths have been identified this year.

Forest diseases of concern were fusiform rust, a stem rust of southern pines; root and stem decays; tree declines--particularly of ash, oak, fir, larch, maple, and red spruce; dwarf mistletoes; scleroderris canker; beech bark disease; butternut canker; and the pinewood nematode, which continues to be an issue related to export of infested wood. Pitch canker, a disease common in the Southeastern United States, is now found in 15 counties in California.

Gypsy Moth *Lymantria dispar* (Linnaeus)

Gypsy moth defoliation decreased from the 1.5 million acres reported in 1995 to 200,000 acres in 1996, to about 50,000 acres in 1997. This is the lowest level of defoliation reported since 1960. Despite the decline in defoliation over the last several years, gypsy moth continues to spread south and westward. The pioit project aimed at slowing the gypsy moth's spread will essentially be completed in 1997; results of this project indicate that gypsy moth spread can be slowed by over 60%; plans are being developed to take this operational in 1999. The Asian gypsy moth eradication effort in North Carolina appears to have been successful as no AGM have been found there to date. So far, no AGM have been identified elsewhere in the U.S.

1995	1996	1997
1.5 million acres 0.6 million ha	200,000 acres 81,000 ha	50,000 acres 20,000 ha

This report was prepared by Forest Health Protection, Washington, DC, for the 1997 Canadian Forest Pest Management Forum.

NOTE: 1997 defoliation figures are estimates and subject to change.

Mountain Pine Beetle *Dendroctonus ponderosae* Hopkins

Mountain pine beetle activity remained low in 1997. Outbreaks occurred on only about 350,000 acres (142,000 ha). This is close to the lowest level ever recorded. The exception to this declining trend is in the Vail, Colorado area where mountan pine beetle infestations in lodgepole pine are increasing rapidly. Other beetles, including Douglas-fir beetle (*Dendroctonus pseudotsugae*), western pine beetle (*Dendroctonus brevicomis*), western balsam bark beetle (*Dryocetes confusus*), engraver beetles (*Scolytus* spp.), and spruce beetle (*Dendroctonus rufipennis*) were more damaging that the mountain pine beetle. Existing spruce beetle outbreaks are expanding and new outbreaks are being detected in the western U.S. Spruce beetle populations were especially high in Alaska, where infestations occur on more than 800,000 acres, and estimates are that over 30 million spruce trees were killed by spruce beetle in 1997.

1995	1996	1997
575,000 acres 233,000 ha	300,000 acres 121,000 ha	350,000 acres 142,000 ha

For the fourth year in a row, no mountain pine beetle outbreaks covering more than 100,000 acres (40,500 ha) were present. The trend to low populations that began in the 1980s may be reversing; mountain pine beetle activity in Colorado increased substantially in 1997 and it appears that a major outbreak is building along the Front Range. In California, mountain pine beetle attack is concentrated in sugar pine, but it is also found associated with other beetles attacking other pine species.

Pine Shoot Beetle *Tomicus piniperda* Linnaeus

The common European pine shoot beetle was discovered in July of 1992 in the vicinity of Cleveland, Ohio. By December of 1992 it had been found in 43 counties in 6 states: Illinois, Indiana, Michigan, Ohio, New York and Pennsylvania. Delimiting surveys have brought the total number of infested counties to 222 as of August, 1997 in the above 6 states plus Maryland, West Virginia, and Wisconsin.

Secondary Exotic Beetles *Hylastes opacus* Erickson

Hylastes opacus, first collected in 1990, is now common in New Hampshire and has been found in Maine, New York, Vermont and West Virginia. This insect normally feeds under the bark of stumps or at the base of unhealthy *Pinus* species, especially scotch pine. Other exotic beetles captured in the northeastern U.S. include *Hylurgus ligniperda*, *Hylurgops palliatus*, *Pityogenes chalcographus* and *Orthotomicus erosus*.

Southern Pine Beetle *Dendroctonus frontalis* Zimmermann

Southern pine beetle activity continued to decrease greatly after producing record damages in 1995.

As of July 17, only about 500 southern pine beetle infestations had been found on the National Forests of the South. This compares to the approximately 5,000 spots that were detected at the same time in 1996, and the 10,500 southern pine beetle spots that were recorded at about the same time in 1995. Spots in 1996 and 1997 were generally much smaller than in 1995. However, beetle activity began picking up in early August and it appears that there may be a substantial problem by the time the year is out.

Spruce Budworm *Choristoneura fumiferana* (Clemens)

Populations continued to be low in 1997. The only significant defoliation occurred in Michigan and Minnesota, mostly on the Ottawa and Superior National Forests respectively, and in the interior of Alaska.

1995	1996	1997
848,000 acres 343,000 ha	456,000 acres 185,000 ha	425,000 acres 172,000 ha

Western Spruce Budworm *Choristoneura occidentalis* Freeman

Western spruce budworm defoliation remained low throughout the West. The defoliated area in Oregon and Washington is estimated at only about 100,000 acres. Total defoliation is estimated to be less than 300,000 acres; the lowest amount ever recorded.

1995	1996	1997
478,000 acres 134,000 ha	332,000 acres 134,000 ha	300,000 acres 121,000 ha

Beech Bark Disease *Nectria coccinea* var. *faginata* + *Cryptococcus fagisuga* Lindinger

Beech bark disease is the result of an attack by the beech scale (*Cryptococcus fagisuga*) followed by invasion of the fungus *Nectria coccinea*. The scale was introduced into North America in about 1890. By 1932 the disease was killing trees in Maine and by 1981 the disease had spread to West Virginia. It is now also found in a small area on the North Carolina/Tennessee border.

Butternut Canker *Sirococcus clavigigenti julandacearum* Nair, Kostichka

Butternut canker has been found from Maine to Georgia and west to Wisconsin. This disease is estimated to have killed 70% of the resource in North Carolina and Virginia. In Wisconsin, about 91% of the live butternut trees are infected and 27% are dead. Although it is too early to estimate the benefits of resistance selection and breeding, trees exhibiting resistance have been found. Currently, the disease is projected to spread and kill most of the resource.

Dogwood Anthracnose *Discula destructiva* Redlin

A damaging foliage and twig disease of native dogwoods was first recognized in 1984 on both the east and west coasts. Damage is most severe in forest environments at higher elevations and in cool, moist areas at the lower elevations. Now a second disease, also an apparent exotic, is causing severe decline of native dogwoods from Virginia to Missouri. The disease, a *Microsphaera* spp. powdery mildew, mimics and masks some of the anthracnose symptoms, making monitoring for that disease more difficult.

Dwarf Mistletoes *Arceuthobium* spp.

Most western conifers can be infected by 1 or more of the 15 species of these parasitic plants found in the Western United States and southeastern Alaska. Most of the damage, however, is caused by seven species: those infecting lodgepole pine, Douglas-fir, western larch, true firs, western hemlock, and ponderosa pine (two species). Dwarf mistletoes affect western conifers on an estimated 22 million acres (8.9 million ha) of commercial forests. Growth and yield are seriously reduced; approximately 383 million cubic feet (10.8 million m^3) of timber are lost annually. Where forest stands are being managed more intensively, losses are slowly but steadily declining.

European Larch Canker *Lachnellula willkommii* (Hartig) Dennis

A quarantine continued in Maine, where movement of larch was restricted in Hancock, Knox, Lincoln, Waldo and Washington Counties.

Fusiform Rust *Cronartium quercuum* (Berk.) Miy. ex Shiral F. sp *fusiforme*

Fusiform rust is the most serious disease of loblolly and slash pines growing in the Southeast. Annual losses are estimated at 194 million cubic feet (5.5 million m^3 of growing stock valued at more than $110 million. About 2.5 million acres (1 million ha) have at least 50 percent of the trees with either a main stem canker or with potentially lethal branch cankers within 12 inches of the stem. An estimated 15.3 million acres (6.2 million ha) have at least 10 percent of the trees with either a main stem canker or a branch canker within 12 inches of the stem.

Pinewood Nematode *Bursaphelenchus xylophilus* (Steiner et Buhrer) Nickle

Reported on 25 pine and 8 non-pine conifer species, pinewood nematode has been found throughout the Eastern United States. Pinewood nematode distribution has not been determined in the West, but it may be widespread there as well. Scotch pine is the species most often killed, and mortality has primarily been limited to introduced pine species. Native pines are resistant to the pine wilt disease, although a few Virginia, sand, and slash pines have been killed in several forest tree seed orchards. Reports of mortality to non-pine hosts are rare.

Pitch Canker *Fusarium moniliforme* Sheld. var. *subglutinans* Wollenw. & Reink.

In the Southeastern United States, pitch canker is widespread in slash, loblolly and shortleaf pine plantations. Discovered in California in 1986, this disease has now been identified in 17 coastal and adjacent inland counties from San Diego to Mendocino County, including all three native stands of Monterey pine. This poses a threat to the genetic base of Monterey pine. Other naturally infected native trees in California include seven pine species and Douglas-fir.

Root and Stem Decay

Although these diseases are found nationwide, their effects are more significant in certain geographic areas and forest types.

In the West, root diseases, especially annosus root disease (*Heterobasidion annosum*) and armillaria root disease (*Armillaria* spp.) are among the most serious forest pests. Mortality is particularly severe in drought-stricken stands where root diseases and bark beetles work together. Damage in western forests has increased greatly in this century because of altered forest conditions and structure due to fire control and past management practices.

In the South, annosus root disease is significant in pine plantations, especially those where thinning has occurred. Bark beetle infestations often occur in root diseased stands. Root diseased trees become hazardous in recreation areas and along roadsides.

Other root decays also affect both hardwood and conifer species in the East and cause an estimated annual mortality of 1 to 2 percent. Stem decays are the most damaging agents to hardwoods, being especially severe where hardwoods have been damaged by storms and wildfire or wounded during careless thinning operations.

GENERAL SCIENTIFIC PRESENTATIONS/
PRÉSENTATIONS GÉNÉRALES SCIENTIFIQUES

Proposal for the Establishment of a Resource Bank of Baculoviruses of Forest Pest Insects: The "Baculobank"

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Insects, as a group, are known to be infected by about 20 virus families. Amongst these families, the Baculoviridae, Poxviridae, Polydnaviridae, Parvoviridae and Reoviridae cause most of the known viral diseases in spruce budworm (*Choristoneura fumiferana)* and other lepidopteran forest pest insects. The two genera within the Baculoviridae, Granulovirus (GV) and Nucleopolyhedrovirus (NPV), have attracted the most interest as potential agents for use in the suppression of forest pest insect populations. What is attractive about the Baculoviridae is that they are restricted to arthropods (primarily to insects), they tend to be host-specific, and many are known to cause epizootics within host populations. For example, population crashes due to NPV epidemics occur in many species of sawflies (Hymenoptera: Diprionidae). Here, NPV infection is density-dependent. These insects are particularly susceptible to communication of the disease as most are communal and feed openly on foliage. Attempts to use NPVs to suppress or eliminate sawfly populations have usually met with success. Similarly, in forest Lepidoptera, the use of NPVs in pest suppression has been successful with insects that feed openly on foliage and where NPV epizootics occur in a density-dependent fashion. As a rule, NPVs have been used successfully to control pest insects only where natural epizootics are known to occur. Availability of virus stocks for application to outbreak populations could possibly bring about a collapse before significant damage is done to the forest. Unfortunately, stocks of viruses are not always readily available even for the purpose of scale-up production, let alone for control applications. It is suggested that the Canadian Forest Service, in partnership with industry, establish a reserve or "bank" of baculoviruses that will be readily available, for scale-up purposes, in the case of pest population outbreaks.

Projet d'établissement d'une banque de baculovirus contre les insectes ravageurs forestiers

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Environ 20 familles de virus sont reconnues comme étant entomopathogènes. La plupart des maladies virales répertoriées chez la tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana*) et d'autres lépidoptères ravageurs sont causées par des Baculoviridae, des Poxviridae, des Polydnaviridae, des Parvoviridae et des Reoviridae. Dans la famille des Baculoviridae, deux genres, à savoir *Granulovirus* (GV) et *Nucleopolyhedrovirus* (NPV), suscitent un vif intérêt en raison de leur potentiel prometteur contre les insectes ravageurs forestiers. L'intérêt des Baculoviridae réside dans le fait qu'ils n'attaquent que les arthropodes (principalement les insectes), qu'ils présentent généralement une grande spécificité à l'égard de l'hôte et qu'ils provoquent souvent des épizooties parmi les populations hôtes. Par exemple, chez de nombreuses espèces de diprions (Hymenoptera: Diprionidae), l'effondrement des populations est souvent provoqué par des épidémies causées par des NPV. Dans ce cas, l'infection à NPV est souvent dépendante de la densité. La propagation des infections virales, chez les diprions, se trouve facilitée par le fait que ces insectes vivent en colonies à l'état larvaire et se nourrissent sans protection sur le feuillage. La plupart des essais de lutte à l'aide de NPV entrepris contre des populations de diprions ont été couronnés de succès. L'utilisation de NPV contre les lépidoptères forestiers a également donné de bons résultats chez les espèces dont les chenilles se nourrissent sans protection sur le feuillage et chez qui les épizooties sont dépendantes de la densité. De façon générale, les NPV se sont révélés efficaces uniquement contre les insectes ravageurs dont les populations sont naturellement réprimées par des épizooties virales. S'il était possible d'obtenir facilement des stocks de virus en vue des les appliquer contre des populations d'insectes, on pourrait peut-être provoquer l'effondrement des populations avant que celles-ci aient le temps de causer des dommages importants. Malheureusement, il n'est pas toujours possible d'avoir accès à ces stocks de virus, même à des fins de production massive. Il est donc recommandé que le Service canadien des forêts, en collaboration avec l'industrie, mette sur pied une banque de baculovirus afin de favoriser la production massive et l'utilisation de ces agents de lutte biologique contre les insectes ravageurs forestiers.

Development of Microbial Control Strategies for Management of Dwarf Mistletoes

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With increased emphasis on partial cutting practices in British Columbia's coastal hemlock forests, conflicts can be expected to arise and must be resolved. Within infested stands that are partially cut, or where large numbers of trees or infected trees are retained, there is a substantial risk of increasing impact because of accelerated seed production and dispersal by dwarf mistletoe and the activation of latent infections by increased light in tree crowns. Microbial control strategies for management of dwarf mistletoe would be appropriate under new forestry practices. The objectives of this new research study are to identify indigenous fungal parasites and to evaluate their potential as biocontrol agents for dwarf mistletoes, including western hemlock dwarf mistletoe *(Arceuthobium tsugense* subsp. *tsugense)* and lodgepole pine dwarf mistletoe *(A. americanum).*

This project began in June 1996 and the focus of research is on biocontrol of western hemlock dwarf mistletoe. As of January 1998, we will initiate work on biocontrol of lodgepole pine dwarf mistletoe. In June 1996 a field survey was conducted in the Vancouver Island and coastal regions of British Columbia to collect, identify, catalogue and evaluate the fungal parasites associated with diseased seeds, shoots and swellings of western hemlock dwarf mistletoe. From these diseased tissues, a total of 200 fungi were isolated and preserved for further research. An *in vitro* method is being developed with tissue culture techniques to screen and evaluate fungal parasites as biocontrol agents for dwarf mistletoe. From our field operations it appears that the most promising fungal parasites are *Colletotrichum gloeosporioides* (a shoot pathogen, newly recorded in Canada) and *Nectria neomacrospora* (an endophytic system pathogen). Several formulations for these two pathogens are under development in the laboratory. An invert emulsion formulation was used to test the efficacy of fungi as biocontrol agents on western hemlock dwarf mistletoe under field conditions. The results of the first-year data will be discussed.

Élaboration de stratégies de lutte microbienne contre les faux-guis

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L'augmentation des coupes partielles dans les forêts côtières de pruche de la Colombie-Britannique laisse présager une intensification des problèmes causés par le faux-gui. En effet, dans les peuplements infestés faisant l'objet de coupes partielles ou dans les peuplements où l'on souhaite conserver un nombre élevé d'arbres infestés, ces pratiques risquent d'accroître de façon substantielle les dommages causés par le faux-gui en accélérant la production de graines et en favorisant la propagation de cette plante nuisible; l'apport accru de lumière au niveau de la cime des arbres risque aussi de stimuler la réactivation des infections latentes. L'application de stratégies de lutte microbienne contre le faux-gui cadre bien avec les nouvelles pratiques forestières. L'objet de la présente recherche est d'identifier les espèces indigènes de champignons parasites et d'évaluer leur efficacité comme agents de lutte biologique contre diverses espèces de faux-guis, dont le faux-gui de la pruche de l'Ouest (*Arceuthobium tsugense* ssp. *tsugense*) et le faux-gui du pin tordu latifolié (*A. americanum*).

Depuis le début du projet, en juin 1996, les travaux ont porté essentiellement sur la lutte biologique contre le faux-gui de la pruche de l'Ouest. Nous prévoyons d'entreprendre les essais de lutte biologique contre le faux-gui du pin tordu latifolié en janvier 1998. En juin 1996, nous avons effectué un relevé sur le terrain afin de recueillir, identifier, répertorier et évaluer le potentiel de champignons parasites associés aux graines, pousses et renflements du faux-gui de la pruche de l'Ouest. Au total, 200 champignons ont été isolés et conservés en vue de recherches ultérieures. Nous avons mis au point une méthode *in vitro* de culture de tissus afin d'isoler les différents champignons parasites et d'évaluer leur potentiel comme agents de lutte biologique contre le faux-gui. D'après nos observations sur le terrain, les champignons *Colletotrichum gloeosporioides* (espèce pathogène des pousses dont la présence au Canada a été signalée tout récemment) et *Nectria neomacrospora* (pathogène endophyte systémique) semblent les plus prometteurs. Plusieurs formulations de ces deux champignons pathogènes sont actuellement en cours d'élaboration en laboratoire. Nous avons utilisé une formulation d'émulsion inverse pour évaluer sur le terrain l'efficacité des champignons comme agents de lutte biologique contre le faux gui de la pruche de l'Ouest. Les résultats de la première année d'essais sont présentés.

The Use of a Snow Mould to Control *Calamagrostis canadensis*

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Seedlings of bluejoint (*Calamagrostis canadensis* [Michx.] Beauv) and white spruce (*Picea glauca* [Moench] Voss) were inoculated with a low-temperature basidiomycete (LTB) and kept at -6 C for 12 weeks before they were moved to a greenhouse. The LTB fungus caused mortality as well as reduction in shoot and root dry weights, and tiller numbers in bluejoint but not in white spruce. In a second growth-chamber experiment, bluejoint was inoculated with LTB and kept at -6 C for 8, 14 and 20 weeks before the plants were moved to a greenhouse. Plant height, shoot dry weight, tiller number and survival decreased with increased incubation times. In a field study, LTB was applied to bluejoint to determine if it could control grass growth. The LTB was applied at five different dosages. The percent cover of bluejoint and other nontarget plants (plants other than bluejoint) was evaluated the following summer and two years after application. The above-ground biomass was harvested and evaluated one, two and three years after inoculation. Significant biomass reductions of bluejoint were evident. In the high-dosage treatment there was an average of 47% reduction in bluejoint biomass. Nontarget plants showed no evidence of being affected by LTB. Species richness and percent cover increased slightly in some plots.

Utilisation d'une moisissure des neiges comme agent de lutte biologique contre le *Calamagrostis canadensis*

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Un basidiomycète psychrophile a été inoculé à des semis de calamagrostide du Canada (*Calamagrostis canadensis* [Michx.] Beauv) et d'épinette blanche (*Picea glauca* [Moench] Voss). Une fois infectés, les semis ont été gardés à -6 °C pendant 12 semaines avant d'être transférés dans une serre. Une mortalité et une réduction des poids anhydres des pousses et des racines et du nombre de talles ont été observées chez le calamagrostide, mais pas chez l'épinette blanche. Dans une deuxième chambre de croissance, une autre série de semis de calamagrostide infectés artificiellement par le basidiomycète ont été gardés à -6 °C pendant 8, 14 et 20 semaines avant d'être transférés dans une serre. La hauteur des plants, le poids anhydre des pousses, le nombre de talles et le taux de survie des semis ont diminué proportionnellement à la durée de l'incubation. Lors d'essais sur le terrain visant à déterminer si le champignon basidiomycète peut neutraliser la croissance de la graminée en conditions naturelles, cinq doses du basidiomycète ont été inoculées au calamagrostide. Le pourcentage de recouvrement par le calamagrostide et d'autres plantes non visées a été évalué au cours de l'été suivant et deux ans après l'application. Les parties aériennes ont été récoltées et pesées au cours de chacune des trois années suivant l'inoculation. Des réductions significatives de la biomasse ont été observées chez le calamagrostide, la réduction moyenne atteignant 47 % dans le cas du traitement effectué à la plus forte dose. Les plantes non visées n'ont pas semblé incommodées par le basidiomycète. Une légère augmentation de la richesse spécifique et du taux de recouvrement a été observée dans certaines parcelles.

The Abbott Deposit Assessment Method (ADAM) for Detection and Quantification of *B.t.* Spray Deposits

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Laboratory and field experiments were conducted in 1996-1997 to validate and test the ADAM kit for detection and quantification of *B.t.* toxins on foliage after aerial application. The ADAM kit is an ELISA (Enzyme-Linked Immuno Sorbent Assay) method developed and marketed by Agdia Inc. (Elkhart, Indiana) on behalf of Abbott Laboratories. Although absolute validation against known amounts of toxin protein on foliage is not feasible, excellent recovery of *B.t.* toxin protein from spray droplets on coniferous foliage was observed in laboratory experiments.

In 1996, the ADAM kit was tested in western Newfoundland in an aerial experimental spray with ABG-6432 and ABG-6414 against eastern hemlock looper. Mean toxin content per branch (one branch/tree, 60 trees/block) was estimated from five flushed buds (approx. 2.5 g wet weight) and correlated with mortality of field-collected L2 in a 5-day bioassay of another set of five shoots from the same branch. In both treatments, larval mortality was highly variable at < 400 ng tx/g foliage but was consistently higher than 70% at > 400 ng tx.

In 1997, the kit was tested in southwestern Quebec in an experimental spruce budworm control program with Foray 48B applied at 15 BIU/ha in 2.4 L. Spray deposition was assessed on two bud clusters per branch (1 branch/tree, 16 trees/block), using ADAM on one bud from each cluster to estimate ng toxin per bud, while the number and size of spray droplets was determined on a second bud. Expected toxin content of each spray droplet was calculated from observed droplet diameter and nominal concentration of the spray mixture (6.35 BIU/L or 12,500 ng tx/μL). There was an approximate 1:1 relationship between observed and expected ng/toxin bud over a range of 0 to 300 ng. The relationship between observed ng tx/bud and larval mortality in bioassays of 20 buds collected from the same branch indicated that at least 80 ng tx/bud were required to produce 50% mortality. This corresponded to a deposit of about 20 droplets/bud.

We conclude that the ADAM kit is a highly sensitive tool for assessing *B.t.* spray deposits. A field kit has been developed that eliminates the need for any laboratory equipment, and permits rapid on-site detection of *B.t.* toxin proteins at levels that are in a biologically relevant range. This user-friendly version will be tested in 1998 for operational assessment of *B.t.* spray deposits.

Application de la méthode Abbott d'évaluation des dépôts (ADAM) pour la quantification des dépôts de pulvérisation de B.t.

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Les chercheurs ont effectué une série d'expériences en laboratoire et sur le terrain en 1996-1997 afin de valider la trousse ADAM et d'en évaluer l'efficacité pour la détection et la quantification des toxines du B.t. déposées sur le feuillage après une pulvérisation aérienne. La trousse ADAM est une méthode ELISA (méthode immuno-enzymatique) élaborée et commercialisée par Agdia Inc. (Elkhart, Indiana) pour les Laboratoires Abbott. Bien qu'il soit impossible de valider de façon absolue la méthode pour des concentrations connues de toxines protéiques sur le feuillage, les chercheurs ont obtenu en laboratoire d'excellents taux de récupération des toxines protéiques du B.t. à partir de gouttelettes déposées sur le feuillage de conifères.

En 1996, la trousse ADAM a été utilisée dans l'ouest de Terre-Neuve dans le cadre d'une pulvérisation aérienne expérimentale d'ABG-6432 et d'ABG-6432 contre l'arpenteuse de la pruche. Les chercheurs ont estimé la concentration moyenne de toxines par branche (une branche/arbre, 60 arbres/parcelle) à partir de cinq bourgeons ouverts (poids humide d'environ 2,5 g) et établi une corrélation entre ces résultats et les taux de mortalité enregistrés dans le cadre d'un essai biologique d'une autre série de cinq pousses prélevées sur la même branche chez des chenilles du deuxième stade récoltées sur le terrain. Dans les deux traitements, les taux de mortalité ont varié considérablement lorsque la concentration de toxines était inférieure à 40 ng de toxine/g de feuillage, mais ont dépassé systématiquement 70 % lorsque ces concentrations étaient supérieures à 40 ng de toxine/g de feuillage.

En 1997, la trousse a été mise à l'essai dans le sud-ouest du Québec dans le cadre d'une pulvérisation expérimentale de Foray 48B (appliqué à raison de 15 MUI/ha dans 2,4 L) contre la tordeuse des bourgeons de l'épinette. Aux fins de l'évaluation des dépôts, deux groupes de bourgeons ont été prélevés sur chaque branche sélectionnée (une branche/arbre, 16 arbres/parcelle). On a utilisé un bourgeon de chaque groupe pour estimer à l'aide de la trousse ADAM la concentration de toxines par bourgeon (en ng), et l'autre pour déterminer la taille et le nombre de gouttelettes. La teneur théorique en toxines de chaque gouttelette a été déduite du diamètre observé de la gouttelette et de la concentration nominale de la bouillie de pulvérisation (6,35 MUI/L ou 12 500 ng de toxine/µL). Une relation approximative de 1 pour 1 a été notée entre les teneurs observée et théorique de toxines par bourgeon, pour un intervalle de 0 à 300 ng. La relation notée entre les concentrations observées par bourgeon et les taux de mortalité larvaire enregistrés dans le cadre d'essais biologiques effectués avec 20 bourgeons provenant d'une même branche a permis d'établir que la concentration de toxines par bourgeon doit être d'au moins 80 ng pour induire une mortalité de 50 %. Une telle valeur correspond à un dépôt d'environ 20 gouttelettes par bourgeon.

Les chercheurs estiment que la trousse ADAM est un outil très sensible pour l'évaluation des dépôts pulvérisation de B.t. Une trousse de terrain ne nécessitant pas l'utilisation d'équipement de laboratoire a été élaborée. Cette trousse permet de détecter rapidement sur place les dépôts de toxines protéiques du B.t. à des concentrations équivalentes à celles induisant un effet biologique. Les chercheurs se proposent d'évaluer en 1998 l'efficacité de cette version simplifiée pour l'évaluation des dépôts de pulvérisation de B.t. en contexte opérationnel.

Diversity of Sapstaining Fungi in Canadian Sawmills

D. Q. Yang *(1)*, P. Gagné *(2)*, M. Gignac *(1)*, and L. Bernier *(2)*

Wood sapstain necessitates the downgrading of timber and results in a decrease in the value of that timber for the end user. Several groups of fungi are responsible for sapstain. The species involved and the severity of the stain vary with the season, local environmental factors, tree species and storage conditions after the timber has been harvested. In order to develop an integrated management system or an environmentally benign technique for use against the stain, it is important to understand the occurrence of staining organisms.

This study was designed to investigate the population diversity of sapstaining fungi in logs and lumber of several Canadian softwood species: jack pine, lodgepole pine, black spruce, white spruce and balsam fir. The sampling was conducted in selected sawmills across Canada in the summer of 1997. Freshly sawn lumber and logs were close-stacked and left in place for one month. The isolation was made from wood that was fully stained. The results clearly showed that the Ophiostomatoid fungi, which include species of *Ophiostoma* and *Ceratocystis*, were the most common species associated with sapstain. Among this group of fungi, *O. piceae* was most frequently isolated from spruce and fir, while *O. piliferum* and *O. minus* were most often associated with pine. Several other Ophiostomatoid fungi, the black yeast *Aureobasidium pullulans* and dematioaceous molds such as *Cladosporium cladosporioides* and *Alternaria alternata* were also found in stained logs and lumber. Studies on the genetic diversity of *O. piceae* and related species are in progress.

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Étude de la diversité des champignons responsables de la coloration de l'aubier dans les scieries canadiennes

D.Q. Yang (1), P. Gagné (2), M. Gignac (1) et L. Bernier (2)

La coloration de l'aubier entraîne le déclassement du bois et une réduction de sa valeur pour l'utilisateur final. Plusieurs groupes de champignons sont mis en cause. Les espèces incriminées et l'ampleur du problème varient en fonction de la saison, des caractéristiques environnementales locales, des essences considérées et des conditions dans lesquelles le bois est conservé après avoir été récolté. Il est important de bien comprendre les facteurs influant sur l'activité des champignons responsables de la coloration de l'aubier pour élaborer un système de gestion intégrée ou une méthode de lutte de la coloration la moins dommageable pour l'environnement.

L'objet de la présente étude est d'identifier les diverses espèces de champignons qui provoquent la coloration de l'aubier dans les grumes et le bois de plusieurs espèces de résineux d'intérêt commercial au Canada, soit le pin gris, le pin tordu latifolié, l'épinette noire, l'épinette blanche et le sapin baumier. Pour ce faire, un échantillonnage a été réalisé dans des scieries choisies en divers endroits du pays au cours de l'été 1997. Des pièces de bois et des grumes fraîchement sciées ont été entreposées en empilage plein et laissées sur place durant un mois. Les champignons ont été isolés des pièces de bois présentant tous les signes de la coloration. Les résultats ont clairement démontré que des champignons ophiostomatoïdes, en particulier des genres *Ophiostoma* et *Ceratocystis*, étaient les espèces les plus fréquemment associées à la coloration. Parmi ce groupe de champignons, l'*O. piceae* était plus fréquemment associé à l'épinette et au sapin, tandis que les *O. piliferum* et *O. minus* étaient plus souvent rencontrés chez le pin. Plusieurs autres champignons ophiostomatoïdes, ainsi que la levure noire *Aureobasidium pullulans* et des moisissures dématioacées comme les *Cladosporium cladosporioides* et *Alternaria alternata*, ont également été isolés à partir de grumes et de bois présentant une coloration. Des études ont été entreprises sur la diversité génétique du *O. piceae* et des espèces apparentées.

A Spatial Analysis of the ESBW Historical Data of Quebec

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An analysis of the temporal patterns of spruce budworm defoliation in Quebec during the last major budworm outbreak (1965-1996) was conducted. The analysis indicated that 80% of the provincial variation in temporal patterns could be represented by 25 defoliation patterns after the spatial trend in year of onset of outbreak had been removed. These representative patterns can be used in decision support systems to improve simulations of probable defoliation patterns in future outbreaks. Further analyses are under way to investigate the association between defoliation pattern characteristics and spatial variables.

Analyse spatiale des données historiques sur la défoliation causée par la TBE au Québec

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Une analyse spatiale des fluctuations temporelles de la défoliation causée par la TBE au Québec lors de la dernière infestation majeure (1995-1996) a été réalisée. Cette analyse a révélé que 80 % de la variation provinciale liée aux fluctuations temporelles pouvaient être représentés par 25 niveaux de défoliation après élimination de la tendance spatiale au cours de l'année du déclenchement de l'infestation. Il est possible d'intégrer ces tendances représentatives dans des systèmes d'aide à la décision afin d'améliorer la précision des simulations des fluctuations probables de défoliation au cours des infestations futures. D'autres analyses visant à déterminer le lien qui existe entre les caractéristiques des fluctuations de défoliation et des variables physiques est en cours.

Validation of Cooke's *B.t.* Efficacy Model: 1996-1997

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Experimental aerial spray applications of *Bacillus thuringiensis (B.t.)* against spruce budworm (*Choristoneura fumiferana* [Clem.]) carried out by the province of Quebec in 1996 and 1997 were used to validate predictions by Cooke's *B.t.* efficacy model. The model simulates the interactions between *B.t.* and the budworm at the behavioral and physiological level, taking into consideration growth of insects as well as foliage, feeding (and defoliation), ingestion of *B.t.* droplets, intoxication, feeding inhibition, and death from *B.t.* or other causes. The model inputs daily minimum and maximum air temperatures and outputs population density, age structure and % defoliation. In this presentation, results of 1996 and 1997 experimental spray applications by SOPFIM were compared with model output, and application of the model in the decision-support context was discussed. The accuracy of predictions (development, population and defoliation levels) was so high in these validation trials that there remains little doubt about the usefulness of Cooke's model as a decision-support tool. Since initial population density is known, and deposit can be predicted or measured, spruce budworm mortality and foliage protection can be predicted with a high degree of confidence. The model has been incorporated in the BioSIM simulation control environment and is thus relatively simple to use under operational conditions. Several areas in need of additional research have been identified: 1) third-instar spruce budworm exposure to spray deposits on various host plant types; 2) biochemical deposit assessment to replace droplet counting on foliage; 3) model validation terms of the relationship between droplet density and efficacy; 4) relative efficacy of first versus second application; and 5) delayed mortality at pupation in larvae that recover from a sublethal dose.

Validation du modèle de l'efficacité du B.t. de Cooke en 1996-1997

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Les auteurs ont utilisé les pulvérisations aériennes expérimentales de *Bacillus thuringiensis* (B.t.) dirigées contre la tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana* [Clem.]) par la SOPFIM, en 1996 et en 1997, pour valider le modèle d'efficacité du B.t. de Cooke. Ce modèle simule les interactions d'ordre comportemental et physiologique entre le B.t. et la tordeuse et tient compte des paramètres suivants : croissance des insectes et du feuillage, alimentation (et défoliation), ingestion des gouttelettes de B.t., intoxication, inhibition de comportement alimentaire, et mortalité causée par le B.t. ou d'autres facteurs. Les valeurs de température de l'air minimale et maximale quotidiennes sont entrées dans le modèle, et celui-ci calcule les densités de population, la structure par âge et le taux de défoliation. Dans le cadre de la présente communication, les résultats des pulvérisations expérimentales de 1996 et de 1997 effectuées par la SOPFIM sont comparés aux résultats fournis par le modèle, et l'utilité du modèle dans une perspective d'aide à la décision est examinée. La grande exactitude des prédictions (développement, population et taux de défoliation) observée dans le cadre de ces essais de validation ne laisse plus planer aucun doute concernant l'utilité du modèle de Cooke comme outil d'aide à la décision. Comme la densité de la population initiale est connue et que la quantité de B.t. déposée peut être mesurée ou prédite, il est possible de prédire avec un haut niveau de certitude les taux de mortalité de la tordeuse et le degré de protection du feuillage obtenu. Ce modèle a été intégré dans le système de simulation de contrôle environnemental BioSIM et est donc relativement facile à utiliser en contexte opérationnel. Les aspects suivants nécessitent toutefois des recherches additionnelles : 1) degré d'exposition des chenilles du troisième stade de la TBE aux dépôts sur le feuillage de diverses plantes-hôtes; 2) évaluation biochimique des dépôts en vue remplacer le dénombrement des gouttelettes sur le feuillage; 3) validation du modèle fondée sur la relation entre la densité des gouttelettes et l'efficacité; 4) comparaison de l'efficacité relative de la première application à celle de la deuxième; 5) mortalité différée au moment de la nymphose chez les chenilles ayant survécu à une dose sublétale.

USDA Forest Service
Forest Health Technology Enterprise Team

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The USDA Forest Service provides technology development and transfer support for forest health programs throughout the United States through the Forest Health Technology Enterprise Team. The mission of the team is to foster the development and use of technologies to protect and improve the health of America's forests. The Enterprise Team delivers forest health technology services to field units and state and private partners in support of the Forest Service' land ethic: "promote the sustainability of ecosystems by ensuring their health, diversity and productivity."

General work areas pursued by the team include:

. **Information Services:** Management and distribution of information about the team and current forest health conditions and trends, through databases, publications, newsletters and internet sites

. **Technical Support Services:** Model runs, airborne video, photo missions, data visualization, photo-interpretation

. **Training and Education:** Certification and continuing education, national training, skill refresher courses, manuals

. **Technology Development:** Forest Health Protection's Special Technology Development Program (STDP), National Agricultural Pesticide Impact Assessment Program (NAPIAP), insect and pathogen models, decision-support systems, pesticide application

. **Methods Improvement:** Biological control, biopesticides, non-target impact studies, environmental fate studies

The Forest Health Technology Enterprise Team conducts its projects from two sites: Fort Collins, Colorado, and Morgantown, West Virginia. The Directors of these units comprise the Leadership Team for the Enterprise Team. Strategic direction and liaison with other organizations in the United States is provided by a Steering Committee consisting of representatives from the Forest Service, Animal and Plant Health Inspection Service, Environmental Protection Agency, National Association of State Foresters, National Plant Board, Agricultural Research Service and academic institutions.

Information management and **technology transfer** are functions common to all projects conducted by the Enterprise Team. Each site provides a unique set of program areas:

FHTET- Fort Collins

. Decision Support Systems
. Insect and Pathogen Impact Models
. Data Analysis and Management
. Data Visualization
. Values: Assessment of Commodity and Non-commodity Values of Forest Health

FHTET- Morgantown

. Biological Control
. Biopesticides
. Non-target Methods
. Pesticide Management
. Pesticide Equipment and Application Technologies

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POSTER SESSION/PRÉSENTATIONS

PAR AFFICHES

The Effect of Two Bacteria on Armillaria Root Disease of Greenhouse-grown White Spruce Trees

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and

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White spruce trees whose roots had been dipped with Agrium Inc. Biological's bacterial isolates Ral-3 and 63-28 or with tap water before planting in pots were inoculated with an isolate of *Armillaria ostoyae*, causal agent of Armillaria root disease. Ten months after planting, the trees were examined for symptoms and signs of Armillaria root disease. Trees dipped in Ral-3 and 63-28 had significantly less Armillaria root disease than the trees dipped in tap water. The Ral-3 treatment reduced the incidence of disease by 21.5% and the 63-28 treatment reduced it by 18.6%. There was a trend for the trees treated with Ral-3 to be larger than the check trees or those treated with 63-28.

Effet de deux bactéries sur l'incidence du pourridié-agaric chez des épinettes blanches cultivées en serre

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Un isolat de l'*Armillaria ostoyae*, agent causal du pourridié-agaric, a été inoculé à des épinettes blanches plantées dans des pots après que leurs racines aient été exposées par trempage à une solution d'isolats bactériens (Ral-3, 63-28) mis au point par la société Agrium Inc. Bacteriological ou à l'eau du robinet. Dix mois après la plantation, les chercheurs ont examiné chaque épinette afin de détecter la présence éventuelle des signes et des symptômes du pourridié-agaric. L'incidence de la maladie était significativement plus faible chez les épinettes dont les racines avaient été exposées aux isolats Ral-3 et 63-28 que chez les épinettes témoins. Les réductions observées s'élevaient à 21,5 % dans le cas du Ral-3, et à 18,6 % dans le cas du 63-28. Les épinettes traitées au Ral-3 semblaient en général plus grandes que les épinettes témoins ou celles traitées au 63-28.

Preliminary Results from Studies of the Ecology and Impact of the Balsam Fir Sawfly in Newfoundland

R. West *(1)*, **D. Ostaff** *(2)*, **J. Piene** *(2)*, **C. Lucarotti** *(2)*, **G. Butt** *(1)*, **D. Quiring** *(3)*, **E. Eveleigh** *(2)*, **and G. Thurston** *(2)*

The balsam fir sawfly, which has severely infested tens of thousands of hectares of precommercially thinned balsam fir stands in western Newfoundland, is threatening future wood supplies in the province. A study was initiated in 1997 to investigate changes in insect abundance and defoliation in thinned and unthinned stands. Factors under examination include the influence of outbreak history on tree-growth patterns, parasitoids and a nuclear polyhedrosis virus.

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Résultats préliminaires des études sur l'écologie et les impacts du diprion du sapin à Terre-Neuve

R. West [1], D. Ostaff [2], J. Piene [2], C. Lucarotti [2], G. Butt [1], D. Quiring [3], E. Eveleigh [2] et G. Thurston [2]

Le diprion du sapin, à l'origine d'infestations graves sur des dizaines de milliers d'hectares de peuplements de sapin baumier ayant fait l'objet d'une éclaircie précommerciale dans l'ouest de Terre-Neuve, menace l'avenir de l'industrie du bois dans la province. Une étude visant à mieux comprendre les fluctuations d'abondance du ravageur et l'évolution des défoliations dans les peuplements faisant l'objet d'éclaircies ou non a été entreprise en 1997. Au nombre des facteurs étudiés figurent l'incidence des infestations antérieures sur la croissance des arbres et les effets des parasitoïdes et d'un virus de la polyédrose nucléaire.

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(2) Service canadien des forêts, Fredericton (Nouveau-Brunswick).

(3) Université du Nouveau-Brunswick, Fredericton (Nouveau-Brunswick).

Evaluation of *Fusarium avenaceum* as a Biological Control Agent for Invasive *Rubus* Species

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A research project has been established to identify indigenous facultative biotrophic and necrotrophic fungi and to evaluate their potential as biocontrol agents for invasive *Rubus* spp., including *R. strigosus*, *R. parviflorus* and *R. spectabilis*, on reforestation sites. To date, a candidate fungus, *Fusarium avenaceum*, has been found to cause moderate-to-severe leaf area necrosis to *Rubus* plants after a foliar inundative application. Inoculum production methods, amendment of inocula with adjuvants and co-application with low doses of glyphosate have also been investigated in an effort to increase pathogenicity. Foliar infection was increased slightly when *F. avenaceum* was grown on a rice-grain substrate, combined with an organosilicone surfactant (0.4% Silwet L-77) and applied to *R. strigosus* and *R. parviflorus* plants under shadehouse conditions. Extraction and analysis of infested rice filtrates for metabolite production indicated the presence of a single phytotoxin, moniliformin, at levels of 3300 ppm. Further research is focused on improvement of the formulation delivery technology under field conditions and phytotoxin analysis. The potential for further development of *F. avenaceum* as a microbial control agent of weedy *Rubus* spp. will be discussed.

Évaluation de l'efficacité du *Fusarium avenaceum* comme agent de lutte biologique contre des espèces de *Rubus* envahissantes

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Cette recherche avait pour objet d'identifier les espèces indigènes de champignons biotrophes et nécrotrophes facultatifs et d'évaluer leur potentiel comme agents de lutte biologique contre un certain nombre d'espèces envahissantes de *Rubus*, notamment les *R. strigosus, R. parviflorus* et *R. spectabilis*, dans les zones de reboisement. Jusqu'à maintenant, une espèce, le *Fusarium avenaceum*, a causé une nécrose foliaire modérée à grave lorsqu'appliquée de façon massive sur le feuillage des plants de *Rubus*. Divers facteurs susceptibles d'accroître le pouvoir pathogène du champignon (amélioration des méthodes de production des inoculums, ajout d'adjuvants aux inoculums et application conjointe de faibles doses de glyphosate) ont également été examinés. Une faible augmentation du taux d'infection foliaire a été observée chez le *R. strigosus* et le *R. parviflorus* lorsque le champignon était cultivé sur un milieu à base de riz et de céréales et appliqué conjointement avec un surfactant organosilicié (Silwet L-77 à 0,4 %) sur des plants exposés à des conditions ombragées. L'extraction et l'analyse des filtrats de riz infestés aux fins de la détection de production de métabolites ont révélé la présence d'une phytotoxine, la moniliformine, à des concentrations de 3 300 ppm. Les chercheurs tentent actuellement d'améliorer les méthodes d'application de la formulation sur le terrain et les techniques d'analyse de la phytotoxine. Le potentiel du *F. avenaceum* comme agent de lutte microbien contre les espèces envahissantes de *Rubus* spp. sera examiné.

Development of *Chondrostereum purpureum* as a Biological Control Agent for Red Alder in Utility Rights-of-way

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and

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A study has been established to evaluate the efficacy of the biocontrol agent *Chondrostereum purpureum* for control of red alder *(Alnus rubra)* in utility rights-of-way near Duncan, British Columbia. A randomized complete block design experiment was used with 5 blocks, in each of which 6 treatments were carried out and 20 observations of red alder trees were made per treatment. The trees were cut at a height of 15-20 cm from the ground and one of the following treatments was applied to each: 1) formulated *C. purpureum* (PFC 2139); 2) formulated *C. purpureum* (PFC 2090); 3) glyphosate (12%); 4) carbopaste; 5) formulated control; and 6) slash brushing control. Ten months after treatment, meansurements of live resprouts, maximum resprout height and dieback of the treated red alder were recorded and subjected to analysis of variance. The mean resprout growth with both biological and chemical formulations was significantly different from that with slash control, but not with formulation control. For maximum shoot height, there were significant differences between slash control and each of the chemical and biological formulations. As well, the carbopaste and *C. purpureum* (PFC 2090) treatments had different effects than the formulation control. The chemical treatments differed significantly from the formulation control in their effect on dieback. These results indicate that treatment of red alder with *C. purpureum* was as effective as treatment with chemical herbicides. A research agreement has been signed between the Canadian Forest Service and MycoLogic Inc. of Victoria to accelerate the registration of *C. purpureum* as a biological control agent for hardwood weeds in rights-of-way and on conifer reforestation sites.

Évaluation de l'efficacité du *Chondrostereum purpureum* comme agent de lutte biologique contre l'aulne rouge dans les emprises de services publics

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L'efficacité du champignon phytopathogène *Chondrostereum purpureum* comme agent de lutte biologique contre l'aulne rouge a été évaluée dans des emprises de services publics situées dans la région de Duncan, en Colombie-Britannique. Aux fins de l'évaluation, un protocole en blocs aléatoires complets a été utilisé dans cinq parcelles. Six traitements ont été effectués dans chacune de ces parcelles, dans chaque cas sur 20 aulnes rouges coupés à 15 à 20 cm du sol. Cinq de ces six traitements reposaient sur l'application sur la souche de chaque aulne de l'un ou l'autre des produits suivants : 1) une formulation d'une préparation mycélienne du *C. purpureum* (PFC 2139); 2) une formulation d'une préparation mycélienne du *C. purpureum* (PFC 2090); 3) une formulation à 12 % de l'herbicide glyphosate (12 %); 4) une formulation de glyphosate en pâte, le Carbopaste^{MC}; 5) une formulation témoin. Le sixième traitement consistait à éliminer les rejets de souche uniquement par débroussaillage. Dix mois après le traitement, le nombre moyen de rejets par souche, la hauteur maximale des pousses vivantes et le taux de dépérissement parmi les aulnes rouges traités ont été déterminés. Les résultats ont ensuite fait l'objet d'une analyse de variance. En ce qui a trait aux effets sur le nombre moyen de rejets par souche, des différences significatives ont été observées entre les formulations biologiques et chimiques, d'une part, et le traitement par débroussaillage; en revanche, aucune différence n'a été notée entre ces formulations et la formulation témoin. Dans le cas de la hauteur maximale atteinte par les pousses vivantes, des différences significatives ont été relevées entre le débroussaillage et chacune des formulations chimiques et biologiques. Des différences significatives ont également été observées entre le Carbopaste^{MC} et les formulations de *C. purpureum*, d'une part, et la formulation témoin, d'autre part. En ce qui a trait aux effets sur le dépérissement, des différences significatives ont également été notées entre les formulations chimiques et la formulation témoin. Ces résultats indiquent que le *C. purpureum* était aussi efficace contre l'aulne rouge que les herbicides chimiques. Un accord de recherche a été conclu entre le Service canadien des forêts et MycoLogic Inc., de Victoria, en vue d'accélérer l'homologation du *C. purpureum* comme agent de lutte biologique et de favoriser ainsi son utilisation contre les plantes nuisibles ligneuses dans les emprises et dans les sites de reboisement de résineux.

Effect of Scarification on the Infection Level of Jack Pine and Black Spruce by *Armillaria ostoyae*

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The levels of infection by *Armillaria ostoyae* (Romagn.) Herink of aerially seeded jack pine *(Pinus banksiana* Lamb.) and black spruce *(Picea mariana* [Mill.] B.S.P.) established after treatments with various scarification methods were measured. The lowest infection level was found on sites scarified with a modified C&H plough. This site-preparation method produced furrows 2-2.5 m wide that often exposed the mineral layer and uprooted stumps when these were encountered. There was less disruption of surface and residual root structure on sites scarified by the TTS disc trencher, the CFS row scarifier and barrels at 1.8-m and 3-m spacings. Sites prepared by these methods had higher, but not significantly higher, infection levels than those treated with the C&H plough.

Effets de la scarification sur les taux d'infection à *Armillaria ostoyae* chez le pin gris et l'épinette noire

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Les chercheurs ont déterminé l'incidence de l'infection à *Armillaria ostoyae* (Romagn.) Herink parmi des pins gris (*Pinus banksiana* Lamb.) et des épinettes noires (*Picea mariana* [Mill.] B.S.P.) semées par voie aérienne après un traitement du sol à l'aide de diverses méthodes de scarification. Les plus faibles taux ont été observés dans les parcelles scarifiées à l'aide d'une charrue C&H. Cette méthode de préparation du sol a produit des raies de 2 à 2,5 m de largeur et a souvent entraîné l'exposition de la couche minérale et des souches déracinées. La trancheuse à disques TTS et le scarificateur et barils du SCF ont creusé des raies de 1,8 m et de 3 m, mais ils ont moins perturbé la surface et la structure racinaire résiduelle. Les taux d'infection observés étaient légèrement plus élevés dans les parcelles préparées à l'aide de ces méthodes que dans les parcelles traitées à l'aide de la charrue C&H, mais les différences relevées n'étaient pas significatives.

Exotic Insect Interceptions from Wooden Dunnage and Packing Material

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A survey was conducted at major Canadian ports of entry in 1997 by CFIA and CFS staff. Numerous quarantine and potential quarantine pests have been intercepted in wooden articles and wood packing/crating materials from Asia, Europe and South America. Interceptions have been made from the following commodities: wooden wire and cable spools from China, wooden crating with granite blocks from India and China, wooden boxes with metal valves from Italy, and wooden pallets with ceramic tiles from Brazil. Non-traditional pathways for the movement of live wood-boring insects have been identified. Canadian Plant Protection officials are working with their counterparts from the United States and Mexico to harmonize regulations in an attempt to prevent the introduction of quarantine pests from wooden articles and packing material into North America.

Interceptions d'insectes exotiques dans le bois d'emballage et de fardage

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Dans le cadre d'un relevé réalisé en 1997 par l'ACIA et le SCF dans les principaux points d'entrée au Canada, de nombreux ravageurs justiciables de quarantaine ou susceptibles de l'être ont été interceptés dans des produits en bois et dans le bois d'emballage et de fardage en provenance de l'Asie, de l'Europe et de l'Amérique du Sud. Ces ravageurs ont été découverts dans les produits suivants : bobines en bois utilisées pour l'expédition de fils et de câbles (Chine), bois de caisse entourant des blocs de granit (Inde et Chine), boîtes en bois contenant des soupapes en métal (Italie) et palettes en bois supportant des tuiles en céramique (Brésil). Des voies d'introduction inhabituelles favorisant la propagation d'insectes perceurs du bois vivants ont été découvertes. Des fonctionnaires de la Division de la protection des végétaux s'emploient actuellement, en collaboration avec leurs homologues des États-Unis et du Mexique, à harmoniser la réglementation en vue de prévenir l'introduction en Amérique du Nord de ravageurs justiciables de quarantaine dans des produits en bois et le bois d'emballage.

The Canadian Food Inspection Agency Plant Health Early Warning System

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Purpose: The Plant Health Early Warning System (PHEWS) is a mechanism for ensuring that the Plant Protection Division (PPD) of the Canadian Food Inspection Agency (CFIA) is alerted to new plant pest situations of potential significance to Canada in the areas of forestry and agriculture. These might include outbreaks of pests in new geographic regions or on new hosts, detections of quarantine-significant pests in other countries and emergence of new pest or disease situations of potential quarantine importance to Canada.

Gathering the Information: Information is gathered from a variety of sources, including published journals, abstracting services, databases, list-servers, Internet and meetings. Special attention is paid to those sources that provide information on pests of plants and plant products of importance to Canada. After a trial period, the intent is to expand the system to include other agencies within Canada. With cooperation, this system could be developed into a NAPPO and, eventually, a global Plant Health initiative.

Screening the Information: The information is screened within the CFIA, Plant Health Risk Assessment Unit. The following types of information are reported:

. new pest situations that may have potential for concern in Canada
. new host records for regulated and potential quarantine pests
. new distribution records for regulated and potential quarantine pests
. new pathways and significant pest interceptions in other countries
. new treatment and/or mitigation measures for regulated and potential quarantine pests
. new diagnostic methods for regulated and potential quarantine pests.

Managing the Information: Each PHEWS item is submitted to PPD in a standardized format that includes a definition of the issue, the source of the information and a brief synopsis of the potential hazard (pest distribution, impact and control). PPD personnel are then responsible for the development of appropriate next steps. Some options that may be appropriate are as follows:

. request a pest risk assessment
. revise an existing policy (d-memo)
. issue a pest alert
. advise district or regional offices
. request on-site inspections
. contact a foreign country for additional information
. initiate increased surveillance, e.g., increased import inspections.

Système d'alerte phytosanitaire rapide (*Plant Health Early Warning System*) de l'Agence canadienne d'inspection des aliments

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Objet : Le système d'alerte phytosanitaire rapide est un mécanisme qui permet à la Division de protection des végétaux (DPV) de l'Agence canadienne d'inspection des aliments d'être rapidement informée de tout nouveau problème causé par un ravageur susceptible d'avoir des conséquences néfastes pour l'agriculture et la foresterie canadiennes (p. ex., pullulation d'un ravageur dans une nouvelle région, infestation de nouveaux hôtes, détection de ravageurs justiciables de quarantaine dans d'autres pays, apparition d'un nouveau ravageur ou d'une nouvelle maladie justiciable de quarantaine au Canada).

Sources de renseignements : Les renseignements sont recueillis à partir de sources diverses (p. ex., articles publiés dans des revues scientifiques, services de résumés analytiques, bases de données, serveurs de listes, internet, comptes rendus de réunions). Une attention spéciale est accordée aux sources qui fournissent des renseignements sur les ravageurs des plantes et des produits végétaux justiciables de quarantaine au Canada. Après une période d'essai, le système sera étendu à d'autres agences canadiennes. Avec la collaboration de tous les intéressés, le système pourrait atteindre l'envergure de l'Organisation nord-américaine pour la protection des plantes et, éventuellement, s'étendre au monde entier.

Sélection des renseignements : La sélection des renseignements est effectuée à l'Unité d'évaluation des risques phytosanitaires de l'ACIA. Les types de renseignements suivants sont retenus :

- apparition au Canada d'un nouveau ravageur susceptible d'y causer des dommages importants;
- mention d'un nouvel hôte pour un ravageur réglementé justiciable de quarantaine;
- mention d'un ravageur réglementé justiciable de quarantaine dans une nouvelle région;
- nouvelles voies d'introduction ou interceptions de ravageurs importants dans d'autres pays;
- nouveau traitement ou nouvelles mesures d'atténuation des dommages s'appliquant à un ravageur réglementé justiciable de quarantaine;
- nouvelles méthodes diagnostiques s'appliquant à un ravageur réglementé justiciable de quarantaine.

Gestion des renseignements : Chaque élément destiné au système est soumis à la DPV sous un format normalisé incluant une définition de la situation, la source de l'information et un bref aperçu du risque potentiel (répartition d'un ravageur, répercussions et mesures de lutte). Le

personnel de la DPV se charge ensuite de recommander les mesures qui s'imposent. Les principales options susceptibles d'être recommandées englobent les mesures suivantes :

- demander une évaluation du risque posé un ravageur;
- revoir une politique en vigueur;
- émettre un avertissement phytosanitaire;
- aviser les responsables de district ou les bureaux régionaux;
- exiger des inspections sur place;
- communiquer avec les autorités du pays étranger concerné afin d'obtenir des renseignements additionnels;
- intensifier la surveillance (accroître le nombre d'inspections des installations d'importation).

The Occurrence of Genetic Markers in the Canadian Gypsy Moth *(Lymantria dispar)* Population

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To distinguish among varieties of gypsy moth, two genetic markers are currently used: a) **mitochondrial,** based on the amplification of a segment of mitochondrial DNA followed by restriction digests (*Nla*III and *Bam*HI (Bogdanowicz et al. 1993) and b) **FS1**, based on the amplification of a segment of the genomic DNA (Garner and Slavicek 1996).

In 1993, 618 specimens were heterozygous (N + A) for both the Asian and the North American bands while 560 were homozygous (N) for the North American band (P. Covello, Agriculture Canada). In 1994, we analyzed 198 specimens using the mitochondrial test and found that 6 were N+/B- (seen mostly in Europe and part of Asia) while 192 were N-/B- (seen mostly in North America and sometimes in Europe). This suggests that the genetic background of North American gypsy moth is not homogenous.

In 1995, we initiated a survey within the area of Canada generally infested with gypsy moth to a) determine the occurrence and distribution of the FS1 and mitochondrial markers in the Canadian gypsy moth population, b) determine if the genetic makeup is different around ports and military bases (where the risk of introducing exotic gypsy moths is high) than in other areas (where there is a low risk of introduction), and c) establish a reference collection to evaluate the diagnostic potential of new markers. Traps were placed on 18 chosen sites with a grid of 40 x 30 km. The distance between traps was 5 km for a total of 63 traps per site. More than 14,000 specimens were collected from the traps. A subset of ~ 2,100 insects (equivalent to 15%) was dissected and DNA was extracted. The DNA extracts were then analyzed using both the mitochondrial and the FS1 genomic markers.

Results showed no significant differences between low and high probability sites within the same province or area. The differences were more pronounced between different parts of the infested area. Ontario had a mitochondrial N+/B- average of 3.62% and FS1 heterozygous (N+A) average of 6.59%, while eastern Canada (Nova Scotia, New Brunswick and Quebec) had a mitochondrial N+/B- average of 0.200% and FS1 heterozygous (N+A) average of 1.67%. The FS1 and mitochondrial markers were able to detect most cases of introduction of exotic gypsy moths. However, more markers are needed to distinguish the North American subpopulation that displays either heterozygous FS1 (N+A) or N+/B- markers from exotic moths with similar genetic typing.

- Bogdanowicz, S., Wallner, W. E., Bell, J., Odell, T.M. and Harrison, R.G. Asian gypsy moths (Lepidoptera: Lymantriidae) in North America: evidence from molecular data. Annals of the Entomological Society of America (1993) 86: 710-715.

- Garner, K.J. and Slavicek, J.M. Identification and characterization of a RAPD-PCR marker for distinguishing Asian and North American gypsy moths. Insect Molecular Biology (1996) 5(2): 81-91.

Présence de marqueurs génétiques parmi la population canadienne de spongieuse (*Lymantria dispar*)

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Pour distinguer les diverses variétés de spongieuse, les chercheurs utilisent actuellement les deux marqueurs génétiques suivants : 1) **un marqueur mitochondrial** : analyse reposant sur l'amplification d'un segment de l'ADN mitochondrial suivie d'une digestion par une enzyme de restriction (*Nla*III et *Bam*HI)(Bogdanowicz *et al.*, 1993); 2) **FS1** : analyse reposant sur l'amplification d'un segment de l'ADN génomique (Garner et Slavicek, 1996).

En 1993, une analyse du marqueur génomique FS1 de 618 spongieuses capturées dans divers ports de l'est du Canada a révélé que 58 de ces spécimens étaient hétérozygotes (N+A) et présentaient les bandes caractéristiques des races asiatique et nord-américaine, tandis que les 560 autres étaient homozygotes (N) et présentaient la bande typique de la race nord-américaine (P. Covello, Agriculture Canada). En 1994, nous avons analysé 198 spécimens à l'aide du marqueur mitochondrial. Six de ces spécimens se sont révélés N+/B- (caractéristique observée principalement en Enrope et dans une partie de l'Asie), tandis que les 192 autres étaient N-/B- (caractéristique observée surtout en Amérique du Nord et parfois en Europe). Ces résultats donnent à croire que le bagage génétique de la race nord-américaine de la spongieuse n'est pas homogène.

En 1995, nous avons entrepris un relevé à l'intérieur de la zone généralement infestée par la spongieuse afin : a) de déterminer la présence et la répartition du marqueur génomique FS1 et du marqueur mitochondrial parmi la population canadienne de spongieuse; b) de déterminer si la constitution génétique de la spongieuse, au voisinage des ports et des bases militaires (endroits où le risque d'introduction de races exotiques de spongieuse est particulièrement élevé), diffère de celle observée dans les autres régions (où le risque d'introduction de races exotiques est moindre); c) de constituer une collection de référence en vue d'évaluer le potentiel diagnostique de nouveaux marqueurs. Des pièges ont été déployés en 18 endroits choisis répartis selon une grille de 40 x 30 km. Les pièges ont été installés à intervalle de 5 km, à raison de 63 pièges par site. Plus de 14 000 spécimens ont été capturés. Un sous-échantillon d'environ 2 100 papillons (soit 15 % des effectifs capturés) ont été disséqués à des fins d'extraction de l'ADN. Les extraits

d'ADN ont alors été soumis à des analyses avec le marqueur mitochondrial et le marqueur génomique FS1.

Les résultats n'ont pas fait ressortir de différences significatives entre les sites à risque élevé et les sites à faible risque compris à l'intérieur d'une même province ou région donnée. Des différences plus marquées ont cependant été relevées entre les régions comprises dans la zone infestée. Ainsi, en Ontario, les pourcentages moyens de spécimens présentant le marqueur mitochondrial N+/B- et de spécimens FS1-hétérozygotes (N+A) s'élevaient à respectivement 3,62 % et 6,59 %, comparativement à respectivement 0,200 % et 1,67 % dans l'est du Canada (Nouvelle-Écosse, Nouveau-Brunswick et Québec). Les marqueurs FS1 et mitochondrial permettent de détecter la plupart des cas d'introduction de spongieuse exotique. Toutefois, d'autres marqueurs sont nécessaires pour distinguer les sous-populations nord-américaines présentant le marqueur FS1-hétérozygote (N+A) ou le marqueur mitochondrial (N+/B-) des sujets exotiques présentant un génotype semblable.

- Bogdanowicz, S., Wallner, W.E., Bell, J., Odell, T.M., and Harrison, R.G. Asian gypsy moths (Lepidoptera: Lymantriidae) in North America: evidence from molecular data. Annals of the Entomological Society (1993) 86: 710-715.

- Garner, K.J. and Slavicek, J.M. Identification and characterization of a RAPD-PCR marker for distinguishing Asian and North American gypsy moths. Insect Molecular biology (1996) 5(2): 81-91.

Exotic Wood-boring Beetles in British Columbia: Interceptions and Establishments

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and

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The low-grade wood and wood products used to support, brace or package commodities during shipment provide a pathway for the global movement of bark and wood-boring beetles. Immature stages of bark and wood-boring insects present within the wood used in such packaging can complete their development and emerge as adults after the commodity has arrived in Canada. Storage of commodities packaged or shipped with low-grade wood products near forested lands or the disposal of wood packaging in or near natural forest provides an avenue for the introduction and establishment of nonindigenous bark and wood-boring insects. Research results are presented which demonstrate that "exotics" are being introduced all the time and that these nonindigenous bark and wood-boring species continue to establish themselves and accumulate in the forests of Canada.

Interceptions et établissement en Colombie-Britannique d'espèces exotiques de coléoptères perceurs du bois

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Le bois et les produits du bois de qualité inférieure utilisés pour l'arrimage, le calage ou l'emballage des marchandises durant leur transport favorisent la dispersion de diverses espèces exotiques de scolytes et de coléoptères perceurs du bois à l'échelle mondiale. Les stades immatures des scolytes et des insectes perceurs du bois vivant dans ces matériels peuvent poursuivre leur développement et émerger sous forme d'adultes une fois parvenus au Canada. L'entreposage de produits emballés ou expédiés avec du bois de qualité inférieure à proximité de régions boisées ou le rejet du bois d'emballage à l'intérieur ou à proximité de forêts naturelles favorisent l'introduction et l'établissement au Canada de diverses espèces non indigènes de scolytes et d'insectes perceurs du bois. Les résultats démontrent que des espèces exotiques de scolytes et d'insectes perceurs du bois atteignent régulièrement le Canada et finissent par s'établir et se multiplier dans les forêts canadiennes.

FOREST PEST MANAGEMENT CAUCUS

ANNUAL MEETING

Forest Pest Management Caucus Annual Meeting
November 19, 1997 - 1:00 p.m. - Ottawa Conference Centre

Chair: Richard Westwood

1. Update of Wood Preservation Registration Status - PRMA

PMRA gave an update on the registration status. A stakeholder meeting will be held on December 5, 1997.

2. Update of Mimic and Release Registration Status - L. Lanteigne

L. Lanteigne, CFS, Atlantic Region, gave an update. Letter of support was requested from the FPMC for temporary registration of GOAL.

ACTION: Nursery Association to send the FPMC a letter requesting support for GOAL.

ACTION: C. Howard will send a letter of support for temporary registration to GOAL once the Nursery Association letter is received.

3. IPM Update - N. Carter

N. Carter updated the committee on the IPM working group. W. Sexsmith, E. Caldwell, R. Westwood and N. Carter had met several times with PMRA assistance to discuss the IPM workshop. PMRA has offered to support the workshop on the basis of past success with similar workshops with stakeholders. The focus of the workshop will be on the budworm. Representatives from provincial and federal governments, the forest industry, NGOs, private woodlots, the pesticide industry and researchers will be invited.

4. NAFTA Update - W. Sexsmith

W. Sexsmith gave a brief update on the NAFTA discussions. The minutes of the June meeting are available from the Secretariat - CIF/IFC. A technical working group has been formed and will meet once a year. The goal will be to achieve a level playing field in North America with respect to pesticide issues by a) harmonizing data requirements for pheromones and b) establishing a joint review program

5. Appointment of a Minor Use Coordinator - E. Caldwell

E. Caldwell noted that the forest sector requires a Minor Use coordinator. Volunteers were requested. Mike Irvine was suggested and Taylor Scarr will consult with him. At present there is little financial support for the coordinator.

6. Appointment of a Representative for the Federal/Provincial/Territorial Committee

At present there is no position available on the committee. However, the FPMC may make a presentation to the committee, and the Chair, Craig Howard, sits on the advisory board.

ACTION: C. Howard to contact W. Sexsmith w.r.t. advising if FPMC will make a presentation to the committee.