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Le Forum sur la répression des ravageurs forestiers est parrainé annuellement par le Service canadien des forêts de Ressources naturelles Canada. Il permet à des représentants de divers gouvernements provinciaux et du gouvernement fédéral de présenter et d'examiner la situation des principaux ravageurs forestiers au Canada et aux États-Unis.

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Program: FOREST PEST MANAGEMENT FORUM 2006

December 5 – 7, 2006
Ottawa Congress Centre, 55 Colonel By Drive, Ottawa, Ontario

TUESDAY, DECEMBER 5th, 2006

08:00	**Registration**	**Foyer**
08:30	**Welcoming Remarks**	**Capital Hall 2B-3B**

Session I: Western Pest Management Issues

Chair: *Sue Farlinger, Natural Resources Canada, Canadian Forest Service*

Western Canada Round-up

09:00 British Columbia Report
Tim Ebata, British Columbia Ministry of Forests and Range

09:20 Alberta Report
Hideji Ono, Alberta Sustainable Resource Development, Forestry Division

09:40 Saskatchewan Report
Rory McIntosh, Saskatchewan Environment, Forest Service Branch

10:00 **Break** **Foyer**

10:30 Manitoba Report **Capital Hall 2B-3B**
Irene Pines, Manitoba Conservation, Forestry Branch

BC's progress in dealing with the MPB disaster

10:50 Mitigating the Effects of the MPB Disaster
Tim Ebata, British Columbia Ministry of Forests and Range

11:20 A Risk Analysis of the Mountain Pine Beetle
Tim Ebata, British Columbia Ministry of Forests and Range

12:00 **Lunch** **Capital Hall 4B-5B**

Session II: Enhanced Pest Management Perspective **Capital Hall 2B-3B**

Chair: *Anthony Hopkin, Natural Resources Canada, Canadian Forest Service*

13:00 Monitoring Impacts of Pest Control Products on Key Microbial Communities of Forest Soils
Richard Winder, Natural Resources Canada, Canadian Forest Service

13:15 Development and Validation of SprayAdvisor - A Decision Support System for Aerial Pesticide Applications
Dean Thompson, Natural Resources Canada, Canadian Forest Service

13:30 Potential Environmental Effects of Imidacloprid as a Systemic Insecticide for Emerald Ash Borer and Asian Longhorned Beetle
Dave Kreutzweiser, Natural Resources Canada, Canadian Forest Service

13:45 Efficacy Trial of *Phlebiopsis gigantea* to Control Annosus Root Rot
Gaston Laflamme, Natural Resources Canada, Canadian Forest Service

Session III: Climate Change **Capital Hall 2B-3B**

Chair: *Nancy Kingsbury, Natural Resources Canada, Canadian Forest Service*

14:00 Climate Change, Natural Disturbance Regimes and the Future of Canada's Forests
Werner Kurz, Natural Resources Canada, Canadian Forest Service

14:30 A Risk Analysis of the Effects of Climate Change on Spruce Budworm Impacts
David Gray, Natural Resources Canada, Canadian Forest Service

15:00 **Break** **Foyer**

15:30 Likely Effects of Climate Change on Southern Pine Beetle Impacts in Eastern North America
Matt Ayres, Dartmouth College, Hanover, New Hampshire

16:00 Integrating Climate Change into Spread and Impact Models for the Mountain Pine Beetle
Terry Shore, Natural Resources Canada, Canadian Forest Service

Session IV: Sponsor's Showcase – 10 minute presentation, 5 minute questions

16:30 **Verdera**

17:00 Pest Forum Steering Committee meeting **Capital Hall 5B**

WEDNESDAY, DECEMBER 6th, 2006

08:00 **Registration** **Foyer**

Session V: Cross-Country Checkup – Ontario and Quebec

Chair: *Pardeep Ahluwalia, Natural Resources Canada, Canadian Forest Service*

Capital Hall 2B-3B

08:30 Ontario Report
Hugh Evans, Natural Resources Canada, Canadian Forest Service

08:50 Quebec Report
Louis Morneau, Ministère des Ressources naturelles et de la Faune du Québec

Session VI: Cross-Country Checkup – Atlantic Canada

Chair: *Pardeep Ahluwalia, Natural Resources Canada, Canadian Forest Service*

09:10 New Brunswick Report
Nelson Carter, New Brunswick Department of Natural Resources

09:30 Nova Scotia Report
Gina Penny, Nova Scotia Department of Natural Resources

10:00 **Break** **Foyer**

10:30 Newfoundland Report **Capital Hall 2B-3B**
Hubert Crummey, Newfoundland Department of Natural Resources

Session VII: Intensive Forest Management (IFM) and Forest Pests

Chair: *Jim Reaves, USDA Forest Service* **Capital Hall 2B-3B**

10:50 Effects of Intensive Management on Insect Pests of Fir and Spruce
Dan Quiring, University of New Brunswick

11:20 The Benefits of Having a Provincial Forest Pathology Program - BC's Perspective
Harry Kope, British Columbia Ministry of Forests and Range

12:00 **Lunch** **Capital Hall 4B-5B**

13:00 Important Diseases in Young Forest Stands in Eastern Canada
Gaston Laflamme, Natural Resources Canada, Canadian Forest Service

13:30 Impact of *Armillaria* Root Disease in Douglas-Fir in B.C.
Mike Cruickshank, Natural Resources Canada, Canadian Forest Service

Session VIII: Pesticide Regulations, Alternatives, Minor Use

Chair: *Michael Irvine, Ontario Ministry of Natural Resources*

14:00 Introduction
Michael Irvine, Ontario Ministry of Natural Resources

14:05 PMRA Update
Terry Caunter, Pest Management Regulatory Agency

Session IX: The Real Story of BioPesticide Regulations: No More Myths

Chair: *Michael Irvine, Ontario Ministry of Natural Resources*

14:20 Introduction
Terry Caunter, Pest Management Regulatory Agency

14:25 Legislative Overview and Importance of Presubmission Consultations
Brian Belliveau, Pest Management Regulatory Agency

14:40 Addressing Human Health and Environmental Data Requirements: Avoid the Pitfalls
Esther Seto, Pest Management Regulatory Agency

15:00 **Break** **Foyer**

Session X: The Real Story of BioPesticide Regulations: No More Myths (continued) **Capital Hall 2B-3B**

Chair: *Michael Irvine, Ontario Ministry of Natural Resources*

15:30 How to Build Data Waivers
Denis Rochon, Pest Management Regulatory Agency

15:50 Alternative Strategies: The A in Efficacy
Terry Caunter, Pest Management Regulatory Agency

16:00 Pest Management Regulatory Panel – There are no stupid questions, only stupid answers

General invitation out to all participants to submit questions to tcaunter@hc-sc.gc.ca prior to Forum

Session XI: Globalization: United States Report

Chair: *Guy Smith, Natural Resources Canada, Canadian Forest Service*

Salle de la Capitale 2B-3B

16:30 Overview of Forest Pests in the U.S.
Jim Reaves, USDA Forest Service

SCIENCE AND TECHNOLOGY À LA CARTE — Capital Hall 4B-5B

Chair: *John Pineau, Canadian Institute of Forestry*

A roving, learn-while-you-eat concept
Hosted by Canadian Institute of Forestry and Forest Pest Management Forum

17:00–21:30 Cash bar and roving buffet dinner; government, commercial and corporate exhibitors; science-knowledge exchange and informal poster session

Session XII: Sponsor's Showcase – 10 minute presentations, 5 minutes for questions

Chair: *Guy Smith, Natural Resources Canada, Canadian Forest Service*

17:30	BioForest Technologies Incorporated	**Capital Hall 2B-3B**
17:45	Forest Protection Limited	
18:15	**Buffet Dinner**	**Capital Hall 4B-5B**
19:30	BASF	**Capital Hall 2B-3B**
19:45	Sylvar Technologies Incorporated	

THURSDAY, DECEMBER 7th, 2006

08:00	**Registration**	**Foyer**
08:30	**Welcoming Remarks**	**Capital Hall 2B-3B**

Session XIII: Globalization: International Update

Capital Hall 2B-3B

Chair: *Marcel Dawson, Canadian Food Inspection Agency*

08:45 International Forest Quarantine Initiatives 2006
Eric Allen, Natural Resources Canada, Canadian Forest Service

Session XIV: CFIA Report

Chair: *Marcel Dawson, Canadian Food Inspection Agency*

08:55 ISPM15 Wood Packaging Standards
Mélanie Mectau, Canadian Food Inspection Agency

09:10 The Canadian Phytosanitary Certification Programs for Exported Wood Products
Jean-Luc Poupart, Canadian Food Inspection Agency

9:30 Update on Emerald Ash Borer, Brown Spruce Longhorn Beetle and Asian Longhorn Beetle
Janet MacDonald, Canadian Food Inspection Agency

10:00	**Break**	**Foyer**

Session XV: Globalization: Invasive Threats

Capital Hall 2B-3B

Chair: *Marcel Dawson, Canadian Food Inspection Agency*

10:20 *Ramorum* Blight Update
John McDonald, Canadian Food Inspection Agency

10:40 European Wood Wasp Update
Loretta Shields, Canadian Food Inspection Agency

12:00	**Lunch**	**Capital Hall 4B-5B**

Programme : Forum 2006 sur la répression des ravageurs forestiers

Du 5 au 7 décembre 2006
Centre des congrès d'Ottawa, 55, promenade Colonel By, Ottawa, Ontario

MARDI 5 DÉCEMBRE 2006

8 h	**Inscription**	**Foyer**
8 h 30	**Mot de bienvenue**	**Salle de la Capitale 2B-3B**

Séance I : La répression des ravageurs dans l'Ouest

Présidente : *Sue Farlinger, Ressources naturelles Canada, Service canadien des forêts*

Salle de la Capitale 2B-3B

Tour d'horizon de l'Ouest canadien

9 h — Rapport de la Colombie-Britannique
Tim Ebata, British Columbia Ministry of Forests and Range

9 h 20 — Rapport de l'Alberta
Hideji Ono, Alberta Sustainable Resource Development, Forestry Division

9 h 40 — Rapport de la Saskatchewan
Rory McIntosh, Saskatchewan Environment, Forest Service Branch

10 h — **Pause** — **Foyer**

10 h 30 — Rapport du Manitoba
Irene Pines, Conservation Manitoba, Direction des forêts

Progrès de la C.-B. dans sa lutte contre le fléau du dendroctone du pin ponderosa

10 h 50 — Atténuer les effets du fléau du DPP
Tim Ebata, British Columbia Ministry of Forests and Range

11 h 20 — Une analyse du risque lié au dendroctone du pin ponderosa
Tim Ebata, British Columbia Ministry of Forests and Range

12 h — **Déjeuner** — **Salle de la Capitale 4B-5B**

Séance II : Perspective de l'amélioration de la lutte contre les ravageurs

Président : *Anthony Hopkin, Ressources naturelles Canada, Service canadien des forêts* **Salle de la Capitale 4B-5B**

13 h — L'effet des produits de lutte contre les organismes nuisibles sur les principales colonies microbiennes du sol forestier
Richard Winder, Ressources naturelles Canada, Service canadien des forêts

13 h 15 — Élaboration et validation de SprayAdvisor, un système d'aide à la décision pour les applications aériennes de pesticides
Dean Thompson, Ressources naturelles Canada, Service canadien des forêts

13 h 30 — Effets environnementaux potentiels de l'imidaclopride utilisé comme insecticide systémique contre l'agrile du frêne et le longicorne étoilé
Dave Kreutzweiser, Ressources naturelles Canada, Service canadien des forêts

13 h 45 — Essai d'efficacité du *Phlebiopsis gigantea* contre la maladie du rond
Gaston Laflamme, Ressources naturelles Canada, Service canadien des forêts

Séance III : Changements climatiques **Salle de la Capitale 2B-3B**

Présidente : *Nancy Kingsbury, Ressources naturelles Canada, Service canadien des forêts*

14 h — Changements climatiques, regimes de perturbations naturelles et avenir des forêts canadiennes
Werner Kurz, Ressources naturelles Canada, Service canadien des forêts

14 h 30 — Analyse des risques liés aux effets des changements climatiques sur les impacts de la tordeuse des bourgeons de l'épinette
David Gray, Ressources naturelles Canada, Service canadien des forêts

15 h — **Pause** **Foyer**

15 h 30 — Effets probables des changements climatiques sur le dendroctone méridional du pin dans l'Est de l'Amérique du Nord
Matt Ayres, Dartmouth College, Hanover, New Hampshire

16 h — Intégration des changements climatiques aux modèles de propagation et les impacts pour le dendroctone du pin ponderosa
Terry Shore, Ressources naturelles Canada, Service canadien des forêts

Séance IV : Pleins feux sur les commanditaires – présentation de 10 minutes, période de questions de 5 minutes

16 h 30 — **Verdera**

17 h — Comité directeur du Forum sur les ravageurs **Salle de la Capitale 5B**

MERCREDI 6 DÉCEMBRE 2006

8 h **Inscription** **Foyer**

Séance V : Tour d'horizon – L'Ontario et le Québec

Président : *Pardeep Ahluwalia*, *Ressources naturelles Canada, Service canadien des forêts* **Salle de la Capitale 2B-3B**

8 h 30 Rapport de l'Ontario
Hugh Evans, Ressources naturelles Canada, Service canadien des forêts

8 h 50 Rapport du Québec
Louis Morneau, Ministère des Ressources naturelles et de la Faune du Québec

Séance VI : Tour d'horizon – Le Canada atlantique

Président : *Pardeep Ahluwalia*, *Ressources naturelles Canada, Service canadien des forêts* **Salle de la Capitale 2B-3B**

9 h 10 Rapport du Nouveau-Brunswick
Nelson Carter, Ministère des Ressources naturelles du Nouveau-Brunswick

9 h 30 Rapport de la Nouvelle-Écosse
Gina Penny, Nova Scotia Department of Natural Resources

10 h **Pause** **Foyer**

10 h 30 Rapport de Terre-Neuve **Salle de la Capitale 2B-3B**
Hubert Crummey, Newfoundland Department of Natural Resources

Séance VII : L'aménagement forestier intensif et les ravageurs forestiers

Président : *Jim Reaves, USDA Forest Service*

Salle de la Capitale 2B-3B

10 h 50 Effets de l'aménagement intensif sur les insectes ravageurs du sapin et de l'épinette
Dan Quiring, Université du Nouveau-Brunswick

11 h 20 Les avantages d'un programme provincial de pathologie forestière – le point de vue de la Colombie-Britannique
Harry Kope, British Columbia Ministry of Forests and Range

12 h **Déjeuner** **Salle de la Capitale 4B-5B**

13 h Maladies importantes dans de jeunes forêts de l'Est du Canada
Gaston Laflamme, Ressources naturelles Canada, Service canadien des forêts

13 h 30 Impact du pourridié-agaric sur le sapin Douglas en Colombie-Britannique
Mike Cruickshank, Ressources naturelles Canada, Service canadien des forêts

Séance VIII : Réglementation des pesticides, produits de remplacement, usages mineurs

Président : *Michael Irvine, Ministère des Richesses naturelles de l'Ontario*

14 h 00 Introduction
Michael Irvine, Ministère des Richesses naturelles de l'Ontario

14 h 05 Des nouvelles de l'ARLA
Terry Caunter, Agence de réglementation de la lutte antiparasitaire

Séance IX : L'heure juste sur la réglementation des biopesticides : la fin d'un mythe

Président : *Michael Irvine, Ministère des Richesses naturelles de l'Ontario*

14 h 20 Introduction
Terry Caunter, Agence de réglementation de la lutte antiparasitaire

14 h 25 Survol de la législation et importance des consultations préalables à la présentation d'une demande
Brian Belliveau, Agence de réglementation de la lutte antiparasitaire

14 h 40 Aborder les besoins en matière de données sur la santé humaine et l'environnement : les pièges à éviter
Esther Seto, Agence de réglementation de la lutte antiparasitaire

15 h **Pause** **Foyer**

Séance X : L'heure juste sur la réglementation des biopesticides : la fin d'un mythe (suite) **Salle de la Capitale 2B-3B**

Président : *Michael Irvine, Ministère des Richesses naturelles de l'Ontario*

15 h 30 Comment préparer des exemptions applicables à la présentation de données
Denis Rochon, Agence de réglementation de la lutte antiparasitaire

15 h 50 Les nouvelles stratégies : un haut degré d'efficacité
Terry Caunter, Agence de réglementation de la lutte antiparasitaire

16 h Groupe d'experts sur la réglementation de la lutte antiparasitaire – Les questions ne sont jamais stupides, seules les réponses peuvent l'être
Tous les participants sont invités à soumettre des questions avant la tenue du Forum à tcaunter@hc-sc.gc.ca

Séance XI : La mondialisation – Rapport des États-Unis

Président : *Guy Smith, Ressources naturelles Canada, Service canadien des forêts*
Salle de la Capitale 2B-3B

16 h 30 Survol des principaux ravageurs forestiers aux États-Unis
Jim Reaves, USDA Forest Service

SCIENCES ET TECHNOLOGIE À LA CARTE — Salle de la Capitale 4B-5B

Président : *John Pineau, Institut forestier du Canada*

Un concept qui vous permet de circuler et d'apprendre tout en mangeant.
Un événement parrainé par l'Institut forestier du Canada et le Forum sur la répression des ravageurs forestiers

17h–21h30 Bar payant et buffet à déguster tout en circulant à travers les exposants du gouvernement, du secteur commercial et de l'entreprise privée; échange de connaissances scientifiques et séance informelle de présentations d'affiches

Séance XII : Pleins feux sur les commanditaires – présentations de 10 minutes, période de questions de 5 minutes

Président : *Guy Smith, Ressources naturelles Canada, Service canadien des forêts*

17 h 30 BioForest Technologies Incorporated — **Salle de la Capitale 2B-3B**

17 h 45 Forest Protection Limited

18 h 15 **Buffet** — **Salle de la Capitale 4B-5B**

19 h 30 BASF — **Salle de la Capitale 2B-3B**

19 h 45 Sylvar Technologies Incorporated

JEUDI 7 DÉCEMBRE 2006

8 h **Inscription** **Foyer**

8 h 30 **Mot de bienvenue** **Salle de la Capitale 2B-3B**

Séance XIII : La mondialisation – Le point sur la situation internationale

Président : *Marcel Dawson, Agence canadienne d'inspection des aliments*

8 h 45 Initiatives internationales visant les ravageurs forestiers justiciables de quarantaine en 2006
Eric Allen, Ressources naturelles Canada, Service canadien des forêts

Séance XIV : Compte rendu de l'ACIA

Président : *Marcel Dawson, Agence canadienne d'inspection des aliments*

8 h 55 La NIMP n° 15, la norme sur les matériaux d'emballage en bois
Mélanie Mectau, Agence canadienne d'inspection des aliments

9 h 10 Les programmes canadiens de certification phytosanitaire des produits de bois destinés à l'exportation
Jean-Luc Poupart, Agence canadienne d'inspection des aliments

9 h 30 Le point sur la situation de l'agrile du frêne, du longicorne brun de l'épinette et du longicorne étoilé
Janet MacDonald, Agence canadienne d'inspection des aliments

10 h 00 **Pause** **Foyer**

Séance XV: La mondialisation – La menace des espèces envahissantes

Président : *Marcel Dawson, Agence canadienne d'inspection des aliments*
Salle de la Capitale 2B-3B

10 h 20 Le point sur la situation de l'encre des chênes rouges
John McDonald, Agence canadienne d'inspection des aliments

10 h 40 La guêpe perce-bois (*Sirex noctilio*) au Canada – État de la situation
Loretta Shields, Agence canadienne d'inspection des aliments

12 h **Déjeuner** **Salle de la Capitale 3B-4B**

Session I: Western Pest Management Issues

Session I / Séance I

Chair: Sue Farlinger

Natural Resources Canada, Canadian Forest Service

Séance I : La répression des ravageurs dans l'Ouest

Présidente : Sue Farlinger

Ressources naturelles Canada, Service canadien des forêts

British Columbia Report / Rapport de la Colombie-Britannique

Presented by / Présenté par :

Tim Ebata, *MSc, RPF*

Forest Practices Branch, British Columbia Ministry of Forests and Range, P.O. Box 9513, Stn Prov Govt, Victoria, BC V8W 9C2

The 2006 Provincial aerial overview survey was conducted from July to September, 2006. Weather conditions throughout most of the province were very good with the exception of cloudy conditions in the far northwest portion of the province and foggy conditions on the west coast of Vancouver Island. Overall, approximately 82% of the forested area of the province was surveyed (vs. 79% in 2005) (figure 1)

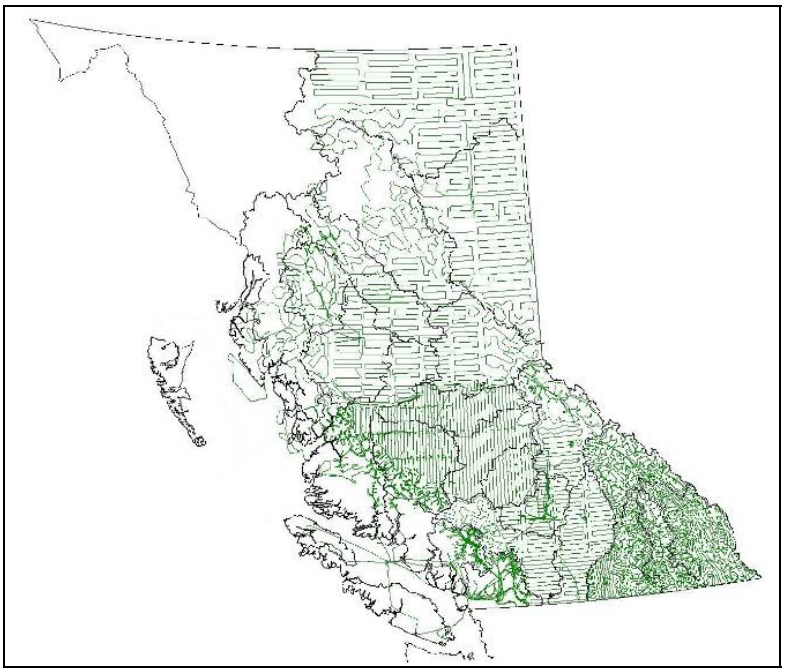

Figure 1. Area covered by the annual aerial overview survey in 2006.

Contractors conduct most of the surveys. Each contractor covers the area roughly equivalent to the old forest region boundaries prior to the MOFR's reorganization in 2002. Some minor contractor performance issues resulted in inconsistencies in mapping coverage between regions and resulted in visible differences in depiction of extensive mountain pine beetle polygons that

spanned across regional boundaries. Efforts are being made to ensure that these inconsistencies are eliminated in the upcoming survey season. The extensive polygons of mountain pine beetle damage complicate digitizing of the data. Intensive GIS manipulation is required to remove non-timber areas from these large polygons to provide more accurate estimates of damaged areas. This requirement for additional analysis delayed the delivery of the final map product somewhat. Ground truthing of accessible disturbances is included in the survey and is carried out whenever the causal agent for damage can not be described from the air. Ground calls are conducted by the aerial survey contractors and by the regional and district forest health specialists.

Defoliator damage of major defoliator species remained static or increased. Eastern spruce budworm remained at endemic levels as they did in 2005. Western hemlock looper also remained relatively unchanged at 6,964 ha. The greatest increases were seen in the area defoliated by the western spruce budworm (603,000 ha) and the two year cycle budworm (67,483 ha). Over 30,000 ha of interior Douglas-fir were treated using Foray 48B to protect high value advanced regeneration that is essential for uneven age management. This is the largest treatment program carried out in B.C. for this defoliator.

The pine needle disease, red band needle blight or Dothistroma, (figure 2) continues to be a serious foliar disease in northwest B.C. Mortality of plantations has resulted in replanting efforts but these have been hampered by hare feeding on newly planted seedlings. Hares feeding on flagged seedlings have produced some interesting looking feces (figure 3).

Figure 2. Severe Dothistroma damage in a lodgepole pine plantation in 2002, Kispiox Timber Supply Area, B.C.

Figure 3. Hare pellets following feeding on seedlings marked with flagging tape, Prince George, B.C.

Yellow cedar decline is a new disturbance agent has been included in the aerial overview survey (figure 4). This phenomenon has been reported in Alaska since the early '90s but has only recently been noted in significant quantities. Approximately 3,839 ha were mapped in 2006. The cause of this decline is not known but is suspected to be linked to climate change.

Figure 4. Yellow cedar decline near Bella Coola, B.C.

Bark beetles continue to the most significant mortality agent in B.C. Spruce beetle damage has increased nearly ten-fold since 2005 (83,360 ha in 2006). Douglas-fir beetle damage has also risen dramatically; 57, 658 ha were mapped in 2006. Several years of drought and repeated defoliation by western spruce budworm has predisposed mature Douglas-fir throughout the southern interior and especially in the 100 Mile Forest District. Western balsam bark beetle continues to be a chronic killer of mature subalpine fir. About 1.6 million ha of very light attack were recorded in 2006 which is slightly greater than in 2005. The mountain pine beetle (MPB) continues to be the most important pest in the province. As predicted, the attacked area increased in 2006 and covers an area of over 9.2 million ha (figure 5). More details on the MPB situation are provided in the presentation on MPB Mitigation Efforts in B.C.

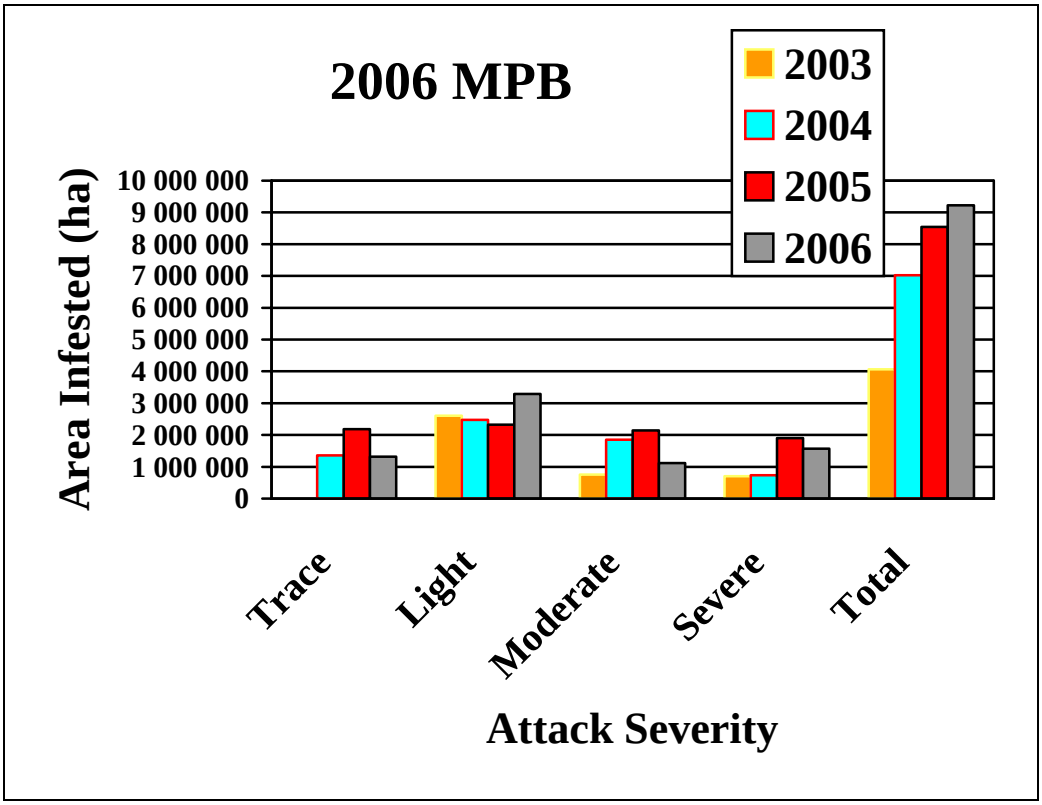

Figure 5. Area infested by mountain pine beetle in 2003 to 2006 in British Columbia.

The province continues to work with the CFIA in preventing the establishment of North American strain of European gypsy moth. Trapping results have determined that three areas require eradication treatments using Btk in the spring of 2007. Three ground applications are proposed for Salt Spring Island, Saanich and Belmont Park (Canadian Forces housing, west of Victoria). An aerial application of approximately 210 ha is planned for an infestation located in Courtenay. Mass trapping trials in Duncan, Gabriola Island and possibly Sidney have shown very encouraging results.

Some other interesting initiatives to report are the preparation of strategic documents that describe the forest program in B.C. to three separate audiences. The first is a brochure that is a plain language description for the general public. The second document, the Forest Health Program document, provides senior government managers a more detailed description of the forest health program and how it links with higher government objectives. The third, the forest health implementation strategy, is an internal document targeted at forest health specialists and operational staff throughout the B.C. Ministry of Forests and Range (MOFR). This document links higher level strategic statements to actual roles and responsibilities of staff and industry based on the Ministry's policies and legislation. All of these documents are expected to be published by March 31, 2007.

The changes in legislation to a results-based regime have established the new function of effectiveness evaluation for MOFR staff. For forest health, an evaluation of free-growing policy has been piloted to determine if stands assumed to be growing at a certain rate based on the free-growing assessment (at age 8-12) are still growing at the assumed rate to rotation ten years later. The pilot project is nearly completed and report should be available in April, 2007.

For more information on the forest program, please check our web site at:

http://www.for.gov.bc.ca/hfp/health/

Alberta Report / Rapport de l'Alberta

Presented by / Présenté par :

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Forest Pest Conditions in Alberta in 2006 and Forecast for 2007

Abstract

Almost all the trees that were infested following the 2005 mountain pine beetle flight were detected and removed. However, beetle infestations increased dramatically following the new beetle flight in 2006. Early indications are that beetles have infested pine stands further north and east than ever before. The gross area of insect-caused aspen defoliation exceeded 5.8 million hectares, an area nearly triple the size of the area defoliated in 2005. However, severity of defoliation was less than in 2005. The forest tent caterpillar was the predominant defoliator. The net area defoliated by the spruce budworm in 2006 was relatively low but it was still twice as big as the net area defoliated in 2005. Severity of defoliation stayed about the same as in 2005. No gypsy moths were detected in the forested area of the province. Forecast on incidence of major forest insect pests in 2007 will be presented.

Situation des ravageurs forestiers en Alberta en 2006 et prévisions pour 2007

Résumé

Presque tous les arbres infestés à la suite de la période d'envol du dendroctone du pin ponderosa en 2005 ont été repérés et éliminés. Cependant, les infestations du dendroctone ont considérablement augmenté à la suite de l'envol de 2006. D'après des données préliminaires, le dendroctone a infesté des pinèdes situées beaucoup plus au nord et à l'est qu'auparavant. La superficie brute des tremblaies défoliées par des insectes s'élevait à 5,8 millions d'hectares. Cette superficie était près de trois fois plus élevée qu'en 2005, mais la gravité de la défoliation était toutefois moindre. La livrée des forêts était le principal défoliateur. En 2006, la superficie nette défoliée par la tordeuse des bourgeons de l'épinette était relativement faible mais tout de même deux fois plus élevée qu'en 2005. La gravité de la défoliation est demeurée à peu près la même qu'en 2005. Aucune spongieuse n'a été découverte dans les forêts de la province. Des prévisions relatives à la situation des principaux insectes forestiers ravageurs en 2007 seront présentées lors de cet exposé

Important Forest Pest Conditions in Alberta in 2006 and Forecast for 2007

The net area defoliated by the spruce budworm in 2006 was relatively low but it was still twice as big as the net defoliated-area in 2005; severity of defoliation remained about the same as in 2005. In 2007, new spruce budworm outbreaks are expected in the Northeast Region of Alberta. The gross area of insect-caused aspen defoliation exceeded 5.8 million hectares, nearly triple the size of the area of defoliation observed in 2005. However, the severity of defoliation was less than in 2005. The forest tent caterpillar was the predominant broadleaf defoliator. No gypsy moths were detected in the forested area of the province. Almost all the trees that were infested following the 2005 mountain pine beetle flight were detected and removed. However, beetle infestations increased dramatically following the new beetle flight that occurred in 2006. Early indications are that beetles have infested pine stands further north and east than ever before. The urban forest in Edmonton was affected by numerous insect pests as well as by diseases and disorders. Although the vector beetles of Dutch elm disease continued to be trapped at various locations Alberta still remains free of this disease.

1.0 INTRODUCTION

This is a summary report on forest pest conditions that were monitored in Alberta in 2006[1]. Reported here are the historical trends, current conditions and forecasts on pest conditions

[1] Pest monitoring surveys were conducted over selected areas of forested Crown land for operational purposes and these do not cover the entire forested land of the province. Although every effort is made to ensure that information reported here is accurate and complete its integrity is not guaranteed.

monitored within the forested Crown land of the province. In addition, pest conditions of Edmonton's urban forest are also described. However, details on invasive alien plant pests in forested Crown land are not included in this report. For details on forest pest conditions in Alberta please visit our forest health website: (http://www.srd.gov.ab.ca/forests/health/p_reports.html) in 2007 spring and refer "2006 Annual Report: Forest Health in Alberta."

The results of pest surveys over forested Crown land are reported by Alberta Sustainable Resource Development in relation to its corporate regions (Northwest NW, Northeast NE, and Southwest SW), which are the forest administrative units in Alberta. Forest pest concerns on other forested lands in Alberta area addressed by: Department of Community Development (provincial parks); Federal Government (National Parks) and Municipal Governments (urban areas).

Alberta's forests are affected by many forest pests other than those reported here. Unless these pests were monitored in 2006 details about them are not reported. Among pests not covered in this report are insect pests such as terminal weevils, other defoliators and sucking insects, other bark beetles and woodborers, and root collar weevils; among diseases that are not reported are lodgepole pine dwarf mistletoe, various foliar diseases including rusts, stem cankers and rots, and Armillaria root disease.

Besides the listed contributors, Roger Brett (Supervising Forest Health Technician, Canadian Forest Service, Edmonton) provided pest survey information on Wood Buffalo National Park and Les Weekes (Forest Officer, Cypress Hills Inter-Provincial Park) provided information on forest pest conditions in Cypress Hills Interprovincial Park reported here.

2.0 INSECT PESTS ON FORESTED CROWN LAND

2.1 CONIFER DEFOLIATORS

2.1.1. Spruce Budworm, *Choristoneura fumiferana* (Clemens)

The spruce budworm outbreak that began in 1987 collapsed in 2004 in all areas except those located in the Northeast Region. The spatial distribution of current spruce budworm defoliation in the province is shown on Figure 1.

Aerial surveys are carried out in the summer by using fixed-wing aircraft to detect infestations and estimate their extent and severity. Defoliation is recorded either digitally by using a tablet personal computer loaded with an electronic map of the area being surveyed (in conjunction with a Global Positioning System) or manually by using hard copies of 1:250 000 scale maps. The surveyors recorded spruce budworm defoliation either as moderate (35-70%) or as severe (>70%).

The results of these aerial surveys are shown on Figure 1. The spruce budworm defoliation covered an estimated net area of 36 771 hectares in 2006. This defoliation was confined to the Northeast and Northwest regions, and to Wood Buffalo National Park. The breakdown of defoliated areas in 2005 vs. 2006, by severity categories, is shown in Table 1. This comparison shows a nearly three-fold increase in total defoliated area in 2006, compared to 2005; during this period severely defoliated area nearly doubled as well.

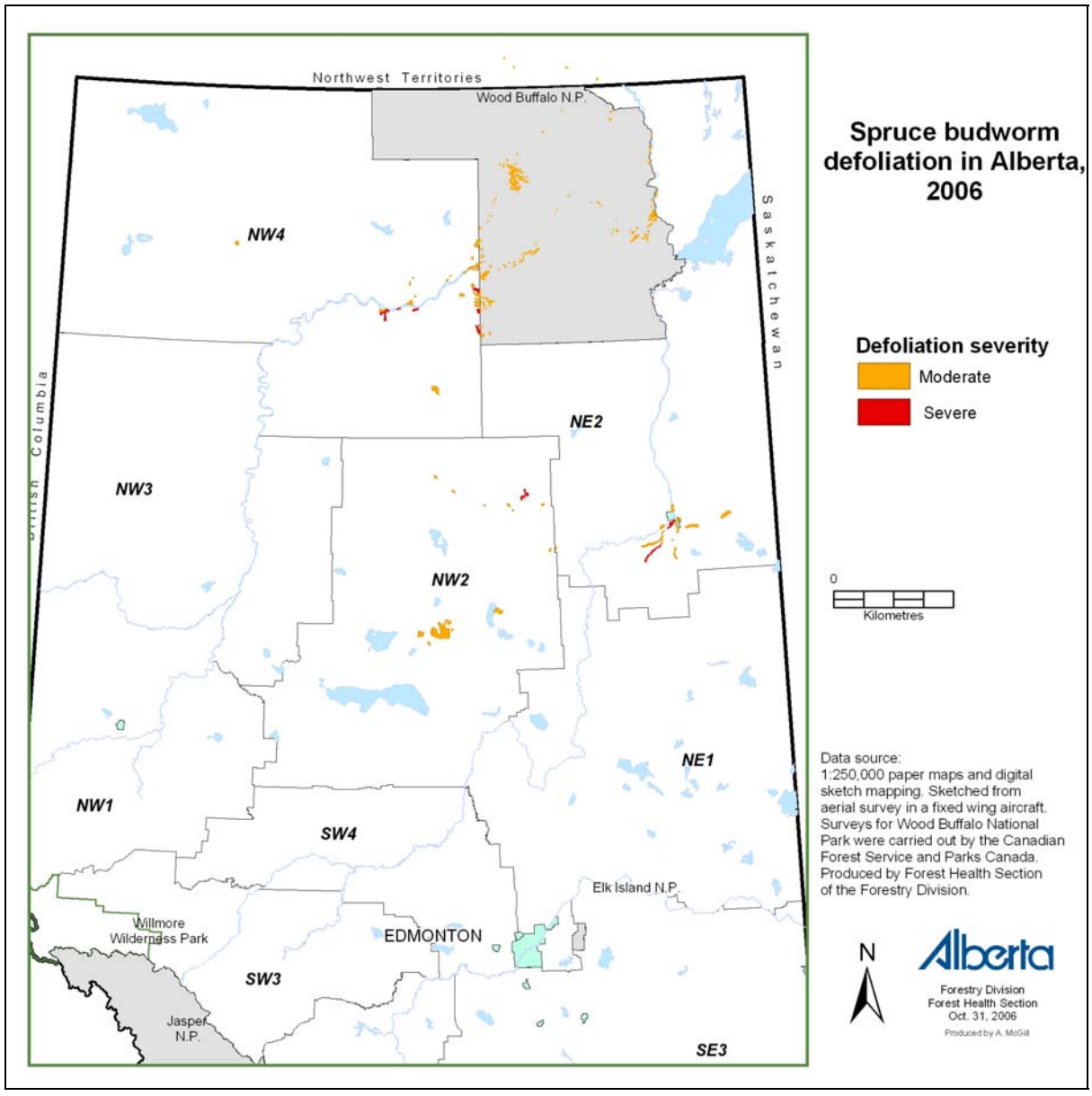

Figure 1. Spruce budworm defoliated areas recorded by severity categories during aerial overview surveys in Alberta, 2006.

In addition, moderate to severe spruce budworm defoliation was reported from Cypress Hills Inter-Provincial Park in southeastern Alberta. The extent and severity of this defoliation was not estimated.

Spruce budworm also severely defoliated many white spruce stands located within the Municipality of Wood Buffalo in northeastern Alberta. The severely infested stands were treated with the microbial insecticide B.t.k. to control these infestations.

Table 1. The extent of spruce budworm defoliation (ha) by severity categories in Alberta[a], 2005 vs. 2006

	2005			2006		
	Moderate	**Severe**	**Total**	**Moderate**	**Severe**	**Total**
Net [b]	6 636	3 384	10 020	17 282	3 901	21 183
Gross [c]	3 495	374	3 869	12 368	3 220	15 588
Total	10 131	3 758	13 889	29 650	7 121	36 771
Change [d]	100%	100%	100%	292%	189%	265%

[a] Extent of defoliation reported from forested Crown land surveyed; national parks excluded
[b] Extent of defoliation reported from inventoried forest land
[c] Extent of defoliation reported from non-inventoried forest land
[d] Comparison of totals under each category in 2005 with corresponding figures in 2006

Multi-Pher I® traps (Le Group Biocontrole, Quebec) baited with female budworm sex pheromone lures (Phero Tech Inc., B.C.) were used to monitor male spruce budworm moth populations in high budworm-risk forest stands. The average count of male moths is used to predict the potential risk of new SBW outbreaks occurring in these stands. The results of this survey are shown on Figure 2. These results show relatively high risk of new spruce budworm outbreaks occurring in the Northeast Region. There is a moderate risk of outbreaks occurring in the Southwest Region where high altitude areas are inhabited by the two-year cycle budworm, *C. biennis* Free.

2.1.2 Western Spruce Budworm, *C. occidentalis* (Freeman)

Douglas-fir stands in the Porcupine Hills area of southern Alberta were severely defoliated by the western spruce budworm. The extent of this defoliation was not estimated in 2006.

2.1.3 Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Rohwer)

Yellowheaded spruce sawflies defoliated young white spruce growing on reclaimed oil and gas lands in the Northeast Region. Some of these stands were severely defoliated and were treated with insecticides. However, defoliation was light in 2006 on affected stands growing on oilsands lands where Entrust 480SC was experimentally sprayed in 2005 to successfully control this pest.

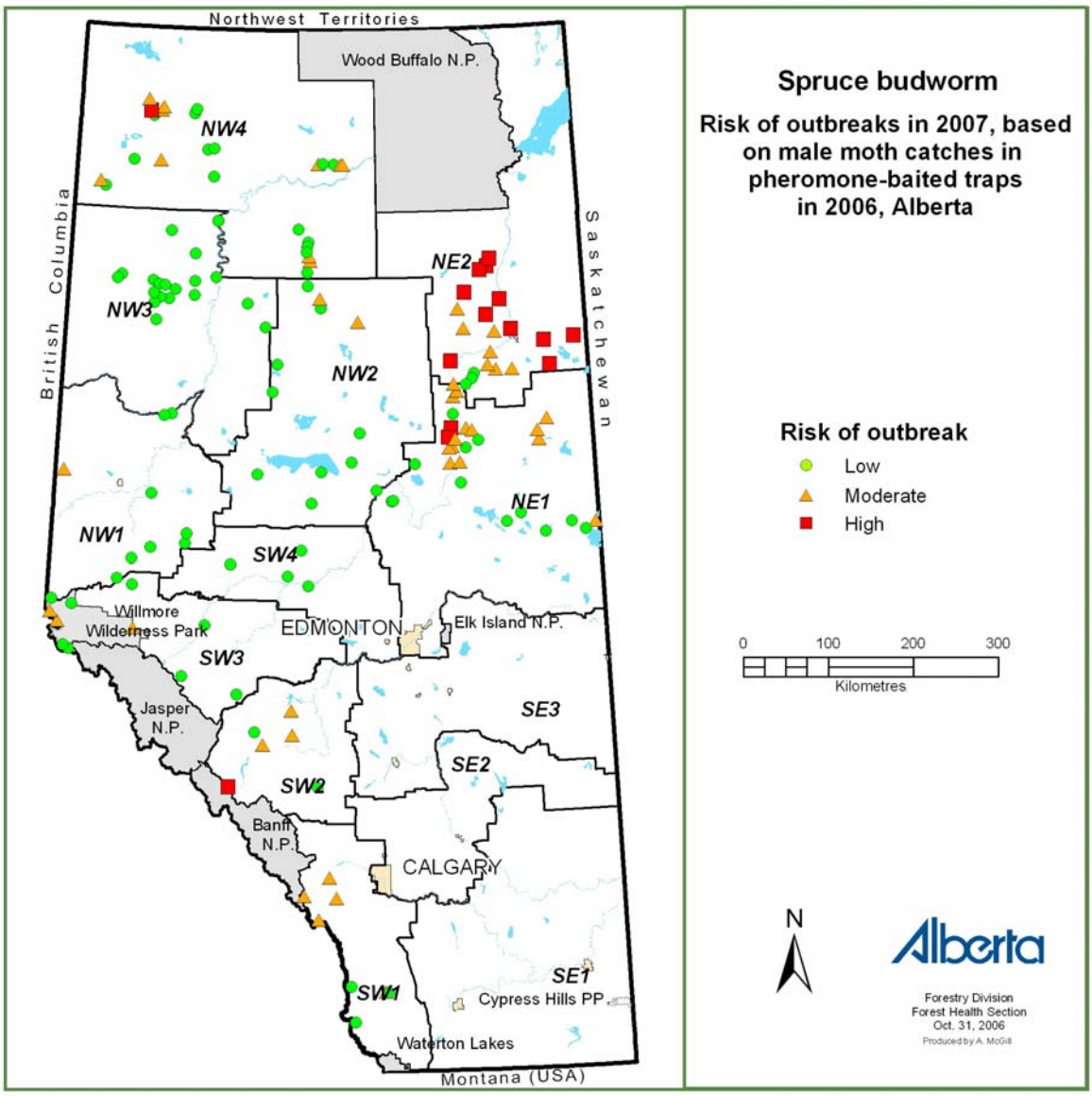

Figure 2. Risk of new spruce budworm outbreaks occurring in 2007, based on male moth catches in pheromone-baited traps in Alberta.

2.2 BROADLEAF DEFOLIATORS

2.2.1 Major Aspen Defoliators

Aerial overview surveys were carried out to estimate the extent and severity of insect pest-caused aspen defoliation over forested Crown land. Fixed-wing aircraft were used in these surveys. Either a tablet PC pre-loaded with digital maps of the survey area and linked with a GPS unit, or hard copies of 1:250 000 scale maps were used to record the extent and severity of defoliation observed during these surveys. The surveyors categorized aspen defoliation as light (<35%), moderate (35-70%) or severe (>70%). The results of these surveys are summarized in Figure 3 and in Table 2.

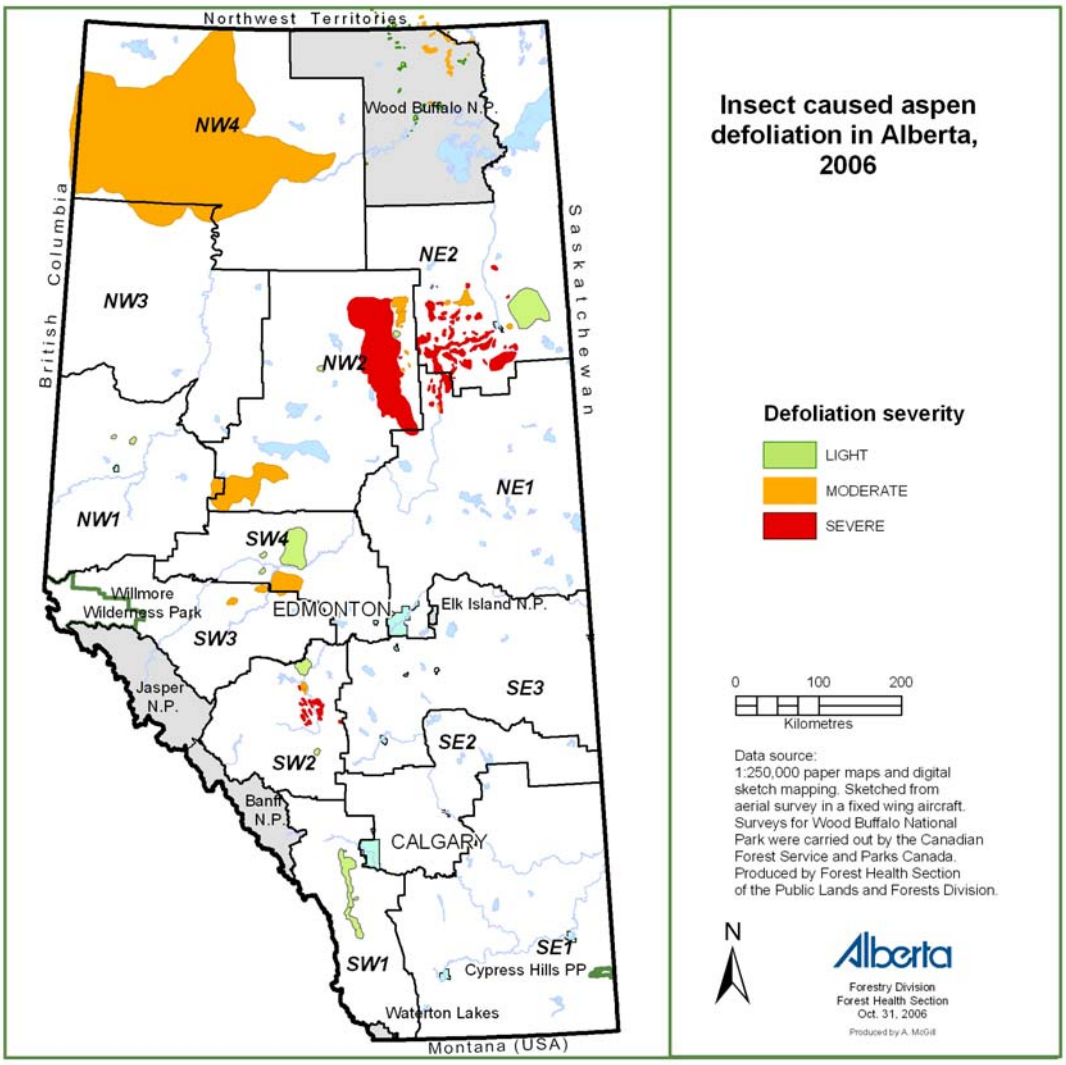

Figure 3. The extent and severity of insect pest-caused aspen defoliation recorded during aerial overview surveys in Alberta, 2006.

In 2006, the gross area with aspen defoliation on forested Crown land was 5.85 million hectares (Table 2). This is a 107% increase compared to the area with gross defoliation in 2005. The forest tent caterpillar (*Malacosoma disstria* Hũbner) was the predominant defoliator of aspen in 2006. Its defoliation was scattered over 5 193 325 hectares accounting for 88.8% of all aspen defoliation in the surveyed area. Compared to 2005, the large aspen tortrix (*C. conflictana* (Walker) populations further declined in 2006 limiting their defoliation to 401 011 hectares (6.9%). The aspen leafroller (*Pseudecenterra oregonana* (Walsingham), populations increased dramatically in 2006 with its defoliation occurring over 256 818 hectares (4.3%).

Table 2. The extent (ha) and severity of insect pest-caused aspen defoliation in Alberta [a], 2005 vs. 2006

Corporate Region	Gross area of defoliation (ha)					
	2005			2006		
	Light	Moderate	Severe	Light	Moderate	Severe
Northeast	2 753	5 035	40 173	161 508	28 859	279 555
Northwest	379 271	287 944	2 061 360	18 027	4 329 260	631 992
Southwest	16 347	7 442	18 062	258 924	108 943	34 088
TOTAL		**2 818 387**			**5 851 155**	

[a] Extent of defoliation reported from forested Crown land surveyed; national parks excluded

2.2.2 Minor broadleaf defoliators recorded on forested Crown land in 2006 were:

a) Aspen serpentine leafminer (*Phyllocnistis populiella* (Chambers)
b) Willow laefminer (*Micrurapteryx salcifoliella* (Chambers)
c) Ash leaf cone roller (*Caloptilia fraxinella* (Ely)
d) Aspen two-leaf tier (*Enargia decolor* (Walker)

2.2.3 Gypsy Moth

No gypsy moths were detected in pheromone-baited traps set up by SRD as a part of a provincial survey spearheaded by the Canadian Food Inspection Agency.

2.3 BARK BEETLES

2.3 1 Mountain Pine Beetle (*Dendroctonus ponderosae* (Hopkins)

The details of mountain pine beetle (MPB) infestations are reported on the basis of the "beetle year," i.e., from September 2005 when 2005 beetle flight was over until occurrence of beetle flight in August 2006.

Ground surveys were carried out after 2005 beetle flight. During these surveys 13 856 infested trees were detected (Table 3). Out of these infested trees, 12 938 were removed by control action. Pheromone baits were used to contain beetles in areas that could not be reached in time to remove infested trees.

Table 3. Results of beetle management program carried out after 2005 mountain pine beetle flight in Alberta

Region / Area	Total Number of Infested Trees	
	Detected	**Controlled**
Southwest 1 & 2	2 526	2 109
Southwest 3	11 029	10 534
Northwest 1	301	295
TOTAL	**13 856**	**12 938**

In 2006, there was a significant increase in MPB infestations in Alberta. Aerial overview surveys carried out in 2006 indicated MPB occurring further north and further east than ever before (Figure 4). In addition, a massive influx of MPB, presumably originating from B.C, scattered beetles over a wide area in northern Alberta. According to early reports from ground survey

crews this influx resulted in a huge infestation scattered over a wide area extending further north and east than ever before.

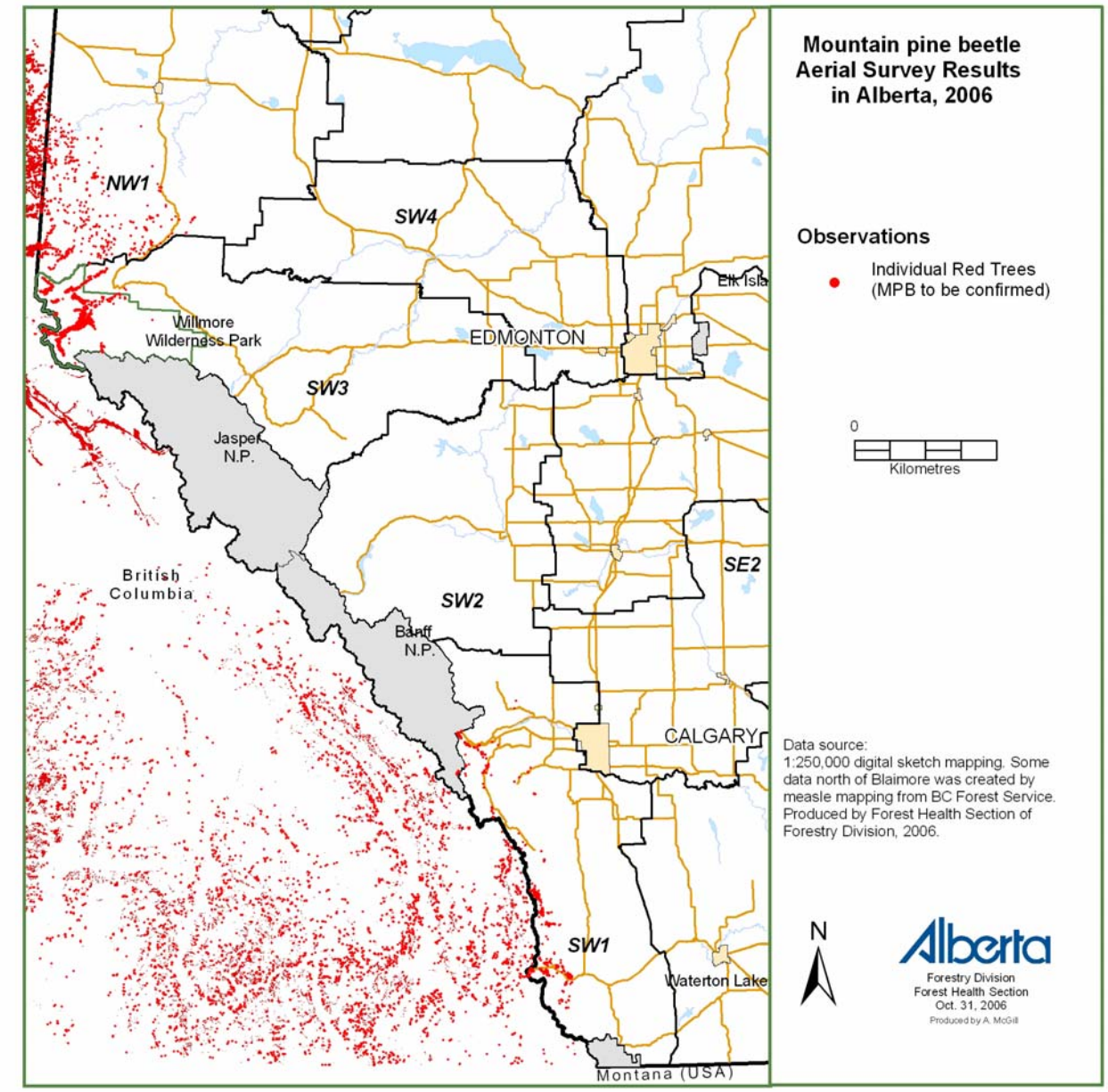

Figure 4. Results of the mountain pine beetle aerial overview survey in 2006, Alberta.

3.0 DISEASES AND DISORDERS ON FORESTED CROWN LAND

3.1 DISEASES

3.1.1 Spruce Needle Rust (*Chrysomyxa* sp.)

In the Southwest Region, a heavy infection caused by spruce needle rust was observed in early summer in the western section of the Southwest Region. White spruce in Switzer Provincial Park and further east were hard hit by this infection.

3.2 DISORDERS

Ice storms that occurred in the fall caused significant damage to ornamental poplars in Cypress Hills Inter-Provincial Park. In addition, the edges of a number of aspen, lodgepole pine and white spruce stands that were facing the ice storms were also damaged.

4.0 PESTS OF URBAN FORESTS

Several pest infestations were reported from the urban forest associated with the City of Edmonton.

4.1 Conifer Pests

4.1.1 Yellowheaded spruce sawfly (*Pikonema alaskensis* (Rohwer)

The yellowheaded spruce sawfly (YHSS) populations continued to increase in 2006 and defoliated a large number of white spruce throughout Edmonton. In 2006, the pest management operations staff sprayed approximately 4400 YHSS-infested trees in the city. In addition, Orthene® was injected into 329 infested trees to control this pest problem.

4.1.2 Spruce Spider Mite (*Oligonychus ununguis* (Jacobi)

Many white spruce in Edmonton were infested by the spruce spider mite. Even some spruce infested by the yellowheaded spruce sawfly were attacked by these mites.

4.2 BROADLEAF TREES

4.2.1 Defoliators

The satin moth, *Leucoma salicis* (L.), numbers in the city appeared to have leveled off in 2006. An increase in the parasitoid wasp, *Cotesia* sp., has kept the satin moth population increase to a minimum. The apple maggot, *Rhagoletis pomonella* (Walsh), population in Edmonton area appears to be spreading but this is still considered to be a minor pest causing cosmetic damage. No gypsy moths, *Lymantria dispar* (L.), were caught in pheromone-baited traps set up at various strategic locations around the city, in conjunction with the Canadian Food Inspection Agency (CFIA). The Bruce spanworm (*Operophtera bruceata* (Hulst) population increased in the outskirts of the city. Few forest tent caterpillar larvae were found in the city but these did not cause noticeable defoliation. The larger boxelder leafroller, *Archips negundana* (Dyar), defoliation on Manitoba maples expanded along the river valley. Several hundred maples were severely defoliated but re-foliated within weeks of peak defoliation. The populations of the forest tent caterpillar, fall cankerworm (*Alsophila pometaria* (Harr.), and amber-marked birch leafminer (*Profenusa thompsoni* (Konow) also increased slightly. In addition, another species of birch leafminer (*Scolloneura vicina*) has been reported in the Edmonton area by the Canadian Forest Service. Signs of parasitism have already been observed on this leafminer. The spiny ash sawfly, *Euparophora parka* (Cress.), increased in numbers compared to those in 2005. This pest was invariably found on ash trees infested by the ash plant bug (*Tropidosteptes* sp.) and the ash leaf cone roller (*Caloptilia fraxinella* (Ely). The ash leaf cone roller was widespread in the city. Nearly all the leaves on some ash trees were affected by this pest. An unidentified *Apanteles* sp. parasitized from 20% to 90% of this caterpillar larvae depending on the neighbourhood. The oblique banded leafroller, (*C. rosaceana* (Harr.) occurred in high numbers on ash trees at a few locations. Several boulevard trees in downtown Edmonton had significant defoliation and leafroller larvae dangling on silk threads caused much consternation with the general public.

4.2.2 Sucking Insects

The European elm scale, *Gossyparia spuria* (Mod.), has become established in the city, especially on young elms. The oyster scale (*Lepidosaaphes* sp.) populations crashed in 2006. The ash plant bug populations exploded in 2006 causing considerable damage including leaf drop on a large number of ash trees. This infestation further stressed out ash trees making them more prone to other pests. The populations of the cottony psyllid, *Psyllopsis discrepans*, made a major comeback attacking almost every black ash in the city. Over 2000 black ash were injected with either Confidor® (Imidacloprid) or Orthene® (Acephate) to control this pest and other pests attacking ash trees. The lace bugs were found on Saskatoon and Mayday but caused minimal damage. The European fruit lecanium (*Parthenolecanium corni*) numbers in the city rose. These attacked ash trees distressed due to other pest attacks. Few ash trees were infested with wooly ash aphid and ash leafcurl aphids (*Prociphilus fraxinifolli*. The clumped pseudo-galls of these insects has considerable amount of honeydew making them potential nuisance species. Trounce® (a mix of insecticidal soap and pyrethrins) was ineffective in controlling these pests within galls.

4.3 Bark Beetles and Weevils

In Edmonton, five smaller European elm bark beetle (*Scolytus multistriatus,* (Marsh.) were captured at 5 out of 84 sites with panel and funnel traps. Though higher than the single beetle trapped in 2005 this still is a low beetle catch. The western ash bark beetle, *Hylesinus californicus* (Swaine), populations continued to be active on dead branches of ash trees. The beetle-killed ash trees have been chipped and used as mulch. Experiments have shown that at least 95% of these beetles in chipped ash bolts are killed making ash chips safe for mulching. The pine engraver, *Ips* pini (Say), and other native bark beetles were found in several dead pine trees in the city; however, there were no mountain pine beetles in these dead pines.

4.4 Diseases and Disorders

4.4.1 Diseases

Forty-seven new cases of the fungal wilt disease, *Dothiorella ulmi*, were confirmed in Edmonton in 2006[2]; many of these trees were too dry to be sampled and cultured to confirm disease incidence. Twelve diseased large elms with over 50% decline of the living canopy were slated for removal in 2006.

Alberta still remains free of Dutch Elm disease in spite of continued capturing of one of its vectors (smaller European elm bark beetle) in traps set up at many locations in the province.

4.4.2 Disorders

In spite of a relatively wet year, the soil moisture deficit continued and the city lost more trees due to drought conditions that prevailed in the previous years. Ash trees in particular were hit hard in 2006. The city up to now has lost a few thousand trees due to drought.

[2] Confirmed by Dr. J.P. Tewari, University of Alberta

N
Northwest Territories
Wood Buffalo
National Park
NW4
High Level
British Columbia
NE2
Saskatchewan
Northwest
NW3
Fort McMurray
Northeast
Peace River
NW2
Grande Prairie
Slave Lake
NE1
NW1
Lac La Biche
Athabasca
Cold Lake
Kakwa Wildland
Provincial Park
SW4
Smoky Lake
Willmore
Wilderness Park
SW3
Edson
Edmonton
Elk Island
National Park
Hinton
Southwest
Jasper
National
Park
SE3
Rocky
Mountain
House
Red Deer
SW2
SE2
Banff
National
Park
Southeast
Calgary
Canmore
SE1
SW1
Medicine Hat
Cypress Hills PP
Waterton
Lakes
National Park
Lethbridge
Corporate Regional Boundaries
Corporate Area Boundaries
National Parks
0 50 100 200
Kilometres
Montana (USA)

Saskatchewan Report / Rapport de la Saskatchewan

Presented by / Présenté par :

***Rory McIntosh*[1], *Robert Moore*[1], *Paul Bolan*[2] *and Jennifer Burleigh*[2]**

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[2] BioForest Technologies Inc., Sault Ste. Marie, ON

Forest Insect and Disease Conditions in Saskatchewan, 2006

Abstract

Spruce budworm, *Choristoneura fumiferana,* remains the most significant insect pest in Saskatchewan forests. Aerial surveys show 2006 defoliation has continued to decline. Decision Support System was used to prioritize 25,000 ha for spraying with *Bacillus thuringiensis* var. *kurstaki*. Treatment began May 31 and ended June 8. Overall, defoliation in Saskatchewan is generally declining but is predicted to remain severe in parts of the northeast. Forest tent caterpillar, *Malacosoma disstria,* was not detected in 2006. Aspen decline in the northwest was mapped during aerial surveys. Dutch elm disease, *Ophiostoma novo-ulmi,* continues to spread in Saskatchewan. In 2006, tree removals in most municipalities and buffers were lower than 2005. Dwarf mistletoe, *Arceuthobium americanum,* and Jack pine budworm, *Choristoneura pinus pinus,* are the most significant pests of Jack pine. Trap catches in 2006 generally declined. Mountain pine beetle, *Dendroctonus ponderosae,* continues to be a major concern. Systematic aerial and ground surveys in Cypress Hills, along with provincial import restrictions, continue. Saskatchewan continues to monitor banded elm bark beetle, *Scolytus schevyrewi*. Seven (unconfirmed) positive traps were revealed in the CFIA Gypsy moth (*Lymantria dispar*) trapping survey.

Insectes et maladies des arbres en Saskatchewan en 2006

Résumé

La tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana*) demeure le plus important insecte ravageur forestier en Saskatchewan. Les relevés aériens ont montré que la défoliation a continué de diminuer en 2006. Le système d'aide à la décision a permis de déterminer qu'il était prioritaire de traiter 25 000 hectares au *Bacillus thuringiensis* var. *kurstaki*. Les pulvérisations ont débuté le 31 mai et pris fin le 8 juin. De façon générale, la défoliation a diminué à l'échelle de la province, mais elle devrait demeurer grave dans certaines parties du nord-est. La présence de la livrée des forêts (*Malacosoma disstria*) n'a pas été relevée en 2006. Un dépérissement du peuplier faux-tremble a été cartographié lors des relevés aériens. La maladie hollandaise de l'orme (*Ophiostoma novo-ulmi*) continue de se propager en Saskatchewan. Le nombre d'arbres abattus en 2006 a diminué par rapport à 2005 dans la plupart des municipalités et des rideaux verts. Le faux-gui (*Arceuthobium americanum*) et la tordeuse du pin gris (*Choristoneura pinus pinus*) sont les ravageurs les plus destructeurs du pin gris. En 2006, les captures dans les pièges étaient généralement à la baisse. Le dendroctone du pin ponderosa (*Dendroctonus ponderosae*) continue d'être une source de préoccupation extrêmement importante. Les relevés aériens et terrestres systématique dans les collines Cypress se sont poursuivis, et les restrictions provinciales touchant les importations ont été maintenues. La Saskatchewan continue d'exercer une surveillance à l'égard du *Scolytus schevyrewi*, scolyte originaire d'Asie attaquant les ormes. Sept spécimens (dont l'identité demeure à confirmer) ont été récupérés dans les pièges déployés par l'ACIA dans le cadre de sa campagne de piégeage de la spongieuse (*Lymantria dispar*).

Status of Forest Insect and Disease Conditions in Saskatchewan - 2006

Executive Summary

Spruce budworm *Choristoneura fumiferana* remains the most significant insect pest in Saskatchewan forests. Aerial surveys show 2006 defoliation has continued to decline. The Spruce Budworm Decision Support System was used to prioritize 25,000 ha for spraying with *Bacillus thuringiensis* var. *kurstaki*. Treatment began May 31 and ended June 8. Overall, defoliation in Saskatchewan is generally declining but is predicted to remain severe in parts of the northeast. Forest tent caterpillar *Malacosoma disstria* were not detected in 2006. Aspen decline in the northwest was mapped during aerial surveys. Dutch elm disease *Ophiostoma novo-ulmi* continues to spread in Saskatchewan. In 2006, tree removals in most

municipalities and buffers were lower than 2005. Dwarf mistletoe *Arceuthobium americanum* and Jack pine budworm *Choristoneura pinus pinus* are the most significant pests of Jack pine. Trap catches in 2006 generally declined. Mountain pine beetle *Dendroctonus ponderosae* continues to be a major concern. Systematic aerial and ground surveys in Cypress hills, along with provincial import restrictions, continue. Saskatchewan continues to monitor banded elm bark beetle *Scolytus schevyrewi*. Seven positive traps were revealed in the CFIA Gypsy moth (*Lymantria dispar*) trapping survey. In 2007, expanded grid trapping will be implemented in the city of Saskatoon.

NATIVE INSECTS AND DISEASES OF THE BOREAL FOREST

Introduction.

The eastern spruce budworm *Choristoneura fumiferana* (Clemens) is the most significant pest of Saskatchewan's Boreal Forest. The spruce budworm (SBW) outbreak began in the early 1980's and continued to increase, reaching a peak in 2002 when 670,000 ha of moderate to severe defoliation were mapped. Defoliation continued to decline to 511,000 ha in 2003; to 292,493 ha in 2004; and to 183,511 in 2005. In 2006, the moderate to severe defoliation recorded in the province had decreased further to 99,692 ha (see Table 1). Almost 90% of the defoliation is classed as moderate and is predominantly found in the northeast near Amisk and Cumberland Lake, and in north central Saskatchewan, from the Prince Albert National Park eastward towards Tobin Lake. (Figure 1).

Photograph: R. McIntosh, SE

Saskatchewan Environment (SE) has conducted a successful foliage protection program against the SBW over the past ten years. Using historical SBW defoliation records, defoliation predictions based on 2005 L2 survey data, and forest management plans, SE developed an aerial spray program to spray 60,416 hectares in 2006. BioForest Technologies Inc. was contracted to provide timing and assessment services for the provincial operational program. The current objective is to limit defoliation in treated stands to below 40%.

Table 1 **Area of moderate to severe defoliation caused by the spruce budworm *Choristoneura fumiferana* 1980-2006**

YEAR (1980's)	Hectares defoliated (Net)	YEAR (1990's)	Hectares defoliated (Net)	YEAR (2000's)	Hectares defoliated (Net)
1980	0	1991	18,780	2000	265,766[1]
1981	0	1991	15,600	2001	438,883
1982	2,000	1992	87,000	2002	669,591
1983	12,700	1993	56,617	2003	511,780
1984	15,100	1994	52,339	2004	282,376
1985	15,000	1995	98,910	2005	183,511
1986	18,500	1996	113,972	2006	99,692
1987	31,600	1997	113,136		
1988	31,600	1998	420,876		
1989	34,650	1999	506,749		

[1] Includes 20,000 hectares detected in an extended survey North of the Churchill River

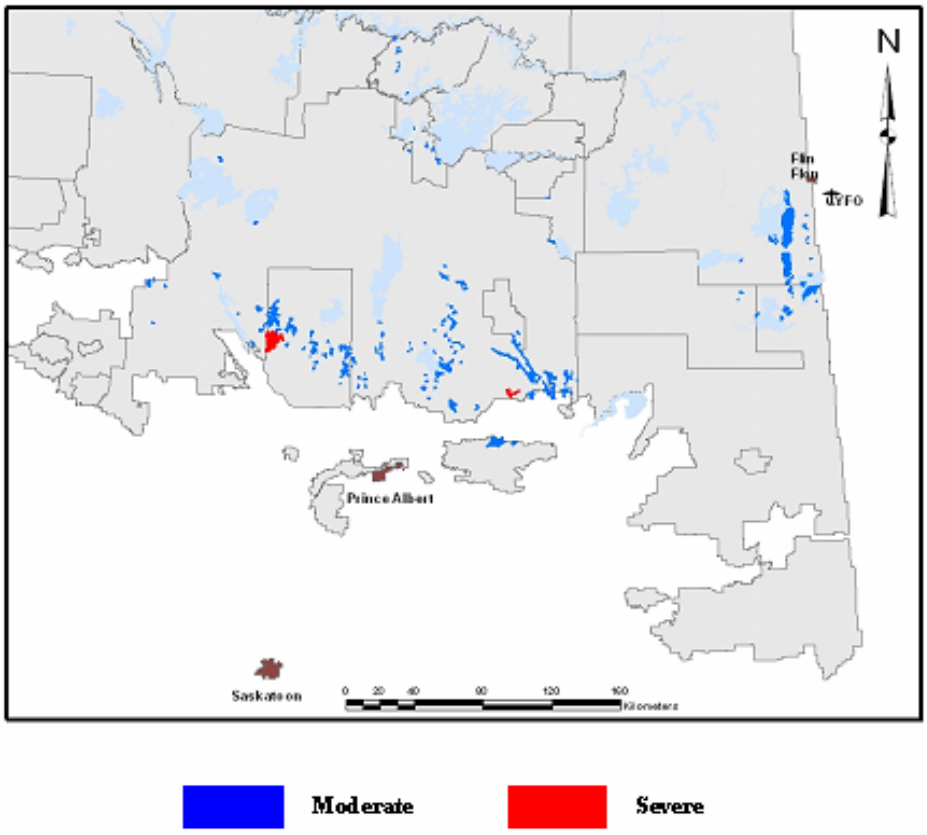


Figure 1. **Distribution of moderate to severe spruce budworm *Choristoneura fumiferana* defoliation, in central and northeastern Saskatchewan in 2006.**

Program Overview

In 2006, SE conducted operational spraying over 26,386 hectares of moderate to severely defoliated white spruce and mixed-wood forest. Of the 26,386 ha treated, 98 ha were treated with a single application and an area 26,288 ha was treated with a double application of the biological insecticide Foray 76B (*Bacillus thuringiensis* var. *kurstaki* [*Btk*]) (Valent BioSciences Corp.) at a rate of 30 BIU/1.5L/ha. Multiple treatment areas were separated by 3-5 days between applications. The program consisted of 10 blocks ranging in size from 1,000 – 4,600 ha (Table 2). The 2006 spray blocks were located in two main geographic areas: Amisk lake and Deschambault Lake in the Creighton area. In 2006 program started May 31 and was completed on June 7 (Table 2)

Aircraft

In total, 3 spray aircraft provided by Battlefords Airspray and Wetaskiwin Aerial Applicators Ltd. were used in the 2006 operational program. Air tractor AT 502B aircraft were each equipped with Sat Loc GPS guidance systems and six AU 4000 Micronaire atomizers and Crophawk flow systems. The Micronaires were set at 7000 rpm and the aircraft flew 90 m swaths at an average speed of 235 kph. The aircraft flew out of the Flin Flon Municipal Airstrip located at Bakers Narrows, Manitoba. One Cessna 172 Cutlass RG observer aircraft was used to monitor the operational treatments.

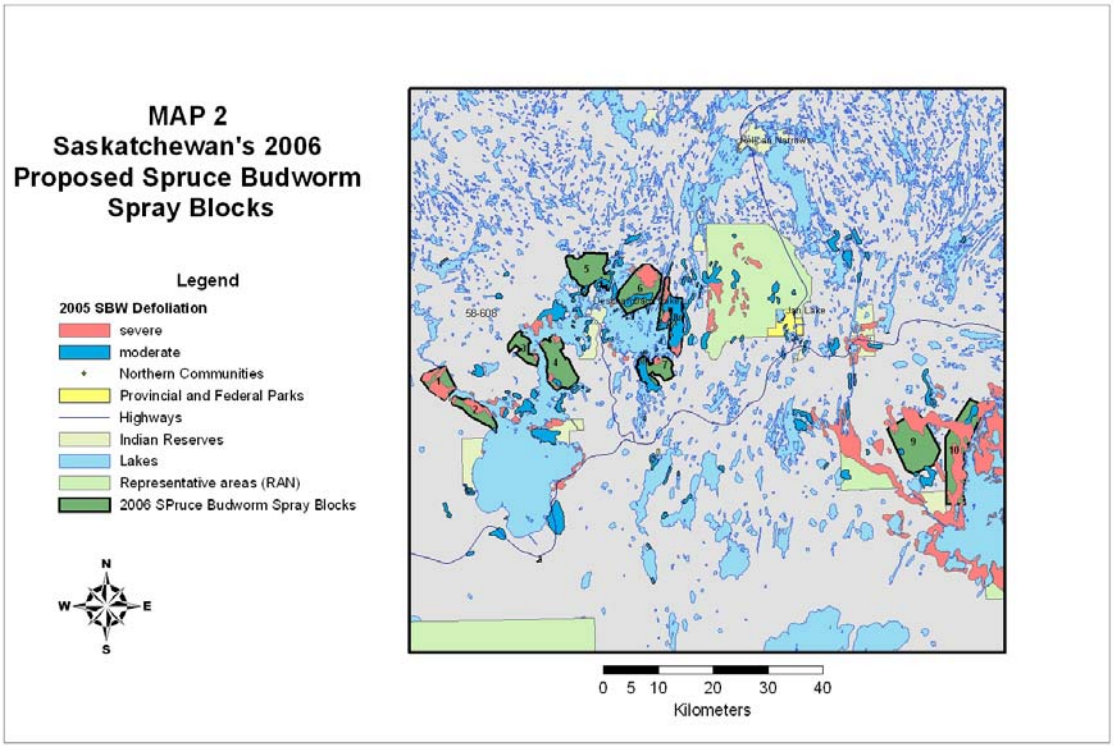


Figure 2. Geographic location and distribution of spray blocks selected for treatment in the 2006 spruce budworm spray operations in Saskatchewan.

Table 2. Summary of the Saskatchewan spruce budworm operational spray program, 2006.

		1st Application			2nd Application		
Block	**Ha(net)**	**Date**	**Ha**	**L**	Date	**Ha**	**L**
1	2,260	June 1	1,834	2,740	June 4	1,781	2,554
2	1,035	June 1	1,405	2,081	June 4	1,374	2,040
3	1,300	June 1	1,453	2,144	June 4	1,314	2,013
4	3,000	June 1,4	3,032	4,420	June 5	3,235	4,827
5	3,150	June 2	3,459	5,147	June 5	3,479	5,060
6	4,652	June 2	2,959	4,516	June 5,6	3,307	4,850
7	1,800	June 4	2,064	3,013	June 5,6,8	2,152	2,887
8	3,610	Not Treated			Not Treated		
9	4,130	May 31, June1	4,984	7,435	June 8	4,429	6,540
10	4,100	June 1,3,8	5,098	7,504	June 6	5,315	7,831
Total	**29,037**		**26,288**	**39,000**		**26,386**	**38,602**

Weather

Between April 1, to early June 2006, climate information was obtained from Atmospheric Environment Services, Environment Canada stations in Prince Albert, and Flin Flon Manitoba. Daily maximum and minimum temperatures were used to calculate degree-day estimates and monitor heat sum accumulation above 2.8°C. In 2006, overall, spring temperatures in both the Flin Flon and La Ronge areas were warmer than average, running from one to two weeks ahead of normal. During the operational spray program, local weather data (temperature, relative humidity, wind speed and wind direction) were collected from SE's Fire Management and Forest Protection Branch network of remote automated weather stations within or near treatment blocks.

Spray Timing

The 2006 SBW aerial spraying program was timed using indices of host and larval development. The Host Development Index (HDI) and Larval Development Index (LDI) were determined from samples collected from insect and host development assessment plots located near spray blocks. On each sample date, SBW larvae (n=50) were collected from host white spruce to determine the LDI using the procedure described by Dorais and Kettela (1982). Binocular microscopes were used to measure head capsule width of all sample larvae to determine instar. The HDI was calculated from new shoot samples (n=120) collected from the mid-crown of six host trees. Spray operations were targeted to begin once LDI = 3.5 to 4.5 and HDI = 4.0 or higher.

In 2006, BioSIM was used to forecast SBW larval development within areas scheduled for aerial application of Btk in 2006. Results from these forecasts supported the scheduling of field insect

and host phenology surveys. Information from the field surveys and forecasts generated by BioSIM were used to determine optimal times for spraying. BioSIM was used to forecast the average date at which a larval development index (LDI) of 4.0 would have been achieved within the planned SBW spray blocks in northeastern Saskatchewan. This LDI value, when coupled with a similar host development index (HDI) value, indicated that spraying could begin.

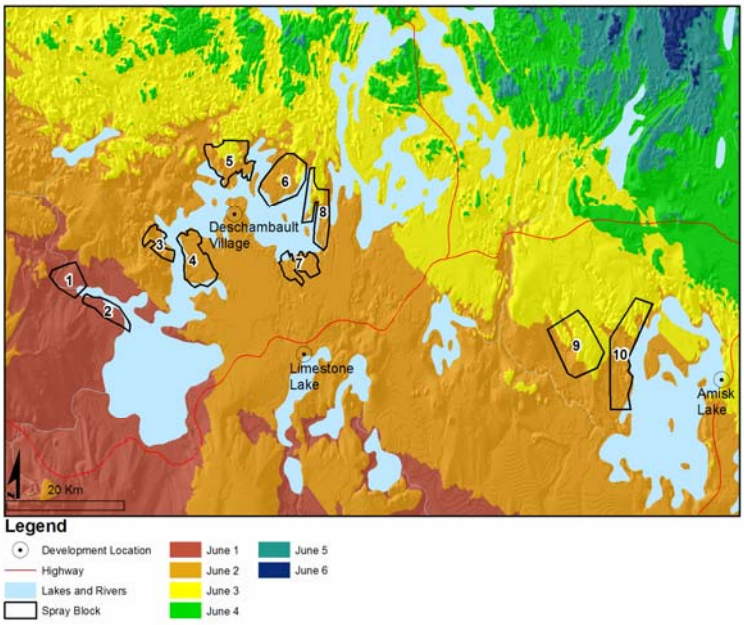


Figure 3. **Forecasts of spruce budworm development (LDI = 4.0) using the BioSIM model in northeastern Saskatchewan based on weather data collected up to September 15, 2006.**

Table 3. **Comparison between actual field assessments and BioSIM predicted dates for the start of spray operations in Saskatchewan (LDI = 4.0).**

Spray Block	BioSIM Predicted LDI =4.0 Date	First Application Spray Date based on field development data
1	1 June	1 June
2	1 June	1 June
3	2 June	1 June
4	2 June	1 & 4 June
5	2-3 June	2 June
6	2-3 June	2 June
7	2 June	4 June
8	2-3 June	Not Sprayed
9	2-3 June	31 May & 1 June
10	2-3 June	1, 3 & 8 June

LDI and HDI data from field surveys together with forecasts generated by BioSIM, were used to determine and guide optimal times for spraying. Table 3 shows the spray blocks and actual dates treated. Block number 8 was selected as a contingency block for treatment in the event any of the other blocks could not be treated. It was ranked lowest using the Spruce Budworm Decision Support System. Since all priority blocks were treated block 8 was not used.

Spray Deposit Monitoring

Spray deposit presence was measured using Accurate Deposit Assessment Methodology (ADAM) field kits, supplied by Valent BioSciences. Foliage samples were collected within 24 hours of the first and second applications from the mid-crown of three trees from each of the plots assessed for deposit. Ninety trees were sampled for deposit assessment following the first application and 48 were sampled following the second application. Samples were stored at 4^{o}C and processed in the laboratory in Prince Albert to determine *Btk* deposit. An average of 71.1% and 85.4% of the samples collected had *Btk* deposit after the first and second aerial applications, respectively.

Spray Efficacy Assessment

In total, 26 spray assessment plots (three white spruce per plot) were established in treatment blocks and another 24 plots in unsprayed control stands to assess the efficacy of the 2006 aerial spray program. A single mid-crown branch (45 cm) was collected from each dominant or co-dominant sample tree for pre-spray and post-spray evaluation.

Foliage protection

The primary objective of the Saskatchewan aerial spray program is to minimize host defoliation. Defoliation was estimated in spray and control areas. The Fettes (1950) ocular method was used to quantify stand defoliation. Pre-spray defoliation was estimated on the day of the spray to maximize the accuracy of the estimate.

Analysis of covariance with pre-spray larval populations as the covariate showed that mid-crown post-spray defoliation rates in the sprayed blocks were significantly lower than those in the unsprayed controls ($P < 0.01$) (Figure 4). In 2006, defoliation rates were well below the provincial target of 40%.

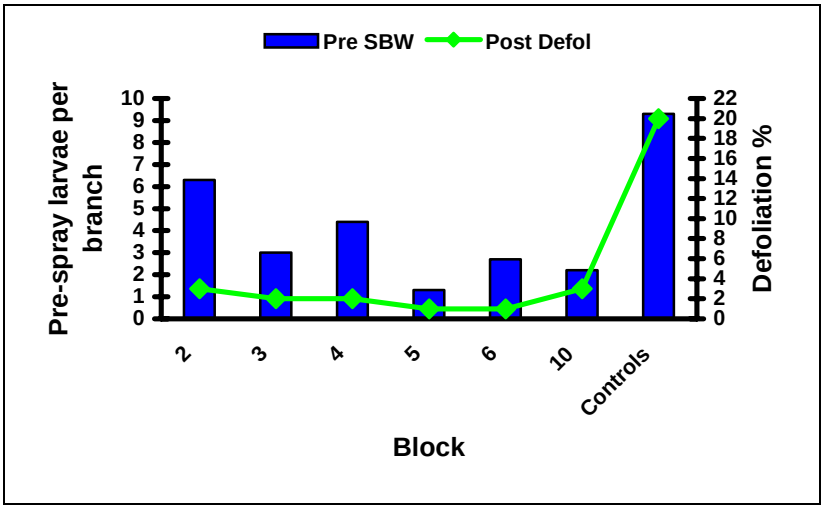


Figure 4. **Pre-spray spruce budworm larval populations and white spruce defoliation in blocks treated with Foray 76B in Saskatchewan, 2006**

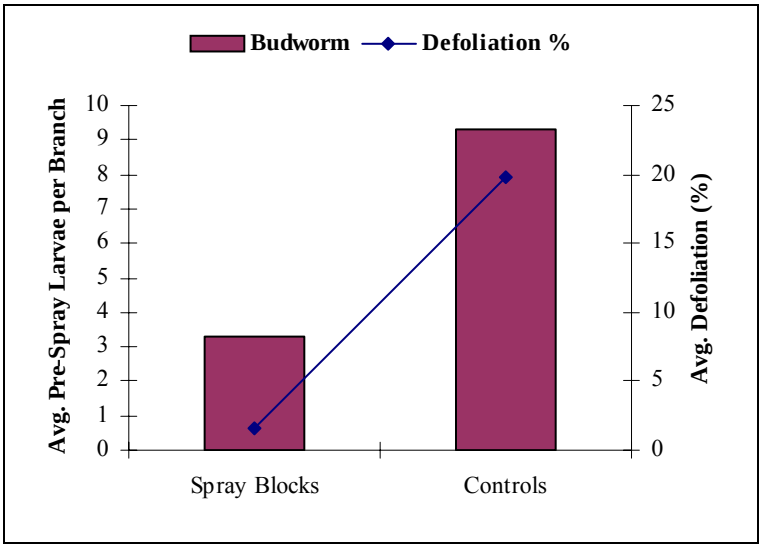


Figure 5. **Average pre-spray spruce budworm populations and defoliation rates on white spruce in blocks treated with Foray 76B and unsprayed controls in Saskatchewan, 2006.**

Spruce Mortality

With the decline of spruce budworm defoliation, significant areas of spruce mortality are now being mapped (see figure 6) particularly in areas of repeat severe defoliation where no treatment has taken place. These areas are most significant in the Prince Albert National Park (PANP), LaRonge Provincial Park; to the east of Amisk Lake and in the Representative areas/reserves. It is interesting to note that the areas where spray operations have taken place around Dore and Smoothestone lakes; the Big River area and east of the PANP around Montreal and Candle lakes

and in the northeast there is little evidence of mortality suggesting that directed salvage and a good treatment program has resulted in effective forest protection.

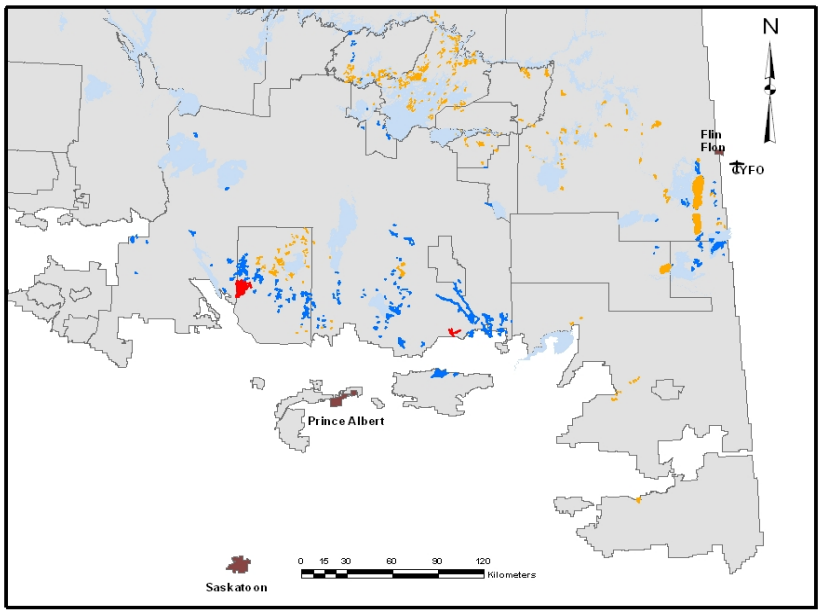


Figure 6. Cumulative mortality caused by Spruce Budworm defoliation in Saskatchewan, 2006.

In 2006 aerial surveys revealed an area of approximately 1,200 hectares of severe defoliation in the Cypress Hills inter-provincial park (Figure 7). Intervention is being considered in 2007.

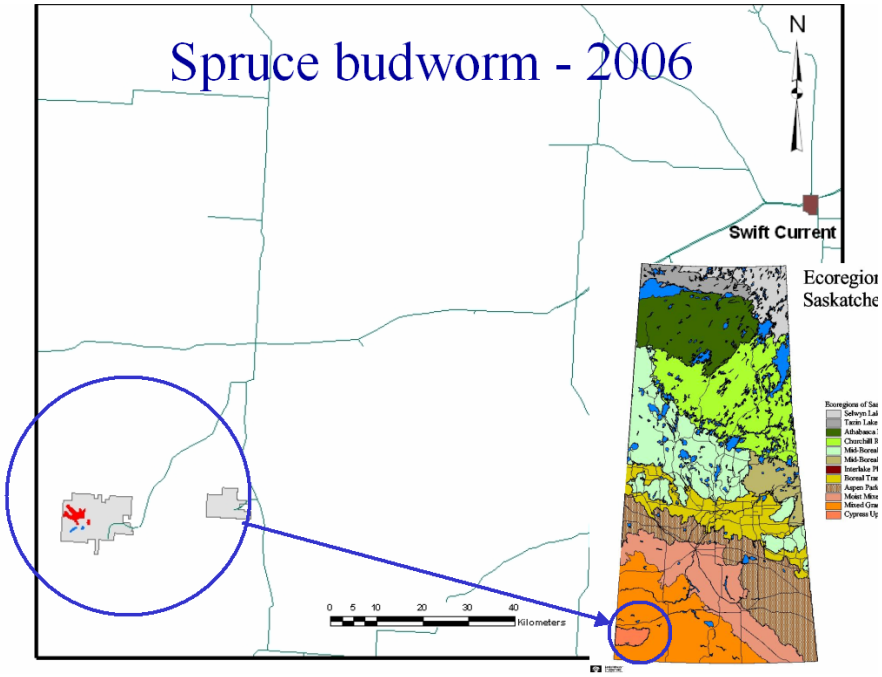


Figure 7. Area of severe Spruce budworm defoliation detected in the western part of the West block in the Cypress Hills Inter-provincial Park in Saskatchewan.

FOREST TENT CATERPILLAR *Malacosoma disstria* Hübner

Outbreaks of the forest tent caterpillar *Malacosoma disstria* (FTC) occur about every ten years within the range of the preferred hosts (poplar, white birch, hard maple and species of oak). Trees are generally not killed during FTC outbreaks but volume losses can be significant. In Saskatchewan, there is significant interest in aspen as a commercially important species in the forest. Forest companies in some regions implement active management of the aspen resource to fuel Oriented Strand Board (OSB) mills. FTC is also considered a significant nuisance in provincial parks, campgrounds, and municipalities. The 2006 aerial surveys did not detect defoliation in any of the commercial forest regions of Saskatchewan.

As part of an early detection and response policy, a network of pheromone monitoring traps were established in 2007. Twenty (20) trapping sites were established in a grid across the commercial forest. In each location, two Multilure traps baited with the Forest tent caterpillar pheromone[1]. A number of these locations were incorporated into the Canadian Forest Service Climate Change Impacts on the Productivity and Health of Aspen (CIPHA) plots. Trap counts ranged from 15 to 114 (Figure 8).

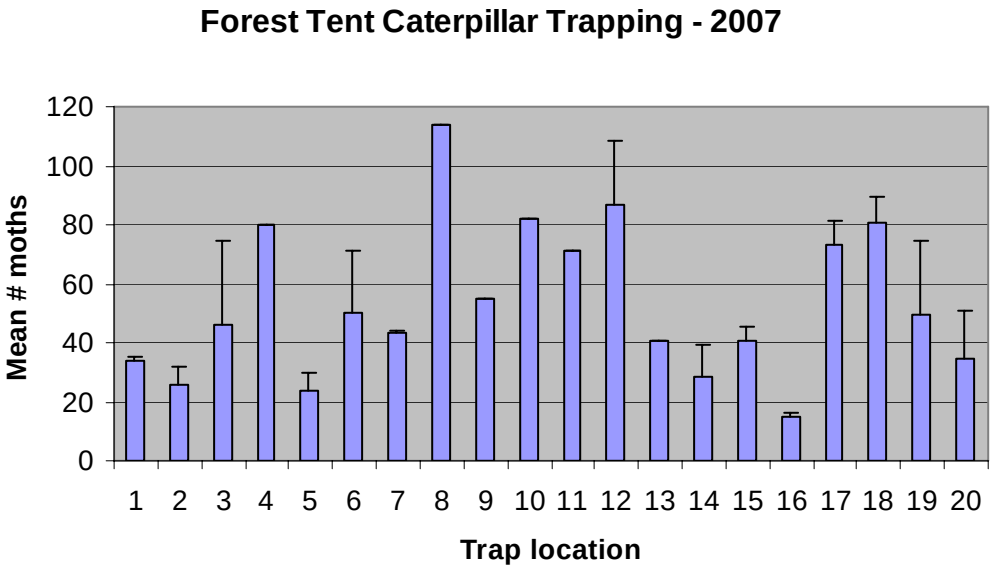


Figure 8. Mean forest tent caterpillar trap catch (+SD) collected from monitoring traps in Saskatchewan 2006. Note: In each of sites 4, 8, 9, 10, 11 and 13, one of the two traps trap was down (n=1).

[1] Product # L3-0508/000. PheroTech Inc. 7572 Progress Way, Delta, British Columbia V4G 1E9

ASPEN DECLINE

In 2006 the extent and severity of aspen decline – the phenomenon of general poor health in aspen, as indicated by crown thinning or large areas of foliage-free, red foliage or dead tops, is significant. Aerial surveys detected an area 68,057 hectares of aspen decline in 2006. Decline is most evident in the western hardwood and island forests but is also becoming visible in eastern SK (Figure 9).

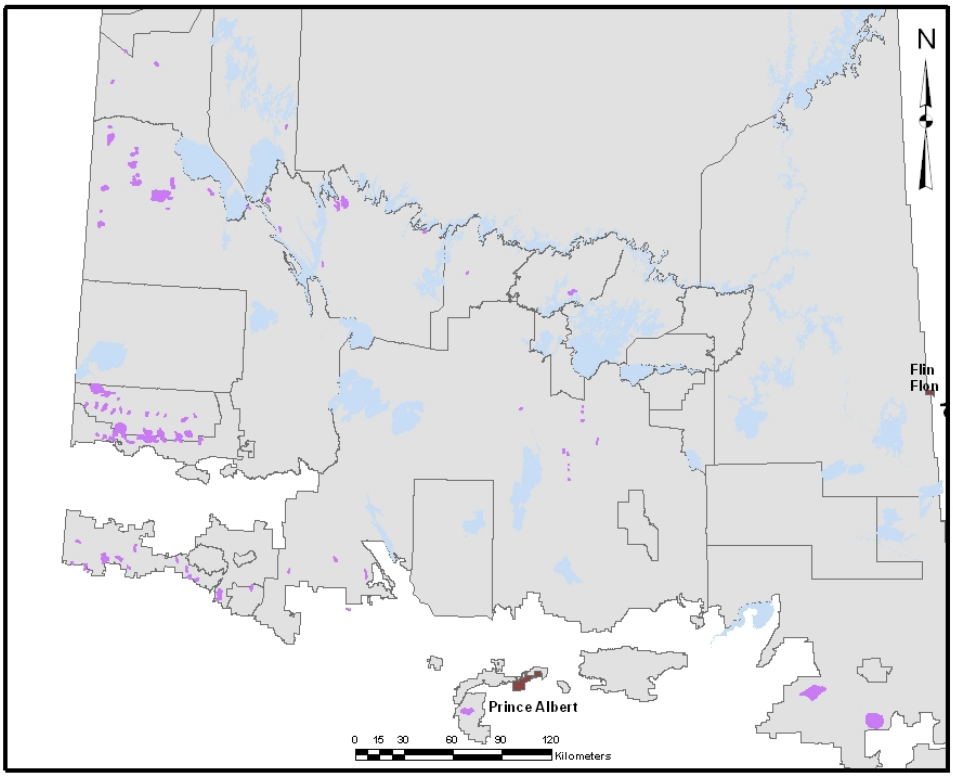


Figure 9. Distribution of areas of Aspen decline observed in aerial surveys in Saskatchewan in 2006.

It is generally recognized that this condition results from the cumulative impacts of periodic defoliation by insects of diseases as well as the negative impacts of environmental conditions such as drought. Although 2005 aerial surveys did not detect FTC defoliation in any of the commercial forest, aspen (*Populus tremuloides*) and Balsam poplar (*Populus balsamifera*) defoliation occurred due to an increasing incidence of foliar diseases likely as a result of the cool wet summers of 2004 and 2005. Ground checks of extensive areas of poor aspen condition revealed significant areas of leaf spot disease *Marssonina populi* infection as well as infection in Balsam poplar caused by the leaf blight *Linospora tetraspora*. The overall poor health of aspen in many areas continues to be a major concern in Saskatchewan. In 2007 SE plans to set up aspen health plots to monitor aspen condition across the province.

JACK PINE BUDWORM *Choristoneura pinus pinus*. Freeman.

Photograph: R. McIntosh, SE.

Jack pine budworm is the most significant defoliator of Jack pine forests in Saskatchewan. The last major outbreak started in 1984, reached a peak in 1986 and collapsed in 1987 (Brandt and Amirault 1994).

In 2004 a network of 16 trapping sites was established to measure baseline trap catches in susceptible forests in Saskatchewan. At each site a cluster of three Multipher™ non-saturating traps were set up and the total number of moths trapped was recorded. In 2006, this network was expanded to cover a total of 25 sites located throughout the commercial forest zone.

In 2006 aerial surveys detected what appeared to be defoliation in an area approximately 1,367 hectares to the northeast of Lac LaRonge just south of the Churchill River (Figure 10). It is suspected that this may be Jack pine budworm but due to remote location, it was not confirmed on the ground. In 2007 SE will continue to closely monitor this area.

Figure 10. Area of Jack pine budworm defoliation (unconfirmed) detected in 2006 surveys.

In 2006 monitoring trap catches were pooled into nine (9) regional clusters based on geographic similarity where trap locations were relatively near to each other (Figure 11). There were three distinct locations where moth catches were quite elevated in comparison to other locations sampled in 2005:

Cluster #1 - Nisbet Island forest near Prince Albert;
Cluster #5 - Canwood Island forest; and
Cluster #9 - Meadow Lake Provincial Park.

Interestingly, all these areas are fringe or island forests.

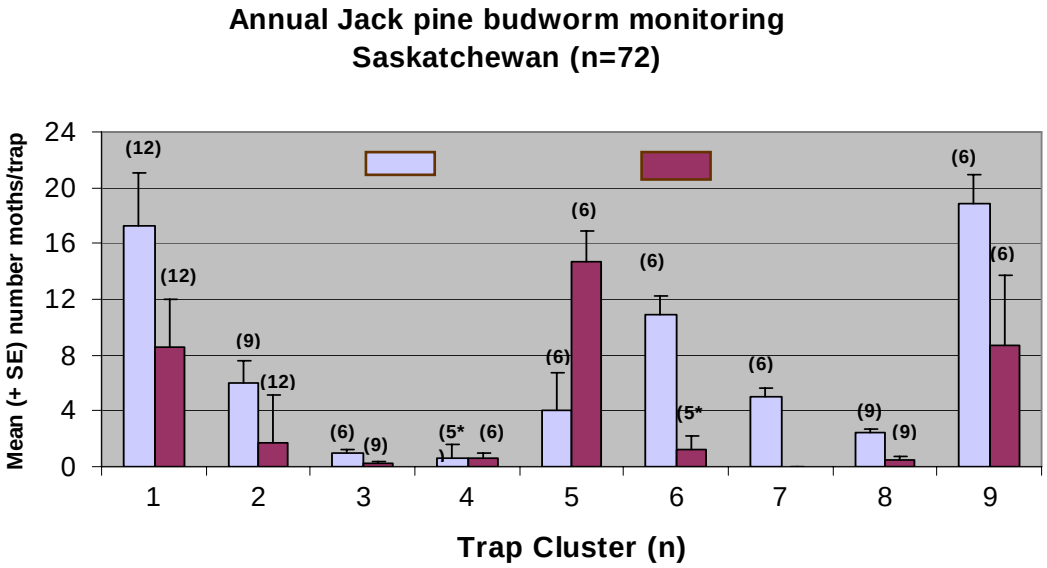


Figure 11. Mean number of moths per trap in each of 9 pooled trap site locations. Trap cluster 1 comprises all traps pooled from 4 sites (for a total of 12 taps) in the Nisbet island forest area; Trap cluster 5 comprises pooled mean of two trapping sites in the Canwood Island forest area; and cluster 9 comprises pooled mean of two trapping sites located in or near the Meadow Lake provincial park. Note: (12) represents the number of traps per cluster

LODGEPOLE PINE DWARF MISTLETOE *Arceuthobium americanum* Nutt. Ex Engelm.

The lodgepole pine dwarf mistletoe *Arceuthobium americanum* (DMT) is the most significant pest in Jack pine *Pinus banksiana* Lamb. forests in Saskatchewan.

In 2006, Provincial standards and guidelines were completed drafted and submitted to public review. These documents will be gazetted and released in 2007.

Photograph: R. McIntosh.

Eastern Larch Bark Beetle - *Dendroctonus simplex* Hopkins

Mortality associated with increased levels of Larch bark beetle *Dendroctonus simplex* (LBB) activity was first detected in the 2002 aerial surveys. Since then, the extent and severity of eastern larch bark beetle infestation has increased. In 2004, an additional area of 225 hectares was mapped bringing the total to just over 2,103 hectares. In 2005, an additional 12,952 hectares of new damage was mapped bringing the total to 15,055 hectares. By 2006 the total cumulative area of larch infested and/or killed exceeded 94,000 hectares (Figure 12). The distribution of the damage is scattered throughout the forest fringe area in the southern part of the mid-boreal lowland and the Nisbet and Fort a la Corne island forests. Pockets of infestation can be found from Cumberland house in the east to Meadow Lake in the west.

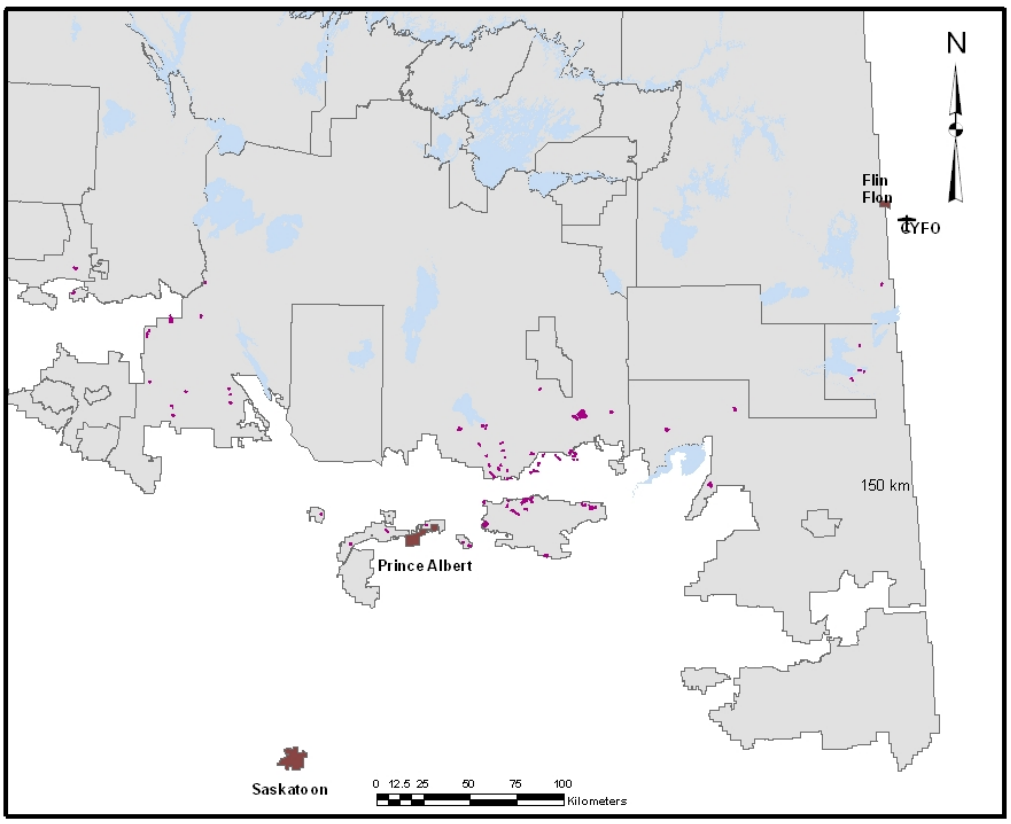


Figure12 . Area of eastern Larch beetle infestation 2006.

INVASIVE INSECTS AND DISEASES OF THE BOREAL FOREST

DUTCH ELM DISEASE MANAGEMENT

Dutch elm disease (*Ophiostoma novo-ulmi* Brasier) (DED) was first confirmed in Regina, Saskatchewan in 1981. Since then, the disease has spread westward along the Red Deer and Carrot river valleys in the northeast and along the Qu'Appelle valley in the east and the Souris river in the southeastern corner of the province and now extends approximately 450 km westward throughout the southeastern portion of the province (Figure 13).

DED Management Program

The major components of the provincial DED management program include:

- **Legislation** - Currently, DED management activities are administered and enforced subject to *The Forest Resources Management Act.*, and The Dutch Elm Disease Regulations.

- **Public awareness and education** - Roadside signs; information leaflets; DED Info line 1 (800) SASKELM; communications campaign SDEDA, SE, & SOS ELMS.

- **Cost-share communities** - SE has entered into partnership with a total of 40 communities to share the costs of program delivery (e.g. elm inventory, staff training, pruning, elm disposal site maintenance regeneration and education/communication.). To qualify for the cost-share program, communities must have 400+ native elm trees and 800 + residents.

- **Surveillance** - BioForest Technologies Inc. conducts 2 surveys (typically late June or early July and August) to detect DED symptoms. Surveys are conducted in 43 communities meeting the 400 elms and 800 resident criteria. This accounts for about 85% of urban elm population in Saskatchewan. Cities with a population exceeding 15,000 residents (Prince Albert, Saskatoon, Regina, Moose Jaw and Yorkton) conduct their own surveillance.

- **Sampling** - Samples are processed and DED infection confirmed at the Saskatchewan Agriculture Food and Rural Revitalization Crop Protection Laboratory in Regina.

- **Pruning** - Conducted annually prior to and following the annual ban which runs from April 1-August 31

- **Buffers** - Currently buffer zones at a 2 km radius have been established around large urban elm populations such as Regina, Estevan and Fort Qu`Appelle. Buffers are also established around the communities of Tisdale and Indian Head. In 2006, SE continued to work on expanding the Regina and city of Moose Jaw buffers.

- **Elm tree sanitation** - Removal of diseased and hazard elms in communities and buffer zones by SE under contract.

- **Beetle trapping** - To monitor elm bark beetle populations in communities. Also, Multilure™ baited traps are located along the Saskatchewan/Alberta border to monitor for European Bark Beetles.

- **Basal trunk treatment –** Applications of Chlorpyrifos® (Dursban) to reduce elm bark beetle populations.
- **Research –** SE partners and collaborates in Research and development initiatives that help improve DED management services.

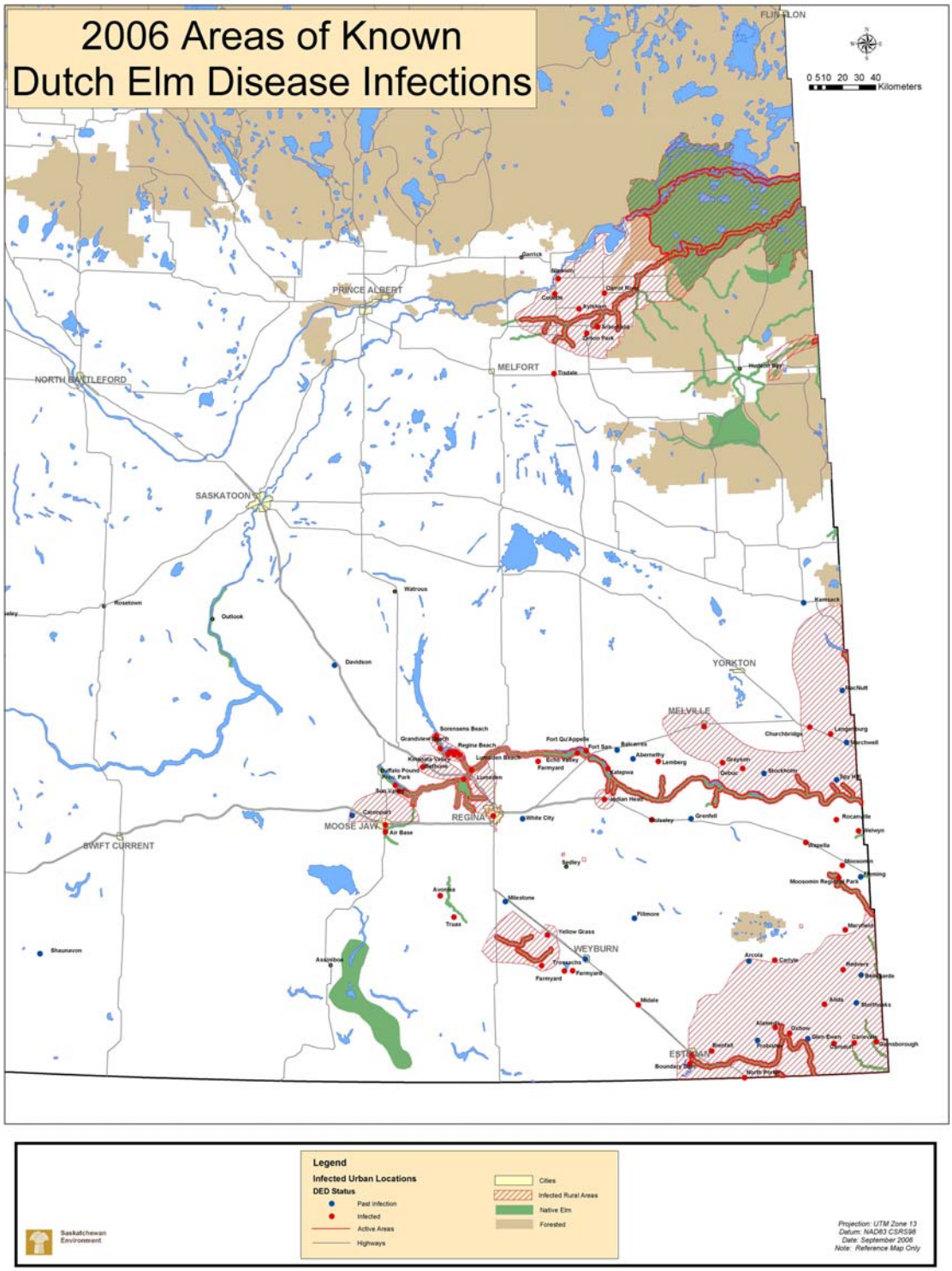


Figure 13. Extent of the spread of Dutch elm disease in Saskatchewan by 2006.

2006 Program Summary

DED continues to spread throughout the province. In 2006, the total number of trees removed was 386. This figure is somewhat lower than the 451 trees removed in 2005. In 2006, the number of trees removed in the municipalities was similar (145 in 2006 as compared to 154 in 2005). However, the distribution of these diseased trees was different. There were significant **decreases** in the Town of Lumsden and community of Regina Beach, while in the town of Carnduff and the resort villages of Katepwa and Fort Qu'Appelle there were **significant increases**. In these areas SE anticipates a growing problem due to proximity of native source of infection and distribution of diseased trees among these communities.

The number of infected trees marked for removal in buffers was significantly lower in 2006 (245) as compared to 2005 (297). The buffers continue to be expanded to protect the cities of Regina and Moose Jaw. In 2006, only two (2) DED positive trees found in the City of Regina, while the cities of Saskatoon, Yorkton, Prince Albert, North Battleford and Swift current remain disease-free

Table 4. Total number of elm trees removed from Saskatchewan municipalities and buffer areas, in 2005 as compared to 2006.

	NO. OF ELMS REMOVED	
LOCATION	**2005**	**2006**
MUNICIPALITIES (DED; HAZARD)	154	145
BUFFERS		
Regina	119	45
Estevan	33	14
Fort Qu'Appelle	42	70
Moose Jaw	60	23
Indian Head	41	87
Tisdale	2	2
BUFFER TOTALS	**297**	**241**
TOTAL	**451**	**386**

Mountain Pine Beetle - *Dendroctonus ponderosae* Hopkins

Photograph: Canadian Forestry Service

The mountain pine beetle *Dendroctonus ponderosae* (MPB) is the most significant insect killing pine forests in western North America. In Saskatchewan, MPB is native to and threatens the old Lodgepole pine Pinus contorta stands growing naturally in the Cypress Hills inter-provincial park (SK/AB). The first infestations were discovered in the Cypress Hills area in Southwestern Saskatchewan in 1980. The outbreak continued to increase through the 1980's until populations dropped to incipient levels in 1986 (Brandt and Amirault 1994). However, this species in not native to the northern forest.

The Threat to Saskatchewan

There is a significant risk to Saskatchewan forest ecosystems. The mountain pine beetle outbreak, which is currently decimating lodgepole pine in British Columbia, has spread east of the Rockies into western Alberta. Incipient populations in southern Alberta (see the Alberta report 2006) are building and outbreaks in the Wilmore wilderness and Jasper area are threatening to spread through the hybrid zone where the natural range of Lodgepole pine overlaps that of Jack pine and spread into the western boreal forest. There is sufficient scientific evidence (Safranyik and Linton 1982; Cerezke 1995) that mountain pine beetle can colonize and breed in Jack pine.

Current estimates reveal the commercial forest zone in Saskatchewan contains nearly 700,000 hectares of 80+year old Jack pine forests, highly susceptible to mountain pine beetle. These forests have an estimated commercial value of $1.1 billion. A further 1 million hectares are approaching a susceptible age. If mountain pine beetle becomes established in the boreal forest, the outbreak could spread throughout the range of boreal Jack pine extending through the Prairie Provinces, Ontario and Quebec to eastern Canada. Preliminary risk assessment exercises have been undertaken to identify the distribution and extent of susceptible stands and their connectivity across the landscape (Figure 14). Saskatchewan Environment also supports research into the development of host suitability and connectivity models which can be integrated with the climate suitability models currently being developed by Canadian Forest Service.

Monitoring susceptible forest cover – Cypress Hills

In 2006, pheromone baited Lindgren multiple funnel traps (Lindgren 1986) were deployed as an early detection system in the Center and West blocks in the Cypress Hills Inter-provincial Park. Ground surveys are conducted to monitor trees around traps for evidence of MPB. All insects

collected in traps are sent in to the Provincial Forest Insect and Disease Expert for identification. As of the time of this report, trap catches are still to be processed. In 2006 SE conducted systematic aerial surveys to detect infested trees. Only two infested trees were found and verified through ground reconnaissance.

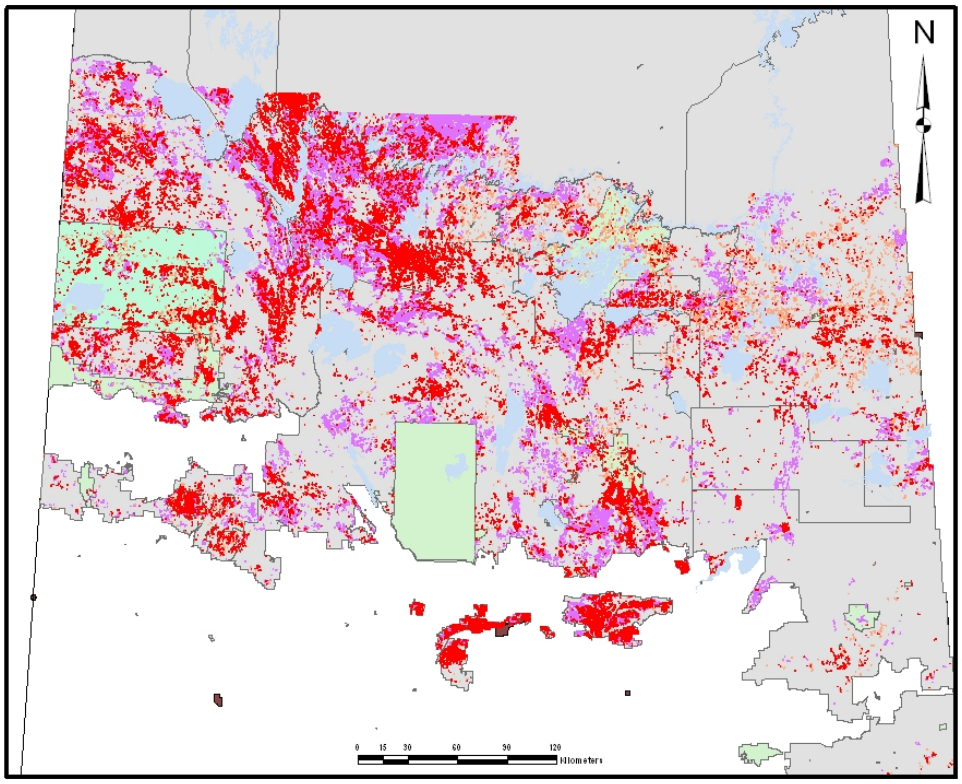


Figure 14. Distribution and connectivity of pure susceptible Jack pine (red) and stands where Jack pine is the leading species (purple) across the landscape in Saskatchewan.

Saskatchewan Strategy & Response

A comprehensive Mountain pine beetle strategy has been developed as part of the overall Forest Health Strategy for Saskatchewan. The two main components of the strategy focuses on prevention; early detection and rapid response; and the second part deals with mitigation of beetle impacts through beetle and forest focused approaches.

1. Prevention

a) Communications and Public Awareness

- Prevention through increased education/information of risks
- In 2005, SE installed 4 foot x 8 foot highway signs (Figure 15) to remind the public not to bring wood with bark into Saskatchewan. These signs were deployed

on the four major transportation routes: Trans Canada highway; highway 7, Highway 16 and highway 55 along the Saskatchewan/Alberta Border.

b) Regulation and Restriction

- On June 27, 2002, a restriction order was released invoking Sections 6c, and 24 of *The Forest Resources Management Act*, to prohibit the import, transport and storage of all pine logs and pine forest products with bark attached originating in the Provinces of Alberta, British Columbia and the United States until further notice. This restriction order remains active.

- Saskatchewan works together with other jurisdictions to develop invasive species pest risk assessment guidelines and to identify critical pathways so that region-wide standards and guidelines can be prepared to reduce the risk of human-caused introductions.

Figure 15. Roadside signs deployed at major highways along the Alberta–Saskatchewan border. Signs are located on Highway 1 (Trans Canada Highway), highway 7, highway 16 (Yellowhead highway) and highway 55.

2. Mitigation - Develop adaptive strategies to mitigate risk and impact

- Saskatchewan is partnering in research and development with Canadian Forest Service Scientists. Research is aimed at better understanding the risk to Jack pine by determining the suitability of Jack pine as host for Mountain pine beetle as well as re-evaluating susceptibility classes on the basis of age and bark thickness. In addition spatial analyses are being undertaken to review the distribution and extent of susceptible Jack pine forests in Saskatchewan. These data will be used to extend the habitat suitability predictions based on Coupled General Circulation Model (CGCM) climate change models so that preventive strategies can be initiated and implemented at the Forest Management Planning and operational level.

European Gypsy Moth – *Lymantria dispar*

Gypsy moth (*Lymantria dispar*) remains a species of significnant concern to hardwood trees in the commercial and urban forest. The Canadian Food Inspection Agency (CFIA) routinely deploy pheromone-baited traps to monitor presence of adults. In 2006 the CFIA continued ongoing monitoring efforts in Saskatchewan by deploying 189 pheromone-baited pherocon IIID traps.

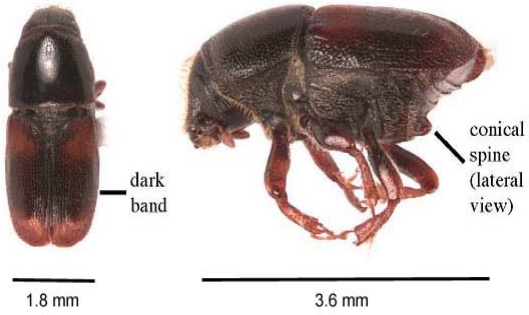
Photograph: R. McIntosh, SE

In 2006 four traps were confirmed positive. Two traps were located in Saskatoon – one trap contained 5 males and the other contained 4. Other positive traps, each containing one male moth, were located in Martensville just north of Saskatoon and one in the City of Regina.

In 2007, in addition to routine provincial monitoring, grid trapping around each of the positive trap locations in Saskatoon will be conducted at a density of 36 traps per square mile.

Banded Elm Bark Beetle – *Scolytus schevyrewi* Semenov

The banded elm bark beetle *Scolytus schevyrewi* is an exotic insect originating in eastern Siberia. In 2004 and again in 2005, 12-funnel Lindgren® funnel traps, baited with commercially available Exotic beetle bait[2], were deployed in 15 locations along the Southern Saskatchewan Border (Figure 16). In addition, the smaller European elm bark beetle *Scolytus multistriatus* (SEBB) bait was added to the trap to monitor for SEBB. Traps were set up at locations ranging from the Antler and Souris Rivers in Southeastern Saskatchewan to the Cypress Hills Inter-provincial park in the west.



To date, samples collected in 2004 and 2005 have been collected and processed. No *Scolytus schevyrewi* have been found in the traps. 2006 trap collections are still to be processed. With the first report of this species being detected in Medicine Hat, Alberta in 2006 (ASRD 2007), SE will increase monitoring efforts in the Southwestern part of the province in 2007.

[2] PheroTech Inc. 7572 Progress Way, Delta BC V4G 1E9

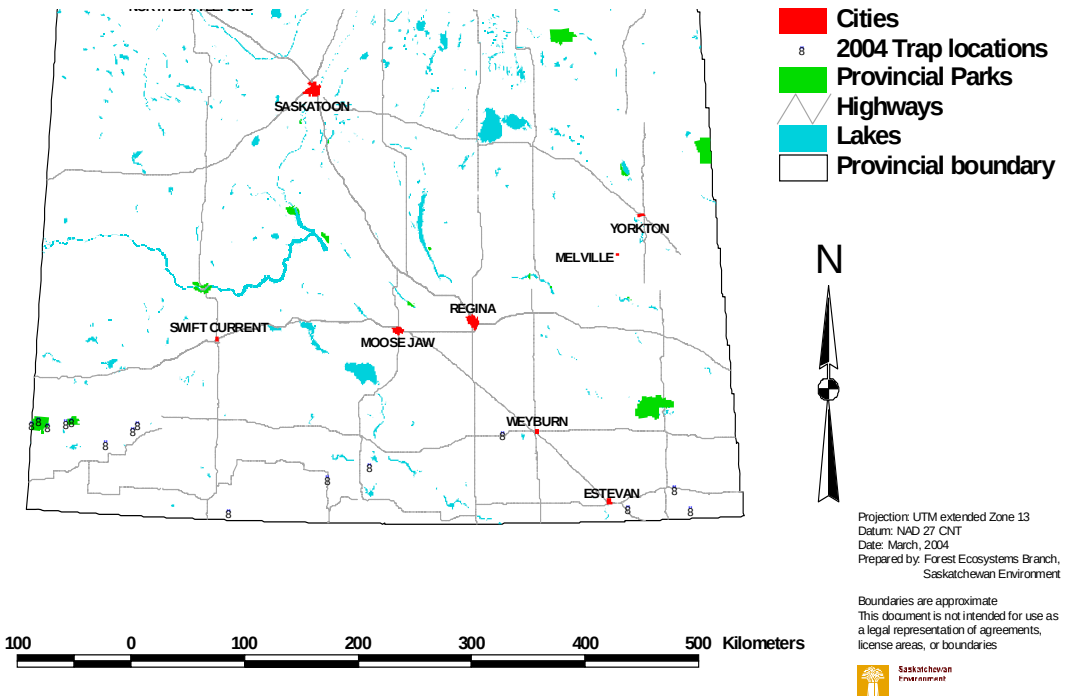


Figure 16. Distribution of *Scolytus schevyrewi* monitoring traps in Southern Saskatchewan 2004-06.

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Manitoba Report / Rapport du Manitoba

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Forest Pest Management in Manitoba – 2006

Abstract

Visit our Website: www.gov.mb.ca/conservation/forestry/

In 2006, approximately 47,168 ha (excluding Riding Mountain National Park) were infested by spruce budworm in Manitoba. The biosynthetic insecticide, Mimic® 240 LV (tebufenozide) was aerially applied to 17,650 ha. Within treatment blocks, the mean population reduction was 78% in the Eastern Region, 83% in the Northwest Region and 89% in Spruce Woods Provincial Forest. Egg mass surveys predict defoliation for 2007 to be extreme in the Spruce Woods Provincial Forest, to decrease in the Northwest Region, to increase in the Eastern Region and be moderate-to-severe in Riding Mountain National Park. Populations of jack pine budworm continue to be endemic throughout Manitoba's jack pine forests. Dutch elm disease (DED) extends throughout the entire natural range of the American elm in Manitoba and a total of 13,823 elm trees were removed between April 1, 2005 and March 31, 2006. DED survey crews marked approximately 14,613 trees for removal in 2006. In October 2005, an aerial survey was conducted to map root disease centres in a 3,000 ha timber operating area in Duck Mountain Provincial Forest. In 2006, ground surveys were conducted to assess the accuracy of the video mapping method and determine the timber volume loss to root disease.

La lutte contre les ravageurs forestiers au Manitoba – 2006

Résumé

Visitez notre site Web à l'adresse suivante : www.gov.mb.ca/conservation/forestry/
(En anglais seulement)

En 2006, la tordeuse des bourgeons de l'épinette au Manitoba a infesté quelque 47 168 hectares (à l'exclusion du parc national du Mont-Riding) au Manitoba. Des applications aériennes de l'insecticide biosynthétique Mimic® 240 LV (tébufénozide) ont été effectuées sur 17 650 hectares. Dans les blocs traités, la réduction moyenne des populations a été de 78 % dans la région de l'Est, de 83 % dans la région du Nord-Ouest et de 89 % dans la forêt provinciale de Spruce Woods. D'après les résultats des relevés des masses d'œufs, en 2007, la défoliation sera extrêmement grave dans la forêt provinciale de Spruce Woods, diminuera dans la région du Nord-Ouest, augmentera dans la région de l'Est et sera modérée à grave dans le parc national du Mont-Riding. Les populations de la tordeuse du pin gris demeureront endémiques dans l'ensemble des pinèdes grises de la province. La maladie hollandaise de l'orme sévit à l'échelle de l'aire naturelle de l'orme d'Amérique au Manitoba, et quelque 13 823 ormes ont dû être abattus entre le 1er avril 2005 et le 31 mars 2006. Les équipes de dépistage de la maladie hollandaise de l'orme ont marqué quelque 14 613 arbres en vue de leur abattage en 2006. En octobre 2005, un relevé aérien a été effectué afin de cartographier les foyers d'infection par des pourridiés dans une zone d'exploitation forestière de 3 000 hectares de la forêt provinciale de Duck Mountain. En 2006, des relevés au sol ont été effectués afin d'évaluer le degré d'exactitude de la méthode de cartographie vidéo et de déterminer les pertes de volume ligneux causées par les pourridiés.

Forest Pests in Manitoba – 2006

Spruce Budworm

In 2006 the spruce budworm, *Choristoneura fumiferana,* infestation continued in Manitoba. Moderate to severe defoliation occurred in the Northwest Region, Lake Winnipeg East area and in Spruce Woods Provincial Park and Forest in southwestern Manitoba and in Riding Mountain National Park. In 2006 spruce budworm defoliation polygons were roughly digitized directly into ESRI Arc View Shapefiles using Tablet PC's by the aerial observers during the detection flights. The total area of infestation, excluding Riding Mountain National Park, was approximately 47,168 ha. The area of infestation was 10,817 ha in the Northwest Region (Figure 1), 11,609 ha in the Eastern Region (Figure 2) and 24,742 ha in Spruce Woods Provincial Forest and Park (Figure 3). The area of defoliation in Riding Mountain National Park was not mapped in 2006.

Figure 1: Spruce Budworm 2006 Defoliation Northwestern Manitoba (10,817 ha)

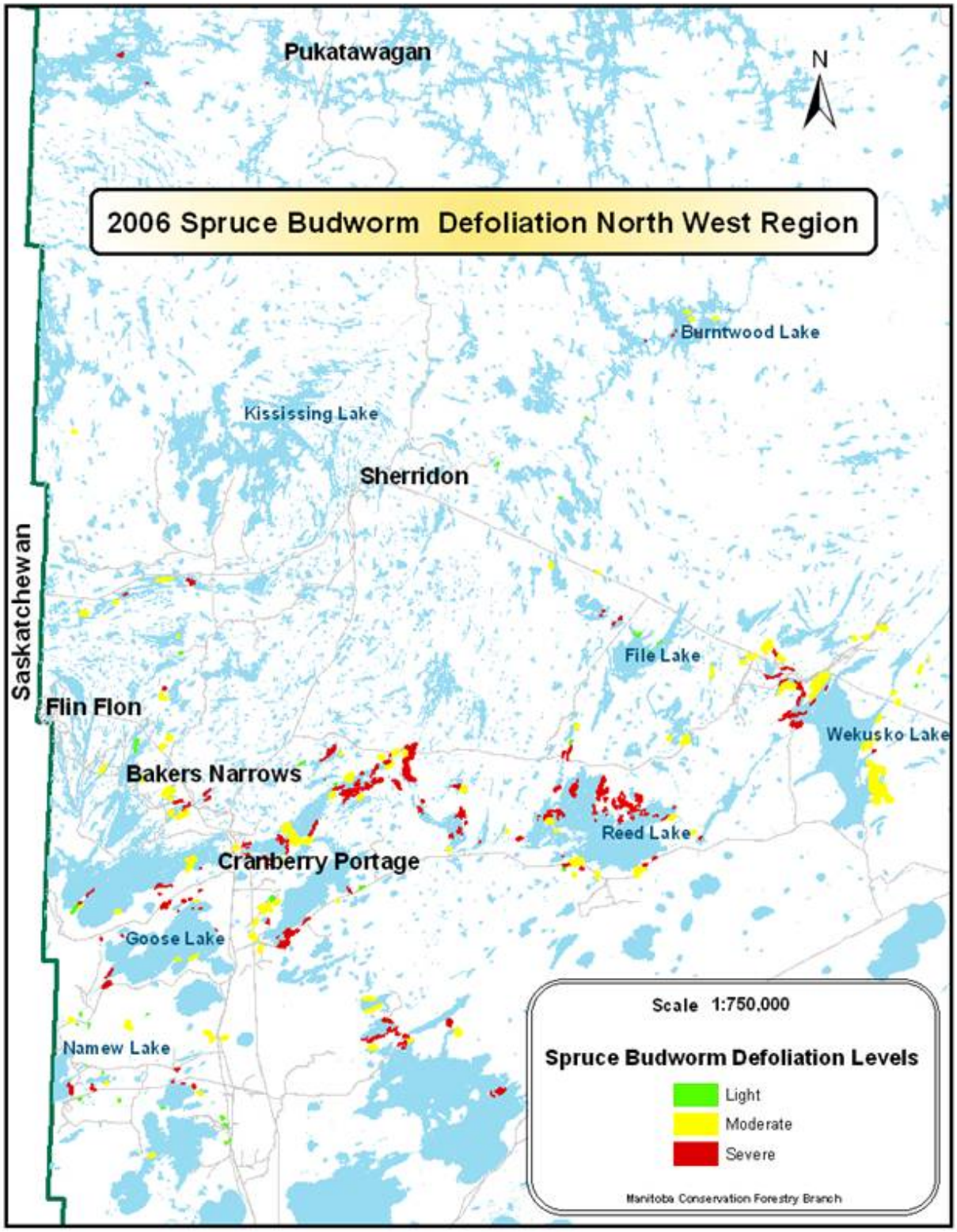


Figure 2: Spruce Budworm 2006 Defoliation Eastern Manitoba (11,609 ha)

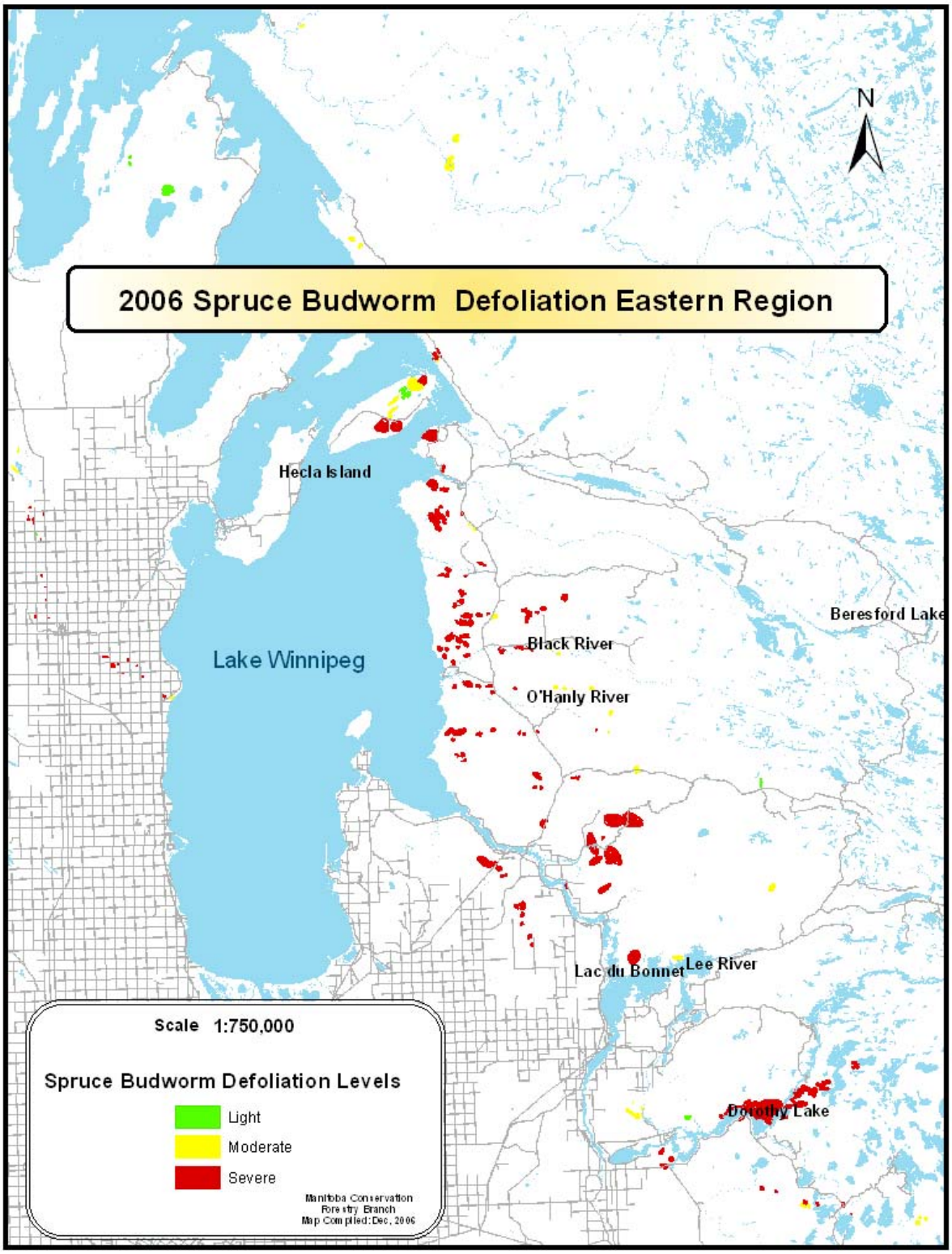
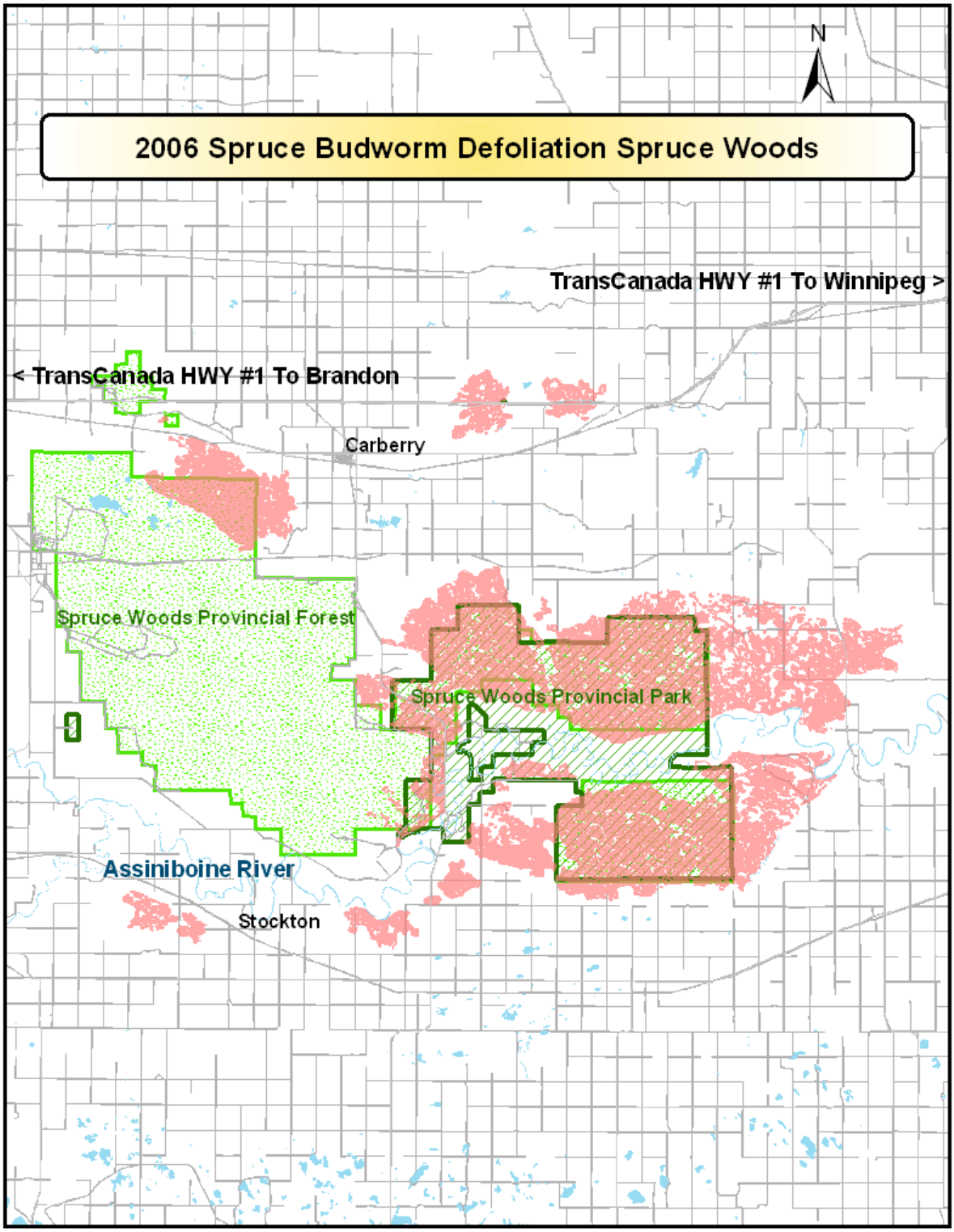


Figure 3: Spruce Budworm 2006 Defoliation Spruce Woods in Southwestern Manitoba (24,742 ha)



Based on the 2005 aerial defoliation survey and defoliation predictions derived from the 2005 egg mass surveys, an operational budworm suppression program was implemented in 2006 within the Tolko Industries Inc. Forest Management License (FML) in the Northwest Region, in Spruce Woods Provincial Forest and in the Tembec Inc. FML in the Eastern Region.

The biosynthetic insecticide, Mimic® 240 LV (tebufenozide) was aerially applied to 14,770 ha in the Northwest Region, 1,900 ha in the Eastern Region and 980 ha in Spruce Woods Provincial Forest. All spray blocks received a single application of 70 grams a.i. of Mimic® 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 product was applied by a team of two Air Tractor AT 602B fixed-wing aircraft each equipped with eight AU 4000 Micronair rotary atomizer nozzles. Thirteen ha were treated with *Bacillus thuringiensis* subspecies *kurstaki* (single application of 30 BIU/ha) at Birds Hill Provincial Park. The insecticide applications were carried out from May 27 to June 9.

Each aerial spray aircraft was equipped with the Satloc AirStar M3 real-time differential Global Positioning System (GPS) aerial navigation system. This system provided guidance over the treatment areas and allowed the pilot to boom off (cease spraying) when flying over designated exclusion zones (buffer areas and non-target sites). Second-by-second GPS and spray application data from each spray aircraft was imported into the Pesticide Application Information System. The use of this system has facilitated faster correction of spray application problems such as faulty flow controllers, as well as providing pilots with feedback on their performance after each spray session. A Cessna 182 aircraft was used for additional navigational support.

The spray blocks were opened for spray operations coinciding with white spruce shoot development index 4.0 (Auger's Class) and peak 4th instar larval development. Pre and post spray surveys were carried out to determine appropriate application timing and success of the spray application in controlling spruce budworm larvae.

The 2006 spray project was successful. Within treatment blocks, the mean population reduction was 78% in the Eastern Region, 83% in the Northwest Region and 89% in Spruce Woods Provincial Forest (Table 1). Generally, light defoliation occurred within the treated blocks, while moderate defoliation occurred in the untreated controls.

Table 1: Spruce Budworm - Percent reduction in larval numbers

Location	Area Treated	Pre Spray Larvae[b]	Post Spray Larvae[b]	Larval Mortality	Corrected Mortality
Eastern Region	1,900 ha [a]	17	4	78%	67%
Eastern Region Untreated Controls	N/A	14	9	33%	N/A
Spruce Woods	980 ha [a]	49	5	89%	80%
Spruce Woods Untreated Controls	N/A	30	15	50%	N/A
Northwest Region	14,770 ha [a]	7	1	83%	71%
Northwest Region Untreated Controls	N/A	12	6	50%	N/A

[a.] Treatment: Mimic, 70-gram a.i./ha
[b.] Number of budworm/45-cm branch

Defoliation assessments and egg mass density surveys to predict 2007 defoliation were conducted throughout the province during the month of August. In the Northeast Region severe defoliation is predicted in Paint Lake Provincial Park near Thompson. Defoliation is predicted to be similar to 2006 in the Northwest Region. Widespread moderate to severe defoliation is predicted for Riding Mountain National Park. Widespread severe to extreme defoliation is predicted for Spruce Woods Provincial Park. Following a number of years with no spruce budworm defoliation in Duck Mountain Provincial Forest, moderate defoliation is predicted within the Davey Lake area in 2007. In the Interlake area defoliation is predicted to be light except for the Arborg/Spruce Sands area where severe defoliation is predicted. The infestation in the Eastern Region is predicted to increase in 2007. See Tables 2 to 6 with reference to defoliation classes as follows:

Light
- up to 35% defoliation of current shoots
- based on <40 egg masses per 10 m^2 of branch area

Moderate
- 35% to 70% defoliation of current shoots
- based on 40 to 185 egg masses per 10 m^2 of branch area

Severe
- greater than 70% defoliation of current shoots and possible feeding on old foliage
- based on >185 egg masses per 10 m^2 of branch area

Table 2: 2006 Spruce Budworm Defoliation and Predictions for 2007 (Northeast Region)

Location	2006 Defoliation	2006 Egg Mass/10m^2	2007 Defoliation Prediction
Jenpeg	5%	26	Light
Paint Lake	55%	915	Severe
Setting Lake	15%	0	Light

Table 3: 2006 Spruce Budworm Defoliation and Predictions for 2007 (Northwest Region)

Location	2006 Defoliation	2006 Egg Mass/10m^2	2007 Defoliation Prediction
Saskatchewan River Forest Section	35%	142	Moderate
Flin Flon/ Bakers Narrows	5%	75	Moderate
Cranberry Lakes	40%	60	Moderate
South Grass River Park	45%	170	Moderate
Sherridon	5%	0	Light
Snow lake	80%	396	Severe

Table 4: 2006 Spruce Budworm Defoliation and Predictions for 2007 (Western Region)

Location	2006 Defoliation	2006 Egg Mass/10m^2	2007 Defoliation Prediction
Dawson Bay, L. Winnipegosis	0%	12	Light
Davey/Pelican Lakes, Duck Mt.	20%	92	Moderate
Riding Mountain National Park	30%	193	Severe
Spruce Woods Forest	55%	506	Severe
Spruce Woods Park	95%	1,078	Severe

Table 5: 2006 Spruce Budworm Defoliation and Predictions for 2007 (Interlake Region)

Location	2006 Defoliation	2006 Egg Mass/10m^2	2007 Defoliation Prediction
Grindstone Pt.	0%	0	Light
Hodgson	5%	0	Light
L. St George	15%	0	Light
Pine Dock	0%	0	Light
Spruce Sands	90%	667	Severe

Table 6: 2006 Spruce Budworm Defoliation and Predictions for 2007 (Eastern Region)

Location	2006 Defoliation	2006 Egg Mass/10m^2	2007 Defoliation Prediction
Birds Hill Park	60%	24	Light
Falcon Lake	0%	8	Light
Dorothy Lake	30%	256	Severe
Rennie River	45%	359	Severe
Lac du Bonnet	25%	12	Light
McArthur Falls	50%	125	Moderate
Nopiming Park	15%	0	Light
Sandy/Black/ O'Hanly Rivers	35%	163	Moderate
Rice River Road	35%	130	Moderate

Spruce budworm pheromone traps were placed at 33 locations throughout the province. Three MULTIPHER® 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. Average moth captures per trap increased in all regions (Table 7).

Table 7: Spruce Budworm Pheromone Trapping

Location	2005 Moth Capture/Trap	2006 Moth Capture/Trap	Percent Change
Northwest Region	365	490	+34%
Northeast Region	264	536	+103%
Western Region	60	142	+136%
Southwest Region (Spruce Woods)	1,357	1,943	+43%
Riding Mountain National Park	N/A	1,226	N/A
Interlake Region	243	379	+56%
Eastern Region	246	574	+133%

Dutch Elm Disease

The removal of diseased and declining trees marked in 2005 was completed. Provincial Dutch elm disease (DED) sanitation crews removed 8,889 trees. Of the 8,889 elm trees that were removed, 5,625 were within the Winnipeg DED buffer zone and 3,264 were removed throughout the remainder of the province. The City of Winnipeg removed 4,562 elms and Brandon removed 372 elms within built-up urban areas of the City. Total elm tree removals were 13,823.

The annual DED surveillance program started on May 15th and ended Sept 1st, 2006. Each of the 38 Cost Sharing Agreement communities was surveyed three times including the firewood survey in early spring. Each Winnipeg buffer zone rural municipality was completely surveyed twice.

The 2006 season was the third year using the computer tracking program called Urban Forest Information System (UFIS). UFIS program crashes/glitches and the need to train new staff slowed the data entry process.

Rapid removal of elms continued for a third year in the test communities. This is an operational research trial to determine whether rapid removal of the current year's diseased and declining trees and firewood will reduce the native elm bark beetle population significantly, which would ultimately lead to a reduction in DED incidence. Seven communities; Manitou, Teulon, Steinbach, Altona, Morris, Treherne, and Selkirk were included in the rapid removal program.

Provincial crews marked 5,342 (3,815 in 2005) elms for removal within the buffer zone around the City of Winnipeg. There were also 3,623 (3,377 in 2005) elms marked in and around the 38 cost sharing communities, bringing the total number of elms marked during the provincial summer survey to 9,496 (7,930 in 2005). In addition, 325 (411 in 2005) firewood piles were

identified for removal throughout the entire survey area. In the City of Winnipeg, 5,613 (3,397 in 2005) elms were marked for removal, 3,391 were diseased and 2,222 were declining elms. In addition, the City of Winnipeg issued 329 (264 in 2005) notices to properly dispose of elm firewood. The City of Brandon had 833 (1,112 in 2005) elms and 41 (57 in 2005) elm firewood piles identified for removal.

In 1982, Manitoba Conservation began using pheromone traps to monitor for the presence and distribution of *Scolytus multistriatus* at several locations across southern Manitoba. The DED survey program participates annually in trapping the smaller European elm bark beetle (EEBB). EEBB traps in the western region were located in Brandon and the International Peace Gardens and in the eastern region in Morris, Otterburne, and St. Adolphe. Riding Mountain National Park was included as an EEBB trapping location in 2006. Six specimens of the smaller European elm bark beetle were captured in rural Manitoba from 1989-2004. No EEBB were captured in 2005. In 2006, two *S. multistriatus* beetles were trapped – one in Otterburne and one in Brandon. No *S. multistriatus* beetles have been captured by the City of Winnipeg within the City limits since 1999.

Jack Pine Budworm

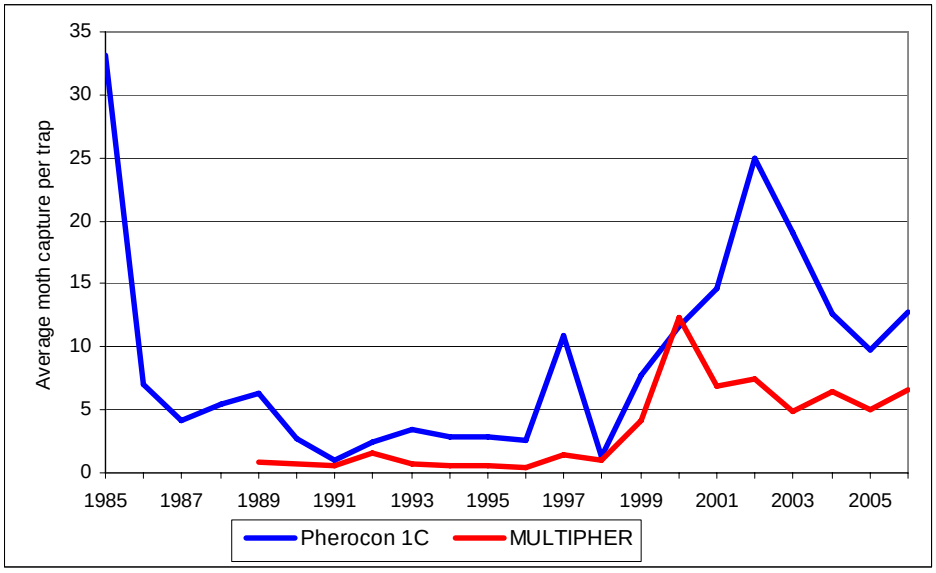
Defoliation by jack pine budworm, *Choristoneura pinus pinus*, in Manitoba, continues to be negligible throughout Manitoba's jack pine (*Pinus banksiana*) forests. Adult jack pine budworm males have been captured with pheromone baited traps since 1985. This trapping method is being evaluated as an early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

Eleven locations across Manitoba were monitored with pheromone traps in 2006. One location was harvested and will be relocated in 2007. Since 1989, two trap types, Pherocon 1C and MULTIPHER®, have been field tested for capture efficiency using a 0.03% or 100 µg concentration of pheromone lure.

In 2006, the number of male moth captures in both trap types increased slightly throughout the province (Figure 4). Moth numbers dropped in two sites, increased significantly in three sites and stayed the same in the remaining six collection sites. Shilo and Whiteshell decreased while Kississing Lake, St. Martin and Belair increased. The provincial average was 13 moths per Pherocon trap and 7 moths per Multipher trap.

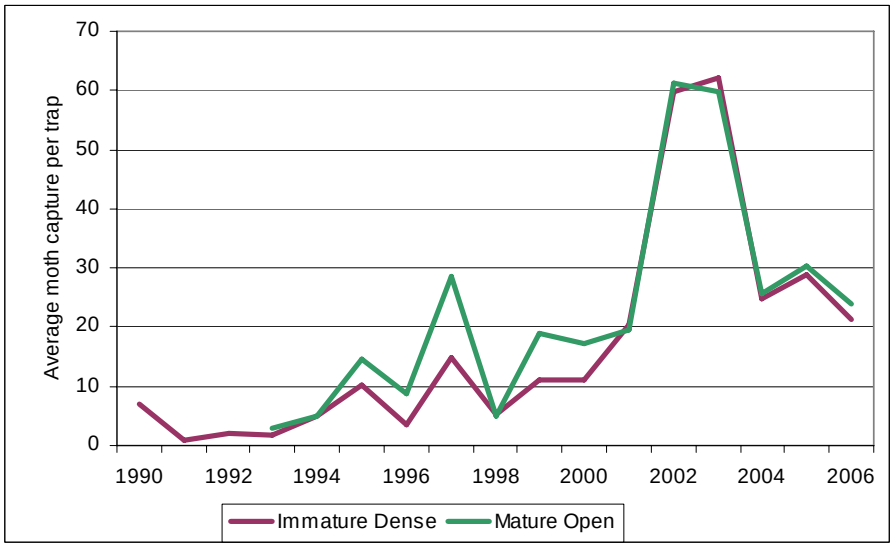
Branch assessment for shoot defoliation and egg masses were completed. No defoliation and no egg masses were recorded. Pollen cone bud levels for 2007 are predicted to be 39% on the branch tips.

Figure 4: Annual average capture of male jack pine budworm moths in two trap types



The Sandilands Provincial Forest was designated as a demonstration site for the Jack Pine Budworm Decision Support System in 1991. Fourteen pheromone locations were established and situated in immature, dense jack pine stands with three Pherocon 1C traps per site. An additional 10 sites were established in 1993 in mature/overmature, open-growing jack pine stands to compare jack pine budworm population levels between the two stand types (Figure 5). Until 2001, moth captures in the mature open stands were slightly higher than the immature dense stands. After that, moth capture levels have been almost equal between stand types as the population increased. The number of moths caught per Pherocon 1C trap decreased slightly to 22 moths per trap in 2006. No defoliation was recorded in the branch assessment but one egg mass was found at Bedford. There has been little difference in pollen cone bud levels between the immature/dense and mature/open jack pine stands.

Figure 5: Annual average capture of male jack pine budworm moths in two stand types



Bronze Leaf Disease of Poplar

In September 2002, extensive browning was observed throughout the crowns of tower poplar in the Carman area. This condition has been identified as bronze leaf disease of poplar caused by *Apioplagiostoma populi*. This disease causes branch death and eventually tree mortality in tower poplar and Swedish columnar aspen. In 2006, this disease spread significantly and infected many shelterbelt plantings of tower poplar throughout southern Manitoba.

Dwarf Mistletoe

Dwarf mistletoe is a parasitic flowering plant that causes tree mortality and is visible on infected trees as a witch's broom. Two species of mistletoe occur in Manitoba, *Arceuthobium americanum* on pine and *A. pusillum* on spruce and occasionally tamarack larch. Approximately 72,000 hectares of jack pine and an unknown area of black and white spruce are infected in the province. Following harvest, small groups and individual residual trees infected with dwarf mistletoe are often left on site and are a constant source of infection to the regenerating host species. Removing these diseased trees after site renewal can be costly and damaging to the regeneration. An alternative method of selectively treating dwarf mistletoe infected trees using herbicides was conducted to determine ease of application, efficacy and time to mortality.

Three registered herbicides were applied during June 2004 in two size categories of diseased residual jack pine and black spruce trees along several regenerating stand block edges. The herbicides were triclopyr, glyphosate and picloram/2,4-D using a basal spray, EZJECT and hack and squirt application method, respectively. The two size classes selected were 10 to 20 cm diameter breast height (dbh) and 20 to 30 cm dbh. Thirty trees were selected per size class per species and rated for vigour in each herbicide treatment. At the time of treatment, the majority of trees were healthy, some were stressed and a few were declining.

Tree vigour and mortality were evaluated for three consecutive seasons and the final assessment occurred in October 2006 (Table 8). Results were variable between size classes and tree species. The smaller diameter trees had higher mortality rates and jack pine was generally more affected than black spruce. The most effective herbicide was picloram/2,4-D although its application method was very labour intensive and resulted in stem breakage in the smaller diameter jack pine.

Table 8: Percent vigour in dwarf mistletoe infected trees three years post treatment October 2006

TREATMENT	TREE SPECIES	DBH CLASS (cm)	TREE VIGOUR (% of total)			
			Healthy	Stressed	Declining	Dead
Triclopyr (Basal spray)	Jack Pine	10 to 20	3.3	0	0	96.7
		20 to 30	23.3	10.0	6.7	60.0
	Black Spruce	10 to 20	3.3	0	10.0	86.7
		20 to 30	56.7	0	3.3	40.0
Glyphosate (EZJECT)	Jack Pine	10 to 20	12.9	9.7	3.2	74.2
		20 to 30	13.3	10.0	13.3	63.4
	Black Spruce	10 to 20	13.3	3.3	0	83.3
		20 to 30	20.0	0	3.3	76.7
Picloram and 2,4-D (Hack and squirt)	Jack Pine	10 to 20	0	0	0	100
		20 to 30	0	0	0	100
	Black Spruce	10 to 20	0	0	2.9	97.1
		20 to 30	0	0	0	100

Armillaria Root Rot

In October of 2005, an aerial survey using a helicopter mounted with video and GPS equipment was carried out to map root disease centres in the Clearwater Creek operating area in Duck Mountain Provincial Forest. Parallel flight lines were flown 170 metres apart at an altitude of 250 metres. A video camcorder (vertical view) combined with the Red Hen Video Mapping System was used to record openings in the forest canopy. Openings that had dead standing trees and the typical crisscross pattern of fallen trees were interpreted as root disease centres. During the 2006 field season, a ground survey was carried out to confirm root disease centres to determine the accuracy of the video interpretation. As well, volume plots were placed within and outside of root disease centres to determine volumes losses to root disease. The identification of root disease centres from the video was approximately 90% accurate. Volume losses to root disease for four survey zones within the operating area were 17%, 39%, 44% and 45%. The intensity and distribution of root disease will assist in establishing harvesting priorities for that operating area.

Eastern Larch Beetle

Outbreaks of the eastern larch beetle occurred throughout the boreal plain forests of Manitoba. Extensive tree mortality has occurred in many tamarack stands. Although the eastern larch beetle often attacks trees that are under stress, many of the infested stands were relatively healthy. It is suspected successive mild winters, resulting in increased over winter beetle survival, and stress

trees from excessive rainfall during the growing seasons of 2000 to 2002, have contributed to the outbreak. An outbreak of the current magnitude has not been previously reported in Manitoba. Harvesting has been occurring within larch beetle infested stands in the Eastern Region. The intended product is rough lumber for use at the steel mill in Selkirk, Manitoba. To date, approximately half of the beetle killed material has been unsuitable for lumber and has been processed into fuel wood.

Large Aspen Tortrix

Severe defoliation of trembling aspen by large aspe203.n tortrix occurred intermittently in southeastern Manitoba. There has not been an outbreak in this area of the province for 12 years.

Black Knot of Cherry

Black knot of cherry has become widespread and is causing severe damage to Shubert chokecherry in southern Manitoba. Shubert chokecherry has been planted extensively as an ornamental in many Manitoba communities. Nursery stock, grown in close proximity to heavily infested native chokecherry has often become infected prior to transplanting.

Mitigating the Effects of the MPB Disaster / Atténuer les effets du fléau du DPP

Presented by / Présenté par :

Tim Ebata, *MSc, RPF*

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Abstract

The negative impacts of the unprecedented mountain pine beetle outbreak currently ravaging B.C.'s pine forests have prompted a multi-disciplinary response by the provincial, federal and local governments. The presentation provides an update on the government-lead initiatives that are quantifying the impacts on communities and the environment.

Résumé

Les impacts négatifs de l'infestation sans précédent du dendroctone du pin ponderosa qui sévit actuellement dans les pinèdes de la Colombie-Britannique ont incité le gouvernement provincial, fédéral et local à mettre en œuvre un programme multidisciplinaire. Dans le cadre de cette présentation, je ferai le point sur les initiatives gouvernementales visant à quantifier les impacts de l'infestation sur les collectivités et l'environnement.

Mitigating the Impacts of the Mountain Pine Beetle Disaster

The mountain pine beetle (MPB) outbreak continues to be the most important factor affecting forest management in B.C. The current status of the outbreak is that it covers an area of over 9.2 million ha and the volume killed to date has been estimated at over 500 million cubic meters of lodgepole pine. The outbreak is projected to peak in 2013 and end by 2023 although it appears that it is growing faster than the models indicated. Overall, 90% of the susceptible pine volume (60 yrs and older) is expected to be killed. See the Provincial Level Projection research results at http://www.for.gov.bc.ca/hre/bcmpb/)

The sheer size of the outbreak has generated some interesting phenomenon. The most significant of these phenomena is the extensive mortality of young lodgepole pine throughout the outbreak area, young stands less than 30 years old, once thought to be non-susceptible, have suffered severe mortality. Trees as small as 8 cm dbh have been killed; the average diameter killed being about 15 cm dbh. Decades of intensive silviculture investments are now being lost. Long-term growth and yield and tree improvement installations are also under attack with some being protected partially with bole applications of Sevin. Another interesting phenomenon is documented success in survival and reproduction in mature white spruce. And finally, a citizen of Prince George photographed a cloud of MPB swarming above the tree tops near the Prince George airport demonstrating the incredible biomass of beetles in flight during mid-summer.

The impact of the beetle goes far beyond the mortality of the trees.

There are many direct and indirect economic impacts:

- Crown revenue (loss of stumpage revenue)
- Revenue to industry (loss of markets, lower quality/prices)
- Fall down (Timber Supply) – impact on local economies
- Oversupply of pine lumber and chips – decrease in competitiveness
- Road infrastructure – huge costs to maintain roads that were not designed to sustain the current volumes generated by the accelerated harvesting.
- Costs for rehabilitation – unsalvaged stands with poor natural regeneration will require some intervention for them to contribute to future timber supply.
- Lost investments in intensive silviculture caused by mortality of young pine

Impacts to the environment include:

- Accelerated cutting
  - Fish habitat – impacts stream temperatures and sediment loads
  - Wildlife habitat & access – loss of essential habitat for some species and increased access makes some species more vulnerable to hunting and poaching.
  - Water quality and supply – denudation changes water interception and retention rates. Faster melting increases sedimentation and reduces summer water supply.
- Water table – loss of live mature tree cover has reduced transpiration rate and soil remains wet longer.
- Slope stability – trees maintain slope stability.

Social impacts have been described as:

- Community stability – timber supply shortage in the near future.
- Limited options for economic diversification
- Health and social impacts – loss of jobs and revenue means increasing stress on the public
- FN community stability and land claims negotiations

To date, the response to mitigate the beetle outbreak's impacts have come in the form of the following accomplishments:

- MPBi ($40 million/ 6 yrs) – 2002-08
- BC MOFR Stewardship Research strategy
- Canada-BC Mountain Pine Beetle Funding, ($100 million/3 yrs – granted to BC) (see http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/can_bc_implement.htm)
- New Fed Funding ($ X million/ Y yrs – unknown conditions at this time)
- Economic diversification funding
- FN committees & negotiations
- 2006 MPB Action Plan – annual updates

The detailed description of the activities, budgets and action plans are provided in the **Mountain Pine Beetle 2006-2011 Action Plan** which is posted at**:**

http://www.gov.bc.ca/pinebeetle

A Risk Analysis of the Mountain Pine Beetle / Une analyse du risque lié au dendroctone du pin ponderosa

Presented by / Présenté par :

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Abstract

The Risk Analysis Framework recently developed for the National Forest Pest Strategy was applied to the mountain pine beetle situation in B.C. as a retrospective example for other provinces. The risk analysis incorporates the basic components of risk assessment, risk mitigation and communication. The MPB situation provides a nearly ideal scenario to use to demonstrate the application of a risk analysis with actual outcomes. Although too late to be applicable for B.C.'s situation, other provinces currently or potentially at risk can use the risk analysis components developed by B.C. to aid in development and management of their own MPB mitigation activities.

Résumé

Le Cadre d'analyse du risque récemment élaboré pour la Stratégie nationale de lutte contre les ravageurs forestiers a été appliqué à la situation du dendroctone du pin ponderosa (DPP) en Colombie-Britannique à titre d'exemple rétrospectif pour d'autres provinces. L'analyse du risque comprend les éléments de base de l'évaluation du risque, de l'atténuation et de la communication. La situation du DPP fournit un scénario quasi-idéal pour faire la démonstration de l'analyse du risque et de ses résultats concrets. Il est certes trop tard pour l'appliquer à la situation de la Colombie-Britannique, mais d'autres provinces actuellement menacées ou susceptibles de l'être peuvent utiliser à profit les éléments d'analyse du risque élaborés par la Colombie-Britannique pour appuyer l'élaboration et la gestion de leurs propres activités d'atténuation du risque posé par le DPP.

Risk Analysis for Mountain Pine Beetle – Lessons from BC

The National Forest Pest Strategy has decided to adopt a variant of the International Plant Protection Convention's (1995) Pest Risk Analysis (PRA) Framework. It consists of three basic components:

– Risk Assessment (how bad could it get & what are the potential impacts to various resources?)
– Risk Response (Mitigation) (what can we do?)
– Risk Communication (explaining the response)

We examined how the PRA methodology could be applied retrospectively to assessing how we would have assessed the mountain pine beetle. With the beetle's expansion eastward, well-beyond its natural range; we propose that BC offers a wealth of information to share with other provinces now threatened by this "native invasive".

In doing this retrospective analysis, it became clear that the PRA process was nearly identical to that used to justify very large allocation of funds for MPB management to the provincial Treasury Board. Funding was based on a risk analysis using the **projected** impacts if it got away. Unfortunately, since about 1996, the MPB population has grown to outbreak levels where little opportunity exists to limit its expansion. Projected impacts are now being compared to the actual impacts occurring across the affected area. B.C.'s experiences should provide excellent information to other provinces as they prepare for the possible eastward expansion of the beetle's range.

Breaking down the PRA into its three fundamental components and subcomponents produces the following:

1. Risk Assessment (Table 1)

- Outbreaks recorded since 1900's – we have a clear understanding of impacts to the hosts
- Scoping out the hazard:
  - Host susceptibility + Provincial forest inventory = hazard maps
  - Host susceptibility is a function of age, species, diameter, basal area, elevation, latitude.
- Risk Rating – CFS Shore/Safranyik Susceptibility and Risk Rating System
- Risk = *f* ("beetle pressure" and stand susceptibility)
- Resource assets at risk: Timber values ("easy" to quantify), environmental (harder), social (even harder).
- Stakeholders are defined (industry, governments, public, First Nations)

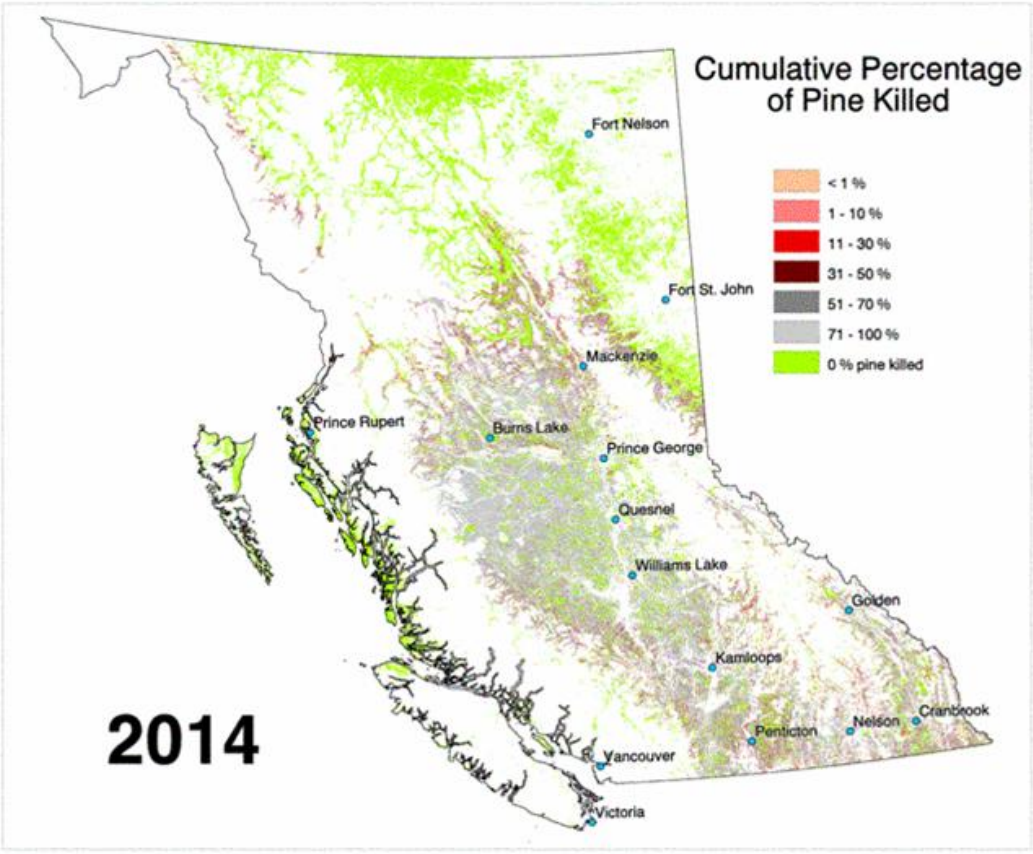
Table 1 - Risk Assessment Summary

Factors	Level of knowledge	Comments
Biology	Excellent	Seles/MPBsim
Host Susceptibility	Excellent	30+ yrs of CFS research
Impacts		
• Economic	Excellent	Stumpage & TS
• Environment	Good	In progress
• Social	Good	In progress

Risk Tolerance Thresholds

- Risk Thresholds vary by geographic area (Fig. 1)
- Function of host volume, susceptibility, access, values at risk, treatment capacity;
- Like a fire: some areas we fight aggressively; others we let burn
- Low threshold = high value timber, high susceptibility, low attack rates
- High threshold = low timber values, low susceptibility, low volumes, high attack rates

Figure 1 :



Overall Risk Tolerance

- Due to the past history of outbreaks and the very large volumes at risk, at a provincial level **risk tolerance for new outbreaks was low**
- An "easy sell" to TB
- TB provided $5-10 million/yr from 1985 – present to suppress beetle infestations
- Harder sell was to show value for $

Value of Mitigation Efforts

- Socioeconomic analysis (1993) (see http://www.for.gov.bc.ca/hfp/publications/00133/)
- Cost of management efforts vs. benefits obtained
- Beetle program costs vs. estimated difference in stumpage revenue between healthy trees and dead trees.
- Other benefits were less tangible – stable fibre flow, stable communities, tax revenue, orderly/planned harvest, non-timber values protected, etc.
- Current situation is actually quantifying the impacts on other values.

2. Risk Response

- Zonation based on most recent infestation data, risk assessment & treatment capacity (e.g., Emergency Bark Beetle Management Area map) (Fig. 2)
- The current map is posted at: http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/maps/ebbma/
- Suppression = 80 – 100% of brood destroyed
- Holding Action = 50-80%
- Salvage = <50%
- Also "No Action" & "Monitor"

Figure 2 :

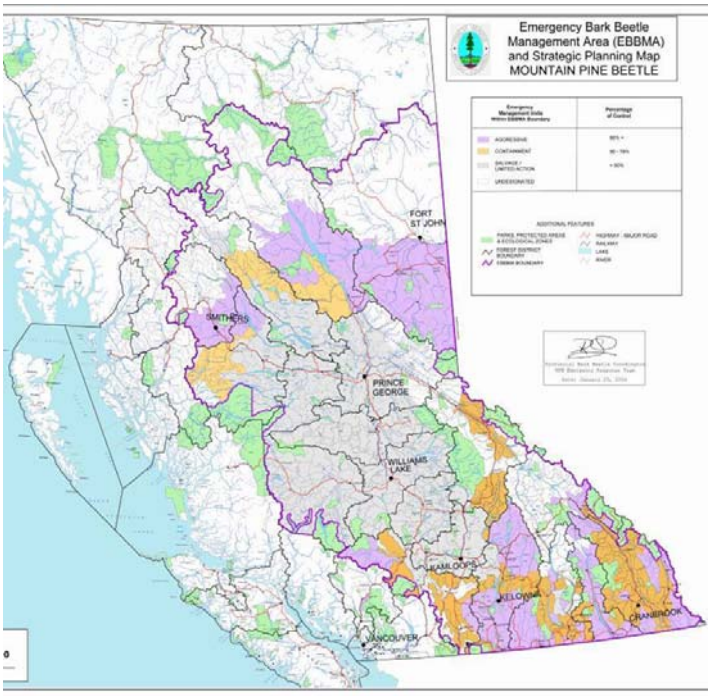


Table 2 – Risk Response Summary - Status of Mitigation Activities

Activity	Status	Comments
Aerial Detection	Fully operational	Overview & detailed methods
Ground Surveys	Fully operational	Standardized methods
Treatments	Fully operational	Suite of options
Monitoring	Fully operational	A performance measure

The activities described in Table 2 are on an operational timetable (Fig 3).

Figure 3:

3. Risk Communication

- 1993 Socio-economic analysis was printed and distributed (now on web)
- Bark Beetle strategic and operational planning procedures are described on the MOFR website along with current information on Spread Control efforts

Summary

- Risk Analysis process is useful for justifying funding requests & communicating risks
- BC examples & experiences can be used by other provinces
- Need good inventory of host
- Need better understanding of potential expansion rates in Jack Pine.

START PLANNING NOW!

Session II: Enhanced Pest Management Perspective

Chair: Anthony Hopkin

Natural Resources Canada, Canadian Forest Service

Séance II : Perspective de l'amélioration de la lutte contre les ravageurs

Président : Anthony Hopkin

Ressources naturelles Canada, Service canadien des forêts

Session II / Séance II

Monitoring Impacts of Pest Control Products on Key Microbial Communities of Forest Soils / L'effet des produits de lutte contre les organismes nuisibles sur les principales colonies microbiennes du sol forestier

Presented by / Présenté par :

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Abstract

Soil microbes contribute to the status of forest soils; the use of chemical or biological agents to control forest pests could conceivably change this vital aspect of the environment. In soils of the coastal Douglas-fir forest of British Columbia, we are assessing the long-term impact of tree removal and the 2-year impact of herbicide application, fungal spore application, and manual brushing on edaphic microbial communities. We have used PCR-DGGE analysis to profile genera-specific 16S rDNA genotypes as well as microbial genotypes involved in nitrogen fixation and methane utilization in forest soils. DGGE bands of interest have been extracted, re-amplified and sequenced. Micro-array analysis of forest soil DNA has been carried out using 16S and nifH 35-mer oligo sequences generated from eluted 16S and nifH DGGE band sequences. Both PCR-DGGE and micro-array analysis revealed shifts in microbial diversity. No significant changes in microbe PCR-DGGE assessed diversity was observed with any of the vegetation control methods applied. We have developed a database to catalogue nominal changes in microbial diversity.

Résumé

Les microbes du sol contribuent au rôle nutritif et fertilisant du sol forestier; l'utilisation d'agents chimiques ou biologiques pour lutter contre les organismes nuisibles de la forêt pourrait modifier à cet aspect vital de l'environnement. Dans le sol de la forêt côtière de Douglas taxifolié, nous étudions les effets à long terme du déboisement, ainsi que les incidences sur deux ans de l'application d'herbicides et de spores fongiques et du débroussaillement manuel sur les colonies

microbiennes édaphiques. Nous avons utilisé l'analyse PCR-DGGE pour recenser les génotypes ADNr 16S spécifiques des genres de même que les génotypes microbiens impliqués dans la fixation de l'azote et l'utilisation du méthane dans le sol forestier. Les bandes DGGE d'intérêt ont été extraites, amplifiées à nouveau et séquencées. L'analyse des puces à ADN de sol forestier a été réalisée au moyen de séquences d'oligo-nucléotides à 35-mer 16S et nifH générées par des séquences de bandes DGGE éluées 16S et nifH. Tant les analyses PCR-DGGE que les analyses des puces à ADN ont révélé des variations de la diversité microbienne. On n'a noté cependant aucun changement significatif de la diversité microbienne, évaluée au moyen de l'analyse PCR-DGGE, résultant des diverses méthodes de contrôle de la végétation utilisées. Nous avons élaboré une base de données afin de cataloguer les changements mineurs dans la diversité microbienne.

Monitoring impacts of pest control products on key microbial communities of forest soils.

Soil microbes contribute to the status of forest soils; the use chemical or biological agents to control forest pests could conceivably change this vital aspect of the environment. In soils of the coastal Douglas-fir forest of British Columbia, we are assessing the long-term impact of tree removal and the 2-year impact of herbicide application, fungal spore application, and manual brushing on edpahic microbial communities. We have used PCR-DGGE analysis to profile genera-specific 16S rDNA genotypes as well as microbial genotypes involved in nitrogen fixation and methane utilization in forest soils. DGGE bands of interest have been extracted, re-amplified and sequenced. Micro-array analysis of forest soil DNA has been carried out using 16S and nifH 35-mer oligo sequences generated from eluted 16S and nifH DGGE band sequences.

We examined the impact of a fungal biological control agent (*Chondrostereum purpureum*), using both universal and nifH primers-specific for *Frankia*, *Azospirillum*, *Herbaspirillum*, and nitrogen-fixers in the Rhizobiales family. There were no significant differences in the number of nifH DGGE bands between the treatments, suggesting that any negative effects from the different vegetation-management treatments on nitrogen-fixing community were transient. Both PCR-DGGE and micro-array analysis revealed shifts in microbial community composition.

We are also gathered information concerning the dynamics of microbial communities in 'baseline' situations. This is a necessary step, because variables such as tree loss, seral progression, and site productivity can otherwise confound impact assessments. We have detected fragments corresponding to the methane monooxygenase gene (pmoA2) of the so-called "uncultured forest soil methanotrophs". Several fragments corresponded to different site types or seasons. However, no significant differences in overall diversity of this group were observed. DGGE was also used to assay the nitrogen reductase (nifH) gene. Of 46 positive signals detected

with DGGE, subsequent incorporation into microarray tests found that 28 were actually ubiquitous, nine were seasonally variable in control and clear-cut plots, four were variable with respect to spatial distribution, and three (a *Paenibacillus* species, an unnamed member of the Intrasporangiaceae, and an unnamed N-fixing bacterial species) were specific to clear-cuts. Again, differences in the overall diversity were not significant. Regarding the impacts of tree loss, we examined fungal diversity among plots with different levels of tree retention, age, and N-fertilization using 18S rDNA primers and DGGE. We found no statistically significant differences in fragment distribution across the different sites; however, other functional groups continue to be evaluated.

In conjunction with the field work, we developed a database named the Edaphic Indicator Research Tool (EdIRT); the purpose of the database is to correlate microbial indicators with environmental conditions and impacts, linking microbial genetic sequences and other signals with details concerning the environment of origin. The database was developed using MS Access, but a free-source (MySQL) version is also maintained, and a PHP interface was developed to facilitate access to the database using standard browsers such as MS Explorer or Mozilla Firefox. The database currently incorporates data from separate indicator studies at the Pacific Forestry Centre and the University of B.C., and will hopefully accommodate further data from other studies when public access is developed.

Development and Validation of SprayAdvisor – A Decision Support System for Aerial Pesticide Applications / Élaboration et validation de SprayAdvisor, un système d'aide à la décision pour les applications aériennes de pesticides

Presented by / Présenté par :

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Abstract

SprayAdvisor is an advanced decision support system (DSS) being developed through an international collaborative venture among researcher groups based in New Zealand, the United States and Canada. The DSS system incorporates a fully integrated spray dispersal model (AGDSIP) and embedded dose-response relations to provide spatially explicit predictions of spray deposition, on-target efficacy and potential off-target effects. To date we have completed 15 case studies, including both fixed-wing and rotary wing scenarios, relative to validation for use under typical aerial herbicide application scenarios in Canada, as well as a dose-response experiment examining competing vegetation and crop tree response to 10 treatment levels of two different glyphosate formulations. Most recently, a major collaborative field study was also completed in Utah to examine the ability of linked near field and far-field dispersal models for predicting long distance transport and deposition of Btk. An overview of these studies will be provided in this presentation with a focus on how the DSS system may contribute to over-arching Canadian Forest Service goals of sustainable forest development and protection of ecological integrity.

Résumé

SprayAdvisor est un système d'aide à la décision (SAD) sophistiqué qui est actuellement élaboré dans le cadre d'un projet de recherche conjoint réunissant des groupes de chercheurs de la Nouvelle-Zélande, des États-Unis et du Canada. Le SAD incorpore un modèle intégré de dispersion de la bouillie de pulvérisation (AGDSIP) et des relations dose-réponse pour fournir des prévisions spatialement explicites des dépôts de pulvérisation, de l'efficacité du traitement et des effets potentiels à l'extérieur des zones ciblées. Jusqu'à maintenant, nous avons mené à bien 15 études de cas, dont des études portant sur des applications réalisées à l'aide d'aéronefs à voilure fixe et d'aéronefs à voilure tournante, dans le but de valider l'emploi du SAD dans des conditions conformes aux scénarios d'application aérienne courants au Canada, ainsi qu'un essai de type dose-réponse afin d'examiner la réaction de la végétation concurrente et des arbres d'avenir à 10 doses de deux formulations différentes de glyphosate. Tout récemment, une importante étude conjointe sur le terrain a également été réalisée en Utah pour examiner la capacité de modèles couplés de dispersion (champ proche et champ lointain) de prévoir le transport sur de grandes distances et le dépôt de B.t.k. Dans le cadre de cette présentation, nous passerons en revue ces études et nous nous attacherons à démontrer comment le SAD peut contribuer aux objectifs primordiaux du Service canadien des forêts d'assurer l'aménagement durable des forêts et de protéger l'intégrité écologique.

Development, Validation and Application of SprayAdvisor as a Decision Support System for Optimizing Aerial Herbicide Spray Programs

Introduction:

Aerial herbicide applications are economic and logistic imperatives for cost-effective control of competing vegetation in many of the most productive forest sites in Canada. Industrial economics, public opinion and forest certification programs induce requirements for continuous improvement in aerial herbicide applications such that the twin goals of silvicultural-effectiveness and environmental protection are realized to the fullest degree possible. Significant scientific knowledge and operational experience pertaining to deposition, fate and effects of aerially–released herbicides in Canadian forest management has been developed over many years. Aerial application methods are continuously improving, particularly as the result of recent technological developments including electronic guidance systems (e.g. AGNAV II), automated booms, differential global positioning systems (DGPS), geographic information systems (GIS), and remote sensing. Advanced knowledge and technologies are increasingly being incorporated into operational practice in Canada. However, full optimization of aerial herbicide spray programs could be greatly facilitated through the development and validation of decision support system (DSS) which fully integrates all of the best scientific and experiential knowledge with the

best technologies available. Fortunately, prior work conducted in New Zealand and the USA provides the basis for such a system, now referred to as the SprayAdvisor DSS. SprayAdvisor has the capability to utilize data captured through these advanced technologies and then process it through integrated spray dispersal (AGDSIP) and dose-response models to yield spatially explicit predictions of herbicide deposition, efficacy, off-target environmental effect contours and productivity. Remote sensing techniques, including satellite and digital image analysis, provide an effective means for post-treatment assessment which can be directly linked to SprayAdvisor outputs. As such, we have undertaken a three-year internationally collaborative research program with the overall goal of further developing, validating and applying the SprayAdvisor DSS for use in Canadian forest management.

Objectives

The goals of this research and development project are to conduct a comprehensive program of knowledge synthesis, gaps analysis, research and development as well as technology transfer leading to delivery of a decision support system and optimization of aerially released pesticide applications in Canadian forestry. The primary deliverable will be the SprayAdvisor Decision Support System validated for use in typical Canadian forestry use scenarios. The program will also assist in the development and application of a variety of other tools and techniques in design, conduct and monitoring of aerial spray programs including:

- Canadian Forest Management Database - providing direct access and full search capability for review of background scientific information
- Remote Sensing Technologies - including methods for utilizing digital aerial photography and near infra-red satellite imagery to monitor efficacy and phytotoxicity contours about herbicide treated spray blocks
- Integrated Technologies - potential use of differential global positioning systems and data, geographic information systems, and smart-booms for achieving silvicultural and environmental exclusion zones within herbicide spray blocks, or to facilitate aerial applications to groups of small spray blocks

Technological developments and scientific knowledge generated through this project will be captured through a series of reports to various funding agencies, journal publications and through direct technology transfer initiatives including a full scale demonstration site which can be used for field tours and a workshop targeted for transfer of the DSS to professional foresters, aerial applicators and regulators. SprayAdvisor DSS provides a mechanism for integrating all of these advanced technologies and scientific knowledge to enhance operational decision making, best management practices and environmental risk assessment methods. As such, our research objectives directly address the goals of sustainable development and environmental protection which are shared by the Canadian Forest Service and various collaborating and supporting agencies associated with this project.

Progress to Date

The following progress has been made against stated objectives:

Integrating Advanced Technologies

In recent years substantial developments in a variety of new technologies including differential global positioning systems (DGPS), geographic information systems (GIS), electronic guidance systems, automated booms and remote sensing have occurred, all of which have potential to enhance aerial herbicide applications. While all of these technologies are used to varying degrees by forest managers and aerial herbicide applicators, full integration in both concept and practice has generally been lacking. Initial studies under this research program were focused on assessing the potential for integrating a suite of modern technologies with a view to optimizing efficacy, cost-effectiveness, environmental protection and post-spray monitoring of aerial herbicide applications. Specific objectives were to:

(a) Evaluate the potential use of electronic guidance and automatic control of spray booms

(b) Assess the uniformity of herbicide deposition on target and depositional patterns about artificial exclusion zones

(c) Compare ground based DGPS tracking, digital and near-infrared satellite image analysis as methods for defining phytotoxicity contours

(d) Assess the potential to realize silvicultural exclusion zones within operational spray blocks.

A draft journal publication summarizing the results of this sub-study has been completed and will be submitted in the second quarter of 2007.

Fixed-Wing Application Case Studies

Post-treatment vegetation assessments have now been completed on 11 experimental spray blocks representing case studies for aerial herbicide applications made with fixed-wing aircraft. All case studies involved applications of glyphosate (Vision) herbicide using a fixed-wing aircraft (Grumman AgCat, piloted by Paul Hodgins of General AirSpray) equipped with an AGNAV2 electronic guidance system. Deposit measurements in both on-target and off-target areas were made via quantitative analysis of glyphosate deposition (total µg/collector) on numerous artificial deposit collectors placed within or adjacent to the spray blocks. Vegetation assessment data for efficacy and off-target phytotoxicity determinations were collected from the sampling transects and locations as used to determine pre-spray vegetation and chemical deposition in the respective year of treatment. Post-spray assessments included densiometer readings at two heights to assess reduction in shrub and herbaceous canopy layers, percent cover estimates and identification of dominant species in the shrub and herbaceous layer vegetation layers as well as stem counts and height estimates for dominant tree species in the riparian zone.

Change in percent cover by species and in average densiometer readings are being compiled and statistically analyzed by block to provide metrics of herbicidal efficacy which may then be assessed relative to on-target deposition measurements, efficacy as determined based on analysis of remotely sensed true colour digital and near-infrared satellite images as well as in comparison to site specific predictions derived from SprayAdvisor DSS. Comparisons of empirical versus SprayAdvisor predictions for on-target and off-target chemical deposition as well as potential non-target effects are ongoing.

Rotary Wing Application Case Studies

Monitoring of on-target and off-target chemical deposition as well as pre-spray vegetation community assessments were completed on six spray blocks near Timmins Ontario on sites managed by either Abitibi Consolidated Co. or Tembec Inc. Spray blocks received aerial chemical site preparation treatments of glyphosate herbicide (VisionMax or Catena) using a rotary wing aircraft (Bell 206B, piloted by N. Gagnon or W. Kay of Gateway Helicopters) equipped with an AGNAV2 electronic guidance system. During spray applications critical meteorological parameters (wind speed, wind direction, relative humidity and air temperature) were monitored using a Campbell Scientific CR10 datalogger and associated probes. Within each spray block, on-target deposit was measured using artificial deposit collectors installed at both the shrub canopy and ground level. Ground deposition was also monitored on transects through various exclusion areas (raptor nesting site, silvicultural exclusion to protect advanced regeneration) and in no-spray and riparian cut-reserve buffers. Final efficacy and remote sensing data will be collected for Ontario rotary wing case studies during the summer of 2007.

Most recently a research program focused on validation of SprayAdvisor in Alberta has been proposed and accepted. Principal investigators for this initiative are D. Thompson (CFS) and M. Mihajlovich (Incremental Forest Technologies) with financial and logistical support from a consortium of forest industries within the province. This research project is intended to provide empirical case study data for six rotary wing applications made under typical conditions of aerial herbicide applications in Alberta.

Comparative Dose Response

Vegetative dose-response relations required to verify SprayAdvisor predictions of efficacy and non-target phytotoxicity will be derived from a comparative dose-response study established in 2005. This small-plot ground-based study involves replicate (n=4) backpack spray applications of both Vision and VisionMax at ten different treatment levels ranging from (0 kg a.e./ha (controls)) through to full chemical site preparation rates. Pre-spray vegetation assessment techniques used in the dose-response study were parallel to those used in monitoring operational spray blocks. Second year post-spray crop tolerance and vegetation control assessments will be completed in the summer of 2007 and data will be analyzed using appropriate regression techniques. These data, in combination with larger paired operational spray-block comparisons conducted by

M. Mihajlovich in Alberta will provide an effective basis for comparative assessment of crop tolerance and efficacy on key crop and target species in Canada.

SprayTrans Validation Study

While the focus of this research to date has been on development and validation of SprayAdvisor for herbicide applications, studies have also been conducted which will facilitate extension to aerial insecticide applications. In this regard, a series of 20 spray trials designed to test and validate predictions of the SprayTrans model (based on linkage between AGDISP and CalPuff/CalMet models) was conducted in the fall of 2006 on the Dugway Proving Grounds near Salt Lake City Utah, involved. Although both AGDISP and CalPuff/CalMet have had extensive validation data sets collected to evaluate and understand performance in many situations, the assumptions made to couple the two models are not trivial and model predictions have not been previously validated. A total of 20 validation trials were conducted during the period of Sept. 8 -15, 2006 at the Dugway Proving Grounds, Dugway Utah. Trials were conducted under various meteorological conditions over a 2 km x 2 km experimental grid with extensive arrays for meteorological and tracer deposition. An AT-188 operated by Forest Protection Limited of Fredericton, NB fully instrumented with DGPS, electronic guidance and equipped with 4 AU 4000 rotary atomizers was employed for all spray applications. *Bacillus thuringiensis* (as FORAY 76B, Valent BioSciences) was utilized as the tracer. This experimental data set provides a sound basis for evaluating the potential to extend SprayAdvisor DSS to cover insecticide application scenarios.

Technology Transfer

Numerous presentations describing the development and validation of SprayAdvisor DSS have been made to various scientific meetings and workshops including annual presentations at the Pest Forum and at the Spray Efficacy Research Group International, presentations to the USDA Aerial Application Research Planning Conference, Ontario Vegetation Management Association and most recently to forest industry collaborators in Alberta.

In addition to these initiatives, research related to the aerial application of pesticides in forestry is being compiled in the Canadian Forest Management (CFM) (http://www.glfc.cfs.nrcan.gc.ca/cfpm) database. This information is being used as a basis for knowledge synthesis, review and gaps analysis. To date more than 200 records of published scientific information have been incorporated into the database and summaries of unpublished data and/or gray literature resident within the Canadian Forest Service have also been undertaken.

Hands-on training and technology transfer workshops are also currently being planned for both eastern and western Canada, the first of which is targeted for May/June 2008 in conjunction with the Tembec Forest Research Partnership at the Canadian Ecology Center in Mattawa, Ontario. The objective of these workshops is to ensure the widespread uptake and use of the SprayAdvisor DSS and associated technologies among key user groups including aerial applicators, forest industry, provincial and federal regulators.

Acknowledgements

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Further Information

For further information on this project, please contact D.G. Thompson (Ph.D.), Canadian Forest Service, Great Lakes Forestry Centre, 1219 Queen St. East, Sault Ste. Marie, ON P6A 2E5. Tel: 705-541-5646 dthompso@NRCan.gc.ca.

Élaboration, validation et application du SprayAdvisor, un système d'aide à la décision pour optimiser les programmes de pulvérisations aériennes d'herbicide

Introduction :

Les applications aériennes d'herbicides sont nécessaires sur le plan économique et logistique pour que la lutte contre la concurrence végétale dans nombre des stations forestières les plus productives du Canada soit rentable. Sous l'influence de l'économie industrielle, de l'opinion publique et des programmes de certification forestière, il est devenu nécessaire d'améliorer sans cesse les applications aériennes d'herbicides pour que se concrétisent le plus possible le double

objectif d'efficacité des interventions sylvicoles et de protection de l'environnement. Au fil des ans, les activités d'aménagement forestier menées au Canada ont permis d'acquérir des connaissances scientifiques et une expérience opérationnelle considérables en matière de dépôt, de devenir et d'effets des herbicides appliqués par voie aérienne. Les méthodes d'application aérienne ne cessent de s'améliorer, notamment grâce aux progrès technologiques récents, y compris les systèmes de guidage électronique (p. ex., AGNAV II), les rampes automatiques, le système de positionnement mondial différentiel (DGPS), les systèmes d'information géographique (SIG) et la télédétection. Les connaissances et les technologies de pointe sont de plus en plus intégrées aux pratiques opérationnelles au Canada. Or, l'élaboration et la validation de systèmes d'aide à la décision (SAD) qui intègrent parfaitement meilleures connaissances scientifiques et expérientielles et meilleures technologies disponibles pourraient faciliter grandement la pleine optimisation de programmes de pulvérisations aériennes d'herbicides. Fort heureusement, des travaux antérieurs menés en Nouvelle-Zélande et aux États-Unis ont jeté les bases d'un tel système, maintenant connu sous le nom de SAD SprayAdvisor. Le SprayAdvisor est capable d'utiliser les données obtenues grâce à ces technologies de pointe et de les traiter au moyen de modèles intégrés de dispersion de la bouillie de pulvérisation (AGDSIP) et de dose-réponse pour obtenir des prévisions spatialement explicites du dépôt d'herbicide, de l'efficacité du traitement, des contours des effets environnementaux hors-cible et de la productivité. Les techniques de télédétection, y compris l'analyse des images satellitaires et numériques, fournissent un moyen efficace d'évaluation post-traitement qui peut être couplé directement aux données de sortie du système SprayAdvisor. À cette fin, nous avons entrepris un programme triennal international de recherches conjointes dont le grand objectif est de parfaire, de valider et de mettre en application le SAD SprayAdvisor pour le mettre au service de l'aménagement des forêts du Canada.

Objectifs

Ce projet de recherche-développement vise à réaliser un vaste programme de synthèse des connaissances, une analyse des lacunes et des activités de recherche-développement et de transfert technologique aboutissant à la mise en œuvre d'un système d'aide à la décision et à l'optimisation des applications aériennes de pesticides sur les forêts du Canada. Son principal produit livrable sera le système d'aide à la décision SprayAdvisor dont l'utilisation sera validée dans les conditions caractéristiques des forêts canadiennes. Le programme contribuera également à l'élaboration et à l'application de divers autres outils et techniques en matière de conception, de réalisation et de surveillance des programmes de pulvérisations aériennes, y compris les suivants :

- Base de données sur la gestion de la forêt canadienne – outil offrant un accès direct à l'information scientifique de base et un moteur de recherche en texte intégral

- Technologies de télédétection – y compris des méthodes d'utilisation de photographies aériennes numériques et d'images satellitaires dans le proche infrarouge pour surveiller l'efficacité des pulvérisations d'herbicides et les contours de phytotoxicité dans les zones traitées

- Technologies intégrées – possibilité d'utiliser des systèmes de positionnement mondial différentiel (DGPS) et leurs données, des systèmes d'information géographique et des rampes intelligentes pour exclure des zones sylvicoles ou environnementales des superficies à traiter à l'aide d'herbicides, ou pour faciliter des applications aériennes sur des groupes de petites parcelles.

Les innovations technologiques et les connaissances scientifiques découlant de ce projet seront décrites dans une série de rapports présentés à divers organismes de financement et dans des publications spécialisées et seront également transmises directement par le biais d'activités de transfert technologique, y compris un site de démonstration pleine grandeur pouvant servir à des visites sur le terrain et un atelier visant le transfert du SAD aux forestiers professionnels, aux applicateurs de pesticides par voie aérienne et aux organismes de réglementation. Le système SprayAdvisor fournit un mécanisme pour réaliser l'intégration de toutes ces technologies et connaissances scientifiques de pointe afin d'améliorer la prise de décisions opérationnelles, les pratiques optimales de gestion et les méthodes d'évaluation des risques environnementaux. À ce titre, les buts de notre recherche contribuent directement aux objectifs en matière de développement durable et de protection de l'environnement que partagent le Service canadien des forêts et les divers organismes qui collaborent et appuient ce projet.

Progrès accomplis à ce jour

Voici l'état d'avancement de nos travaux :

Intégration des technologies de pointe

Au cours des dernières années, des percées technologiques considérables ont été réalisées dans divers domaines, y compris les systèmes de positionnement mondial différentiel (DGPS), les systèmes d'information géographique (SIG), les systèmes de guidage électronique, les rampes automatiques et la télédétection, et toutes ont le potentiel d'améliorer les applications aériennes d'herbicides. Même si toutes ces technologies sont utilisées à divers degrés par les aménagistes et les applicateurs d'herbicides par voie aérienne, elles ne sont généralement pas pleinement intégrées au niveau conceptuel et pratique. Les études initiales menées dans le cadre de ce programme de recherche étaient principalement axées sur l'évaluation des possibilités d'intégration d'une série de technologies modernes afin d'optimiser l'efficacité, la rentabilité, la protection de l'environnement et la surveillance post-traitement des applications aériennes d'herbicides. Leurs objectifs étaient les suivants :

a) Évaluer le potentiel d'utilisation de systèmes de guidage électronique et de contrôle automatique des rampes de pulvérisation
b) Évaluer l'uniformité du dépôt d'herbicide sur la zone ciblée et les caractéristiques de dépôt autour des zones d'exclusion artificielle
c) Comparer l'utilisation du suivi au sol à l'aide d'un DGPS et de l'analyse des images satellitaires dans le proche infrarouge et des images numériques comme méthodes pour définir les contours de phytotoxicité
d) Évaluer la possibilité de vraiment exclure des zones sylvicoles dans les régions où sont effectuées des opérations de pulvérisation.

La version préliminaire d'un article résumant les résultats de cette sous-étude a été rédigée et sera soumise à une publication spécialisée au cours du deuxième trimestre de 2007.

Études de cas de l'application par aéronef à voilure fixe

Nous avons maintenant terminé les évaluations post-traitement de la végétation dans les 11 parcelles expérimentales de traitement constituant les études de cas de l'application aérienne d'herbicides par aéronef à voilure fixe. Toutes ces études de cas comportaient des applications de glyphosate (Vision) effectuées par un aéronef à voilure fixe (un Grumman AgCat, piloté par Paul Hodgins de la General AirSpray), équipé d'un système de guidage électronique AGNAV2. Une méthode d'analyse quantitative du dépôt de glyphosate sur de nombreux collecteurs artificiels (µg total /collecteur) placés dans les parcelles à traiter et dans des zones adjacentes a été utilisée pour mesurer le dépôt hors-cible et dans les parcelles traitées. Pour déterminer l'efficacité et la phytotoxicité hors-cible, les données d'évaluation de la végétation ont été recueillies dans les sites et les transects d'échantillonnage qui avaient servi à établir la végétation pré-traitement et le dépôt de produits chimiques lors de l'année même du traitement. Les évaluations post-traitement ont consisté à utiliser un densiomètre pour mesurer à deux hauteurs différentes du couvert la réduction de la strate arbustive et de la strate herbacée, à estimer le pourcentage de couvert et à identifier les espèces dominantes de la strate arbustive et de la strate herbacée ainsi qu'à dénombrer les tiges et à estimer la hauteur des essences dominantes de la zone riveraine. Nous compilons actuellement les changements du pourcentage de couvert par espèce et des mesures densiométriques moyennes et nous effectuons des analyses statistiques par parcelle afin d'obtenir des mesures de l'efficacité de l'herbicide qui pourront ensuite être comparées aux mesures du dépôt dans la zone visée, à l'efficacité établie à partir de l'analyse d'images numériques en couleur naturelle de télédétection et d'images satellitaire dans le proche infrarouge ainsi qu'à des prévisions spécifiques au site établies par le système SprayAdvisor. Nous effectuons actuellement des comparaisons des prévisions empiriques et des prévisions du SprayAdvisor sur le dépôt hors-cible d'herbicide et le dépôt dans la zone visée ainsi que des effets non visés potentiels.

Études de cas de l'application par aéronef à voilure tournante

Une surveillance du dépôt d'herbicide hors-cible et dans la zone à traiter ainsi que des évaluations pré-traitement des communautés végétales ont été réalisées dans six parcelles de traitement près de Timmins, en Ontario, dans des sites aménagés par la société Abitibi Consolidated Co. ou par Tembec Inc. Des applications aériennes de glyphosate (VisionMax ou Catena) ont été effectuées par un aéronef à voilure tournante (un Bell 206B, piloté par N. Gagnon ou W. Kay de la Gateway Helicopters), équipé d'un système de guidage électronique AGNAV2, à titre de traitements de préparation de terrain. Lors des pulvérisations, un enregistreur de données CR10 de la société Campbell Scientific et les sondes connexes ont été utilisés pour surveiller les paramètres météorologiques critiques (vitesse et direction du vent, humidité relative et température de l'air). Des collecteurs artificiels installés dans la strate arbustive et au sol ont été utilisés pour mesurer le dépôt d'herbicide dans chaque zone traitée. Le dépôt au sol a également été surveillé dans des transects établis dans diverses zones d'exclusion (site de nidification d'oiseaux de proie, zones de protection de la régénération préétablie) et dans des

zones de non-pulvérisation et des rideaux riverains. Les données finales sur l'efficacité et de télédétection nécessaires aux études de cas des applications par aéronef à voilure tournante effectuées en Ontario seront recueillies durant l'été 2007.

Un programme de recherche visant à valider le SprayAdvisor en Alberta a récemment été proposé et accepté. D. Thompson (SCF) et M. Mihajlovich (Incremental Forest Technologies) sont les chercheurs principaux de ce projet auquel un consortium d'industries forestières de la province apportera une aide financière et logistique. Ce projet de recherche vise à obtenir des données empiriques d'études de cas pour six applications aériennes d'herbicides par aéronef à voilure tournante effectuées dans les conditions caractéristiques qui prévalent en Alberta.

Étude comparative de la dose-réponse

Les relations dose-réponse de la végétation nécessaires pour vérifier les prévisions du système SprayAdvisor à l'égard de l'efficacité et de la phytotoxicité non visée seront établies à partir des résultats d'une étude comparative de la dose-réponse, entreprise en 2005. Dans le cadre de cette étude effectuée au sol dans de petites placettes, on utilisera des pulvérisateurs à dos pour effectuer des applications, avec quatre répétitions (n = 4), de dix doses différentes de Vision et de VisionMax, allant d'une dose nulle (0 kg e.a./ha (traitements témoins)) à la dose complète recommandée pour la préparation chimique du terrain. Les méthodes d'évaluation pré-traitement de la végétation utilisées lors de l'étude dose-réponse étaient semblables à celles utilisées pour surveiller les zones de traitement opérationnelles. Les évaluations post-traitement du contrôle de la concurrence végétale et de la tolérance des tiges d'avenir seront réalisées durant l'été 2007, et les données de cette deuxième année seront analysées à l'aide de techniques de régression appropriées. Ces données, combinées aux résultats des comparaisons par paires effectuées par M. Mihajlovich en Alberta dans des zones de traitement opérationnelles, fourniront de bons éléments de base pour effectuer une évaluation comparative de la tolérance des tiges d'avenir et de l'efficacité du produit chez les principales espèces visées et les principales essences cultivées dans les forêts du Canada.

Étude de validation du SprayTrans

Même si ce projet de recherche a jusqu'à maintenant été axé sur l'élaboration et la validation du SprayAdvisor pour les applications d'herbicides, des études ont également été effectuées pour faciliter son adaptation aux applications aériennes d'insecticides. À cette fin, une série de 20 essais de pulvérisation destinés à vérifier et à valider les prévisions du modèle SprayTrans (couplage des modèles AGDISP et CalPuff/CalMet) a été effectuée durant l'automne 2006 sur le polygone d'essai Dugway, près de Salt Lake City, dans l'Utah. Même si de vastes ensembles de données de validation avaient été compilés pour évaluer et comprendre la performance des modèles AGDISP et CalPuff/CalMet dans de nombreuses situations, les hypothèses posées pour coupler les deux modèles sont non négligeables, et les prévisions du modèle n'avaient jamais été validées auparavant. Un total de 20 essais de validation a été effectué sur le polygone d'essai Dugway (Dugway, Utah) du 8 au 15 septembre 2006. Les pulvérisations expérimentales ont été réalisées dans des conditions météorologiques variées selon une grille de 2 x 2 km et avec une batterie d'instruments de mesure des paramètres météorologiques et du dépôt du produit marqué.

Toutes ont été effectuées par un AT-188, exploité par la Forest Protection Limited de Fredericton (Nouveau-Brunswick) et équipé d'un DGPS, d'un système de guidage électronique et de quatre pulvérisateurs centrifuges AU 4000. Le produit marqué utilisé était le *Bacillus thuringiensis* (le FORAY 76B de Valent BioSciences). Cet ensemble de données expérimentales fournit de solides fondements pour évaluer la possibilité d'élargir l'application du SAD SprayAdvisor à des activités de pulvérisations d'insecticides.

Transfert de technologie

L'élaboration et la validation du SprayAdvisor ont fait l'objet de nombreuses communications qui ont été présentées lors de divers ateliers et réunions scientifiques, y compris des communications annuelles lors du Forum sur la répression des ravageurs forestiers et de l'atelier du Spray Efficacy Research Group International, des exposés aux participants à l'USDA Aerial Application Research Planning Conference, à l'assemblée générale annuelle de l'Ontario Vegetation Management Association et, tout dernièrement, à des collaborateurs de l'industrie forestière en Alberta.

En plus de ces activités, les résultats des recherches sur les applications aériennes de pesticides en milieu forestier sont compilés dans la base de données sur la gestion de la forêt canadienne (http://www.glfc.cfs.nrcan.gc.ca/cfpm). Cette information sert à faire une synthèse et un bilan des connaissances et à analyser les lacunes. À ce jour, plus de 200 entrées contenant des données scientifiques publiées ont été versées dans la base de données. De plus, on a entrepris d'y verser des résumés de données inédites et/ou de la littérature grise faisant partie du fonds documentaire du Service canadien des forêts.

Des ateliers de formation pratique et de transfert de la technologie sont en cours de planification pour l'Est et l'Ouest du Canada, et le premier devrait se dérouler en mai/juin 2008 au Centre écologique du Canada de Mattawa (Ontario), en collaboration avec le Partenariat pour la recherche forestière de Tembec. Ces ateliers visent à garantir l'acceptation et l'utilisation à grande échelle du SAD SprayAdvisor et des technologies connexes au sein des principaux groupes d'utilisateurs, y compris les pilotes effectuant les applications aériennes, l'industrie forestière et les organismes provinciaux et fédéraux de réglementation.

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acharné et à l'excellent soutien technique de B. Staznik, D. Chartrand, M. O'Toole, R. Laliberte, L. Perry et A. Pino. Nous voulons également remercier P. Hodgins, N. Gagnon et W. Kay ainsi que les équipes affectées aux pulvérisations de la General Airspray and Gateway Helicopters. Enfin, un grand merci à Jeff Leach (Tembec-Spruce Falls), C. Parsons (Tembec-Timmins), R. White (Abitibi Consolidated) et M. Kligour (ministère des Richesses naturelles de l'Ontario) pour leur aide et leur soutien logistique. Pour terminer, nous voulons souligner l'aide financière récente apportée au projet par un consortium d'industries forestières de l'Alberta, y compris ANC Timber Ltd., Blue Ridge Lumber Inc., Canadian Forest Products Ltd., Manning Diversified Forest Products Ltd., Vanderwell Contractors Ltd., Miller-Western Forest Products ainsi que CANFOR et Weyerhaeuser Co. Ltd., une aide qui a beaucoup contribué à garantir l'applicabilité du SAD SprayAdvisor à l'échelon national.

Pour renseignements

Pour de plus amples renseignements sur ce projet, veuillez communiquer avec D.G. Thompson (Ph.D.), Service canadien des forêts, Centre de foresterie des Grands Lacs, 1219, rue Queen Est, Sault Ste. Marie, ON P6A 2E5. Tél : 705-541-5646 dthompso@NRCan.gc.ca.

Potential Environmental Effects of Imidacloprid as a Systemic Insecticide for Emerald Ash Borer and Asian Longhorned Beetle / Effets environnementaux potentiels de l'imidaclopride utilisé comme insecticide systémique contre l'agrile du frêne et le longicorne étoilé

Presented by / Présenté par :

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Abstract

Imidacloprid as a systemic insecticide has been shown to be highly effective for control or prevention of tree defoliation by Emerald Ash Borer (EAB) and Asian Longhorned Beetle (ALB). However, systemic applications of imidacloprid may pose a risk of harm to natural decomposer organisms in forest litter or water bodies through leaf fall from treated trees or through direct exposure from soil applications and leaching. We are measuring the fate and effects of imidacloprid in aquatic and terrestrial microcosms treated with leaves collected at senescence from imidacloprid-treated ash and maple trees, and treated directly with imidacloprid to simulate soil applications and leaching scenarios. Microcosm results to date indicate that leaves that fall from green ash trees treated at levels to control EAB will not cause significant adverse effects on litter-dwelling earthworm survival, growth, or reproduction, on terrestrial microbial decomposition activity, on aquatic insect survival or feeding rates, or on aquatic microbial respiration or decomposition activity. Imidacloprid added directly to microcosms to simulate soil applications and leaching to water bodies was 10-100X more toxic to aquatic insects than foliar concentrations, and caused significant adverse effects on earthworm survival, growth and reproduction at realistic concentrations. Early indications from ALB studies are that the translocation dynamics of imidacloprid in sugar maple trees are different from those in ash trees and could result in foliar concentrations that pose greater risk of harm to decomposer organisms than leaves from treated ash trees.

Résumé

Il a été démontré que l'imidaclopride était un insecticide systémique très efficace pour lutter contre l'agrile du frêne et le longicorne étoilé ou prévenir la défoliation des arbres causée par ces ravageurs. Cependant, les applications systémiques d'imidaclopride risquent d'affecter les microorganismes décomposeurs naturellement présents dans la litière ou dans les plans d'eau par suite de la chute des feuilles des arbres traités ou d'une exposition directe résultant d'applications et du lessivage du sol. Nous étudions le devenir et les effets de l'imidaclopride dans des micro-écosystèmes aquatiques et terrestres. À cette fin, nous y avons placé des feuilles de frênes et d'érables traités à l'imidaclopride récoltées au moment de leur sénescence, et nous y avons effectué des applications directes d'imidaclopride pour simuler des scénarios d'application et de lessivage du sol. D'après les résultats obtenus jusqu'à maintenant dans ces micro-écosystèmes, les feuilles tombant de frênes verts traités à l'aide de doses efficaces contre l'agrile du frêne n'ont pas d'effets néfastes importants sur la survie, la croissance ou la reproduction des vers de terre de la litière, l'activité des microorganismes décomposeurs terrestres, la survie ou le taux d'alimentation des insectes aquatiques ou la respiration microbienne ou la décomposition en milieu aquatique. Ajouté directement aux micro-écosystèmes pour simuler des applications dans le sol et le lessivage vers des plans d'eau, l'imidaclopride était 10 à 100 fois plus toxique pour les insectes aquatiques que les concentrations foliaires. Les applications directes d'imidaclopride à des doses réalistes ont eu des effets néfastes significatifs sur la survie, la croissance et la reproduction des vers de terre. D'après des données préliminaires d'études sur le longicorne étoilé, la dynamique de la translocation de l'imidaclopride chez l'érable à sucre est différente de celle chez le frêne et pourrait entraîner l'accumulation dans le feuillage des érables traités de concentrations plus néfastes pour les organismes décomposeurs que celles observées dans le feuillage des frênes traités.

Potential Environmental Effects of Imidacloprid as a Systemic Insecticide for EAB and ALB

Extended Abstract

Imidacloprid as a systemic insecticide has been shown to be highly effective for control or prevention of tree defoliation by Emerald Ash Borer (EAB) and Asian Longhorned Beetle (ALB). However, systemic applications of imidacloprid may pose a risk of harm to natural decomposer organisms in forest litter or water bodies through leaf fall from treated trees or through direct exposure from soil applications and leaching.

This project is investigating the efficacy and translocation dynamics of imidacloprid in ash and maple trees for control of EAB and ALB in field trials. To determine potential non-target

effects, we are measuring the fate and effects of imidacloprid in aquatic and terrestrial microcosms treated with leaves collected at senescence from imidacloprid-treated ash and maple trees, and treated directly with imidacloprid to simulate soil applications and leaching scenarios.

Last year's forum report (February 2006) gave results from field trials against EAB and from microcosm experiments using leaves from ash trees. The current paper reports on field trials against ALB in sugar maple trees and focuses on preliminary results from microcosm experiments under an ALB treatment scenario.

To determine if imidacloprid in leaves that fall from treated maple trees poses a risk of harm to decomposer organisms, and to compare this risk with a direct exposure to imidacloprid under a soil application scenario, we are conducting a series of laboratory microcosm experiments. The microcosms are designed to test under quasi-natural conditions (using field-collected stream water, detritus, forest litter, etc., collected at a single source and time), and the experiments are being conducted under OECD Good Laboratory Practice (GLP) compliance through a Standards Council of Canada (SCC) certification. The study plan and microcosm experimental setup have been audited by SCC and verified to be on track for GLP compliance.

Parallel experiments are being conducted in aquatic and terrestrial microcosms. Response measurements in aquatic microcosms include:

1) Initial imidacloprid concentrations in leaves and water

2) Fate of imidacloprid in leaves and water

3) Survival of leaf-shredding aquatic insects (stonefly *Pteronarcycs dorsata*, and cranefly *Tipula* sp.)

4) Feeding rates of aquatic insects

5) Microbial decomposition rates on leaf material over a 14-day experimental period.

Response measurements in terrestrial microcosms include:

1) Initial imidacloprid concentrations in leaves and litter

2) Fate of imidacloprid in leaves and litter

3) Survival of litter-dwelling earthworms (*Dendrobaena octaedra*)

4) Growth of earthworms

5) Cocoon production by earthworms

6) Leaf consumption by earthworms

7) Microbial decomposition rates over a 35-day experimental period.

The following is a brief synopsis of results from the project over the last year. These results are preliminary only because many of the analyses are still underway.

Imidacloprid is effective against ALB in maple trees. Field trial results are very preliminary but indicate that applications to maple trees that result in foliar concentrations of 3-10 ppm or higher will control ALB defoliation.

Samples for determining translocation and fate of imidacloprid in sugar maple trees for ALB control are still being analyzed. Early results from samples analyzed to date indicate that imidacloprid translocation dynamics in sugar maple trees are different from those in ash trees. Imidacloprid in sugar maple leaves accumulates and dissipates more slowly over the season such that concentrations in leaves at senescence are higher in sugar maple than in ash. There is considerable variation among maple species in their rates of imidacloprid uptake and dissipation, with sugar maple intermediate among species. Average concentrations in sugar maple leaves at senescence were about 4 to 6 ppm, compared to concentrations of about 1 ppm or often less in ash leaves at senescence. Higher concentrations of imidacloprid in maples leaves at the time of leaf-fall may have implications for non-target effects on decomposer organisms.

Leaves from imidacloprid-treated sugar maple trees added to aquatic microcosms resulted in increased mortality of one leaf-shredding insect species, *Tipula* sp., at realistic concentrations. Mortality of these insects in microcosms with leaves from treated maple trees was 3-4X higher than in controls. The other test species, *Pteronarcycs dorsata*, did not exhibit significant mortality at realistic concentrations. This is in contrast to results from the previous experiments with leaves from treated ash trees added to microcosms in which there was no significant mortality of either species at realistic concentrations. It appears that imidacloprid in leaves of treated sugar maple trees may be more toxic to aquatic leaf-shredding insects than imidacloprid in leaves of treated ash trees, probably owing to the higher concentrations in sugar maple leaves at time of leaf-fall.

In addition to effects on survival of at least one test species of aquatic insects, leaves from treated sugar maple trees also inhibited feeding rates by surviving aquatic insects. Decomposition rates were reduced by about 20-50% in leaves from treated sugar maple trees at realistic concentrations in comparison to controls (leaves from non-treated maple trees).

Aquatic microbial decomposition activity on leaf material was also reduced in microcosms with leaves from treated sugar maple trees at realistic concentrations. Microbial decomposition of leaf materials was about 2-5X less in microcosms with leaves from imidacloprid-treated maples trees than in controls. This contrasts with previous microcosm experiments in which imidacloprid in ash leaves did not inhibit microbial decomposition activity.

Imidacloprid added directly to aquatic microcosms to simulate soil applications and leaching to water bodies was 50-100 X more toxic to the aquatic insects than imidacloprid in leaf material. Leaves from treated sugar maple trees caused about 30-40% mortality when concentrations in leaves were 4-6 ppm, while imidacloprid added directly to the water caused 40-70% mortality at 0.05-0.10 ppm. Significant feeding inhibition among aquatic insects occurred at 0.012 ppm in water.

Imidacloprid added directly to the water of aquatic microcosms did not inhibit aquatic microbial decomposition activity on maple leaves when concentrations in water ranged from 0.012 to 0.096 ppm. The previous microcosm experiments indicated that concentrations in water of up to 15 ppm did not inhibit microbial decomposition of leaf material from ash trees.

Leaves from imidacloprid-treated sugar maple trees at realistic concentrations (4-6 ppm) added to terrestrial microcosms did not result in mortality of litter-dwelling earthworms. However, there were significant feeding inhibition effects on earthworms exposed to leaves at realistic concentrations, and this resulted in significant reductions in earthworm growth rates.

Imidacloprid added directly to terrestrial microcosms to simulate soil applications was more toxic to earthworms than imidacloprid in maple leaves. Mortality of earthworms ranged from 25-100% at concentrations of 3-14 ppm in litter, with an estimated LC_{10} of about 2 ppm and LC_{50} of about 6 ppm. There were feeding inhibition effects on earthworms at test concentrations of 3 ppm and above.

Terrestrial microbial decomposition activity did not appear to be adversely affected by imidacloprid, either on leaves from treated trees or on leaves in microcosms treated directly, at any test concentration.

Tentative Conclusions from 2006 Results

1) Imidacloprid is effective against ALB at concentrations in leaves of about 3-10 ppm or higher

2) Translocation dynamics of imidacloprid in sugar maple are different from those in ash; uptake and dissipation are slower, resulting in higher average concentrations in maples leaves at leaf-fall (about 4-6 ppm) compared to average concentrations in ash of about 1 ppm or less

3) Leaves that fall from imidacloprid-treated sugar maple trees into nearby water bodies may pose a risk of harm to aquatic leaf-shredding insects, and to aquatic microbial decomposers. This contrasts with previous experiments in which it was demonstrated that leaves from imidacloprid-treated ash trees pose little risk of adverse effects on aquatic microbial decomposition or on leaf-shredding insect survival, although there may also be insect feeding inhibition on treated ash leaves at realistic concentrations

4) Imidacloprid concentrations in water (that may result from soil applications and leaching) will pose much greater risk of harm to aquatic insects than imidacloprid in leaves. Aqueous concentrations were 50-100 X more toxic to aquatic insects than foliar concentrations. There were no effects of aqueous concentrations on aquatic microbial decomposition rates.

5) Leaves that fall from imidacloprid-treated sugar maple trees on to the forest floor will pose little risk of mortality to litter-dwelling earthworms. However, feeding rates and

growth rates of earthworms exposed to treated maple leaves at realistic concentrations are likely to be reduced.

6) Imidacloprid concentrations in litter from direct applications are more toxic to earthworms than imidacloprid in leaves from treated maple trees.

7) When imidacloprid is used as a systemic insecticide for the control of ALB in sugar maple trees, it will pose less risk of harm to aquatic and terrestrial decomposer organisms when applied as stem injections than when applied as soil injections or drenches

8) Given that adverse effects occurred on aquatic and terrestrial decomposer organisms exposed to imidacloprid at realistic concentrations through direct application or through consumption of leaves from treated maple trees, an alternative systemic insecticide to control ALB should be investigated.

Efficacy Trial of *Phlebiopsis gigantea* to Control *Annosus* Root Rot / Essai d'efficacité du *Phlebiopsis gigantea* contre la maladie du rond

Presented by / Présenté par :

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Abstract

A biocontrol program using *Phlebiopsis gigantea* (Fr.) Jülich is being developed to manage *Heterobasidion annosum* (Fr.) Bref., a serious root disease of red pine plantations in southern Ontario and Quebec. This saprophytic *Basidiomycete* has been successfully registered as a classical biological control agent in Europe. In order to proceed with the registration in Eastern Canada, efficacy under forest conditions must be demonstrated with formulations using isolates of *P. gigantea* from this region. Trials were conducted in 4 red pine plantations located in Ontario in the counties of York (1), Simcoe (2) and Dufferin (1) under operational thinning methods. Plots were selected in areas that had the disease or were very adjacent to plantations with the disease. Two strains (GLFC; LFC104) of *P. gigantea* isolated respectively in Ontario and Québec were used. The GLFC strain was formulated at GLFC whereas the LFC104 strain was formulated by the Verdera Company. The 2 strains were tested against controls consisting of stumps treated with the 2 formulations without *P. gigantea* and two stumps without treatment. In each location the experimental area was divided into two blocks and the six treatments were randomly distributed amongst 90 stumps within each block. Six weeks after treatment, a 5 cm wood disc was collected from one half of the treated stumps for isolation of *P. gigantea* and *H. annosum*. Fifteen control stumps were not harvested. The stumps not collected after 6 weeks were collected after 1 year to confirm the infection rates of the introduced *P. gigantea* strains and to determine the infectivity of wild type strains of *P. gigantea*. After 6 weeks the success rate of introducing *P. gigantea* to freshly cut stumps was 100% for both strains. *Heterobasidion annosum* was present on control stumps in the four locations, but with a higher frequency at the York site. The pathogen was not found on any stumps treated with the biocontrol agent. The carrier used to introduce the biocontrol agent did not inhibit the infection of stumps by *H. annosum* or wild type strains of *P. gigantea*.

Résumé

Un programme de lutte biologique avec *Phlebiopsis gigantea* (Fr.) Jülich est en développement pour contrer *Heterobasidion annosum* (Fr.) Bref., cause d'une importante maladie des racines dans les plantations de pin rouge du sud de l'Ontario et du Québec. Ce Basidiomycète saprophyte a été homologué comme agent de lutte biologique en Europe. En vue de procéder à son homologation dans l'Est du Canada, son efficacité en forêt doit être démontrée avec des formulations d'isolats indigènes de *P. gigantea*. Les essais ont eu lieu dans quatre plantations de pin rouge localisées en Ontario dans les comtés de York (1), Simcoe (2) et Dufferin (1) lors d'opérations d'éclaircies. Les places d'études ont été sélectionnées dans des aires avec présence de la maladie ou adjacentes à des plantations malades. Deux isolats (GLFC; LFC104) de *P. gigantea*, isolées respectivement de l'Ontario et du Québec, ont été utilisées. L'isolat GLFC a été formulé au Centre de Foresterie des Grands-Lacs alors que l'isolat LFC104 a été formulé par la compagnie Verdera. Les deux isolats ont été comparés à deux témoins constitués des agents de formulations sans *P. gigantea*, ainsi que deux témoins sans aucun traitement. Dans chacune des plantations, la place d'études était divisée en deux blocs et les six traitements ont été distribués au hasard sur 90 souches à l'intérieur de chacun des blocs. Six semaines après le traitement, un disque de 5 cm d'épaisseur était prélevé du dessus des souches pour isoler *P. gigantea* et *H. annosum*, sur la moitié des arbres traités. Dans chacun des blocs, 15 souches non traitées ont été laissées intactes en vue d'une récolte après un an. Les souches non récoltées après six semaines ont été collectées après un an, afin de vérifier le taux d'infection des isolats de *P. gigante*a introduit et de déterminer le taux d'infection des isolats indigènes de *P. gigantea* dans la plantation. Après 6 semaines, le taux de succès d'introduction de *P. gigantea* sur les coupes fraîches des souches de pin rouge ont été de 100% pour les deux isolats. *H. annosum* était présent sur les souches témoins dans les quatre plantations; le taux le plus élevé était dans la plantation de York. *H. annosum* n'était pas présent sur aucune des souches traitées avec *P. gigantea*. Les formulations sans l'agent de bio-contrôle n'ont pas inhibé l'infection des souches par *H. annosum* ou les souches indigènes de *P. gigantea.*

Session III: Climate Change

Chair: Nancy Kingsbury

Natural Resources Canada, Canadian Forest Service

Séance III : Changements climatiques

Présidente : Nancy Kingsbury

Ressources naturelles Canada, Service canadien des forêts

Session III / Séance III

Climate Change, Natural Disturbance Regimes and the Future of Canada's Forests / Changements climatiques, régimes de perturbations naturelles et avenir des forêts canadiennes

Presented by / Présenté par :

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Abstract

The forest and carbon dynamics of Canada's boreal forest are strongly affected by regional disturbance regimes. Wildfires and forest insects are the dominant natural disturbance types, with regional differences in their past and current contributions. Disturbances affect the carbon and non-carbon-dioxide greenhouse gas emissions in the year of disturbance. They also affect the post-disturbance emissions from residual dead organic matter and the rate of carbon uptake in stands recovering from disturbance. At the landscape-level, the forest age-class structure is the result of past disturbance regimes. Forest age-class structure also has a major impact on future forest dynamics.

Climate change is predicted to affect both fire and insects disturbance regimes in Canada's boreal forests. Changes in forest disturbance regimes result in changes in forest age-class structure, ecological processes, the greenhouse gas balance, and the future supply of timber, wildlife habitat and other goods and services valued by society. To predict the future characteristics of Canada's boreal forest, the combined impacts and interactions of changes in wildfires, insects, forest growth dynamics, succession, management and salvage logging activities need to be assessed.

Models that project future forest conditions with consideration of these impacts and their interactions can assist in assessing the impacts of climate change and in developing mitigation and adaptation strategies. Future research needs to improve the simulation of insect dynamics which can be a major challenge in cases where there have not been historic precedents, such as the possible eastward migration of the Mountain Pine Beetle through the boreal forest.

Although forests will be affected by climate change, human activities can affect their contribution to mitigating atmospheric greenhouse gas increases. How this is best achieved is the subject of ongoing research activities.

Résumé

Dans la forêt boréale du Canada, les régimes de perturbations à l'échelle régionale influent énormément sur la dynamique des forêts et du carbone. Le feu et les insectes forestiers sont les principaux agents de perturbation, mais leurs effets passés et présents varient selon les régions. Durant l'année où elles surviennent, les perturbations affectent les émissions de dioxyde de carbone et de gaz à effet de serre autres que le dioxyde de carbone. Elles influent également sur les émissions post-perturbation provenant de la matière organique morte résiduelle et sur le taux d'absorption du carbone par les peuplements en voie de rétablissement. La structure des classes d'âge des forêts composant le paysage résulte des régimes passés de perturbations. Elle a également un impact de taille sur la dynamique future de la forêt.

Il est prévu que le changement climatique affectera les régimes de perturbations dues au feu et aux insectes dans la forêt boréale du Canada. Des modifications des régimes de perturbations des forêts se traduisent par des changements de la structure des classes d'âge, des processus écologiques, du bilan des gaz à effet de serre ainsi que de l'approvisionnement futur en bois, de l'habitat faunique et d'autres biens et services appréciés par la société. Pour prévoir les caractéristiques futures de la forêt boréale du Canada, il faut évaluer les impacts et les interactions combinés des changements au niveau des feux de forêt, des insectes, de la dynamique de la croissance des forêts, de la succession, de l'aménagement et des activités d'exploitation forestière.

Les modèles qui prévoient l'état futur des forêts en tenant compte de ces impacts et de leurs interactions peuvent aider à évaluer les répercussions du changement climatique et à élaborer des stratégies d'atténuation et d'adaptation. Les travaux de recherche futurs doivent améliorer la simulation de la dynamique des insectes, une tâche qui peut s'avérer très difficile lorsqu'il n'existe aucun précédent historique, comme dans le cas de la possible migration du dendroctone du pin ponderosa vers l'Est, dans la forêt boréale.

Les forêts seront certes affectées par le changement climatique, mais les activités humaines peuvent influer sur le rôle qu'elles pourront jouer dans l'atténuation de l'augmentation des gaz à effets de serre dans l'atmosphère. Des activités de recherche en cours étudient les meilleurs moyens d'y arriver.

A Risk Analysis of the Effects of Climate Change on Spruce Budworm Impacts / Analyse des risques liés aux effets des changements climatiques sur les impacts de la tordeuse des bourgeons de l'épinette

Presented by / Présenté par :

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Abstract

Each year, insects and fire cause losses to Canada's forests that are only 15% less than the total harvested volume. Losses caused by insect outbreaks constitute approx. 65% of these natural disturbance losses, and the spruce budworm was, until recent years, the major cause of the losses from insect outbreaks. Large spatial variation in the severity and duration of a spruce budworm outbreak exist at the landscape scale and climate contributes significantly to this variation.

An overwhelming amount of evidence has been accumulated that indicates that the global climate is warming. Estimates of global mean temperature increases (2100 vs. 2000) range from approx. 2-3.5°C. Important question are: "How will climate change affect the outbreak characteristics (i.e., duration and severity) of spruce budworm outbreaks"; and "What will be the consequences of these outbreaks on fibre production?" The spruce budworm system includes 4 species of host, 25 species of parasites, hyperparasites and disease agents, and the spruce budworm. Each of the components of this system is known to be influenced by some aspect of weather. However, it is not known in sufficient detail how each component will respond to changes in climate, nor what will be the net effect of these interacting components on spruce budworm outbreaks in an altered climatic environment. The questions posed above were addressed by a multivariate reduced rank regression analysis whereby the spatial matrix of outbreak characteristics **(Y)** was modeled as a function of the spatial matrix **(X)** which was itself comprised of the statistically significant 6 climate variables, 7 forest variables and 2 spatial variables.

The results of the regression analysis predict that under the future climate projected by the CGCM3[1] and the IPCC SRES B1 scenario, spruce budworm outbreaks will have an average increase in duration of 6 years, and an average increase in severity (% defoliation) of 15%. The largest increases in outbreak duration are predicted for eastern Québec and the Gaspé region; the largest increases in outbreak severity are predicted for southern and northern Ontario.

Because forest composition was shown to have a significant effect on spruce budworm outbreaks, long-term estimates of spruce budworm impacts must be made by a method that recognizes that

[1] http://www.cccma.bc.ec.gc.ca/

spruce budworm outbreaks alter forest development, and thus modify the forest conditions that will influence future outbreaks. The method should also recognize that the interactive relationship between spruce budworm outbreaks and forest development occurs within a landscape that is continually modified by harvesting and fire. The landscape dynamics model, *LADS* (*LA*ndscape *D*ynamics *S*imulator) incorporates sub-models of stand growth and development, harvesting, spruce budworm outbreaks and fire. Simulated spruce budworm outbreaks and fire are climate-dependent; however, the stand growth sub-model is not climate-dependent in the current version of *LADS*. *LADS* was run for 100 years, 10 times for each climate scenario (historic and 2100) in District 15 of Newfoundland and the total volume harvested per run was recorded.

Risk is defined[2] as "the probability of an event occurring and the consequences of the occurrence". Risk analysis (syn. = risk estimation) is "the quantification of the probabilities and the expected consequence(s) for identified risks". Outcomes from *LADS* are partially stochastic and therefore results are best presented as risk estimations (Figure 1), where a reduction in volume harvested (or a reduction in the estimated probability of a given harvest volume) is predicted due to the combined effects of spruce budworm and fire.

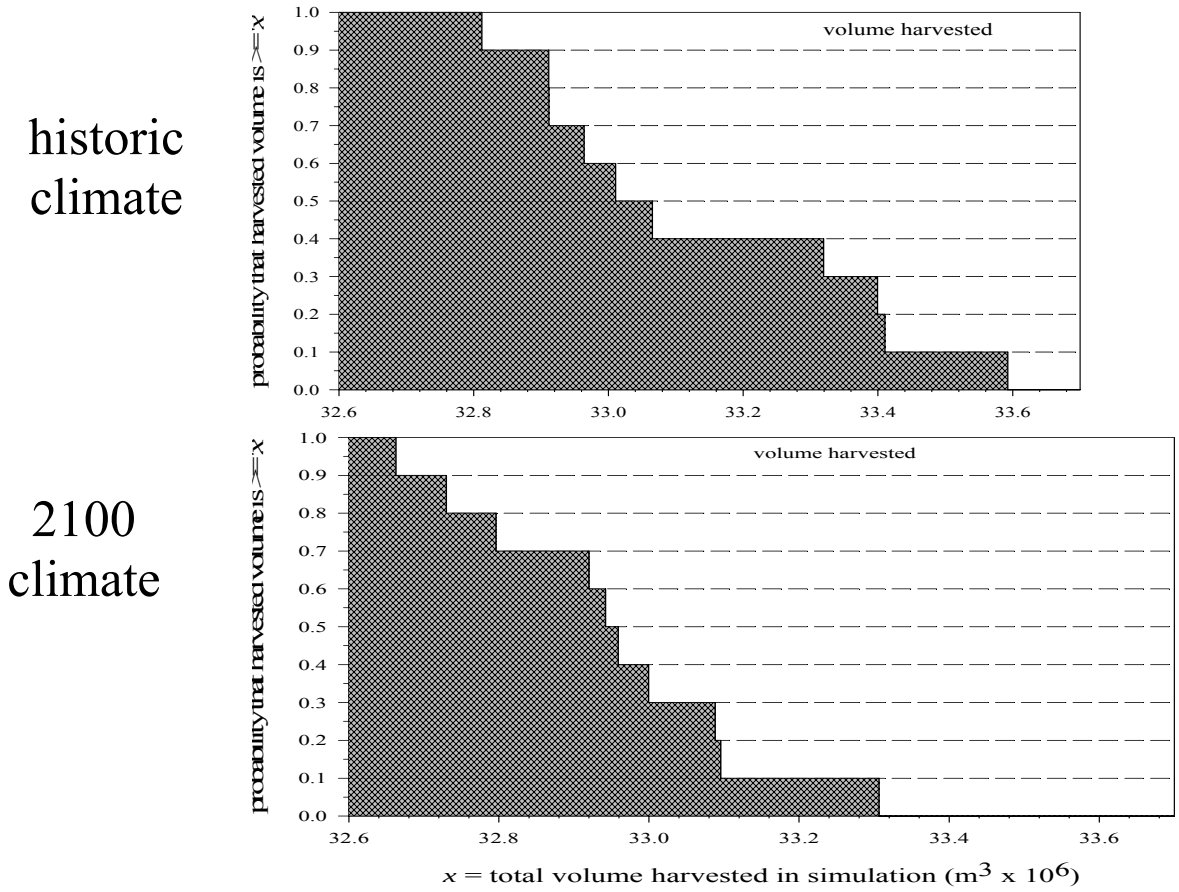

Figure 1. Predicted probabilities of harvesting at least *x* m^3

[2] Society for Risk Analysis: http://www.sra.org

Résumé

Bon an mal an, les pertes infligées aux forêts canadiennes par les insectes et le feu représentent seulement 15% de moins que le volume total de bois récolté. Les pertes attribuables aux infestations d'insectes comptent pour environ 65 % des pertes dues aux perturbations naturelles, et la tordeuse des bourgeons de l'épinette a été, jusqu'à ces dernières années, la principale cause des pertes associées aux infestations d'insectes. La gravité et de la durée des infestations de tordeuse des bourgeons de l'épinette varient considérablement à l'échelle du paysage, et les conditions climatiques expliquent une bonne part de ces variations. Une accumulation de signes accablants indique que le climat mondial se réchauffe. Selon les estimations, on s'attend à ce que la température moyenne mondiale augmente d'environ 2 à 3,5 °C entre 2000 et 2100. Devant l'ampleur du phénomène, d'importantes questions surgissent : quelle incidence les changements climatiques auront-ils sur les caractéristiques (p. ex. durée et gravité) des infestations de tordeuse des bourgeons de l'épinette? Quelles seront les conséquences de ces infestations sur la production de fibre? Le système de la tordeuse des bourgeons de l'épinette comprend quatre espèces d'hôtes, 25 espèces de parasitoïdes, d'hyperparasitoïdes et d'agents entomopathogènes et la tordeuse des bourgeons de l'épinette elle-même. S'il est établi que chacune des composantes de ce système subit l'effet de certains aspects météorologiques, leur réponse aux changements climatiques et l'effet net de leur interaction sur les infestations de tordeuse des bourgeons de l'épinette dans un environnement climatique altéré demeurent à préciser. Pour répondre aux deux questions énoncées précédemment, nous avons utilisé une analyse de régression multivariée à rang réduit dans laquelle la matrice spatiale des caractéristiques des infestations **(Y)** a été modélisée comme une fonction de la matrice spatiale **(X)**, elle-même constituée de six variables climatiques, de sept variables forestières et de deux variables spatiales statistiquement significatives. L'analyse de régression révèle qu'en présence des conditions climatiques prévues par le modèle climatique MCCG3.1 et le scénario SRES B1 du GIEC, la durée moyenne des infestations de tordeuse des bourgeons de l'épinette augmentera de six ans, et leur gravité (pourcentage de défoliation) moyenne, de 15 %. Les plus fortes augmentations de la durée des infestations se produiront dans l'est du Québec et la région de Gaspé, et les plus fortes augmentations de la gravité des infestations, dans le sud et le nord de l'Ontario.

Comme la composition forestière a un effet important sur les infestations de tordeuse des bourgeons de l'épinette, il faut, pour évaluer les impacts à long terme des infestations, utiliser une méthode qui reconnaît que les infestations altèrent la croissance des peuplements forestiers et, de ce fait, les conditions forestières influant sur les futures infestations. Cette méthode doit également reconnaître que la relation interactive entre les infestations de tordeuse des bourgeons de l'épinette et la croissance des peuplements forestiers a lieu dans un paysage qui est continuellement modifié par l'exploitation forestière et le feu. Le modèle de simulation de la dynamique des paysages LADS (Landscape Dynamics Simulator) intègre des sous-modèles de la croissance et du développement des peuplements, de l'exploitation forestière, des épidémies de tordeuse des bourgeons de l'épinette et du feu. Les simulations des épidémies de tordeuse des bourgeons de l'épinette et des feux sont dépendantes des conditions climatiques, mais le sous-modèle de la croissance des peuplements ne l'est pas dans la version actuelle du simulateur. Le modèle LADS a été appliqué à une période de 100 ans, à dix reprises pour chaque scénario de

climat (historique et 2100) dans le district 15 de Terre-Neuve, et le volume total récolté par passage du modèle a été consigné.

Le risque est défini comme la probabilité d'occurrence d'un événement et ses conséquences. L'analyse de risque (synonyme = évaluation du risque) est la quantification des probabilités et des conséquences prévues de risques prédéterminés. Les résultats du modèle LADS sont en partie stochastiques. En conséquence, ils sont mieux présentés comme des évaluations du risque (figure 1), dans lesquelles une réduction du volume récolté (ou une réduction de la probabilité estimée d'un volume récolté donné) est prévue en fonction des effets combinés de la tordeuse des bourgeons de l'épinette et du feu.

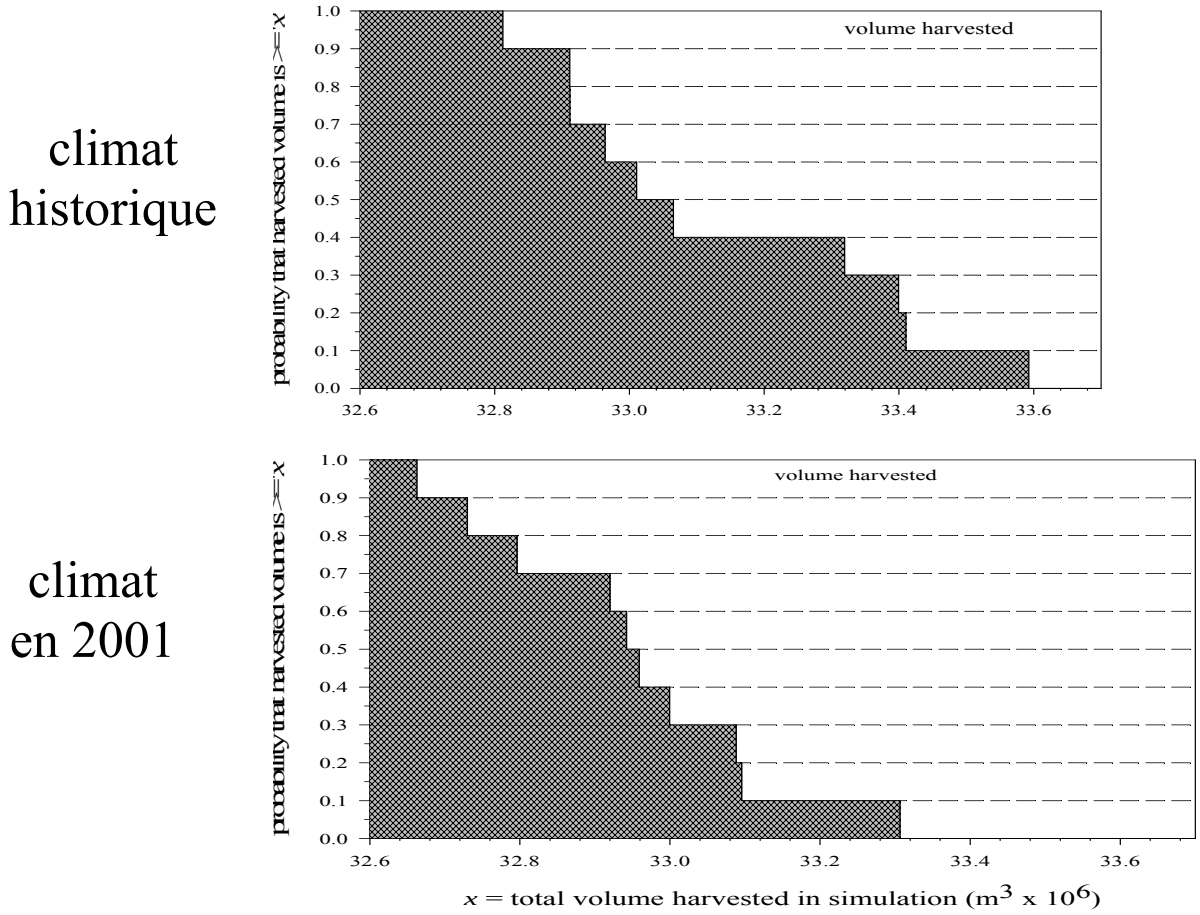

Figure 1. Probabilités prévues d'une récolte d'au moins *x* m³

Likely Effects of Climate Change on Southern Pine Beetle Impacts in Eastern North America / Effets probables des changements climatiques sur le dendroctone méridional du pin dans l'est de l'Amérique du Nord

Presented by / Présenté par :

Matt Ayres

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Integrating Climate Change into Spread and Impact Models for the Mountain Pine Beetle / Intégration des changements climatiques aux modèles de propagation et d'impacts pour le dendroctone du pin ponderosa

Presented by / Présenté par :

***Terry Shore* and A.L. Carroll**

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Abstract

Mountain pine beetles have killed pine trees over 10 million hectares in British Columbia and western Alberta in the current epidemic and are continuing to spread eastward. The magnitude of this epidemic has overwhelmed management efforts and caused serious disruption to the forest industry. Limiting factors for beetle population spread are the supply of mature pine and unfavourable climatic factors, particularly severe cold weather during vulnerable life stages. Anthropogenic activities including fire suppression and harvesting preference have resulted in an abundance of mature pine. Climate change has resulted in modifications to temperature and moisture factors that have benefited the beetle in extending its range in Canada.

A model of climatic suitability for the mountain pine beetle has been developed and used to map out climatic suitability zones across Canada. Utilizing a climate change model, possible future climatic suitability for the beetle has also been mapped.

Spatially explicit landscape level models have been developed and used to project the spread and impact of the mountain pine beetle in British Columbia and Alberta under various management scenarios. By integrating the output of the climatic suitability model into the spread and impact models we can look at possible current and future spread scenarios of mountain pine beetle in Canada.

Résumé

L'actuelle infestation du dendroctone du pin ponderosa a décimé quelque 10 millions d'hectares de pinèdes en Colombie-Britannique et dans l'ouest de l'Alberta et continue de se propager vers l'est. L'ampleur de cette infestation a anéanti les efforts d'aménagement et gravement perturbé les activités de l'industrie forestière. La quantité de pins mûrs et les conditions climatiques défavorables, notamment un temps particulièrement froid lors des stades vulnérables de développement, constituent des facteurs limitant la propagation des populations du dendroctone. Les interventions humaines, y compris la suppression des incendies et les activités privilégiées d'exploitation, ont engendré une abondance de pins mûrs. Les modifications des conditions de température et d'humidité résultant de l'évolution du climat ont permis au dendroctone d'étendre son aire de répartition au Canada.

Un modèle de compatibilité climatique a été élaboré pour le dendroctone du pin ponderosa. Ce modèle a été utilisé pour cartographier les zones du Canada présentant actuellement des conditions climatiques favorables au ravageur. Un modèle de changement climatique a également servi à cartographier les zones susceptibles de présenter des conditions climatiques favorables au dendroctone dans le futur.

Des modèles spatialement explicites à l'échelle du paysage ont été élaborés et utilisés pour extrapoler la propagation et l'impact du dendroctone du pin ponderosa en Colombie-Britannique et en Alberta selon divers scénarios d'aménagement. L'intégration de la sortie du modèle de compatibilité climatique aux modèles de propagation et des impacts nous permet d'examiner les scénarios possibles de propagation actuelle et future du dendroctone du pin ponderosa au Canada.

Integrating Climate Change Into Spread and Impact Models for the Mountain Pine Beetle

The mountain pine beetle is currently devastating mature pine stands in western Canada. Tree mortality as a result of the current epidemic is spread over 10 million ha in British Columbia. The beetle infestation has moved into Alberta and is entering the boreal jack pine forest.

The range expansion of mountain pine beetle to the north and east can be attributed to changes in climate which have made previously unsuitable areas climatically benign for this insect. A climatic suitability index has been developed for mountain pine beetle (Carroll et al. 2004) and utilized to map suitability zones for Canada and parts of the U.S.A., both for the present and for future climates. This climatic suitability model is based on a number of key variables relating to temperature and precipitation thresholds for the beetle interpolated

between weather stations. The climatic suitability maps produced show that much of Canada becomes climatically suitable for the mountain pine beetle in the near future.

Several models have been developed for projecting the susceptibility, spread and impact of the mountain pine beetle in pine forests (Shore et al. 2006, Shore et al. in press). These models are currently being used in projects examining scenarios for the eastward spread of the mountain pine beetle. By integrating the climatic suitability index into these models we are able to improve their sensitivity, because we are specifically relating climatic conditions that are important to the beetle to the landbase. Also, by using the climatic suitability index in our models it allows us to project future scenarios based on climate predictions.

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Session IV / Séance IV

Session IV: Sponsor's Showcase

Séance IV : Pleins feux sur les commanditaires

SESSION V: CROSS-COUNTRY CHECKUP – ONTARIO AND QUEBEC

Session V

Chair: Pardeep Ahluwalia

Natural Resources Canada, Canadian Forest Service

SÉANCE V : TOUR D'HORIZON – L'ONTARIO ET LE QUÉBEC

Séance V

Président : Pardeep Ahluwalia

Ressources naturelles Canada, Service canadien des forêts

Ontario Report / Rapport de l'Ontario

Presented by / Présenté par :

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Status of Important Forest Pests in Ontario – 2006

Abstract

In 2006, jack pine budworm (*Choristoneura pinus pinus* Freeman*)* populations expanded in northwestern Ontario, defoliating over 720,000 ha. The outbreak in the east half of Ontario was under 20,000 ha. The spruce budworm (*Choristoneura fumiferana* Clem.) population increased again in 2006, and the defoliated area is almost 800,000 ha primarily in the northeast. Forest tent caterpillar (*Malacosoma disstria* Hbn) defoliated 370,000 ha. The gypsy moth (*Lymantria dispar* L.) increased to 10,000 ha almost all in southern Ontario. Large aspen tortrix (*Choristoneura conflictana* (Wlk.)) infestations occurred in widely separated infestations totalling over 30,000 ha. The damage by the hickory bark beetle (*Scolytus quadrispinosus* Say) intensified in southern Ontario. There were declines in the areas infested by larch casebearer (*Coleophora laricella* Hbn.), the aspen twoleaf tier (*Enargia decolor* (Wlk.)) and pine false webworm (*Acantholyda erythrocephala* L.). Summer storms (July 17 and August 2) resulted in blowdown in several districts of the northeast and southern parts of the province. Total area of storm damage was 57,135 ha. For the second year there were no new increases in the area of aspen decline in northeastern Ontario which had previously been recorded from 2000 to 2004. Introduced pests of significance included pine shoot beetle (*Tomicus piniperda* L.) with reports on Scots pine (*Pinus sylvestris* L) across much of southern Ontario; there were no new finds of the Asian longhorned beetle (*Anoplophora glabripennis* Motschulsky) but there were expansions in the range of emerald ash borer (*Agrilus planipennis* Fairmaire), which most recently been found in London, Middlesex County. An extensive trapping program this year for the European wood wasp (*Sirex noctilio* Fabricus) found this insect across southwestern and southcentral Ontario.

Principaux ravageurs forestiers en Ontario – État de la situation en 2006

Résumé

En 2006, la tordeuse du pin gris (*Choristoneura pinus pinus* Freeman) a étendu son aire dans le nord-ouest de l'Ontario et y a défolié plus de 720 000 ha. Dans la moitié est de la province, l'infestation couvrait moins de 20 000 ha. Les effectifs de la tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana* Clem.) ont de nouveau augmenté en 2006, et la défoliation, concentrée dans le nord-est de la province, s'étendait sur presque 800 000 ha. La livrée des forêts (*Malacosoma disstria* Hbn) a défolié 370 000 ha. La superficie défoliée par la spongieuse (*Lymantria dispar* L.), essentiellement confinée au sud de l'Ontario, a augmenté pour atteindre 10 000 ha. La tordeuse du tremble (*Choristoneura conflictana* (Wlk.)) a causé des infestations très éparses couvrant une superficie totale de plus de 30 000 ha. Les dégâts causés par le scolyte du caryer (*Scolytus quadrispinosus* Say) se sont intensifiés dans le sud de l'Ontario. Les superficies infestées par le porte-case du mélèze (*Coleophora laricella* Hbn.), la noctuelle décolorée (*Enargia decolor* (Wlk.)) et le pamphile introduit du pin (*Acantholyda erythrocephala* L.) ont diminué. Les tempêtes estivales du 17 juillet et du 2 août ont entraîné la chute de nombreux arbres dans plusieurs districts du nord-est et du sud de la province et ont provoqué des dégâts sur un total de 57 135 ha. Pour la deuxième année consécutive, la région touchée par le dépérissement du peuplier faux-tremble n'a pas augmenté dans le nord-est de l'Ontario, contrairement à la tendance observée de 2000 à 2004. Parmi les ravageurs introduits d'importance, le grand hylésine des pins (*Tomicus piniperda* L.) a causé des dommages au pin sylvestre (*Pinus sylvestris* L.) dans une bonne partie du sud de l'Ontario; aucune nouvelle découverte de longicornes étoilés (*Anoplophora glabripennis* Motschulsky) n'a été signalée, mais l'agrile du frêne (*Agrilus planipennis* Fairmaire) a étendu son aire et a été trouvé tout récemment à London, dans le comté de Middlesex. Cette année, une vaste campagne de piégeage a confirmé la présence de la guêpe perce-bois (*Sirex noctilio* F.) dans les régions du sud-ouest et du centre-sud de l'Ontario.

STATUS OF IMPORTANT FOREST PESTS IN ONTARIO IN 2006

OVERVIEW

In 2006, jack pine budworm (*Choristoneura p. pinus* Freeman*)* populations expanded in northwestern Ontario, defoliating more than 720,000 ha. The outbreak in northeastern Ontario was just less than 20,000 ha. The area defoliated by the spruce budworm (*Choristoneura fumiferana* Clem.) increased in 2006 to almost 800,000 ha, primarily in the northeast. Forest tent caterpillar (*Malacosoma disstria* Hbn) defoliated 370,000 ha. Gypsy moth (*Lymantria dispar* L.) defoliation increased to 10,000 ha, mostly in southern Ontario. Large aspen tortrix (*Choristoneura conflictana* (Wlk.)) infestations occurred in widely separated infestations totalling over 30,000 ha. The damage caused by the hickory bark beetle (*Scolytus quadrispinosus* Say) intensified in the 344,982 ha affected area of southern Ontario. Area infested by larch casebearer (*Coleophora laricella* Hbn.), the aspen twoleaf tier (*Enargia decolor* (Wlk.)) and pine false webworm (*Acantholyda erythrocephala* L.) declined. Summer storms resulted in blowdown in several districts of the northeast and southern parts of the province totaling 57,135 ha. For the second year the area of aspen decline in northeastern Ontario, which was mapped from 2000 to 2004, did not increase. Introduced pests of significance included pine shoot beetle (*Tomicus piniperda* L.), which was reported on Scots pine (*Pinus sylvestris* L.) across much of southern Ontario; there were no new finds of the Asian longhorned beetle (*Anoplophora glabripennis* Motschulsky) but there were expansions in the range of emerald ash borer (*Agrilus planipennis* Fairmaire), which has most recently been found in London, Middlesex County. An extensive trapping program this year for the European wood wasp (*Sirex noctilio* Fabricus) found this insect across southwestern and southcentral Ontario.

MAJOR FOREST INSECTS AND DISEASES

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

There was a significant enlargement of the spruce budworm infestation in 2006. The majority of this increase occurred in the North Bay District of northeastern Ontario. Here, the infested area almost tripled to 690,731 ha from the 250,936 ha infested in 2005. Newly infested areas of spruce, *Picea* spp. and balsam fir, *Abies balsamea* (L.) forest were mapped to the north, south and east of the existing infestation. Increased areas of damage also occurred in the Sudbury and Sault Ste. Marie districts of the Northeast Region (Table 1 and Figure 1).

Table 1: Gross area of moderate-to-severe defoliation caused by the spruce budworm in Ontario, 2003 - 2006.

Region	Area (ha)			
District	2003	2004	2005	2006
Northwest				
Kenora	1 188	138	209	0
	1 188	138	209	0
Northeast				
North Bay	158 305	187 854	250 936	690 731
Sault Ste. Marie	0	0	302	3 250
Sudbury	41 071	40 448	47 768	72 739
	199 376	228 302	299 006	766 720
Southern				
Bancroft	3 805	6 675	0	0
Kemptville	2 117	11 381	9 238	6 341
Parry Sound	0	0	0	2 796
Pembroke	22 818	32 858	28 988	21 349
Peterborough	422	470	44	0
	29 162	51 384	38 270	30 486
TOTAL	229 726	279 824	337 485	797 206

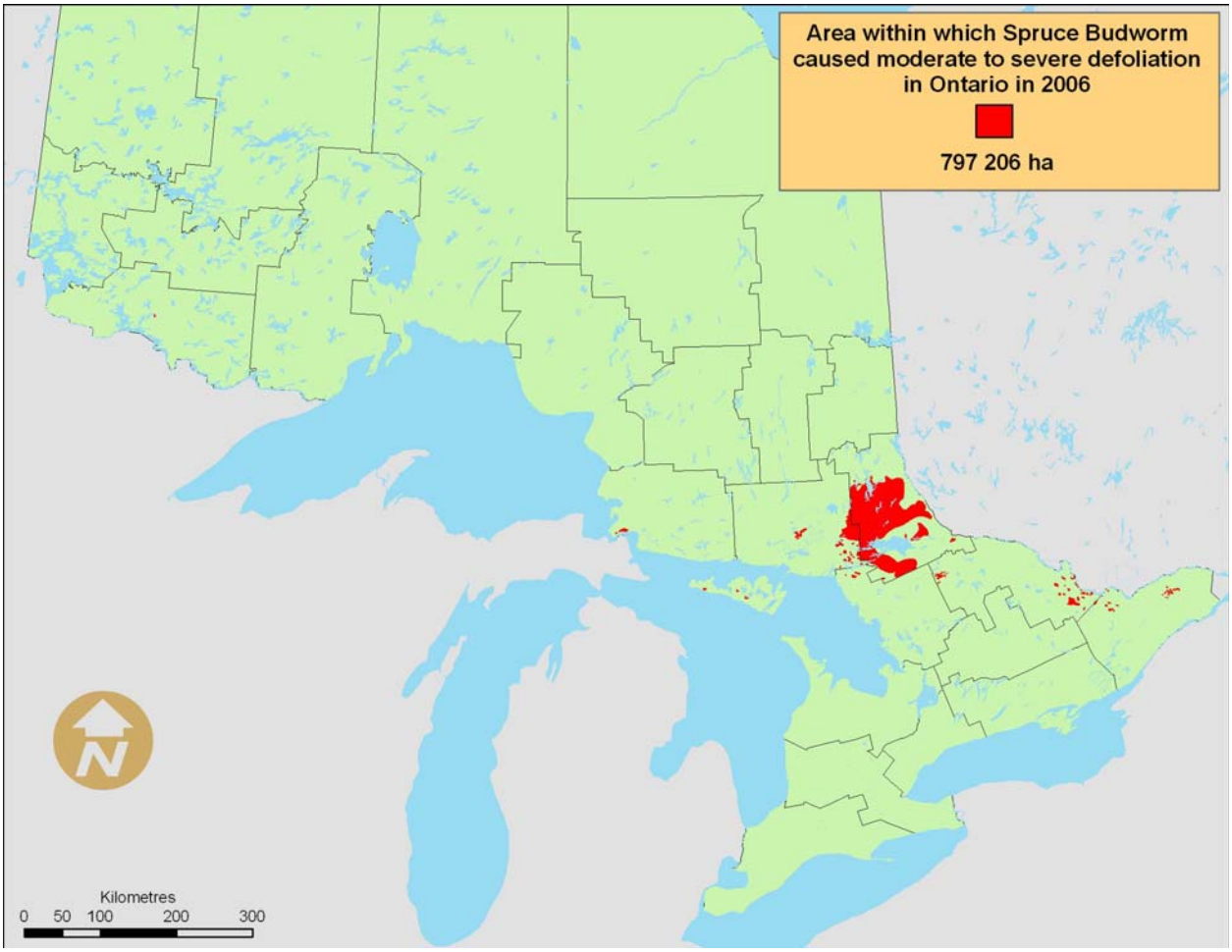

Figure 1. Areas of spruce budworm defoliation in Ontario in 2006.

In the area that has been infested for several years, tree mortality has been recorded for the past few years. This area within which tree mortality occurred was 17,060 ha in 2005. In 2006 small new areas of tree mortality were recorded near the southwest arm of Lake Temagami and near the town of Field, North Bay District. The area within which new mortality occurred is 2,796 ha. (Table 2 and Figure 2).

In the Southern Region there were newly infested areas in the Parry Sound District and in Algonquin Park but there was a decline in the affected area of Pembroke and Kemptville districts. In southern Ontario the overall area of moderate-to-severe defoliation decreased from 38,270 ha in 2005 to 30,486 ha in 2006. There were also numerous points of spruce budworm-related tree mortality reported in the Pembroke and Kemptville districts.

In the Northwest Region, the only recorded damage due to spruce budworm was in the Fort Frances District where 317 ha of light defoliation was recorded.

Table 2: Cumulative area of spruce and balsam fir mortality caused by the spruce budworm in Ontario, 2003 - 2006.

Region	Area (ha)			
District	2003	2004	2005	2006
Northeast				
North Bay	3 549	9 839	11 748	14 544
Sudbury	3 920	3 974	5 312	5 312
	7 469	13 813	17 060	19 856
TOTAL	7 469	13 813	17 060	19 856

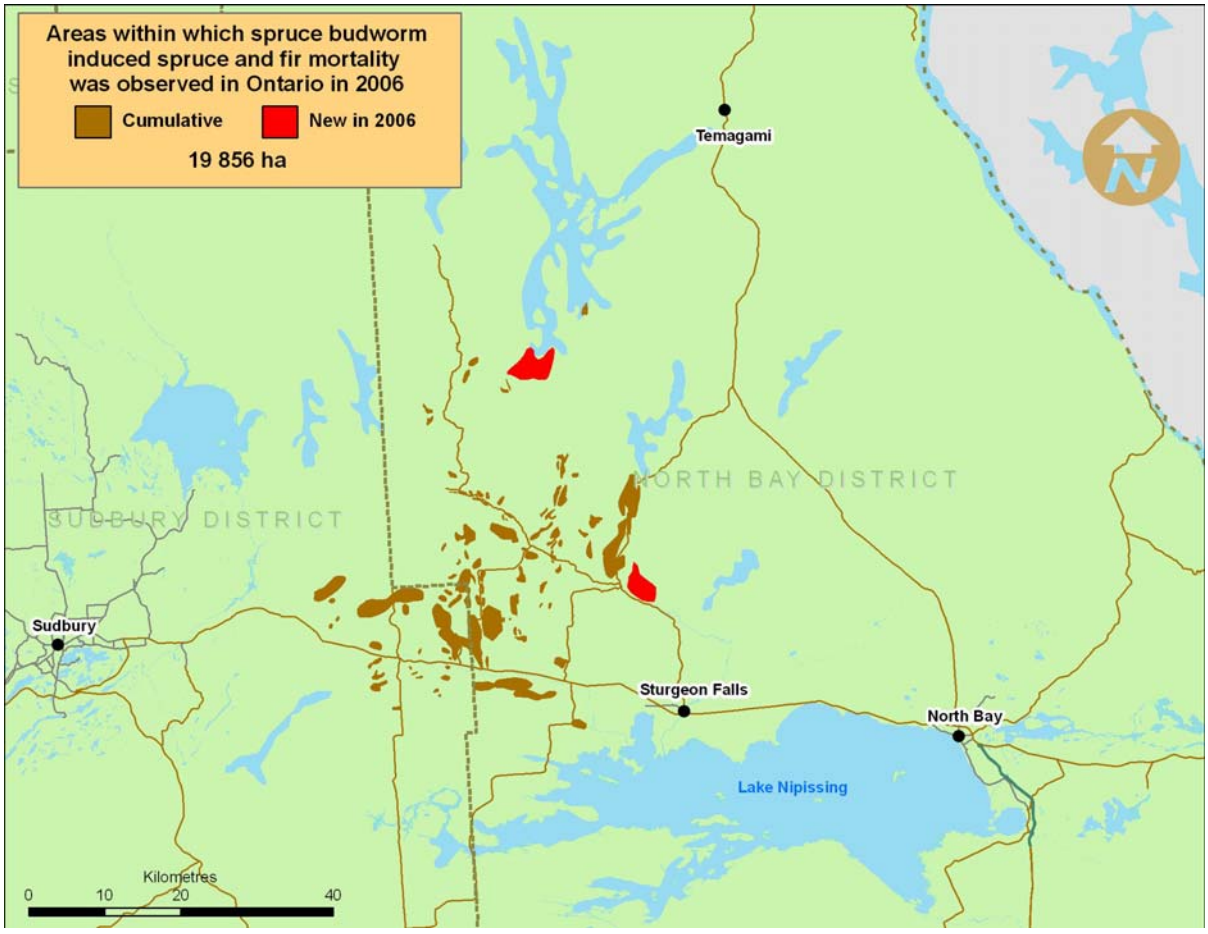

Figure 2. Areas of spruce budworm mortality in Ontario in 2006.

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

There was a huge increase in the area of defoliation caused by the jack pine budworm in 2006. Last year in the Northwest Region almost all of the damaged area was in the Fort Frances District. This area enlarged from 85,328 ha in 2005 to 355,134 ha in 2006. There were also dramatic increases in the adjoining districts of Dryden and Kenora, where the area affected is 116,195 ha and 248,843 ha, respectively. Jack pine, Pinus banksiana Lamb. is now affected by jack pine budworm in a total of 720,172 ha. (Table 3 and Figure 3).

Table 3: Gross area of moderate-to-severe defoliation caused by the jack pine budworm in Ontario, 2004 - 2006.

Region / District	Area (ha)		
	2004	2005	2006
Northwest			
Dryden	0	1 983	116 195
Fort Frances	0	85 328	355 134
Kenora	0	1 134	248 843
		88 445	720 172
Northeast			
Sault Ste. Marie	0	953	951
Sudbury	851	2 599	14 038
	851	3 552	14 989
Southern			
Parry Sound	0	0	4 548
Pembroke	0	222	407
	0	222	4 955
TOTAL	**851**	**92 219**	**740 116**

In northeastern Ontario the total area defoliated increased from 3,552 ha in 2005 to 14,989 ha in 2006 and is still confined to Sault Ste. Marie and Sudbury districts. In the Southern Region there were newly infested areas along the eastern shoreline of Georgian Bay and a reoccurrence of the pest in Pembroke District.

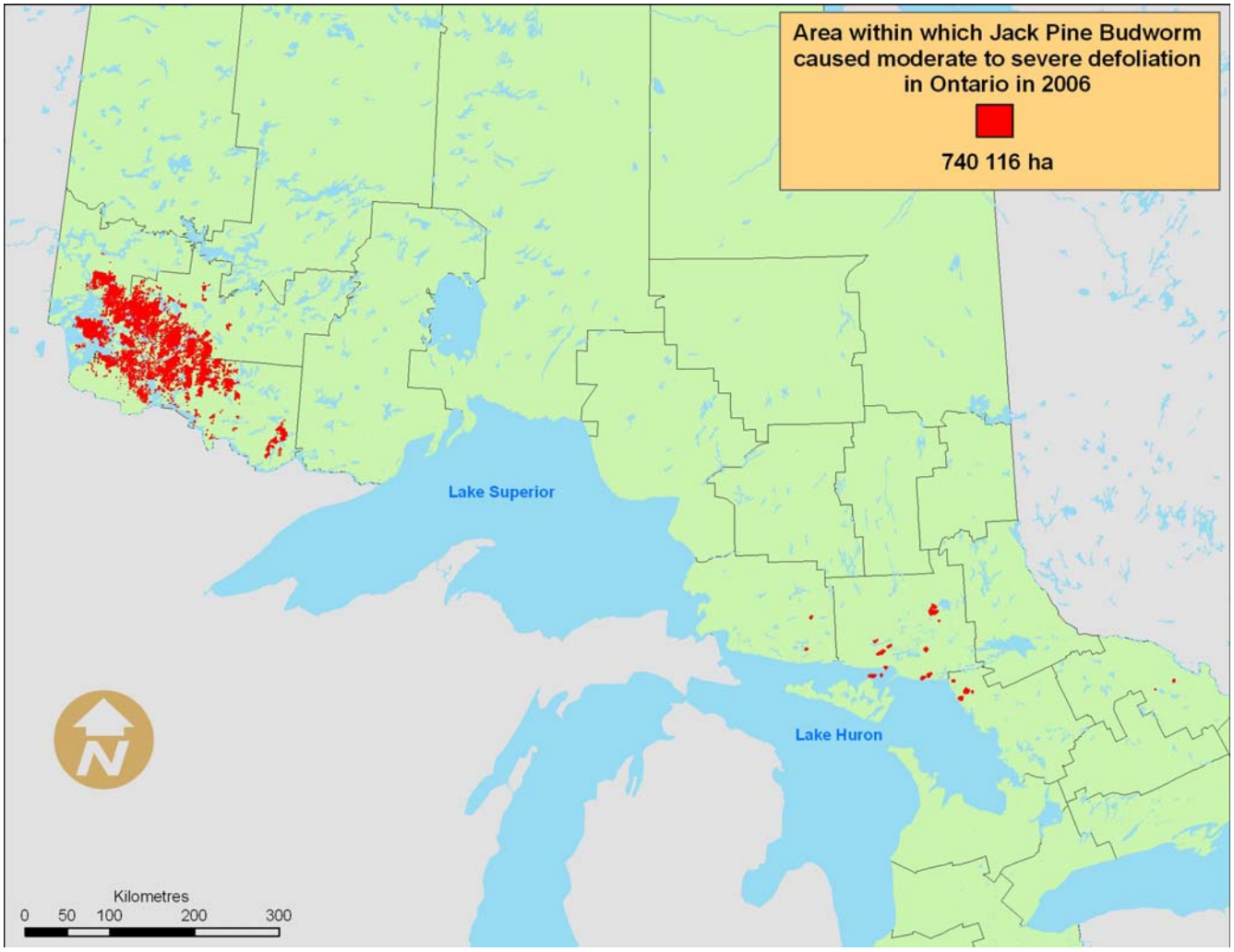

Figure 3. Areas of jack pine budworm defoliation in Ontario in 2006.

Gypsy Moth, *Lymantria dispar* (L.)

There were increased areas of defoliation in the Southern Region. The affected area was 445 ha in Aurora District, 776 ha in Aylmer District and 8,997 ha in the Guelph District. This amounted to a total of 10,218 ha compared with the 1,242 ha that was mapped in 2005. There was a small area of damage (132 ha) on islands in Lake Nipissing, North Bay District (Table 4 and Figure 4). Gypsy moth has been a problem in urban settings. A highly successful spray operation was conducted against gypsy moth in the city of Mississauga in 2006 (Fleischmann, 2006).

Table 4: Gross area of moderate-to-severe defoliation caused by the gypsy moth in Ontario, 2003 - 2006

Region / District	Area (ha)			
	2003	2004	2005	2006
Northeast				
North Bay	0	177	0	132
Sault Ste. Marie	130	0	0	0
Sudbury	979	0	0	0
	1 109	177	0	132
Southern				
Aurora	0	0	69	445
Aylmer	0	16	32	776
Bancroft	5 216	248	0	0
Guelph	0	0	1 141	8 997
Kemptville	938	0	0	0
Midhurst	11 728	0	0	0
Parry Sound	25 732	0	0	0
Peterborough	14 690	0	0	0
	58 304	264	1 242	10 218
TOTAL	**59 413**	**441**	**1 242**	**10 350**

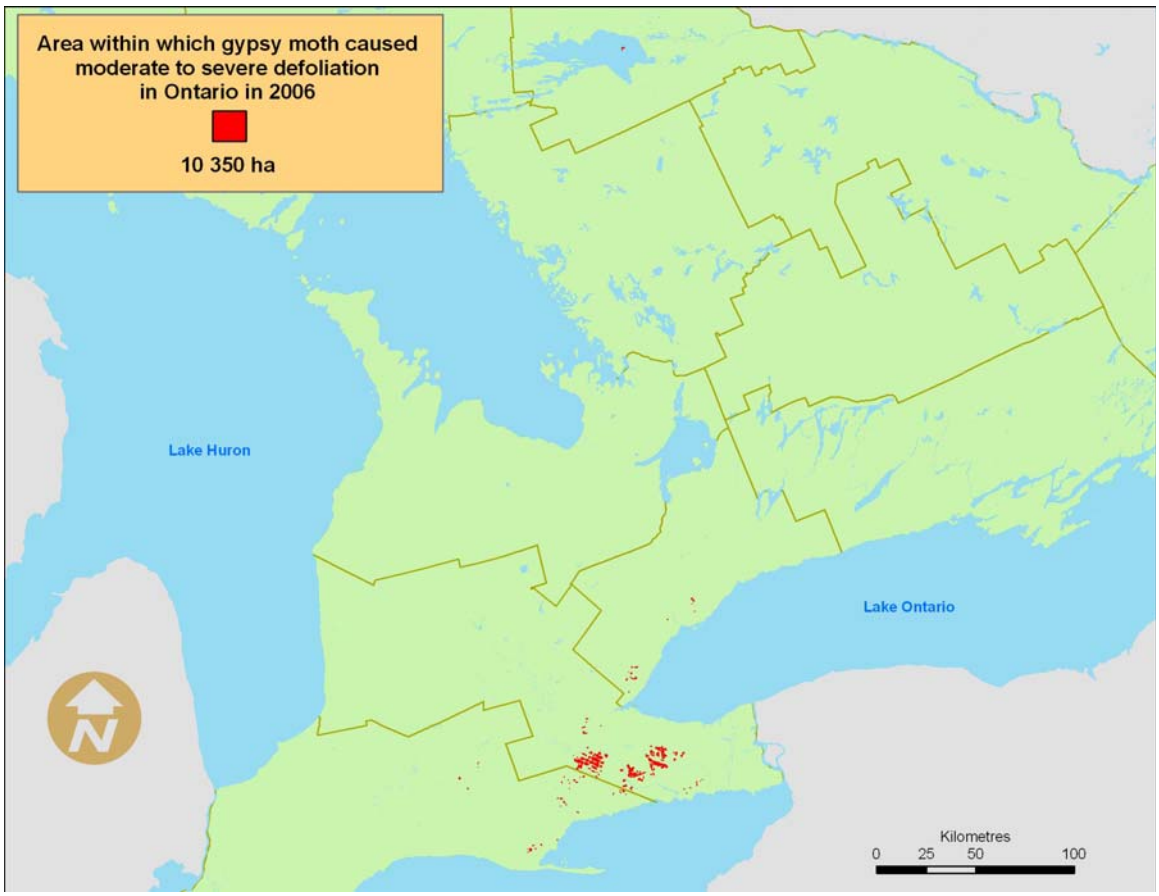

Figure 4. Areas of gypsy moth defoliation in Ontario in 2006

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The current outbreak of forest tent caterpillar peaked in 2001 with more than 13 million hectares of infestation and extensive areas of defoliation across the entire province. Since then there has been a decline in the infested area. This year a total of 370,759 ha of moderate-to-severe defoliation occurred, mostly in the Sudbury District (355,532 ha) with smaller areas in the North Bay (4,946 ha) and Parry Sound (10,281 ha) districts. Parry Sound District was the only location where the affected area increased from last year. Infested areas in the other districts continued to decline (Table 5 and Figure 5).

Table 5: Gross area of moderate-to-severe defoliation caused by the forest tent caterpillar in Ontario, 2003 – 2006

Region / District	Area (ha)			
	2003	2004	2005	2006
Northwest				
Fort Frances	6 345	0	0	0
Nipigon	857 302	583 505	0	0
Thunder Bay	1 893 982	22 991	0	0
	2 757 629	606 496	0	0
Northeast				
Hearst	141 690	29 223	0	0
Kirkland Lake	418 379	2 549	0	0
North Bay	318 330	143 239	28 501	4 946
Sault Ste. Marie	26 549	0	0	0
Sudbury	608 301	458 767	435 399	355 532
Timmins	155 477	3 459	0	0
	1 668 726	637 237	463 900	360 478
Southern				
Midhurst	2 798	1 915	0	0
Parry Sound	60 889	31 886	5 932	10 281
	63 687	33 801	5 932	10 281
Total	**4 490 042**	**1 277 534**	**469 832**	**370 759**

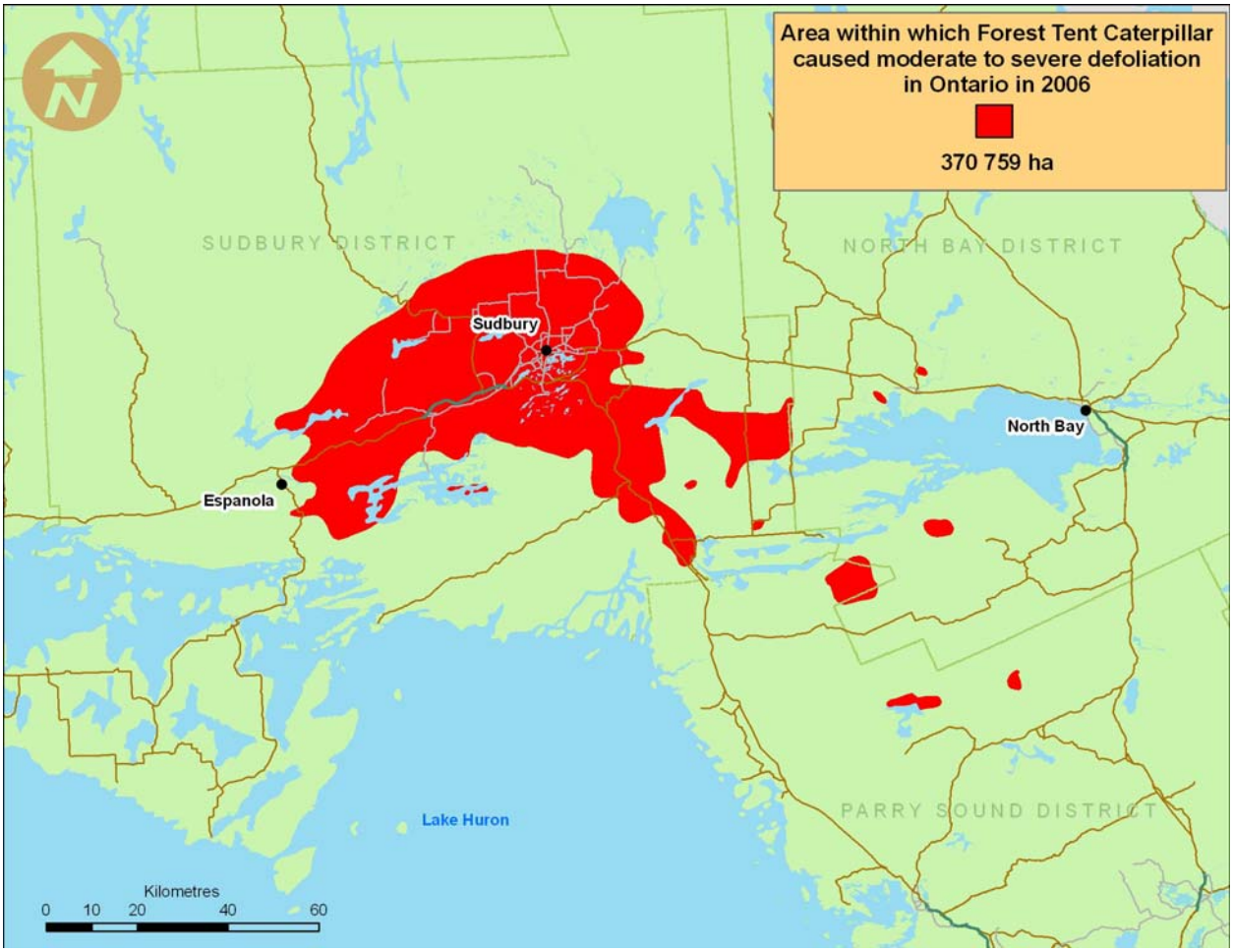

Figure 5. Areas of forest tent caterpillar defoliation in Ontario in 2006.

Pine False Webworm, *Acantholyda erythrocephala* (L.)

Pine false webworm defoliation resulted in moderate-to-severe damage on 286 ha in pine plantations, all of which occurred in Midhurst District of southern Ontario. This marks a reduction from the 732 ha of damage reported in 2005. The primary host of the insect was eastern white pine, *Pinus strobus* L.

There were several other reports of pine false webworm elsewhere in the province: red pine, *Pinus resinosa* Ait. and jack pine were lightly damaged near Kakabeka Falls, Thunder Bay District; red and white pine were heavily damage in a small pocket near Sault Ste. Marie; moderate defoliation was reported in Westmeath Township, Pembroke District; and low populations occurred on understory pines in previously heavily damaged stands in the Ganaraska Forest, Peterborough District.

Larch Casebearer, *Coleophora laricella* (Hbn.)

Areas of damage from larch casebearer were less evident in 2006; however 991 ha of heavy defoliation were mapped in Kemptville District; about 10 percent of what was recorded in 2005. Repeated damage for consecutive years has resulted in many areas of tamarack, *Larix laricina* (Du Roi) K. Koch mortality in the Kemptville and Pembroke districts.

Hickory Bark Beetle, *Scolytus quadrispinosus* Say

The hickory bark beetle has caused damage in the London area of southwestern Ontario since 2001 when hickory tree mortality occurred in an area of 134 ha. In each subsequent year the area of damage increased, reaching a high in 2005 at 344,982 ha although this was a gross figure that included urban and agricultural lands. There was no increase in the affected area in 2006, however within the affected areas, numbers of insects are still high and residual hickories are still being attacked. Bitternut hickory, *Carya cordiformis* (Wangenh.), and shagbark hickory, *C. ovata* (Mill.) K. Koch, are the most commonly affected species; both occur as scattered individuals within hardwood stands in southwestern Ontario.

Whitespotted Sawyer Beetle, *Monochamus s. scutellatus* (Say)

Jack pine tree mortality occurred over an area of 1,322 ha as a result of sawyer beetle activity. Most of this damage occurred in the Collins Lake area, Thunder Bay District with lesser amounts occurring to the east in Nipigon District. Most of the trees had sustained maturation feeding damage in 2005 and previous to that the area had suffered from snow damage.

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

In southern Ontario the large aspen tortrix recurred in the Burk's Falls area of the eastern part of Parry Sound District. The defoliated area was 5,937 ha in 2006. In the far northwest part of the province there were newly infested areas of defoliated trembling aspen, *Populus tremuloides* Michx. These occurred in numerous areas of the northwest part of Kenora District (23,681 ha) and further north in the Berens River area and at Artery Lake in Red Lake district (1,076 ha).

Cedar Leafminers, *Argyresthia* spp.

This complex of leafmining insects occurred over a reduced area compared with 2005 but still amounted to 16,204 ha. This damage was all recorded in Kemptville District where there is whole and top tree mortality of eastern white cedar, *Thuja occidentalis* L., in areas of recurring leafminer infestation.

Fall Webworm, *Hyphantria cunea* (Drury)

There were reports of fall webworm from across the province. A number of hardwood hosts were affected. Occurrences of the pest were generally confined to small areas, but in Aylmer District in southern Ontario damage was mapped on approximately 300 ha of southern hardwood forest.

Bronze Poplar Borer, *Agrilus liragus* B. & B.

The bronze poplar borer occurred in a 126 ha area in Ledger Township, Nipigon District in northwestern Ontario. The host of the borer is balsam poplar, *Populus balsamifera* L., but it was also recorded on trembling aspen this year.

Aspen Two-leaf Tier, *Enargia decolor* (Wlk.)

Close to 5,000 ha were defoliated by the aspen two-leaf tier in the Shining Tree and Elk Lake areas of Timmins and Kirkland Lake districts, Northeastern Region. This marks a reduction from the 78,404 ha mapped in 2005.

OTHER INSECTS AND DISEASES

A number of other pests of significance occurred in Ontario in 2006. The **Hickory Leafroller, *Argyrotaenia juglandana* (Fern.)** defoliated shagbark hickory an area of 925 ha in the Guelph and Aylmer districts, Southern Region. Sugar maple, *Acer saccharum* Marsh. was moderately defoliated by the **American Dagger Moth, *Acronicta americana* (Harr.)** near Providence Bay on Manitoulin Island, Northeastern Region. The **Bronze Birch Borer, *Agrilus anxious* Gory**. was reported as a factor in the decline of birch, *Betula* spp. trees from areas across the province. A high incidence of **Eastern Dwarf Mistletoe, *Arceuthobium pusillum* Peck** occurred on spruce in Northern Bruce Peninsula, Midhurst District, Southern Region. High levels of **Armillaria Root Rot, *Armillaria* spp**. were mapped on jack pine in a 352 ha area west of Jellicoe, Nipigon District, Northwest Region. Moderate-to-severe foliar damage was caused to basswood, *Tilia americana* at several locations from Lake Simcoe west to Essex County in southern Ontario by **Basswood Leafminer, *Baliosus nervosus* (Panz.)**. The **Birch Casebearer, *Coleophora serratella* (L.)** recurred for the fourth year in Peterborough and Bancroft districts of southcentral Ontario and caused moderate-to-severe damage to white birch, *Betula papyrifera* Marsh. American beech, *Fagus grandifolia* suffered twig and branch mortality from **Oystershell scale, *Lepidosaphes ulmi* (L.)** at locations in Parry Sound, Bancroft, Midhurst and Pembroke districts, Southern Region. There were numerous reports of **Dutch Elm Disease, *Ophiostoma ulmi* (Buisman) Nannf.** across southern Ontario. Also in southern Ontario, **Maple Leafrollers, *Sparganothis acerivorana* MacK.** and ***S. pettitana* (Rob.)** caused defoliation on 13 ha of sugar maple in Aurora District and high populations occurred through much of Pembroke District.

ABIOTIC FOREST DISTURBANCES

Aspen Decline/Mortality

This condition caused widespread aspen decline and tree mortality in the Hearst to Cochrane area of northeastern Ontario. Damaged areas were first mapped in 2000 and continued to 2004 when the accumulated area of damage totalled over one half million hectares. Average annual mortality in a number of study plots indicate that tree mortality reached a high in 2005 when the average accumulated mortality was 74 percent. There have been no new areas of decline or mortality related to this occurrence in the past two years. The mortality is believed to have been caused by a multitude of stressful events such as repeated forest tent caterpillar defoliation, drought and unseasonable freeze/thaw occurrences.

Storm Damage

In 2006 a number of storms resulted in tree damage and sometimes blowdown over large tracts of forested areas. A winter storm of wet snow, in early February, caused considerable tree damage in Bruce and Grey counties of southern Ontario. There were several summer storms that resulted in extensive widespread tree damage on a total of 57,135 ha. Two storms, one on July 17th and the other on August 2nd were responsible for most of the damage.

There were three tracts of damage caused by the July 17th storm. In the north, a complex of thunderstorms that began near Hornepayne and tacked eastwards to the Quebec border left large areas of blowdown in the northern part of the Chapleau District (10,235 ha), the adjacent area of Hearst District (1,020 ha) and near Larder Lake, Kirkland Lake District (1,904 ha). Another series of thunderstorms began west of Manitoulin Island continued eastwards south of Sudbury, through North Bay and Mattawa and then down the Ottawa River valley to the Deep River area. This system of thunderstorms generated microbursts, which caused extensive blowdown totalling almost 40,000 ha. Most of the damage was mapped from North Bay to the Quebec border and through the north end of Algonquin Park and along the Ottawa River. Storm activity in southern Ontario resulted in a number of tornados and an area of blowdown (4 ha) near Newmarket.

On August 2nd there were at least nine tornados reported by Environment Canada, all in southcentral and southeastern Ontario. Significant areas of blowdown were reported from Christian Island in Georgian Bay and damaged areas were mapped in an east-west lines in Peterborough, Haliburton and Hastings counties and extended into Renfrew County in the Combermere area, which was particularly heavily hit (Figure 6).

Also in 2006 following a storm on June 21 two small pockets of blowdown, totalling 208 ha, were mapped west of Kakabeka Falls in Thunder Bay District in Northwestern Ontario.

Other Abiotic Damage

In the Northwest Region below average rainfall and hot temperatures resulted in widespread **Drought Damage** in Red Lake, Dryden and Sioux Lookout districts. In southern Ontario damage was reported on red pine in a 7,070 ha upland area north of Black Donald Lake, Pembroke District and also on shallow soils on the Carden Plain in Peterborough District. **Frost Damage** on new shoots of balsam fir occurred in low lying areas, Sault Ste. Marie District, Northeast Region. **Heavy Flowering and Seed** occurred on a number of tree hardwood and coniferous tree species in northeastern and southern Ontario and in some instances thinning tree crowns resulted. **White Pine Browning,** which was prevalent in northeastern Ontario in 2005, was not evident in 2006. **White spruce mortality** was recorded on over 4,410 ha of natural overmature white spruce in the Wawa area. Associated with this condition was the **Northern Spruce Engraver, *Ips perturbatus* (Eich.)**. In southern Ontario dying white spruce occurred on Canadian Forces Base Borden; the associated insects were the **Northern Engraver, *Ips borealis* Sw.** and another bark beetle, ***Dryocoetes affaber* (Mann.).**

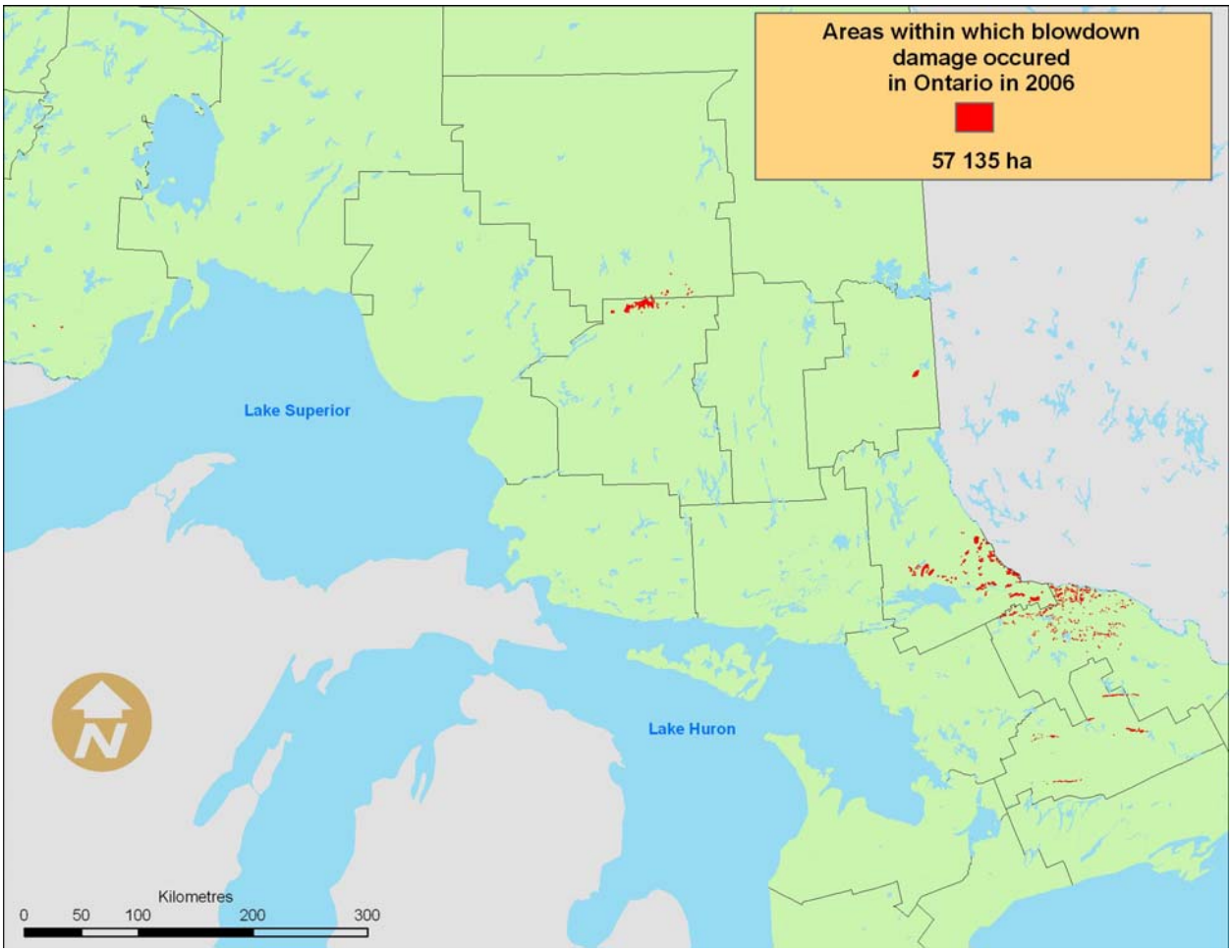

Figure 6. Areas of blowdown in Ontario in 2006.

INVASIVE PESTS

Emerald Ash Borer, *Agrilus planipennis* Fairmaire

The emerald ash borer (EAB) was first detected in Canada in Windsor in 2002. Since then it has been found throughout Essex County and through much of the Municipality of Chatham-Kent. Last year newly infested areas were located in Lambton County and in the Municipality of Dutton/Dunwich within Elgin County. In November 2006, the Canadian Food Inspection Agency (CFIA) confirmed the presence of the Emerald Ash Borer in London, Ontario. This marks the first occurrence of the pest in Middlesex County. In an effort to slow the spread of this pest the CFIA has implemented Ministerial Orders under the Plant Protection Act, which regulate the movement of ash wood and wood products and firewood of all species out of regulated areas where EAB has been found. Regulated areas surround the infested areas. Surveys are being conducted by CFIA. The generally infested area, positive sites and areas regulated are depicted in Figure 7 (CFIA map).

Damage surveys within areas where EAB has become established were conducted again in 2006. An ever increasing amount of damage to stands containing ash is evident in this area. Most of the heaviest damage still occurs west of the Ash Free Zone, the area within which all ash trees were removed between Lake St. Clair and Lake Erie, in Essex County and the west part of Chatham-Kent (Figure 8).

Asian Longhorned Beetle, *Anoplophora glabripennis* (Motschulsky)

The Asian longhorned beetle was first discovered in Toronto and the adjacent area of Vaughan in September of 2003. An aggressive eradication plan was established at that time. It began in November 2003 with removal of all known susceptible host tree species. Most of the trees were removed in 2004 but the discovery of outliers on the periphery of the original area of infestation necessitated the removal of more trees in 2005. All of these locations are within the regulated area that was established in February of 2004. There remains a diligent effort by CFIA, the City of Toronto and other co-operators to detect the Asian longhorned beetle. No new infestations were reported in 2006.

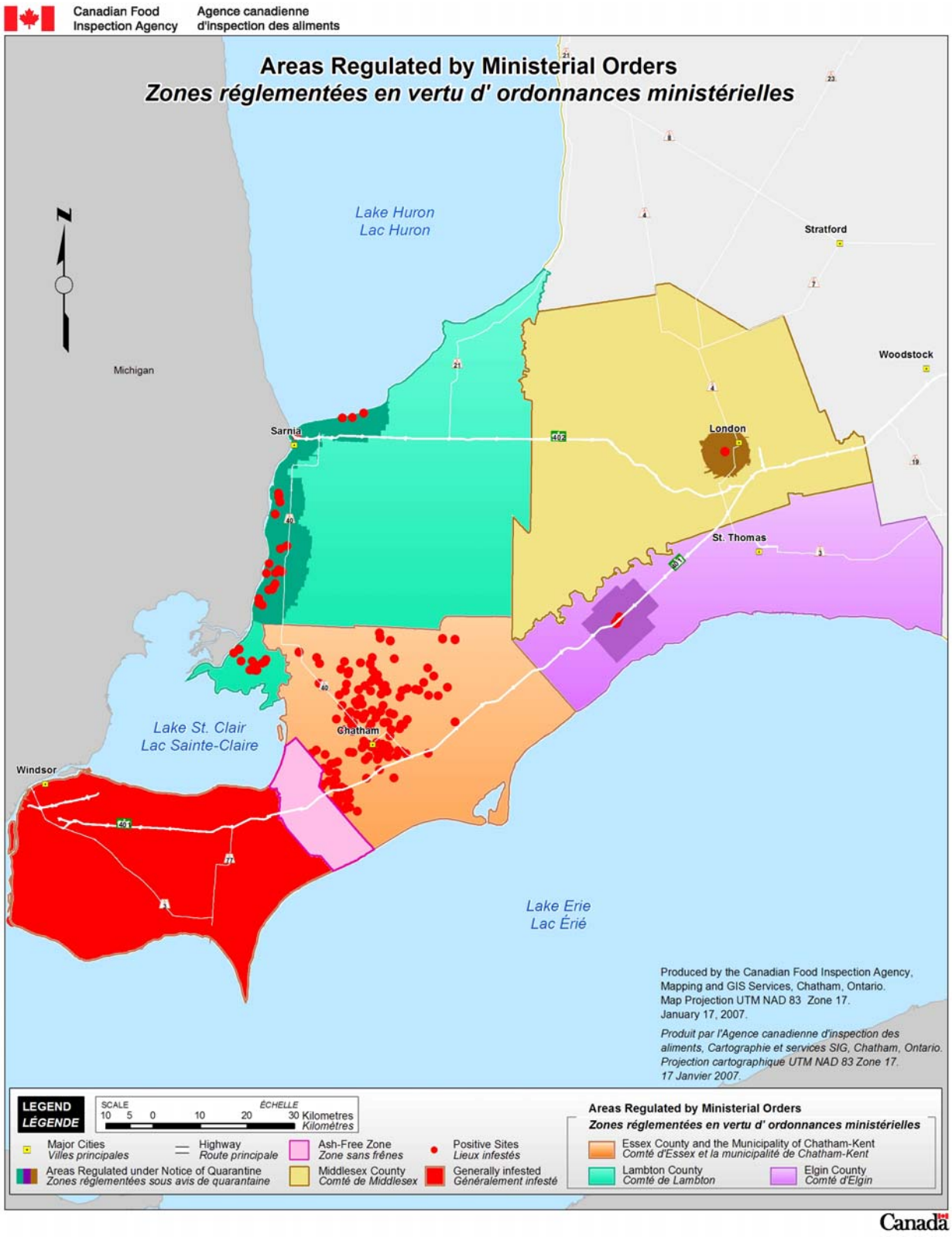

Figure 7. Locations of emerald ash borer in Ontario in 2006 recorded by the Canadian Food Inspection Agency.

Figure 8. Areas of damage and mortality caused by the emerald ash borer in Ontario in 2006.

European Wood Wasp, *Sirex noctilio* (Fabricus)

The European wood wasp was first detected in North America in a 2004 collection from Fulton in upstate New York. In 2005 the CFS/MNR team deployed a number of traps to specifically monitor for this pest in southeastern Ontario. There were positive results from 4 of 36 locations. Three of these were in Prince Edward County and the other was in Leeds and Grenville County. Also in 2005 there were two positive locations from CFIA traps, which occurred near Uxbridge, Durham Region and in the City of Cambridge, Waterloo Region.

In 2006 trapping surveys were conducted across southern Ontario. Traps were deployed in a total of 131 pine stands from across southern Ontario. Positive collections of *S. noctilio* were made at 37 of these sites (Figure 9).

Figure 9. European wood wasp survey results in Ontario in 2006.

In addition traps were set out through some the adjacent area of northeasten Ontario. Here a total of 27 sites were selected, traps were baited and deployed. Results were negative for *S. noctilio* at all of these locations.

Other Invasive Pests

A new distribution point was recorded for the **Introduced Pine Sawfly, *Diprion similis* (Htg.)** in the Town of Sioux Lookout in northwestern Ontario. A new positive site for **Scleroderris Canker, *Gremmeniella abietina* (Lagerb.) M. Morelet** was recorded in Laurier Township, in northeast Parry Sound District, Southern Region. **Satin Moth, *Leucoma salicis* (L.)** was collected for the first time from Manitoulin Island in northeastern Ontario. There were high numbers of satin moth at a number of locations especially in the Sudbury area. **Pine Shoot Beetle, *Tomicus piniperda* (L.)** numbers remain high at locations in southern Ontario.

ACKNOWLEDGEMENTS

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Quebec Report / Rapport du Québec

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http://www.mrnf.gouv.qc.ca/forets/fimaq/insectes/fimaq-insectes-portrait.jsp

ÉTAT DE SITUATION DES PRINCIPAUX RAVAGEURS FORESTIERS AU QUÉBEC EN 2006

Résumé

La tordeuse des bourgeons de l'épinette est demeurée le principal ravageur des résineux. Les infestations de la tordeuse du tremble se sont agrandies dans plusieurs régions de la province. Une tempête en juillet a causé d'importants chablis dans le sud-ouest du Québec.

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

Les aires infestées par la tordeuse des bourgeons de l'épinette ont augmenté en 2006 dans la province. Elles totalisent près de 50 500 hectares comparativement à 43 265 hectares l'année dernière (Tableau 1). Des défoliations ont encore été relevées dans les régions de l'Outaouais, des Laurentides, du Centre-du-Québec, de la Mauricie et du Saguenay-Lac-Saint-Jean alors qu'on détectait, pour la première fois depuis 1992, la présence de dégâts dans la région de la Côte-Nord.

L'épidémie demeure majoritairement concentrée dans les forêts privées du sud de la région de l'Outaouais où des défoliations sont relevées annuellement depuis 1992. Quelque 46 000 hectares y ont été touchés en 2006, soit près de 6 000 hectares de plus qu'en 2005.

Les infestations locales recensées depuis plusieurs années dans les régions des Laurentides, du Centre-du-Québec et de la Mauricie n'ont pas connu d'expansion importante au cours des ans. Les dégâts y ont même été moins étendus et moins graves en 2006. La situation est similaire au Saguenay-Lac-Saint-Jean où l'étendue et la gravité des dégâts ont diminué cette année. Bien que quelques nouveaux foyers soient apparus le long de la rivière Saguenay et dans la plaine du Lac

Saint-Jean, les défoliations demeurent majoritairement confinées dans les limites de la ville de Saguenay.

Le fait saillant de l'année 2006 est la détection d'îlots de défoliation couvrant quelque 2 300 hectares dans la région de la Côte-Nord. Les forêts affectées sont localisées au nord de Baie-Comeau et au nord-ouest de Port-Cartier.

Tableau 1 - Superficies touchées par la tordeuse des bourgeons de l'épinette au Québec en 2006 (en hectares).

Régions administratives	Niveaux de défoliation			Total
	Léger	Modéré	Grave	
Saguenay-Lac-Saint-Jean	**745** (323) [1]	**207** (356)	**332** (934)	**1 284** (1 613)
Estrie	**0** (0)	**0** (0)	**0** (0)	**0** (0)
Centre-du-Québec	**45** (61)	**14** (58)	**11** (148)	**70** (267)
Mauricie	**479** (50)	**172** (388)	**27** (594)	**678** (1 032)
Laurentides	**17** (0)	**9** (91)	**0** (0)	**26** (91)
Outaouais	**7 745** (3 228)	**13 592** (11 009)	**24 784** (26 025)	**46 121** (40 262)
Côte-Nord	**1 780** (0)	**435** (0)	**104** (0)	**2 319** (0)
Total	**10 811** (3 662)	**14 429** (11 902)	**25 258** (27 701)	**50 498** (43 265)

( ) [1] : Superficies touchées en 2005

Prévisions pour 2006

L'inventaire des larves en hibernation à l'échelle provinciale permet de suivre l'évolution des populations de tordeuses des bourgeons de l'épinette à court terme. Plusieurs stations d'observation ont été ajoutées cette année suite à la découverte d'un foyer d'infestation sur la Côte-Nord. Les relevés de L2 réalisés par la Société de protection des forêts contre les insectes et les maladies (SOPFIM) ont permis d'évaluer les populations de tordeuse dans 54 sites additionnels. Quelque 636 sites ont été analysés en 2006 pour dresser les prévisions.

Le relevé des larves en hibernation (L2) n'indique pas d'expansion majeure de l'épidémie de tordeuses en 2007. Les défoliations seront encore importantes dans le territoire infesté depuis plusieurs années dans la région de l'Outaouais. La progression des dégâts vers le nord-ouest de cette zone devrait s'y poursuivre l'année prochaine. Les foyers d'infestation localisés dans les régions du Centre-du-Québec et de la Mauricie seront encore actifs en 2007. Les dommages

persisteront également dans la région du Saguenay-Lac-Saint-Jean et ils devraient devenir plus apparents le long de la rivière Saguenay et dans la plaine du lac Saint-Jean. Dans la région de la Côte-Nord, les infestations locales connaîtront une expansion dans les secteurs avoisinants les aires infestées en 2006 et les dommages s'y intensifieront. Finalement, des dégâts devraient être apparents dans quelques localités du sud de l'Abitibi-Témiscamingue, près de la frontière de l'Ontario. Dans les autres régions de la province, les relevés des L2 montrent de faibles populations de tordeuse des bourgeons de l'épinette. On note, dans le réseau de pièges à phéromones, des captures de papillons généralement plus élevées qu'en 2006 dans la plupart des régions.

TORDEUSE DU PIN GRIS
Choristoneura pinus pinus Free.

L'infestation de ce défoliateur du pin gris s'est poursuivie pour une troisième année consécutive sur l'île du Grand Calumet dans la région de l'Outaouais. Les superficies défoliées sont passées de 562 hectares en 2005 à 179 hectares cette année, en partie à cause des coupes forestières réalisées dans les peuplements affectées. La présence de l'insecte dans des brise-vent de pin gris à proximité de la pépinière de Normandin dans la région du Saguenay-Lac-Saint-Jean est presque disparue suite à la mortalité et la récolte des arbres touchés durant les dernières années. Le relevé des populations anticipées ne laisse pas entrevoir de défoliation ailleurs dans la province que dans la zone infestée cette année en Outaouais.

ARPENTEUSE DE LA PRUCHE
Lambdina fiscellaria fiscellaria (Guen.)

Aucune défoliation n'a été relevée pour cet insecte en 2006. Les prévisions sur l'évolution des populations de ce ravageur pour 2005, établies à l'aide du relevé des œufs, seront disponibles à l'automne.

TORDEUSE DU TREMBLE
Choristoneura conflictana (Wlk.)

Les populations de ce défoliateur ont continué leur progression en 2006 au Québec. Les superficies infestées par la tordeuse du tremble se sont encore agrandies cette année et totalisent plus de 125 000 hectares. Les dégâts variant de léger à élevé se retrouvent sur le peuplier faux-tremble des peuplements mélangés et feuillus. On note une baisse de la sévérité des dommages dans certains secteurs affectés depuis trois ans.

Les aires défoliées ont augmenté pour couvrir la plupart des peuplements de peuplier faux-tremble dans la région du Saguenay-Lac-Saint-Jean bien que l'intensité des dommages soit moindre. Dans la région de la Côte-Nord, la présence de l'insecte s'est généralisée pour s'étendre de la rivière Saguenay jusqu'à l'est de Sept-Îles mais les dégâts semblent généralement moins importants. De la défoliation causée par le papillon satiné, *Leucoma salicis*, s'est mêlée à celle de la tordeuse du tremble dans certains secteurs urbains en bordure du fleuve Saint-Laurent. Les infestations dans la région du Bas-Saint-Laurent ont plus que doublé en 2006. En plus des foyers actifs l'année dernière, les dommages, généralement de niveau modéré à grave, se sont étendus vers l'est. Dans la région de la Gaspésie-Îles-de-la-Madeleine, des dégâts ont été observés pour

une première année le long de la côte. L'insecte a causé, dans la région de la Capitale-Nationale, des dégâts significatifs variant de légers à élevés à l'est de la Route 381 (Baie-Saint-Paul) jusqu'à la rivière Saguenay (unité de gestion de Charlevoix). La zone touchée par la tordeuse du tremble dans la région de la Mauricie s'étend de l'ouest de la réserve faunique de Mastigouche (unité de gestion du Bas-Saint-Maurice) jusqu'à l'est de l'unité de gestion de Windigo-et-Gouin (Kiskissink) et au sud jusqu'aux limites de Saint-Georges-de-Champlain. Dans la région de Lanaudière, des superficies de plus de 800 hectares ont été touchées par des défoliations de niveau modéré à grave. Quelques foyers d'infestation persistent dans l'Outaouais où les défoliations y sont légères. L'épidémie actuelle devrait commencer à se résorber de manière plus significative l'année prochaine dans les secteurs infestés au cours des dernières années.

LIVRÉE DES FORÊTS
Malacosoma disstria Hbn.

Aucune infestation de la livrée des forêts n'a été relevée cette année bien que des colonies aient été rapportées dans le sud de l'Outaouais et dans le sud-est du Saguenay-Lac-Saint-Jean.

SPONGIEUSE
Lymantria dispar (L.)

Au Québec, ce ravageur exotique n'est pas préoccupant depuis plusieurs années. En 2006, des dommages n'ont été rapportés que dans quelques plantations de chênes rouges dans le sud de la province.

DÉGÂTS CLIMATIQUES

Des chablis importants sont survenus lors de la tempête du 17 juillet 2006. Plus de 20 000 hectares de peuplements mélangés et feuillus ont été endommagés dans les régions de l'Abitibi-Témiscamingue, de l'Outaouais, de la Mauricie et des Laurentides.

Bilans du relevé des insectes et maladies des arbres du Québec:
http://www.mrnf.gouv.qc.ca/forets/fimaq/insectes/fimaq-insectes-portrait.jsp

Cartes des relevés aériens de défoliation:
http://www.mrnf.gouv.qc.ca/forets/fimaq/insectes/fimaq-insectes-portrait-superficies.jsp

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Quebec pest reports can be found at:

http://www.mrnf.gouv.qc.ca/forets/fimaq/insectes/fimaq-insectes-portrait.jsp

Aerial survey maps can be found at:
http://www.mrnf.gouv.qc.ca/forets/fimaq/insectes/fimaq-insectes-portrait-superficies.jsp

PRINCIPAL FOREST PESTS IN QUEBEC 2006

Abstract

The spruce budworm continued to be the principal pest of conifers in 2006. Infestations of large aspen tortrix spread over a wider area in several regions of the province. A thunderstorm in July resulted in major windfalls in southwestern Quebec.

SPRUCE BUDWORM

*Choristoneura fumiferan*a (Clem.)

In 2006, there was an increase in the total area infested by spruce budworm, to 50,500 hectares as compared to 43,265 last year (Table 1). Defoliations were observed in the Outaouais, Laurentides, Centre-du-Québec, Mauricie and Saguenay-Lac-Saint-Jean administrative regions, and for the first time since 1992, there was damage in the Côte-Nord (North Shore) region. The outbreak is for the most part concentrated in private forests in the southern part of the Outaouais region, where there have been defoliations every year since 1992. Some 46,000 hectares in this region were affected in 2006, which is almost 6,000 hectares more than in 2005. Local infestations in the Laurentides, Centre-du-Québec and Mauricie regions have not expanded over the years, and indeed damage was less extensive and less serious in 2006. The situation is similar in the Saguenay-Lac-Saint-Jean region, where damage declined in extent and seriousness this year. While some new centres of infestation appeared along the Saguenay River and in the floodplain of Lake Saint-Jean, defoliations were mostly confined to the town of Saguenay.

The highlight of 2006 was the discovery of patches of defoliation covering some 2300 hectares in the Côte-Nord region. The affected forests are north of Baie-Comeau and northwest of Port-Cartier.

Table 1 - Land area (ha) affected by spruce budworm in Quebec, 2006

Administrative Region	Degree of defoliation			Total
	Light	Moderate	Severe	
Saguenay-Lac-Saint-Jean	**745** (323) [1]	**207** (356)	**332** (934)	**1 284** (1 613)
Estrie	**0** (0)	**0** (0)	**0** (0)	**0** (0)
Centre-du-Québec	**45** (61)	**14** (58)	**11** (148)	**70** (267)
Mauricie	**479** (50)	**172** (388)	**27** (594)	**678** (1 032)
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Total	**10 811** (3 662)	**14 429** (11 902)	**25 258** (27 701)	**50 498** (43 265)

( ) [1] : Land area affected in 2005

Forecasts for 2007

The provincial inventory of hibernating larvae makes it possible to track short-term changes in spruce budworm populations. Several observation sites were added in 2006 after a centre of infestation was discovered in the Côte-Nord region. The L2 (hibernating larvae) surveys by SOPFIM (society to protect forests against insects and diseases) evaluated populations at 54 additional sites. Some 636 sites were analysed in 2006 in order to prepare forecasts. The L2 survey suggests no major expansion of the budworm outbreak in 2007. There will continue to be major defoliations in the areas of the Outaouais region that have been infested for many years. The northwest march of the defoliation in the region is expected to continue next year. Localized centres of infestation in the Centre-du-Québec and Mauricie regions will continue to be active in 2007. Damage will likewise persist in the Saguenay-Lac-Saint-Jean region and will become more apparent along the Saguenay River and in the floodplain of Lake Saint-Jean. In the Côte-Nord region, local infestations will expand to areas bordering those infested in 2006, and damage will intensify. Finally, damage will become apparent in a few localities in the southern Abitibi-Témiscamingue region near the Ontario border. In the other administrative regions of Quebec, the L2 surveys show only small budworm populations. The budworm pheromone trap data reveal moth captures that are generally higher than in 2006 in most regions.

JACK PINE BUDWORM
Choristoneura pinus pinus Free.

Jack pine budworm infestation continued for the third consecutive year on Grand Calumet Island in the Outaouais region. The defoliated land area decreased from 562 hectares in 2005 to 179 hectares in 2006, in part because trees in affected stands were cut down. The insect has almost disappeared from jack pine windbreaks near the Normandin forest nursery in the Saguenay-Lac-Saint-Jean region as a result of mortality as well as harvesting of affected trees in recent years. The population survey does not foretell defoliation anywhere in the province outside the part of the Outaouais region that was infested this year.

WESTERN HEMLOCK LOOPER
Lambdina fiscellaria fiscellaria (Guen.)

No defoliation by the western hemlock looper was observed in 2006. Population forecasts for 2007, based on the egg survey, will be available in the fall.

LARGE ASPEN TORTRIX
Choristoneura conflictana (Wlk.)

Tortrix populations continued to move through Quebec in 2006. The infested land area increased once again this year, to a total of over 125,000 hectares. Damage to aspen poplar varied from light to severe in mixed and deciduous stands. The severity of damage declined in some areas that had been affected for three years. Defoliated areas increased, now affecting most aspen poplar stands in the Saguenay-Lac-Saint-Jean region, although the severity of the damage is less. In the Côte-Nord region, the insect now has a more wide-ranging presence, from the Saguenay River to east of Sept-Îles, but damage appears to be in general less severe. In some urban areas along the St. Lawrence, defoliation by the tortrix is mixed with defoliation by the satin moth *Leucoma Salicis.* Infestations in the Bas-Saint-Laurent (Lower St. Lawrence) region more than doubled in 2006. In addition to last year's active centres, damage (for the most part moderate to severe) moved eastward. In the Gaspésie-Îles-de-la-Madeleine (Gaspé & Magdalen Islands) region, damage was observed for the first time along the coastline. In the Quebec City region, there was significant damage (light to severe) east of Highway 381 (Baie-Saint-Paul) as far as the Saguenay River (Charlevoix management unit). In the Mauricie region, the affected area extends from western part of the Mastigouche wildlife reserve (Bas-Saint-Maurice management unit) to the eastern part of the Windigo-et-Gouin (Kiskissink) management unit, and south as far as the town limits of Saint-Georges-de-Champlain. In the Lanaudière region, areas totalling over 800 hectares were affected by moderate to severe defoliations. There continue to be a few centres of infestation in the Outaouais region, with light defoliation. The current outbreak should recede to a greater degree next year in those areas that have been infested in recent years.

FOREST TENT CATERPILLAR
Malacosoma disstria Hbn.

No tent caterpillar infestation was observed this year, though colonies were reported in the southern part of the Outaouais region and in the southeastern part of the Saguenay-Lac-Saint-Jean region.

GYPSY MOTH
Lymantria dispar (L.)

In Quebec, this exotic pest has not been a concern for several years now. In 2006, damage was reported only at a few red oak plantations in the southern part of the province.

WEATHER-INDUCED DAMAGE

There were major windfalls during the thunderstorm of July 17, 2006. Over 20,000 hectares of mixed and deciduous stands were damaged in the Abitibi-Témiscamingue, Outaouais, Mauricie and Laurentides regions.

Session VI: Cross-Country Checkup –

Atlantic Canada

Session VI / Séance VI

Chair: Pardeep Ahluwalia

Natural Resources Canada, Canadian Forest Service

Séance VI : Tour d'horizon – Le Canada atlantique

Président : Pardeep Ahluwalia

Ressources naturelles Canada, Service canadien des forêts

New Brunswick Report / Rapport du Nouveau-Brunswick

Presented by / Présenté par :

***Nelson Carter*, L. Hartling, D. Lavigne, J. Gullison, D. O'Shea, J. Proude, R. Farquhar, and D. Winter**

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Preliminary Summary of Forest Pest Conditions in New Brunswick in 2006 and Outlook for 2007

SUMMARY

Spruce Budworm:

In 2006, 60% of the pheromone traps were positive, down from the high of 81% recorded last year. Also, the Provincial mean trap catch decreased from 3.8 to 2.7 moths/trap. Only 2 over wintering L2 larvae were detected in one plot on the extreme north-western part of the Province. While these numbers are well below levels to forecast defoliation, the evidence of increasing populations continues to unfold since 1997, when trap catch was at its lowest. It remains to be seen how long before populations become high enough to cause noticeable defoliation. Defoliation by spruce budworm in NB was last recorded in 1995 when the last outbreak subsided. Since then, populations have remained low.

Hemlock Looper:

No defoliation was forecast for 2006, and none was detected. Following a minor population increase in 2004, pheromone trap catches declined in 2005 and 2006. No defoliation is forecast for 2007.

Gypsy Moth:

Defoliation was last detected in 2003 and populations have been generally low up to 2005. The winter of 2005-06 was very mild, however, and egg survival was very high, leading to increases in pheromone trap catches and new egg masses this fall. These increases were in southern New Brunswick with much of the northern part of the Province still free from this pest. The high populations of the years 2001-03 increased the risk of long-range spread of gypsy moth by humans, hence new positive sites have been found in the past few years. In 2005, the CFIA increased the regulated areas from the smaller parish level to the larger county level and included eight counties, plus the City of Miramichi. In 2005, evidence of new populations was found in Moncton and Memramcook in Westmorland County, and Bouctouche in Kent County, extending the distribution of gypsy moth farther eastward in the Province, yet the CFIA did not alter the regulated areas to include those two Counties. In 2006, new egg masses were again found in Memramcook and Bouctouche, and for the first time in Sackville and Petitcodiac. If this winter is mild again, some localized defoliation would not be surprising in 2007, though an intensive forecast survey was not done.

Whitemarked Tussock Moth:

In 2005, population increases (since 2002) had been detected by pheromone traps supplemented with ground observations raising speculation that greater numbers might occur in 2006. Indeed, the frequency of encountering incidental levels of larvae in the field significantly increased in 2006. Moreover, the trend of increasing moth catches in pheromone traps continued in terms of: percent of traps positive (39%), maximum trap catch (reached 12 moths); and mean trap catch (reached 0.92 moths/trap). While these numbers are not great, the trend from the past years indicated the upward trend. The operational lure in use is known to be somewhat insensitive. In fact, research led by Dr. G. Grant - CFS Great Lakes is being done to develop an alternative lure and trap system and results will be reported elsewhere. An egg-mass/life stage survey was conducted in southern New Brunswick at 245 locations. Egg masses were detected at only 2% of the sites, yet 26% were positive for new cocoons. Examination of the cocoons/pupae found that on average 25% had successful emergence; 39% were parasitized; 22% failed to successfully complete development; 7% were diseased; and 6% were predated upon.

Rusty Tussock Moth:

Populations were slightly lower than 2005 and remain at low endemic levels with no significant upward trend being obvious since pheromone trapping began in 1998.

Jack Pine Budworm:

Populations remain at low endemic levels according to pheromone trap catches since 1997.

Forest Tent Caterpillar:

According to pheromone trap catch data, populations seemed to decline from 2002 to 2005. In 2006, increases in trap catches were detected. It remains to be seen whether this is the start of an increasing trend in populations. The last two outbreaks were recorded in 1979-84 and 1991-96, and another one has been anticipated in the near future if the past pattern repeats. Pheromone trap catches in 2006, however, were well below any threshold of damage and no defoliation is expected from this pest in 2007.

Balsam Twig Aphid:

Populations increased in 2006. This came on the heels of a declining population trend that had previously peaked in 2001.

Balsam Gall Midge:

Populations had remained very low for several years, following a declining trend from the peak in 1998. Increases were detected in 2006 and may continue to do so for the next few years if the past trend repeats itself.

Balsam Woolly Adelgid:

A spring survey at 12 sites indicated adult populations were up at 6 sites, down at 5 sites and no change at the other site. Increases were not unexpected given the warmer temperatures experienced last winter, however, a declining trend in several coastal sites suggests there are other factors influencing population changes.

Butternut Canker:

This disease was first confirmed to be in NB in 1997 at 5 sites near Woodstock. In 2004, the CFS confirmed several more positive sites, some about 50 km farther north. In 2005, butternut trees were put on the Endangered List under the Canadian *Species at Risk Act*, partly because of the presence of butternut canker. The CFS reported no change in 2006.

Hemlock Woolly Adelgid:

In 2005, a detection survey for this non-native pest was conducted for the first time in 30 hemlock stands (25 mainly in south-western areas, and 5 in eastern areas) and no symptoms of the insect were found. No survey was done in 2006.

There were no reported changes for other foreign pests including: **Brown Spruce Longhorn Beetle** (absent), **Pine Shoot Beetle** (absent), **European Larch Canker** (present throughout southern NB), and **European Race of Scleroderris Canker of Pines** (known only at 3 sites in north-western NB).

Miscellaneous insects and diseases (especially prevalent this year) were reported throughout the Province.

No significant pests were encountered in Provincial seed orchards or the Provincial forest tree nursery

Preliminary Summary of Forest Pest Conditions in New Brunswick in 2006 and Outlook for 2007

Introduction:
Outbreaks of minor and major forest pests occasionally occur and cause variable amounts of growth loss and tree mortality. Besides affecting the natural forest, outbreaks can adversely affect high-value reforestation and tree improvement programs, from nurseries to seed orchards, to plantations and thinned stands. Thus, long-term forest management plans are constantly under threat of possible compromise from unwanted pest outbreak. In addition to timber losses, major effects can be caused to non-timber values such as terrestrial and aquatic wildlife habitat, recreational sites and aesthetics.

Besides native pests, today's global economy brings increased risk from the accidental introduction of insects and diseases from around the World. Such introductions could not only cause direct impacts on natural forests and the environment, but also indirect economic impacts through regulations placed on domestic, national, or international movement of goods. These trade issues can negatively affect the ability of small and large companies to be competitive in local and global markets. For all these reasons, it is necessary to know about the status of forest pests and the threats they pose.

Monitoring and forecasting the status of forest pests requires the use of different techniques that reflect survey objectives, pest population levels, the pest's biology, and knowledge of relationships between numbers of pests and damage. For some pests these are well established; and for others these are not. Aerial surveys provide the means to map damage in various categories to assess the extent and severity of outbreak over vast areas.

For some insects, surveys can be conducted to establish population levels by sampling appropriate locations for eggs or egg masses, depending on the female's egg laying habits. Surveys of larvae can be conducted during the insect's active feeding period, or during periods when they are inactive, such as in the over-wintering stage. Surveys of pupae to estimate insect population levels are less common.

Special odours or scents, called pheromones, are given off by female insects to attract males of the same species for mating. In recent years, the identification and artificial synthesis of sex pheromones for a number of forest insects has led to the use of pheromone-baited traps as a technique to monitor these pests. This is especially true when populations are very low and not detectable by traditional survey sampling intensity for other life stages. Because these artificial lures are often very potent, they sometimes offer the opportunity to detect subtle increases that might not be as easily detected by the other means. In other instances, they might still be under development and results have to be interpreted with caution. Depending on thresholds or yearly trends, these surveys could result in the implementation of other methods to forecast levels of damage expected the ensuing year.

One of the cornerstones of DNR's pest monitoring program is the use of pheromone traps for the early detection of changes in population levels of many softwood and hardwood forest pests, before they increase to potential outbreak status. It is important, however, to be aware that the number of insects captured in a trap is greatly influenced by the type of lure used, its concentration, the trap design and the insect species itself. Therefore, a moth count considered to be biologically significant for one species may be insignificant for another by several orders of magnitude. Consequently, the absolute number of insects in a trap is not as important as the trends between years and over time.

PESTS OF SOFTWOODS

Spruce Budworm

No defoliation by spruce budworm has been reported since 1995, the last year that controls were applied. Since then, operational monitoring has been done using a combination of spruce budworm pheromone traps to capture male moths and branch samples to collect over wintering second instar larvae (L2). Monitoring locations are more or less evenly distributed throughout the Province. Pheromone trap catches were lowest in 1997. Since then there has been a generally upward trend in the percent of traps that have caught moths; and maximum trap catch since 1995 has only ranged from 6 to 54 moths/trap. In 2006, trap catch was down slightly from 2005, i.e., 60% *cf.* 81 % traps positive and mean trap catch was 2.68 *cf.* 3.81 moths/trap (Table 1).

Table 1. Summary of spruce budworm pheromone trap surveys conducted by FPMS in New Brunswick from 1995 to 2006.

Year	Number of traps	Percent of traps in each class of moths/trap			Maximum trap catch	Mean trap catch	% of traps positive
		0	1-10	>10			
1995	296	42%	50%	8%	0 - 47	3.27	58%
1996	99	53%	41%	6%	0 - 54	3.24	47%
1997	148	73%	27%	0%	0 - 6	0.49	27%
1998	148	67%	33%	0%	0 - 10	0.95	33%
1999	155	59%	41%	<1%	0 - 12	1.05	41%
2000	154	55%	42%	3%	0 - 25	1.67	45%
2001	197	42%	50%	8%	0 - 32	2.90	58%
2002	198	65%	33%	2%	0 - 12	1.02	35%
2003	198	57%	39%	4%	0 - 18	1.89	43%
2004	196	52%	45%	4%	0 - 17	1.86	49%
2005	255	19%	73%	8%	0 - 41	3.81	81%
2006	281	40%	54%	6%	0 - 42	2.68	60%

In 1998, DNR modified its L2 monitoring survey (which replaced the egg mass survey in 1985) by using a combination of sampling intensities consisting of a 'traditional' set of plots, where 3 trees/plot are sampled; and more intensive plots, where 30 trees/plot are sampled. Additional plots are added as deemed necessary in any particular year, and this may also be followed by supplementary sampling to refine the population forecast.

From 1995 to 2006, L2 surveys also show endemic populations within the Province. Only trace levels have been detected at a small number of plots fluctuating from a low of 0% in 1999 to a high of 7.1% in 2004 (Table 2). In 2006, only one plot had detectable larvae (i.e., 2 larvae from a 3-tree plot). That plot was located on the north-western part of the Province referred to as the 'panhandle'. Overall, the apparent population increase revealed by the pheromone trap data is less clear with the L2 data at this time, possibly reflecting the different sensitivities of each survey, as currently conducted, to detect subtle changes within low density spruce budworm populations.

Table 2. Summary of spruce budworm larvae detected in L2 surveys conducted by FPMS in New Brunswick from 1995 to 2006. (Supplementary samples to refine the forecast are not included in this table).

Year	Number of plots	Number of trees/plot	Number of branches	Number (%) of plots with L2 detected	Number of L2 detected
1995	814	3	2442	28 (3.4%)	65
1996	503	3	1509	3 (0.6%)	8
1997	317	3	951	2 (0.6%)	2
1998	75	3 & 30	900	3 (4.0%)	4
1999	75	3 & 30	900	0 (0.0%)	0
2000	75	3 & 30	900	1 (1.3%)	5
2001	78	3 & 30	909	1 (1.3%)	1
2002	75	3 & 30	900	1 (1.3%)	1
2003	79	3 & 30	1020	4 (5.1%)	8
2004	99	3 & 30	1269	7 (7.1%)	19
2005	95	3 & 30	1041	3 (3.2%)	5
2006	100	3 & 30	1056	1 (1.0%)	2

In addition to DNR's pheromone trap and L2 surveys, JD Irving, Limited conducts similar surveys on parts of their freehold limits and submits samples to FPMS for processing. Their pheromone trap results were similar to the provincial survey, but L2 results are not available at this time.

Jack Pine Budworm

Defoliation by jack pine budworm in New Brunswick has not been reported since 1983, though monitoring is conducted annually because of the importance of natural jack pine stands and plantations for the Provincial wood supply. A network of pheromone traps was initiated in 1997 at locations selected to represent these stands. No moths were caught in the first year, but since then moths have been caught annually, albeit in low numbers, with the maximum being 41 moths in one trap in 1999 (Table 3). In that year, a follow-up L2 survey was done, but no larvae were detected. In 2004, it was decided to switch from Delta traps (sticky on 3 sides) to the Multi-Pher1® traps with Vaportape II® killing strip to improve the quality of samples collected and facilitate more accurate moth identification. Survey results in 2006 indicate that jack pine budworms remain at endemic levels in the Province (Table 3).

Table 3. Summary of jack pine budworm pheromone trap surveys conducted by FPMS in New Brunswick from 1997 to 2006.

Year	Number of traps	% of traps positive	Percent of traps in each class of moths/trap					Moths/trap (range)	Mean trap catch
			0	1-10	11-20	21-40	>40		
1997	46	0%	100%	0%	0%	0%	0%	0	0.00
1998	52	42%	58%	42%	0%	0%	0%	0 – 8	1.42
1999	51	55%	45%	45%	8%	0%	2%	0 – 41	3.25
2000	51	27%	73%	25%	2%	0%	0%	0 – 17	1.45
2001	51	57%	43%	47%	2%	8%	0%	0 – 30	1.51
2002	51	41%	59%	35%	4%	2%	0%	0 – 22	1.92
2003	50	26%	74%	24%	2%	0%	0%	0 – 14	1.12
2004	50	34%	66%	34%	0%	0%	0%	0 – 10	1.46
2005	49	39%	61%	39%	0%	0%	0%	0 – 10	0.82
2006	47	43%	57%	43%	0%	0%	0%	0 – 9	1.02

In 2006, we paired our standard traps, baited with a pheromone lure produced by the New Brunswick Research & Productivity Council (RPC) (source may soon no longer be available), with traps baited with a lure commercially available from Phero Tech Inc. (PTI) in British Columbia. Traps were placed approximately 40-m apart at each location, and 42 pairs of traps were ultimately available for comparison. Half the traps caught no moths at all. Of the 21 positive pairs, those baited with the RPC lure caught more moths 67% of the time; those with the PTI lure had higher counts 19% of the time; and trap catches were identical 14% of the time. Trap catches were very low with mean catch being 1.07 moths/trap for the RPC lure and 0.45 moths/trap for the PTI lure. Although these were statistically different ($P<0.001$), we would like to have had higher populations to compare. Similar studies done in higher populations in Manitoba and Saskatchewan have yielded no significant differences between the two lure sources, indicating a switch to the PTI lure may be acceptable.

Hemlock Looper

This insect can kill trees in a single year. The only reported outbreak of hemlock looper in New Brunswick occurred from 1989 to 1993. Areas affected were in the north-western, north-central and south-western parts of the Province. In the north, the Canadian Forest Service (CFS) estimated about 650 000 m^3 of merchantable balsam fir were killed during this period, though salvage harvesting by Fraser Inc. and Repap New Brunswick Inc. reduced the volumes actually lost. Controls were applied in 1990, 1991 and 1993.

Since 1997, populations have been monitored using a network of pheromone traps throughout the Province supplemented by egg surveys as needed. Pheromone trap catches had increased 3.3-fold Province wide in 2000 (hinting an impending outbreak), but decreased in 2001, though defoliation was mapped over 760 ha that year. In 2002 and 2003, no defoliation was recorded and trap catches resembled those of 1997-1999 (Table 4).

Table 4. Summary of hemlock looper pheromone trap surveys conducted by FPMS in New Brunswick from 1997 to 2006.

Year	Number of traps	% of traps positive	Mean trap catch*	Moths/trap (range)*
1997	**103**	**99**	**92**	**0 – 448**
1998	**95**	**99**	**71**	**0 – 524**
1999	**98**	**100**	**69**	**3 – 411**
2000	**99**	**100**	**230**	**3 – 863**
2001	**199**	**>99**	**89**	**0 – 837**
2002	**101**	**99**	**77**	**0 – 444**
2003	**98**	**100**	**64**	**1 – 342**
2004	**101**	**100**	**157**	**6 – 1127**
2005	**198**	**>99**	**115**	**0 – 723**
2006	**93**	**99**	**105**	**0 – 649**

** Numbers are based on pheromone lure strength of 10-µg. For 1997 to 2000, the numbers of moths/trap (using 200-µg lure) were converted to estimates of moth catches using 10-µg strength lure using the equation: Y = 0.565 X + 1.469 developed from a 3-year study, 1998 – 2000.*

In 2004, a 2.5-fold Province-wide increase in trap catch over 2003 occurred, somewhat resembling the increase seen in 2000. Highest trap catches occurred in the extreme northwest close to the Québec border and in the north-central parts of the Province. Consequently, a follow-up egg survey was done in selected areas to see if populations were high enough to anticipate defoliation in 2005. Based on previous experience with the number of eggs encountered, no defoliation was anticipated for 2005, and none was detected from aerial surveys or ground observations. Likewise, no defoliation was reported in 2006.

In 2006, the operational pheromone trapping survey was maintained throughout the Province. Mean and maximum trap catch decreased slightly from 2004 and 2005 levels suggesting the increase in 2004 was part of normal population fluctuations. Nonetheless, such increases are worthy of attention to ensure prompt detection of an outbreak. Complete results are not yet available from traps placed out by JD Irving, Limited on their freehold limits.

Whitemarked Tussock Moth

The last outbreak of this pest in New Brunswick occurred in the 1970s. In 1975, the area defoliated was 25 000 ha, and in 1976 it was 202 400 ha. Thus, the population explosion of this insect in Nova Scotia in 1997 coupled with their forecast for 1998 caused great interest in New Brunswick. Since 1998, however, annual monitoring with pheromone traps and occasional egg mass searches had not revealed any significant populations in this Province (Table 5).

Table 5. Summary of adult whitemarked tussock moths caught in pheromone trap surveys conducted by FPMS in New Brunswick from 1998 to 2006.

Year	Number of traps	Number (%) of traps positive	Moths/trap (range)	Mean trap catch
1998	**59**	**5 (8%)**	**0 – 4**	**0.17**
1999	**57**	**2 (4%)**	**0 – 2**	**0.05**
2000	**54**	**2 (4%)**	**0 – 1**	**0.04**
2001	**49**	**0 (0%)**	**0**	**0.00**
2002	**49**	**1 (2%)**	**0 – 1**	**0.02**
2003	**49**	**6 (12%)**	**0 – 4**	**0.22**
2004	**51**	**5 (10%)**	**0 – 1**	**0.10**
2005	**49**	**12 (24%)**	**0 – 4**	**0.51**
2006	**75**	**29 (39%)**	**0 – 12**	**0.92**

Nonetheless, a low-level increasing trend in populations seems somewhat evident since 2001 when no moths were detected followed by increases up to 2006 when the highest percent (39%) of traps were positive with the highest mean (0.92 moths/trap) and maximum trap catch (12 moths) (Table 5). Indeed, the frequency of encountering incidental levels of larvae in the field significantly increased in 2006. In view of these changes, an egg-mass/life stage survey was conducted in southern New Brunswick at 245 locations (i.e., 3 lower-crown branches x 20 balsam fir trees/plot x 245 plots = 14 700 branches examined). New cocoons were found at 26% of the sites, yet new egg masses were only detected at 2% of the sites. Examination of the cocoons/pupae found that on average 25% of the insects successfully emerged from their pupal cases, 39% were parasitized; 22% failed to successfully complete development, 7% were diseased; and 6% were predated upon. Whether these low-level changes in pheromone trap catches and findings of cocoons are indications of an impending outbreak, or are normal endemic fluctuations, remains to be seen. It will be interesting to see what unfolds in 2007.

Note: There is a concern about the sensitivity of the pheromone lure currently in use and research is being conducted (led by Dr. G. Grant of the CFS Great Lakes with collaboration in NB by FPMS, and in NS by NSDNR) to see if a better lure might be developed for monitoring this insect. Details of those trials will be reported elsewhere.

Rusty Tussock Moth

This insect, of European origin, is now transcontinental in distribution. It is highly polyphagous and can attack most conifers and hardwoods. Outbreaks are usually small and of short duration, and are not common in New Brunswick, but they have been reported several times in Newfoundland. Each year since 1998, pheromone traps used for detecting whitemarked tussock moth have also caught moths of this closely related species (Table 6).

Table 6. Summary of adult rusty tussock moths caught in pheromone trap surveys conducted by FPMS in New Brunswick from 1998 to 2006.

Year	Number of traps	Number (%) of traps positive	Moths/trap (range)	Mean trap catch
1998	**59**	**19 (32%)**	**0 – 9**	**0.9**
1999	**57**	**20 (35%)**	**0 – 11**	**1.4**
2000	**54**	**14 (26%)**	**0 – 10**	**0.8**
2001	**49**	**19 (39%)**	**0 – 20**	**1.8**
2002	**49**	**30 (61%)**	**0 – 18**	**1.5**
2003	**49**	**21 (43%)**	**0 – 12**	**1.3**
2004	**51**	**17 (33%)**	**0 – 10**	**1.0**
2005	**49**	**26 (53%)**	**0 – 20**	**2.4**
2006	**75**	**30 (40%)**	**0 – 32**	**2.1**

In 2005, the mean trap catch was the highest yet, and the data hinted an increasing trend from 2003, though overall results were not significantly beyond levels seen in the past. And, no defoliation has been detected so far, thereby suggesting that the numbers of moths being caught are below the threshold of impending detectable larval feeding, and hence below an indication of when an egg mass survey might be needed. Thus no defoliation was forecast for 2006 and none was detected. Populations appear to be stable at low endemic levels with no significant upward trends being evident (Table 6), and no defoliation is forecast for 2007.

Balsam Twig Aphid

This insect is not a significant forest pest, though it can be a major problem for the Christmas tree industry. Populations are monitored in a general way throughout the Province by assessing their presence on balsam fir branch samples collected for the spruce budworm L2 survey. Analyses of

data from previous years indicate a tendency for balsam twig aphid populations to increase and decrease in general synchrony throughout the Province (though local variations do occur). In 2006, populations increased with 70% of the plots having signs of damage. Because these data are collected at a limited number of locations widely distributed throughout the Province, Christmas tree growers need to monitor conditions on their own property.

Balsam Gall Midge

This insect is also not considered a significant forest pest, but like the balsam twig aphid it can be a problem for Christmas tree growers. Populations of balsam gall midge are also monitored around the Province by assessing their presence on balsam fir branch samples collected for the spruce budworm L2 survey. As with balsam twig aphid, analyses of previous years' data indicated a tendency for balsam gall midge populations to increase and decrease in general synchrony (with some local variations) throughout the Province. Likewise, the data since 1984 suggest a cyclical trend in populations. In this case, because balsam gall midge populations have been low for a few years, we speculated increases might soon occur if the past trend repeated. In 2006, an increase was indeed detected as 23% of the plots had galls present. Again, Christmas tree growers need to monitor conditions on their own property because these data come from a limited number of samples widely distributed throughout the Province.

Balsam Woolly Adelgid

This insect, of European origin, was first found in the Maritimes in the early 1900s and in Québec in 1964. It only attacks true firs of the genus *Abies*. Symptoms of attack, especially gouty tops, are noticeable in southern New Brunswick where local tree mortality, severe in some cases, has been reported in recent years. It has been speculated that populations had increased in the 1990s due to a number of milder winters. Mortality of the adelgid's over-winter dormant stage increases when temperatures reach -20^{o}C and is complete at -37^{o}C. Concerns by forest industry prompted distribution surveys, over-winter survival surveys and small-scale studies on growth impact in the past few years.

Surveys conducted since 2002 have revealed symptoms attack throughout southern New Brunswick below an irregular line drawn in a general north-easterly direction from about Nackawic in the west to the City of Miramichi in the east. This southern part of the Province below this general line is associated with milder winter temperatures more conducive to over winter survival of the insect and corresponds very well to Plant Hardiness Zones 4b, 5a and 5b for New Brunswick (see http://sis.agr.gc.ca/cansis/nsdb/climate/hardiness/intro.html). Curiously,

this line is similar to, but a little farther south than reported in the literature (i.e., Fig. 32 in Prebble, M.L. (editor). 1975. Aerial control of forest insects in Canada. Env. Can. Ottawa).

A system to monitor population changes of balsam woolly adelgid was initiated at 12 locations in the southern region of the Province in the spring of 2003. Last winter was generally mild. In the spring, samples from 6 of the sites, revealed increases in the number of adults; 5 had decreases; and 1 had no change. Increases were not unexpected given the warm temperatures experienced last winter. Another mild winter in 2006-07 would be conducive to more population increases. Of curiosity, however, are several sites along the coast where, despite the milder winter temperatures, populations have been declining suggesting other factors influencing population levels.

Brown Spruce Longhorn Beetle

This non-native insect was confirmed present in Nova Scotia in the spring of 2000 and it was subsequently revealed that it had been present at least since 1990, but had mistakenly been mis-identified as a similar native species. It appears capable of killing red, white, black and Norway spruce and poses a threat to spruce forests and associated forest industry. Eradication actions, begun in 2000, are being undertaken under the leadership of the Canadian Food Inspection Agency (CFIA) under the federal *Plant Protection Act*. So far, surveys have not detected its presence in New Brunswick. Nonetheless, reports from Nova Scotia confirmed a significant increase in area over which the beetle was found in 2006, thus jeopardizing any continued eradication actions. There is speculation that increases could be associated with extensive wind-thrown trees from Hurricane Juan in 2003. That raises the concerns in New Brunswick because softwood from that Province is sometimes delivered to mills in New Brunswick. The CFIA have maintained dialogue with government and industry representatives of both provinces, and CFS researchers, regarding an expanded management zone and conditions of treatment that would facilitate the continued movement of host spruce material. Since the CFIA has been surveying for BSLB in New Brunswick, it seems that increased efforts are warranted in 2007.

Pine Shoot Beetle

Since 1992, this non-native insect has gradually been found from Ontario eastward into Québec and in the Lake States, ultimately reaching Maine in 2000. In Ontario, it has been found in association with mortality in Scots, red, white and jack pines, though it is uncertain whether Scots pine must be present to enable populations to become high enough to damage the other pine species. Quarantine regulations are in place under the federal *Plant Protection Act* administered

by the CFIA. So far, monitoring surveys done by the CFIA and CFS have not detected its presence in New Brunswick.

Introduced Pine Sawfly

The introduced pine sawfly, whose native range is eastern and northern Europe, was first discovered in North America in 1914 in New Haven, Connecticut. It is now found in the Central and Lake States, in all the New England states and New York as well as the Provinces of Ontario, Québec and New Brunswick. Outbreaks have occurred in North Carolina, Tennessee, and Virginia in the late '70s and '80s. Common hosts are white pine, Scotch pine, jack pine, and red pine. It may also feed on other less common species of pine. Planted and natural trees of all sizes may be attacked. Defoliation is usually most severe in the upper crown but heavily infested trees may be completely defoliated in a single season.

In 2005, regional Pest Detection Officers reported introduced pine sawfly on white pine at several locations in the Doaktown District (i.e., Grand Lake Road area - large numbers of larvae and severe defoliation), and at several locations in the Coles Island District (i.e., Pangburn area - few larvae and trace defoliation). Samples (one each) were also identified from Bathurst and Newcastle. Such observations are in keeping with similar incidental reports in the past, but concerns for intensive white pine management in some areas may suggest an increased awareness in 2006, given reported outbreaks elsewhere as noted above. Only incidental observations of the larvae were detected in 2006. Populations detected in 2005 in plantations in the Grand Lake Road area seemed to subside in 2006.

Pine Leaf Adelgid

According to the literature, the life cycle of the pine leaf adelgid extends over two years and involves five different forms and two hosts. Its primary hosts are red and black spruce and its secondary hosts are generally eastern white pine and occasionally red, Scots and Austrian pine. It occurs in all Canadian provinces as well as Maine, New Hampshire, Vermont and New York. Damage on spruce consists of the formation of cone-shaped galls that do not affect the health of the trees. On pine, damage may cause mortality of shoots and even tree death. Records indicate that this insect has rarely been a major pest and only in New Brunswick and Nova Scotia. In New Brunswick, an outbreak started in 1942 and within 10 years all stands of red spruce and eastern white pine in most of the Province were infested. In 1948, populations declined unexpectedly, and have rarely been reported since then.

In 2005, the pine leaf adelgid was reported to cause widespread attack on white pine generally north and south of the Miramichi River in central New Brunswick (e.g., north and south of the Priceville and Doaktown area; west of Bartibog to Shinnickburn - south of Blackville; and just north of Popple Depot) as well as eastern New Brunswick (i.e., Rogersville to Saint-Louis de Kent). Damage on white pine was generally much less evident in 2006. Damage to branch tips could be a concern to those wishing to use white pine for making Christmas wreaths, however, an outbreak such as that reported above would also be of great interest in areas of intensive white pine management.

Gray Spruce Looper

This insect is apparently widely distributed in North America and sometimes is also referred to as the gray forest looper. It feeds on an array of tree species including balsam fir, hemlock, larch, cedar, spruces and more rarely on pines. Information about insect numbers and damage in New Brunswick is sparse. Since the institution of our pheromone trap survey for spruce budworm, a few gray spruce looper adults have typically been found in these traps, but in 2005 the numbers were “unusually” high with some traps having as many as 10 to 177 moths/trap. This is somewhat curious because the spruce budworm is a member of the Family Tortricidae, and the gray spruce looper is a member of the Family Geometridae. The “high” catches occurred in traps set out both by FPMS and J.D. Irving, Limited in north-western New Brunswick. Ground surveys at the four locations with the highest moth counts detected low numbers of larvae and slight amounts of defoliation on individual branch tips of balsam fir, red, black and white spruce in both plantations and thinnings. In 2006, the incidence of gray spruce looper returned to the more common incidental levels of the past. We will remain vigilant for this insect in future surveys in case numbers do substantially increase.

Hemlock Woolly Adelgid

The hemlock woolly adelgid, native to Japan, was first reported in western U.S. (Oregon) in 1924, and in eastern U.S. in the mid-1950's near Richmond, VA. In the U.S., it feeds only on hemlock tree species (*Tsuga* spp.). The two tree species native to western U.S., western hemlock and mountain hemlock, are not noticeably affected. In contrast, the two tree species native to eastern U.S., eastern hemlock and Carolina hemlock, can be severely defoliated and killed, often within five years of infestation. All ages and sizes of eastern hemlock trees are susceptible to damage. As of 1999, the USDA Forest Service had documented the insect in eleven eastern states from North Carolina to Massachusetts. In Maine, after several years of detection on nursery stock (starting in 1999) its presence in the natural forest was first detected in 2003. The Maine Forest Service implements aggressive efforts to contain or slow the spread of this pest in the State. Infested sites occur in York County in the southern part of the State.

FPMS conducted a survey of representative hemlock stands in 2005 and found no evidence of this pest. FPMS did not conduct a survey for this pest in 2006.

European Larch Canker

This non-native disease was first found by the CFS in New Brunswick in 1980. It is capable of killing mature and immature larch trees. It is present mostly throughout the southern half of the Province and quarantine regulations are in place administered by the CFIA under the federal *Plant Protection Act*. In 1977, the CFS found a positive site outside, but close to the known regulated area, but the CFIA have made no changes to the regulated zone. Surveys by the CFS from 1998 to 2000 did not detect any new positive sites, and no specific survey has been done since then.

Scleroderris Canker of Pine – European Race

The North American race of this disease seldom causes mortality to trees over 2-m tall, though branches up to this height are affected. The European race, however, is capable of killing much taller trees. It was once thought to occur at about a dozen sites in New Brunswick, but newer testing methods used by the CFS in 1998 confirmed only one site was actually positive for the European race (found on Scots pine in north-western New Brunswick). In 1999, two nearby sites (within a few kilometres) were confirmed positive (one Scots pine and the other red pine). No new positive sites have been reported since then. Quarantine regulations are in place under the federal *Plant Protection Act* administered by the CFIA.

PESTS OF HARDWOODS

Gypsy Moth

Populations of this pest have greatly declined over the past few years. Historically, gypsy moth was reported present in south-western New Brunswick in the mid-1930s but eradicated by 1940. It was 'rediscovered' in the same general area in 1981, and since then it has gradually expanded its range in the Province. Quarantine regulations have been put in place under the federal *Plant Protection Act* administered by the CFIA. Defoliation (~ 4 ha of second-growth poplar) was first mapped from the air in 1987. Increasing populations were detected in south-central

regions between 1998 and 2000. This led to three consecutive years of defoliation (from 2001 to 2003) followed by population collapse due to extremely cold winter temperatures in 2002-03 and 2003-04, and build-up of larval diseases (i.e., nuclear polyhedrosis virus and the fungus *Entomophaga maimaiga*), along with other natural bio-controls. Some private landowners had some of their property aerially sprayed with *B.t.* in 2002 and 2003.

Annual surveys indicate that low-density populations persist in known infested areas in southern New Brunswick and at some sites distant from them (e.g., as far northeast as Miramichi City). During the years with high populations and defoliation there was an increased risk of spread of this pest, hence finding new positive sites was anticipated. In 2005, the CFIA increased the regulated areas from the smaller parish level to the larger county level and included eight counties, plus Miramichi City. The regulated counties include: Charlotte, Carleton, York, Sunbury, Kings, Queens, Saint John, and Albert. These new regulated areas incorporated all the positive sites found outside the regulated area from 1993 to 2004. In the fall of 2005, evidence of new populations was found for the first time in Moncton and Memramcook in Westmorland County, and Bouctouche in Kent County, extending the known distribution of gypsy moth farther eastward in the Province. The CFIA did not, however, add these two counties to the regulated areas in 2006.

The winter of 2005-06 was very mild and egg survival was very good. A total of 22 egg masses were collected from three sites and 46% to 99% of the eggs in each mass hatched; overall, 92% of the eggs hatched. This raised expectations of population increases in 2006, though no defoliation was forecast. In the pheromone trap survey, trap catches were up from 2005. Not surprisingly, new egg mass counts were also up based on fall egg-mass/life stage survey results. These increases were primarily in southern New Brunswick. In contrast, pheromone trapping results from northern New Brunswick still suggest that large portions of the northern part of the Province remain free of this pest.

In the southeast, new egg masses were found for a second consecutive year in Memramcook and Bouctouche, and found for the first time in Petitcodiac and in Sackville (reported by the CFIA). All these locations fall in either Westmoreland or Kent Counties - the candidate counties to be added to the regulated area by the CFIA. If this winter is mild again, populations are expected to increase. Although an intensive forecast survey was not done, egg densities found during the fall survey are not expected to cause defoliation in 2007; however, some localized damage may occur.

Forest Tent Caterpillar

The last two outbreaks of this insect each lasted about 6 years (from 1991-96; and 1979-84) with a 12-year period between the start of each. The former outbreak peaked at about 0.4 million ha and the latter peaked at about 1.4 million ha. If the same trend were to repeat, a build-up of

populations would have occurred about 2003. Therefore, in 2002, in anticipation of another outbreak, pheromone traps were set out in a network of locations evenly distributed throughout the Province to establish baseline data for comparison in following years. From 2002 to 2005, there appeared to be a decreasing population trend as reflected in the trap catch data giving no evidence of an impending outbreak (Table 7). In 2006, however, there was a slight increase in numbers, and of course, it remains to be seen if this is indeed the beginning of an increasing trend that leads to another outbreak. At these levels there may be no biological difference between years. In western Canada, the threshold for damage is >100 moths/trap. If this is applicable to New Brunswick conditions, populations will have to increase substantially before damage is again detected in this Province.

Table 7. Summary of forest tent caterpillar moths caught in pheromone trap surveys conducted by FPMS in New Brunswick from 2002 to 2006.

Year	Number of traps	% of traps positive	Percent of traps in each class of moths/trap						Maximum catch	Mean catch
			0	1-10	11-25	26-50	51-100	>100		
2002	128	88	13%	70%	23%	2.3%	1%	0%	51	7.8
2003	125	77	23%	62%	13%	2%	0%	0%	41	5.2
2004	130	76	23%	71%	5%	0%	0%	0%	23	2.7
2005	137	59	41%	58%	1%	0%	0%	0%	16	1.7
2006	133	70	30%	67%	3%	0%	0%	0%	21	2.8

Satin Moth

This insect primarily feeds on leaves of poplar and willow. At the end of the last outbreak of the forest tent caterpillar, defoliation by satin moth was detected for several years. An area of 4 388 ha of poplar was estimated to have been killed due to repeated defoliation by satin moth in combination with weakening by forest tent caterpillar defoliation and two summers with drought conditions. Since 2001, however, no significant defoliation has been detected.

Greenstriped Mapleworm

This is a native insect that attacks all species of maple (red and sugar being preferred) and occasionally other hardwoods. Outbreaks are usually not extensive and last only 2 to 3 years, though some tree mortality has been reported from Ontario to Nova Scotia, including

New Brunswick. In New Brunswick, defoliation has been reported for 1937, 1956, 1976-79, 1993-94, and 1997. In 2002, defoliation was mapped over 63 ha. Defoliation was again detected in 2003 in the same general location, but over a smaller area and was not mapped during the aerial survey. No defoliation was mapped in 2004. In 2005, FPMS staff detected larvae and defoliation north of Priceville and at Bettsburg. Subsequently, it was detected by FPMS staff and Regional Pest Detection Officers at a number of scattered locations north and south of the Miramichi River from Boiestown to Renous/Blackville in the central part of the Province. A small isolated pocket of insects was again detected north of Priceville in 2006.

Orangehumped Mapleworm

According to the literature, the orangehumped mapleworm preferably feeds on sugar maple and occasionally on other species of hardwood such as beech, basswood, elm, and oak. Reportedly, outbreaks are rare and of short duration and occur over limited area. In 2005, larvae and small scattered stands of defoliated beech were detected by staff of Bowater Maritimes Inc. north-west of Boiestown in an area know as Sisters Mountain/Rocky Brook area. There were no populations detected or reported in 2006.

Fall Webworm

This insect is a common defoliator of hardwood trees in late summer. The webs it makes resemble silken “nests” and these were commonly seen along the roadside around the Province in 2004. Similar conditions had been reported in the early 1990s. In 2005, there were numerous incidental reports though seemingly less than the year before. In 2006, the insect was again reported and observations made at sporadic locations throughout most regions of the Province but seemed much more prevalent in the lower Saint John River Valley.

Fall Cankerworm

This insect periodically reaches outbreak levels throughout its range in North America. Host trees include elm, oak, ash, and maples as well as many fruit trees and shrubs. In 2005, feeding damage was reported to about 15 ha along the southwest Miramichi River (near Blissfield) but no larvae were found at the time it was subsequently investigated (mid-July). Damage was evident

on elm, hawthorne, alders, pin cherry, butternut and maple, and fall cankerworm was suspected. In 2006, a visit was made in late May to the area where defoliation had been reported last year and numerous larvae of fall cankerworm were found.

Butternut Canker

In the United States, this non-native disease is causing severe mortality of butternut trees throughout their range. This disease was first confirmed present in New Brunswick by the CFS in 1997 at five sites in the general vicinity of Woodstock, but no regulatory action was taken by the CFIA. Butternut is not a major component of our native forests, nor is it of major economic importance, but the disease could pose threat to our natural forest biodiversity. In 2004, the CFS confirmed several new positive sites. In 2005, butternut trees were put on the Endangered List under the Canadian *Species at Risk Act*. No evidence of newly infected areas was reported in 2006.

MISCELLANEOUS

Due to the very warm spring and often wet conditions this year, foliar diseases became common throughout the summer. Discolouration on balsam poplar occurred widely throughout the Province and was associated mostly with Linospora Leaf Blight (*Linospora tetraspora*) as well as the weevil *Isochnus* (*Rhynchaenus*) *rufipes*. Some samples had rust disease as well (*Melampsora* sp.). White birch was seen to have a necrotic yellowing of foliage progressing to a brown scorched appearance. Foliage samples appeared to have symptoms of Septoria Leaf Spot (*Septoria betulae*). There was also evidence of sporadic damage by the birch leaf miner (*Fenusa pusilla*) in both northern and southern New Brunswick.

Damage to trembling aspen was attributed to a more complex set of insects and diseases. In many areas, trees damaged early in the summer put forth a second crop of leaves and the subsequent tree crowns appeared thinner than normal. Among the pests encountered were: spotted aspen leaf roller (*Pseudosciaphila duplex*), poplar leaf folding sawfly (Phyllocolpa spp.), leaf tiers (*Acleris* sp.), aspen webworm (*Tetralopha aplastella*), and the beetle aspen skeletonizer (*Phratora purpurea purpurea*). The fungal disease Marssonina leaf spot (*Marssonina brunnea* = *Drepanopeziza tremulae*) was evident on foliage samples throughout the Province. In some areas, symptoms were abiotic.

ASSESSMENTS OF PLANTATIONS AND THINNINGS

Regional DNR staff, designated as Pest Detection Officers, conduct pest assessments in a sub-set of high-value plantations and thinned stands in each of DNR's four Administrative Regions. Survey results have not yet been compiled, but no major pests or significant areas of damage were reported.

SEED ORCHARD PEST MONITORING & NURSERY PEST SUPPORT

Routine monitoring of pest conditions was conducted in DNR's first- and second-generation seed orchards. At Kingsclear and Wheeler Cove, egg sampling for spruce cone maggot in the black spruce stands produced very low numbers, so there was no need for control measures. At Queensbury, the white spruce stands produced a heavy cone crop and cone maggot numbers were sufficiently low that no controls were applied. Some cone maggot activity was also detected in the balsam fir stand at Kingsclear. At Kingsclear, yellowheaded spruce sawfly numbers in the black spruce stands were low enough that very little damage was seen. Some trees in those stands had endured considerable damage over the past several years. In a field of young white spruce, sawfly larvae were found in low numbers on scattered trees; these were manually removed to prevent damage.

At Wheeler Cove, yellowheaded spruce sawfly numbers on black spruce were low and trace levels were found on the red spruce at Queensbury. White pine weevil was responsible for the loss of several dozen leaders on the black spruce at Wheeler Cove and less than a dozen leaders on the Norway spruce at Queensbury. Spruce budworm and jack pine budworm numbers remained low in all spruce and jack pine stands respectively.

There were few pest enquiries from DNR's Kingsclear forest tree nursery in 2006.

Nova Scotia Report / Rapport de la Nouvelle-Écosse

Presented by / Présenté par :

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Status of Some Forest Pests in Nova Scotia

Blackheaded Budworm *Acleris variana* (Fernald)

Nova Scotia has seen two past outbreaks of the black headed budworm with 240,000 hectares infested in the 1930's and another 20,000 hectares reported infested in 1950.

In 2005 we found many light and some moderate populations in the Cape Breton Highlands Plateau but populations weren't as large as the outbreak of 2004. In 2006 there were light samples in the Cape Breton Highlands but this is closer to what we perceive as background populations. 2006 aerial surveys showed no defoliation. The population has collapsed but we're continuing to monitor.

Jack Pine Budworm *Choristoneura pinus pinus* (Freeman)

Jack Pine Budworm continues to cause damage. We've seen low to moderate defoliation in the southern end of the province (Figure 1). However, in Nova Scotia jack pine budworm is feeding on white pine and not jack pine its usual host.

Pale Winged Grey *Iridopsis ephyraria* (Walker)

The pale winged grey is a fairly new pest of hemlock in Nova Scotia (Figure 2). The area of pale winged grey defoliation has expanded but not with the same intensity of mortality that we originally saw in Kejimkujik National Park.

Hemlock Looper *Lambdina fiscellaria fiscellaria* (Guenée)

Hemlock Looper damage was new in 2006. Eighty nine hectares were defoliated in the Cape Breton Highlands National Park (Figure 3). This is our first defoliation in 10 years. We're continuing to monitor and have found some moderate to high populations so our concern level is up but, to date, this is the only area with any defoliation.

Brown Spruce Longhorn Beetle *Tetropium fuscum* (Fabricius)

When it comes to the brown spruce longhorn beetle the Canadian Food Inspection Agency is the lead agency. We're helping wherever we can i.e. surveys, trapping etc. but overall the CFIA does the bulk of the work. There's been a dramatic increase in the number of positive traps found outside the CFIA Ministerial Boundary. The CFIA is in the process of consulting with industry about the future of Ministerial Boundary. Trapping has occurred in areas outside the Halifax Regional Municipality. We're looking at greatly increasing, if possible doubling, our trapping effort from 175 traps in 2006 to 350 traps in 2007, filling in holes, especially in the Eastern portions of Halifax County.

Spruce Beetle *Dendroctonus rufipennis* (Kirby)

Spruce beetle damage and activity has increased across the province in 2006.

Spruce Budworm *Choristoneura fumiferana* (Clemens)

Across the province, positive pheromone traps have been at low levels but they conform to the trend we've seen since 2002 of increasing trap numbers (Figures 6, 7 and Table 1).

Table 1: Number of positive spruce budworm pheromone traps across Nova Scotia from 2002-2006.

Year	# of Positive Traps
2002	5
2003	18
2004	11
2005	33
2006	26

Prior to 2002 we hadn't found anything for 10 years. This causes us to be on alert. Our L2 survey has yet to be completed. However, we haven't found any larvae since 1995 but due to the increasing numbers in our pheromone traps we expect to find some in the future.

Updates on Various Insects and Diseases

- Increased whitemarked tussock moth damage and activity in 2006.
- Mild winters have increased activity and damage by balsam woolly adelgid.
- *Sirococcus* shoot blight damage intensified in red pines due to mild winters and wet spring.

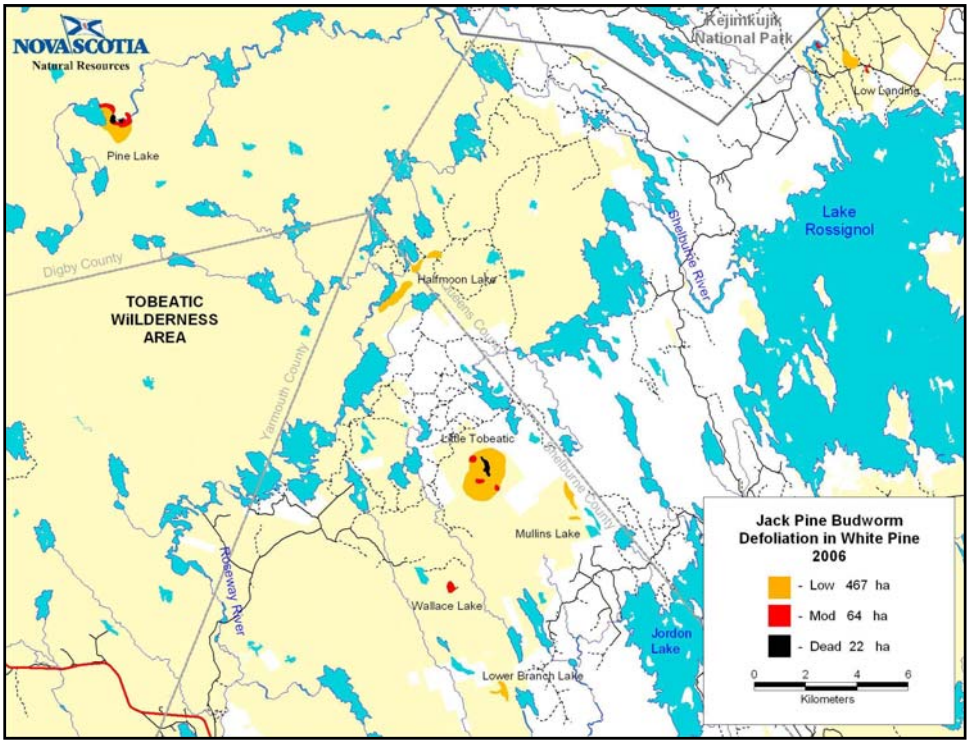

Figure 1: Jack pine budworm (*Choristoneura pinus pinus*) defoliation in white pine 2006.

Figure 2: Pale winged grey (*Iridopsis ephyraria*) moths.

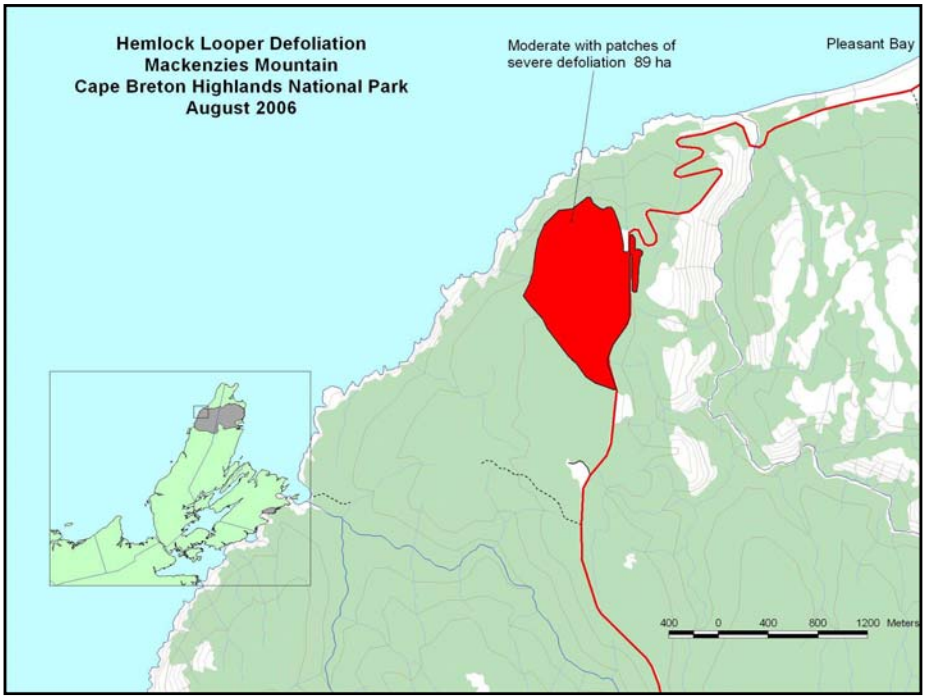

Figure 3: Hemlock looper (*Lambdina fiscellaria fiscellaria*) defoliation on Mackenzie mountain, Cape Breton Highlands National Park August 2006.

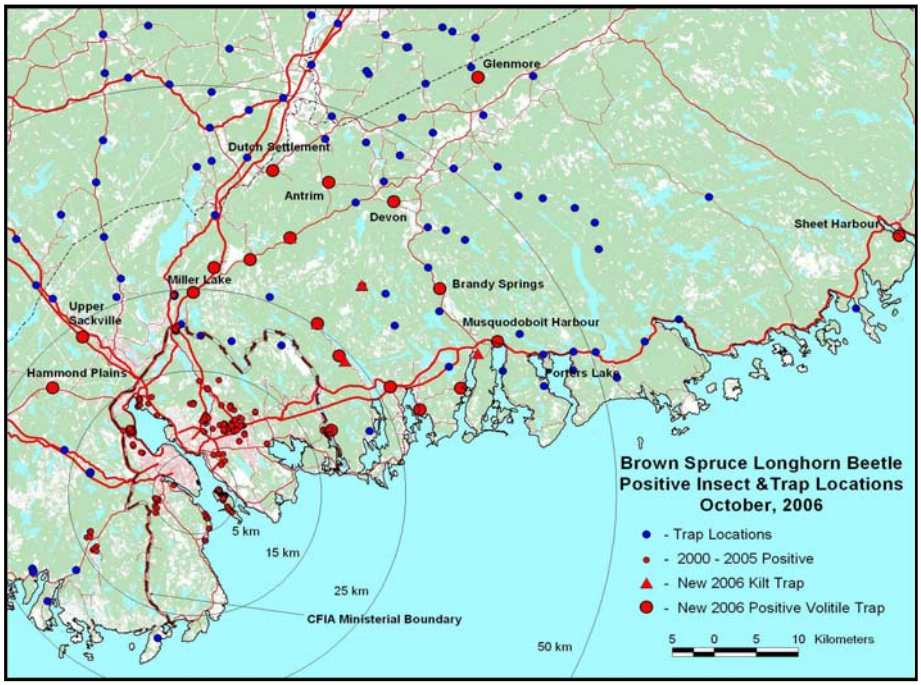

Figure 4: Brown spruce longhorn beetle (*Tetropium fuscum*) positive insect & trap locations 2006.

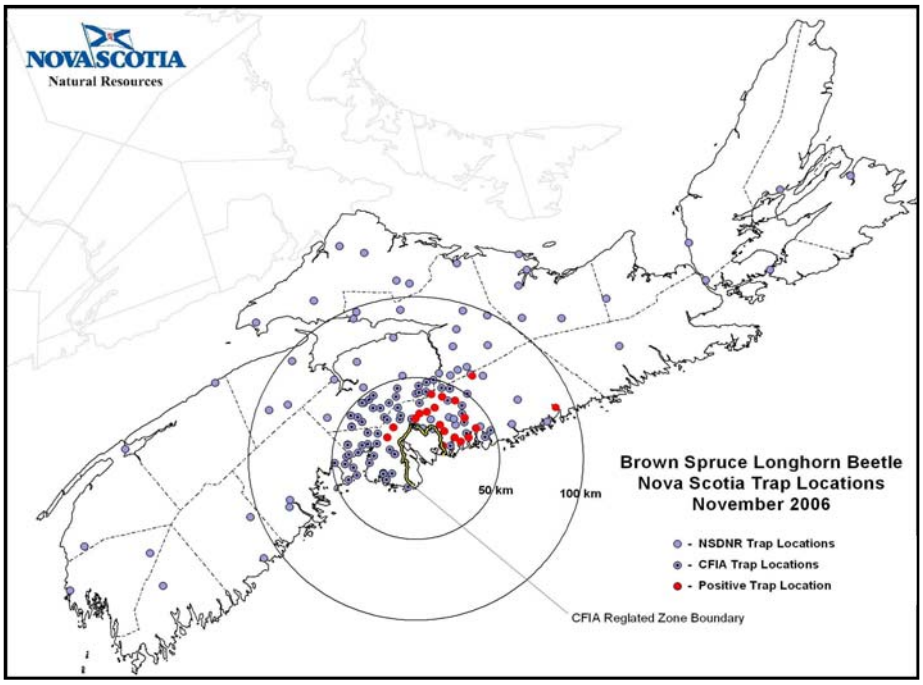

Figure 5: Brown spruce longhorn beetle (*Tetropium fuscum*) Nova Scotia trap locations 2006.

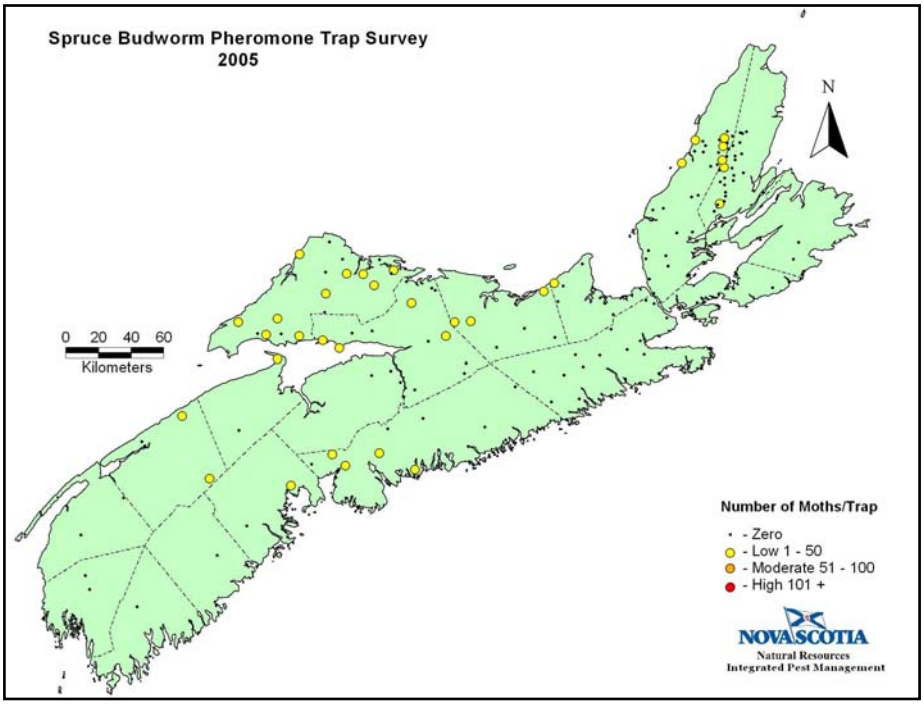

Figure 6: Spruce budworm (*Choristoneura fumiferana*) pheromone trap survey 2005.

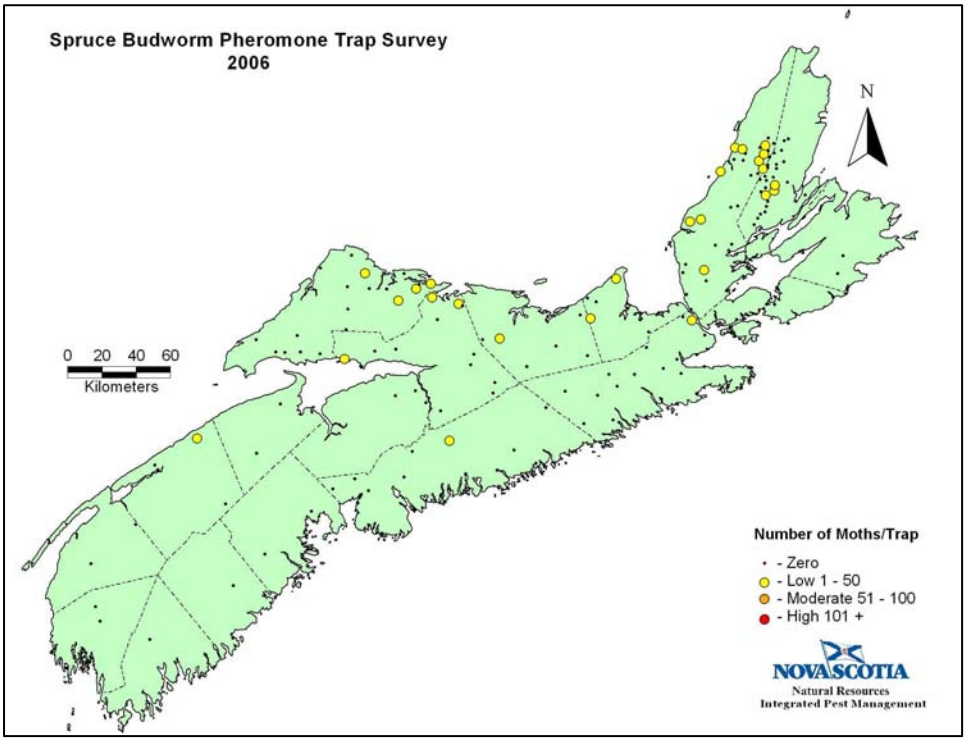

Figure 7: Spruce budworm (*Choristoneura fumiferana*) pheromone trap survey 2006.

Newfoundland Report / Rapport de Terre-Neuve

Presented by / Présenté par :

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Status of Important Forest Insect Activity in 2006 and Outlook for 2007 - Newfoundland & Labrador

SUMMARY

On-going infestations of two major forest insect defoliators continued in 2006 and a small infestation of a third insect defoliator was detected. The largest of these was the balsam fir sawfly on the west coast of the Island in the Deer Lake area. A balsam fir control program was undertaken in 2006 on 15,200 hectares (ha). Pockets of hemlock looper infestation occurred on the Northern Peninsula and newly detected pockets at two general locations in eastern Labrador. A small infestation of spruce budworm was identified south of Happy Valley-Goose Bay in Labrador. A number of other insects caused some localized damage throughout the Province. The chronic incidence of balsam woolly adelgid on balsam fir throughout the Island continues to be of concern. Information on the 2006 status and activity and the outlook for 2007 for each major insect follows.

Activité des principaux insectes ravageurs des forêts en 2006 et aperçu pour 2007 – Terre-Neuve-et-Labrador

RÉSUMÉ

En 2006, les infestations de deux importants insectes ravageurs forestiers se sont poursuivies, et une petite infestation d'un troisième insecte défoliateur a été décelée. La plus importante infestation, qui met en cause le diprion du sapin, sévit sur la côte ouest de l'île, dans le secteur de

Deer Lake. Un programme de lutte couvrant 15 200 hectares (ha) a été entrepris contre le ravageur en 2006. Des foyers d'infestation d'arpenteuses de la pruche ont été signalés dans la péninsule Great Northern, et d'autres foyers ont été découverts récemment à deux endroits de l'est du Labrador. Une petite infestation de tordeuse de bourgeons de l'épinette a été signalée au sud de Happy Valley-Goose Bay, au Labrador. Plusieurs autres insectes ont causé des dommages localisés en divers endroits de la province. La présence chronique de puceron lanigère du sapin sur le sapin baumier demeure préoccupante à l'échelle de l'île. De plus amples informations sur l'état et l'activité des principaux insectes ravageurs forestiers en 2006 et un aperçu de la situation prévue en 2007 sont présentés ci-après.

MAJOR FOREST INSECTS

Spruce Budworm - *Choristoneura fumiferana* (Clem.)

The last incidence of aerially detected infestation and defoliation was recorded in 1992 in the Crabbes River – Codroy Pond area in the southwestern part of the Island. A newly detected and localized infestation in Labrador in 2006 was unexpected. Reports of defoliation on white spruce and balsam fir in the Traverspine River area south of Happy Valley-Goose Bay were investigated and subsequent follow-up sampling confirmed the causal agent was spruce budworm. A total area of approximately 1,000 ha was affected. It is expected that this infestation will continue in 2007 and the general area will be monitored to determine the extent and expansion, if any, of the population.

Moth trapping of adult males using budworm lures continued in 2006 at 48 sites (Fig. 1) on the Island, two (2) traps per site. This was an increase of five (5) sites from the 2005 number. The additional sites were established in central locations based on higher trappings recorded in 2005.

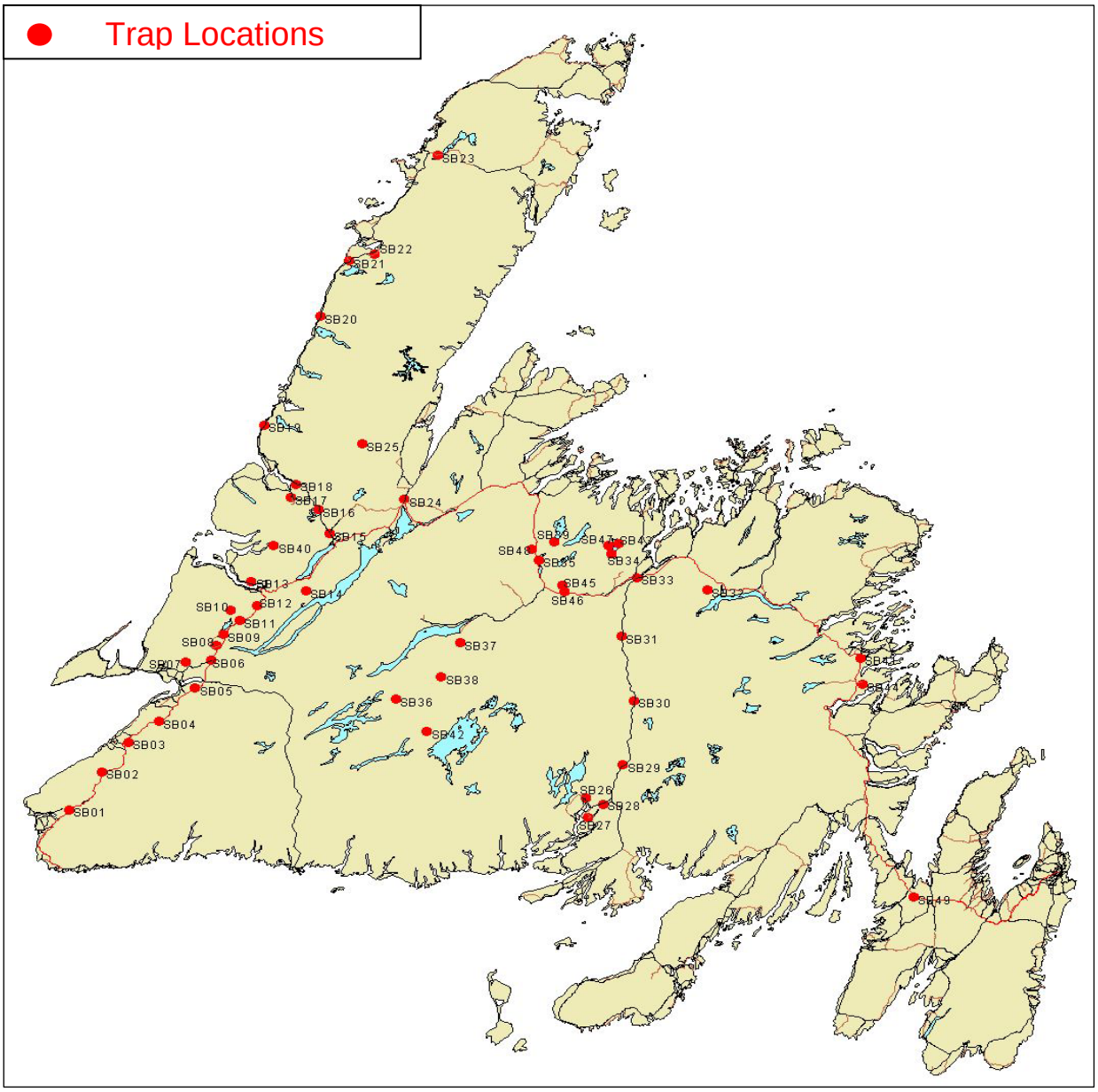

Figure 1. 2006 Spruce Budworm trap locations

Results (Table 1) from the 2006 trapping program indicated a significant decrease in the number of moths collected compared with the previous six (6) years since the Province started trapping in 2000. (Sites with a missing trap were excluded from the summary). Although high numbers were trapped at several locations in 2005, there was no defoliation and no budworm population was detected in 2006.

Table 1. Spruce Budworm Pheromone Trapping

SPRUCE BUDWORM PHEROMONE TRAPPING							
Mean No. Moths / Site (Categories)	**Number of sites by year & by category**						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
0	12	7	14	14	9	13	29
>0 – 5	15	15	14	13	23	17	15
>5 - 10	5	9	1	5	2	3	2
>10 - 20	1	6	4	1	3	2	0
>20 - 40	2	1	4	1	1	0	0
>40 - 60	0	1	0	0	0	2	0
>60 - 80	0	0	0	0	0	2	0
>80 - 100	0	0	0	0	1	1	0
>100	0	0	0	0	0	2	0
No. of Sites	**35**	**39**	**37**	**34**	**39**	**42**	**46**

Hemlock Looper - *Lambdina fiscellaria fiscellaria* (Guen.)

Forecast 2006:
The moderate and severe defoliation forecast for 2006 was for some approximately 3,000 ha of forest to be affected on the Northern Peninsula in the River of Ponds – Hawkes Bay – Port au Choix general area (Fig. 2). An additional pocket of infestation was predicted on the northwest side of Hare Bay just south of the St. Anthony Airport.

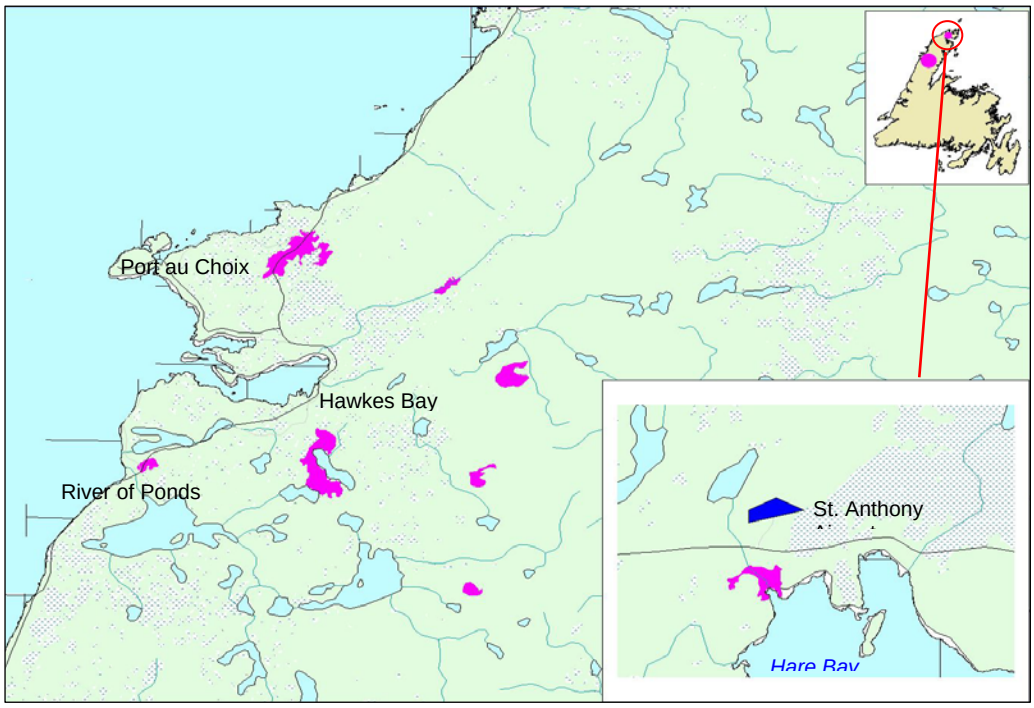

Figure 2. 2006 Hemlock Looper Moderate & Severe Defoliation Forecast

Control 2006:

The Canadian Forest Service-Atlantic in Corner Brook, in partnership with and assistance from the Department of Natural Resources, did some follow-up work on the hemlock looper population in late winter / early spring. Indications were that there was spring egg parasitism occurring that was affecting the looper eggs. A treatment option was considered, but based on the size and locations of the infestation, the incidence of parasitism and the overall population levels, a decision was made not to initiate control action in 2006.

Defoliation 2006:

The hemlock looper caused moderate and severe defoliation on the Northern Peninsula on some 250 ha (versus 530 ha in 2005) (Fig. 3). Pockets of defoliation were located southeast of River of Ponds near Eastern Blue Pond, southeast of Eddies Cove West, east of Castors River, and north of St. Anthony Airport.

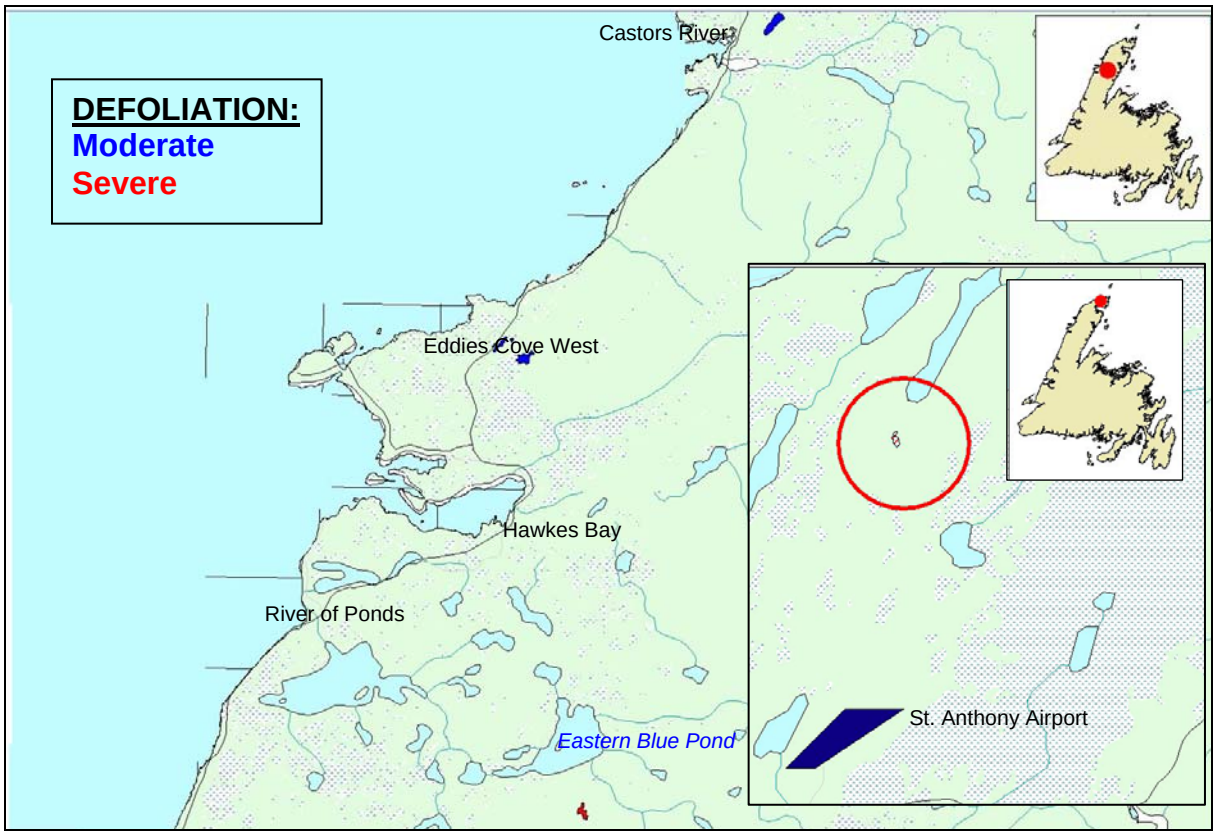

Figure 3. 2006 Hemlock Looper Defoliation – Insular Newfoundland

In Labrador, approximately 600 ha of moderate and severe defoliation were mapped in a number of pockets in two general areas: on the Eagle River [Figure 4 (A)], about 100 ha and west of Charlottetown [Figure 4 (B)], about 500 ha.

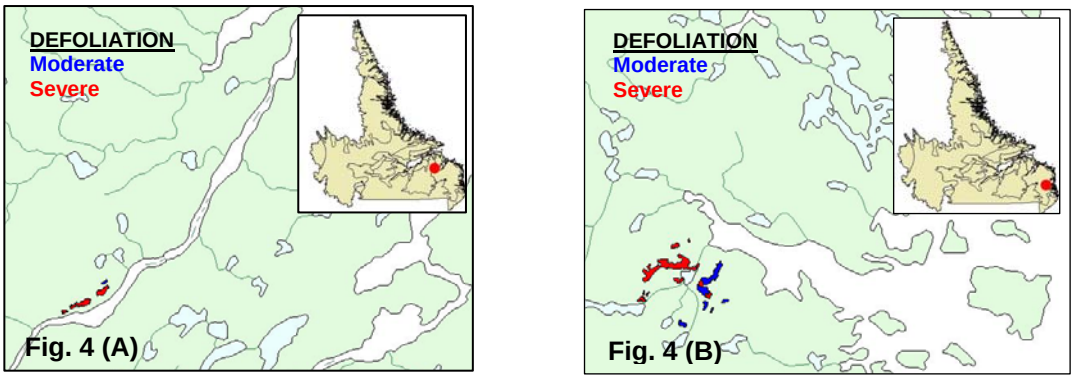

Figure 4. 2006 Hemlock Looper Defoliation in Labrador

Research in 2006:

On-going research on the hemlock looper conducted through the University of New Brunswick (Dr. Dan Quiring) and the Canadian Forest Service – Atlantic in Corner Brook (Dr. Lucie Royer) along with various other partners, collaborators and cooperators, continued in 2006. Aspects include a hazard rating assessment, population density / defoliation estimates, and various factors (biotic and abiotic) influencing the population levels and survival.

Outlook for 2007:

The annual fall hemlock looper forecast survey was conducted on 1,056 plots. The number of sample points was similar to previous years, but there were some adjustments in plot locations to reflect changes in observed and expected looper population levels. Based on this survey, the initial 2007 outlook is that moderate and severe defoliation will occur in several scattered locations on the Northern Peninsula on some 2,500 - 3,000 ha in the 10 Mile Lake-Round Lake area, northeast of Castors River (Fig. 5), and a pocket further south in the Main River area. As a result of this information, extra sampling is being proposed to further refine the forecast boundaries on the Northern Peninsula. Final area figures will be generated once all information is collected.

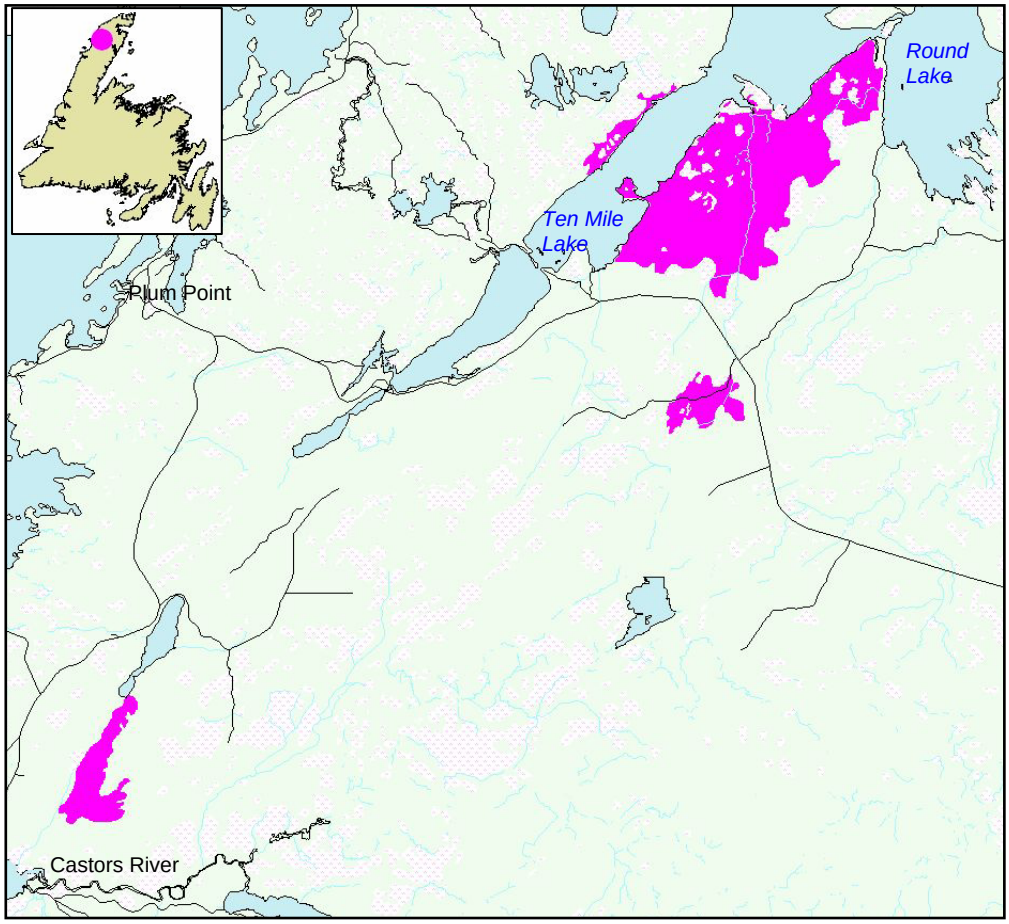

Figure 5. 2007 Hemlock Looper Moderate + Severe Defoliation Forecast

The pockets of infestation in Labrador are expected to continue in 2007. Based on limited samples collected to date, there will likely be an expansion of infestation particularly in the Charlottetown area, in the range of several thousand hectares.

Balsam Fir Sawfly - *Neodiprion abietis* complex

Forecast 2006:

Moderate and severe defoliation was forecast to occur on approximately 41,000 ha in western NF (Fig. 6) extending from the east side of North Arm – Goose Arm (Bay of Islands) eastward to Bonne Bay Big Pond to Deer Lake and southeast towards Grand Lake to Pynn's Brook and westward north of Old Man's Pond in the Goose Arm Brook vicinity.

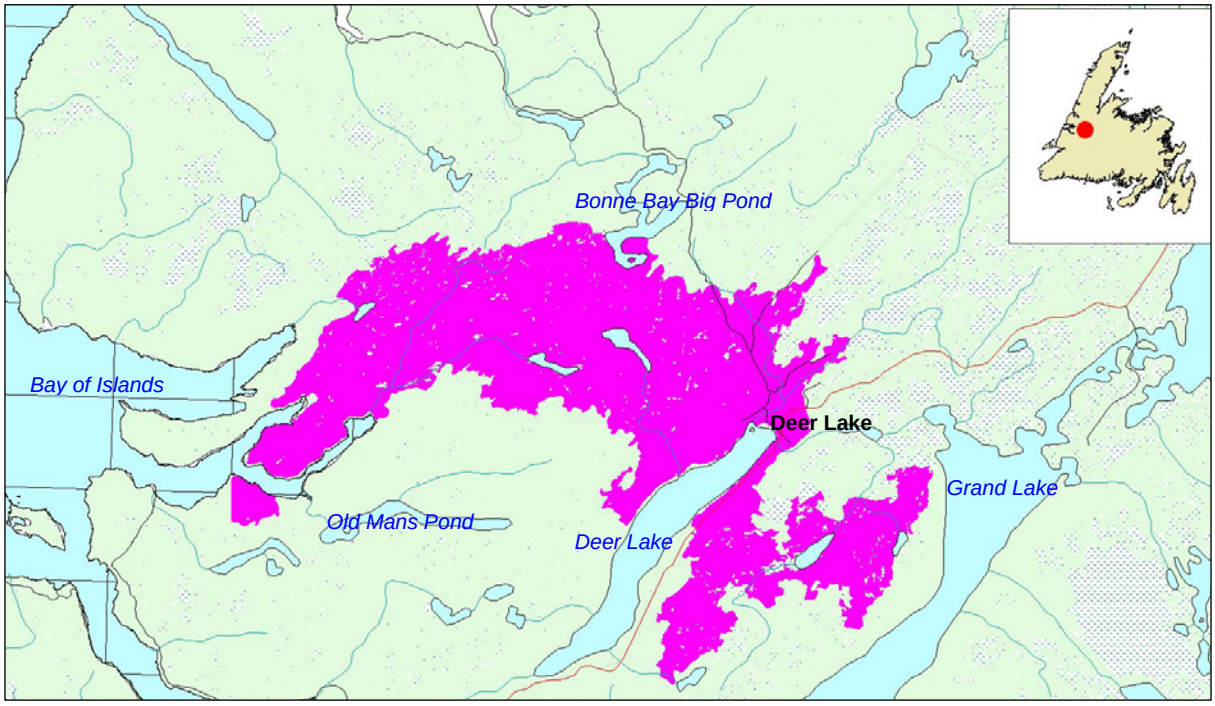

Figure 6. 2006 Balsam Fir Sawfly Moderate + Severe Defoliation Forecast

Control 2006:

As reported in 2004, a registration package for Abietiv (the control product derived from the naturally occurring balsam fir sawfly disease, nucleopolyhedrovirus) was submitted by the Canadian Forest Service - Atlantic (Fredericton, NB) to Health Canada - Pest Management Regulatory Agency (PMRA) for review and assessment with the intent to obtain registration for use in controlling the sawfly. The data met the strict guidelines and requirements of PMRA in terms of being an acceptable control with minimal or no risk to humans, other animals or the environment. The product was approved for registration in April 2006 as an operational tool to combat this insect.

Based on the forecast, the Department of Natural Resources (DNR), in partnership with Corner Brook Pulp & Paper Ltd (CBPP), proposed to carry out a balsam fir sawfly control program. The objective was to treat as much, as practical, of the increasing and peaking sawfly infestation in order to maximize the impact of the Abietiv on the sawfly population.

The control program (under environmental assessment review and approvals and license from the Department of Environment & Conservation) consisted of one (1) application of Abietiv (nucleopolyhedrovirus) in a solution of water and molasses to eleven (11) blocks totaling 15,200 ha. Treatment occurred in early to mid-July using three (3) Dromader M18 spray aircraft contracted from Supermarine Aircraft Inc out of Ontario and operating out of the Deer Lake Airport. One (1) helicopter was used for supervision and support.

Treatment locations (Fig. 7) were within the forecast boundaries and located in the general North Lake – Goose Arm Pond area to Grindstone Pond, southwest of Bonne Bay Big Pond and westward towards Kennedy Lake. One separate area was south of Pynn's Brook.

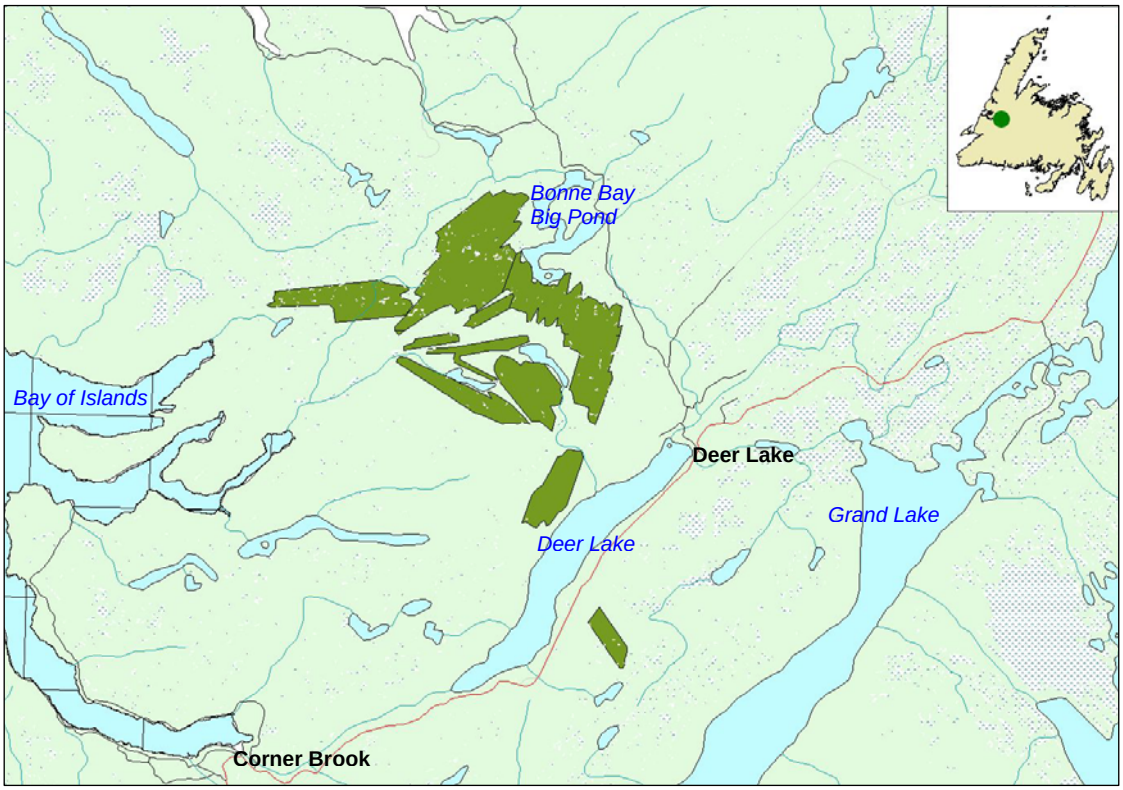

Figure 7. 2006 Balsam Fir Sawfly Treatment Areas

The season, in terms of tree and insect development, was about 2.5 weeks ahead of normal, but this did not impact on the program.

Results 2006:

The program was carried out successfully in terms of application and treatment timing. As expected, there was some reduction in sawfly larval numbers but only limited foliage protection. This is because of the nature of the product (disease) which has to be eaten by the insect, more produced by that insect and then released to infect other larvae. The scientific information provided by the Canadian Forest Service, indicates that the major effect on the population is expected to occur in the year following treatment.

Defoliation 2006:

In 2006, the balsam fir sawfly caused moderate and severe defoliation in western NF (Fig. 8) in areas generally predicted to be affected. However, there was some expansion to the east and northeast. Approximately 67,200 ha were recorded (compared to 57,300 ha in 2005). Of note is that although there has been some tree mortality associated with this on-going infestation, the major impact is tree growth loss and weakened condition making these trees more susceptible to other detrimental factors. This is significant particularly for areas that have been thinned (silviculture treatment) at considerable expense for sustainable forest management.

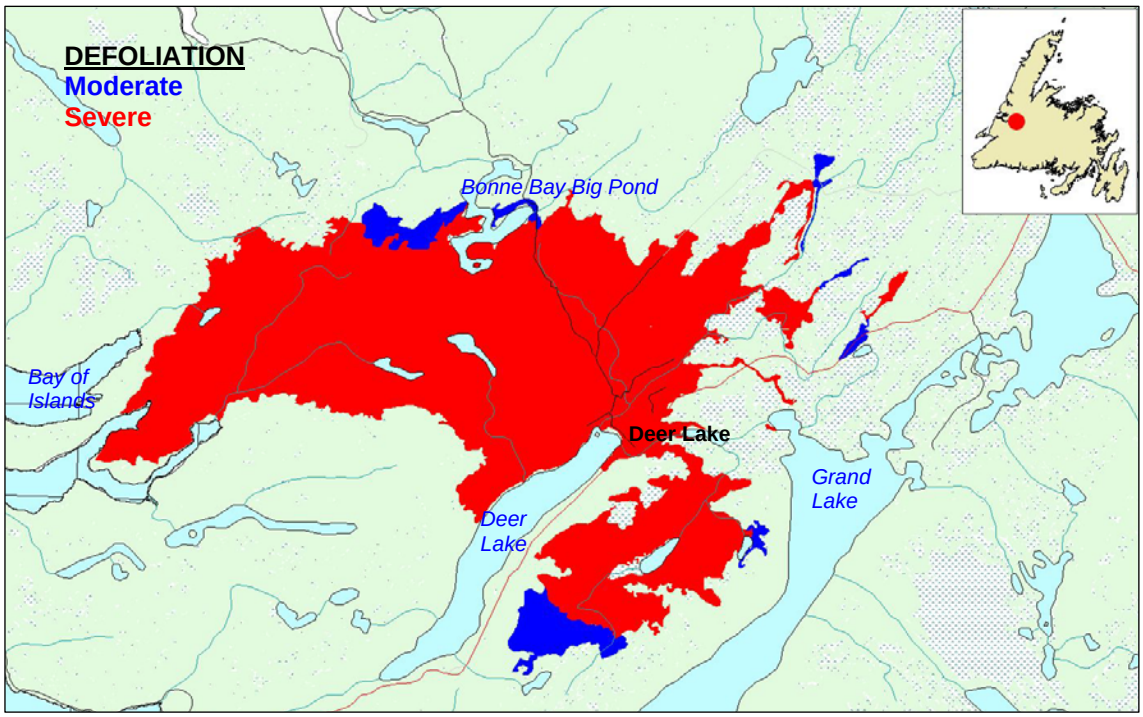

Figure 8. 2006 Balsam Fir Sawfly Defoliation

Outlook for 2007

The infestation in western NF is expected to continue with predicted defoliation expanding into new areas on the leading northeastern and eastern edge of the 2006 infestation. Based on 237 sample points, approximately 33,000 ha (productive forest) are forecast to receive moderate and severe defoliation (Fig. 9). These are mainly second growth balsam fir stands, including those that have been thinned. Some of these stands are being affected by balsam woolly adelgid and have been affected by the hemlock looper in previous years as well. This further increases the concern. Additional samples are proposed to further refine the 2007 forecast. Once all data is collected and analyzed, a decision on what, if any, control action will be recommended for 2007 and the possible extend of any program.

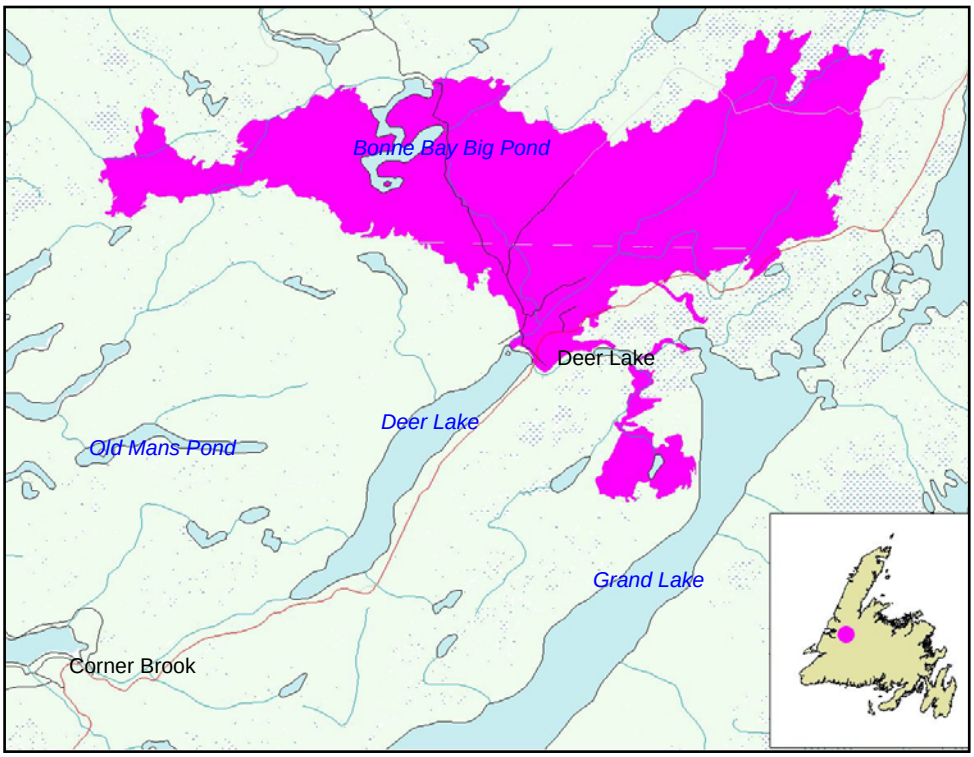

Figure 9. 2007 Balsam Fir Sawfly Moderate + Severe Defoliation Forecast

OTHER INSECTS

There are no other major insect concerns at this time that warrant control intervention. However, there are a number of insects that were observed to be causing damage throughout the Province, as follows.

On-going **bark beetle** activity in Labrador was mapped again in 2006. A number of locations were identified having cumulative (over several years) severe damage with various degrees of mortality, mainly on black spruce. In 2005, there were several pockets north of Goose Bay (totaling approximately 4,200 hectares) and also southeastward of Goose Bay in the general area of the Kenamu River (totaling approximately 6,400 hectares). There was a slight expansion in area of attack in the Kenamu location in 2006.

Several species of bark beetles on white spruce are still active throughout the insular part of the Province. This has been particularly noticeable on the west coast in the Humber Valley. This beetle activity is being studied by the Canadian Forest Service with input from the provincial Department of Natural Resources, to determine the extent, beetle species and other factors affecting spruce there.

The chronic **balsam woolly adelgid** is still prevalent on balsam fir throughout the Island. New areas of infestation / damage were observed in 2006. On-going research by University of New Brunswick and Canadian Forest Service researchers with input and assistance from DNR regional staff, and funded in part by the Province and forest industry, continued in 2006 to further investigate potential impacts and risk factors which are influencing the current status of this insect including impacts on thinned and unthinned stands.

A number of pockets of severe defoliation caused by the **yellowheaded spruce sawfly** identified in 2005 in NF southwest of Hinds Lake (totaling about 20 ha) and north of Conne River Pond off the Bay d'Espoir highway (totaling about 12 ha) continued in 2006. In addition, a small pocket of infestation on a plantation in the Dykes River area of Labrador occurred in 2006.

In 2005, **spruce budmoth** was noted to be causing defoliation on a number of white spruce plantation sites (several hundred hectares) on the Northern Peninsula east of Bellburns in the Brians Pond-Flat Pond area. Observations indicated that damage had occurred for several years. This activity continued in 2006 with some slight expansion. However, the intensity was not as great in 2006 compared to 2005. In addition, reports were also received of budmoth activity continuing in the Glide Lake-Pynn's Brook area in western NF.

The **balsam fir gall midge** again caused severe damage mainly on the west coast in the Goose Arm area north of Corner Brook and other areas near Corner Brook Lake, in the Cormack-Birchy Ridge area northeast of Deer Lake and on the northern Peninsula, in the Pikes Feeder vicinity.

Pine shoot moth has been detected in a number of locations in western and central NF affecting planted and natural red pine stands. This insect attacks buds and developing shoots of its host tree. Follow-up surveys and population assessments will be conducted in 2007 to determine the extent and intensity of this insect.

Session VII: Intensive Forest Management (IFM) and Forest Pests

Chair: Jim Reaves

USDA Forest Service

Séance VII : L'aménagement forestier intensif et les ravageurs forestiers

Président : Jim Reaves

USDA Forest Service

Session VII / Séance VII

Effects of Intensive Management on Insect Pests of Fir and Spruce / Effets de l'aménagement intensif sur les insectes ravageurs du sapin et de l'épinette

Presented by / Présenté par :

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Abstract

I will discuss some of the benefits and costs of three components of intensive management (tree breeding to select resistant trees, plantation establishment, and thinning) for integrated pest management using recent research we have carried out on pests of conifers. There is strong genetically based resistance in most conifers to defoliators, gallers and stem feeders. However, tree height growth is often inversely related to resistance. Similarly, although planting low densities of trees in plantations increases tree growth rates, it can also increase damage by pests of "open-grown" trees. Thinning can also increase tree growth rates, but is the major cause of the recent balsam fir sawfly outbreak in western Newfoundland. Taken together, these studies show that intensive management can decrease or increase pest problems. We need to understand the effects of intensive management on pest insects so that we can more accurately predict future wood supply and the need for pest suppression tactics, as well as to take advantage of the opportunities intensive management offers to reduce pest problems.

Résumé

Dans cette présentation, j'examinerai certains des coûts et avantages de trois composantes de l'aménagement intensif (amélioration des arbres en vue de la sélection d'arbres résistants, établissement de plantations et pratique d'éclaircies) pour la lutte intégrée contre les ravageurs en me fondant sur les résultats de nos projets de recherche récents sur les ravageurs des conifères. La plupart des conifères sont dotés d'une grande résistance génétique aux défoliateurs, aux insectes galligènes et aux ravageurs des tiges. Toutefois, l'accroissement en hauteur d'un arbre est souvent inversement proportionnel à sa résistance. De la même façon, si l'établissement de

plantations à faible densité permet d'accroître le taux de croissance des arbres, il peut également mener à une augmentation des dommages causés par les ravageurs chez les arbres « en croissance libre ». La pratique d'éclaircies peut aussi améliorer la croissance des arbres, mais elle est considérée comme la principale cause de la récente infestation du diprion du sapin dans l'Ouest de Terre-Neuve. Les résultats combinés de ces études montrent que l'aménagement intensif peut soit atténuer soit aggraver les problèmes causés par les ravageurs. Nous devons comprendre les effets de l'aménagement intensif sur les insectes ravageurs pour être en mesure de mieux prévoir l'approvisionnement futur en bois et l'ampleur des mesures de lutte requises et tirer parti des possibilités de réduction des problèmes causés par les ravageurs offertes par l'aménagement intensif.

The Benefits of Having a Provincial Forest Pathology Program – BC's Perspective / Les avantages d'un programme provincial de pathologie forestière – le point de vue de la Colombie-Britannique

Presented by / Présenté par :

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Abstract

The forest pathology program in British Columbia is healthy and growing. At present, in the British Columbia Forest Service there are 5 full time forest pathologists who are accountable for minimizing disease damage to the forest resource, forest health stewardship and creating forest health opportunities. There are also 29 trained forest health specialists throughout the province that act as a first response team when investigating forest health issues. Some of the specific responsibilities of the largest provincial forest pathology program in Canada are: 1) the monitoring of incidence and severity of forest diseases and treatment response trials; 2) effects and interactions with forest practices; 3) development and support of insect and disease growth-and-yield models; 4) basic research on pathogen biology and ecology; 5) genetic resistance and demonstrations; 6) innovative treatments; 7) forest health extension and training.

Résumé

Le programme de pathologie forestière de la Colombie-Britannique se porte bien et est en pleine croissance. À l'heure actuelle, le service des forêts de la Colombie-Britannique emploie cinq pathologistes à temps plein qui ont pour mandat de réduire le plus possible les dommages infligés aux ressources forestières par les maladies, de promouvoir l'intendance des forêts et de créer de nouvelles occasions de préserver la santé des forêts. La province compte une équipe de 29 spécialistes de la santé des forêts qui sont les premiers intervenants dépêchés pour examiner divers problèmes liés à la santé des forêts. Parmi les responsabilités particulières associées à ce programme provincial de pathologie forestière, reconnu comme le plus important au Canada, mentionnons: 1) la surveillance de l'incidence et de la gravité des maladies des forêts et l'essai de

traitements; 2) l'évaluation des effets et des interactions avec les pratiques forestières; 3) l'élaboration et l'application de modèles de croissance et de rendement en présence de maladies et d'insectes forestiers; 4) la conduite de recherches fondamentales sur la biologie et l'écologie des agents phytopathogènes; 5) l'étude de la résistance génétique et la tenue de démonstrations; 6) la mise au point et l'évaluation de méthodes de traitement novatrices; 7) la prestation de services de vulgarisation et de formation dans le domaine de la santé des forêts.

THE BENEFITS OF HAVING A FOREST PATHOLOGY PROGRAM A BC PERSPECTIVE

The repatriation of forest health functions through additional staff and an increased budget means that the BC Ministry of Forests and Range is delivering a competent forest health stewardship program for BC forests.

By way of example of the forest pathology capacity (2006), the table below enumerates the forest pathology professionals and practioners across western North America.

Number of trained and practicing forest pathologists in the Pacific northwest of Canada and the US			
BC	Alberta	Alaska	Washington & Oregon
7	**0**	**2**	**4**
Additional forest health staff with a forest pathology background			
20 +	**0**	**0**	**6**

For a forest health program to function properly and to use the forest pathology capacity efficiently, an implementation strategy has to be developed. Outlined below is the forest health implementation strategy for British Columbia:

The strategy states that it is to monitor the health of Crown lands and responds appropriately in order to reduce the impacts of damaging agents, including invasive plants. The implementation strategy further breaks down into certain separate issues, objectives and goals:

Legislation and policy support
- Development of provincial, regional and Timber Supply Area strategies
- Participation in interagency efforts
- Support for statutory decision-makers

Program Delivery
- Program planning, management and partnering
- Detection, assessment and prediction of pest damage
- Treatment of pest outbreaks and prevention of establishment of exotic pests
- Management of endemic pests during forest operations and of established invasive plants

Adaptive Management
- Monitoring and evaluation of treatment regimes
- Facilitation or provision of training and extension activities
- Operational research and monitoring of pest behaviour and populations (natural and managed)

WHY DO WE NEED FOREST PATHOLOGIST?

Forest pathologists learn how trees and pests function, how they interact, and how the environment affects that interaction. They manage a wide range of biotic damaging agents and they apply hazard and risk ratings to the results of surveys, inventories and monitor activities to determine priority pests and areas for treatment. When treating for pests, forest pathologists are knowledgeable of the tenets of integrated pest management (IPM), which optimizes the use of chemical controls, and it attempts to create cultural and growth conditions that hinder development of diseases.

Many forest pathologists wear more than one hat and what unifies their tasks is that they study the interactions of small, rapidly developing microorganisms within big, spatially heterogeneous, slow-developing forests. Spanning these vast scales makes forest pathologists unique.

Important Diseases in Young Forest Stands in Eastern Canada / Maladies importantes dans de jeunes forêts de l'Est du Canada

Presented by / Présenté par :

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Abstract

Roughly 10 diseases were selected from those that affect forests in eastern Canada. Key facts are listed for each disease. Damage caused by other pests is too often attributed to white pine blister rust, a disease that is viewed with considerable pessimism by foresters. Through our research, this trend has been reversed. The ecology of *Ribes* should be better understood. *Scleroderris* canker European strain only spreads over short distances because only the asexual stage of the fungus occurs in North America. The introduction of the other mating type from Europe must be prevented as it would allow the formation of ascospores, which are responsible for the spread of the disease over large distances. European larch canker is present in New Brunswick and poses a looming threat to larch in Eastern Canada. *Sphaeropsis sapinea* is an endophyte present in pines; mortality by this fungus occurs during drought stress. Foresters have given up on beech because of beech bark disease, among other things. However, microorganisms can be developed to control the two exotic pests involved in this disease. Beech trees that are also infected by *Nectria galligena* increase the inoculum level and promote the infection of other hardwood species. Butternut canker: butternut is an endangered species that generates more interest within Environment Canada than within the forest industry. *Armillaria* root rots (*Armillaria* spp.): the species and their distribution are relatively well known in Canada, except in the Maritimes. *Fomes* root rot continues to spread northward in the absence of a preventive product. *Tomentosus* root rot is present throughout Canada; damage is most pronounced in spruce close to 40 years old. New root rots are appearing.

Résumé

On a sélectionné une dizaine de maladies parmi celles qui affligent des peuplements forestiers de l'Est canadien. Pour chacune d'elles, on liste des faits importants. On attribue trop souvent à la rouille vésiculeuse du pin blanc des dégâts causés par d'autres ravageurs, ce qui laisse planer beaucoup de pessimisme chez les forestiers. Nos recherches ont permis de renverser cette tendance. L'écologie des *Ribes* devrait être mieux connue. Le chancre scléroderrien de race européenne ne se propage que sur de courtes distances parce qu'en Amérique, on ne retrouve que le stade asexué du champignon. Par contre il faut prévenir l'introduction d'Europe de l'autre type sexuel (*mating type*) qui permettrait la formation d'ascospores responsables de la dispersion de la maladie sur de longues distances. Le chancre européen du mélèze présent au Nouveau-Brunswick : un danger qui plane sur les mélèzes de l'Est canadien. *Sphaeropsis sapinea*: endophyte présent chez les pins; la mortalité par ce champignon se manifeste lors de stress de sécheresse. Les forestiers ont abandonné le hêtre à cause, entre autres, de la maladie corticale du hêtre. Pourtant, des micro-organismes peuvent être développés pour contrer les deux ravageurs exotiques impliqués dans cette maladie. Les hêtres infectés aussi par *Nectria galligena* augmentent le taux d'inoculum et favorisent l'infection d'autres essences feuillues. Le chancre du noyer cendré: une essence en voie de disparition qui suscite plus d'intérêt au Ministère de l'Environnement que chez les industriels forestiers. Les pourridiés, *Armillaria* spp.: les espèces et leurs distributions sont assez bien connues au Canada, sauf dans les Maritimes. La maladie du rond: elle continue de progresser vers le nord en l'absence de produit préventif. La carie rouge alvéolaire: elle est présente partout au Canada et les dommages sont plus remarqués sur les épinettes de près 40 ans. De nouveaux pourridiés apparaissent.

Introduction

Dans l'Est du Canada, beaucoup d'attention et d'efforts ont été portés sur les insectes défoliateurs dont la tordeuse des bourgeons de l'épinette. J'aimerais donc attirer votre attention sur 10 maladies d'arbres toujours présentes dans cette partie du Canada. Avant de vous présenter des faits importants pour chacune de ces maladies, j'aimerais rappeler quelques notions de protection des forêts.

La suite d'étapes logiques en protection des forêts sont le diagnostic, le pronostic et le contrôle. La recherche et le développement sur le diagnostic progressent rapidement, grâce en autres aux nouvelles techniques moléculaires. Mais le contrôle des ravageurs risque de stagner parce que les recherches sur les ravageurs qui doivent nous permettre de comprendre les conditions qui mènent à une épiphytie sont quasi inexistantes en pathologie forestière. Nous avons abdiqué face à des maladies importantes comme la rouille vésiculeuse en remplaçant le pin blanc par le pin rouge. Puis, comme le chancre scléroderrien race européenne menaçait le pin rouge, nous avons planté

du pin gris qui souvent ne trouve pas preneur à cause des cimes trop branchues. Il existe des solutions à ces problèmes et nous devons y mettre des efforts pour les développer.

Le contrôle des insectes du feuillage par des arrosages aériens nous a fait oublier que la lutte directe aux ravageurs n'est pas la seule approche. La lutte directe n'est pas adaptée aux microorganismes ou aux insectes colonisant l'intérieur des tissus. L'approche écosystémique nous permet d'ouvrir de nouveaux horizons pour contrer les ravageurs forestiers. Cette approche vise à conserver un équilibre entre les trois principales composantes d'un écosystème : le peuplement forestier, les milieux et les ravageurs.

Afin d'amorcer une réflexion sur notre attitude face à ces maladies, voici donc des faits sur dix pathosystèmes de grande importance.

Rouille vésiculeuse du pin blanc

Dans les années 1930, durant la crise économique qui sévissait, des plantations d'arbres visaient à donner du travail à des chômeurs. C'est ainsi qu'à Valcartier à 40 km au nord de la ville de Québec, des anciennes terres agricoles abandonnées furent reboisées. En 1933, 302,000 semis de pins blancs ont été plantés. Mais à cause de l'introduction de la rouille vésiculeuse du pin blanc en Amérique autour de 1900, la mortalité de ces pins augmentait chaque année. On a relevé la mortalité des pins blancs en 1935, 1939, 1946 et 1955 et celle-ci fut respectivement de 19%, 22%, 40 % et 50 %. Depuis ce dernier relevé de 1955, on assumait que la plantation était une perte totale. J'ai visité cette plantation en 2006 pour apprendre qu'elle avait été éclaircie autour de 1995.

Dans le Parc national de la Mauricie, le brûlage contrôlé est utilisé en vue de favoriser la régénération de pin blanc. Or, un relevé démontrait que des symptômes de la rouille vésiculeuse étaient présents sur plus de 45% des tiges et que des infections multiples apparaissaient sur un très grand nombre d'arbres. Une visite de ces lieux à l'été 2006 avec les responsables du Parc nous ont permis de corriger ces observations. Les symptômes observés n'étaient pas ceux de la rouille, mais bien ceux d'un acarien *Trisetacus alborum*.

On dit qu'il n'y a pas de pin blanc en Gaspésie et pourtant nos collègues forestiers du Collège de Gaspé nous en ont montré de très beaux. Certes il n'y en a moins que dans l'Outaouais, mais le pin blanc a toujours été présent en Gaspésie. La coupe du pin blanc et la destruction de la régénération par le feu seraient les causes principales de sa forte diminution. Quelques grands pins blancs sont actuellement laissés sur les sites de coupes afin de conserver un habitat pour quatre espèces d'oiseaux.

À Mont-Laurier, des plantations de pin blanc très affectées par la rouille et situées non loin de cette ville poussaient certains forestiers à éliminer cette essence de la région. Mais en remontant encore plus au nord de Mont-Laurier, il existe de superbes de plantations de pin blanc qui ont été élaguées au bon moment et où la maladie est sous contrôle.

On retrouve le pin blanc même à Terre-Neuve et des essais d'élagage ont été faits en vue de contrer la rouille dans la région de Gander. Mais les pins blancs sont aussi présents dans l'ouest de l'île ainsi que dans l'extrême est, soit sur la péninsule d'Avalon. Et en utilisant le « Forest Site Classification Manual », on peut choisir les sites moins favorables au *Ribes* spp., l'hôte alternant de la rouille vésiculeuse.

Chancre scléroderrien - race européenne

Cette maladie importée d'Europe s'attaque d'abord aux pousses des pins et peut ensuite causer des chancres aux troncs. Des recherches conduitent au Service canadien des Forêts permettent de contrôler cette maladie. D'abord les inspections phytosanitaires empêchent la distribution de cette maladie en région comme cela a été le cas dans le passé. De plus, nous avons démontré que le stade sexué du champignon n'existe pas au Canada, le champignon ne produisant que des conidies qui ne sont disséminées que sur de courtes distances qui sont à peu près l'équivalent de la hauteur des infections.

Il faut prévenir toute nouvelle épidémie de plantations en plantations en nettoyant celles qui sont actuellement infectées de l'Est canadien; les méthodes que nous avons développées permettent de faire ce nettoyage avec un succès assuré. Il faut aussi éviter l'introduction de l'autre type sexuel (mating type) de ce champignon exotique, car la formation d'apothèces permettrait au champignon de se disséminer sur de grandes distances.

Chancre européen du mélèze

Une autre maladie exotique importée d'Europe a été détectée pour la première fois en Amérique au Massachusetts en 1927. Après quelques interventions d'éradication, la maladie semblait avoir disparu. Mais elle a été retrouvée dans les années '80 dans les provinces Maritimes et dans l'état du Maine. Cette maladie ne semble pas se propager, mais comme la stratégie des champignons est de produire des millions de spores années après années, et que ces spores sont disséminées sur de grandes distances, il faut s'attendre qu'avec le temps, cette maladie couvrira une très grande superficie. Cette maladie peut inquiéter les forestiers qui font de la plantation de mélèzes hybrides dans la Baie des Chaleurs.

Diplodia pinea* = *Sphaeropsis sapinea

Cette maladie cause une brûlure des rameaux souvent bénigne sur les arbres vigoureux. Le champignon responsable est un champignon endophyte qui colonise les aiguilles bien souvent sur les semis en pépinière. En effet, le champignon se développe sur les cônes de pin rouge dans les brise-vents autour des pépinières forestières. En plantation, le champignon demeure dans les aiguilles sans exprimer de symptôme. Quand survient une sécheresse, *D. pinea* cause alors des brûlures de pousses qui peuvent provoquer la mort de pins rouges. De là l'importance d'avoir une

inspection phytosanitaire des semis dans nos pépinières forestières. Mais, il faut aussi choisir des sites appropriés au pin rouge afin que ceux-ci soit moins affectés par les sécheresses.

Maladie corticale du hêtre

Cette maladie exotique est encore en progression dans l'Est canadien, surtout vers l'ouest en Ontario et au Québec. Par contre des peuplements sont encore exempts de maladie dans les zones cartographiées comme infectées. Il est irresponsable de laisser cette maladie à elle-même sans aucune intervention. Il existe la possibilité de développer des agents de lutte biologique autant contre l'insecte que contre le champignon pathogène.

Chancre du noyer cendré

Le noyer cendré est en voie de disparition à cause de l'introduction de la maladie en Amérique dans les années '50-60. Il y a possibilité d'intervenir pour prolonger la vie des noyers infectés ou de diminuer l'impact de la maladie. Le champignon exotique (*Sirococcus*) peut être confondu avec un champignon indigène (*Melanconis*) qui serait moins virulent. Il existe des peuplements sains qui mériteraient d'être protégés. Selon des études menées au Vermont, des espèces de scolytes seraient des vecteurs importants de la maladie. Il serait irresponsable de ne rien faire pour sauver cette espèce d'arbres.

Les pourridiés

Parmi tous les ravageurs, c'est le groupe ayant le plus grand impact sur les pertes ligneuses en volume dans nos forêts canadiennes (Rapport d'information ST-X-8 du SCF, 1994) Ce rapport est basé sur des données couvrant la période de 1982 à 1987.

Le Pourridié – agaric

Ce sont les pourridiés les plus connus et causés par des espèces d'*Armillaria*; il en exite plus de 10 espèces en Amérique du Nord. Ces espèces sont bien connues pour chacune des provinces canadiennes, sauf dans les Maritimes. Nous avons fait un compte rendu de la situation mondiale dans un chapitre du livre édité par le Dr. J.J. Guillaumin : Laflamme, G. et Guillaumin, J.-J. 2005. Ch.15: L'armillaire, agent pathogène mondial: répartition et dégâts.

Maladie du rond

La cause de cette maladie est le champignon pathogène *Heterobasidion annosum*. Il infecte d'abord une souche fraîchement coupée lors d'une éclaircie; puis il progresse sur les arbres voisins par les racines. La mort de ces arbres autour d'une souche infectée a donné le nom à la maladie. Elle progresse du sud vers le nord; elle est apparue dans la péninsule du Niagara en 1955, puis près d'Ottawa en 1975. Nous l'avons détectée du côté québécois de l'Outaouais en 1989 et enfin le ministère des Ressources naturelles du Québec l'a rapportée dans la région de Drummonville en 2005. Nous travaillons actuellement sur la production d'un produit biologique, mais il sera très difficile d'homologuer un tel produit au Canada, à cause des sommes d'argent énormes nécessaires à cette fin et du marché très restreint. Mais le produit n'en demeure pas moins très efficace.

Enfin il faut surveiller cette maladie dans l'ouest canadien, car elle progresse des États-Unis vers la Colombie Britannique. Deux autres maladies semblables existent en Europe, l'une sur le sapin (*H. abietinum*) et l'autre sur les épinettes (*H. parviporum*); il faut donc prendre les mesures nécessaires afin d'éviter leur introduction au Canada.

Carie rouge alvéolaire

Ce pourridié est causé par le champignon ***Inonotus tomentosus.*** Cette maladie des racines est présente partout au Canada, affectant principalement les épinettes. Elle a fait l'objet de travaux surtout en Ontario par R. Whitney. Des études faites au Québec par Pomerleau dans les années '50 signalent son importance dans trois régions. Les dommages incluant le volume de pourriture et mortalité, sont surtout remarqués dans les plantations d'épinettes vers l'âge de 40 ans. Au Québec, la maladie a été relevée dans les plantations de la Mauricie dans les années '60. Dans la région du nord de Montréal à Harrington, de même que dans la Beauce à Mégantic, on observe une grande incidence de mortalité causée par cette maladie. Dans la forêt de Petawawa en Ontario, l'épinette ne peut survivre sur la majorité des sites de ce territoire à cause de ce pourridié.

Autres pourridiés

Il existe d'autres pourridiés dont certains pourraient être de nouvelles maladies des racines selon les travaux de G. Warren à Terre-Neuve et présentés à ce forum en 2004 (Root and Butt Rots in Semi-mature, Pre-commercially Thinned Stands of Balsam Fir in Newfoundland.). Les pertes par les pourridiés seraient de 7 à 15 fois plus importantes dans les peuplements ayant fait l'objet d'une éclaircie pré-commerciale à Terre-Neuve. Des résultats semblables ont été observés au Nouveau Brunswick 25 ans après l'éclaircie.

Conclusion

Des forestiers canadiens ont tendance à sous-estimée l'importance des dégâts causées par les maladies. D'autres ont une attitude pessimiste face aux maladies des arbres; ils préfèrent changer d'essences au lieu de faire face aux problèmes et à trouver des solutions. La raison principale de cette attitude serait leur confinement à la lutte directe, comme elle se pratique contre les insectes du feuillage. L'approche écosystémique est la meilleure façon de contrer les agents pathogènes en protection des forêts. On peut intervenir par différente moyens. Ainsi, on peut appliquer la méthode préventive comme le traitement des souches par *P. gigantea* pour prévenir la colonisation d'un site par la maladie du rond. Des moyens sylvicoles comme l'éclaircie au bon moment vont prévenir *I. tomentosus*. L'élagage de jeunes plantations peut contrer le chancre scléroderrien et la rouille vésiculeuse. Le choix de site adéquat pour une essence donnée peut prévenir des maladies comme la rouille vésiculeuse, la carie rouge alvéolaire et le pourridié-agaric. Une meilleure connaissance de l'effet des coupes pré-commerciales évitera des pertes par les pourridiés.

La protection des forêts contre les agents pathogènes débute déjà en pépinière (*Diplodia, Gremmeniella*,…). Et tout au long du développement du peuplement forestier, il faut parfois intervenir, soit entre 6 et 20 ans pour la rouille vésiculeuse et le chancre scléroderrien, de 25 à 40 ans pour les pourridiés causés par *I. tomentosus* et *H. annosum,* et même davantage.

Impact of *Armillaria* Root Disease in Douglas-Fir in B.C. / Impact du pourridié-agaric sur le sapin Douglas en Colombie-Britannique

Presented by / Présenté par :

***Mike Cruickshank*[1], *D.J. Morrison*[1], *I.R. Cameron*[2], *R. Macdonald*[3], *J.W. Goudie*[4], *S. Stearns-Smith*[5].**

[1] Natural Resources Canada, Canadian Forest Service - Pacific Forestry Centre, 506 West Burnside Road, Victoria, BC V8Z 1M5

[2] Azura Formetics, Kamloops, BC

[3] RamSoft Systems Ltd., Victoria, BC

[4] BC Ministry of Forests and Range, 722 Johnson Street, Victoria, BC V8W 1N1

[5] Stearns-Smith Assoc., Victoria, BC

Armillaria ostoyae is a naturally occurring disturbance agent that is usually in dynamic equilibrium with in undisturbed forests. The distribution of *A. ostoyae* is northern circumpolar, but there are more than 30 species globally. In the British Columbia (BC) southern interior, most stands have some level of infestation by Armillaria root disease (10-80% diseased depending on the ecosystem). On infested sites, practices that create stumps that become inoculum upset the balance in favor of the fungus. The fungus is capable of infecting and killing any species of tree and many herbs and shrubs. Currently, and especially in the long-term, timber production on many of these managed sites is not sustainable because most conventional forestry practices, especially selective logging, increase the incidence of diseased trees. There are 35 years of interior Douglas-fir plantations in BC (Interior Cedar Hemlock ecosystem) at risk to this disease. Impacts accumulate through mortality (0.5 to 2.0 % per year) or through growth reduction of diseased trees (20-60% reduction). Stand level losses are similar to individual tree losses because infected and dead trees do not free-up resources that their neighbors could use. This mainly occurs because the disease affects the largest trees, most trees are infected and cannot respond, and dead trees become inoculum sources and infect their neighbors. A timber supply analysis estimates that the disease impacts from Douglas-fir plantations alone are 7%. The main effect of the disease is to lower long-term site productivity because the fungal inoculum is amplified through forestry activities and accumulates with each stand entry. There is little opportunity to salvage the losses because losses occurred as reduced increment or the dead trees are dispersed in space and time.

Session VIII: Pesticide Regulations, Alternatives, Minor use

Session VIII / Séance VIII

Chair: Michael Irvine

Ontario Ministry of Natural Resources

Séance VIII : Réglementation des pesticides, produits de remplacement, usages mineurs

Président : Michael Irvine

Ministère des Richesses naturelles de l'Ontario

PMRA Update / Des nouvelles de l'ARLA

Presented by / Présenté par:

Terry Caunter

Pest Management Regulatory Agency, 2720 Riverside Drive, Ottawa, ON K1A 0K9

Health Canada's Pest Management Regulatory Agency Update

Forestry Forum 2006 – December 6, 2006

Terry Caunter
Project Manager
Alternative Strategies Section
Efficacy & Sustainability Assessment Division

Pest Management Regulatory Agency (PMRA)
Health Canada

Health Canada Santé Canada

Relevant Federal Act and Regulations

- Pest Control Products Act (PCPA) & Pest Control Products Regulations (PCPR)
- New PCPA & PCPR came into force June 2006
  - More information:
    - http://www.pmra-arla.gc.ca/english/index-e.html

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PMRA Mandate

- Primary objective is to prevent unacceptable risks to people & the environment from the use of pest control products

PMRA Mandate

- Support sustainable development designed to enable the needs of the present to be met without compromising the ability of future generations to meet their own needs

PMRA Mandate

- Ensure that only those pest control products that are determined to be of acceptable value are approved for use in Canada

PMRA Mandate

- Minimize health & environmental risks posed by pest control products, and encourage development & implementation of innovative, sustainable pest management strategies by facilitating access to pest control products that pose lower risks & by other appropriate measures

PMRA Mandate

- Encourage public awareness in relation to pest control products by informing the public, facilitating public access to relevant information and public participation in the decision-making process

PMRA Mandate

- For greater certainty, protection and consideration afforded to children in this Act shall also extend to future generations

What Comes Next?

- Implementation of the Act & Regulations
- Minimizing health & environmental effects
  - Since 1998, as a matter of policy, the PMRA established policies that required additional protection for children and pregnant women and took into account pesticide exposure from all sources, including food and water
  - Policies now formalized into law

Risk Reduction

- The new Act also supports pesticide risk reduction, for example, by ensuring that only pesticides that make a useful contribution to pest management are registered and by expediting the registration of lower-risk products
- Value now includes efficacy, and economic and social impacts

Risk Reduction Groups Established

- Collaborate with (potential) applicants & user groups to facilitate the registration of reduced-risk products according to stakeholder consensus expressed as “a risk reduction strategy”

Facilitating Access to Lower Risk Pest Control Products

- Stakeholders appreciate having a commodity/use specific contact point at the PMRA that:
  - understands the specific issues associated with their industry
  - results in less regulatory confusion
  - fosters a better overall relationship with the PMRA

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Facilitating Access to Lower Risk Pest Control Products

- What can we do with you?:
  - Forestry liaison for forestry issues
  - Wood preservative (CSA technical committee)
  - Forestry Forum Steering Committee
  - National Forest Pest Strategy Working Group
  - Invasive alien species support
  - Pine beetle support
  - Misc. forest pests support

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Facilitating Access to Lower Risk Pest Control Products

- Contact potential applicants, researchers, sector groups
- Share information and contacts among all of the groups
- Provide a regulatory overview
  - a better understanding of the regulatory system
  - general & specific peer reviewed information

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Facilitating Access to Lower Risk Pest Control Products

- Other potential benefits:
  - help stakeholders make more informed choices & avoid regulatory pitfalls
  - search for alternatives inside & outside of Canada
  - act as a liaison between stakeholders
  - advise potential applicants to request an official pre-submission consultation

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Facilitating Access to Lower Risk Pest Control Products

- Resources for stakeholders

  Establish a rapport of trust between PMRA and stakeholders through continuity, dedication, and communication

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Facilitating Access to Lower Risk Pest Control Products

- Risk reduction groups established
  - Forestry Sector
    - Terry Caunter - 613-736-3779 tcaunter@hc-sc.gc.ca

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Facilitating Access to Lower Risk Pest Control Products

- Risk reduction groups established
  - Ornamentals, Christmas trees, & Horticultural Greenhouses
    - Imme Gerke - 613-736-3794
      imme_gerke@hc-sc.gc.ca
    - Chi Tran – 613-736-3833
      chi_tran@hc-sc.gc.ca

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Public Awareness

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Public Awareness

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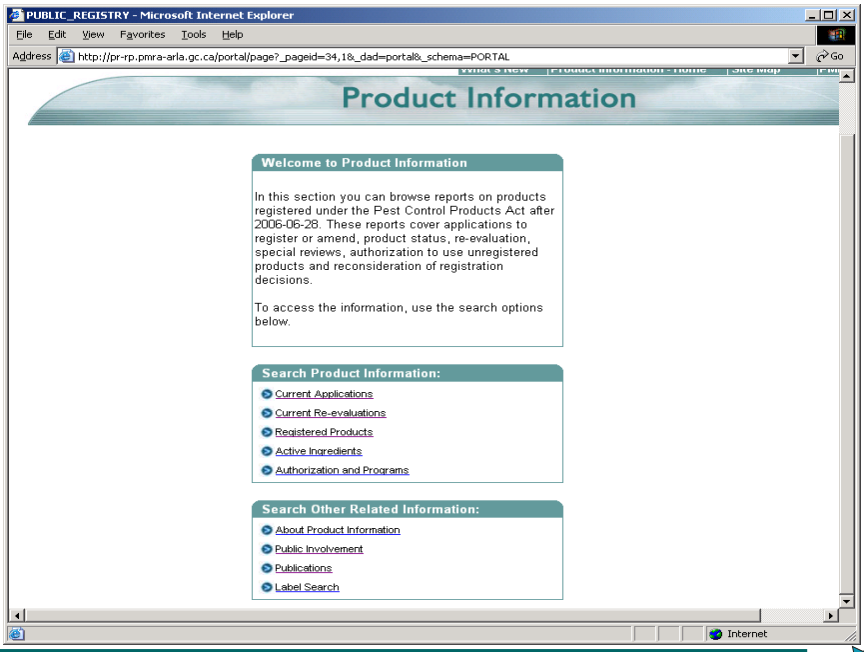
Public Awareness



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Public Awareness

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Public Awareness

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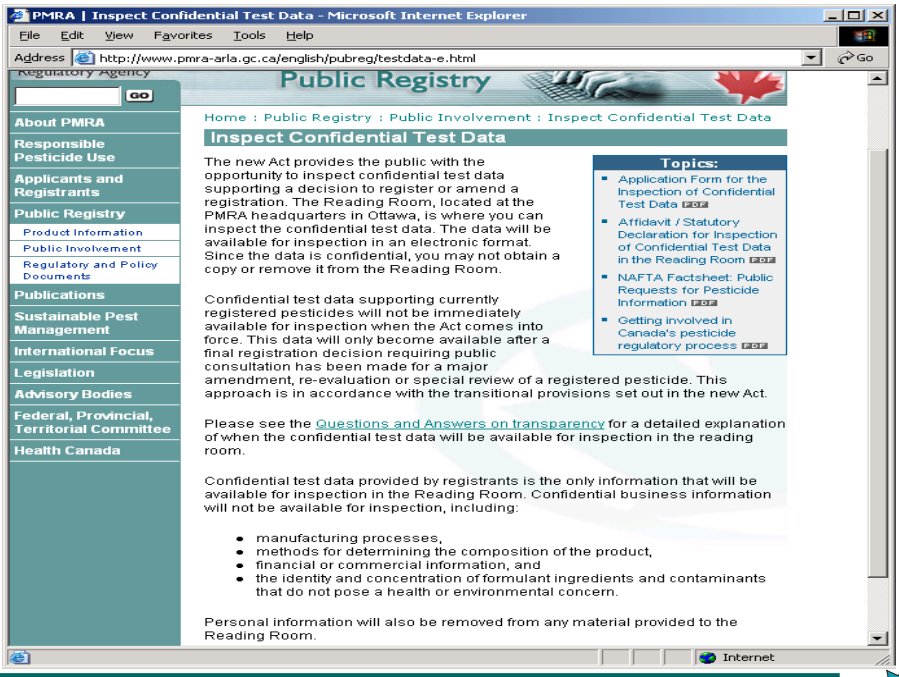
Public Awareness



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Public Awareness

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Public Awareness

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Registration Highlights

- Re-evaluation
  - *Bacillus thuringiensis* group
    - Proposed Acceptability for Continuing Registration (PACR) document PACR2006-09
    - *Re-evaluation of Bacillus thuringiensis*
    - Comments until January 15, 2007
    - Key elements:
      - Harmonization with EPA and international regulatory bodies
      - Emphasis on product characterization standards
      - Label upgrades to reflect PMRA standards
    - Label recommendations not etched in stone
      - Comments & concerns will be taken into account before a final re-evaluation decision is reached

Registration Highlights

- Re-evaluation
  - Carbaryl, Dichlorvos, Diazinon, Trichlorfon
    - Reviews continuing
  - Chlorpyrifos
    - Elm bark beetle uses to be continued

Registration Highlights

- Registrations
  - Tebufenozide
    - full registration granted for Mimic 240LV Forestry Insecticide
    - buffer zone clarifications continuing with Manitoba

Registration Highlights

- Registrations
  - Neodiprion abietis nucleopolyhedrovirus (NPV)
    - ABIETIV Flowable Biological Insecticide for control of Balsam Fir Sawfly (CFS)
    - First NPV product registered using field collected virus, hence higher regulatory burden

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Registration Highlights

- Registrations
  - Mountain Pine Beetle Anti-aggregation Pheromone
    - Verbenone Pouch (Pherotech International)
    - Mountain pine beetle (*Dendroctonus ponderosae*) pheromone slow release device for use on pine trees and in pine stands

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Registration Highlights

- Registrations
  - Imidacloprid – Emergency Registration
    - Confidor 200 SL Systemic Insecticide (Bayer CropScience)
    - Emerald ash borer on ash trees & Asian long-horned beetle on trees
    - Cottony ash psyllid on ash trees & Europeon elm scale on elm trees

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Registration Highlights

- Registrations – minor use
  - *Bacillus thuringiensis* Berliner
    - Foray 48B / 76B (Valent BioSciences)
    - Jackpine budworm on Jackpine
    - Pale-winged gray moths on forests & woodlands
    - Black-headed budworm in forests

Registration Highlights

- Pending Registrations
  - Douglas-fir and Spruce beetle pheromone
    - MCH Bubble cap (Pherotech International)
    - Decision by spring 2007
  - Spirotetramat (Bayer CropScience)
    - aphids, mites in Christmas trees

Registration Highlights

- Research permit samples
  - permits for imidacloprid & neem granted fro wood boring insects
  - pheromone and non-host volitile anti-aggregant blend against Western pine beetle
  - various permits for Bt formulations for forest pests
  - imidacloprid for control of *Eriococcus spurius* on elm trees
  - triclopyr for control of aspen, balsam, white birch in spruce

Session IX: The Real Story of BioPesticide Regulations: No More Myths

Session IX / Séance IX

Chair: Michael Irvine

Ontario Ministry of Natural Resources

Séance IX : L'heure juste sur la réglementation des biopesticides : la fin d'un mythe

Président : Michael Irvine

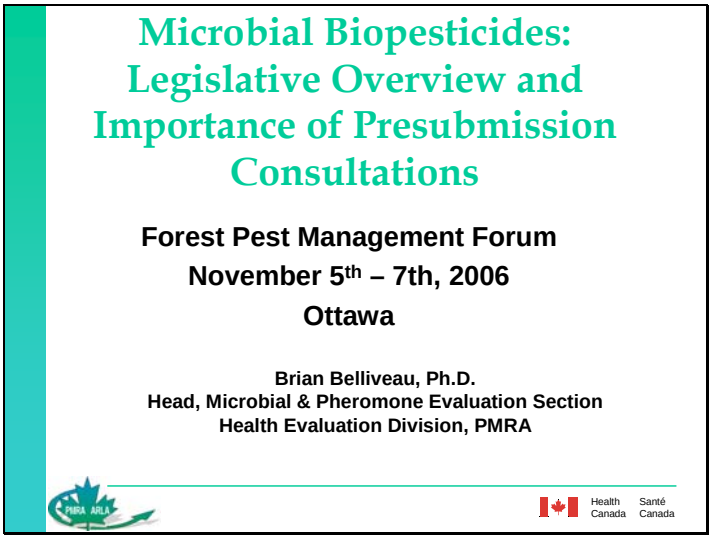
Ministère des Richesses naturelles de l'Ontario

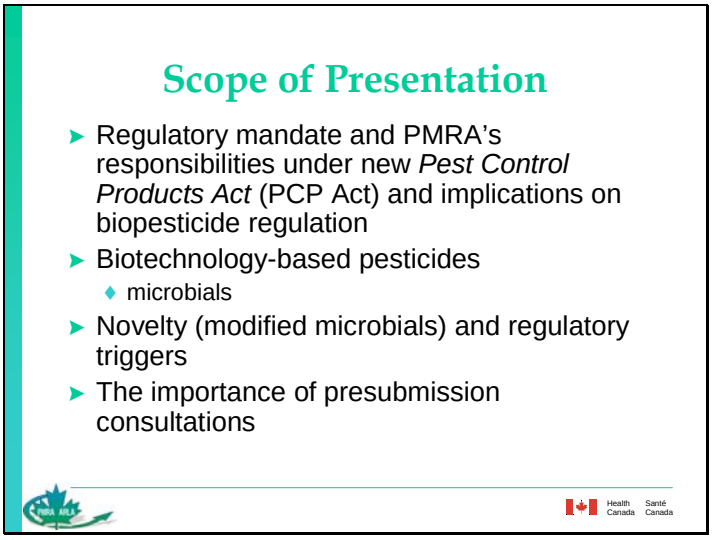
Legislative Overview and Importance of Presubmission Consultations / Survol de la législation et importance des consultations préalables à la présentation d'une demande

Presented by / Présenté par :

Brian Belliveau

Pest Management Regulatory Agency, 2720 Riverside Drive, Ottawa, ON K1A 0K9





Pest Control Products Act and Regulations

- New **PCPA (2002)** came into force on June 28, 2006; Existing Regulations also in effect on June 28, 2006 (Canada Gazette Part II, Vol. 140, No. 13)

- "pest control product" means
  - means a product,***organism*** or a substance, including a product, an ***organism*** or a substance derived through ***biotechnology***…that is manufactured, represented, distributed or used as a means for directly or indirectly controlling,destroying, attracting or repelling a pest for mitigating or preventing its injurious, noxious or troublesome effects [s. 2(1)]

Mandate

- Minister's primary objective is to prevent unacceptable risks to people and the environment from the use of pest control products [s. 4(1)]
- Acceptable risk [s. 2(2)]
  - Risks are acceptable if there is reasonable certainty that no harm to human health, future generations, or the environment will result from exposure to or use of the product, taking into account its conditions or proposed conditions of registration

Necessary Considerations

- In furthering primary objective of preventing unacceptable risks, the Minister **shall**:
  - Support sustainable development;
  - Seek to minimize risks and encourage development and implementation of sustainable pest management strategies by facilitating access to products that pose lower risks;
  - Encourage public awareness by informing the public, facilitating access to information; and
  - Ensure only products of acceptable value are approved for use

Evaluating Products

- Minister shall: [s. 7]
  - Conduct evaluations considered necessary wrt health or environmental risks or value;
  - Expedite evaluations of products that pose lower health or environmental risks;
  - Consider information from applicant, and may consider additional information
    - Applicant has burden of persuading Minister risks and value are acceptable; this may include information from reviews from OECD member countries
  - Apply scientifically based approach;
  - Follow government policy (e.g., TSMP); and
- In determining if risks or value are acceptable, the Minister may take into account information on risks and value of other products registered for the same use

Science/Evaluation

- Health: more prescriptive in how assessments are conducted but largely codifies existing practice
- Environment: now explicitly mentioned but broad definition of what to protect
- Value: defined albeit broadly
- Comparative risk/value

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Implications for Implementation

- None of the previous points were in the old PCPA, however:
  - Some concepts are in PCPA regulations; many are already in practice
- Lots of flexibility!
  - Act is not prescriptive in most areas

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Implications for Implementation

- Up to PMRA to decide level of evaluation necessary wrt risks and value
  - Must be scientifically based and follow government policy
  - Can be different for different products
  - Put in level of evaluation effort commensurate with potential level of risk posed by the pesticide

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Implications for Microbial Pesticides

- No major changes to microbial evaluation or risk assessment processes; DIR2001-02 registration guidelines still current
- Research permit guidelines (PRO93-05) are now codified (with minor changes) in PCP Regulations
  - Research Authorizations (formerly Research Permits) [s. 47 – 50]
  - Research Notification [s. 51 – 54]
  - Exemptions [s. 55]; only laboratory research exempt for microbials

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Pest Control Products Act and Regulations

- PCP Regulations defines "biotechnology" to mean
  - The application of science and engineering to the direct or indirect use of living organisms or parts or products of living organisms in their natural or modified forms [s. 2(1)]

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Pest Control Products Act and Regulations

- MPCAs modified through classical mutational or recombinant nucleic acid procedures are not regulated differently under the PCPA (PCPA regulates the product, not the process)
- Additional data on characterization (Part M2) are required for a Tier I risk assessment of a GMO (e.g., details of modifications/ manipulations, sequence data, expression of modified sequences or inserts, potential pleiotropic effects, impact on host range)

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Pest Control Products Act and Regulations

- Insertion of novel (i.e., foreign) genes to the MPCA (e.g., scorpion toxin genes inserted into a baculovirus genome) could trigger additional testing to assess human health impacts as well as environmental fate and ecotoxicological effects
- Additional health and environmental safety tests triggered by the genetic modification are determined on a case-by-case basis (best discussed early in development at presubmission consultations with PMRA)

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Presubmission Consultations

- Mainly intended as a forum to discuss registration requirements, but can be used to discuss requirements in support of research authorizations

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Presubmission Consultations

Prepare for a Presubmission Consultation
Assemble an initial data package consisting of:

- fill in form requesting pre-submission meeting
- proposed label, product profile, use pattern, int/l regulatory status
- list of ingredients (active, formulants)
- detailed organism characterization
- short summaries of available info on efficacy, manufacturing process, product specs, environmental and human health effects
- scientific rationales for proposed data waivers
- proposed study protocols, if available

PMRA will schedule a Pre-submission Consultation to be held within about 45 days of receiving this request and data package

↓

Pre-submission consultation

- A meeting of PMRA regulators, researcher, industry partner, regulatory consultant
- Will determine requirements for a registration submission appropriate to the MPCA and formulations to be registered

↓

Determines
Additional Data Requirements
Information needed for data waivers
Study Protocols

This information is provided to the applicant / researcher in the form of DACO tables. **These tables are valid for 24 months**

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Final Thoughts

- New PCP Act and Regulations have updated and refined mandate respecting health, environmental risks and value of all pesticides
- Requirements for registration and research are largely unaffected by new Act and Regulations.
- Current evaluation practices for microbials are already aligned with new requirements of PCP Act and Regulations
- Lower risk products recognized (includes biopesticides)
- Presubmission consultations are critical for microbial pesticides. PMRA's advice is free!

PMRA ARLA

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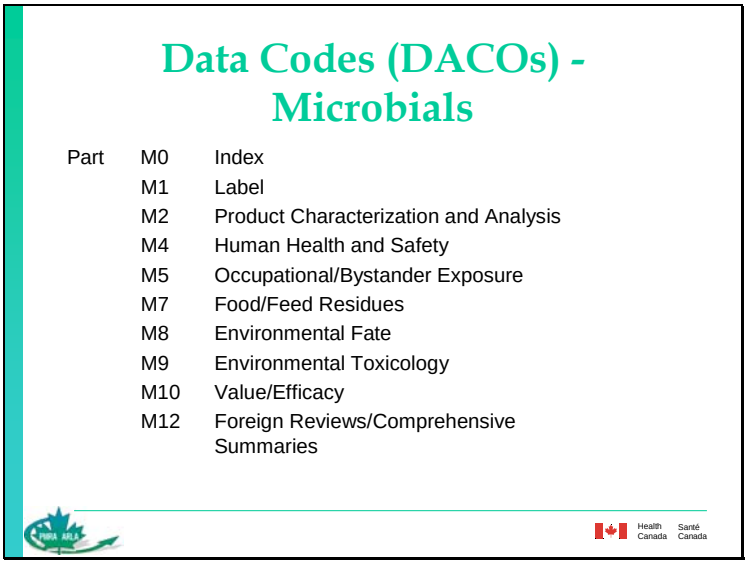
Addressing Human Health and Environmental Data Requirements: Avoid the Pitfalls / Aborder les besoins en matière de données sur la santé humaine et l'environnement : les pièges à éviter

Presented by / Présenté par :

Esther Seto

Pest Management Regulatory Agency, 2720 Riverside Drive, Ottawa, ON K1A 0K9



Product Characterization and Analysis

- Detailed information on characterization significantly influences the nature and extent of data required to assess safety to human health and the environment.
- Includes information related to origin, derivation and identification of the Bt strain, biological properties (e.g., potential enterotoxin production), manufacturing methods and quality assurance, disclosure of ingredients, analytical data and methodology, storage stability testing, physical and chemical properties

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Human Health and Safety: Tier I Studies

Title/Animal Species	Dose	Test Material
Acute oral: Rat (preferred)	single high dose (10^8 MPCA units/animal)	TGAI
Acute pulmonary: Rat (preferred)	intratracheal instillation of single high dose (10^8 MPCA units/animal)	TGAI
Intravenous infectivity: Newly weaned mouse or hamster	single high dose (10^7 MPCA units/animal) injected intravenously	MPCA
Acute dermal toxicity: Rabbit	single high dose (2g/kg bw) applied to ~ 10% of body surface area for a 24-h exposure	EP
Dermal irritation study: Rabbit	single dose (0.5 mL or 0.5 g/animal) applied to small area (6 cm^2) for a 4-h exposure	EP
Reporting hypersensitivity incidence	all MPCAs are considered potential sensitizing agents	MPCA or EP

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Environmental Fate and Effects

- Tiered Approach:

  -Tier I - acute toxicity/infectivity testing on non-target organisms

  -Tier II - environmental fate (persistence and dispersal) plus additional acute toxicity testing

  -Tier III - chronic toxicity (life cycle) testing plus definitive toxicity testing

  -Tier IV - experimental field testing (toxicity and/or fate)

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Environmental Fate and Effects: Environmental toxicology Tier I

Test	Test Material	Type of test
Avian oral	TGAI or EP	Maximum Challenge Concentration
Avian pulmonary, inhalation or injection		
Wild mammals		
Fish: Freshwater		
Fish: Estuarine or marine		
Arthropods: Terrestrial		
Arthropods: Aquatic		
Non-arthropod invertebrates: Terrestrial		
Non-arthropod invertebrates: Aquatic		
Plants: Terrestrial		
Plants: Aquatic		

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Addressing Requirements

- Test data/information requirements identified during presubmission consultation denoted by "R" or "CR"
  - "R" means data/information are required:
    - data on the test organism
    - published scientific literature
    - surrogate information or bridging data to another strain/species, if both belong to a well-known (familiar) taxon
    - a rationale to waive the requirement because it is unnecessary or impractical
  - "CR" means data are conditionally required if specified conditions are met or could be triggered

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Data Issues

- Lack of ID method specific to the MPCA isolate (must distinguish from other species isolates)
- Inadequate discussion on potentially toxic metabolic by-products (possible triggers for higher tier human health and ecotox. studies)
- Inadequate description of biological properties (mode of action, relatedness to pathogens, resistance to antibiotics, etc.)

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Data Issues

- QA/QC data lacking for microbial products, including 5 batch analysis for microbial contaminants
- No/inadequate storage stability studies for microbial products to support storage claims (temperature range and shelf life) on EP label
- MSDSs or manufacturer's specifications (plus tech. info.) on formulants (e.g., emulsifiers, stabilizers, preservatives) missing

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Data Issues

- No request for pre-submission consultation to identify product-specific data requirements
- Waiver requests missing or not based on sound scientific reasoning
- Waivers not supported by literature on related species/strains/isolates or results of literature search (key search words, data bases), if no papers published
- Citations without copies of literature

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Data Issues

- Multiple papers addressing a single data requirement not accompanied by a critical review demonstrating how each one addresses the requirement
- Test substance not clearly identified in study report
- Inappropriate test material (PAI, TGAI, EP) and test concentrations selected
- Not enough raw data to allow for independent analysis by Agency evaluators

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Labelling Issues

- Standard statements not followed as per Registration Handbook and/or Guidelines (microbials), e.g., disposal for TGAI, MP, EP
- Always require “POTENTIAL SENSITIZER” and “CAUTION - EYE IRRITANT” (if no eye irritation study submitted) on principal display panel (microbials)

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Labelling Issues

- Include date of manufacture and expiry statement (microbials) on principal display panel
- Product name and guarantee on label does not match PSF (TGAIs and EPs)
- Strain designation not included in Guarantee line of TGAI, EP labels (microbials)

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Ensuring a Complete Submission

- Covering letter (purpose, content)
- Forms (application, application fees form, product specification form)
- Draft Labels for TGAI and each EP
- Documentation (letters of confirmation, support, agent, certification, etc.)
- E-Index of submitted data/studies

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Ensuring a Complete Submission

- Data/Studies
- Foreign reviews of data, if appropriate
- Formatting Options: PMRA, OECD or U.S. EPA formats accepted in either a paper or electronic submission

INCOMPLETE SUBMISSIONS MAY NOT GO FORWARD

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Parting Advice

- Avoid disappointments:
  - Read your submission package carefully and ensure all required data elements (DACOs) are fully addressed and binders/e-files are properly formatted BEFORE submitting to PMRA
  - Incomplete submissions will result in delays, costing you time (remember - the review clock re-starts if there are deficiencies) and $$

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Session X: The Real Story of BioPesticide Regulations: No More Myths (continued)

Session X

Chair: Michael Irvine

Ontario Ministry of Natural Resources

Séance X : L'heure juste sur la réglementation des biopesticides : la fin d'un mythe (suite)

Séance X

Président : Michael Irvine

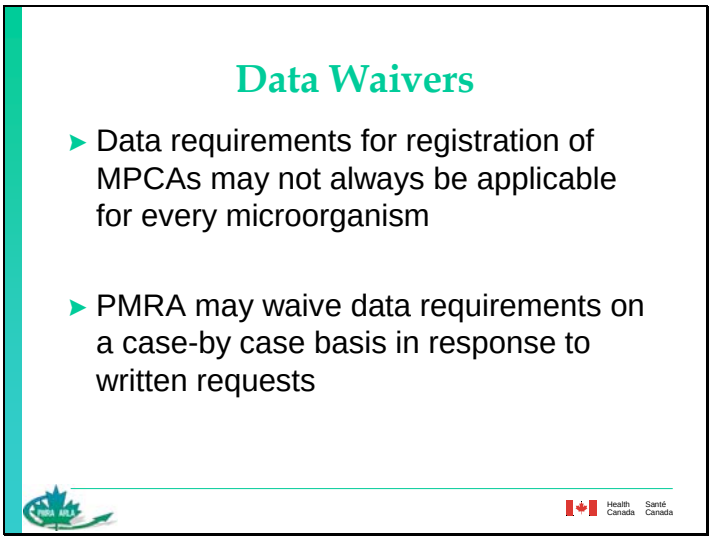
Ministère des Richesses naturelles de l'Ontario

How to Build Data Waivers / Comment préparer des exemptions applicables à la présentation de données

Presented by / Présenté par :

Denis Rochon

Pest Management Regulatory Agency, 2720 Riverside Drive, Ottawa, ON K1A 0K9



Waiver Requests

- Waiver requests must:
  - explain why the data requirement should be waived
  - suggest alternative means of obtaining data to address the underlying concern(s) of the data requirement
  - furnish any other information that may support the request

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Possible Reasons To Waive Testing

- A study is not practical or is not applicable for a particular organism
- A study is already available in published scientific literature
- The data are not useful in risk evaluation

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Underlying Concerns

- Infectivity of MPCA
- Toxicity of MPCA:
  - Allergens
  - Microbial toxins and other toxic metabolites
  - Extraneous host residues from MPCAs produced in cell cultures, whole animals or other living forms

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Underlying Concerns

- Potential effect(s) of manufacturing impurities or formulation ingredients
- Exposure

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Supporting Information

- Biological properties
  - known host range
  - growing temperatures
  - natural occurrence
  - ecological niche

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Supporting Information

- Surrogate data
  - data on a related organism or strain
  - relationship of tested strain to the MPCA must be well described
- Information on the effects of formulation ingredients/impurities
  - Material Safety Data Sheets (MSDS)
  - published literature

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Supporting Information

- Literature search results in relevant databases
  - BIOSIS, PubMed, Biological Abstracts, AGRICOLA, TOXLINE, etc.
  - include key search words
- Published scientific literature
  - legible copies must be submitted

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Notes on Published Literature

- Mini literature review(s) summarizing all relevant studies
- Explain how the literature addresses the underlying concern
- Make sure all the necessary information is available in published study

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Waivers for Human Health and Safety (Part M4)

- avoid requesting waivers for all health studies
- some studies may be easier to waive than others
  - e.g., combined dermal toxicity & irritation
  - infectivity requirement may be waived for a particular route of exposure

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Waivers for Human Health and Safety (Part M4)

- In waivers, include a discussion on:
  - toxicity of metabolites/toxins
  - toxicity of formulation ingredients for EP studies
  - additional personal protective equipment may be required

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Environmental Fate (Part M8)

- not required at Tier 1
- fate data may be useful in supporting waivers for environmental toxicology

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Waivers for Environmental Toxicology (Part M9)

- Waivers can be based on:
  - Hazard:
    - literature search for adverse effects
    - toxicity of metabolites/toxins
    - toxicity of formulation ingredients
  - Exposure:
    - natural occurrence and/or fate data

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Alternative Strategies: The A in Efficacy / Les nouvelles stratégies : un haut degré d'efficacité

Presented by / Présenté par :

Terry Caunter

Pest Management Regulatory Agency, 2720 Riverside Drive, Ottawa, ON

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Value

- Definition of value
  - Product's actual or potential contribution to pest management, including efficacy, effect on host, health, safety, environmental benefits, social and economic impact

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Value: Social & Economic

- PMRA will take into account social and economic impacts
  - Will help make informed decisions
    - when risks are identified
    - re-evaluation impacts
  - Can help in setting priorities for review
    - resources limited; thus have to make best use

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Efficacy: A Matter of Perspective?

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Efficacy: Legislated

- Efficacy
  - Established in new PCPA and Regulations
  - Determination of rates to be used for risk assessments
  - Efficacy Guidelines for Plant Protection Products: Dir2003-04
    - http://www.pmra-arla.gc.ca/english/pdf/dir/dir2003-04-e.pdf

Efficacy: A Matter of Proof

- Performance claims for "control"
  - Supported by efficacy data which demonstrates that the product consistently reduces pest numbers or pest damage to a commercially acceptable level

Efficacy: A Matter of Proof

- Will allow a label claim for "suppression"
  - Efficacy data show that a product does not consistently reduce pest populations or damage to a level typically required to achieve commercially acceptable control
  - May be acceptable provided that the applicant can show that the demonstrated level of performance has value in a pest management program

Efficacy: A Matter of Proof

- "Suppression" claim may be considered:
  - Product has a new or different mode of action which, when used with products with other modes of action, could contribute to management of pesticide resistance
  - Product has little or no negative impact on pest predators or parasites and could be incorporated into an IPM program for management of the targeted pest and other pests

Some Known Challenges

- Forestry stakeholders
  - Cost of operational aerial research trials
    - $60,000 per replicate
  - Research permit burden
    - 6 months for a new active ingredient (Federal)
    - both Federal & Provincial permits required
  - Number & scope of efficacy trials
    - initial registrations
    - minor use additions

Some Known Challenges

- Regulator
  - Label claims have to be supported
  - Data must reflect the reality of the pest biology and spraying conditions
  - Data must be science/evidence based

Harmonization Efforts

- International Efforts
  - European Food Safety Authority (EFSA)
    - Efficacy requirements
  - European and Mediterranean Plant Protection Organization (EPPO)
    - Minor uses
    - Efficacy requirements
  - National Drugs and Poisons Schedule Committee's (NDPSC) - Australia
    - Efficacy requirements

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Efficacy: Relaxing the Burden

- Already implemented changes
  - Minor uses
    - Less efficacy data required
  - CropLife initiative
    - Reduced aerial efficacy data for expansion of established chemical pesticides
  - Use of efficacy data from other countries
    - Similar climate, flora, pests
  - Multiple year Research permits

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Efficacy: Relaxing the Burden

- Future possible initiatives
  - Formulation changes:
    - CAL EPA recent decision for no efficacy data requirement as long as rates are the same
  - Crop grouping
    - Discussion initiated for agricultural sector
    - Relevancy for Forestry & BioPesticides
  - Pest grouping
    - More complex due to pest biology

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Efficacy: Relaxing the Burden

- Future possible initiatives
  - Tank-mix: no data requirement as long as there is no potential chemical reaction between the mixes
  - Geographical specific data requirements
    - weather conditions during growing season do not vary much among different geographical locations

Efficacy: Relaxing the Burden

- Future possible initiatives
  - Reduction in aerial application data
    - Aerial application technology has significantly advanced in recent years
    - BioPesticides are predominantly used in forestry sector
    - On a case by case level, for minor uses, ground data have been considered in lieu of aerial application data

Efficacy: Relaxing the Burden

- Future possible initiatives
  - Question: Can ground application efficacy data be extrapolated to cover aerial application?
  - Challenge to forestry sector:
    - Scientific rationale required to initiate dialogue with the PMRA
    - Deposit data very important
    - Could lead to overall policy to not require aerial efficacy data for label expansions of extra pests

Efficacy: Relaxing the Burden
Stakeholder Engagement
Working groups on efficacy issues
Industry standards
Protocol standardisation
We work together, we succeed!
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Session XI: Globalization: United States Report

Session XI / Séance XI

Chair: Guy Smith

Natural Resources Canada, Canadian Forest Service

Séance XI : La mondialisation :

Rapport des États-Unis

Président : Guy Smith

Ressources naturelles Canada, Service canadien des forêts

Overview of Forest Pests in the U.S. / Survol des principaux ravageurs forestiers aux États-Unis

Presented by / Présenté par :

Jim Reaves

USDA Forest Service, 1400 Independence Ave., SW, Washington, D.C. 20250, U.S.A.

This presentation is not available. / Cette presentation n'est pas disponible.

SCIENCE AND TECHNOLOGY À LA CARTE

Chair: John Pineau

Canadian Institute of Forestry

A roving, learn-while-you-eat concept

Hosted by Canadian Institute of Forestry and Forest Pest Management Forum

SCIENCE ET TECHNOLOGIE À LA CARTE

Président : John Pineau

Institut forestier du Canada

Un concept qui vous permet de circuler et d'apprendre tout en mangeant

Un événement parrainé par l'Institut forestier du Canada et le Forum sur la répression des ravageurs forestiers

Science and technology à la carte / Science et technologie à la carte

Effect of *Phlebiopsis gigantea* Treatment on the Microbial Diversity of Red Pine Stumps / Effet du traitement de *Phlebiopsis gigantea* sur la diversité microbienne des souches de pin rouge

Presented by / Présenté par :

M.T. Dumas[1] and G. Laflamme[2].

[1] Natural Resources Canada, Canadian Forest Service – Great Lakes Forestry Centre, 1219 Queen St. East, Sault Ste. Marie, ON P6A 2E5

[2] Natural Resources Canada, Canadian Forest Service – Laurentian Forestry Centre, 1055 du P.E.P.S., P.O. Box 10380, Stn. Sainte-Foy, Québec, QC G1V 4C7

Abstract

Heterobasidion annosum (Fr.) Bref. is a serious root disease of red pine plantations in southern Ontario and Quebec. A biocontrol program using *Phlebiopsis gigantea* (Fr.) Jülich is being developed to manage this disease. The aim of this study was to measure the impact of this treatment on microbial succession. The microbial diversity of red pine stumps was determined following treatments with 2 strains of *P. gigantea* in 2 different formulations against untreated controls after 6 weeks. Forty species of bacteria were identified from red pine stumps using plasmalemma fatty acid analysis. *Pseudomonas* species were the most common bacteria isolated. The populations and diversity of prokaryotes inhabiting the treated stumps were similar to the untreated control stumps. Stumps treated with *P. gigantea* had an influence on the populations and diversity of fungi. The most frequently isolated fungi were *Hormonema dematoides* Lagerberg & Melin, *Alternaria alternata* (Fr.) Keissler, *Cladosporium cladosporoides* (Fres.) de Vries, *Mortierella isabellina* Oud. & Koning, *Bjerkandera adusta* (Willd.:Fr.) Karst, *Phacidiopycnis* sp., and *Penicillium* spp. Fourteen fungal species were found only on non treated stumps. Actinomycetes are being identified.

Résumé

Heterobasidion annosum (Fr.) Bref. cause une importante maladie des racines dans les plantations de pin rouge au sud de l'Ontario et du Québec. Un programme de lutte biologique avec le champignon *Phlebiopsis gigantea* (Fr.) Jülich est en développement en vue de contrer

cette maladie. Le but de cette étude était de mesurer l'impact de ce traitement sur la succession microbienne. La diversité microbienne des souches de pin rouge fut déterminée suite aux traitements avec deux isolats de *P. gigantea*, chacun ayant une formulation particulière, et comparée à celle de souches non traitées. Les disques ont été prélevés sur les souches 6 semaines après la coupe des arbres. Quarante espèces de bactéries furent identifiées sur les souches de pin rouge en utilisant l'analyse des acides gras du plasmalemme. Les espèces de *Pseudomonas* étaient les bactéries les plus communes. Les populations et la diversité des procaryotes sur les souches traitées étaient semblables à celles des témoins. Les souches traitées avec *P. gigantea* ont eu une influence sur les populations et sur la diversité des champignons. Les champignons les plus fréquemment isolés sur ces souches (?) furent *Hormonema dematoides* Lagerberg & Melin, *Alternaria alternata* (Fr.) Keissler, *Cladosporium cladosporoides* (Fres.) de Vries, *Mortierella isabellina* Oud. & Koning, *Bjerkandera adusta* (Willd.:Fr.) Karst., *Phacidiopycnis* sp., et *Penicillium* spp. Quatorze espèces fongiques n'ont été trouvées que sur les souches non traitées. Nous sommes à identifier les *Actinomycetes*.

Alien Threats to Canada's Forests: Developing a Global Inventory of Insects that Feed on Trees Native to Canada / Menaces posées par les espèces exotiques pour les forêts canadiennes : élaboration d'un inventaire mondial des insectes ravageurs des essences indigènes du Canada

Presented by / Présenté par :

R. Duncan, E. St. Louis and E. Allen

Natural Resources Canada, Canadian Forest Service - Pacific Forestry Centre, 506 West Burnside Road, Victoria, BC V8Z 1M5

Abstract

One approach in the development of effective early detection tools for forest alien invasive species is to identify organisms attacking Canadian tree species in other countries. This project will provide a synthesis of information (species, hosts, distribution, damage) on insects currently known to feed on trees of Canadian origin planted anywhere on the globe outside their native range.

Résumé

Une des approches utilisées pour élaborer des outils de détection précoce des espèces exotiques envahissantes consiste à identifier les organismes qui attaquent les essences indigènes du Canada dans d'autres pays. Ce projet fournira une synthèse des informations disponibles (espèce, hôtes, répartition, dégâts) sur les insectes qui attaquent nos essences indigènes dans d'autres pays.

The Effectiveness of One-Time Tree Injections with Imidacloprid for Control of Emerald Ash Borer (*Agrilus planipennis*) for Two Seasons / Efficacité sur deux ans d'injections uniques d'imidaclopride dans les arbres contre l'agrile du frêne (*Agrilus planipennis*)

Presented by / Présenté par :

B. Helson[1], D. Thompson[1], J. McFarlane[1], D. Chartrand[1], N. McKenzie[2], and G. Otis[2]

[1] Natural Resources Canada, Canadian Forest Service – Great Lakes Forestry Centre, 1219 Queen St. East, Sault Ste. Marie, ON P6A 2E5

[2] Environmental Biology, University of Guelph, Guelph, ON N1G 2W1

Abstract

Fifty residential green ash trees in Windsor, Ontario, ranging from 7 to 26 cm dbh, were injected with an experimental 5% formulation of imidacloprid (ITIS) with Systemic Tree Injection Tubes (STIT) at a dosage of 0.25 g /cm dbh on 25 June (early) or 17 September (late) 2003 to determine the effectiveness of this highly targeted approach for protecting trees and controlling emerald ash borer (EAB). In 2004 and 2005, adult emergence, exit holes on branches and trunks, and foliar crown density on injected trees were compared with similar untreated trees. Leaf samples were periodically collected for analysis of imidacloprid residues by HPLC during 2003 (first season) and 2004 (second season). Imidacloprid was rapidly taken up and effectively translocated in ash trees following injections of ITIS irrespective of tree size, site condition or injection timing. Foliar residues were detectable throughout the second season following either the June or September injections the previous year. Carry over of foliar residues in deciduous ash trees demonstrate dynamic cycling and sufficient persistence to expose EAB to toxicologically effective levels of imidacloprid for two seasons. These injections provided effective control of EAB larvae and protection of ash trees from damage for two seasons. No major differences in efficacy as measured by relative numbers of exit holes and crown densities occurred between 9 cm and 17 cm dbh trees, early and late injections or different sites. Trunk injection with imidacloprid is a highly targeted approach, which substantially reduces potential exposure to humans and non-target organisms and thus is the most acceptable approach for managing EAB from a human or environmental risk perspective.

Résumé

Nous avons utilisé des tubes d'injection systémique (STIT) pour injecter une formulation expérimentale d'imidaclopride (ITIS) à 5 % à raison de 0,25 g/cm de dhp dans 50 frênes verts présentant un dhp de 7 à 26 cm dans le but d'évaluer l'efficacité de cette approche hautement ciblée comme méthode de protection des arbres et de lutte contre l'agrile du frêne. Les injections ont été effectuées le 25 juin (hâtives) ou le 17 septembre 2003 (tardives), dans un quartier résidentiel de Windsor (Ontario). En 2004 et 2005, nous avons comparé le nombre d'adultes émergés et de trous de sortie sur les branches et les troncs et la densité du feuillage des cimes chez les arbres ayant reçu des injections et chez des sujets similaires non traités. En 2003 (première campagne) et 2004 (deuxième campagne), nous avons récolté régulièrement des échantillons de feuilles pour en déterminer les concentrations de résidus d'imidaclopride par CLHP. L'imidaclopride était rapidement absorbé et efficacement véhiculé par la sève des frênes à la suite des injections d'ITIS, peu importe les dimensions de l'arbre, les conditions du site ou le moment de l'injection. Des résidus foliaires ont été détectés durant toute la deuxième campagne à la suite des injections effectuées l'année précédente en juin ou en septembre. La rémanence des résidus foliaires chez les frênes met en évidence un cycle dynamique et une persistance suffisante pour exposer l'agrile du frêne à des concentrations toxiques efficaces d'imidaclopride pendant deux ans. Ces injections ont permis de réprimer efficacement les larves de l'agrile du frêne et de protéger les frênes contre les dommages causés par ce ravageur durant une période de deux ans. L'efficacité de la méthode a été évaluée en fonction de l'abondance relative des trous de sorties et de la densité de la cime. Aucune différence majeure n'a été relevée entre les arbres de 9 cm et de 17 cm de dhp, entre les périodes des injections (hâtives ou tardives) ou entre les sites. L'injection d'imidaclopride dans les troncs est une approche hautement ciblée qui réduit considérablement le risque d'exposition pour les humains et les organismes non ciblés. Elle constitue donc actuellement la méthode de lutte contre l'agrile du frêne la plus acceptable, tant d'un point sanitaire qu'environnemental.

Effectiveness of Azadirachtin as a Systemic Insecticide for the Management of Emerald Ash Borer (*Agrilus planipennis*) / Efficacité de l'azadirachtine utilisée comme insecticide systémique contre l'agrile du frêne (*Agrilus planipennis*)

Presented by / Présenté par :

Blair Helson[1], Dean Thompson[1], John McFarlane[1], Teresa Buscarini[1] and Joe Meating[2]

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[2] BioForest Technologies Inc., 105 Bruce St., Sault Ste. Marie, ON P6A 2X6

Abstract

The potential of azadirachtin as a systemic insecticide for emerald ash borer management was evaluated by determining: 1.uptake, translocation and persistence following trunk injections of ash trees; 2. efficacy on larvae in small and large injected trees as measured by changes in adult emergence and ash tree crown density; and 3. effects on adult mortality, female fecundity and fertility following ingestion of ash leaves containing azadirachtin. Azadirachtin was rapidly taken up and effectively translocated uniformily in different ash trees (mean dbh = 22 cm) following trunk injections with TreeAzin, a formulation of azadirachtin which is custom designed for tree injections with the EcoJect System. Treeazin at dosages of 0.1 and 0.25 g azadirachtin/cm dbh was highly efficacious in reducing adult emergence and protecting small ash trees (mean dbh = 8 cm) from crown damage related to larval girdling. TreeAzin also showed definite potential for EAB control in large trees (mean dbh = 37 cm). Following ingestion of leaves containing azadirachtin by emerald ash borer adults, survival and proportion of females laying eggs were not significantly affected. However fecundity and particularly fertility were significantly reduced, resulting in a 99% reduction in potential reproduction. Tree injections of TreeAzin with the EcoJect system is a very promising, highly targeted, safe, new management tool for Emerald Ash Borer.

Résumé

Pour déterminer le potentiel de l'azadirachtine utilisée comme insecticide systémique contre l'agrile du frêne, les paramètres suivants ont été évalués : 1) assimilation, translocation et rémanence après injection dans le tronc de frênes; 2) efficacité contre les larves dans des frênes de petites et grandes dimensions ayant reçu des injections, telle qu'évaluée d'après les taux d'émergence des adultes et la densité de la cime des arbres traités; 3) effets sur la mortalité des adultes et sur la fécondité et la fertilité des femelles ayant ingéré des feuilles de frêne contenant de l'azadirachtine. L'azadirachtine a été assimilée rapidement et véhiculée uniformément dans les différents frênes (dhp moyen de 22 cm) après injection de TreeAzin, formulation d'azadirachtine conçue spécialement pour administration à l'aide du système d'injection EcoJect. Aux doses de 0,1 et de 0,25 g d'azadirachtine/cm de dhp, le TreeAzin s'est révélé très efficace, réduisant les taux d'émergence des adultes et prévenant l'annélation de la cime des petits frênes (dhp moyen de 8 cm) par les larves. Le TreeAzin a également montré un potentiel certain contre le ravageur dans les arbres de grandes dimensions (dhp moyen de 37 cm). L'ingestion de feuilles contenant de l'azadirachtine n'a eu aucun effet significatif ni sur la survie des adultes ni sur la proportion des femelles qui ont pondu des œufs. En revanche, la fécondité et la fertilité des femelles ont diminué considérablement, la réduction du potentiel de reproduction atteignant 99 %. L'injection de TreeAzin dans les frênes avec le système EcoJect constitue un nouvel outil de lutte très prometteur, hautement ciblé et sécuritaire contre l'agrile du frêne.

Barcoding Rust Fungi: Could Mitochondrial Gene COI be the Key? / Le gène mitochondrial COI est-il un bon candidat pour la creation d'un code barre chez les rouilles?

Presented by / Présenté par :

M. Allaire, C. Morin, M.-J. Bergeron, and R.C. Hamelin

Natural Resources Canada, Canadian Forest Service – Laurentian Forestry Centre,

1055 du P.E.P.S., P.O. Box 10380, Stn. Sainte-Foy, Québec, QC G1V 4C7

Abstract

DNA barcoding is emerging as an extremely powerful tool that allows more precise taxonomic identification and diagnostic for groups as diverse as algae, animals, plants and fungi. This could be particularly useful for the economically important group of rust fungi which represents more than 7000 species worldwide and comprises important tree pathogens. A large-scale Canadian barcoding project proposes to use a 650 base pair- segment of the mitochondrial gene cytochrome oxidase I (*COI*) as a universal means for barcoding species. Although this gene has proven useful in studies of animals, there are serious problems in fungi, including the presence of introns in the targeted barcode region. For this reason, we have added a second component to the barcoding initiative, by using the well characterized ribosomal internal transcribed spacer (*ITS*) region. We obtained *ITS* sequences for 200 rust isolates from diverse geographic and host backgrounds and *COI* sequences from some rusts and basidiomycetes. Among the biological questions that we are addressing are host-specificity, co-evolution of rusts with their hosts, the presence of cryptic species and hybridization.

Résumé

Les codes barres d'ADN se révèlent être un puissant outil d'identification taxonomique et de diagnostique pour des espèces d'origines variées. Leur utilisation serait particulièrement utile pour les champignons de la famille des rouilles, un groupe d'importance économique qui comprend plus de 7000 espèces à travers le monde incluant de grands agents pathogènes forestiers. Un projet canadien d'envergure propose d'utiliser une portion de 650 paires de bases du gène mitochondrial de la cytochrome oxydase I (*COI*) comme base universelle pour

déterminer le code barre des espèces. L'utilité de ce gène est bien établie chez les animaux, mais dans le cas des champignons, plusieurs problèmes, comme la présence d'introns dans la zone ciblée, rendent sont utilisation difficile. Nous avons donc séquencé également la région ribosomale *ITS* (internal transcribed spacer), déjà très bien caractérisée chez les champignons. À ce jour, nous avons pu obtenir les séquences *ITS* d'environ 200 isolats provenant de différents hôtes et origines géographiques, qui s'ajoutent aux quelques séquences COI obtenues. Cette somme d'information nous permettra de répondre à différentes questions biologiques tel que la coévolution des rouilles avec leurs hôtes, la spécificité des hôtes, la présence d'espèces cryptiques et l'hybridation.

Taxonomy and Bioinformatics on the Front Line: Battling Alien Insects in Canadian Forests / Taxinomie et bioinformatique sur la ligne de front dans la lutte contre les espèces exotiques dans les forêts canadiennes

Presented by / Présenté par :

J.T. Huber[1], D. Langor[2] and B. McAfee[1]

[1] Natural Resources Canada, Canadian Forest Service, 580 Booth Street, Ottawa, ON K1A 0E4

[2] Natural Resources Canada, Canadian Forest Service - Northern Forestry Centre, 5320 - 122 Street, Edmonton, AB T6H 3S5

Abstract

Timely identifications of alien species permit effective management responses by allowing the scientific community rapidly to access existing information on them (Huber and Langor 2004). Species identification depends on availability of expert taxonomists, collections of authoritatively identified specimens, and specialized literature. Biological collections contain labelled specimens which objectively record the occurrence of species in space and time. Bioinformatics – mining existing specimen collections and taxonomic literature, will help make taxonomic information more widely and quickly accessible. Alien insects and fungi on Canadian trees, represented by about 35,000 specimens in the Canadian National Collection of Insects, Arachnids and Nematodes, and the six collections of the Canadian Forest Service, are being data based for a national project to develop an interconnected network of information on accurately identified and geo-referenced specimens. The information will be distributed through the Canadian Biodiversity Information Facility (http://www.cbif.ca).

Reference:

Huber, J.T. & Langor. D.W. 2004. Systematics: Its role in supporting sustainable forest management. The Forestry Chronicle 80(4): 451-457.

Résumé

L'identification rapide des espèces étrangères permet l'adoption de méthodes d'interventions appropriées en permettant à la communauté scientifique d'accéder rapidement à l'information existante sur ces organismes (Huber et Langor 2004). L'identification des espèces dépend de la

disponibilité des taxinomistes chevronnés, des collections de spécimens identifiés par des experts faisant autorité en la matière et d'une documentation spécialisée. Les collections biologiques contiennent des spécimens étiquetés qui enregistrent objectivement l'occurrence des espèces dans l'espace et le temps. La bioinformatique – la recherche parmi des collections existantes de spécimens ou de la littérature taxinomique afin d'en faire la digitalisation, contribuera à rendre l'information taxinomique largement et rapidement accessible. Les espèces exotiques d'insectes et de champignons sur les arbres des forêts canadiennes, représentées par environ 35 000 des 16 millions de spécimens dans la Collection nationale canadienne d'insectes, arachnides et nématodes et les six plus petites collections du Service canadien des forêts, seront intégrées dans une base de données. Cette initiative est réalisée dans le cadre d'un projet national visant à développer un réseau interconnecté de données sur les spécimens correctement identifiés et géoréférencés. La diffusion de l'information sera assurée par l'intermédiaire du Système canadien d'information sur la biodiversité (http://www.cbif.gc.ca).

Référence:

Huber, J.T. & Langor. D.W. 2004. Systematics: Its role in supporting sustainable forest management. The Forestry Chronicle 80(4): 451-457.

Towards a Canadian Invasive Plant Strategy / Vers une stratégie canadienne de lutte contre les plantes envahissantes

Presented by / Présenté par :

Cory Lindgren

Canadian Food Inspection Agency, Invasive Alien Species Section, 59 Camelot Drive, Ottawa, ON K1A OY9

Abstract

An invasive plant is a harmful organism whose introduction or spread threatens the environment, the economy, or society including human health. The number of new plant incursions and their impacts have increased each year accelerating in the last 30 years due to exponential increases in air travel, the increased speeds at which commodities and people traverse the globe, increased ports of entry, expanded exports and imports into new international markets, increased interest in the use of exotic plants in gardening and water gardening, and increased access to foreign ecosystems. It is estimated that invasive plants cost the Canadian economy millions of dollars annually. There is a need for a Canadian Invasive Plant Strategy that enhances collaboration among governments, economic sectors, stakeholders, and the international community. The CFIA will provide leadership and coordination throughout the overall development of the Strategy, partnering with other federal departments, provinces and territories, industry and Canadians concerned with invasive plants. A Canadian Invasive Plant Strategy will be consistent with the Invasive Alien Species Strategy for Canada, focusing on prevention, early detection, rapid response and management of invasive plants. The Strategy will provide a framework for a federal/provincial/territorial approach to reducing the threat of invasive alien plants to Canadian economic, environmental and social values.

Résumé

Une plante envahissante est un organisme nuisible dont l'introduction ou la propagation menacent l'environnement, l'économie ou la société, notamment la santé humaine. Le nombre d'entrées de nouvelles plantes au pays, et leurs effets néfastes, augmentent d'année en année, surtout depuis trente ans, en raison de l'augmentation exponentielle des voyages en avion, de la vitesse accrue à laquelle les produits et les gens parcourent le globe, du nombre accru des points d'entrée, des échanges commerciaux qui se multiplient avec de nouveaux marchés internationaux, de l'intérêt grandissant des amateurs de jardinage, terrestre ou aquatique, pour les plantes

exotiques, et de l'accès facilité aux écosystèmes étrangers. Il est estimé que les plantes envahissantes coûtent chaque année à l'économie canadienne des millions de dollars. Il est nécessaire d'élaborer une stratégie canadienne de lutte contre les plantes envahissantes pour favoriser la collaboration entre les gouvernements, les secteurs économiques, les intervenants et la communauté internationale. L'Agence canadienne d'inspection des aliments (ACIA) exercera un leadership et assurera la coordination durant l'élaboration globale de la stratégie, en collaboration avec d'autres ministères fédéraux, les provinces et les territoires, l'industrie et les Canadiens préoccupés par les plantes envahissantes. La stratégie canadienne de lutte contre les plantes envahissantes sera en phase avec la Stratégie nationale de lutte contre les espèces exotiques envahissantes, en mettant l'accent sur la prévention, la détection précoce, l'intervention rapide et la gestion des plantes envahissantes. La stratégie fournira un cadre fédéral-provincial-territorial qui permettra de réduire la menace que constituent les plantes exotiques envahissantes pour l'économie, l'environnement et la société au Canada.

Invasives At Your Fingertips / Les espèces envahissantes à portée de main

Presented by / Présenté par :

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Abstract

Forest stewardship for sustainability requires scientific information to assess past and project future impacts to forest ecosystems resulting from forest invasive alien species (FIAS). Primary information is required for analysis and synthesis, for rapid display and for policy assessment. We provide primary and synthesized information and tools for investigation and communication for several levels of inquiry from the long-term data legacy of forest survey and research in Canada. We are building a web-based database application composed of 3 sources of primary historical scientific data on invasive species: 1) voucher specimen labels, 2) survey collections, and 3) a searchable document library. System functionality will include capabilities for sorting, mapping, exporting and reporting. In addition, a multi-agency web-based portal is being developed for publishing and updating information on FIAS. It will include fact sheets, maps, management responses, economic and ecological analyses, as well as links to the FIAS database and other relevant information from domestic and international sources (advisories, surveys, published literature). This will be the primary entry point for the public to the CFS FIAS initiative and its outputs.

Résumé

Pour assurer la gérance et la durabilité des forêts, il faut disposer des données scientifiques nécessaires pour évaluer et prévoir les impacts futurs des espèces forestières exotiques envahissantes (EFEE) sur les écosystèmes forestiers. Il faut disposer de données primaires à des fins d'analyse et de synthèse, de divulgation rapide et d'évaluation stratégique. Nous puisons à même les données amassées au fil des ans dans le cadre de relevés et de projets de recherche sur les forêts du Canada pour fournir, en réponse à divers types de requêtes, des outils et des données primaires et de synthèse à des fins d'étude et de communication. Nous élaborons une base de données Web intégrant trois grandes sources de données scientifiques historiques sur les espèces envahissantes : 1) étiquettes des spécimens de référence; 2) collections constituées lors des relevés; 3) bibliothèque de documents interrogeables. Le système sera doté de fonctionnalités permettant le tri, la cartographie, l'exportation et l'établissement de rapports. De plus, nous élaborons actuellement un portail Web multi-agences pour diffuser et mettre à jour l'information sur les EFEE. Ce portail contiendra notamment des fiches de renseignements, des cartes, des informations sur les mesures de gestion prises, des analyses économiques et écologiques ainsi que des liens à la base de données sur les EFEE et d'autres renseignements pertinents provenant de sources nationales et internationales (avis, enquêtes, documents publiés). Il sera la principale porte d'accès du public à l'initiative concernant les EFEE du SCF et à ses résultats.

Sudden Oak Death: Risk and Diagnosis in Canada / L'encre des chênes rouges (sudden oak death) : risque et diagnostic au Canada

Presented by / Présenté par :

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Abstract

An updated version of the risk assessment of sudden oak death, caused by *Phytophthora ramorum* (*Pr*), was produced in 2006 on behalf of the Canadian Food Inspection Agency. This assessment indicates that the disease is a real threat to Canadian forests and urban trees, and consequently to the forest and horticultural industries. Based on numerous criteria, the overall risk was assessed as "high" for British Columbia and "medium" for the southern part of the eastern Canadian provinces. Research needs that could improve the accuracy of this assessment have also been identified, among which the study of the susceptibility of several tree species common in eastern Canadian forests. Thus, we have recently undertaken a study in a quarantine laboratory and preliminary results related to the capacity of *Pr* to infect and sporulate on seedlings of six tree species are presented. Furthermore, a real-time PCR method for detecting *Pr*

has been developed in a Canadian Forest Service laboratory. In a recent international validation contest, this method ranked among the most effective for detecting *Pr* and differentiating it from other genetically related species.

Résumé

Une mise à jour de l'évaluation du risque de l'encre des chênes rouges, causée par le *Phytophthora ramorum* (Pr), a été produite en 2006 pour le compte de l'Agence canadienne d'inspection des aliments. Cette évaluation indique que la maladie est une réelle menace pour les forêts et les arbres urbains au Canada et, par conséquent, pour les industries forestière et horticole. En se basant sur de nombreux critères, le risque global fut évalué comme étant « élevé » pour la Colombie-Britannique et « moyen » pour le sud des provinces de l'Est canadien. Des besoins de recherche furent aussi identifiés afin d'améliorer le niveau de confiance en cette évaluation, dont celui d'étudier la sensibilité de plusieurs espèces d'arbres communes dans les forêts de l'Est canadien. Nous avons récemment entrepris une étude en ce sens dans un laboratoire de confinement et les premiers résultats sont présentés concernant l'aptitude du Pr d'infecter et de sporuler sur des semis de six espèces forestières. Par ailleurs, une méthode de détection du Pr utilisant la PCR en temps réel a été développée dans un laboratoire du Service canadien des forêts. Cette méthode s'est classée parmi les plus efficaces pour détecter le Pr et le différencier des autres espèces qui lui sont apparentées génétiquement lors d'un récent concours international.

Insect Production Services Exhibit / Exposition des Services de production d'insectes

Abstract

The Canadian Forest Service (CFS) is a world leader in understanding forest insect outbreaks and in developing protection tools that are environmentally responsible. During the past four decades, laboratory-reared insects produced by the Insect Production Services (IPS) team at the Great Lakes Forestry Centre (GLFC) have facilitated research in both areas.

Our insectarium is the only facility in North America that rears multiple forest insect species and the only one in the world that mass-produces spruce budworm. The insects that we produce are in support of pest management and related research at GLFC, other CFS establishments, provincial/state agencies and numerous universities across Canada and the U.S. In addition, our insects are used for teaching purposes at a range of educational institutions and for public education at high-profile establishments.

As part of our recently inaugurated website (www.insect.glfc.cfs.nrcan.gc.ca), we have established a world-wide database of insect producers who are willing to sell or donate live insects. It is intended to provide researchers with a current source for accessing live insect cultures and to give producers the opportunity to expand their client base.

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Résumé

Le Service canadien des forêts (SCF) est reconnu comme un chef de file mondial de l'étude des infestations d'insectes forestiers et de l'élaboration d'outils de protection respectueux de l'environnement. Les insectes produits en laboratoire par l'équipe des Services de production d'insectes du Centre de foresterie des Grands Lacs (CFGL) facilitent la recherche dans ces deux domaines depuis quatre décennies.

Notre insectarium est le seul établissement en Amérique du Nord qui élève de nombreuses espèces d'insectes forestiers, et le seul au monde qui produit des quantités massives de tordeuse des bourgeons de l'épinette. Les insectes que nous produisons sont utilisés dans le cadre des projets en lutte antiparasitaire et dans d'autres domaines connexes menés par des chercheurs du CFGL, d'autres établissements du SCF, de divers organismes provinciaux ou d'État et de nombreuses universités du Canada et des États-Unis. Nos insectes sont également utilisés dans un grand nombre d'établissements d'enseignement ou d'organismes réputés spécialisés dans l'éducation du public.

Sur notre site Web (www.insect.glfc.cfs.nrcan.gc.ca), que nous venons d'inaugurer tout récemment, nous présentons une liste exhaustive des producteurs qui, à l'échelle mondiale, sont prêts à vendre ou à donner des insectes vivants. Les personnes qui souhaitent se procurer des insectes vivants y trouveront une liste des ressources disponibles, et les producteurs, une occasion d'élargir leur clientèle.

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Session XII: Sponsor's Showcase

Session XII / Séance XII

Chair: Guy Smith

Natural Resources Canada, Canadian Forest Service

Séance XII : Pleins feux sur les commanditaires

Président : Guy Smith

Ressources naturelles Canada, Service canadien des forêts

Session XIII: Globalization: International Update

Session XIII / Séance XIII

Chair: Marcel Dawson

Canadian Food Inspection Agency

Séance XIII : La mondialisation : Le point sur la situation internationale

Chair : Marcel Dawson

Agence canadienne d'inspection des aliments

International Forest Quarantine Initiatives 2006 / Initiatives internationales visant les ravageurs forestiers justiciables de quarantaine en 2006

Presented by / Présenté par :

Eric Allen

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Abstract

The major activities of three international forest quarantine groups are discussed. The IPPC Technical Panel on Forest Quarantine initiated a revision of ISPM 15; The International Forestry Quarantine Research Group evaluated possible new wood treatments for wood packaging and assessed the results of a surveys for pests associated with bark on treated wood packaging; and the IUFRO working group "Invasive alien species and international trade" had its inaugural meeting in Radom, Poland.

Résumé

Les principales activités de trois groupes internationaux de quarantaine des ravageurs forestiers sont passées en revue. Le Groupe technique sur les organismes de quarantaine forestiers a entrepris une révision de la NIMP n° 15. Le Groupe de recherche international sur les organismes de quarantaine forestiers a évalué de nouvelles options de traitement des matériaux d'emballage en bois et examiné les résultats d'un relevé des ravageurs associés à l'écorce des matériaux d'emballage en bois traité. Pour sa part, le nouveau groupe de travail sur les espèces exotiques envahissantes et le commerce international, mis sur pied par l'Union internationale des instituts de recherches forestières (IUFRO), a tenu sa première réunion à Radom, en Pologne.

International Forest Quarantine Initiatives

CFS Pest Forum Dec 7, 2006

With the expansion of global trade problems with invasive alien pests have also grown. In order to reduce the international movement of plant pests and protect valuable plant resources, national plant protection regulations and international standards continue to be developed. There is an increasing recognition that such regulations be "science-based" as identified in the World Trade Organization Sanitary and Phytosanitary Measures (WTO-SPS) agreement. This need is clearly recognized by the Commission on Phytosanitary Measures (CPM), the governing body of the International Plant Protection Convention (IPPC). Science is valuable to plant health regulators as it is a useful tool to identify and address plant pest problems, and is often used in "technical justification" required in domestic and international trade disputes.

Within the structure of the IPPC, a group known as the Standards Committee initiates new international plant protection standards, relying on expert working groups and technical panels to provide accurate scientific information as a basis for their development. Members of these groups are recognized global experts in science and plant health regulatory issues and work from within their national institutions (universities, government agencies, etc) for the benefit of the IPPC.

One of the IPPC panels, the Technical Panel on Forest Quarantine, has a specific mandate to address technical aspects of forest quarantine issues, review relevant technical and scientific information and to provide guidance to the Standards Committee as requested on development, amendment and revision of standards. The key accomplishments of this group in 2006 were: revision of the international wood packaging standard ISPM No. 15, evaluating pest risks associated with bark on treated wood packaging, identifying forest pests for consideration for development of harmonized international diagnostic protocols (by the IPPC – Technical Panel on Diagnostic Protocols), and collaboration with the Secretariat of the Montreal Protocol to discuss strategies for limiting the environmental impact of methyl bromide for wood packaging.

Another group, the International Forestry Quarantine Research Group (IFQRG) is an independent body formed in 2004 focusing on global forestry quarantine issues. This group of scientific specialists and plant health regulators produces issue-specific analyses and undertakes collaborative research in cooperation with the IPPC. In 2006 this group focused on analyzing of risks associated with bark on treated wood packaging and evaluation of new wood treatments (alternatives to heat treatment and methyl bromide fumigation) for potential inclusion in ISPM 15.

The International Union of Forest Research Organizations (IUFRO) has initiated a new working group, WG 7.03.13 – Alien Invasive Species and International Trade. This group held its inaugural meeting in Poland in July, 2006. The objectives of the working group are to:

- Share information and research results
- Develop data sharing agreements and contribute to global pest information systems
- Coordinate joint research and monitoring efforts
- Encourage improvement and extension of Pest Risk Analysis techniques
- Provide research support toward the development of mitigation strategies
- Act as an interface with other IUFRO Working Parties with particular interests in invasive species, e.g. population dynamics, bark beetles, etc.

A monograph of the proceedings of the meeting was published by the Polish Forest Research Institute, Warsaw.

SESSION XIV: CFIA REPORT

Session XIV / Séance XIV

Chair: Marcel Dawson

Canadian Food Inspection Agency

SÉANCE XIV : COMPTE RENDU DE L'ACIA

Président : Marcel Dawson

Agence canadienne d'inspection des aliments

ISPM15 Wood Packaging Standards / La NIMP n° 15, la norme sur les matériaux d'emballage en bois

Presented by / Présenté par :

Mélanie Mectau

Canadian Food Inspection Agency, 59 Camelot Drive, Ottawa, ON K1A 0Y9

This presentation is not available. / Cette presentation n'est pas disponible.

The Canadian Phytosanitary Certification Programs for Exported Wood Products / Les programmes canadiens de certification phytosanitaire des produits de bois destinés à l'exportation

Presented by / Présenté par :

Jean-Luc Poupart

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Abstract

The CFIA has introduced 2 certification programs for facilities wishing to produce wood packaging material in accordance with the provisions of the International Standard for Phytosanitary Measures (ISPM No. 15), entitled Guidelines for Regulating Wood Packaging in International Trade and for those facilities wishing to produce wood products to meet the phytosanitary heat treatment standard of 56 degrees C for 30 minutes.

The Canadian Wood Packaging Certification Program (CWPCP), Policy Directive D-01-05, was designed for wood packaging facilities with or without heat treating capabilities to produce ISPM no. 15 compliant wood packaging material.

The Canadian Heat Treated Wood Product Certification Program (CHTWPCP), Policy Directive D-03-02, was developed for other wood processing facilities with heat treating capabilities, brokers, pre-fabricated home manufacturers, and re-manufacturing facilities to produce wood products compliant to the phytosanitary heat treatment standard of 56 degrees C for 30, and are also eligible for use in the production of ISPM no. 15 compliant wood packaging material.

The two certification programs are based on a quality systems approach which involves an overall oversight by the CFIA, evaluation and verification audits by a third party service provider, and facility registration.

Résumé

L'ACIA a mis en œuvre deux programmes de certification pour les établissements qui souhaitent produire des matériaux d'emballage en bois conformément aux dispositions des Normes internationales pour les mesures phytosanitaires (NIMP n° 15), intitulées Directives pour la réglementation des matériaux d'emballage à base de bois dans le commerce international, de même que pour les établissements qui souhaitent produire des produits en bois conformément à l'exigence phytosanitaire prescrivant un traitement à la chaleur permettant d'atteindre une température interne minimale de 56 °C pendant au moins 30 minutes.

Le Programme canadien de certification des matériaux d'emballage en bois (PCCMEB), décrit dans la directive D-01-05, vise à permettre aux établissements qui produisent des matériaux d'emballage en bois et qui sont dotés ou non d'installations de traitement à la chaleur de produire des matériaux d'emballage en bois conformément à la NIMP n° 15.

Le Programme canadien de certification des produits de bois traités à la chaleur (PCCPBTC), objet de la directive D-03-02, a été élaboré à l'intention des établissements de transformation du bois dotés d'installations de traitement à la chaleur, des courtiers, des usines de production de maisons préfabriquées et des fabricants de produits en bois rescié. Il leur permet de produire des produits du bois conformes à la norme phytosanitaire, qui exige un traitement à la chaleur permettant d'atteindre une température interne minimale de 56 °C pendant au moins 30 minutes, ainsi que des matériaux d'emballage en bois conformes à la NIMP n° 15.

Les deux programmes de certification reposent sur des systèmes qualité qui comportent une supervision générale de l'ACIA, des audits d'évaluation et de vérification par un tiers fournisseur de services et l'enregistrement de l'établissement.

Update on Emerald Ash Borer, Brown Spruce Longhorn Beetle and Asian Longhorn Beetle / Le point sur la situation de l'agrile du frêne, du longicorne brun de l'épinette et du longicorne étoilé

Presented by / Présenté par :

Janet MacDonald

Canadian Food Inspection Agency, 59 Camelot Drive, Ottawa, ON K1A 0Y9

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Session XV: Globalization: Invasive Threats

Session XV / Séance XV

Chair: Marcel Dawson

Canadian Food Inspection Agency

Séance XV : La mondialisation – La menace des espèces envahissantes

Président : Marcel Dawson

Agence canadienne d'inspection des aliments

Ramorum Blight Update / Le point sur la situation de l'encre des chênes rouges

Presented by / Présenté par :

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Abstract

Phytophthora ramorum is a quarantine pest that was first regulated by Canada in 2001 when this newly described oomycete was reported to be causing a disease known as sudden oak death in coastal California. At that time, little was known of the biology and potential risks from this pathogen, so strict regulatory and eradication measures were put in place to control the nursery pathway, recognized as the principal means of possible spread. The host range has now expanded to over 68 genera, including many common nursery species. In nurseries, the disease is best described by the common name *ramorum* blight and typically causes foliar blights and leaf spots. It is considered a minor production problem readily controlled with fungicides. Since 2003, monitoring of imports has resulted in a few detections at nurseries and landscape sites in coastal south-west British Columbia. Because of the 90 day movement restrictions and consequent extensive plant destruction to achieve eradication, these measures have been very costly to the nursery industry. No spread beyond these sites has been detected. Survey data for 2006 will be presented and policy options discussed.

Résumé

Le *Phytophthora ramorum* est un phytoravageur justiciable de quarantaine qui a été réglementé pour la première fois par le Canada en 2001, lorsque cet oomycète récemment décrit a été identifié comme l'agent d'une maladie appelée encre des chênes rouges sur la côte californienne. À cette époque, les connaissances sur la biologie et les risques potentiels de ce pathogène étaient très sommaires, et des mesures de réglementation et d'éradication strictes ont été prises pour réglementer les pépinières, reconnues comme principale voie de dissémination possible. La liste des plantes hôtes connues inclut maintenant plus de 68 genres, y compris de nombreuses espèces courantes produites en pépinière. Dans les pépinières, la maladie provoque généralement un dépérissement du feuillage et des taches foliaires. Elle est considérée comme un problème de production mineur facile à régler à l'aide de fongicides. Depuis 2003, la surveillance des importations a permis de détecter quelque cas de la maladie dans des pépinières et des sites d'aménagement paysager du sud-ouest de la côte de la Colombie-Britannique. L'interdiction de déplacer du matériel potentiellement infesté durant une période de 90 jours et la destruction massive de végétaux qui a dû être effectuée pour éliminer totalement le phytoravageur ont coûté très cher aux pépinières. Aucune propagation de la maladie n'a été signalée hors de ces endroits. Les données des enquêtes de 2006 seront présentées, et les options stratégiques envisageables seront passées en revue.

Update on the European Wood Wasp (*Sirex noctilio*) in Canada / La guêpe perce-bois (*Sirex noctilio*) au Canada – État de la situation

Presented by / Présenté par :

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Abstract

The European woodwasp (*Sirex noctilio* Fabricus) is an introduced wood boring woodwasp, which is native to Europe, Asia and North Africa. It is primarily a pest of pine trees, and was first confirmed in Ontario in the fall of 2005.

Soon after the initial detections, survey planning was underway to fully detect and delimit populations of *S. noctilio* in Ontario and Quebec. Smaller survey efforts were also initiated in Nova Scotia and New Brunswick in 2006.

2006 survey results identified at least 36 locations in Ontario where *S. noctilio* adults were trapped. There were no confirmations of *S. noctilio* in Quebec, Nova Scotia and New Brunswick.

A *Sirex noctilio* stakeholder meeting was held in Ottawa in September 2006. Stakeholders representing the forest products industries, Christmas tree and nursery industries, woodlot members and other federal and provincial departments participated at the meeting. Leading scientists from Canada and the United States presented the latest research and information on this insect.

Research needs have been identified, and research has begun in the areas of community ecology (understanding tree/site characteristics of infested stands, the competitive nature of *S. noctilio* with native bark beetles and other siricids), improving detection methodologies, determining the presence of biological control agents (*B. siricidicola*) and the development of spread models.

A cost benefit assessment is also being conducted to determine the most effective means of regulating the movement of high risk pine commodities.

Résumé

La guêpe perce-bois (*Sirex noctilio* Fabricius) est un insecte xylophage introduit originaire d'Europe, d'Asie et d'Afrique du Nord. Il attaque principalement le pin, et sa présence en Ontario a été confirmée pour la première fois au cours de l'automne 2005.

Peu après les détections initiales, la planification de relevés permettant de détecter et de délimiter toutes les populations du ravageur en Ontario et au Québec a été entreprise. Des relevés de moindre envergure ont également été menés à bien en Nouvelle-Écosse et au Nouveau-Brunswick en 2006.

Dans le cadre de la campagne de piégeage menée en 2006, des *S. noctilio* adultes ont été capturés à au moins 36 endroits distincts en Ontario. La présence du ravageur n'a cependant été confirmée ni au Québec, ni en Nouvelle-Écosse ni au Nouveau-Brunswick.

Une rencontre d'intervenants préoccupés par le *Sirex noctilio* a eu lieu à Ottawa en septembre 2006. Y ont assisté des représentants du secteur des produits forestiers, de producteurs d'arbres de Noël et de propriétaires de pépinières et de boisés, ainsi que des représentants d'autres ministères fédéraux et provinciaux. Des experts scientifiques du Canada et des États-Unis ont présenté les résultats de recherche et les renseignements les plus récents sur le ravageur.

Les besoins en matière de recherche ont été déterminés, et des recherches ont été entreprises dans les domaines suivants : écologie des communautés (détermination des caractéristiques des arbres et des sites dans les peuplements infestés, nature de la compétition opposant le *S. noctilio* aux espèces de scolytes indigènes et aux autres Siricides), amélioration des méthodes de détection, détermination de la présence d'agents de lutte biologique (*B. siricidicola*) et élaboration de modèles de dissémination.

Une évaluation coûts-avantages a également été entreprise pour déterminer la stratégie la plus efficace pour réglementer le déplacement de produits de pin à haut risque.

Update on the European wood wasp (*Sirex noctilio*) in Canada

The European woodwasp (*Sirex noctilio* Fabricus) is an introduced wood boring woodwasp, which is native to Europe, Asia and North Africa. It is primarily a pest of pine trees, and was first confirmed in Ontario in the fall of 2005. Soon after the initial detections, survey planning was underway to fully detect and delimit populations of *S. noctilio* in Ontario and Quebec.

In 2006, surveys for the provinces of Ontario and Quebec were contracted out to the Ontario Ministry of Natural Resources (OMNR) and the Ministère des Ressources Naturelles et de la Faune et des Parcs du Québec (MRNQ). Smaller, survey efforts were also initiated in Nova

Scotia and New Brunswick by the Canadian Food Inspection Agency (CFIA). The survey protocol was collaboratively developed by the Canadian Forest Service, the CFIA, and the provincial ministries of Ontario and Quebec.

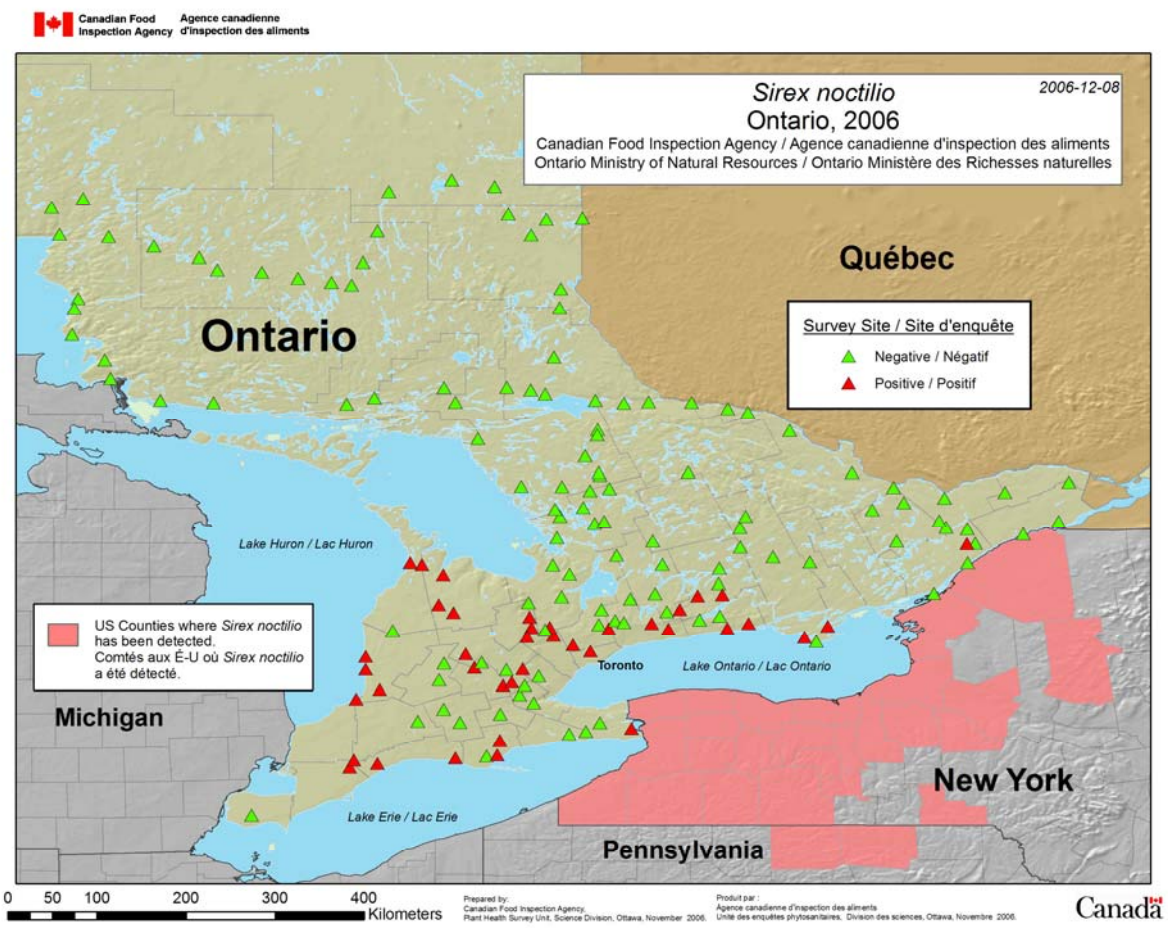
Intercept panel traps and 12-unit Lindgren funnel traps were deployed at each survey location. Each trap was baited with a 70/30 alpha beta pinene lure. Sites targeted for this survey included unmanaged or overstocked pine stands with a low to mild level of decline or mortality. Sites near mills that import round pine from New York State were also targeted. All traps were deployed in late June to early July. There were approximately 150 survey locations in Ontario and Quebec. Survey traps were deployed in 10 locations in each of New Brunswick and Nova Scotia.

2006 survey results identified 38 locations in Ontario where *S. noctilio* adults were trapped. There were no confirmations of *S. noctilio* in Quebec, Nova Scotia and New Brunswick The map showing the locations where *S. noctilio* adults were trapped in 2006 is being provided for reference.

The USDA continued to survey for *S. noctilio* in 2006. Final results indicate that there are 25 counties in New York State and two counties in Pennsylvania where *S. noctilio* adults have been trapped.

Research needs have been identified, and research has begun in the areas of community ecology (understanding tree/site characteristics of infested stands, the competitive nature of *S. noctilio* with native bark beetles and other siricids), improving detection methodologies, determining the presence of biological control agents (*B. siricidicola*) and the development of spread models.

A *Sirex noctilio* stakeholder meeting was held in Ottawa in September 2006. Stakeholders representing the forest products industries, Christmas tree and nursery industries, woodlot members and other federal and provincial departments participated at the meeting. Leading scientists from Canada and the United States presented the latest research and information on this insect. The primary focus of this meeting was to educate the participants about *S. noctilio*. A break out session to discuss regulatory options and management and control options was also part of the agenda. Recommendations from these discussions included a cost benefit assessment to determine the most effective means of regulating the movement of high risk pine commodities, a cost benefit assessment for the implementation of a biological control program, a pine inventory pathway study, continued research to address significant gaps and continued outreach.


Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments
Sirex noctilio
Ontario, 2006
2006-12-08
Canadian Food Inspection Agency / Agence canadienne d'inspection des aliments
Ontario Ministry of Natural Resources / Ontario Ministère des Richesses naturelles
Québec
Ontario
Survey Site / Site d'enquête
Negative / Négatif
Positive / Positif
Lake Huron / Lac Huron
US Counties where Sirex noctilio has been detected.
Comtés aux É-U où Sirex noctilio a été détecté.
Toronto
Lake Ontario / Lac Ontario
Michigan
New York
Lake Erie / Lac Erie
Pennsylvania
0 50 100 200 300 400 Kilometers
Prepared by:
Canadian Food Inspection Agency,
Plant Health Survey Unit, Science Division, Ottawa, November 2006.
Produit par :
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Unité des enquêtes phytosanitaires, Division des sciences, Ottawa, Novembre 2006.
Canada