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Proceedings of the / Compte rendu du

Forest Pest Management FORUM 2005 sur la répression des ravageurs forestiers

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December **6-7-8** décembre
2005

Ottawa Congress Centre / Centre des congrès d'Ottawa

55 Colonel By Drive / 55, promenade du Colonel By
Ottawa, Ontario, Canada

Natural Resources Canada   Ressources naturelles Canada

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Forest Pest Management Forum (2005 : Ottawa, Ont.)
Proceedings of the Forest Pest Management Forum 2005 [electronic resource] = Compte rendu du Forum sur la répression des ravageurs forestiers 2005.

Electronic monograph in PDF format.
Mode of access: World Wide Web.
Text in English and French.
ISBN 0-662-49318-4

1. **Trees--Diseases and pests--Control--Canada--Congresses.**
2. **Forest insects--Control--Canada--Congresses.**
3. **Insect pests--Control--Canada--Congresses.**
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5. **Forest management--Canada--Congresses.**

I. **Great Lakes Forestry Centre.**
II. **Title.**
III. **Title: Compte rendu du Forum sur la répression des ravageurs forestiers 2005.**

SB764.C3F66 2006 634.9'670971 C2006-980163-0E

CATALOGAGE AVANT PUBLICATION DE BIBLIOTHÈQUE ET ARCHIVES CANADA

Forest Pest Management Forum (2005 : Ottawa, Ont.)
Proceedings of the Forest Pest Management Forum 2005 [ressource électronique] = Compte rendu du Forum sur la répression des ravageurs forestiers 2005.

Monographie électronique en version PDF.
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II. **Titre.**
III. **Titre: Compte rendu du Forum sur la répression des ravageurs forestiers 2005.**

SB764C3F66 2006 634.9'670971 C2006-980163-0F

Catalog Number Fo121-1/2005-PDF
ISBN 0-662-49318-4
ISSN 1911-0855

Numéro de catalogue Fo121-1/2005-PDF
ISBN 0-662-49318-4
ISSN 1911-0855

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Ottawa, ON
December 6-7-8, 2005 / 6-7-8 décembre 2005

The Forest Pest Management Forum is sponsored annually by Natural Resources Canada, Canadian Forest Service, to provide a platform for representatives of various provincial governments and the federal government to present, review and discuss current forest pest conditions in Canada and the United States.

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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Acknowledgements / Remerciements

The 2005 Forest Pest Management Forum was a resounding success once again thanks to the contribution of many people. First of all, we wish to thank the presenters, who shared their knowledge of the issues discussed and who also provided summaries for these proceedings.

We are also grateful to all those who participated in *Science and technology à la carte* and the *Forum 2005 Special Feature*. Our Thanks go also to the logistical support team.

Last but not least, we wish to thank all the participants, who came from many different regions of Canada and the United States.

The 2005 Forum Organizing Committee

Le Forum 2005 sur la répression des ravageurs forestiers a connu encore un grand succès grâce à la contribution de plusieurs personnes. Nous remercions tout d'abord nos conférenciers qui ont fait état de leurs connaissances sur la question discutée et qui ont bien voulu les résumer pour les besoins du présent recueil.

Nous aimerions aussi témoigner notre reconnaissance aux personnes qui ont participé à *Sciences et technologie à la carte* et à *l'Événement spécial du Forum 2005* et au soutien technique.

Nos remerciements vont également aux participants et aux participantes qui provenaient de différentes régions du Canada et des États-Unis.

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FOREST PEST MANAGEMENT FORUM 2005

December 6 – 8, 2005
Ottawa Congress Centre, 55 Colonel By Drive, Ottawa, Ontario

TUESDAY DECEMBER 6, 2005

08:00 **Registration** — Foyer/ Capital Hall 3B-4B

08:30 **Welcoming Remarks** — Capital Hall 3B-4B
Richard Fadden, Deputy Minister, Natural Resources Canada

Chair: *Gordon Miller, Natural Resources Canada, Canadian Forest Service*

08:45 **Federal Perspective on International Trade and Forest Pests**
Jim Farrell, Natural Resources Canada, Canadian Forest Service

Session I: Western Pest Management Issues

Western Canada Round-up

09:15 British Columbia Report
Tim Ebata, British Columbia Ministry of Forests and Range

09:35 Alberta Report
Hideji Ono, Alberta Environment, Lands and Forest Division

09:55 Saskatchewan Report
Rory McIntosh, Saskatchewan Environment, Forest Services Branch

10:15 **Break** — Foyer/ Capital Hall 1B-2B

10:45 Manitoba Report
Irene Pines, Manitoba Conservation, Forestry Branch

Economics of the Mountain Pine Beetle – *moderator: Tim Ebata* — Capital Hall 3B-4B

11:05 Economics of the outbreak
Bill Wilson, Natural Resources Canada, Canadian Forest Service

11:35 Economic impacts of the mountain pine beetle: wood and pulp quality
Tim Ebata, British Columbia Ministry of Forests

12:00	**Lunch**	Foyer/ Capital Hall 1B-2B

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

Impacts of Dwarf Mistletoe

13:00 Biology and impact of the lodgepole pine dwarf mistletoe on pine in the Prairie Provinces — Capital Hall 3B-4B
James Brandt, Natural Resources Canada, Canadian Forest Service

Session II: North of 60

13:30 NWT Report

13:45 Spruce beetle outbreak in Alaska – Past, present and future management implications
Roger Burnside, State of Alaska, Department of Natural Resources

Session III: Globalization – International Update

14:15 International Union of Forest Research Organizations (IUFRO) update
Eric Allen, Natural Resources Canada, Canadian Forest Service

Session IV: National Parks Perspective

14:30 Severe defoliation of eastern hemlock (*Tsuga canadensis*) at Kejimkujik National Park and National Historic Site of Canada by the pale-winged gray moth *(Iridopsis ephyraria* Wlk)
Blair Pardy, Parks Canada
Presented by Walter Fanning, Nova Scotia Department of Natural Resources

15:00	**Break**	Foyer/ Capital Hall 1B-2B

Session V: Globalization – Invasive Threats — Capital Hall 3B-4B

15:30 Sudden oak death: Not always sudden, not always oak, and not always death
Michael Celetti, Ontario Ministry of Agriculture, Food and Rural Affairs

15:50 *Phytophthora ramorum*: Main issues from the 2005 Canadian risk assessment
Danny Rioux, Natural Resources Canada, Canadian Forest Service

16:15 Sirex woodwasp is established in North America … Now what?
Dennis Haugen, United States Department of Agriculture – Forest Service

17:30 Pest Forum Steering Committee meeting

WEDNESDAY DECEMBER 7, 2005

08:00	**Registration**	Foyer/ Capital Hall 3B-4B

Session VI: Cross-Country Checkup – Ontario and Quebec — Capital Hall 3B-4B

08:30 Ontario Report - Status of important forest pests in Ontario – 2005
Anthony Hopkin, Natural Resources Canada, Canadian Forest Service

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

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

09:10 Session Briefing
J. Edward Hurley, Natural Resources Canada, Canadian Forest Service

09:15 Poplar productivity perils
Dr. Jan Volney, Natural Resources Canada, Canadian Forest Service

09:45 Pest surveys in managed renewed forests of Manitoba
Irene Pines, Manitoba Conservation, Forestry Branch

10:05 **Break** — Foyer/ Capital Hall 1B-2B

10:35 Pests in forest plantations: lessons and challenges — Capital Hall 3B-4B
Louis Morneau, Ministère des Ressources naturelles et de la Faune

Session VIII: Cross-Country Checkup – Atlantic Canada

11:00 New Brunswick Report
Nelson Carter, New Brunswick Department of Natural Resources

11:20 Nova Scotia Report
Walter Fanning, Nova Scotia Department of Natural Resources

11:40 Newfoundland Report
Hubert Crummey, Newfoundland Department of Natural Resources

12:00	**Lunch**	Foyer/ Capital Hall 1B-2B

Chair: *Greg Stubbings, Canadian Food Inspection Agency, Plant Products Directorate*

Session IX: Regulatory Affairs — Capital Hall 3B-4B

Pesticide Regulations, Alternatives, Minor Use

13:00 Introduction
Michael Irvine, Ontario Ministry of Natural Resources

13:05 PMRA: Going forward with a strategic agenda
Karen Dodds, Pest Management Regulatory Agency

13:35 PMRA Update: The 3 Rs: re-evaluation, registrations and research permits
Terry Caunter, Pest Management Regulatory Agency

CFIA Update – *moderator: Marcel Dawson*

13:55 Introduction
Marcel Dawson, Canadian Food Inspection Agency

14:00 Update on *Sirex noctilio* in the US, and Canada's policy
Loretta Shields, Canadian Food Inspection Agency

14:20 Information on the hemlock woolly adelgid and the CFIA's policy proposal
Kevin Inouye, Canadian Food Inspection Agency

14:40 Canada's adoption of ISPM 15 for wood packaging materials
Trevor Yu, Canadian Food Inspection Agency

14:55	**Break**	Foyer/ Capital Hall 1B-2B

Session X: Molecular Diagnostics – Potential Applications and Issues — Capital Hall 3B-4B

15:25 Molecular diagnostic: From Pasteur to PCR
Richard Hamelin, Natural Resources Canada, Canadian Forest Service

15:40 The need for validation of molecular assays
Marie-Josée Côté, Canadian Food Inspection Agency

15:55 Designing a reliable molecular assay
Kurt Zeller, United States Department of Agriculture – Animal and Plant Health Inspection Service

16:15 From biological collections to the monitoring of life forms
André Lévesque, Agriculture and Agri-Food Canada

Session XI: Globalization – United States Report — Capital Hall 3B-4B

16:35 Overview of forest pests in the US and the Forest Health Technology Enterprise Team
Marla Downing, United States Department of Agriculture – Forest Service

SCIENCE AND TECHNOLOGY À LA CARTE — Capital Hall 1B-2B

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

17:15 – 21:30 Cash bar and roving buffet dinner; government, commercial, corporate exhibitors; science-knowledge exchange and informal poster session

THURSDAY DECEMBER 8, 2005

FORUM 2005 SPECIAL FEATURE
SCIENCE FOR ENHANCED PEST MANAGEMENT IN CANADA

08:00 **Registration** Foyer/ Capital Hall 3B-4B

Morning Session — Capital Hall 3B-4B

Chair: Anne Bordé, *Natural Resources Canada, Canadian Forest Service*

08:30 Welcoming Remarks – *Geoff Munro*
Natural Resources Canada, Canadian Forest Service

08:45 A research future for Canada: Report from the November 2004 Pest Management Methods Science and Technology Workshop
Guy Smith[1]

09:00 Development of molecular tools for monitoring spruce budworm health
Speaker: *Kees van Frankenhuyzen*[1]
Collaborators: *Kees van Frankenhuyzen*[1]*, Richard Hamelin*[2] *and George Kyei-Poku*[1]

09:20 Detection of cereulide, the emetic toxin in a commercial *Bacillus thuringiensis*-based product - A tale of caution
Speaker: *Kees van Frankenhuyzen*[1]*,*
Collaborators: *George Kyei-Poku*[1]*, Kees van Frankenhuyzen*[1] *and Debbie Gauthier*[1]

09:40 Advanced methods for monitoring the impacts of pest control products on key microbial communities of forest soils
Speaker: *Richard Winder*[4]
Collaborators: *Richard Winder*[4] *and Phyllis Dale*[4]

10:00 **Break** Foyer/ Capital Hall 1B-2B

10:30 Development and validation of SprayAdvisor DSS for aerial herbicide applications in Canada — Capital Hall 3B-4B
Speaker: *Dean Thompson*[1]
Collaborators: *Dean Thompson*[1]

10:50 Introduction to ECOBIOM – Biological control against forest pests (insects and pathogenic microorganisms) in Canada
Speaker: *Robert Lavallée*[2]
Collaborators: *ECOBIOM Team*

11:00 Field efficacy of *Beauveria bassiana-treated* polyester tree bands for trapping and infecting the brown spruce longhorn beetle in Nova Scotia
Speaker: *Jon Sweeney*[3]
Collaborators: *Jon Sweeney*[3] *and Graham Thurston*[3]*, D. Boyle*[2] *and J. Price*[5]

11:20 The use of *Beauveria bassiana* as a potential control method against the white pine weevil (*Pissodes strobi*) and the pine shoot beetle (*Tomicus piniperda*)
Speaker: *Richard Trudel*[6]
Collaborators: *Robert Lavallée*[2]*, Richard Trudel*[6]*, Claude Guertin*[6]*, Chantal Côté*[2]*, Pierre Desrochers*[2] *and Peter de Groot*[1]

11:40 A biological control option for white pine weevil (*Pissodes strobi*) in British Columbia
Speaker: *Harry Kope*[4]
Collaborators: *Harry Kope*[4]*, René Alfaro*[4] *Isabel Leal*[4]*, Robert Lavallée*[2]*, Richard Trudel*[6]*,Claude Guertin*[6]*, Chantal Côté*[2]*, Pierre Desrochers*[2] *Peter de Groot*[1]*, Jon Sweeney*[3] *and Graham Thurston*[3]

12:00 Conclusion of late morning session
Speaker: *Robert Lavallée*[2]
Collaborators: *ECOBIOM Team*

12:05 **Lunch** Foyer/ Capital Hall 1B-2B

Afternoon Session

Capital Hall 3B-4B

Chair: To be determined

13:00 Environmental fate and ecological impacts of systemic insecticides for the control of exotic wood boring insect pests
Speaker: *Dave Kreutzweiser*[1]
Collaborators: *Dave Kreutzweiser*[1]*, Dean Thompson*[1]*, Blair Helson*[1]*, Steve Holmes*[1] *and Taylor Scarr*[7]

13:20 Effect of *Phlebiopsis gigantea* treatment on the microbial diversity of red pine stumps
Speaker: *Mike Dumas*[1]
Collaborators: *Gaston Laflamme*[2]*, Mike Dumas*[1]*, N.W Boyonoski*[1]*, M. Blais*[2] *and C. Côté*[2]

13:40 ARSENAL™ (imazapyr) herbicide for forest vegetation management
Speaker: *Michael Irvine*[7]
Collaborators: *Len Lanteigne*[3]*, Doug Pitt*[1]*, Milo Mihajlovich*[8] *and Michael Irvine*[7]

13:50 Pheromone formulations for use in early intervention pest management strategies of the spruce budworm
Speaker: *Ed Kettela*[3]
Collaborators: *Ed Kettela*[3]*, Peter Silk*[9] *and David C. Davies*[10]

14:10 Open Discussion

14:30 Closing Remarks

1. *Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre*
2. *Natural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre*
3. *Natural Resources Canada, Canadian Forest Service, Atlantic Forestry Centre*
4. *Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre*
5. *Maritime Microbiologicals, Fredericton, New Brunswick*
6. *Institut National de la recherche Scientifique, Institut Armand-Frappier, Laval, Québec*
7. *Ontario Ministry of Natural Resources, Sault Ste. Marie, Ontario*
8. *Incremental Forest Technologies Limited, Edmonton, Alberta*
9. *Silk Biochemical Services, Fredericton, New Brunswick*
10. *Forest Protection Limited, Fredericton, New Brunswick*

Thank you for attending the 2005 Forest Pest Management Forum
See you next year!

FORUM 2005 SUR LA RÉPRESSION DES RAVAGEURS FORESTIERS

Du 6 au 8 décembre 2005
Centre des congrès d'Ottawa, 55, promenade Colonel-By, Ottawa (Ontario)

LE MARDI 6 DÉCEMBRE 2005

08:00 **Inscription** — Foyer/ Salle de la Capitale 1B-2B

08:30 Mot de bienvenue — Salle de la Capitale 3B-4B
Richard Fadden, Sous-ministre, Ressources naturelles Canada

Président : *Gordon Miller, Ressources naturelles Canada, Service canadien des forêts*

08:45 Point de vue du fédéral sur le commerce international et les ravageurs forestiers
Jim Farrell, Ressources naturelles Canada, Service canadien des forêts

Séance I : La répression des ravageurs dans l'Ouest

Tour d'horizon de l'Ouest canadien

09:15 Rapport de la Colombie-Britannique
Tim Ebata, Ministère des Forêts et des Parcours de la Colombie-Britannique

09:35 Rapport de l'Alberta
Hideji Ono, Ministère de l'Environnement de l'Alberta, Division des terres et forêts

09:55 Rapport de la Saskatchewan
Rory McIntosh, Ministère de l'Environnement de la Saskatchewan, Direction des services forestiers

10:15 **Pause** — Foyer/ Salle de la Capitale 1B-2B

10:45 Rapport du Manitoba
Irene Pines, Conservation Manitoba, Direction des forêts

Économie et dendroctone du pin ponderosa – *président : Tim Ebata*

Salle de la Capitale 3B-4B

11:05 Aspects économiques de l'infestation
Bill Wilson, Ressources naturelles Canada, Service canadien des forêts

11:35 Impacts économiques du dendroctone du pin ponderosa : qualité du bois et de la pâte
Tim Ebata, Ministère des Forêts et des Parcours de la Colombie-Britannique

12 h **Déjeuner** Foyer/ Salle de la Capitale 1B-2B

Président : *Pardeep Ahluwalia, Ressources naturelles Canada, Service canadien des forêts*

Impacts du faux-gui Salle de la Capitale 3B-4B

13:00 Biologie et impact du faux-gui du pin tordu sur les pins des Prairies
James Brandt, Ressources naturelles Canada, Service canadien des forêts

Séance II : Au nord du 60e parallèle

13:30 Rapports des Territoires du Nord-Ouest
James Brandt, Ressources naturelles Canada, Service canadien des forêts

13:45 Épidémie du dendroctone de l'épinette en Alaska – Les implications d'aménagement passées, présentes et futures
Roger Burnside, State of Alaska, Department of Natural Resources

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

14:15 Nouvelles de l'Union internationale des instituts de recherches forestières (IUFRO)
Eric Allen, Ressources naturelles Canada, Service canadien des forêts

Séance IV : Regard sur les parcs nationaux

14:30 Les pruches du Canada (*Tsuga canadensis*) du parc national et lieu historique national du Canada Kejimkujik gravement défoliées par l'arpenteuse à taches (*Iridopsis ephyraria* Wlk)
Blair Pardy, Parcs Canada
Présenté par Walter Fanning, Nouvelle-Écosse
Département des Ressources naturelles

15:00 **Pause** Foyer/ Salle de la Capitale 1B-2B

Séance V : La mondialisation – La menace des espèces envahissantes

Salle de la Capitale 3B-4B

15:30 L'encre des chênes rouges: une maladie pas toujours fulgurante ni mortelle qui ne s'attaque pas qu'aux chênes
Michael Celetti, Ministère de l'Agriculture, de l'Alimentation et des Affaires rurales de l'Ontario

15:50 *Phytophthora ramorum*: principaux resultants de l'analyse du risque canadienne de 2005
Danny Rioux, Ressources naturelles Canada, Service canadien des forêts

16:10 La guêpe perce-bois est établie en Amérique du Nord – Et maintenant?
Dennis Haugen, United States Department of Agriculture, Forest Service

17:30 Comité directeur du Forum sur les ravageurs

LE MERCREDI 7 DÉCEMBRE 2005

08:00 **Inscription** Foyer/ Salle de la Capitale 3B-4B

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

Salle de la Capitale 3B-4B

08:30 Rapport de l'Ontario - Insectes et maladies des arbres d'importance en Ontario en 2005
Anthony Hopkin, Ressources naturelles Canada, Service canadien des forêts

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

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

09:10 Information sur la séance
J. Edward Hurley, Ressources naturelles Canada, Service canadien des forêts

09:15 La productivité du peuplier et ses risques
Dr. Jan Volney, Ressources naturelles Canada, Service canadien des forêts

09:45 Études des parasites dans des renouvellements forestiers gérés du Manitoba
Irene Pines, Conservation Manitoba, Direction des forêts

10:05 **Pause** Foyer/ Salle de la Capitale 1B-2B

10:35 Les ravageurs des plantations forestières : leçons du passé, défis du futur
Louis Morneau, Ministère des Ressources naturelles et de la Faune du Québec

Salle de la Capitale 3B-4B

Séance VIII : Tour d'horizon – Le Canada atlantique

11:00 Rapport du Nouveau-Brunswick
Nelson Carter, Ministère des Richesses naturelles du Nouveau-Brunswick

11:20 Rapport de la Nouvelle-Écosse
Walter Fanning, Ministère des Richesses naturelles de la Nouvelle-Écosse

11:40 Rapport de Terre-Neuve
Hubert Crummey, Ministère des Richesses naturelles de Terre-Neuve

12:00 **Déjeuner** Foyer/
Salle de la Capitale 1B-2B

Président : *Greg Stubbings, Agence canadienne d'inspection des aliments, Direction générale des produits végétaux*

Séance IX : La réglementation

Salle de la Capitale 3B-4B

Réglementation des pesticides, produits de remplacement, usages mineurs

13:00 Introduction
Michael Irvine, Ministère des Richesses naturelles de l'Ontario

13:05 ARLA : Aller de l'avant avec un plan stratégique
Karen Dodds, Agence de réglementation de la lutte antiparasitaire

13:35 Des nouvelles de l'ARLA et de trois de ses secteurs d'activités : réévaluation, homologations et permis de recherche
Terry Caunter, Agence de réglementation de la lutte antiparasitaire

Compte rendu de l'ACIA

13:55 Introduction
Marcel Dawson, Agence canadienne d'inspection des aliments

14:00 Présence du Sirex noctilio aux États-Unis : état de la situation et politique du Canada à l'égard du ravageur
Loretta Shields, Agence canadienne d'inspection des aliments

14:20 Information sur le puceron lanigère de la pruche (*Adelges tsugae* Annand) et sur le projet de directive de l'ACIA
Kevin Inouye, Agence canadienne d'inspection des aliments

14:40 Adoption par le Canada de la NIMP n^{o} 15 sur les matériaux d'emballage en bois
Trevor Yu, Agence canadienne d'inspection des aliments

14:55 **Pause** Foyer/
Salle de la Capitale 1B-2B

Séance X : Le diagnostique moléculaire – Applications potentielles et enjeux

Salle de la Capitale 3B-4B

15:25 Diagnostic moléculaire : de Pasteur à la réaction en chaîne de la polymérase (PCR)
Richard Hamelin, Ressources naturelles Canada, Service canadien des forêts

15:40 L'importance de la validation dans le diagnostic moléculaire
Marie-Josée Côté, Agence canadienne d'inspection des aliments

15:55 La mise au point d'un test moléculaire fiable
Kurt Zeller, United States Department of Agriculture – Animal and Plant Health Inspection Service

16:15 Des collections biologiques à la surveillance des formes de vie
André Lévesque, Agriculture et Agroalimentaire Canada

Séance XI : La mondialisation – Rapport des États-Unis

Salle de la Capitale 3B-4B

16:35 Survol des organismes nuisibles des forêts aux États-Unis et de la Forest Health Technology Enterprise Team
Marla Downing, United States Department of Agriculture – Forest Service

SCIENCES ET TECHNOLOGIE À LA CARTE

Salle de la Capitale 1B-2B

- 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

17h15–21h30 Bar payant et buffet à déguster tout en circulant; exposants du gouvernement, du secteur commercial, de l'entreprise privée; échange de connaissances scientifiques et séance informelle de présentations par affiches

LE JEUDI 8 DÉCEMBRE 2005

ÉVÉNEMENT SPÉCIAL DU FORUM 2005
LA SCIENCE ET L'AMÉLIORATION DE LA LUTTE CONTRE LES RAVAGEURS AU CANADA

08:00 **Inscription** — Foyer/ Salle de la Capitale 3B-4B

Séance du matin — Salle de la Capitale 3B-4B

Président : *Anne Bordé, Ressources naturelles Canada, Service canadien des forêts*

08:30 Mot de bienvenue – *Geoff Munro*
Ressources naturelles Canada, Service canadien des forêts

08:45 La recherche au Canada: Rapport de l'atelier de novembre 2004 portant sur les aspects technologiques et scientifiques des méthodes antiparasitaires
Guy Smith[1]

09:00 Mise au point d'outils moléculaires de surveillance de la santé de la tordeuse des bourgeons de l'épinette
Conférencier : *Kees van Frankenhuyzen*[1]
Collaborateurs : *Kees van Frankenhuyzen*[1]*, Richard Hamelin*[2] *et George Kyei-Poku*[1]

09:20 Détection de la céreulide, la toxine émétique d'une formulation commerciale à base de *B. thuringiensis* – un récit édifiant
Conférencier : *Kees van Frankenhuyzen*[1]*,*
Collaborateurs : *George Kyei-Poku*[1]*, Kees van Frankenhuyzen*[1] *et Debbie Gauthier*[1]

09:40 Méthodes avancées de surveillance des impacts des produits antiparasitaires sur les principales communautés microbiennes des sols forestiers
Conférencier : *Richard Winder*[4]
Collaborateurs : *Richard Winder*[4] *et Phyllis Dale*[4]

10:00 **Pause** — Foyer/ Salle de la Capitale 1B-2B

10:30 Élaboration et validation du SAD SprayAdvisor pour les applications aériennes d'herbicide au Canada — Salle de la Capitale 3B-4B
Conférencier : *Dean Thompson*[1]
Collaborateurs : *Dean Thompson*[1]

10:50 Introduction au Groupe de recherche ECOBIOM – la lutte biologique contre les ravageurs forestiers (insectes et microorganismes pathogènes) au Canada
Conférencier : *Robert Lavallée*[2]
Collaborateurs : *Groupe de recherche ECOBIOM*

11:00 Efficacité au champ de bandes de polyester imprégnées de spores de *Beauveria bassiana* utilisées pour piéger et infecter le longicorne brun de l'épinette en Nouvelle-Écosse
Conférencier : *Jon Sweeney*[3]*,*
Collaborateurs : *Jon Sweeney*[3] *et Graham Thurston*[3]*, D. Boyle*[2] *et J. Price*[5]

11:20 L'utilisation de *Beauveria bassiana* comme méthode de lutte contre le charançon du pin blanc (*Pissodes strobi*) et le grand hylésine des pins (*Tomicus piniperda*)
Conférencier : *Richard Trudel*[6]
Collaborateurs : *Robert Lavallée*[2]*, Richard Trudel*[6]*, Claude Guertin*[6]*, Chantal Côté*[2]*, Pierre Desrochers*[2] *et Peter de Groot*[1]

11:40 Une méthode potentielle de lutte biologique contre le charançon du pin blanc (*Pissodes strobi*) en Colombie-Britannique
Conférencier : *Harry Kope*[4]
Collaborateurs : *Harry Kope*[4]*, René Alfaro*[4] *Isabel Leal*[4]*, Robert Lavallée*[2]*, Richard Trudel*[6]*,Claude Guertin*[6]*, Chantal Côté*[2], *Pierre Desrochers*[2,] *Peter de Groot*[1]*, Jon Sweeney*[3] *et Graham Thurston*[3]

12:00 Conclusion (de la séance de la fin de la matinée)
Conférencier : *Robert Lavallée*[2]
Collaborateurs : *Groupe de recherche ECOBIOM*

12:05 **Déjeuner** Foyer/
Salle de la Capitale 1B-2B

Séance de l'après-midi

Salle de la Capitale 3B-4B

Président : À déterminer

13:00 Devenir dans l'environnement et effets écologiques d'un insecticide systémique contre des insectes xylophages exotiques
Conférencier : *Dave Kreutzweiser*[1]
Collaborateurs : *Dave Kreutzweiser*[1]*, Dean Thompson*[1]*, Blair Helson*[1]*, Steve Holmes*[1] *et Taylor Scarr*[7]

13:20 Effet du traitement par *Phlebiopsis gigantea* sur la diversité microbienne des souches de pin rouge
Conférencier : *Mike Dumas*[1]
Collaborateurs : *Gaston Laflamme*[2]*, Mike Dumas*[1]*, N.W Boyonoski*[1]*, M. Blais*[2] *et C. Côté*[2]

13:40 Emploi de l'herbicide ARSENAL™ (imazapyr) à des fins de gestion de la végétation forestière
Conférencier : *Michael Irvine*[7]
Collaborateurs : *Len Lanteigne*[3]*, Doug Pitt*[1]*, Milo Mihajlovich*[8] *et Michael Irvine*[7]

13:50 Formulations de phéromone utilisables dans le cadre de stratégies d'intervention précoce contre la tordeuse des bourgeons de l'épinette
Conférencier : *Ed Kettela*[3]
Collaborateurs : *Ed Kettela*[3]*, Peter Silk*[9] *et David C. Davies*[10]

14:10 Discussion ouverte

14:30 Mot de la fin

1. *Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie des Grands Lacs*
2. *Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie des Laurentides*
3. *Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie de l'Atlantique*
4. *Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie du Pacifique*
5. *Maritime Microbiologicals, Fredericton (Nouveau-Brunswick)*
6. *Institut national de la recherche scientifique - Institut Armand-Frappier – Laval (Québec)*
7. *Ministère des Richesses naturelles de l'Ontario, Sault Ste. Marie (Ontario)*
8. *Incremental Forest Technologies Limited, Edmonton (Alberta)*
9. *Silk Biochemical Services, Fredericton (Nouveau-Brunswick)*
10. *Forest Protection Limited, Fredericton (Nouveau-Brunswick)*

Merci d'avoir participé au Forum 2005 sur la répression des ravageurs forestiers

À l'an prochain!

Welcoming Remarks / Mot de bienvenue

NRCan – Deputy Minister Speech for the 2005 Forest Pest Management Forum

It is my pleasure to open the 2005 Forest Pest Management Forum. I want to welcome participants from across the country and our colleagues from the United States.

The Canadian Forest Service of Natural Resources Canada (NRCan) is pleased to have a lead role in bringing together pest management experts to report progress, share the latest knowledge, and contribute to the development of policy and priorities.

A key message coming out of this annual gathering this year, and every year, is that forest pest management is essential to sustaining a healthy forest and a strong forest sector.

There is a host of good reasons to make such a statement – and never more than now:

- ❖ Provinces and territories need to protect the forest resource and minimize their costs for controlling native and alien forest pests.
- ❖ The federal government wants to maintain healthy forests and a competitive forest sector, given the importance of their role in the economic, environmental and social fabric of this country.
- ❖ And industry wants to prevent disruptions to the wood supply and the land base from which they draw it.

There is nothing wrong with such enlightened self-interest.

But because of the wide-ranging and complex nature of forest pest issues, a unified approach is the only viable way to ensure success over the long term.

So for pest management, self-interest should be the national interest. We need a national pest management strategy.

During the course of this forum, others will elaborate on details of this strategy we envision and will speak to necessary next steps, but let me at least sketch out roughly some of the issues to be addressed as this concept unfolds.

To start, we have to remove barriers. Take, for example, the problematic distinction between "native" and "alien" species.

If the pest is native:

- ❖ Local/provincial jurisdictions are seen to be responsible;
- ❖ The federal government is called in when infestations reach crisis proportions.

If the pest is alien:

- ❖ Local/provincial jurisdictions believe it is a federal responsibility;
- ❖ The federal government gets local/provincial collaboration when infestations reach crisis proportions.

At the end of the day, it is irrelevant where the pests come from.

All of them must be managed in a timely, cost-effective and efficient way to minimize their impacts.

We have to shift the way we approach pest management:

- ❖ From actions that are specific to local pests to, as I have said, a national strategy;
- ❖ From emergency responses to proactive/pre-emptive actions;
- ❖ From ad hoc responses to those that are risk-assessment based – taking actions to fit the need;
- ❖ From chance findings to systematic monitoring on the ground and at points of entry -- and this does not mean re-establishing the Forest Insect and Disease Survey. It means making use of modern technology and all the tools available to us – remote sensing, computerized outbreak progression models and the like.
- ❖ From making distinctions between native and alien species to managing forest pests regardless of origin;
- ❖ And from focusing on wood supply to a sustainable development approach – one that is inclusive of environmental and social aspects as well as economic.

In terms of surveillance, we need a strong early warning system. Our current capacity is ad-hoc; locally based and isolated and quite uneven across the country.

Successful pest management demands a systematic, planned approach and a national program with strong regional delivery.

That can be accomplished by building upon capacities that already exist within:

- ❖ My department, where CFS initiatives and programs are already in place: Mountain Pine Beetle; Enhanced Pest Management Methods; Invasive Alien Strategy; A-base programs (NRCan-CFS has helped develop products for pest control for more than a half century); and the just-announced forest industry strategy;
- ❖ Other federal departments (CFIA, EC, Borders);
- ❖ Provinces and Territories;
- ❖ Industry.

And by building on current relationships:

- Federal partners on IAS – NRCan, CFIA, AAFC, EC;
- OGDs "at the table" with needs and interests;
- CCFM S&T Working Group;
- Joint Meetings of Ministerial Councils;
- FPAC S&T Committee;
- And last, but certainly not least, you – The National Pest Forum.
    - I was pleased to learn that you have, over the past year or so, undertaken a study of pest management from a sustainable forest management perspective. It demonstrates your leadership in this area and reflects my belief that you must play a fundamental role in any national strategy.

I foresee a three-pronged approach to the national strategy:

1. A National Policy Framework that builds upon the National IAS strategy; integrates native and alien species efforts; and fosters collaboration among agencies and organizations.

   This would be an over-arching framework that would include, but not be limited to, forest pests. So, for example, zebra mussels and other non-forest pests would be included.

    - Environment Canada will take the lead on this with NRCan-CFS support.

2. Landscape-specific approaches:

   As a sub-set of the national framework, strategies specific to various landscapes would be put into place:

    - Aquatic
    - Terrestrial
        - Forest; Agriculture; Wildlife.
            1. Forest is, of course of principal interest to us. NRCan-CFS and the CFIA will take the lead here.

3. Pest-specific efforts:

   And this is self-explanatory:

    - Multiple jurisdictions
    - Issue specific (Mountain Pine Beetle; Emerald Ash Borer, Brown Spruce Long-horned Beetle, etc.)
        - Here NRCan-CFS would take the lead with CFIA and other partners.

"Prongs" two and three are where I especially expect you people to shine. Not only through the leadership you traditionally show, but also in facilitating the much-needed multi-agency, multi-jurisdictional collaboration and partnering that are crucial ingredients to making this concept work.

I present all this as food for thought as you work through the excellent program ahead of you. I wish you another productive and enjoyable forum.

Session 1

Western Pest Management Issues

Chair: Gordon Miller

Natural Resources Canada, Canadian Forest Service

Séance 1

La répression des ravageurs dans l'Ouest

Président : Gordon Miller

Ressources naturelles Canada, Service canadien des forêts

British Columbia Report

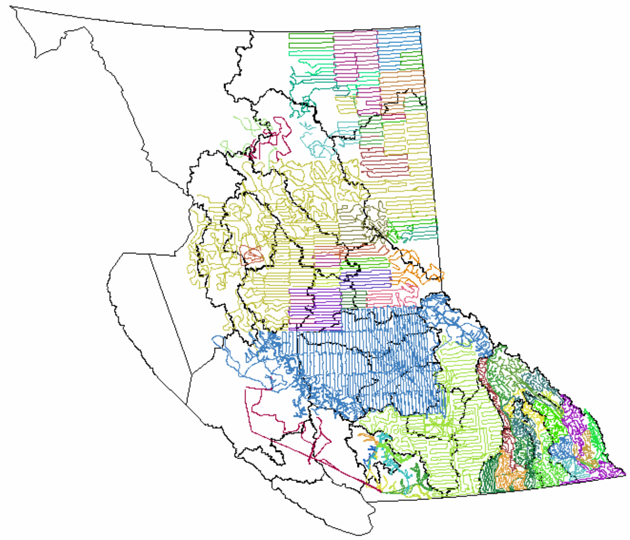
Rapport de la Colombie-Britannique

Presented by:

Tim Ebata, *Forest Health Project Specialist*
British Columbia Ministry of Forests and Range, Victoria, B.C.

Forest Health Conditions in British Columbia, December, 2005

This report provides a brief summary of the highlights from the 2005 aerial overview survey of the Province of British Columbia as well as some other noteworthy surveys and activities. The aerial overview survey has been conducted by the Ministry of Forests and Range (BCMOFR) since 1999. Prior to this date, surveys were conducted up to 1995 by the Canadian Forest Service's Forest Insect and Disease Survey (FIDS) that was officially disbanded in 1996. The fixed-wing aerial survey is conducted over the entire forested land-base by the BCMOFR regardless of ownership. The exception has been for surveys of the Queen Charlotte Islands which is still surveyed by the CFS. The Rocky Mountain National Parks are surveyed by former FIDS staff. Data standards were developed with the assistance of the FIDS staff using data collection standards that were developed to become national standards. Recent improvements to the survey have been the addition of recreational level handheld GPS track files to document the timing and location of individual flights, the use of customized 1:100,000 scale maps prepared on recent ortho-rectified Landsat 5 black and white imagery, and the addition of two additional severity categories for improved mapping of the extensive mountain pine beetle outbreak. The overview is conducted by five contractors who provide draft regional digitized maps that are combined into a single provincial coverage.



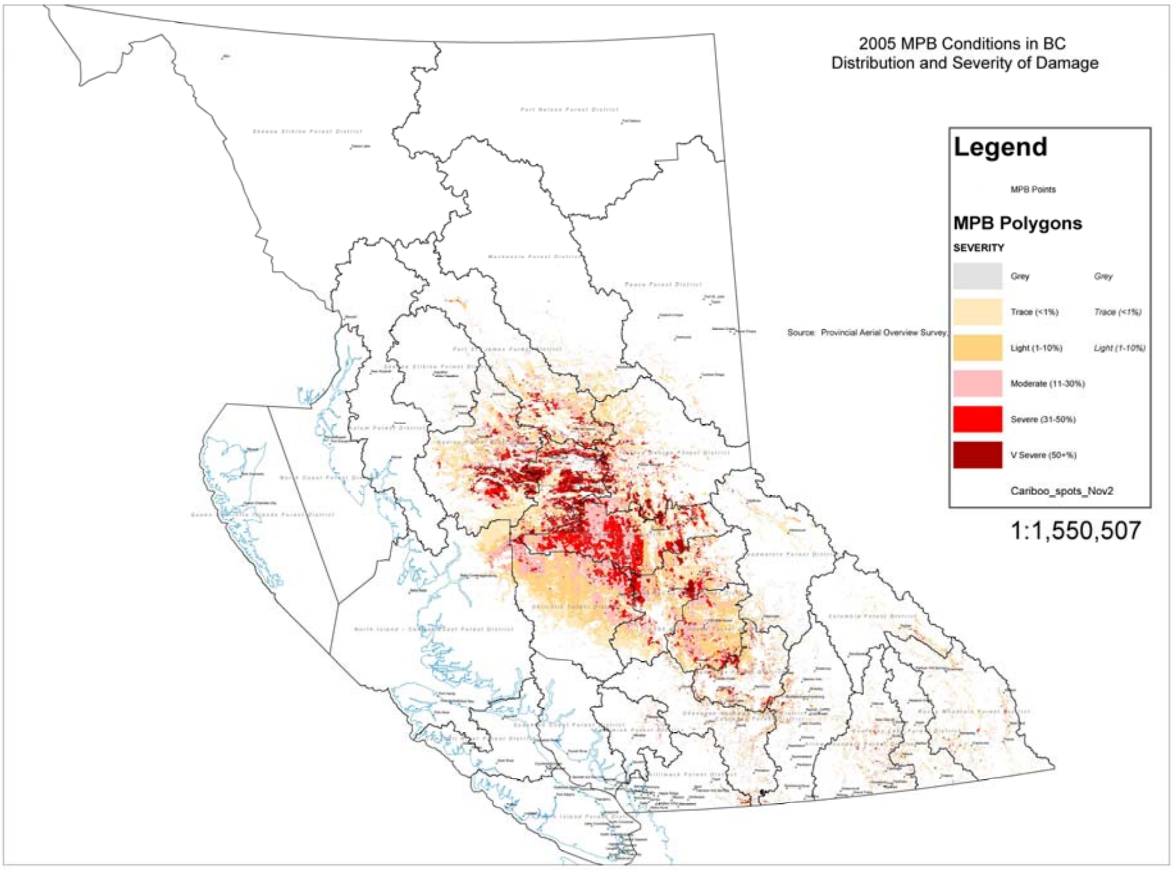
Results from this year's survey were as follows. Dothistroma (redband) needle blight continues to defoliate and impact significant areas of the Kispiox Timber Supply Area in northwest B.C. Although only 1,960 ha was mapped during the overview survey, low-level helicopter surveys have mapped over 40,000 ha of affected lodgepole pine of all ages. Alex Woods, Regional Forest Pathologist based in Smithers, B.C., has recently published a report in Bioscience that provides evidence that the rise in Dothistroma damage is directly related to warm, wet summers that has been associated with global climate change. B.C.'s Chief Forester has organized a MOFR task force to examine the climate change issue, its impacts on forest ecosystems and potential solutions. Are other provinces preparing themselves similarly?

Defoliators in B.C. have generally declined with the exception of the western spruce budworm. Eastern spruce budworm (*Choristoneura fumiferana*), has declined dramatically to only 703 ha from 29,417 ha in 2004. This decline is consistent with the trends observed in other western provinces. Western spruce budworm (*C. occidentalis*) continues to be active in portions of the former southern Cariboo and Kamloops although numbers dropped from 621,000 ha in 2004 to 454,123 ha in 2005. Treatment operations of high priority stands using single applications of Foray 48B were carried out on 28,000 ha in the former Cariboo Region and 2,400 ha in the former Kamloops Region. Western hemlock looper defoliation rose slightly from 5,732 ha in 2004 to 6,058 ha in 2005 and will be continued to be monitored to provide early detection of an outbreak.

Gypsy moth eradication efforts are being continued in 2005 in three areas – Saanich, Salt Spring Island and Nanaimo. These small infestations will be treated with Btk in Spring, 2006. Three other small infestations will be mass trapped to continue efforts to determine the efficacy and applicability of this treatment.

Bark beetles continue to be the most significant damaging agent recorded during the overview survey. Douglas-fir beetle declined from 34,000 ha in 2004 to only 5,144 ha possibly due to the decline in moisture stress induced beetle mortality after drought conditions in 2003. Spruce beetle numbers also declined from 41,875 ha in 2004 to 9,721 ha in 2005, primarily in the eastern half of the Cariboo region. Western balsam bark beetle continues to be a chronic mortality agent in mature subalpine fir stands but covering extensive areas (~1.4 million ha in 2005). The mountain pine beetle is the most important disturbance agent in B.C. This aggressive killer of mature pine now infests an area of 8.7 million ha (from 7.1 million ha in 2004). As expected, there was less of an increase in area but more intensification within areas lightly infested in previous years. The previous winter was the 10^{th} successive mild winter where most of the infested area of the province did not experience significant periods of -40 C temperatures for 5 days or more. Mild winters resulted in very limited overwinter mortality in most of the MPB's range with the exception being in some infestations on the east side of the Rocky Mountains in the Peace forest district. In some locations, the only living larvae were located at the base of the tree below the snowline.

Some strange things were observed in 2005 as a direct result of the massive size of the MPB outbreak. In late summer, billions of dead MPB adults washed ashore of lakes in the Vanderhoof district indicating the magnitude of the biomass of MPB in flight during the summer's emergence period. Young pine stands are showing unexpectedly high rates of mortality by three different insects. First, young pine (<12 yrs old) in plantations were observed dying at the margins of mature stands killed by MPB. Warrens root collar weevil larvae were found to be girdling the young pine and it was determined that the adult weevils that would have normally attacked mature trees migrated from the dead stands into the plantations. Second, an extensive aerial and ground survey of young pine conducted by regional entomologists Dr. Lorraine Maclauchlan and Leo Rankin revealed that stands as young as ages 20-30 yrs old and exceeding 14 cm dbh were consistently being killed throughout the MPB "blast zone" by both MPB and pine engraver (*Ips pini*). Mortality ranged from 0 to 99%. Surveys will continue in 2006 to further investigate this phenomenon.


2005 MPB Conditions in BC
Distribution and Severity of Damage
Legend
MPB Points
MPB Polygons
SEVERITY
Grey
Trace (<1%)
Light (1-10%)
Moderate (11-30%)
Severe (31-50%)
V Severe (50+%)
Cariboo_spots_Nov2
1:1,550,507
Source: Provincial Aerial Overview Survey

In 2005 several major government initiatives were begun or continued relating to the MPB disaster. The "MPB Action Plan" was finalized. This document outlines at a high level the priorities and focus of government's efforts to minimize the impacts of the MPB. Directed by the action plan, a Forest Stewardship Research Strategy was written to direct research to address key stewardship issues resulting from the MPB outbreak and in particular, the increased levels of salvage harvesting. The BC government also announced the "Forests for Tomorrow" program to address reforestation issues from both the 2003 and 2004 fires in the Southern Interior and the MPB. For the third year, the Federally funded Mountain Pine Beetle research continued to fund valuable research projects supporting the province's efforts. The most significant announcement in 2005 was the $100 million dollar grant provided to the province for MPB related activities. The breakdown of the expenditures is described in Table 1.

Activity	**3 yr Distribution**
Community Diversification	$13.2
Natural Range	$4.5
Fuel Management	$24.8
R&D – Wood Products	$6.3
Parks/Protected Areas MPB Mitigation	$2.7
Spread Control	**$21.7**
Inventory	$10.9
R&D – Biophysical	$6.7
Ecosystem Restoration	$7.0
Corporate Support	$2.2
TOTAL	**$100 Million**

Source: www.for.gov.bc.ca/hfp/mountain_pine_beetle/can_bc_implement.htm

About $21 million is being targeted for spread control that will attempt to limit or prevent the spread of the MPB into Alberta and to the rest of Canada via the expansive jackpine forests. This year, $11 million is being spent fighting the MPB in the border districts with the bulk of the funding allocated to the Peace Forest District. This district has the highest chance of success due to the poor winter survival rates that support suppression efforts.

Alberta Report

Rapport de l'Alberta

Presented by:

<u>Hideji Ono</u>, Land and Forest Division,
Alberta Sustainable Resource Development

Compiled By:

S. Ranasinghe

Contributors:

T. Hutchison, C. Kominek, T. Kobliuk, E. Lee, D. Lux, and M. Maximchuk
(Alberta Sustainable Resource Development) and
M. Jenkins (City of Edmonton)

Important Forest Pest Conditions in 2005 and Forecasts for 2006 in Alberta

Abstract

This is a report on major forest pest infestations and management programs that occurred in Alberta's forested land in 2005. Many different forest pests occur in the province but details of only those that caused infestations in 2005 are presented in this report.

Spruce budworm defoliated an estimated 15 469 ha in 2005; this is a 50% drop compared to the area defoliated in 2004. The severity of budworm defoliation also declined in 2005. Tree kill was observed in forest stands moderately to severely defoliated by the budworm for over eight or more consecutive years. Regionally, moth catches in pheromone traps indicated that the risk of new spruce budworm outbreaks occurring in 2006 has decreased in the southwest; is remaining about the same in the northwest, and has increased in the northeast, compared to the risk in 2005.

This year, insect-caused aspen defoliation increased dramatically in northern Alberta. This defoliation was scattered over an area of 2 959 001 ha, nearly quadrupled compared to the 632

810 ha affected in 2004. As expected, the forest tent caterpillar defoliation increased in extent and intensity.

The number of new attacks by the mountain pine beetle (MPB) increased significantly compared to 2004. In 2004/05, slightly over 6000 infested trees were felled and burned compared to 1332 found in 2004/05. New patches of MPB-infested trees were detected in southwest Alberta as well as further north than before.

Field data generated during a two-year study to compare the impact of woodborer vs. checking in fire-killed timber were analyzed. The results showed much higher impact due to checking damage, compared to woodborer damage.

1.0 INTRODUCTION

This is a summary of noteworthy forest insect and disease pest conditions and management programs that occurred in Alberta in 2005. For details of Alberta's forest pest conditions (including details about invasive plants) either refer to *2005 Annual Report: Forest Health in Alberta* or visit the Forest Health Website at **http://www3.gov.ab.ca/srd/forests/health/p_reports.html**.

Municipal governments look after forest pest concerns within the settled area of the province. In the forested area, the Department of Community Development (CD) handles forest health issues in provincial parks. Forest health concerns in national parks are a federal government responsibility. Responsibility for forest health in other forested Crown lands in Alberta falls within the mandate of the Department of Sustainable Resource Development (SRD).

The Forest Health Officers (FHO) — Tom Hutchison, Northeast Corporate Region (NE), Daniel Lux and Christie Ward (SW1 and SW2) and Erica Lee (SW3 and SW4), Southwest Corporate Region and Mike Maximchuk, Northwest Corporate Region (NW) — provided pest details of the forested Crown land. Mike Jenkins (The City of Edmonton) provided the urban forest pest information. Les Weekes provided information on forest health conditions in Cypress Hills Provincial Park.

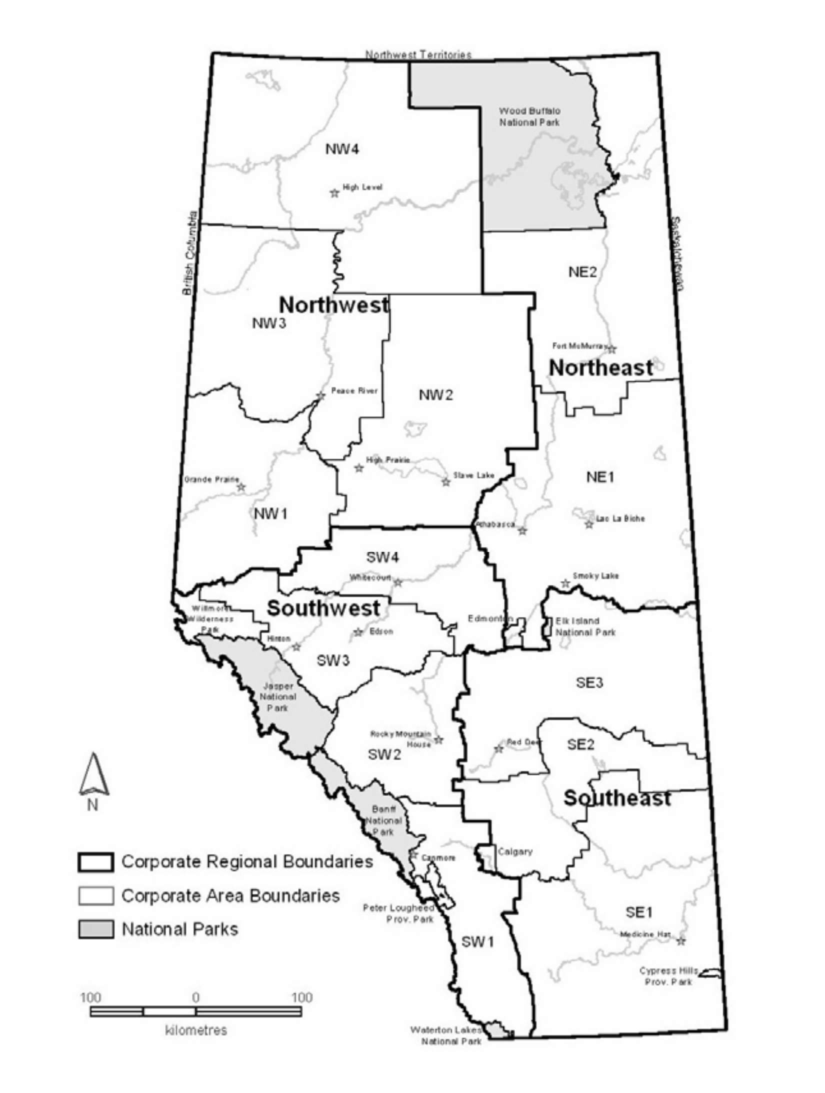


Figure 1. Corporate regions and areas of the Department of Sustainable Resource Development, Alberta in 2005.

2.0 FOREST PEST CONDITIONS IN 2004 AND FORECAST FOR 2005

2.1 Defoliators

2.1.1 Conifer Defoliators

Spruce Budworm, Choristoneura fumiferana (Clemens)
Aerial Overview Surveys

The extent and severity of spruce budworm defoliation were estimated during aerial overview surveys carried out in the summer. The procedures used for these surveys are described in the “Forest Health Aerial Survey Manual” (Ranasinghe and Kominek, 1999). The severity of spruce budworm defoliation was rated either as moderate (>35% to 70% defoliation) or severe (over 70% defoliation) because light defoliation (> 0 - 35% defoliation) is not easily recognizable from the air. The results of these aerial surveys are summarized in Table 1.

Table 1. The extent of spruce budworm defoliation (ha) by severity categories in Alberta[a], 2004 vs. 2005

	2004			**2005**			
	Moderate	Severe	Total	Moderate	Severe	Total	Change (%)
Net [b]	20 245	6677	26 922	6636	3384	10 020	- 63%
Gross [c]	3105	624	3729	5075	374	5449	46%
Combined	23 350	7301	30 651	11 711	3758	15 469	- 50%

[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*

In 2005, aerially visible spruce budworm defoliation was confined to the Northwest and Northeast corporate regions. The spruce budworm defoliated an estimated net area of 10 020 hectares of inventoried forested land. In addition, spruce budworm defoliation was scattered over a gross area of 5449 hectares of forested land that has not been inventoried (Table 1). The figures on Table 1 show a 63% drop in budworm-defoliated area in inventoried spruce forest in 2005 compared to the corresponding area defoliated in 2004. The reduction in defoliated area was more pronounced in the Northeast Region (NE) than in the Northwest Region (NW) (Figures 2 and 3). In the non-inventoried spruce forest, budworm-defoliated area increased by about 46%. The severity of budworm defoliation was also reduced in 2005 compared to 2004. Compared to 2004, the extent of defoliation was lower in 2005 in every severity category except the gross area of moderate defoliation.

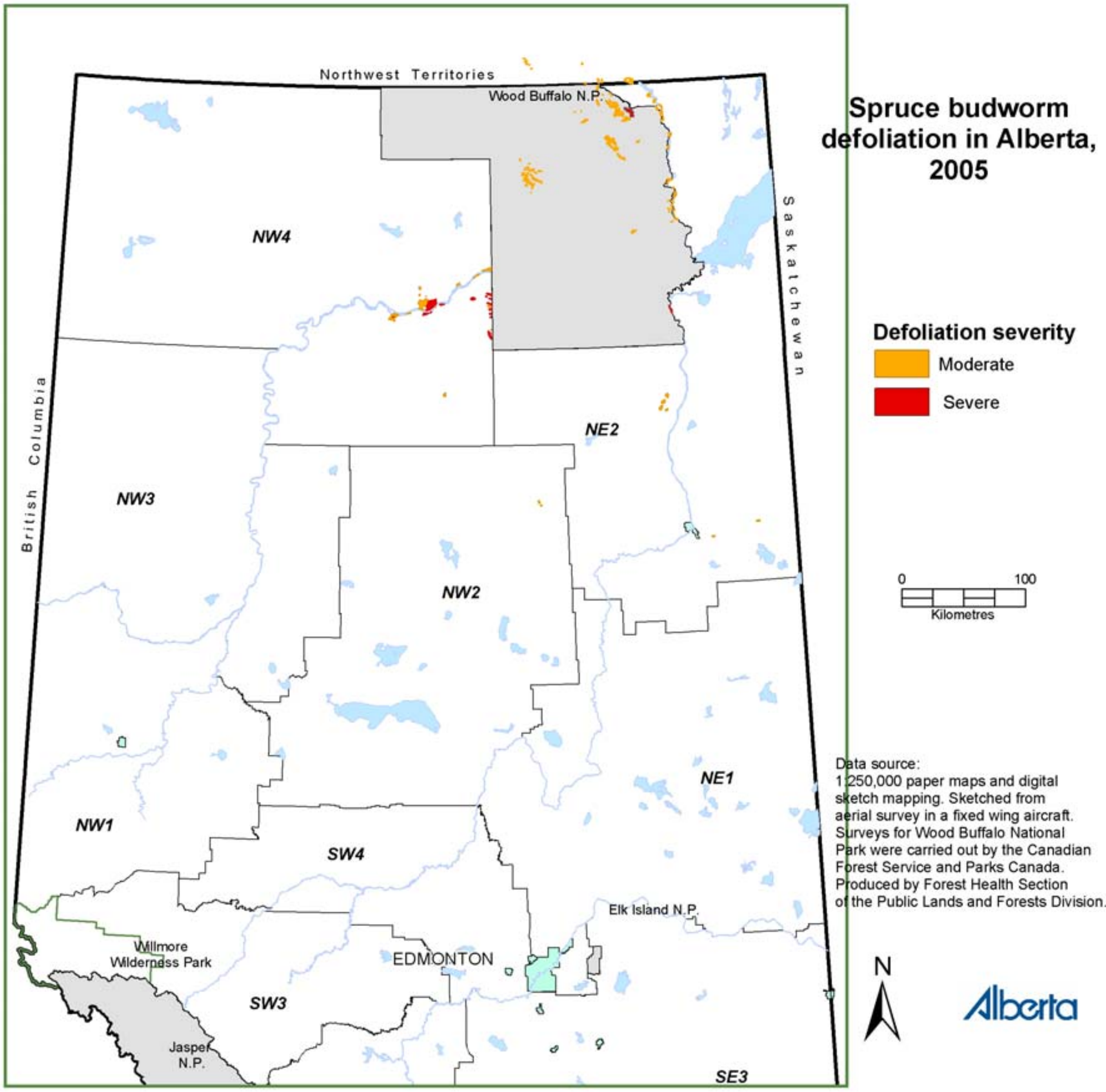


Figure 2. Spatial distribution of moderate and severe spruce budworm defoliation in Alberta, 2005.

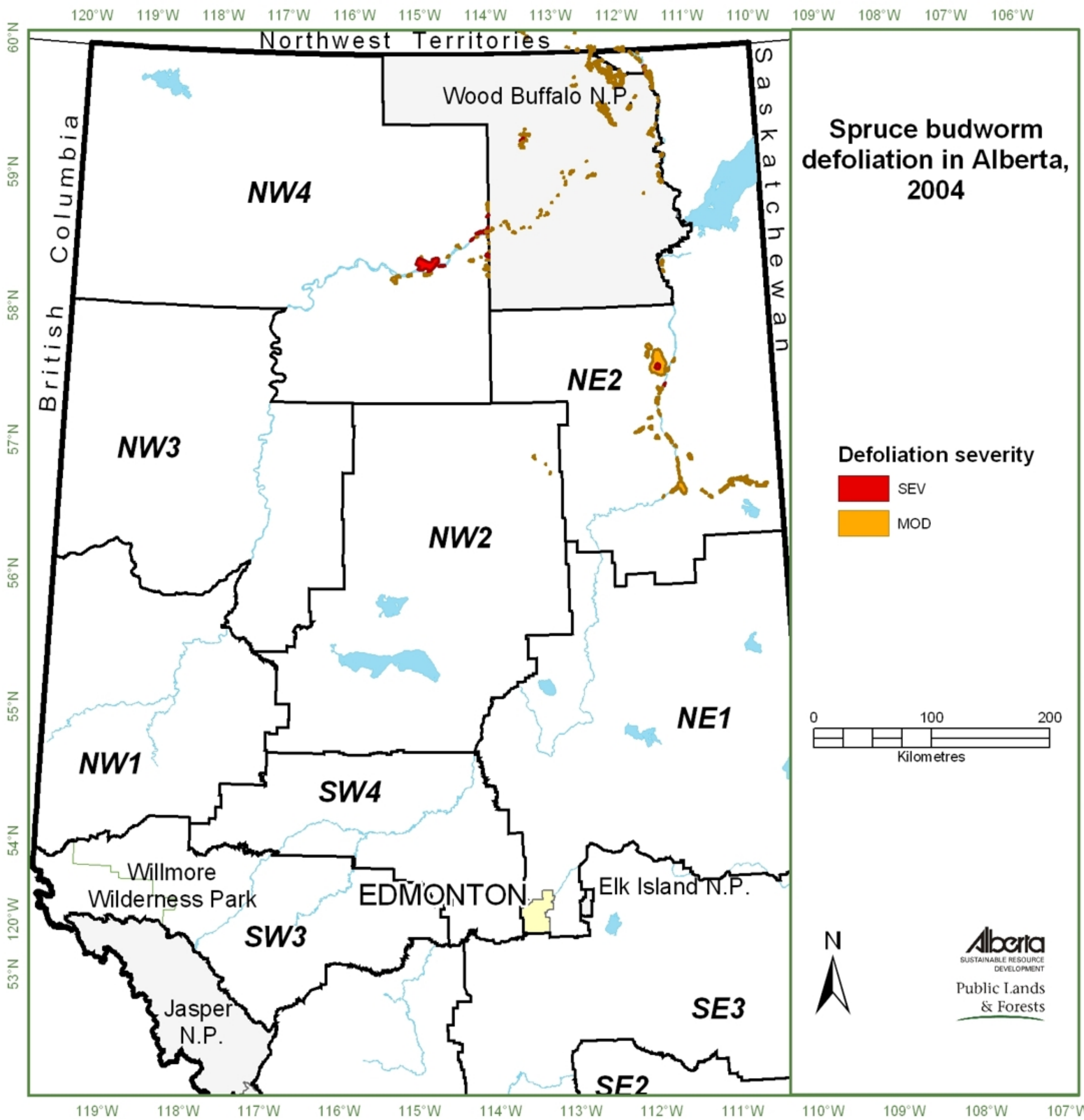


Figure 3. Spatial distribution of moderate and severe spruce budworm defoliation in Alberta, 2004.

Forecast for 2005 Based on Pheromone Trap Catches in 2005

Male spruce budworm populations were monitored provincewide by using Multi-Pher I® traps (Le Groupe Biocontrole, Quebec) baited with female budworm sex pheromone lures (Plastic lure, Phero Tech Inc., B.C.). The procedure for deploying these traps is described in the "Spruce Budworm Management Guide" (Ranasinghe and Kominek 1998). The predictions based on moth catches in pheromone-baited traps are shown on Figure 4.

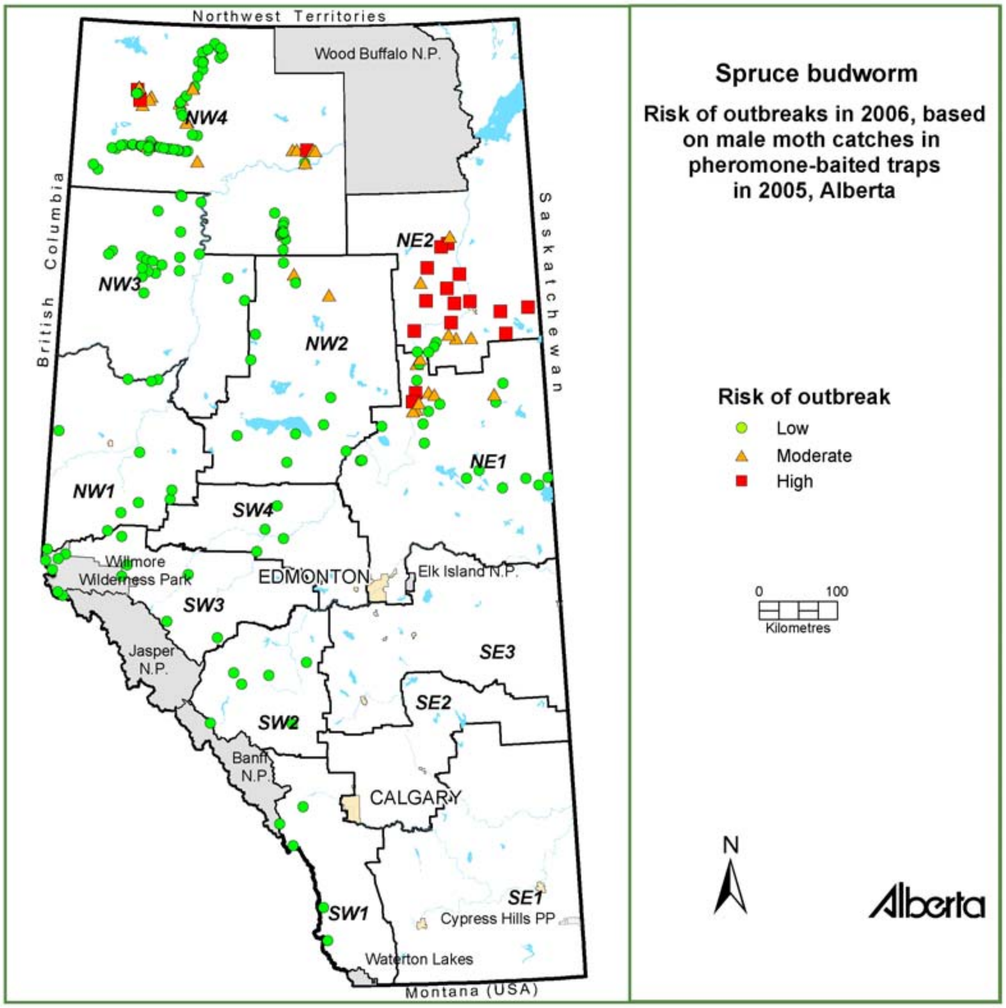


Figure 4. Forecast on risk of new spruce budworm outbreaks occurring in 2006, based on moth catches in pheromone-baited traps in 2005 in Alberta.

The results of this survey indicate that the risk of new outbreaks occurring in 2006 is low in all the areas except in the Waterways Area of the NE Region. In this area, 59% of the 32 plots had moth counts indicative of high outbreak risk in 2006; in comparison only 29% of these plots had a high risk of outbreak in 2005. In the NW Region the risk of new outbreaks in 2006 is low, similar to what was observed in 2004. In the SW Region, the risk of outbreaks in 2006 is low; this was expected because most of this region has the two-year cycle budworm, *C. biennis* Free and the odd years synchronize with the down-cycle of these budworm populations.

Yellowheaded Spruce Sawfly

The yellowheaded spruce sawfly (YHSS) continued to defoliate young white spruce growing on reclaimed oil and gas lands near Fort McMurray, Cold Lake and Bonnyville in northeastern Alberta. However, data on the extent and severity of these defoliations have not been collected.

2.1.2 Aspen Defoliators

The regional forest health officers and a contractor carried out aerial surveys to estimate the extent and severity of insect pest-caused aspen defoliation over the forested Crown land. Personnel from the Canadian Forest Service and Parks Canada surveyed defoliation on Wood Buffalo National Park; the other national parks and provincial parks were not surveyed. Fixed wing aircraft were used in these surveys. Either a tablet PC combined with a GPS or visual observations recorded on a 1:250 000 scale map were used. The surveyors categorized aspen defoliation as light (<35%), moderate (35-70%) or severe (>70%). The results of these surveys are summarized in Table 2 and shown on Figure 5.

Table 2. The extent of insect pest-caused aspen defoliation in Alberta[a] *in 2004 vs. 2005*

Corporate Unit	Gross area of defoliation (ha)					
	2004			2005		
	Light	Moderate	Severe	Light	Moderate	Severe
Northeast	5182	105	0	2751	20 341	40 141
Northwest	5567	305 933	277 419	379 349	414 223	2 060 390
Southwest	15 773	19 848	2983	16 333	7433	18 040
TOTAL		**632 810**			**2 959 001**	

[a] National and provincial parks excluded

The forest tent caterpillar was the main defoliator of aspen in 2005. The total gross area defoliated in 2005 was nearly three million hectares (Table 5). This is about a four-fold increase compared to the gross defoliated area in 2004. The severity of defoliation also increased in 2005 compared to 2004. This was most pronounced in the NW Region (Figure 5).

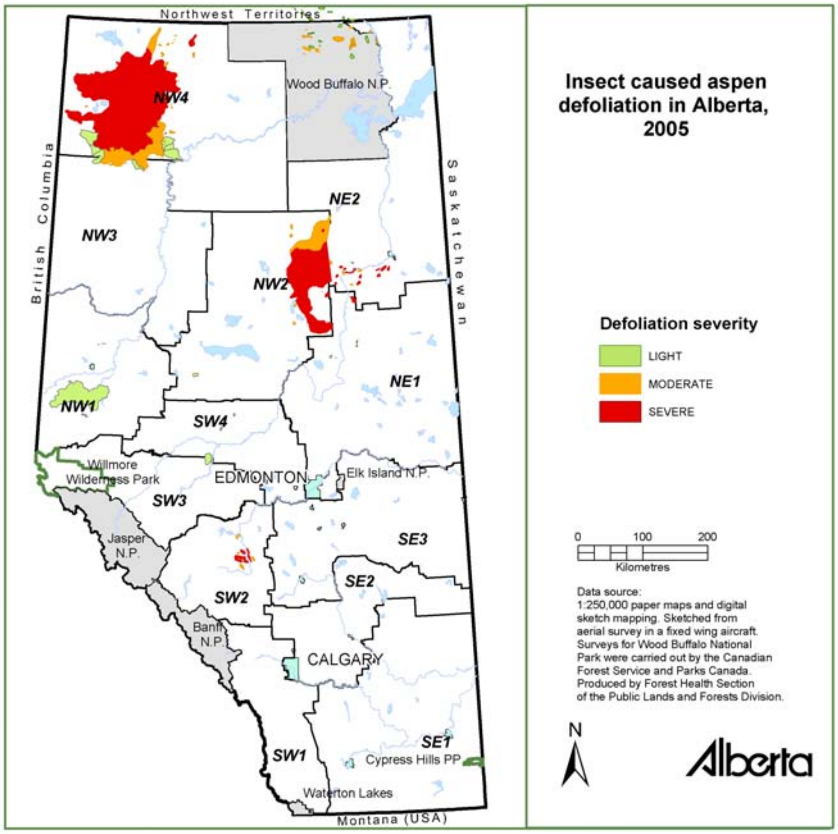


Figure 5. Spatial distribution of insect pest-caused aspen defoliation in Alberta, 2005.

Forest Tent Caterpillar, Malacosoma disstria Hűbner

Forest tent caterpillar (FTC) moth populations in the Northwest Region were monitored by using Unitraps® baited with pheromone lures (Phero Tech Inc., B.C.). A summary of the average trap catches in 10 monitoring plots over three consecutive years is shown on Figure 7.

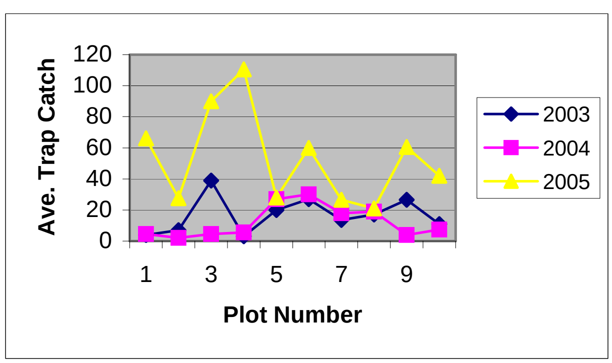


Figure 7. Average forest tent caterpillar moth catches in 10 plots with pheromone-baited traps located in the Northwest Region, 2003 – 2005.

These trap catches as well as the defoliation levels were rather low in 2003 and in 2004.. However, in 2005 forest tent caterpillar populations and defoliation levels were high as shown by the increased extent and severity of defoliation. Thus, moth immigration rather than increase in local moth population appears to be responsible for the increased severity of defoliation.

Gypsy Moth, Lymantria dispar (L.)

The Public Lands and Forests Division set up 74 traps as a part of the annual gypsy moth survey conducted by the Canadian Food Inspection Agency (CFIA). Delta traps baited with Dispalure® were used in this survey. No gypsy moths were caught in these 74 traps that were deployed in July-August at high-risk areas such as the truck stops, railway yards, and campgrounds.

2.2 Bark Beetles

2.2.1 Conifer

Mountain Pine Beetle, Dendroctonus ponderosae Hopkins

Aerial Overview Surveys

2004/05 Aerial Surveys

The Forest Health Officers and a private contractor carried out aerial surveys over high MPB-risk forested areas in the province. The survey covered mature pine forest along the eastern slopes of the Rockies extending from Kakwa Provincial Park in the north to the US border in the south.

Pine trees symptomatic of MPB infestations were detected during aerial surveys carried out over Kakwa Provincial Park, in connection with the MPB control program conducted in the summer of 2005. Pines symptomatic of the MPB were also detected in the Bow Valley, south of Spray Lake, along the Oldman River and south of Crowsnest Pass during aerial surveys. Pine trees with reddish crowns symptomatic of the MPB were found in Willmore Wilderness Park (WWP) during the initial aerial survey carried out in the fall of 2004. However, hundreds of additional red or fading trees were later observed on a rotary-wing flight over WWP on June 28, 2005. This observation led to another survey program in July 2005 that led to detection of a few thousand suspected fading trees in WWP.

2004/05 Surveying of MPB Incidence by Using Pheromone Baits

A two-component aggregation pheromone bait (Phero Tech Inc., B.C.) was used to monitor MPB presence in high-risk lodgepole pine stands in southwestern Alberta . The monitoring sites located in stands where MPB is known to occur were relocated further east to stands with no known beetle presence. The procedure for deploying these pheromone baits is described in "Mountain Pine Beetle Management Guide" (Kominek, 1999).

The trend of MPB incidence at these baiting sites during the past three years is shown on Figure 8.

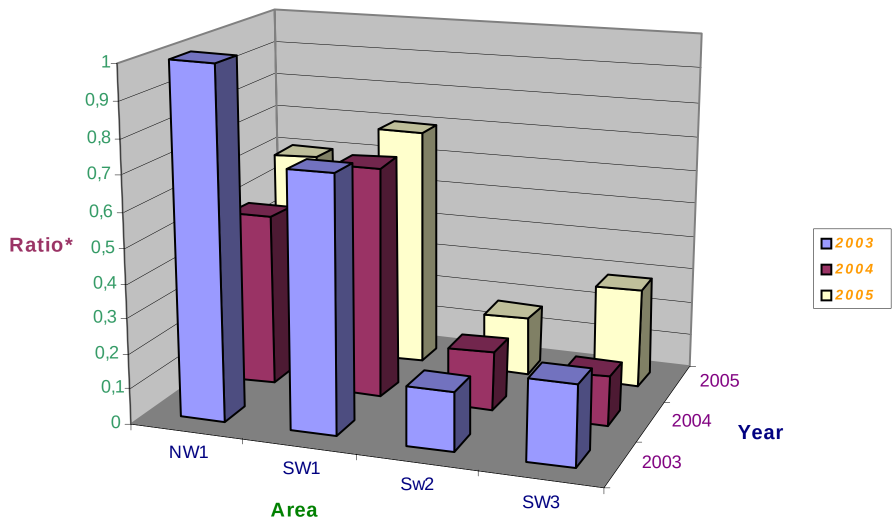


Figure 8 *Trends of mountain pine beetle incidence at pheromone-baited sites in Alberta, 2003-2005 (*Ratio = No. of sites with MPB/Total no. of sites)*

2004/05 Ground Surveys

Ground surveys to detect current attacks (green attacks) of MPB were carried out concurrently with the 2005 control program at Kakwa Provincial Park. Crews were dispatched to those sites where pine trees with reddish crowns were detected during aerial surveys. These crews surveyed the pines within a 100-metre circle around each infested tree to detect any other trees with current MPB attacks. Altogether, 64 green attack trees and 523 faders were detected at Kakwa Provincial Park by these crews.

A four-person crew carried out ground surveys in late fall through winter of 2004/05 in the areas of Willmore Wilderness Park (WWP) identified during the aerial surveys. They detected 895 green attacks during this period. In 2005 summer firefighters were brought in to control the MPB. They conducted ground surveys as a part of the control program following detection of hundreds of red and fading trees along several drainages in the WWP. These crews eventually detected 805 green attack trees and 3545 faders in WWP.

2.3 Diseases and Disorders

Diseases

A number of diseases routinely affect forest trees in Alberta. Needle casts and rusts, dwarf mistletoe, stem cankers and rusts, stem and root decay caused by fungi, cone rusts, seedling diseases, leaf rusts and blights are among the common diseases affecting forest trees in Alberta. However, these diseases are not routinely surveyed and consequently, not reported here.

Hypoxylon Canker

A substantial increase in the hypoxylon canker was observed on aspen in the Cypress Hills Provincial Park. The infection was particularly severe near the Elkwater Townsite. Some aspen stands in the park were nearly 100% infected. The mature aspen in the park are showing advanced signs of decay.

Disorders

Hail Damage

Hail damaged an estimated 2171 hectares of aspen in the Peace River Area of the Northwest Region. The affected area was located along the Chinchaga Forestry Road, north of Manning. This area was ground-truthed to confirm the hail damage.

3.0 MOUNTAIN PINE BEETLE PEST MANAGEMENT PROGRAMS

3.1 Introduction

Mountain Pine Beetle Management

A comprehensive program to manage the mountain pine beetle infestations in the province was undertaken in 2005. This program included education and awareness, prevention, monitoring, surveying, assessment and control operations aimed at MPB population reduction.

Prevention

A ministerial order under the authority of Alberta Forests Act, RSA 2000 c.F-22 was issued on March 24, 2005 prohibiting transportation of any pine logs or pine products with bark attached, within Alberta. This moratorium was in effect from May 1 to September 30.

With the assistance of Alberta Transportation – Inspection Services, SRD implemented a program geared to prevent transportation of pine logs or pine products with bark attached within the province. During this moratorium period five trucks loaded with pine material were refused entry into the province. In two of these cases, blue stain and pitch tubes were visible on logs.

Control Programs to Reduce MPB Populations

Municipal and Private Lands

The Town of Canmore cut and burned 58 infested trees while the Municipal District of Bighorn treated 22 infested trees. In addition, 100 infested trees were removed from the Silvertip golf course and 72 infested trees were removed from the Three-Sisters Mountain Village.

Banff National Park

Approximately 1200 MPB-infested trees were removed from the park by hand fall and burn during late fall of 2004 and early winter of 2005. In addition, park personnel placed about 500 aggregation pheromone baits to contain the beetle population within the infested area.

SW Region

During the fall of 2004, three patches of MPB infested trees were found in the Willmore Wilderness Park during an aerial survey (Table 6). A four-person crew cut and burn MPB-infested trees in this park.

Table 3. ***Incidence and control of mountain pine beetle infestations in Willmore Wilderness Park, Alberta in the Fall of 2004***

Site	Area (ha)	No. of Trees Controlled	Days Used	Manpower
Beaverdam Creek	160	398	175	
Meadowland Creek		130	128	76
Casket Creek	130	369	241	
Total	420	895	492	

During a subsequent flight in early summer of 2005 more red and fading trees were detected in Willmore Wilderness Park. This detection prompted another survey and control program. These surveyors also found infested trees in Kakwa Wildland Provincial Park that was included in this control program.

Altogether, 5301 trees were treated during this operation. The details of this control program are given on Table 4.

Table 4. Details of MPB Control in Willmore Wilderness Park and Kakwa Wildland Provincial Park in 2005 Summer

Area	Status	FMU ID	MPB Green Attack	MPB Faders	Lodgepole Pine Cut & Burned	Whitebark Pine Cut & Burned	Non-MPB trees Cut	Total Treated
Kakwa Wildland	Non-FMA	Non-FMU	64	533	597	0	2	599
Willmore WP	Non-FMA	Non-FMU	805	3545	4269	81	5	4355
Outside Parks	Non-FMA	Non-FMU	5	28	33	0	0	33
	Non-FMA	FMU E8	14	90	104	0	0	104
	Non-FMA	FMU E10	3	181	184	0	0	184
	Non-FMA	FMU G3	0	2	2	0	0	2
	Non-FMA	FMU G6	0	1	1	0	0	1
Weyerhaeuser FMA	FMA	FMU G3	3	18	21	0	0	21
	FMA	FMU G6	0	2	2	0	0	2
TOTAL			894	4400	5213	81	7	5301

Use of Pheromone Baits

In areas where time was running out to cut and burn green attack trees before beetle emergence, pheromone baits were used to limit spread of emerging beetle. In each case, the largest healthy host tree closest to the infested tree was baited with a two-component MPB aggregation pheromone (Phero Tech Inc., B.C.). The intention was to trap any beetles emerging from the green attack tree in the baited-tree.

Following ground surveys from 2004 fall through the winter of 2005, the control crews cut and burned on the stump 346 MPB-infested trees in the Bow Valley. In addition, six infested trees were cut and burned in Blairmore area.

4.0 RESEARCH AND DEVELOPMENT

4.1 Woodborer Impact Study

The results of this study are summarized on Figure 9.

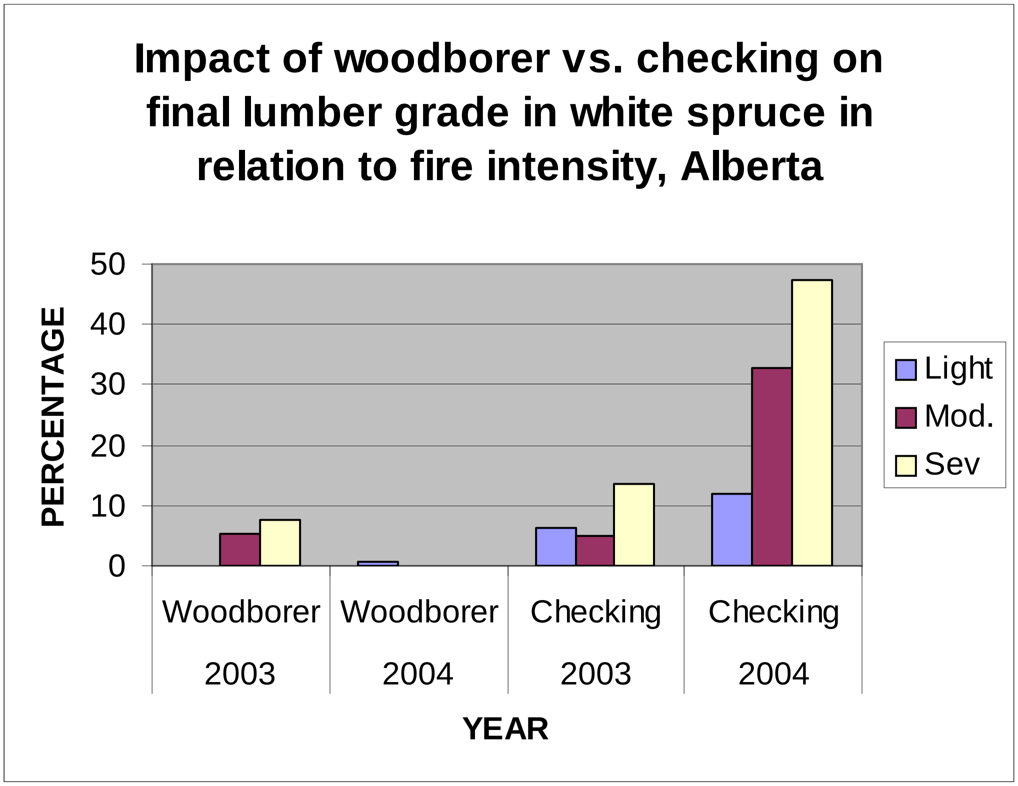


Figure 9. Summary results of a study on the woodborer vs. checking impact in relation to wildfire intensity study in Alberta.

These results indicated the following:

- Higher % incidence of woodborer damage in the first year compared to the second year post-burn;
- Higher % incidence of checking damage in the second year than in the first year post-burn.
- Overall, woodborer impact on the final grade of affected lumber is significantly lower than the checking impact. Woodborer damage had no impact on dimensional lumber but had some impact on boards used for decorating panels. Checking downgraded significantly more fire-killed structural lumber and boards than woodborer damage did; severely burned wood had significantly higher checking damage than wood burned with lesser intensity.

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Saskatchewan Report

Rapport de la Saskatchewan

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and
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Status of Forest Insect and Disease Conditions in Saskatchewan - 2005

Executive Summary

The eastern spruce budworm *Choristoneura fumiferana* is the most significant insect pest in Saskatchewan's Boreal Forest. Since 1981, 5.6 million ha have been severely defoliated. In 2005, 183,511 hectares sustained moderate to severe defoliation. Spruce Budworm Decision Support System was used to prioritize spray blocks in approximately 30,000 ha of severely defoliated forest. These blocks were treated with *Bacillus thuringiensis* var. *kurstaki* (Foray 76B). Spray deposit using ADAM kits was used to measure deposit. Defoliation was not significantly (*P*=0.06) reduced in treatment blocks over controls. Defoliation rates were highly variable and on average exceeded the provincial target of 40% defoliation target. However, post-

spray defoliation in the spray blocks averaged only 31%. Preliminary predictions for 2006 are for generally reduced, but still moderate to severe defoliation forecasts in the northeastern part of the province. Populations are declining or collapsing in central and north central parts of the province. The Forest tent caterpillar *Malacosoma disstria* populations were low and no areas of severe defoliation were detected in the aerial surveys over the provincial forest. Hardwood defoliation did occur predominantly in the northwestern part of the province. Defoliation was attributed to increased incidence of leaf spot disease *Marssonina populi*, likely as a result of high levels of rainfall. Dutch elm disease (DED) *Ophiostoma novo-ulmi* Brasier continued to spread in the province. In 2005, DED extent and severity was similar to 2004 but different in its distribution. In total, 154 infected elm trees were removed: from communities and 297 from buffer zones. The number of trees removed from buffers was significantly lower than in 2004. In 2005, the legal authority of Saskatchewan Environment to manage DED under *The Forest Resources Management Act* was finalized when new Dutch Elm Disease Regulations were passed through Cabinet. Lodgepole pine dwarf mistletoe *Arceuthobium americanum* remains the most significant pest of Jack pine. Management, through silvicultural sanitation is ongoing. Provincial standards and guidelines are currently under public review and will be complete by 2006. Saskatchewan Environment continues to monitor Jack pine budworm populations. In 2004 and again in 2005, no defoliation was observed in aerial surveys. In general, trap catches were lower than in 2004, however, in 2005 monitoring locations were pooled into clusters of geographic similarity. In 2005, elevated trap counts were detected in clusters located in and around the Nisbet and Canwood island forests and in Meadow Lake Provincial Park. In 2005, aerial surveys detected a total of 15,055 ha of Larch mortality attributed to increased infestations of the Larch bark beetle *Dendroctonus simplex*. Outbreak severity of Mountain pine beetle *Dendroctonus ponderosae* in British Columbia and Alberta together with the proximity of the outbreak to boreal Jack pine raised significant concerns around the spread of into the boreal forest, led to the province drafting a restriction order under the authority of *The Forest Resources Management Act (1996)* banning the import, transport or storage of any pine forest products with bark attached originating in British Columbia, Alberta, or the United States. In 2005, new highway signage was established on the four major highways crossing the Saskatchewan Alberta border. Provincial monitoring of Banded elm bark beetle (*Scolytus schevyrewi*) was initiated in 2004 and continued in 2005. No banded elm bark beetles have been found in traps to date. Routine CFIA Gypsy moth *Lymantria dispar* monitoring revealed one positive trap in Saskatoon. Yellow-headed spruce sawfly *Pikonema alaskensis*, and the spruce weevil *Pissodes strobi* are also insects of interest in Saskatchewan

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. (Figure 1). Defoliation continued to decline slightly to 511,000 ha in 2003 and by 2004, the area defoliated decreased significantly to 292,493 ha (Figure 1).

In 2005, the moderate to severe defoliation recorded in the province decreased further to 183,511 ha (Figure 2). The defoliation is predominantly in the northeast and around La Ronge Provincial Park in north central Saskatchewan (Figure 2).

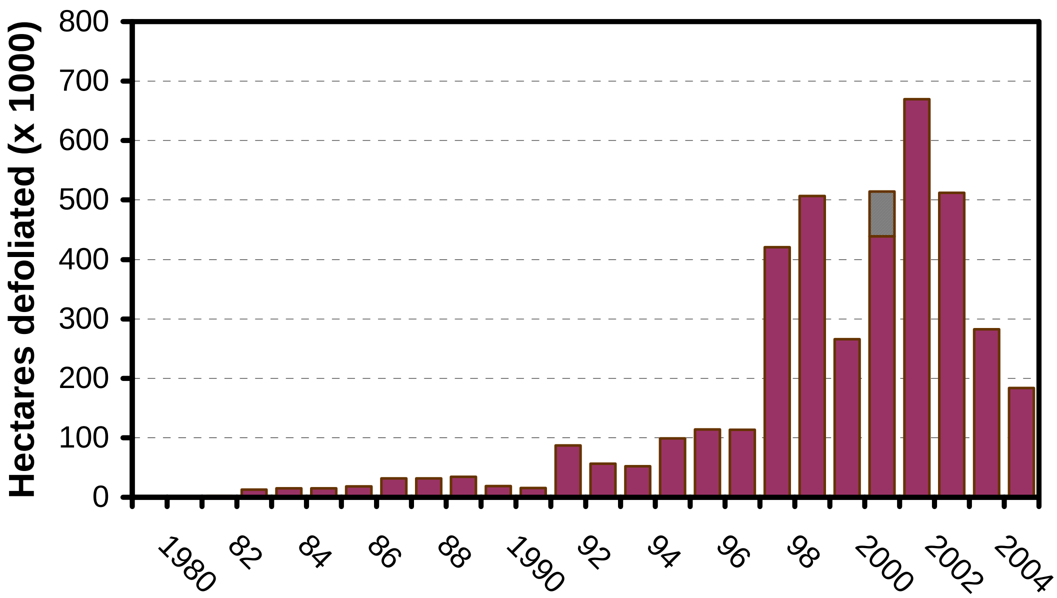
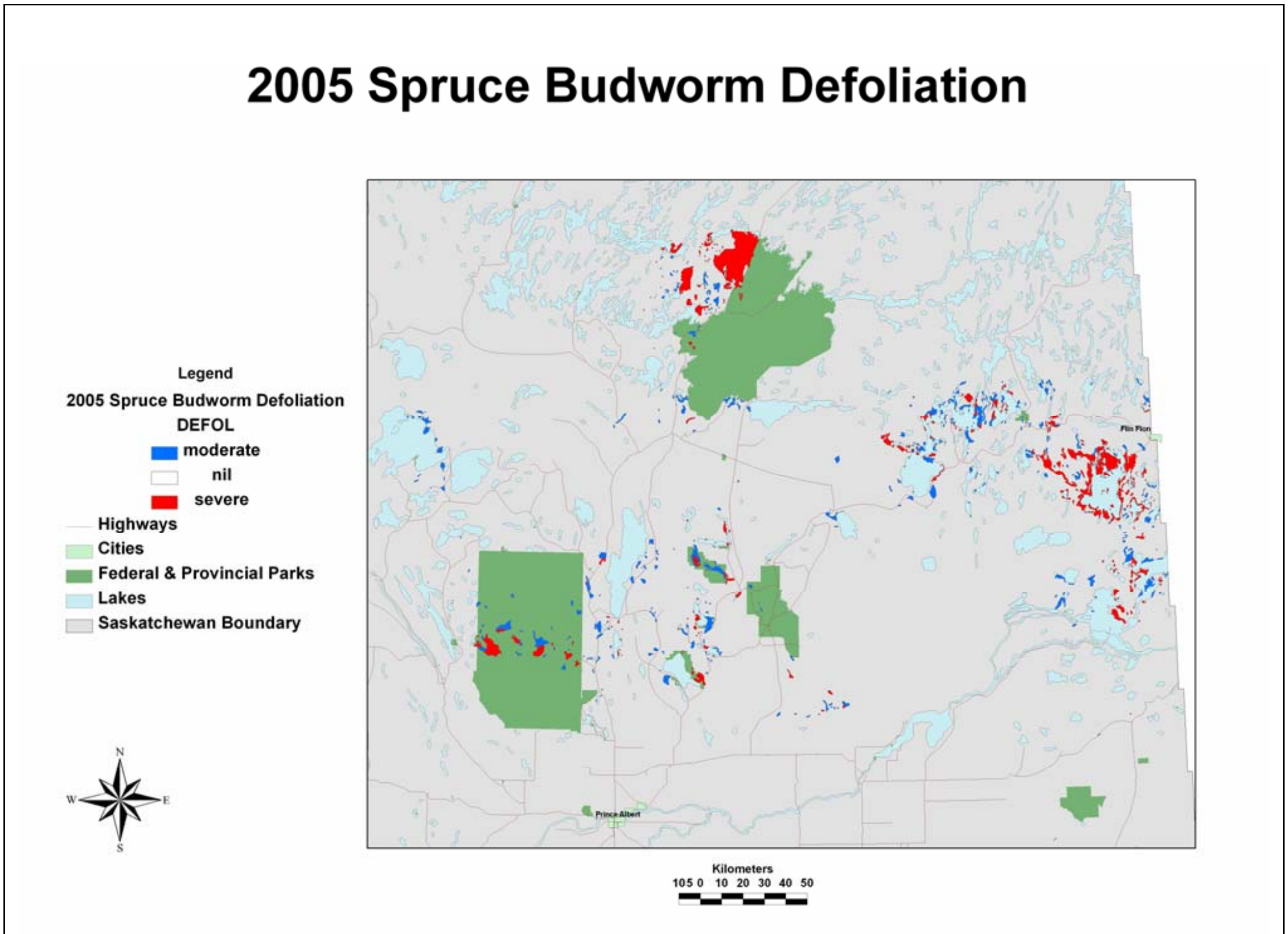


Figure 1. *Area of moderate to severe defoliation caused by the spruce budworm Choristoneura fumiferana 1980-2005.*

Saskatchewan Environment (SE) has conducted a successful foliage protection program against the SBW over the past eight years. Using historical SBW defoliation records, defoliation predictions based on 2004 L2 survey data, and forest management plans, SE developed an aerial spraying program to spray 60,416 hectares in 2005. 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%.



. Distribution of moderate to severe spruce budworm *Choristoneura fumiferana* defoliation, in central and northeastern Saskatchewan in 2005.

Program Overview

In 2005, SE conducted operational spraying over 60,416 hectares of moderate to severely defoliated white spruce and mixed-wood forest. Of the 60,416 ha treated, 2,865 ha were treated with a single application, 21,394 ha were treated with a double application, and 4,921 ha were treated with a triple application of the biological insecticide Foray 76B (*Bacillus thuringiensis* var. *kurstaki* [*Btk*]) (Valent BioSciences Corp.) at a rate of 30 BIU/1.5L/ha. In multiple treatment areas, applications were separated by 3-5 days between applications. The program consisted of 15 blocks ranging in size from 122 – 6,773 ha (Table 1). The 2005 spray blocks were located in two main geographic areas: Amisk lake and Deschambault Lake in the Creighton area. Weather and poor flying conditions delayed the start of the program. Due to high winds and significant rainfall between June 2 and 6, when La Ronge (Saskatchewan) and Flin Flon (Manitoba) received 9.4 and 15.4 mm of rain respectively, the 2005 program did not start until June 8 and was completed on June 17 (Table 1)

Table 1. Summary of the Saskatchewan spruce budworm operational spray program, 2005.

Block	Ha (net)	1st Application Date	Ha	L	2nd Application Date	Ha	L	3rd Application Date	Ha	L
1	2,007	June 13,15	1,095	1,625	June 17	979	1,459			
2	4,630	June 11,15	3,300	4,976	June 17	3,340	5,129			
3	1,524	June 13,15	1,305	1,988						
4	3,657	June 10	3,328	4,966	June 13,15	2,612	3,885			
5	1,527	June 10,11	1,128	1,625	June 15	1,287	1,947			
6	423	June 11	307	493	June 15	348	518			
7	364	June 11	456	743	June 15	279	428			
8	3,914	June 9	3,110	4,665	June 13	3,200	4,832			
9	2,159	June 11	1,682	2,500	June 15	1,819	2,867			
10	122	June 11	148	240	June 15	106	165			
11	2,296	June 10,11	1,784	2,695	June 14	1,793	2,757			
12	1,289	June 9,10	1,054	1,608	June 14	1,070	1,650			
13	1,747	June 10,11	1,458	2,188	June 15,17	1,484	2,278			
14	6,452	June 9	4,550	6,813	June 10	4,282	6,390	June 16	4,217	6,412
15	6,773	June 8,9	4,475	6,800	June 12,13	3,716	5,621	June 17	704	1,145
Total			29,180	43,925		26,315	39,926		4,921	7,557

Aircraft

In total, 5 spray aircraft provided by Battlefords Airspray and Wetaskiwin Aerial Applicators Ltd. were used in the 2005 operational program. Air tractor AT 502B aircraft were each equipped with SatLoc 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.

Weather

Between April 1, to early June 2005, 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. Accumulated heat sum was used to monitor conditions in the spray areas and aid timing and operational decisions. In 2005, heat sum accumulation in Prince Albert and La Ronge were roughly two weeks ahead of 2004. In Flin Flon, Manitoba, weather conditions were slightly warmer than average. During the operational spray program, local weather data (temperature, relative humidity, wind speed and wind direction) was obtained from Saskatchewan Environments' Fire Management and Forest Protection Branch (FMFP) network of remote automated weather stations within or near treatment blocks.

Spray Timing

The 2005 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.

Spray Deposit Monitoring

Spray deposit was assessed using Accurate Deposit Assessment Methodology (ADAM) field kits, supplied by Valent BioSciences. Blocks 1, 2, 5, 6, 8, 9, and 15 were assessed for deposit. 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. Samples were stored at 4^{o}C and processed in the laboratory in Prince Albert to determine *Btk* deposit. In total, ninety (90) trees were sampled for deposit assessment following the first application. In 2005, deposit was assessed as present or absent. On average, 92% of samples contained *Btk,* slightly down from last year's average of 96%.

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 2005 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.

Population Measures

Overall, pre-spray spruce budworm populations were 35.4 larvae per branch (SD = 23.4) in the treated blocks and 40.8 larvae per branch (SD = 22.7) in the control blocks (Table 2). Pre-spray budworm populations in the treated blocks were not significantly different from the control plots (t-test, P = 0.27).

Table 2. Spruce budworm populations and white spruce defoliation in operational blocks treated with Foray 76B at 2 x 30BIU/ha in Saskatchewan, 2005.

	Larvae per branch				Mean Defoliation (%)		
	Pre-spray	SD	Post-spray	SD	Pre-spray	Post-spray	Total
Block 1	44.0	25.9	2.6	1.7	40	35	75
Block 2	29.1	20.2	1.3	1.2	35	32	67
Block 5	35.5	20.4	2.6	2.4	15	41	56
Block 6	41.8	20.7	2.5	2.2	11	22	32
Block 8	20.7	10.3	0.9	0.4	7	16	23
Block 9	20.0	13.3	2.4	2.3	10	15	26
Block 15	52.4	28.8	1.9	1.2	25	56	81
Overall	35.4	23.4	2.0	1.8	22	31	53
Controls	40.8	22.8	2.4	1.9			61

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.

Defoliation Assessment

Total defoliation rates in the sprayed blocks were not significantly different from those in the unsprayed controls (t-test, $P = 0.06$). Total white spruce defoliation averaged 53% in the sprayed blocks and 61% in the unsprayed controls (see Table 2). Light defoliation was recorded in 26.7% of the sprayed blocks and 8.3% of the unsprayed control blocks. Moderate defoliation was recorded in 42.8% of the sprayed blocks and 58.3% of the unsprayed control blocks. Severe defoliation was recorded in 28.9% of the sprayed blocks and 33.3% of the unsprayed control blocks (Figure 3).

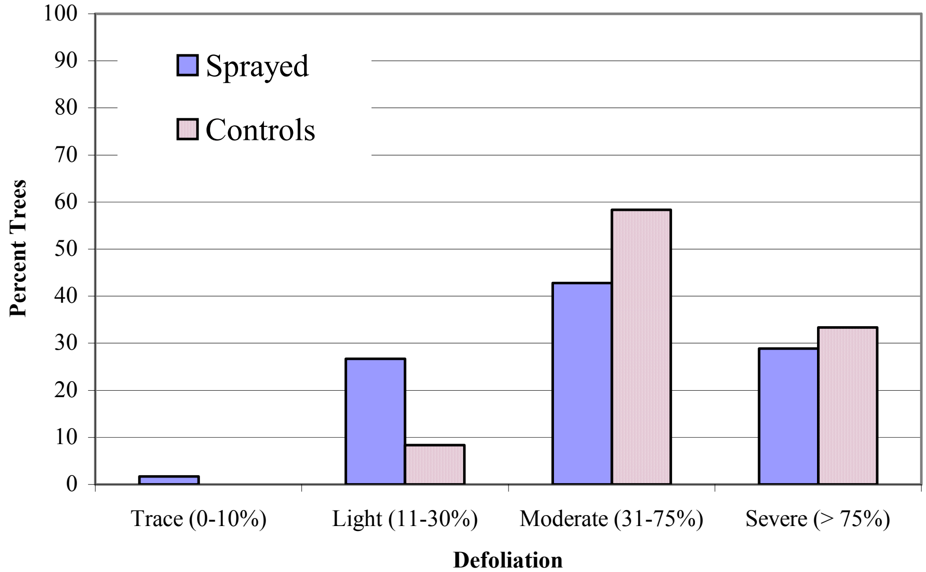


Figure 3. *Frequency distribution of defoliation classes in spray blocks in Saskatchewan, 2005.*

The high total defoliation rates in Blocks 1 and 2 may be due in part to high pre-spray defoliation in those two blocks (average defoliation = 40% and 35%, respectively). High pre-spray defoliation in Blocks 1 and 2 may have occurred because the first applications to those two blocks occurred toward the end of the program. In general, pre-spray defoliation in the spray blocks would likely have been lower if rain had not delayed the start of the spray program. The LDI at the time of the first application in Block 1 was 5.4, which is fairly high. Block 1 also had high pre-spray budworm populations, averaging 44.0 larvae per branch, which may also help to explain the relatively lower level of foliage protection in Block 1.

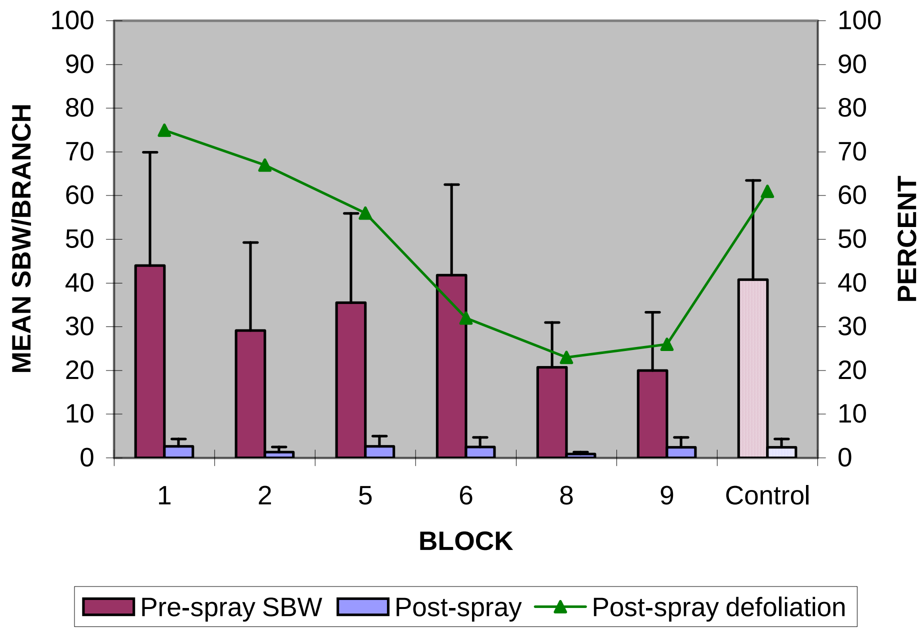


Figure 4. *Overall average (+SE) pre- (maroon) and post-spray (lilac) spruce budworm per branch and percent post-spray (green line) defoliation on white spruce sampled in blocks which received double application of Btk in the 2005 spray program.*

Table 2 shows that pre-spray defoliation was not high in Block 5 (average defoliation = 15%). However, pre-spray budworm populations were moderately high, averaging 35.5 larvae per branch, and the percentage of trees with *Btk* deposit after the first application was somewhat low, averaging 75%, which might explain the lower foliage protection in Block 5.

The overall total defoliation rates (see Figure 5) were higher than the provincial target (40%) in the sprayed blocks (average defoliation = 53%) than in controls (61%). Of the sprayed blocks, Blocks 1, 2, 5 and 15 all had total defoliation rates over 40% (average defoliation = 75%, 67%, 56%, and 81%, respectively). However, post-spray defoliation in the spray blocks averaged only 31%.

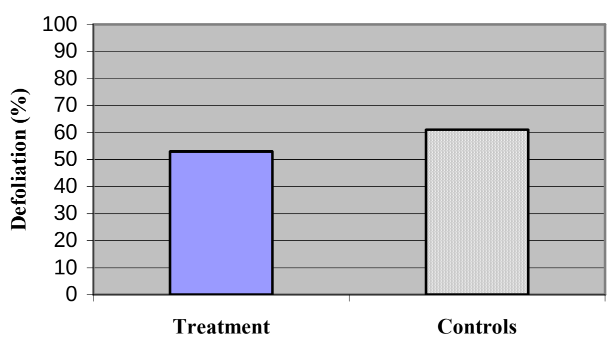


Figure 5. Overall defoliation by Spruce Budworm in sprayed and untreated control plots in Saskatchewan, 2006.

Summary of 2005 spray program and predictions for 2006

- In 2005, spring temperatures were unusually cool in much of Canada. The wet weather and cooler temperatures delayed the onset of the 2005 aerial spraying program. The program began June 8 and was complete by June 17, 2005.
- The 2005 aerial spray program treated 60,416 ha for the control of SBW. Of the 60,416 ha treated, 2,865 ha were treated with a single application, 21,394 ha were treated with a double application, and 4,921 ha were treated with a triple application of the biological insecticide Foray 76B (*Bacillus thuringiensis* var. *kurstaki)* at a rate of 30 BIU/1.5L/ha. The program treated 15 blocks ranging in size from 122 – 6,773 ha.
- Defoliation rates were highly variable and on average exceeded the provincial target of 40% defoliation target. However, post-spray defoliation in the spray blocks averaged only 31%.
- Aerial surveys and overwintering L2 surveys conducted in 2005. Lower populations than in 2004, but still moderate to severe and defoliation is predicted in the northeastern portion of the province. Populations in the northeastern part of the province will continue to cause severe defoliation..
- Defoliation in upland black spruce not as prevalent as in 2004.
- In Central Saskatchewan, severe defoliation is anticipated in the Weyakwin, Swan and Candle Lake areas, however, defoliation in Prince Albert National Park (PANP) north of Waskesiu, is minimal. Defoliation in areas south of Waskesiu in PANP is expected to continue. Average number of L2 larvae dropped from 971 per10sq m branch in 2004, to 659 per10sq m branch in 2005
- Number of sites where severe defoliation is predicted declined from 60% in 2004 to 27% in 2005.
- In the north central region, to the north of La Ronge and in the Wapawekka hills populations have collapsed. Mortality is evident in this region.
- In 2006, the operational spray program will likely be focused in the northeastern part of Saskatchewan.

FOREST TENT CATERPILLAR *Malacosoma disstria* Hübner

INTRODUCTION

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 a renewed interest in aspen as a commercially important species in the forest. Forest companies in some regions now implement active management of the aspen resource to fuel new

Oriented Strand Board (OSB mills). FTC is also a significant nuisance especially in provincial parks, campgrounds, and municipalities. Future economic initiatives, and the need to address safety and nuisance issues in the parks, will most likely result in increased interest in protection programs to minimize losses to pests such as the FTC in the future.

The 2005 aerial surveys did not detect defoliation in any of the commercial forest regions of Saskatchewan. However, aspen *(Populus tremuloides)* and Balsam poplar *(Populus balsamifera)* defoliation did occur in 2005. As a result of the cool wet summers of 2004 and 2005 we have observed and increasing incidence of aspen defoliation by leaf spot diseases. Aerial Surveys detected significant areas of leas spot disease *Marssonina populi* infection as well as infection in Balsam poplar caused by the leaf blight *Linospora tetraspora* (Figure 6).

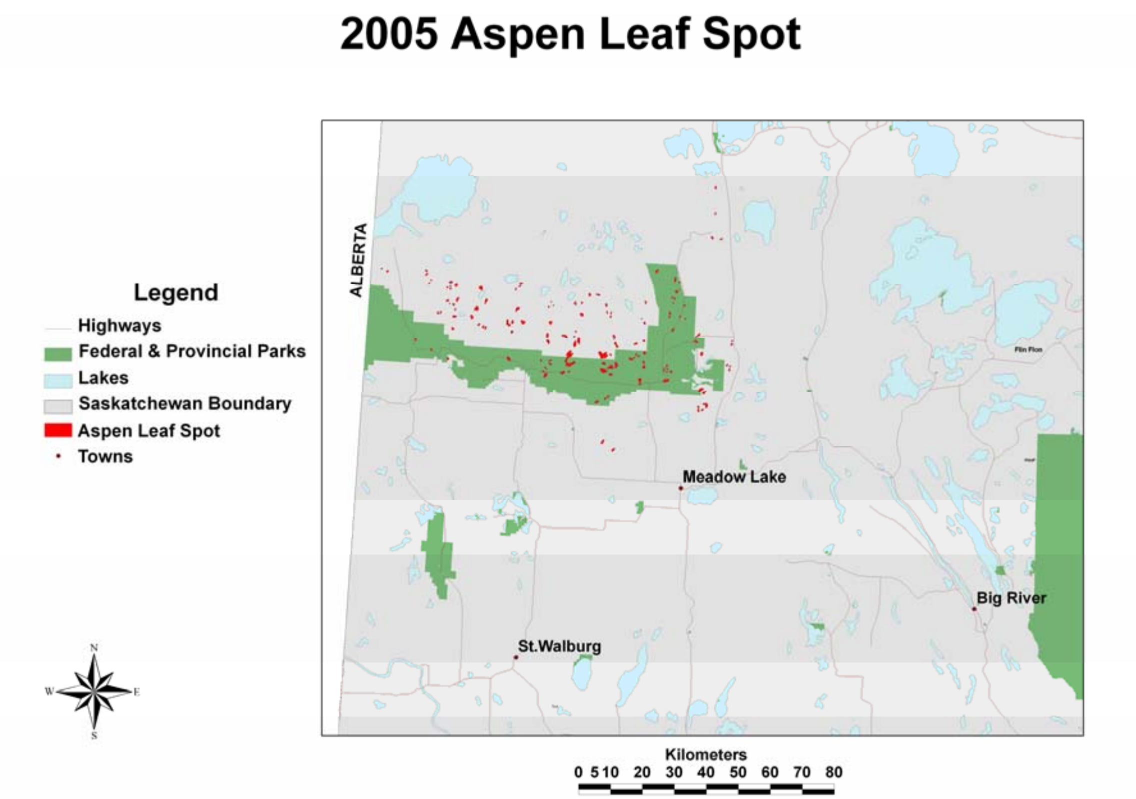


Figure 6. Distribution of stands infected by leaf spot disease *Marssonina populi* and leaf blight *Linospora tetraspora* in Saskatchewan 2005.

JACK PINE BUDWORM ***Choristoneura pinus pinus.*** **Freeman.**

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 2005, this network was expanded to cover a total of 23 sites located throughout the commercial forest zone (Figure 7).

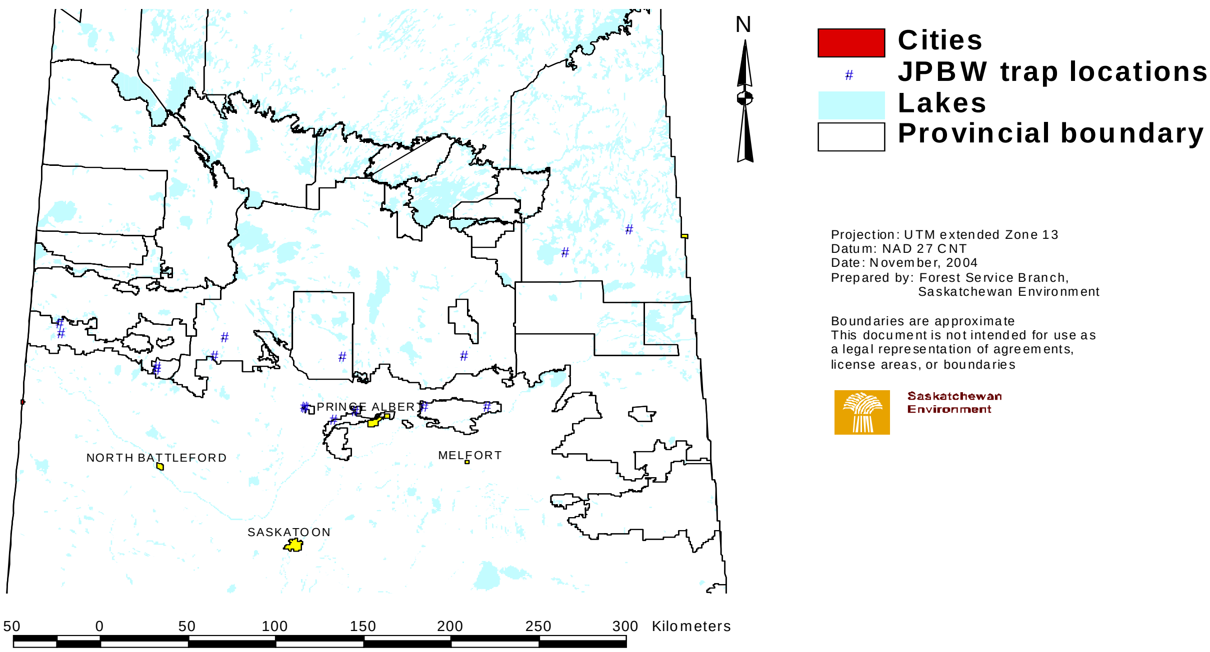


Figure 7. Location of the 23 Jack pine budworm trapping sites set up to monitor trap catchers to provide an early warning system of future outbreak.

In 2005 monitoring trap catches were pooled into nine (9) regional clusters based on geographic similarity where trap locations were relatively near to each other (Figure 8). 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. In 2005, no defoliation was observed in aerial surveys.

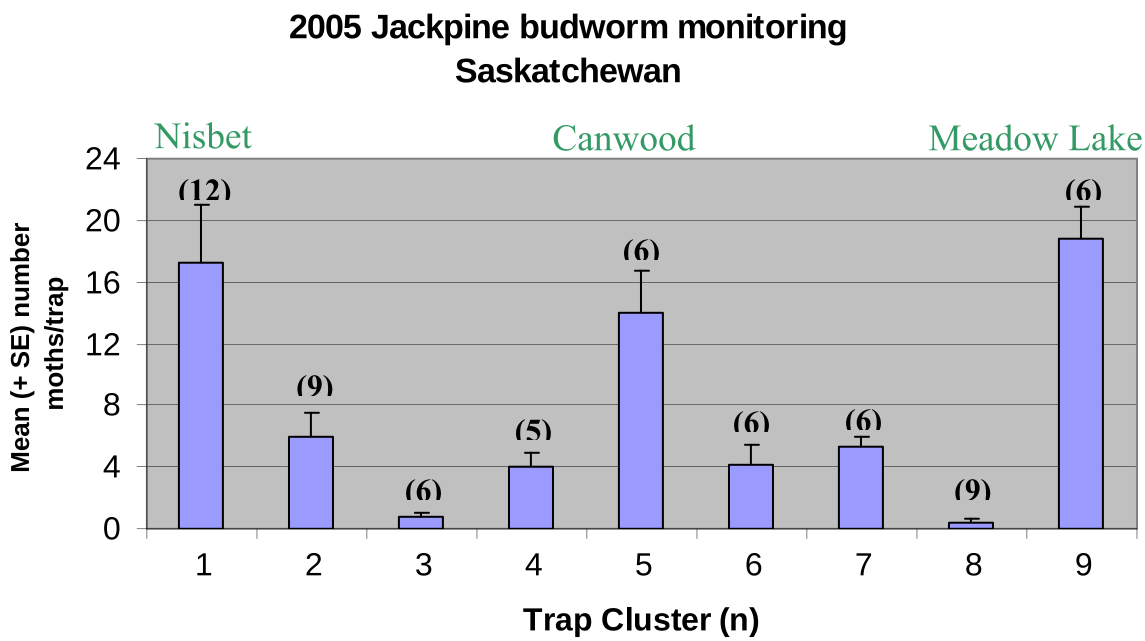


Figure 8. Mean number of moths per trap in each of 9 pooled trap site locations. Trap cluster 1 comprises all traps pooled from 4 sites (for a total of 12 taps) pooled from sites in the Nisbet island forest area; Trap cluster 5 comprises pooled mean of two trapping sites in the Canwood Island forest 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. DMT is distributed throughout the boreal plains ecoregion. There are also extensive areas of severely infested Jack pine to the southeast of Lake Athabasca; however, this area is not within the operational forest land-base. Forest management practices, such as fire-suppression and selective logging have created conditions that expedite the spread of this parasitic plant. The most recent surveys were those conducted

by the Forest Insect and Disease Survey (FIDS). As a result of these surveys, it was estimated that between 1984 and 1996 205,000 ha of Jack pine forest are severely infested resulting in an estimated 369,000 m3 lost to mortality (Brandt *et al* 1998). The most significantly impacted areas are those found in the forest management zone in the Boreal Transition Ecoregion – in particular in the Canwood, Fort a la Corne and Nisbet Island forests (Figure 7). On June 28 2002, two lightning strikes started the Crutwell forest fire. This fire burned an area of approximately 9,000 ha, sanitizing a significant portion of the most severely infested Jackpine stands in the northern part of the Nisbet forest.

Currently, two strategies are currently used in DMT management in Saskatchewan :

1. Sanitation in existing stands. Tactics used here focus on limiting host-availability. This is achieved mostly through clearcutting severely infested stands of Jack pine and limiting the spread to other susceptible stands in the forest through the use of non-host stands and geographic features to act as buffers.
2. Exclusion and sanitation in future forests. Tactics include integration of a 20 m buffer zone to isolate new regeneration from adjacent infestations. Buffers can be maintained clear or encourage the establishment of non-host species to restrict seed dispersal into the new stand.

Provincial standards and guidelines have been drafted and reviewed. These documents will be released in April 2006.

The eastern spruce mistletoe *Arceuthobium pusillum* is a pest in black *Picea mariana* (Mill) B.S.P. and white spruce *P. glauca* and is found predominantly in the east-Boreal region in the Hudson Bay area. This species is considered, at the moment, to be of lesser economic significance.

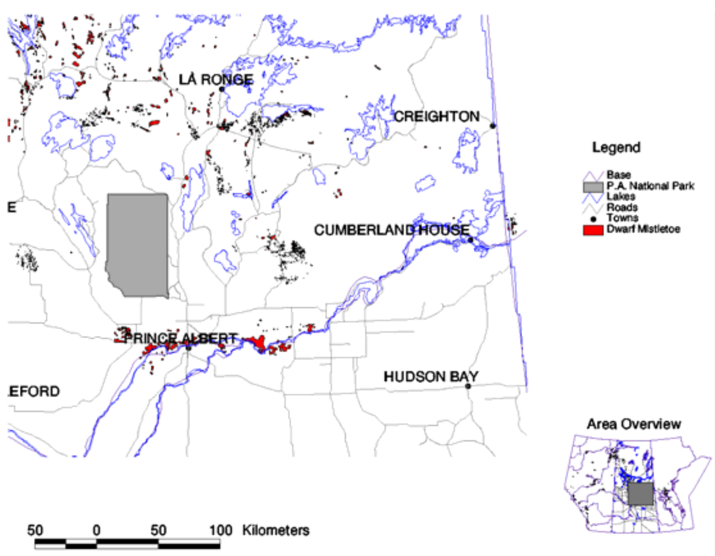


Figure 9. *Distribution of severe mistletoe infestations in Jack Pine stands in Central Saskatchewan (Lat 53° - 56° N and Long 102° -108° W). Brandt et al. 1998.*

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 8).

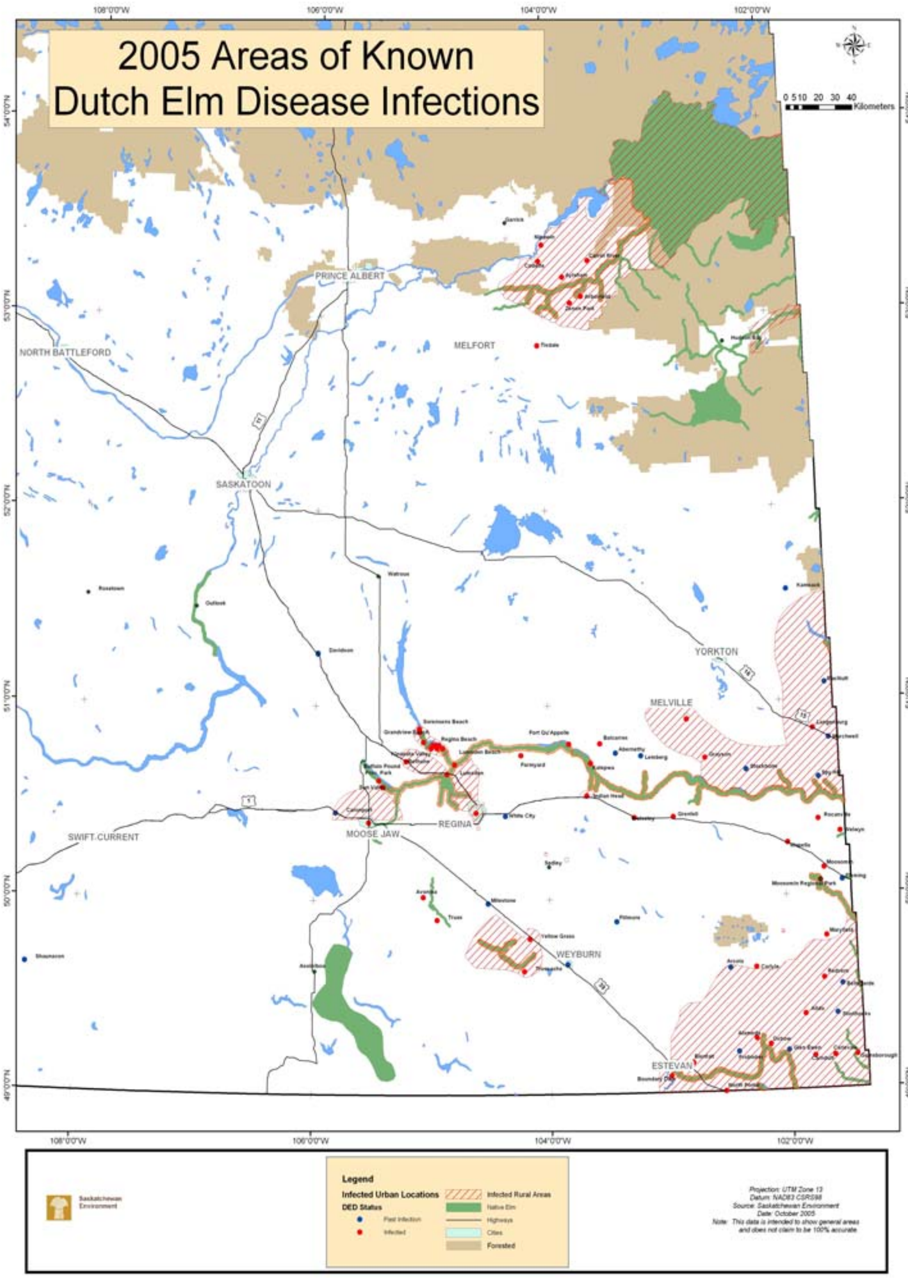


Figure 10. *Extent of the spread of Dutch elm disease in Saskatchewan by 2005.*

DED Management Program

In Saskatchewan, DED management is administered by the Forest Services Branch (FSB) of Saskatchewan Environment (SE). Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR) and the Saskatchewan Dutch Elm Disease Association (SDEDA) work cooperatively with SE to facilitate the management of DED. In previous years, SE conducted all the DED surveillance; however, since 2001, DED surveillance and removals services are under contract.

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*. In February 2005, new Dutch Elm Disease Regulations were passed by Cabinet.
- **Public awareness and education -** Roadside signs; information leaflets; DED Infoline 1 (800) SASKELM; communications campaign SDEDA, SE, & SOS ELMS.
- **Cost-share communities –** SE has entered into partnership with a total of 39 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. conduct 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 2005, 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.
- **Reforestation** - Improve species diversity and age class distribution in the urban forest. An urban diversification program through Tree Canada Foundation was launched on May 12, 2000. Part of this initiative was the introduction of 1,000 Discovery Elm *Ulmus davidiana* var. *japonica* c.v, along with 25 other non-host species, for distribution among about 35 communities in Saskatchewan. Although, this program has been discontinued, tree diversification is encouraged

- **Research –** SE partners and collaborates in Research and development initiatives that help improve DED management services.

2005 Program Summary

DED continues to spread throughout the province. In 2005, the total number of trees removed was 451. This figure is somewhat lower than the 586 trees removed in 2004. In 2005, the number of trees removed in the municipalities was similar (154 in 2005 as compared to 152 in 2004). However, the distribution of these diseased trees was different. There were significant **decreases** in the Cities of Regina and Estevan and in the Town of Lumsden, while in the resort villages of Katepwa, Regina Beach 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 2005 (297) as compared to 2004 (434). The buffers continue to be expanded to protect the cities of Regina and Moose Jaw. In 2005, only two (2) DED positive trees found in the City of Regina. This number is significantly lower than the 11 trees removed in 2004.

In 2005 the incidence of DED in Siberian elm was confirmed. This is the first record of Siberian elm infection in SK. However, no new infections were found in previously infected communities of Balcarres, Grenfell, Tisdale, Moose Jaw and Indian Head. In addition, the cities of Saskatoon, Yorkton, Prince Albert, North Battleford and Swift current remain disease-free

Table 3. Total number of elm trees removed from Saskatchewan municipalities and buffer areas, in 2004 as compared to 2005.

	NO. OF ELMS REMOVED	
LOCATION	**2004**	**2005**
MUNICIPALITIES (DED; HAZARD)	152	154
BUFFERS		
Regina	228	119
Estevan	93	33
Fort Qu'Appelle	37	42
Moose Jaw	60	60
Tisdale	8	2
Indian Head	8	41
BUFFER TOTALS	**434**	**297**
TOTAL	**586**	**451**

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. As a result of aerial surveys in 2005, an additional 12,952 hectares of new damage was mapped bringing the current total to 15, 055 hectares. 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. Currently, Larch is not considered a commercial product, however, there are initiatives to explore value-added opportunities and alternative forest products in Saskatchewan.

INVASIVE NOT NATIVE PESTS TO THE BOREAL FOREST

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).

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 are building and outbreaks in the Willmore wilderness and Jasper area are threatening to spread through the intergression zone where the natural range of Lodgepole pine overlaps the natural range of Jack pine and 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 – a major species in the boreal forest. The commercial zone in Saskatchewan's boreal forest 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.

Monitoring susceptible forest cover – Cypress Hills

In 2005, pheromone baited Lindgren multiple funnel traps (Lindgren 1986) were deployed as an early detection system in the Center and West blocks. 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.

Currently, management includes cutting the most susceptible stands in an attempt to re-structure age class distribution as well as increased monitoring. In 2002, forest health surveys were developed to monitor the health of trees in the core area. These surveys continue in 2005 and will help in the early detection of mountain pine beetle activity in the core area and allow for timely intervention.

Saskatchewan Strategy & Response

The two main strategies are summarized in Table 4 :

1. Prevention

a) Communications and Public Awareness

- Prevention through increased education/information of risks and develop "market demand" for de-barked wood. If processors demand de-barked logs, merchants will be forced to supply that demand
- In addition, in 2005, Saskatchewan Environment installed new 4 foot x 8 foot highway signs (Figure 11) to remind the public not to bring wood with bark into Saskatchewan. These signs have been deployed along the Saskatchewan/Alberta Border on the four major transportation routes: Trans Canada highway; highway 7, Highway 16 and highway 55.

Figure 11. *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.*

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 is still active in 2005.

- 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.

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.

Table 4. Summary of Saskatchewan's response to MPB threat.

Communications	Restriction/Regulation
MPB Information package sent to: forest products processors known log home companies implement highway signage on major highways between Alberta and Saskatchewan.	**Ministers Order** Order under authority of *the Forest Resources Management Act* Order restricts import, storage or transport of Pine forest products with bark attached originating in BC, AB or US
Media releases CBC TV, CBC Radio, Missinipe Broadcasting Corporation. Interview translated into Cree & Dene; Local and provincial print media Environmental Newsline article, SE website[1.]	**June 27, 2002 Order Mailed to AB & BC** • copies sent to CFIA, Canada Customs; SK Dept. Transportation • SK coordinate with Region BC, AB, MB and ON • SK collaborate and integrate efforts with AB • AB will require valid SK documentation to allow entry of shipments into AB after Sept 31 SE enforcement officers informed as to seizure protocols

1. http://www.se.gov.sk.ca/media/Saskatchewan%20Environmentnewsline/Pine_Beetle.htm

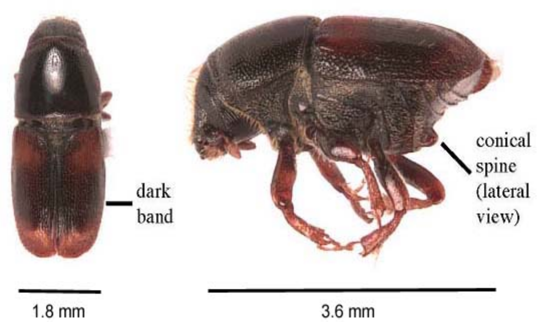
Since the mountain pine beetle is not a restricted pest, the Canadian Food Inspection Agency (CFIA) has no mandate to regulate the beetle even in logs shipped into Canada from the United States. In 2002, Alberta Sustainable Resource Development employees intercepted 3 truck-loads transporting cant wood (25% bark attached) which contained active MPB galleries. The trucks and logs were seized and officials alerted Saskatchewan Environment. The threat of human-caused introduction continues to be significant.

European Gypsy Moth – *Lymantria dispar*

Gypsy moth (*Lymantria dispar)* remains a species of significant 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 2005 the CFIA continued ongoing monitoring efforts in Saskatchewan by deploying 171 pheromone-baited pherocon IIID traps. Only one positive trap was found in the Gabriel Dumont Park in Saskatoon. The CFIA will expand trapping in this location to determine if any moths survived.

Introduction of Gypsy moth egg masses by importing Christmas trees from high-risk areas is still considered to be the most significant pathway. Communications were released to remind the public to help reduce the risk of introduction. Proper disposal, in municipal burning or mulching programs, was recommended.

Banded Elm Bark Beetle – *Scolytus schevyrewi* Semenov

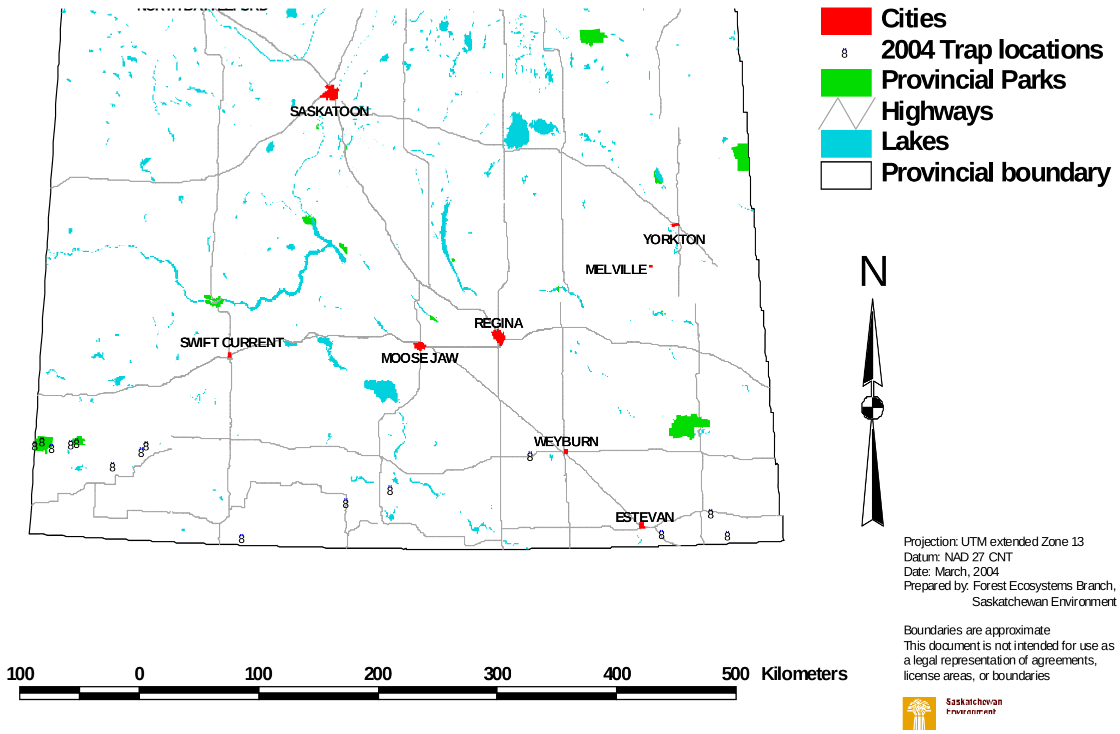


The banded elm bark beetle *Scolytus schevyrewi* is an exotic insect originating in eastern Siberia. In 2004 and again in 2005, 12-funnel Lindgren® funnel traps, baited with commercially available Exotic beetle bait[1], were deployed in 15 locations along the Southern Saskatchewan Border (Figure 12). 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.

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

Figure 12. Distribution of Scolytus schevyrewi monitoring traps in Southern Saskatchewan 2004-05.



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Manitoba Report

Rapport du Manitoba

Presented by:

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Forest Pests in Manitoba – 2005

Spruce Budworm

In 2005 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. In 2005 spruce budworm defoliation polygons were roughly digitized directly into ESRI ArcView Shapefiles using Tablet PC's by the aerial observers during the detection flights. The total area of infestation was approximately 65,550 ha. The area of infestation was 33,902 ha in the Northwest Region (Figure 1), 6,961 ha in the Eastern Region (Figure 2), and 24,687 ha in Spruce Woods Provincial Forest and Park (Figure 3).

Based on the 2004 aerial defoliation survey and defoliation predictions derived from the 2004 egg mass surveys, an operational budworm suppression program was implemented in 2005 within the Tolko Industries Inc. Forest Management License (FML) in the Northwest Region.

The biosynthetic insecticide, Mimic® 240 LV (tebufenozide) was aerially applied to 21,756 ha in the Northwest Region. 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 5000 Micronair rotary atomizer nozzles. The insecticide applications were carried out from June 7 to June 15.

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 tip 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 2005 spray project was successful. Within treatment blocks, the mean population reduction was approximately 80% (Table 1). Light defoliation occurred in the treated blocks within the Saskatchewan River Forest Section, while moderate defoliation occurred in the untreated controls. In the Highrock Forest Section, moderate defoliation occurred in the treated blocks, while severe defoliation occurred in the untreated controls (Table 2). Larval mortality due to the Mimic treatment is not always complete at the time of the post spray survey. Therefore, population levels in the treated and untreated controls were also compared in the egg stage. The number of egg masses per surviving post spray larvae was significantly higher in the untreated controls than in the spray blocks in the Saskatchewan River Forest Section, but not in the Highrock Forest Section (Table 1).

Figure 1: Spruce Budworm 2005 Defoliation Northwestern Manitoba (33,902 ha).

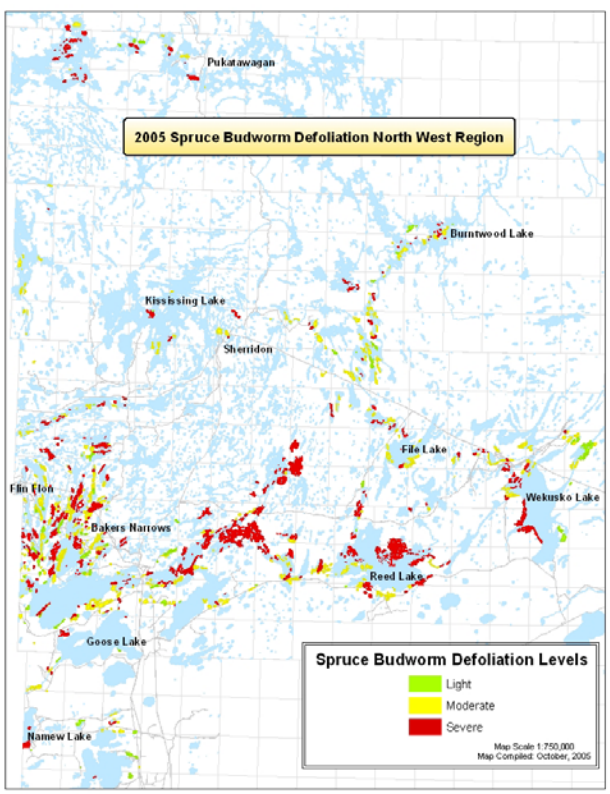


Figure 2: Spruce Budworm 2005 Defoliation Eastern Manitoba (6,961 ha).

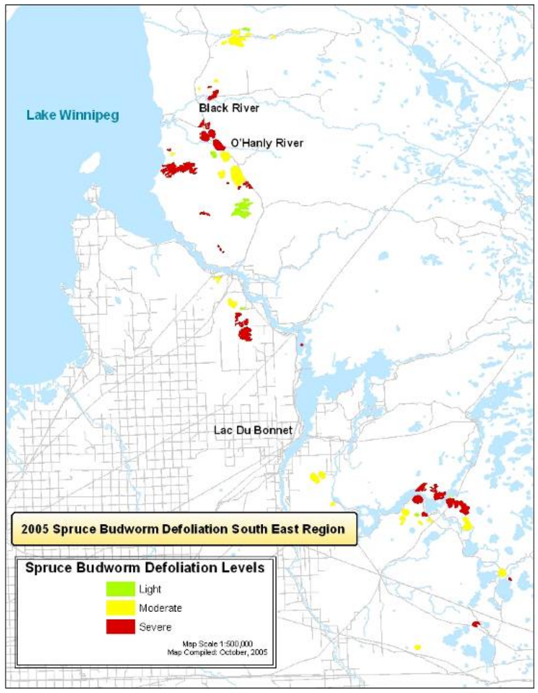


Figure 3: Spruce Budworm 2005 Defoliation Southwestern Manitoba (24,687 ha).

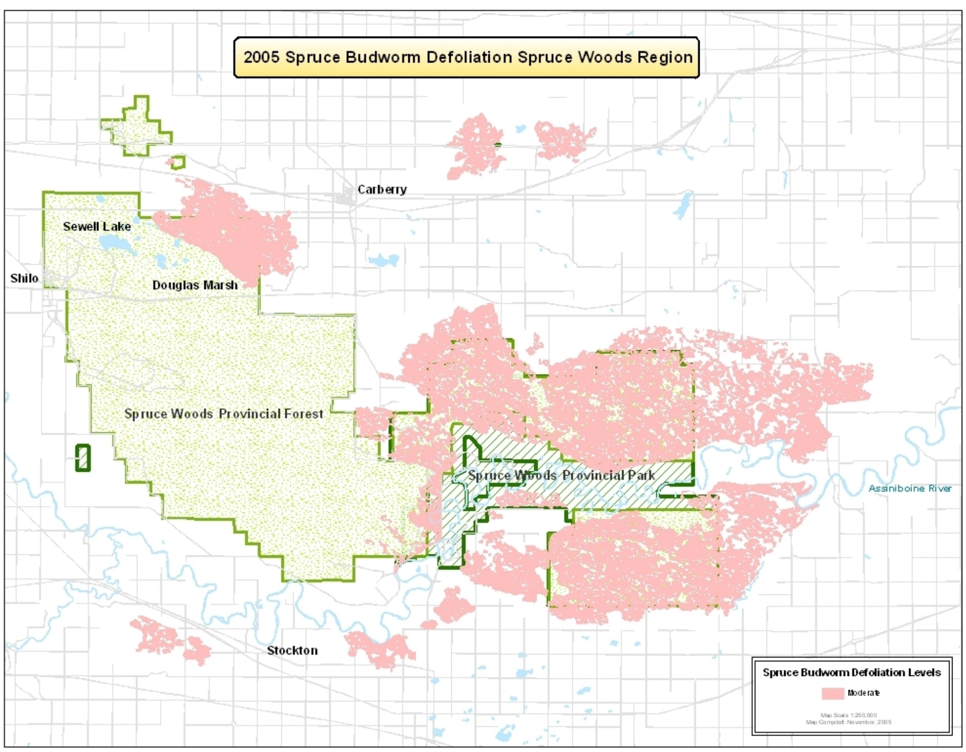


Table 1: Spruce Budworm (Northwest Region) - Percent reduction in larval numbers and egg masses/surviving post spray larvae.

Location	Area Treated	Pre Spray Larvae[b]	Post Spray Larvae[b]	Larval Mortality	Egg Masses /Surviving Larvae
Saskatchewan R. Forest Section	9,898 ha[a]	10	2	80%	.75
Saskatchewan R. Untreated Controls	N/A	13	5	61%	6
Highrock Forest Section	11,867 ha[a]	16	3	81%	2.8
Highrock Untreated Controls	N/A	18	7	62%	3.1

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

Defoliation and hazard rating surveys were conducted in the spray and untreated control blocks during the month of August. Highrock Forest Section had a moderate hazard rating and the Saskatchewan River Forest Section had a low hazard rating (Table 2). Defoliation classes are 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: Spruce Budworm (Northwest Region) - 2005 defoliation hazard rating for 2006.

Location	2005 Defoliation	2006 Hazard Rating
Saskatchewan River Forest Section [a]	Light	Low
Saskatchewan River Untreated Controls	Moderate	Low
Highrock Forest Section [a]	Moderate	Moderate
Highrock Forest Section Untreated Controls	Severe	Moderate

[a.] Treatment: Mimic, 70-gram a.i./ha

Egg mass surveys were carried out in other regions of the province. Defoliation predictions for 2006 range from light to moderate in the Eastern Region, light in the Interlake Region, severe in the Spruce Woods Provincial Park and Forest, light in the Duck Mountain and Lake Winnipegosis areas and light in the Northeast Region. See Tables 3 to 6.

Table 3: 2005 Spruce Budworm Defoliation and Predictions for 2006 (Eastern Region).

Location	2005 Defoliation	2005 Egg Mass/10m^2	2006 Defoliation Prediction
Birds Hill Park	Moderate	76	Moderate
Falcon Lake	Light	0	Light
Dorothy Lake	Severe	60	Moderate
Lac du Bonnet	Moderate	25	Light
McArthur Falls	Moderate	11	Light
Nopiming Park	Light	9	Light
Black/O'Hanly Rivers	Moderate	81	Moderate
Sandy River	Moderate	62	Moderate
Manigotagan	Light	12	Light
Rice River Road	Light	11	Light

Table 4: 2005 Spruce Budworm Defoliation and Predictions for 2006 (Northeast Region).

Location	2005 Defoliation	2005 Egg Mass/10m^2	2006 Defoliation Prediction
Jenpeg	Light	0	Light
Paint Lake	Moderate	145	Moderate
Setting Lake	Light	0	Light

Table 5: 2005 Spruce Budworm Defoliation and Predictions for 2006 (Interlake Region).

Location	2005 Defoliation	2005 Egg Mass/10m^2	2006 Defoliation Prediction
Grindstone Pt.	Light	0	Light
Hodgson	Light	0	Light
L. St George	Light	0	Light
Pine Dock	Light	0	Light

Table 6: 2005 Spruce Budworm Defoliation and Predictions for 2006 (Western Region).

Location	2005 Defoliation	2005 Egg Mass/10m^2	2006 Defoliation Prediction
Dawson Bay	Light	0	Light
Davey Lake	Light	0	Light
Pelican Lake	Light	0	Light
Spruce Woods Park	Severe	440	Severe
Spruce Woods Forest	Severe	99	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 are presented by region in Table 7.

Table 7: Spruce Budworm Pheromone Trapping.

Location	2005 Moth Capture/Trap
Northwest Region	365
Northeast Region	264
Western Region	60
Southwest Region (Spruce Woods)	1,357
Interlake Region	243
Eastern Region	246

Dutch Elm Disease

The annual Dutch elm disease (DED) surveillance program started on May 17th and ended Sept 2nd, 2005. The survey program ended fairly early because the external symptoms were masked by early fall colouration.

All of the 37 cost-sharing communities were surveyed three times including the firewood survey in the early spring. The Winnipeg buffer zone rural municipalities were completely surveyed twice.

Black spot of elm or elm anthracnose and leaf scorch were significant problems in some communities and caused confusion to homeowners. A wind storm in July caused quite a lot of limb damage and blow down. Consequently, more elm wood was being stored for firewood. Next year it is expected that there will be an upswing in elm bark beetle numbers from the damaged trees and the stored wood.

The 2005 season was the second year using the new computer tracking program called Urban Forest Information System. The program has performed well after some contract work in early spring on the reporting functions. The GPS/GIS component has not been implemented yet because this will involve new hardware, new software and many hours of programming. This phase is being initiated and is anticipated to be operational within two years.

Tree removal data from the past year is provided as follows: From April 1, 2004 to March 31, 2005 Provincial DED sanitation crews removed 8,412 trees. Of the 8,412 diseased and hazard trees that were removed, 4,762 were removed within the Winnipeg DED Buffer Zone and 3,650 were removed throughout the remainder of the Province. The Cities of Winnipeg and Brandon removed 3,373 and 1,077 trees in 2004/05, respectively.

Surveillance data for the current year is provided as follows: During the 2005 Provincial summer survey, 4,024 elms were marked for removal within the buffer zone area around the City of Winnipeg. There were also 3,869 elms marked in and around the 37 cost-sharing communities, bringing the total number of elms marked during the Provincial summer survey to 7,893 In addition, 410 firewood piles were identified for removal throughout the entire survey area. In the City of Winnipeg, 3,397 elms were marked for removal, of which 2,279 were diagnosed as having DED and the remainder 1,118 classified as hazards. In addition, the City of Winnipeg issued 264 firewood notices. The City of Brandon had 1,112 elms and 57 elm firewood piles identified for removal.

The major vector of DED in Manitoba is the native elm bark beetle, *Hylurgopinus rufipes*. The more aggressive smaller European elm bark beetle, *Scolytus multistriatus*, occurs sporadically in the province and does not play a role in the transmission of DED. Manitoba Conservation has been monitoring this beetle since 1982 using pheromone traps. Manitoba Conservation operates traps in five locations spread over southern Manitoba. Six specimens were captured in total in rural Manitoba from 1982-2004. In 2005, no specimens were captured. Trap monitoring is terminated after two killing frosts, usually by mid-November. In 2006, pheromone traps will be located in Riding Mountain National Park in western Manitoba. In its biennial survey, the City of Winnipeg found three smaller European elm bark beetles in 1999 and none have been captured since.

Jack Pine Budworm

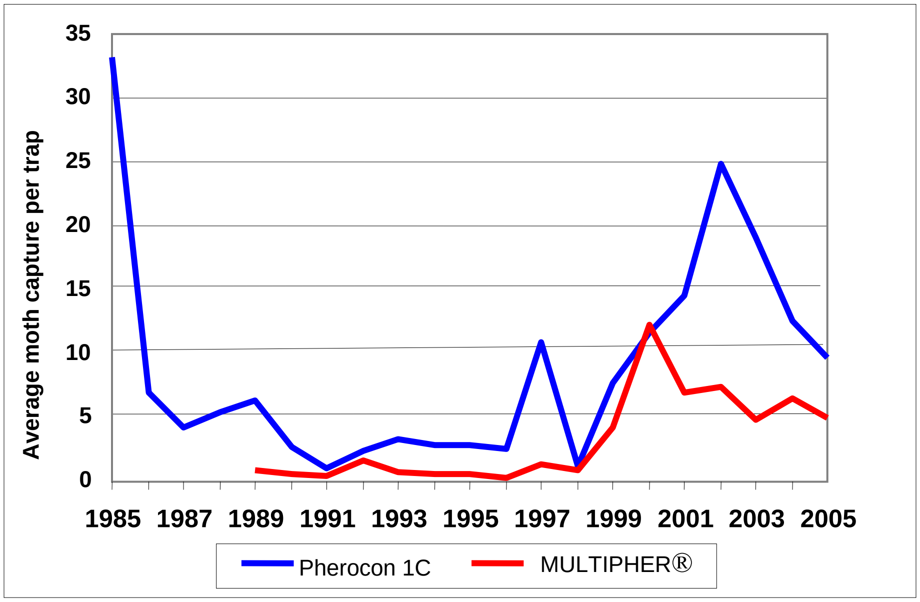
Defoliation by jack pine budworm, *Choristoneura pinus*, in Manitoba, continues to be negligible and the annual average moth captures have decreased in several areas throughout Manitoba's jack pine (*Pinus banksiana*) forests. Adult jack pine budworm males have been monitored with pheromone baited traps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

Twelve locations across Manitoba are monitored with pheromone traps. 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 2005, the number of male moth captures in both trap types decreased slightly throughout the province (Figure 4). Moth numbers dropped significantly in three sites, increased significantly in three sites and stayed the same in the remaining six collection sites. Shilo, Kississing Lake, and Moose Lake Road decreased while Whiteshell, St. Martin and Grand Rapids increased. The overall provincial average was 10 moths per Pherocon trap and 5 moths per Multipher trap. A plausible reason for the slight drop could be the cool, wet weather Manitoba experienced in the spring of 2005 which followed the coldest summer on record in 2004.

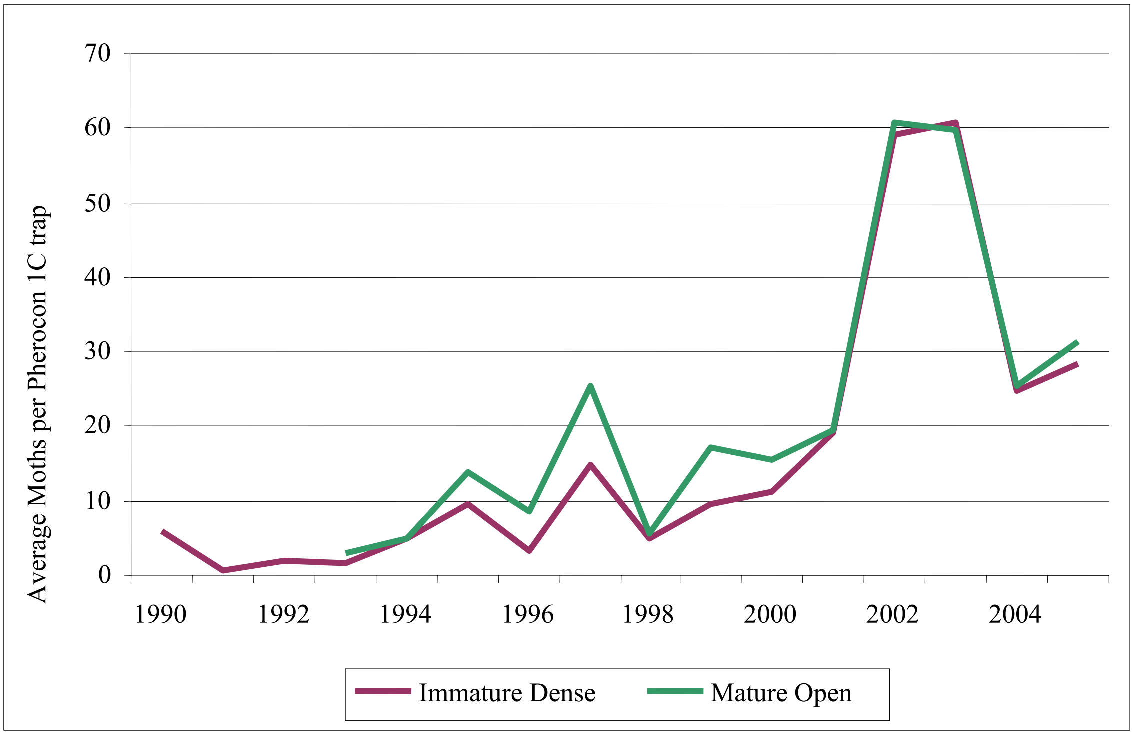
Branch assessment for shoot defoliation and egg masses were completed. No defoliation was recorded but one egg mass was found in the Whiteshell site. Pollen cone bud levels for 2006 are predicted to be 57 % on the branch tips.

Figure 4: Annual male jack pine budworm moth capture 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 increased slightly in 2005. There has been little difference in pollen cone bud levels between the immature/dense and mature/open jack pine stands.

Figure 5: Annual average male jack pine budworm moth captures in two stand types.



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 selected herbicides were triclopyr, glyphosate and picloram/2,4-D using a basal spray, EZJect and hack and squirt application method, respectively. At the time of treatment, thirty trees per size class per species were selected and rated for vigour in each herbicide treatment (Table 8). Tree vigour was assessed for two consecutive seasons both in the spring and fall.

Table 8: Percent tree vigour at pre-treatment June 2004 in selected dwarf mistletoe infected trees.

TREATMENT	TREE SPECIES	DBH CLASS (cm)	TREE VIGOUR (% of total)			
			Healthy	Stressed	Declining	Dead
Triclopyr (Basal spray)	Jack Pine	10 – 20	86.7	6.7	6.7	0
		20 – 30	93.3	6.7	0	0
	Black Spruce	10 – 20	100	0	0	0
		20 – 30	100	0	0	0
Glyphosate (EZ-Ject)	Jack Pine	10 – 20	100	0	0	0
		20 – 30	93.3	6.7	0	0
	Black Spruce	10 – 20	93.3	6.7	0	0
		20 – 30	96.7	3.3	0	0
Picloram and 2,4-D (Hack and squirt)	Jack Pine	10 – 20	98.0	2.0	0	0
		20 – 30	100	0	0	0
	Black Spruce	10 – 20	97.1	2.9	0	0
		20 – 30	100	0	0	0

The final assessment occurred in November 2005 (Table 9) and results were variable between size classes and tree species. The smaller diameter trees had higher mortality rates and the most effective herbicide was the picloram/2,4-D although this method was very labour intensive and stem breakage occurred in the smaller diameter jack pine size category.

Table 9: Percent tree vigour at post-treatment November 2005 in selected dwarf mistletoe infected trees.

TREATMENT	TREE SPECIES	DBH CLASS (cm)	TREE VIGOUR (% of total)			
			Healthy	Stressed	Declining	Dead
Triclopyr (Basal spray)	Jack Pine	10 to 20	0	6.7	0	93.3
		20 to 30	33.3	13.3	0	53.4
	Black Spruce	10 to 20	10	13.3	13.3	63.4
		20 to 30	60	16.7	6.6	16.7
Glyphosate (EZ-Ject)	Jack Pine	10 to 20	19.4	16.1	6.4	58.1
		20 to 30	33.3	30	6.7	30
	Black Spruce	10 to 20	10.0	43.4	13.3	33.3
		20 to 30	26.7	23.3	13.3	36.7
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 1994, a Pre-Harvest and intensive ground survey found a mature jack pine stand to be 74.5% infected with Armillaria root rot. This stand was selected for a site preparation trial in comparing stumps removed and stumps left plus the long term impact of Armillaria on planted seedlings. The stand was harvested in 1995, stumps were removed from a 10 acre area in 1996, then the stand was Bracke site prepared and planted with white spruce in 1997. In 1998, two 4 hectare blocks were established, one in the stumps removed area and one in the stumps left site. In May 2005, an intensive ground survey was conducted to determine the incidence of Armillaria in these two blocks. Survey lines were set 25 meters apart and Global Positioning System (GPS) coordinates were collected for each pocket of dead trees infected with Armillaria root rot. The number of dead trees within each pocket was also recorded. Results showed the stumps left block had over twice the level of Armillaria infections, 1.64% stems per hectare, than the stumps removed block, 0.7 % stems per hectare. The number of dead trees within each pocket of Armillaria also differed between blocks. The stumps left block had a maximum number of 20 trees present in one pocket whereas the stumps removed block only had a maximum of 2 trees in one pocket.

In October of 2005, an aerial survey using a helicopter mounted with video and GPS equipment was conducted to map root disease centres in the Clearwater Creek operating area in Duck Mountain Provincial Forest. Parallel flight lines were flown 170 meters 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. 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, *Dendroctonus*, *simplex* LeConte, have occurred throughout the Southeastern, Interlake, Western and Northwestern regions of Manitoba. Extensive tree mortality has occurred in many tamarack stands. The eastern larch beetle typically attacks trees that are under stress from other insects and/or environmental factors (fire, flooding, defoliation from larch sawfly and larch case bearer). However, in this case there are no obvious stress factors associated with this mortality. The infested stands appear to be relatively healthy.

Adult, larval and pupal stages are present throughout the winter. However, the literature (David Langor's work in Newfoundland) states that only the adults are able to over-winter and that the larvae and pupae in the trees are often killed by cold temperatures.

Manitoba experienced four successive mild winters between 1998 and 2002. It is suspected that the mild winters have allowed larvae and pupae to successfully over-winter, resulting in larger than normal populations emerging in the spring. It is suspected that increased over wintering survival of larvae and pupae during four or five consecutive winters with above normal temperatures may have contributed to the infestation. There have been outbreaks previously reported in Manitoba.

Extensive mortality of tamarack had been reported in the Maritimes, eastern United States and Alaska during the 1970's.

Harvesting has been going on within eastern larch beetle infested areas. The intended product is rough lumber for use at the steel mill in Selkirk, Manitoba. However, approximately half of the beetle killed material has been unsuitable for lumber and has been processed into fuel wood.

Wind Damage

A violent windstorm on July 31, 2005 caused many mature jack pine trees to be blown down in the Sandilands Provincial Forest and the surrounding community of Sandilands, Manitoba. Approximately 800 hectares of Crown forest and as much as 110,000 m3 of jack pine timber were severely affected. The current softwood Annual Allowable Cut for FMU 20 is 124,940 m3. The most severely damaged timber must be harvested as quickly as possible to reduce the fire hazard in this area and to prevent damage from secondary insects and disease.

Spruce Needle Rust

The wet conditions in the spring and summer of 2005 created ideal conditions for spruce needle rust, predominately in eastern Manitoba. The disease is more severe where and when the alternate host, Labrador tea is abundant and during periods of moist weather. There are two species of fungi, *Chrysomyxa ledi* and *Chrysomyxa ledicola*, that cause spruce needle rust in Manitoba. The host trees in Manitoba are the native black and white spruce and the introduced Colorado spruce. The two fungi are similar with white blisters containing bright orange spores that are easily noticeable during the summer months. The infected parts of the tree often look pale, making the infection even more obvious. It is only the current year's needles that contract the rust, causing the needles to dry out, turn red, die and fall off the tree in late summer. The fungi alternate between the spruce host in the winter and Labrador tea in the summer. Both hosts are required to complete its life cycle.

Although infected trees look quite sickly they will recover in the following year. These rusts are not considered a serious problem to native trees like white and black spruce as they are usually less vulnerable to the fungus than introduced species.

Leaf Diseases of Deciduous Trees

In 2005, anthracnose diseases of deciduous trees were prevalent throughout southern Manitoba. Damage due to these diseases commonly occurs after cool, wet weather during bud break and early leaf development. Maples, ash, oaks and elms all displayed symptoms of necrosis on their leaves this year. In some areas ash trees experienced a sudden loss of leaflets. Elm anthracnose (black spot of elm) was very common in urban areas where there are large populations of elm. Late season damage and discolouration of leaves created some difficulty for Dutch elm disease survey staff to identify late summer DED infections.

Poplar leaf diseases were also very evident in 2005. Leaf spots such as Marssonina and Septoria leaf spot were common on native and hybrid poplars. Melampsora leaf rust was common on poplars especially plains cottonwood and cottonwood hybrids. This disease resulted in extensive premature leaf drop throughout heavily infested areas.

Economics of the outbreak

Aspects économiques de l’infestation

Presented by:

Bill Wilson
Natural Resources Canada, Canadian Forest Service
Victoria, BC

This presentation is not available

Economic impacts of the mountain pine beetle: wood and pulp quality

Impacts économiques du dendroctone du pin ponderosa : qualité du bois et de la pâte

Presented by:

***T.M. Ebata*[1]**, *T. Byrne*[2], *and P. Watson*[3]
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[3] *Paprican, Vancouver, British Columbia*

Abstract

The "shelf life" of beetle-killed (BK) timber is dependent on the change in wood and eventually chip quality over time. This presentation summarizes two MPB funded projects that attempt to address the impacts of the beetle on wood quality and the economic impacts this may have. The first project looked at the various factors that impact the quality of lumber produced from beetle killed timber. The two main issues are: 1) blue-stain – leading to degrade and unacceptability in appearance grade markets like Japan; and 2) dryness – that leads to lower lumber volume and grade recovery. Other issues involve the impact of wood borers, the durability of beetle-killed wood (vs. unattacked wood); and the problems faced when using dry pine chips to make OSB. The overall message is that you can still make quality solid wood products out of standing dead trees but at some point in time, it becomes uneconomic. For the pulp and paper industry, the news isn't encouraging. B.C.'s chips are considered very high quality internationally and therefore have a market advantage. Increasing the pine component and worse, increasing the component from dry snags, reduces overall quality and competitiveness. Chips made from standing dead trees tend to be very dry and do not absorb the chemicals used to digest them into pulp as readily as chips from freshly cut trees. The blue-stain also presents a challenge by increasing the efforts to bleach the pulp that increases the cost of production. Resin content of the chips is higher in attacked trees and results in spots, holes, and tears that further increases production costs. The higher concentration of extractives in BK pulp increases the coefficient of friction and thus produces wrinkles in paper. Finally, higher extractive levels produce a lot of foam in the effluent which can blow around and increase toxicity of effluent. BK wood and pulp pose significant challenges to the forest industry and more operational research is required.

Résumé

La « durée de conservation » du bois des arbres tués par le dendroctone dépend du changement que subira avec le temps la qualité du bois et, en fin de compte, des copeaux. Cette présentation résume deux projets financés par le Programme sur le dendroctone du pin ponderosa qui tentent de cerner les impacts du dendroctone sur la qualité du bois et les répercussions économiques que ces impacts peuvent avoir. Le premier projet s'est intéressé aux divers facteurs qui influent sur la qualité du bois de sciage produit à partir d'arbres tués par le dendroctone. Les deux grands problèmes sont les suivants : 1) le bleuissement – entraînant un déclassement (catégorie de finition) et le rendant inacceptable sur des marchés comme la Japon et 2) le dessèchement – entraînant une diminution du volume de bois et du potentiel d'utilisation. D'autres enjeux sont liés à l'impact des insectes xylophages, à la durabilité du bois des arbres tués par le dendroctone (par opposition au bois non ravagé) et aux problèmes rencontrés lors de la transformation de copeaux de bois de pin sec en panneaux OSB. Il en ressort qu'il est tout de même possible de fabriquer des produits en bois massif de qualité à partir d'arbres morts encore sur pied, mais que l'opération finit par devenir peu rentable. Cette constatation n'est pas encourageante pour l'industrie des pâtes et papiers. Le copeaux de la Colombie-Britannique sont réputés internationalement pour leur grande qualité et jouissent donc d'un avantage commercial. Accroître la composante de bois de pin et, pire encore, celle provenant de chicots secs, réduit la qualité et la compétitivité générales. Les copeaux provenant d'arbres morts encore sur pied ont tendance à être très secs et n'absorbent pas les produits chimiques utilisés pour les réduire en pâtes aussi facilement que les copeaux provenant d'arbres récemment abattus. Le bleuissement complique également les choses, car il nécessite un blanchiment plus poussé qui fait augmenter les coûts de production. La teneur en résine des copeaux provenant des arbres attaqués est plus élevée et se traduit par des taches, des trous et des déchirures qui font augmenter encore plus les coûts de production. Les concentrations plus élevées de matières extractibles de la pâte provenant du bois d'arbres tués par le dendroctone font augmenter le coefficient de frottement et produisent donc des faux-plis dans le papier. Enfin, elles entraînent la formation d'une grande quantité de mousse dans les effluents, mousse qui peut être emportée par le vent et accroître la toxicité des effluents. Le bois et la pâte provenant d'arbres tués par le dendroctone sont un sérieux casse-tête pour l'industrie forestière et exigent d'autres recherches opérationnelles.

Biology and impact of the lodgepole pine dwarf mistletoe on pine in the Prairie Provinces

Biologie et impact du faux-gui du pin tordu sur les pins des Prairies

Presented by:

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Abstract

Lodgepole pine dwarf mistletoe (LPDM) is distributed throughout much of western North America where it occurs on two principal hosts, jack and lodgepole pine. Other than decay, LPDM is the most important pine pest in west-central Canada. Annual volume losses for mistletoe-infected jack and lodgepole pine in the prairie provinces are 2.3×10^6 m^3. Most knowledge of LPDM is based on the work of Hawksworth and colleagues working on Colorado populations of mistletoe-infected lodgepole pine; no studies have examined the parasite's life cycle on jack pine. Based on field inoculations, I found host penetration began during June–August after germination in May and usually continued until June–July of the next year. Symptoms of infection occurred about 13–15 months after germination. Aerial shoots emerged primarily during July–August in the second season after inoculation. Pistillate plants flowered in 4 years. Staminate plants flowered in 5 years. Most pistillate plants produced seed in 5 years. Thus, LPDM has a 5-year life cycle on jack pine, which has implications on LPDM management in jack pine. For additional information please refer to the following manuscripts:

Brandt, J.P. 2006. Life cycle of Arceuthobium americanum *on* Pinus banksiana *based on inoculations in Edmonton, Alberta. Canadian Journal of Forest Research. 36:1006-1016.*

Brandt, J.P., Hiratsuka, Y., and Pluth, J.P. 2005. Germination, penetration, and infection by Arceuthobium americanum *on* Pinus banksiana*. Canadian Journal of Forest research 35(8): 1914-1930*

Résumé

Le faux-gui du pin tordu latifolié (FGPTL) est présent dans la majeure partie de l'Ouest de l'Amérique du Nord où il parasite deux hôtes principaux, le pin gris et le pin tordu latifolié. Le FGPTL est, outre la carie, l'organisme le plus nuisible des pins dans le centre-ouest du Canada. Les pertes annuelles de volume causées par le faux-gui chez le pin gris et le pin tordu latifolié dans les Prairies sont de l'ordre de $2{,}3 \times 10^6$ m^3. La plupart des connaissances sur le FGPTL viennent des travaux de Hawksworth et de ses collègues qui ont étudié des populations du Colorado de pins tordus latifoliés infectées par le faux-gui; aucune étude ne s'est intéressée au cycle biologique de ce parasite sur le pin gris. Grâce à des inoculations effectuées sur le terrain, j'ai constaté que la pénétration de l'hôte débutait en juin-août, après la germination des graines en mai, et se poursuivait habituellement jusqu'en juin-juillet de l'année suivante. Les symptômes d'infection sont apparus environ 13 à 15 mois après la germination. Les pousses aériennes du faux-gui sont principalement apparues en juillet et août de la deuxième saison après l'inoculation. Les plantes femelles ont fleuri en quatre ans, et les plantes mâles, en cinq ans. La plupart des plantes femelles ont produit des graines en cinq ans. Par conséquent, le FGPTL a un cycle biologique de cinq ans sur le pin gris, ce qui a des incidences sur la lutte contre le FGPTL chez le pin gris.

Session II

North of 60

Chair: Pardeep Ahluwalia

Natural Resources Canada, Canadian Forest Service

Session II / Séance II

Séance II

Au nord du 60e parallèle

Président : Pardeep Ahluwalia

Ressources naturelles Canada, Service canadien des forêts

NWT Report

Rapports des Territoires du Nord-Ouest

Presented by:

J.P. Brandt
Natural Resources Canada, Canadian Forest Service
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Edmonton, Alberta

This presentation is not available

Spruce beetle outbreak in Alaska – Past, present and future management implications

L'infestation du dendroctone de l'épinette en Alaska – impacts sur l'aménagement passé, présent et futur des forêts

Presented by:

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Abstract

This talk describes the scope of the 1990s spruce beetle (*Dendroctonus rufipennis*) epidemic in south-central Alaska, then compares and contrasts the biological, social and economic ramifications on the State of Alaska and private landowners' management response to the epidemic, including the direct and indirect effects of that management on the local communities of the Kenai Peninsula. Implications of the various actions to address both forest health and fire management of spruce beetle outbreaks before, during and after the outbreak are discussed.

From 1920-1989, approximately 780,000 ha of Alaska spruce (*Picea* spp.) forests were infested by the spruce beetle (*Dendroctonus rufipennis*). From 1990-2000, an extensive spruce beetle outbreak of unprecedented size and magnitude caused mortality of spruce across more than 1.5 million ha of Alaska's forests. Roughly half of recent spruce beetle activity is concentrated on the Kenai Peninsula of south-central Alaska; almost twice the area infested in the 70 years prior to 1990. Early management actions by the State of Alaska to address the beetle impacts concentrated on wood salvage with economic restraints dependent on timber receipts. During the peak of the 1990s Kenai Peninsula spruce beetle epidemic, management actions were impacted by disparities between State and private landowner reforestation requirements and public and organizational disagreements on how to best achieve sustainable forest management. Most stands were over 90% infested by the spruce beetle by the mid-1990s. Government landowners have adjusted management strategies on beetle-impacted lands to restore forest health and manage fire within the wild land urban interface. This has current and future implications on sustaining natural spruce forest while still meeting the Forest Resources and

Practices Act regeneration standards. Challenges remain to maintain timber sale economics and reducing risk of catastrophic fire while meeting the needs of communities now dealing with hazardous fuels reduction efforts, reforestation to non-native species, and other forest management issues affecting the spruce beetle-impacted forest.

Résumé

Cet exposé décrit l'ampleur de l'infestation du dendroctone de l'épinette (*Dendroctonus rufipennis*) qui a sévi dans le centre-sud de l'Alaska durant les années 1990, puis compare et met en balance les conséquences biologiques, sociales et économiques des mesures prises par l'État de l'Alaska et les propriétaires privés, y compris leurs effets directs et indirects sur les collectivités locales de la péninsule Kenai. Il examine les incidences des diverses mesures prises à l'égard de la santé des forêts et de la gestion des incendies avant, pendant et après l'infestation sur les superficies affectées.

De 1920 à 1989, quelque 780 000 hectares de forêt d'épinettes (*Picea* spp.) de l'Alaska ont été infestées par le dendroctone de l'épinette (*Dendroctonus rufipennis*). De 1990 à 2000, une infestation à grande échelle de ce ravageur, d'une ampleur et d'une gravité sans précédent, a causé une mortalité de l'épinette sur plus de 1,5 million d'hectares de forêt de l'Alaska. Environ la moitié du territoire ravagé récemment par le dendroctone de l'épinette se trouve dans la péninsule Kenai, dans le centre-sud de l'Alaska, et la superficie touchée est de près du double de celle infestée au cours des 70 années précédant 1990. Pour réagir aux impacts du dendroctone, l'État de l'Alaska a commencé par pratiquer des coupes de récupération et a fixé comme contraintes économiques les recettes pouvant être tirées de ces coupes. Au plus fort de l'infestation du dendroctone de l'épinette des années 1990 dans la péninsule Kenai, les exigences différentes de l'État et des propriétaires privés en matière de reboisement et des divergences d'opinions au sein du public et d'ordre organisationnel sur les meilleurs moyens de parvenir à un aménagement durable des forêts ont eu des impacts sur les mesures prises. Dès le milieu des années 1990, la plupart des peuplements étaient infestés à plus de 90 % par le dendroctone de l'épinette. Les propriétaires fonciers gouvernementaux ont rajusté leurs stratégies d'aménagement des terrains forestiers affectés par le dendroctone afin de rétablir la santé des forêts et de gérer les incendies dans les zones périurbaines. Cette réorientation a des répercussions actuelles et futures sur la pérennité des forêts naturelles d'épinettes, même s'il faut toujours satisfaire aux normes de régénération de la *Forest Resources and Practices Act*. Il reste des défis à relever pour maintenir le caractère rentable de la vente de bois et réduire les risques de feux de forêt catastrophiques tout en répondant aux besoins des collectivités qui s'emploient actuellement à réduire les charge de combustibles, à reboiser avec des essences non indigènes et à s'attaquer à d'autres questions d'aménagement touchant la forêt affectée par le dendroctone de l'épinette.

Spruce beetle (*Dendroctonus rufipennis*) outbreaks in Alaska – Past, present and future management implications

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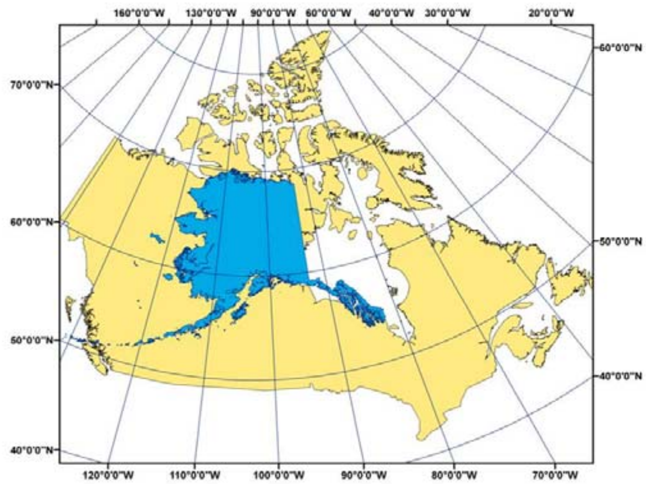
Hello. I want to thank the forum steering committee for making it possible for me to present at your annual Canada Forest Pest Management Forum here in Ottawa. I hope I haven't bitten off too big a chunk to talk about today, but am going to attempt within the allotted time to do my best to relay Alaska's experiences with spruce beetle outbreaks in Alaska and the past, present and future management implications of the recent 15+ year outbreak that ended in 2000.

Briefly, my goals for this talk. The first half of the talk will run you through the history of Alaska's spruce beetle outbreaks, some of the research and management into the biology and management of spruce beetle in Alaska, how agencies and the public responded, with a brief chronology of action plans and events that illustrate the challenges faced by the State of Alaska foresters and how they were addressed. In the second half we'll look at the management scenario that was created by this epidemic, current events, what we learned, and the implications of large beetle outbreaks for future forest management. It's my sincere intent to relay to you some of my perspective and insights into what the forest managers and local communities may have learned to address critical forest management issues and information needs during the epidemic.

One "perspective" is to first align the subject area with the real world, in time and space. Alaska in this slide is slightly shifted in longitude to compare and contrast its respective space with Canada in the northern boreal forest.



Alaska's forests consist of 119 million acres (48 million ha) of productive forest lands across all ownerships. 12 million acres of commercial forest lands are within this total, concentrated in the coastal fringes from Afognak Island in the west, east to Icy Bay, and the Tongass National Forest in the southeast panhandle. The Kenai Peninsula's forests contain only minimal commercial forest land but are much more significant in terms of fisheries, wildlife, and mineral resources than forestry. At this scale the Kenai Peninsula doesn't stand out well, however, the south-central portion of the state (lower center of photo) follows this general % mix of federal, state and private Alaska Native corporation ownership.

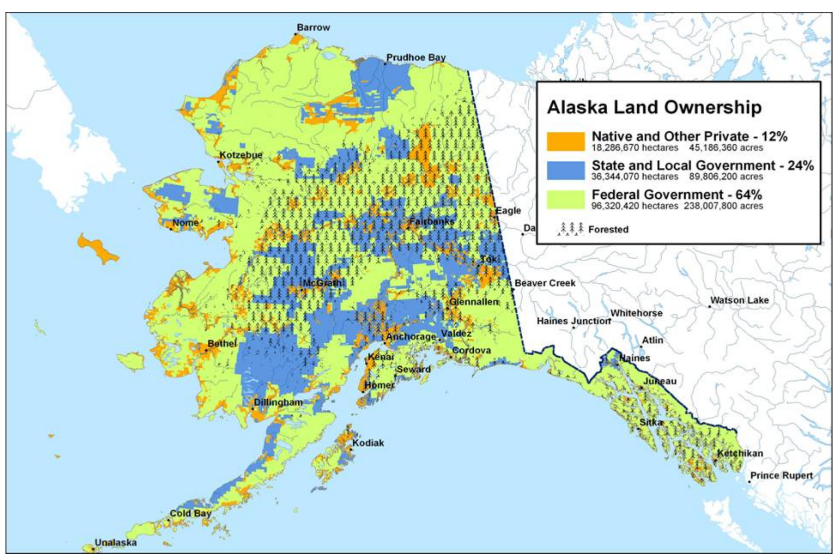


Fig. 1 ***Alaska: 64% federal government ownership; 24% state land ownership; the remaining 12% of land area is predominantly owned by 12 Native Regional corporations established under the Alaska Native Claims Settlement Act of 1971.***

The 1990s Alaska spruce beetle epidemic lasted only 15 years; however, total aerial extent of beetle infestation during those 15 years was more than twice the area of cumulative beetle infestation from all areas in the 70 years prior to 1989 (Fig. 2).

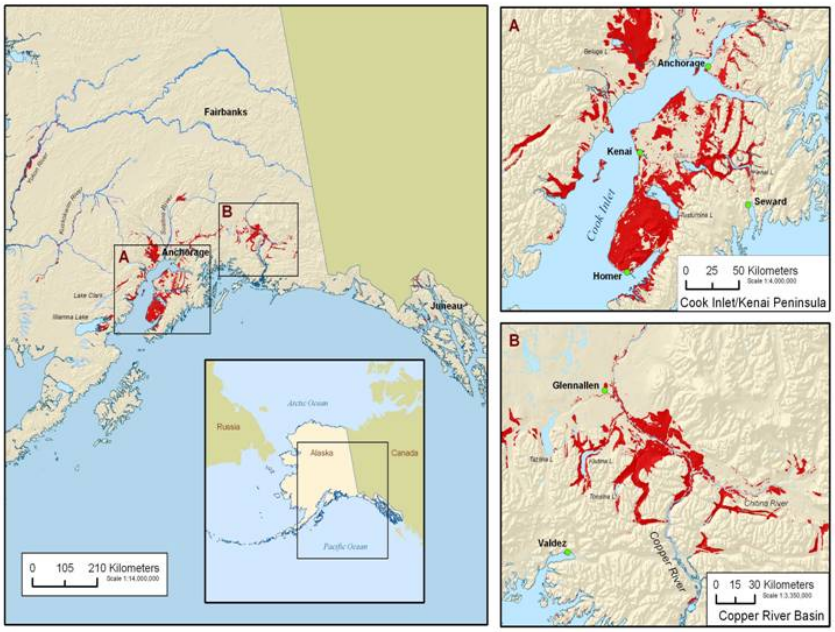


Fig. 2 Historically, most spruce beetle activity has centered in two geographic areas: the Kenai Peninsula of South-Central Alaska and upper Copper River region of southern Interior Alaska.

Here's a brief summary of the 1970s-1990s spruce beetle research and how understanding of the causes of outbreaks had progressed prior to the 1990s epidemic:

1) The earliest recorded spruce beetle outbreaks were primarily associated with weather events and early mining and resource exploration activity (e.g., 1920s Copper River outbreak aided by land clearing and mining activity from the Kennecott Copper development)
2) Most large outbreaks initiated from a forest disturbance of >1,000 acres (windthrow & oil & gas seismic line clearing)
3) Historically, most reported outbreaks repeated in the same areas at 20-30 year periods; highest hazard was in stands with at least a 70% component of spruce of >25cm dbh
4) 1970s and 1980s research focused on determining basic beetle biology, modeling stand dynamics during outbreaks, and developing silvicultural systems to reduce risk (probability of infestation) and hazard (potential volume losses over 2-3 years given a stand becomes infested)
5) 1990s research focused on use of natural chemical attractants (determining the pheromone complex) and anti-aggregants to provide tools for managers to mitigate tree losses and expansion of existing infestation centers

This talk focuses primarily on south-central Alaska, and specifically the Kenai Peninsula, which sustained fully 60% of the total forest area impacted during the 1990s spruce beetle epidemic…also, our 15 year experience on the Kenai Peninsula with this outbreak essentially "re-wrote the book" on what could be expected in terms of the extent and magnitude of spruce beetle outbreaks in North America.

Fig. 3 ***Fully 70 percent of Alaska's population and 50% of Alaska's 3,300 miles of roads are concentrated in the South-central portion of the state. South-central is the State's most diverse population center—an area of world-class fish and wildlife resources (Prince William Sound and Cook Inlet ecosystems)…the primary resources supporting the Region are sport and commercial fishing and tourism, within mining and forestry as secondary industries within this main population center of Alaska. The Kenai and Copper River support some of the largest runs of anadromous fish in North America (all 5 species of Pacific salmon are found here) along with their main predators, grizzly, Alaska brown and black bear.***

Overview of Alaska Spruce Beetle Damage Surveys & Research 1920-1989

- Earliest recorded outbreak: Copper River region--early 1920s (200,000 ac) (1990s epidemic on Kenai Peninsula initially
- Most early outbreaks surveyed as personnel & resources were available (Alaska did not achieve Statehood until 1959; routine aerial surveys of susceptible forest stands started in early 1970s on the Kenai Peninsula)
- Early outbreaks associated with a significant forest disturbance (wind throw, land & oil & gas seismic line clearing, improper slash management during land clearing operations)
- Historical outbreaks cycled over 20-30 year periods in the same general areas as stands reached susceptible size & ages classes (declined to endemic levels within 2-5 years)
- Research & management studies focused primarily on beetle biology, stand dynamics & beetles, and silvicultural methods to mitigate spot infestations (1970s & 1980s)
- Late 1980s & early 1990s research focused on developing stand risk & hazard models and mitigation using natural chemical attractants, beetle anti-aggregants, and chemical preventive measures

- 1990s spruce beetle epidemic shifted research focus to understanding communities' responses to spruce beetle outbreaks by providing tools to landowners & managers to mitigate losses during outbreaks

As high as 1.1 million acres of active infestation was mapped statewide in a single year during the 1990s epidemic. Fully 60% of new beetle activity was mapped in south-central Alaska. Most stands by 1996 were over 80% beetle-killed. Pure spruce stands sustained over 90% infestation in trees down to 7.5 cm dbh at the peak of the outbreak in 1996.

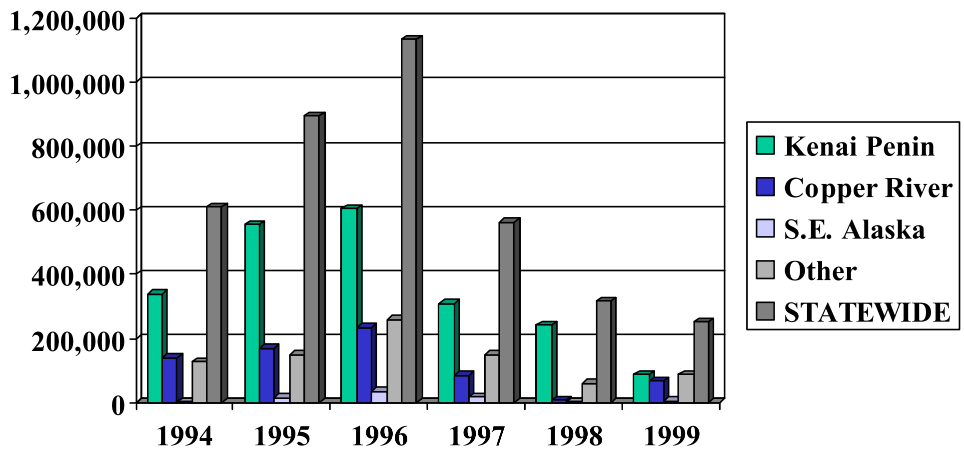


Fig. 4 - Regional spruce beetle activity in Alaska (1994-1999)

The following list is a brief chronology of "early" pre-1990s outbreak forest management history in South-central Alaska, including the constraints that public forest managers operated under to be able to "manage" beetle outbreaks. The take home message here is that without any significant forest marketing & utilization infrastructure to address large scale harvest, forest management in Alaska has, and will continue to be, driven by existing local markets and scales for forest operations when an outbreak occurs.

Forest Pest Management in South-Central Alaska prior to 1990s SB Epidemic

- Lack of infrastructure for access/operability (this has not changed significantly, to date)
- Most sales under 500,000 board feet
- Utilization primarily for local markets & uses (house logs, dimensional lumber, firewood)
- Forest "best management" practices administered during A.S. 38 timber sale process (18-24 months with public & agency involvement)
- Emergency regulations to address significant insect & disease infestations/infections did not exist on a regional basis (most productive forest lands within "unorganized" boroughs)

- Difficult to enforce suppression of infestations outside the normal timber sale process & during general forest land clearing (Region-wide prevention/mitigation measures in current regulations)
- Tyonek Spruce Beetle outbreak in the mid-1970s necessitated a major change in forest management – supported major wood chip market to Japan

Fig. 5. ***Stand conditions that lead to spruce beetle infestations (left to right from top of slide). Wind thrown trees, snow and ice damage, unsuitable cold wet sites for spruce growth, fringe areas of burned stands, rights-of-way construction, unmanaged stands, poor logging techniques, clear-cut harvest and improper slash disposal, and improper slash removal after thinning***

Infestations over 1,000 acres from any of these stand conditions have the potential to reach epidemic proportions where natural predators and parasites which, in our experience, are conditions that can contribute to incipient infestations over 1,000 acres and have the potential to reach epidemic status.

Traditionally, foresters will look at bark beetle "management" in a typical stand as a series of silvicultural steps that must be taken to prevent bark beetle populations from building up to the level that impacts their long-term forest management objectives to achieve a sustainable and economical forest "product" from the management efforts. The reality of forest management in Alaska prior to the 1990s epidemic is that forest managers were continually hampered to provide sustainable forest management due to other, more real, considerations—accessibility of the timber, existing markets (or lack thereof), allowable cut formulas that were not current or updated, inability to respond timely under the current timber sale regulations, etc.

Looking back in time, because “20-20 vision is easy to have”, the reasons for expansion of the 1990s spruce beetle epidemic was a combination of all of these but especially; and we now know that the infestation levels reached in the 1990s outbreak over just a short period of years were a result of natural events (climatic shifts), a large area of unmanaged spruce forest providing a virtual salad bowl for the natural disturbance agent, and lack of an effective system for the State of Alaska to manage “forest practices” on the landscape.

Once researchers and managers realized that the 1990s outbreak was not controllable at the stand level, it became necessary to implement forest practices and reforestation standards to ensure a sustainable resource base while at the same time attempting to mitigate further losses (i.e., protect the timber base). The State of Alaska’s objectives were to achieve adequate reforestation on most impacted lands (including private lands) by designing the timber sale process so as to mitigate further losses while ensuring a minimum stocking standard with the proceeds from the sale. This was not possible in most cases. Approximately 80% of the infested acreage in the State-managed area was not harvested because these objectives could not be met—the State of Alaska decided early on that it did not want to get into the business of subsidizing timber sales on the Kenai Peninsula, at the expense of a much greater risk: and that was to ensure that the fish and wildlife resource base was not impacted at the expense of attempting to attain full product value from forestry activities. Some success was achieved by a number of small landowners & forest operators who adjusted their timber harvest techniques to mitigate beetle buildup and obtain significant product value from the harvest operation during the 1990s epidemic. Also, small landowners in several areas utilized individual tree treatments with preventive insecticides to protect high value trees that survived the epidemic.

The State of Alaska’s action plan was finalized about 4 years into the outbreak with adoption of the W. Kenai Peninsula & Kalgin Island Forest Health Management Plan; slash management and reforestation operations on all timber harvest over 10 acres were directed through the annual filing of a forest Plan of Operations by State and Private (mostly Alaska Native Corp.) forest operators & landowners.

The State’s forests are managed on a 5-year revolving system with proposed harvest and “beetle salvage” areas entering a timber harvest schedule each year with projections of proposed actions 5 years out; parcels had to be in the FYSTS plan for at least 1 year to enable public and agency review of the proposed sales before a forest land use plan and contract could be finalized for the timber salvage sale.

The 1992 Kenai Peninsula forest health management plan established seven (7) priority areas in which timber salvage harvest operations would be conducted. Public involvement and participation ended up being key to the most successful forest management and reforestation efforts. During these operations, an effort was made to coordinate with adjacent public and private landowners and operators next to the State parcels to provide a viable, economic sale that would ensure reforestation of the lands within 7 years.

The 1993 Forest Resources & Practices Act (FRPA) regulations provided “best slash management” practices that were enforced by State FRPA foresters and requirements for landowners to meet the minimum reforestation stocking standards within the filed Plan of

Operations. Forest operators and landowners could apply for a reforestation exemption to be able to proceed with some sales that were not economic due to "significant infestation by bark beetles". This was a very trying and challenging time for the State's forest managers due to increasing pressure from the local communities to avoid subsidizing timber sales but also ensuring that beetle-impacted lands regenerated to a healthier condition after beetles and harvest.

Slide 19

The 1992 Kenai Peninsula forest health management plan identified approximately 410,000 acres of operable spruce acreage where timber sales could occur while maintaining the fish and wildlife resource base on the Kenai Peninsula. Between the times that the FHMgt Plan was adopted and fully implemented, an additional 600,000 acres of spruce forest was infested on the W. Kenai Peninsula!

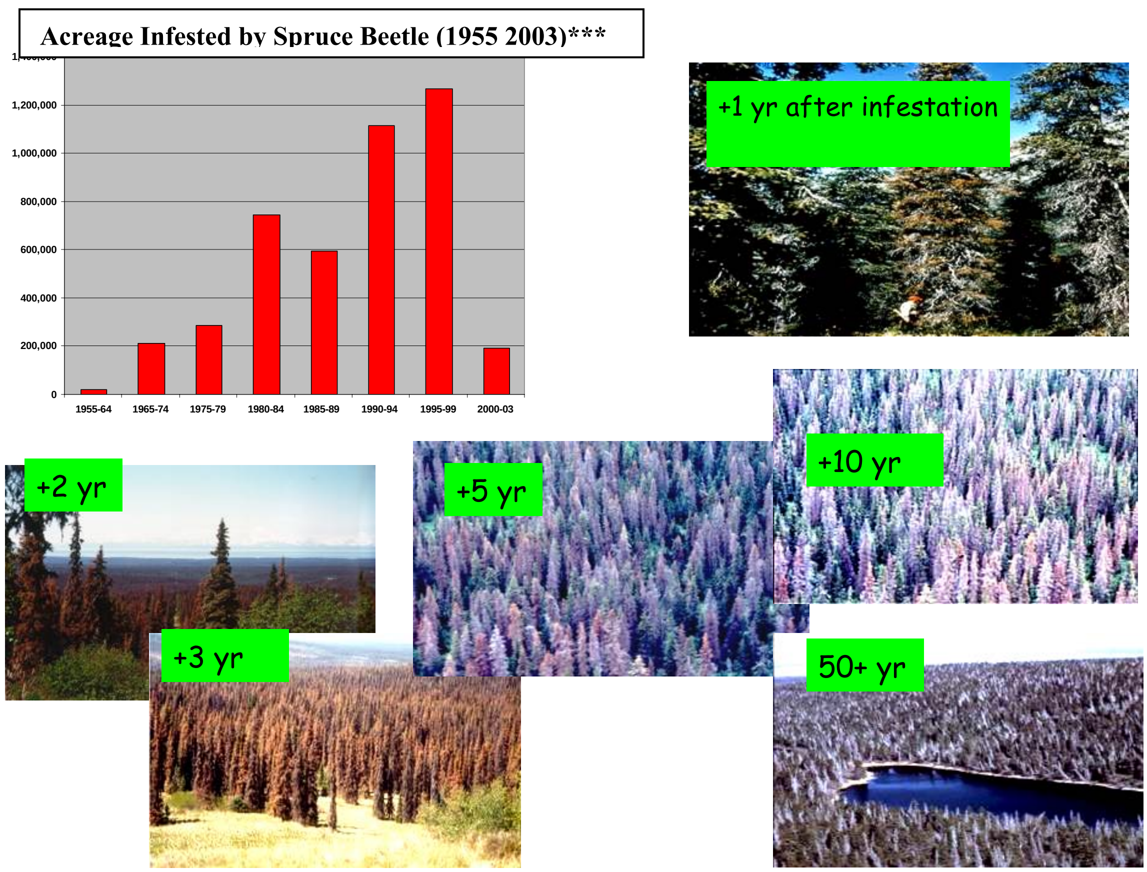


Fig. 6 ***To give some additional perspective on the forest condition of the Kenai Peninsula by 1995 here is a series of photos that shows the progression of stand condition after initial beetle infestation. On the Kenai Peninsula, by 1997, approximately 85% of the infested area had been impacted similar to the "+5 yr" photo in the middle of this slide.***

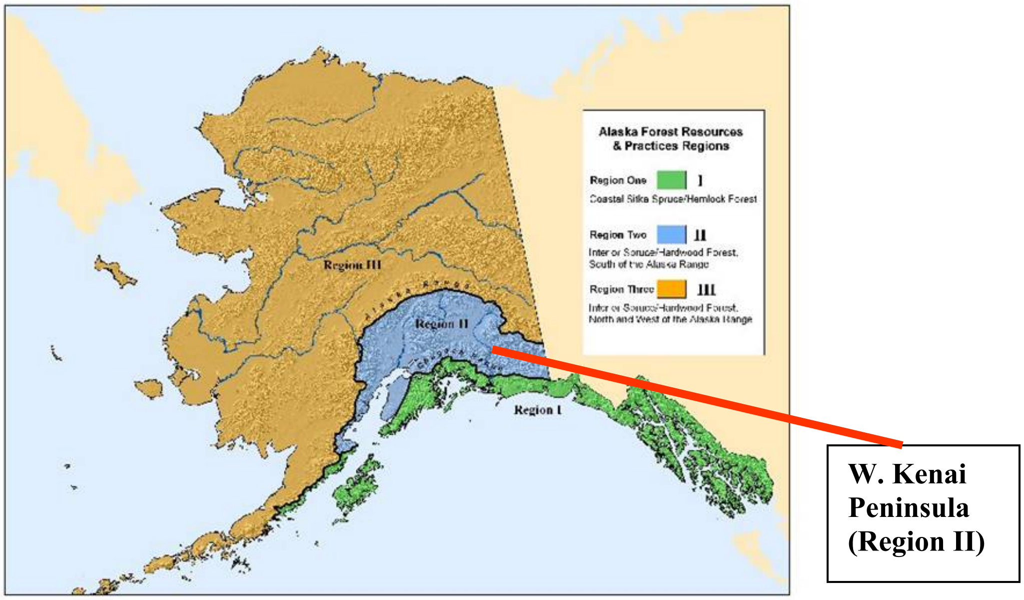


Fig. 7 ***1990s Alaska Forest Resources & Practices Act regions—Region II encompasses the Kenai Peninsula and upper Copper River region forests.***
Alaska FRPA Regulations (Regions I & II reforestation & SB mitigation)

- ***11AAC 95.370 Slash***

…within "…a potential or known bark beetle infestation area..operator shall include a <u>spruce slash reduction, isolation, or abatement plan</u> in the detailed plan of operations…"

- ***11AAC 95.375 Reforestation Requirement***

"…<u>a landowner shall reforest to the fullest extent practicable unless the stand is significantly composed of insect and disease-killed</u>, fire killed, wind thrown, or fatally damaged trees…"
(Reforestation must be achieved within 7 years in FRPA Regions I & II; within 5 years in Region I. Variations from the minimum required post-harvest stocking are considered by State of Alaska DNR on a case by case basis. Effectiveness monitoring & best management practices aid field foresters & landowners with interpretation of the FRPA standards)

Given the expansion of the outbreak to epidemic proportions by 1993, the implemented FRPA regulations were designed to require operators to follow good slash management efforts and make an attempt to reforest (enhance regeneration) during the harvest operation to minimize additional infestation on landownerships adjacent to ongoing forest harvest operations AND try to meet the minimum stocking requirements under the FRPA.

Reforestation accomplished with 7 years of harvest could include a combination of residual trees and seedlings to average a minimum of 450 trees per acre that survived a minimum of 2 years after harvest and adequate stocking on at least 90% of the harvested area.

Disappointingly, forestry research activities during the outbreak concentrated primarily on mitigating and containing beetles during harvest…beetle control utilizing trapout and prevention measures (anti-aggregant pheromones) at the stand level did not work. The State of Alaska and U.S. Forest Service put some funding into environment perception research in the early 1990s and has followed through with subsequent studies in the affected communities that have helped explain how publics and communities deal with and respond to bark beetle outbreaks.

NOTE: Retrospective studies have helped both researchers and managers (and hopefully, interested publics) with how these natural events can be explained and what we can expect from future epidemics…a lot of interest was generated from these studies also in understanding if what we were seeing was outside the range of normal variations in beetle cycles over the tree and climate record.

1990s forestry research (Kenai Peninsula)

Pheromone mitigation strategies:

- Attractants used primarily for "containment" strategies at yarding & log storage areas
- Not definitively established that semiochemical "management" of beetles is effective during epidemics

Retrospective Studies:

- Dendrochronology & Climate Change Record, Harvest Residuals infestation survey

Environment Perception Surveys:

- Consensus that something should be done
- Considerably less consensus on what management response should be
- Public not convinced that prevention & control measures are safe (i.e., herbicides to control competing vegetation/preventive sprays to protect individual trees)
- No consistent relationship between publics' perceived "ends" that managers' recommended "means" would achieve the desired forest condition

Now I'm going to back up a little with a brief chronology of how managers responded to the 1990s spruce beetle epidemic…the responses and initial actions taken were greatly affected by what was previously known about large outbreaks; i.e., most had initiated from infestations greater than 1,000 acres from some disturbance event and did not last for more than 5 years—in hindsight, the Kenai Peninsula outbreak lasted fully 12+ years and did not return to endemic beetle population levels until 2002.

Spruce Beetles & Management Chronology 1980s & 1990s

1973-1975	* 250,000 ac (101,000 ha) infested in a remote area on W. side of Cook Inlet (near Tyonek)
1976-1981	Spruce chip export operation operation at Tyonek to supply Japanese market
1988	– 40,000 ac (16,200 ha) spruce beetle "spot" detected by aerial surveys south of Tustumena L./Kenai Peninsula (area had been previously infested in the 1960s & 1970s vs. 309,000 ac of new spruce beetle activity statewide
1990	* – Forest Resources & Practices Act amended to address more Best Management Practices on operable State & private forest lands across Alaska (process for slash management & establishing "zones of infestation/infection")
1990-1993	Expansion of Tustumena oubtreak and spot outbreaks on mainland Kenai Peninsula (statewide ongoing SB activity--1,900,000 ac/769,000 ha—approx. 50% of this activity on mainland Kenai Peninsula
1993	* (June) – FRPA regulations adopted for Alaska (3 FRPA regions). AKDNR adopts Forest Health Mgt. Plan for Kenai Peninsula & Kalgin Island (Salvage Harvest Priority Areas described in the plan)
1993-1998	Chip and pulp market active on Kenai Peninsula--primarily on State of AK and Private Alaska Native Corporation ownerships (Cook Inlet Region Inc, Ninilchik Native Assn.)
1997	1.13 million acres of new spruce beetle activity mapped statewide (new and ongoing beetle activity 3.2 million acres statewide vs. 1.4 million acres of infested forest within Kenai Peninsula Borough on Kenai Peninsula
2000	Significant decline in U.S. West Coast pulp market ceases Kenai Peninsula sale activity

As stated previously, the State of Alaska's primary management objective in conducting forest operations during the outbreak was to protect the forest resource and sustainability of stands during harvest operations; action was taken early on to revise the Forest Resources & Practices Act regulations to help ensure adequate reforestation and to offer a regular sale program that helped maintain market economies (i.e., salvage utilization for pulp and chips/some dimensional lumber) for maximum utilization focused toward adequate reforestation in the seven priority timber salvage areas. With chip markets declining as the epidemic peaked, this was a significant challenge…we're just now trying to determine how effective we were with meeting these objectives.

With no regional infrastructure in place for utilization of most forest products locally, the 1990s epidemic on the Kenai Peninsula presented a major challenge to obtain enough product value to harvest large areas economically. At one point near the peak of the outbreak, large Private landowners (AK Native Corporations) were able to sell Net Operating Losses as tax deductions on the open market to make sub-economic sales profitable to maintain their bottom line for their shareholders. State of Alaska managers during the same period utilized available matching federal grants and funding to salvage harvest the operable areas, while maintaining reforestation objectives and protecting critical fish and wildlife habitat. Some matching funding was (and still is) available to small landowners and large private landowners to develop forest management plans for their ownerships and fund prevention thinning and other forest health restoration activities that will enhance forest health and meet other objectives for developing wildlife habitat on impacted areas. Community groups were mobilized with agency cooperation to address the most immediate needs by the 1998 Spruce Bark Beetle Task Force—additional federal funding to the Kenai Peninsula Borough have directed subsequent efforts to assess fire fuels and develop a fire risk and hazard mitigation plan and process for hazard fuels permit sales that are restoring forest health on critical lands within the WUI.

I will very briefly illustrate one of the three retrospective studies completed during the period of the 1990s which enabled researchers, managers and the public to better understand the ecological

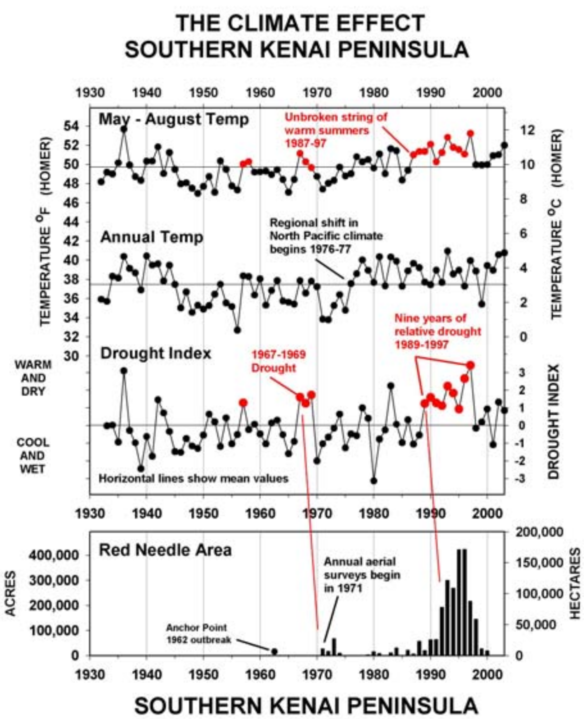


Fig. 8 ***The climate record and spruce beetle outbreaks on the southern Kenai Peninsula (1930-2000); courtesy of Dr. Ed Berg, Ecologist, USFWS***

role of bark beetles in a changing climate, the effects of beetle infestation during harvest,….as well as looking at the effectiveness of the FRPA and landowner efforts to achieve adequate reforestation in managed stands after the outbreak. One ecological study conducted by Dr. Ed Berg with the U.S. Fish & Wildlife Service highlights some of the dendroecological and climate effects during the 1990s spruce beetle epidemic on the Kenai Peninsula research conducted by Ed Berg, USFWS Ecologist on the Kenai National Wildlife Refuge during the mid-1990s. This work demonstrated a relationship between warming climate & drought cycles as significant factors in helping to initiate large spruce beetle outbreak. Dr. Berg’s research on the Kenai Peninsula and collaborative work with David Henry in Kluane Provincial Park in the Yukon Territory—looked at the spruce growth pulses associated with past beetle outbreaks (back 250-350 years from the tree record), as well as radiocarbon dating for the fire record (which of course went back much further). From this research, Ed Berg concluded that, at least on the Kenai Peninsula, there is no direct relationship between incidence of fire and spruce beetle outbreaks but climate warming and landscape level beetle outbreaks show a direct relationship in terms of the length and intensity of the outbreaks. This research was important for all to understand that the spruce beetle is a natural part of the forest ecosystem that can consistently derail human ambitions and economies.

After significant harvest had occurred across the Kenai Peninsula managers became concerned that spruce residuals and advanced regen seedlings were being impacted by a secondary bark beetle, *Ips perturbatus* (the Northern Spruce Engraver).

A "point in time" infestation assessment was completed in 2001 to estimate bark beetle infestation in harvest residuals. Data was also collected to compare infestation patterns in unharvested tracts. Details of how effective the harvest prescriptions were to mitigate additional beetle losses in the small residuals were difficult to piece together (lack of good information), however. Preliminary data from this post-outbreak study in harvested areas suggested strongly that spruce beetle was still a significant mortality factor of spruce residuals during the period of most green tree and salvage harvest activity, even in residuals down to 2.5 cm dbh; Ips mortality turned out to be less of a concern, however, was still competing with spruce beetle at some level across the harvest area.

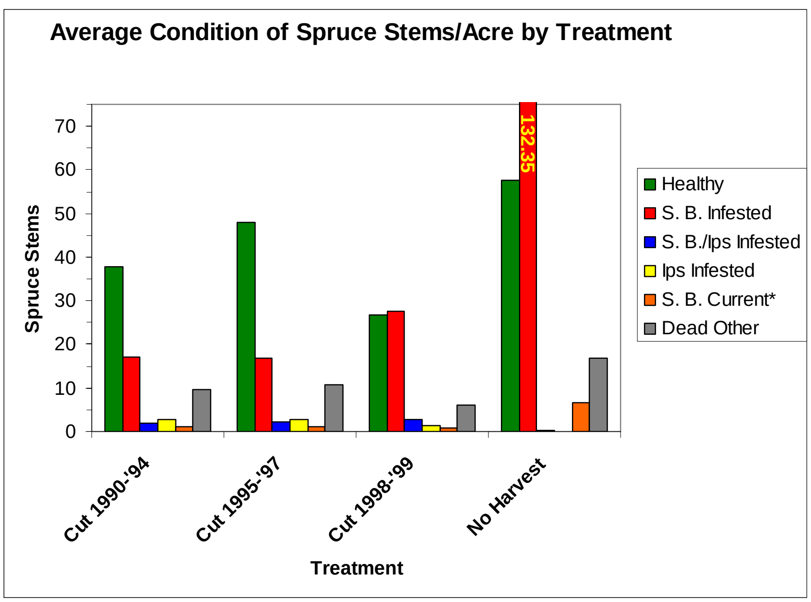


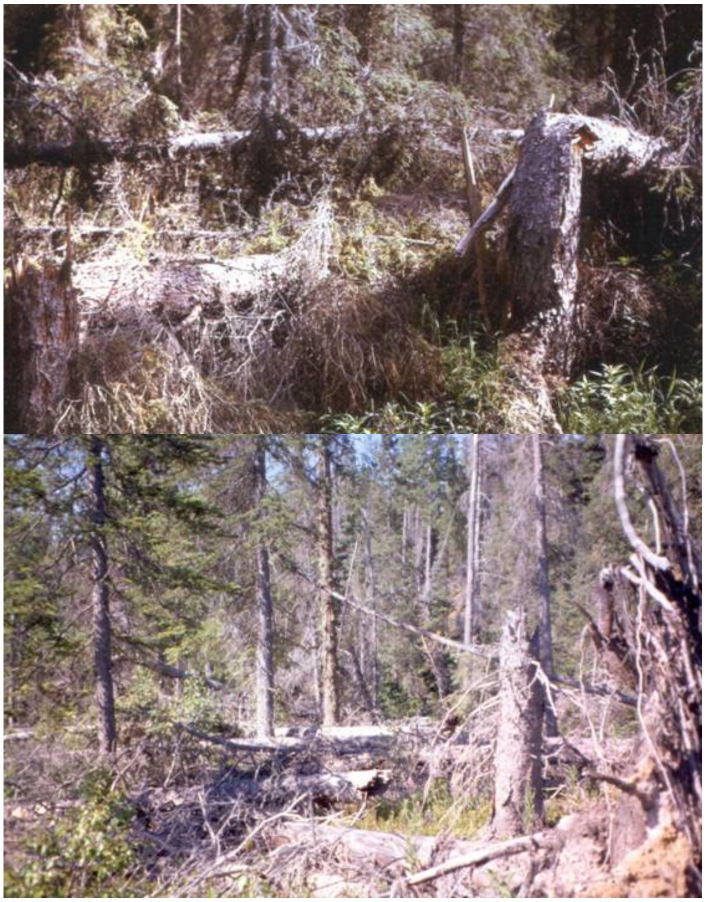
Fig. 9 ***Summer 2000 bark beetle infestation survey of harvest residuals (nine 2.5ac plots in each of four "treatment" classes harvested at different times during the peak of the Kenai Peninsula spruce beetle epidemic)***

Here are some key conclusions drawn from the various forestry research and retrospective studies completed during and after the peak of the 1990s beetle epidemic on the Kenai Peninsula: arrived at, now almost 9 years after the peak of the Kenai Peninsula outbreak:

- The Kenai Peninsula has experienced several Spruce Beetle outbreaks over the last 250+ years (mean interval of 52 yrs based on dendro-ecological studies by Ed Berg, USFWS)
- The Kluane and Kenai outbreaks are associated with a warmer 20th century climate and an aging forest. Kluane interval approx. 130 yrs.)
- Runs of at least 2 warm summers are necessary to initiate a spruce beetle outbreak (may also initiate a change in beetle behavior, further complicating "control" efforts, i.e., "life cycle" shifts to epidemic population growth
- Beetle epidemics are "mitigated, not controlled" (2000 harvest area bark beetle infestation study)
- Communities must be involved early in the public process to take full advantage & "ownership" of proposed forest management solutions
  (Also, managers need to be involved to encourage public participation)
- Utilization (salvage) needs to occur within 10 years to capture forest product value; fire risk may extend 75+ yrs post-epidemic

Recent studies have given us an additional perspective on the relationship between bark beetles and fire on the Kenai Peninsula: radiocarbon dating research suggests about a 600 year fire interval on the Kenai Peninsula vs. an approximate 50-year spruce beetle outbreak interval from the dendroecological studies completed in the mid-1990s.

I'll touch on the remainder of my conclusions with respect to future forest management implications from the 1990s beetle epidemic using a series of maps illustrating the current bark beetle impacts in relation to past and current forest fire activity. My conclusions are aided by some excellent mapping and GIS work completed by the Kenai Peninsula Borough Spruce Bark Beetle Mitigation Program office since 1997 that has helped us reconstruct how successful we were in "managing" the after-effects of the 1990s spruce beetle epidemic.



15 Years After the Largest Spruce Beetle Outbreak in North America

****<u>15 years after the Largest Spruce Beetle Outbreak in North America</u> (lead in to current situation and implications for future forest management of beetle outbreaks.*

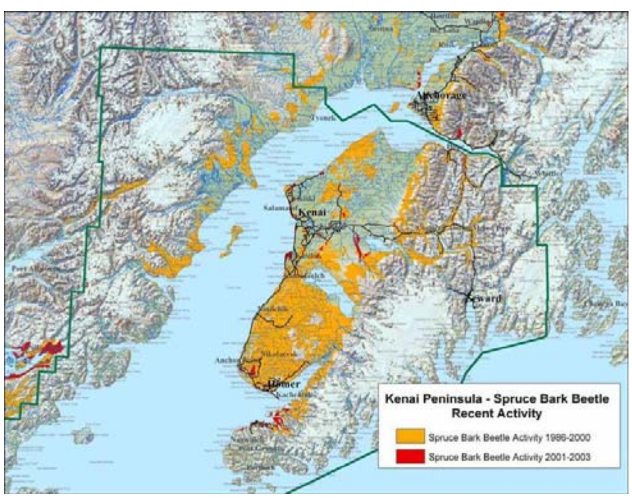


Fig. 10 **Current Situation-Kenai Peninsula. Yellow orange areas illustrate areas that are now non-productive spruce forest, with stand replacement of spruce to scattered to no hardwood, and under story of *Calamagrostis Canadensis* grass (50-100% of spruce component currently dead). With the exception of the northwestern Peninsula (center of map north of Kenai and Sterling Highway), stands on the southern half of the Kenai were predominantly pure spruce with a variable component of mature birch.**

The Kenai Peninsula Borough, with significant funding from Congress in 1996-1997, initiated an ecosystem level vegetation mapping of the mainland Kenai Peninsula. 1:30,000 CIR photography was used to conduct a stand level (Min. mapping size of 10 acres) photo and ground interpreted

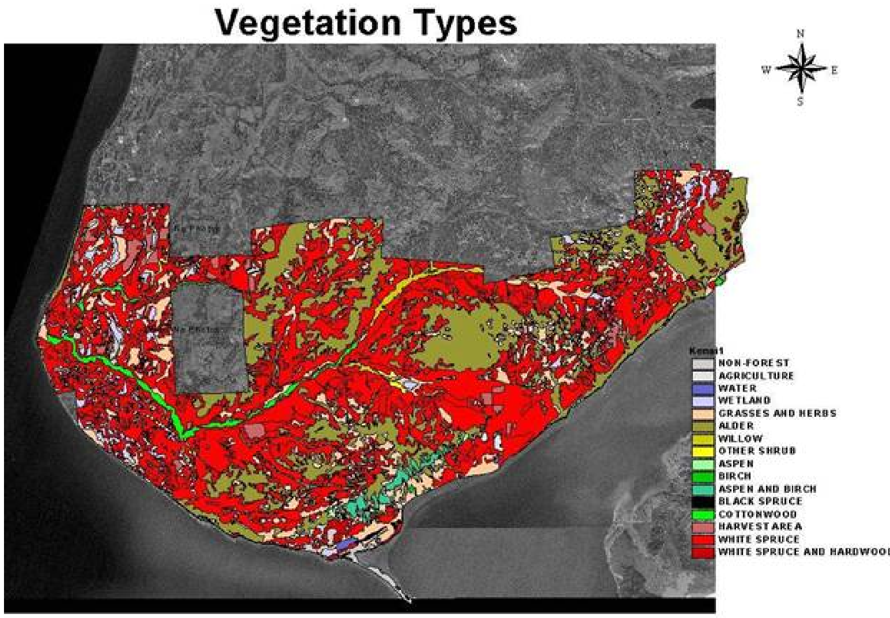
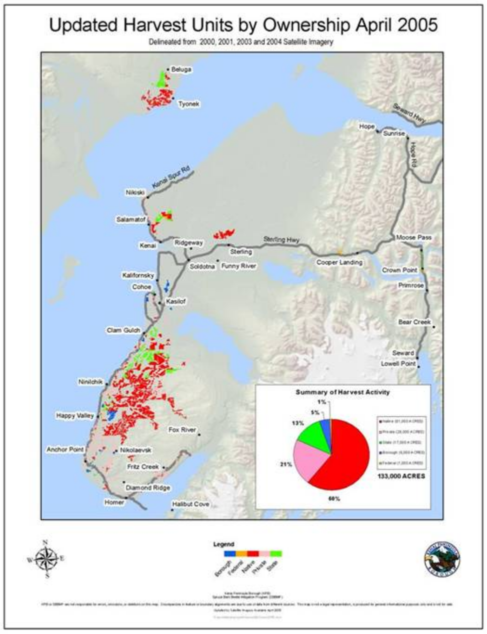


Fig. 11 Kenai Peninsula Borough-Ecosystem Level Vegetation Mapping System

vegetation inventory for the Kenai Peninsula Borough. The photo-interpreted inventory data has been used in conjunction with GIS'd forest damage information from the USFS & State of Alaska forest damage survey for higher level analyses of stand composition, fire risk and hazard, and other forest management layers to support fuels reduction work and assess forest resource impacts within the beetle-impacted areas. In addition, high resolution imagery obtained since 2000 have enabled the borough to provide additional information to agency and publics that have provided us a reconstruction of our forest management efforts during the 1990s beetle epidemic. Timber harvest assessments, landownership patterns in the beetle-killed forest, as well as fire risk and hazard and fuels mapping are now occurring.

The borough's GIS database, along with assessments using the high resolution imagery to model areas with varying beetle impacts have also given us insight into areas that could benefit from forest management and pest risk assessments to assess potential for future forest resource management efforts.



Kenai Peninsula Timber Harvest Activity 1973-2004

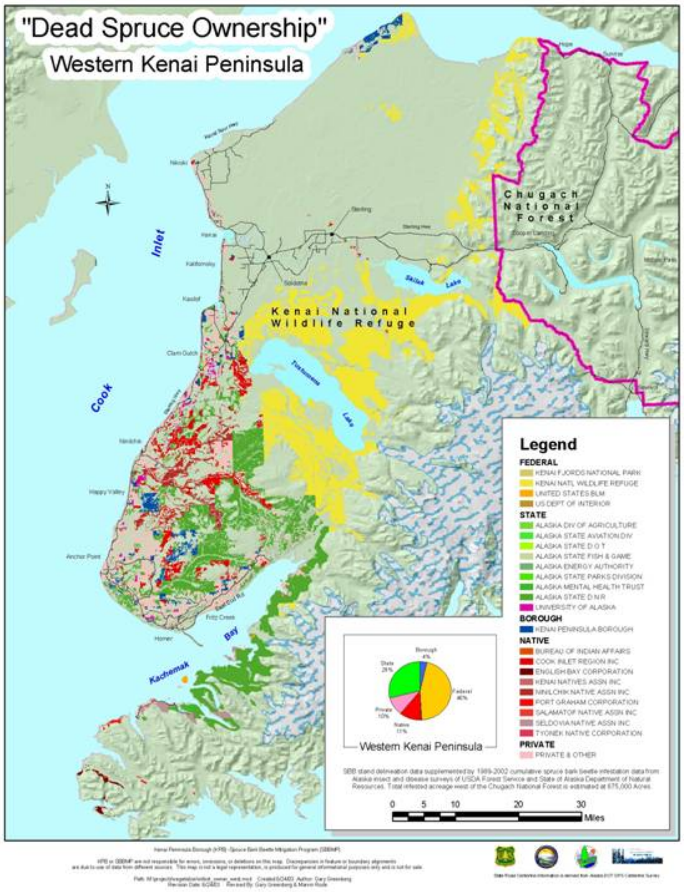
(derived from AK forest damage survey GIS data & Satellite Imagery)

AK Native/Other Pvt	109,000ac	81%
State of AK	17,000ac	13%
KPB/Local Govt.	6,000ac	5%
Federal	1,000ac	1%

Total harvest (est.) = 133,000ac
(54,000ha)

Fig. 12 ***Harvest activity 1973-2004 Approximately 80% of the unharvested area (w. Kenai Peninsula mainland) received moderate to heavy infestation (30-100% infestation of residual spruce stems). Note: the map does not depict the infested acreage (approx. 94,000 ac) within the Chugach National Forest but that figure is included in the acreage summary at the lower right of the legend.***

Since the collapse of the chip pulp market in 1999, medium to large timber sale activity has essentially been halted on the Kenai Peninsula, since no timber or pulp processing infrastructure exists. Local small milling operations for some dimensional products, value added product, and firewood have continued with a small sales (i.e., 50,000 bf or smaller). Although the statutory A.S. 38 timber sales have essentially stalled, hazardous fuels permit sales are occurring to fill some of that gap for the existing local markets and operators. The hazard fuels permitting process is also much shorter (3-6 mo. vs. 18-24 mo.) which enables more rapid utilization of some product but also a mechanism to bring these stands into a more productive state. Hazard fuels projects are also subject to the FRPA reforestation requirements.



"Dead Spruce" Ownership 1989-2002 (Mainland Kenai Peninsula)

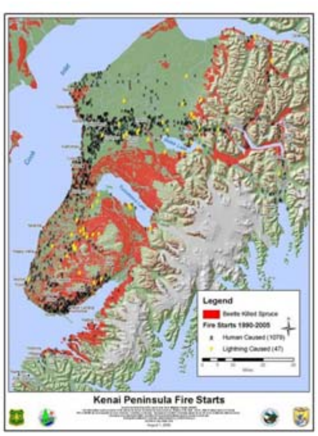
AK Native/Other Private	21%
State of Alaska	29%
Kenai Borough/Local Govt.	4%
Federal (incl. CNF 94,000ac)	46%

Total Acres (Moderate-High Infestation by 2002):

AK Native/Other Pvt	162,000 ac
State of Alaska	223,000 ac
KPB/Local Govt.	31,000 ac
Federal	354,000 ac
TOTAL:	**770,000ac (312,000 ha)**

Fig. 13 ***Of approximately 1.1 million acres impacted by spruce beetle on the western (mainland) Kenai Peninsula, roughly 133,000 acres was harvested and reforested. Ownership of the harvest units is detailed on the lower right of this slide.***

As of 2005 there remains approximately 189,000 acres of untreated spruce beetle-killed forest area within the WUI of the mainland Kenai Peninsula, in both moderate to heavy infestation beetle infestation and fire susceptibility classess.

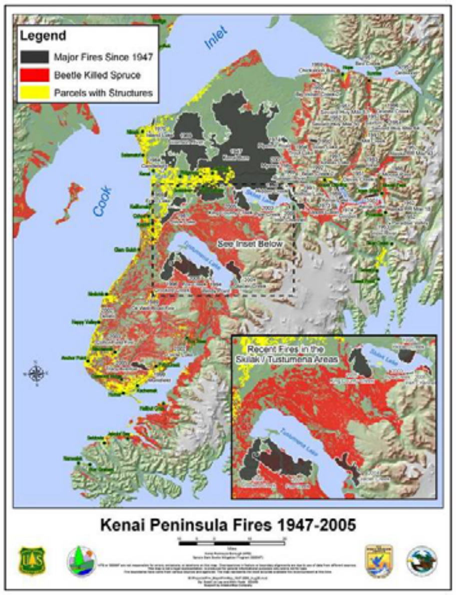


Human-caused
vs.
Lightning-caused
Fires

1990-2005
Kenai Peninsula

Fig. 14 ***Fire activity on the Kenai Peninsula during and since the 1990s spruce beetle epidemic.***

The Kenai Peninsula Borough foresters have assembled various GIS data layers into a fire risk model from their ELVMS (Ecosystem Level Vegetation Mapping System) analysis and the borough's GIS'd tax parcel database. Along with the fire fuels assessments they have assembled from the aerial survey forest damage database and historical fire data, they are able provide fire risk assessments of landowner parcels with structures from a fire and safety risk perspective to all of the agency cooperators (both fire and resource managers). The next series of maps illustrates some of these recent fire fuels and safety assessments.



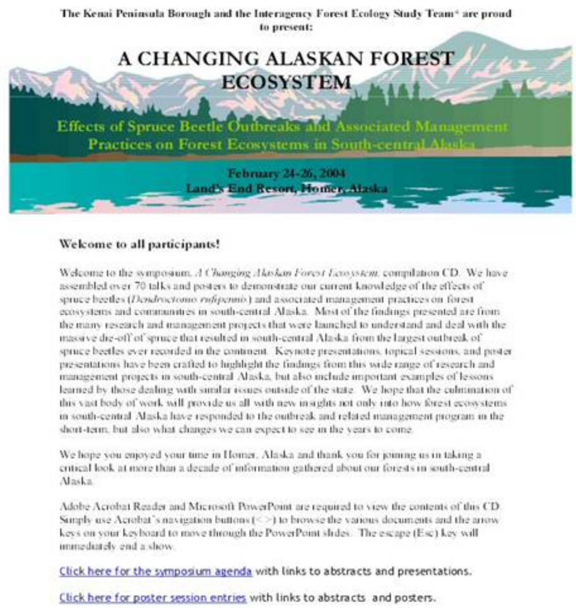
Kenai Peninsula
1947-2005

Major fire activity
vs.
Beetle-Damaged
Stands & Parcels
With Structures

Fig. 15 ***GIS'd information that is being used by agencies, and in the local communities, for fire and defensible space planning and agency action initiatives to bring more awareness of catastrophic wildfire potential, the importance of fire safety planning, forest insect damage assessments, and defensible space management in the communities.***

Since about 2002 we have seen a significant increase in lightning caused fire starts in south-central Alaska, which had historically been a region for primarily human caused fire starts.

Recently, a symposium was held on the southern Kenai Peninsula to bring together 30 years of spruce beetle research and management information as a way to highlight some of what was learned about spruce beetle, looking at management of the 1990s spruce beetle epidemic in south-central Alaska, and the effects of management. A compilation of manuscripts describing previously unpublished and unique aspects of these "spruce beetle effects" from the work in south-central Alaska has been submitted to the Journal of Forest Ecology and Management for publication in late 2006.


The Kenai Peninsula Borough and the Interagency Forest Ecology Study Team* are proud to present:

A CHANGING ALASKAN FOREST ECOSYSTEM

Effects of Spruce Beetle Outbreaks and Associated Management Practices on Forest Ecosystems in South-central Alaska

February 24-26, 2004
Land's End Resort, Homer, Alaska

Welcome to all participants!

Welcome to the symposium, *A Changing Alaskan Forest Ecosystem*, compilation CD. We have assembled over 70 talks and posters to demonstrate our current knowledge of the effects of spruce beetles (*Dendroctonus rufipennis*) and associated management practices on forest ecosystems and communities in south-central Alaska. Most of the findings presented are from the many research and management projects that were launched to understand and deal with the massive die-off of spruce that resulted in south-central Alaska from the largest outbreak of spruce beetles ever recorded in the continent. Keynote presentations, topical sessions, and poster presentations have been crafted to highlight the findings from this wide range of research and management projects in south-central Alaska, but also include important examples of lessons learned by those dealing with similar issues outside of the state. We hope that the culmination of this vast body of work will provide us all with new insights not only into how forest ecosystems in south-central Alaska have responded to the outbreak and related management program in the short-term, but also what changes we can expect to see in the years to come.

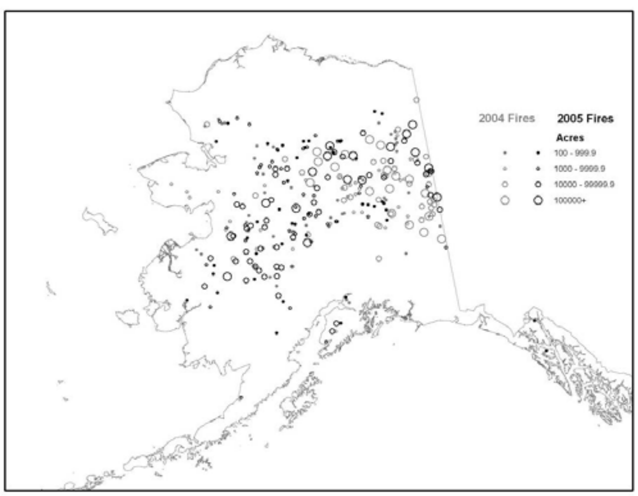
We hope you enjoyed your time in Homer, Alaska and thank you for joining us in taking a critical look at more than a decade of information gathered about our forests in south-central Alaska.

Adobe Acrobat Reader and Microsoft PowerPoint are required to view the contents of this CD. Simply use Acrobat's navigation buttons (< >) to browse the various documents and the arrow keys on your keyboard to move through the PowerPoint slides. The escape (Esc) key will immediately end a show.

Click here for the symposium agenda with links to abstracts and presentations.

Click here for poster session entries with links to abstracts and posters.

Fig. 16 ***Feb. 2004 INFEST Symposium* in Homer, AK examined the past 30 years of research & management of spruce beetle in South-Central Alaska***
**** sponsored by the Kenai Peninsula Borough & Interagency Forest Ecology Study Team (USFS, State of AK, USFWS, KPB, USGS cooperators)***



2004 AK fire activity:
6.8 million acres burned (131 fires > 100ac
2005 AK fire activitiy:
4.6 million acres burned (156 fires > 100ac)

Fig. 17 ***Fire regimes are changing as evidenced by the back to back large fire seasons of 2004 and 2005. The black areas on the map and where fires have occurred since 1996. Other information denotes potential "at-risk" areas for the immediate future.***

We're back to endemic levels of spruce beetle across Alaska, as of the 2005 aerial forest damage survey. Nonetheless, this doesn't give a complete picture of the current situation since spruce beetle is now becoming more active in Interior and western Alaska that have not experienced outbreaks in the past.

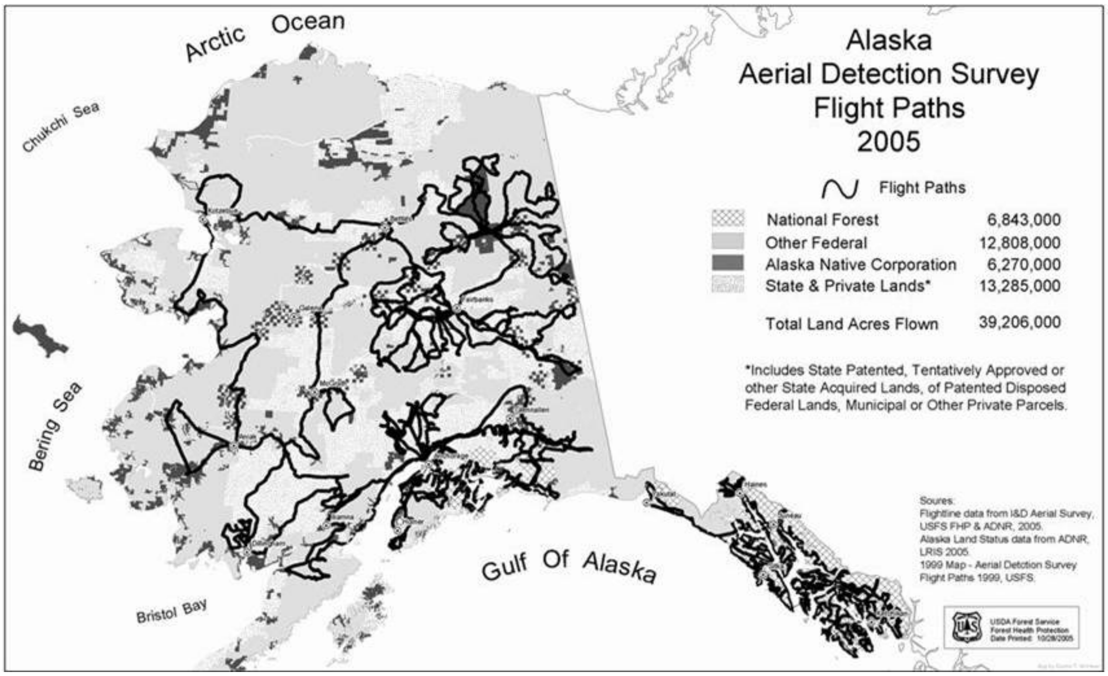


Fig. 18 ***…2005 Alaska forest insect & disease survey: 70,000ac of active spruce beetle infestation.***

In summary, I would like to put forth my impressions in the aftermath of the 1990s spruce beetle epidemic with respect to future forest management considerations and what I feel was learned from our "management" experience during the outbreak. Following that, I have provided a very short list of current and future implications that, in my opinion, should direct our future management efforts.

What was learned in managing the Kenai Peninsula beetle outbreak?

- Effective public process is essential to good forest management
- Communities must be fully engaged in the process to be able to effectively participate in the process
- There is no "silver bullet" that will "control" natural processes (stand replacements with non-native species will ultimately bring other management challenges)
- Markets & economics dictate real gains for fully sustainable forest management

- Retrospective studies both during & after a beetle outbreaks are important to understand time cycles of outbreaks or "don't forget to look into the rear view mirror"
- Beetle suppression & fire suppression go hand in hand

Current & Future Implications of 1990s SB outbreak on forest management :

- Fire regimes are changing with changing climate (fire suppression strategies are evolving/beetle-killed trees will influence fire hazards at some level for 75+ years post-epidemic)

- Carbon loss from major beetle outbreaks could affect cycles for 60-70 years (20 yr lag in reforestation could double loss of carbon during this same period)

- Reforestation with non-native tree species could only delay risk of future pest outbreaks

- Will communities be able to effectively address future outbreaks when they occur?

- Climate shifts are evidence for continued changes on the forest landscape, including major bark beetle disturbances & fires and, possibly, at even shorter intervals than has occurred in the recent past

Several factors have aided the end results from this epidemic (and that is, major stand conversion from conifers to hardwoods with increased fire-prone stands in key population centers of Alaska, including the Kenai Peninsula). Other factors will continue to complicate our efforts at sustainable forest resource management, and that will be how we as agencies respond to the challenges of helping communities understand what needs to be done to improve the natural condition of the forest but also helping explain how we are to operate effectively given the interactions of changing native species and climate cycles in our forest and pest management operations.

I want to acknowledge the individuals who provided critical pieces to the content of this presentation since, without their help and expertise; it wouldn't have been possible to tell a piece of the history of the 1990s Alaska spruce beetle epidemic.

- State of Alaska, Dept. of Natural Resources, Div. of Forestry: Alison Arians, Hans Buchholdt, Martha Freeman, Rick Jandreau, Graham Mahal, Robert Ott;
- USDA Forest Service: Richard "Skeeter" Werner (retired), Edward Holsten (retired), Dustin Wittwer, Lori Trummer;
- US Fish & Wildlife Service: Edward Berg, Andrew DeVolder
- US Geological Survey/Wildlife Habitat Group: Steve Matsuoka
- Kenai Peninsula Borough: Michael Fastabend, Gary Greenberg, Marvin Rude, Robert Wilfong;

- Interagency Forest Ecology Study Team (INFEST) for South-Central Alaska

"To steal from one is plagiarism. To steal from many is 'research'…"
(Author: Anonymous)

Websites for Alaska Forest Insect & Disease information & Kenai Peninsula bark beetle and fire risk/hazard information:

1. KPB Spruce Bark Beetle Mitigation Program (vegetation mapping, fire risk/hazard mapping, forest insect mapping on Kenai Peninsula)
http://www.borough.kenai.ak.us/sprucebeetle/default.htm

2. USFS/AKDOF 2005 forest damage surveys overview mapping
http://www.fs.fed.us/r10/spf/fhp/aerial_survey/2005quadindex.htm

3. State of Alaska Dept. of Natural Resources, Div. of Forestry, Forest Health Protection Program (Insect & Disease Surveys & Reports)
http://www.dnr.state.ak.us/forestry/insects/surveys.htm

Session III

Globalization − International Update

Chair: Pardeep Ahluwalia

Natural Resources Canada, Canadian Forest Service

Session III / Séance III

Séance III

La mondialisation − Le point sur la situation internationale

Président : Pardeep Ahluwalia

Ressources naturelles Canada, Service canadien des forêts

International Union of Forest Research Organizations (IUFRO) update

Nouvelles de l'Union internationale des instituts de recherches forestières (IUFRO)

Presented by:

Eric Allen
Natural Resources Canada, Canadian Forest Service

This presentation is not available

Session IV

National Parks Perspective

Chair: Pardeep Ahluwalia

Natural Resources Canada, Canadian Forest Service

Séance IV

Regard sur les parcs nationaux

Président : Pardeep Ahluwalia

Ressources naturelles Canada, Service canadien des forêts

Severe defoliation of eastern hemlock (*Tsuga canadensis*) at Kejimkujik National Park and National Historic Site of Canada by the pale winged gray moth (*Irodopsis ephyraria* Wlk)

Les pruches du Canada (*Tsuga canadensis*) du parc national Kejimkujik et lieu historique national du Canada (PNLHNCK) gravement défoliées par l'arpenteuse à taches (*Iridopsis ephyraria* Wlk)

Presented by:

Walter Fanning, *Nova Scotia, Department of Natural Resources for Blair Pardy, Parks Canada*
1869 Upper Water St.
Halifax, Nova Scotia B3J 1S9

Abstract

In 2002, severe defoliation of eastern hemlock (*Tsuga canadensis*) trees was observed over about 400 ha in Kejimkujik National Park and National Historic Site of Canada (KNPNHS). The initial infestation was confined to an area known as Canning Field and was subsequently attributed to feeding by abundant larvae of the pale-winged gray moth (*Iridopsis ephyraria* Wlk), a previously innocuous and little-studied native moth. The insect is known to be widespread in southern Nova Scotia and elsewhere, but has previously only been reported at harmless population levels. The outbreak of the pale-winged gray, considered a generalist feeder, was unusual in that it had a focus specifically on eastern hemlock. Concerns about the long-term persistence of eastern hemlock on the KNPNHS landscape saw park managers work with a number of partners to develop an extensive research program – little or no information existed in the literature on this insect – with the desired result being the accumulation of enough knowledge to develop a scientifically-based management response to the insect if required. In addition to the development of an advisory board made up of diverse interests, a series of open houses were held as well as other public consultation mechanisms to discuss management options. This presentation describes Parks Canada's approach to the management of the issue of this highly visible and contentious insect outbreak.

Résumé

En 2002, on a observé une grave défoliation de la pruche du Canada (*Tsuga canadensis*) sur plus de 400 hectares du parc national Kejimkujik et lieu historique national du Canada (PNLHNCK). Le foyer initial d'infestation était confiné dans un secteur appelé champ de Canning, et les dégâts ont par la suite été attribués à l'alimentation d'une grande quantité de larves de l'arpenteuse à taches (*Iridopsis ephyraria* Wlk), un lépidoptère autrefois inoffensif et peu étudié. Cet insecte est connu pour être répandu dans le sud de la Nouvelle-Écosse et ailleurs, mais avait toujours été relevé à des niveaux de population inoffensifs. L'infestation de l'arpenteuse à taches, considérée comme un insecte à comportement généraliste, était inhabituelle en ce sens qu'elle n'affectait que la pruche du Canada. Les préoccupations soulevées par la persistance à long terme de la pruche du Canada dans le paysage du PNLHNCK ont poussé les gestionnaires du parc à élaborer, en collaboration avec un certain nombre de partenaires, un programme de recherche détaillé – la documentation contenant peu ou pas d'information sur cet insecte – dont le but était de recueillir suffisamment de renseignements pour élaborer, au besoin, des mesures antiparasitaires scientifiquement fondées contre cet insecte. Outre la mise sur pied d'un comité consultatif composé de représentants d'horizons variés, on a eu recours à une série de journées portes ouvertes ainsi qu'à d'autres mécanismes de consultation publique pour examiner les options de lutte. Cette présentation décrit la méthode adoptée par Parcs Canada pour gérer le problème causé par l'infestation de ce ravageur très apparent et très discuté.

Session V

Globalization − Invasive Threats

Chair: Pardeep Ahluwalia

Natural Resources Canada, Canadian Forest Service

Séance V

La mondialisation − La menace des espèces envahissantes

Président : Pardeep Ahluwalia

Ressources naturelles Canada, Service canadien des forêts

Sudden oak death: not always sudden, not always oak, and not always death

L'encre des chênes rouges : une maladie pas toujours fulgurante ni mortelle qui ne s'attaque pas qu'aux chênes

Presented by:

***M.J. Celetti*[1]** *and R. Wilson*[2].
[1]*Ontario Ministry of Agriculture, Food and Rural Affairs, University of Guelph, Guelph, Ontario*
[2]*Ontario Ministry of Natural Resources, Forest Health & Silviculture Section, 70 Foster Drive, Sault Ste. Marie, Ontario P6A 3V1*

Abstract

Sudden Oak Death (SOD), caused by the pathogen *Phytophthora ramorum*, is a new disease that is killing tens of thousands of live oaks, tanoaks and black oaks over a 300 km^2 area along the coast of California and the southwest corner of Oregon. The pathogen has subsequently been found infecting numerous taxonomically unrelated tree species as well as cultivated and wild woody shrub species. In 2004, infected ornamental camellia plants from a large California nursery were inadvertently distributed to nurseries across North America, increasing the risk of introduction into the natural landscape of eastern North America. Natural infections discovered in Europe, together with preliminary pathogenicity studies, have indicated that the pathogen can infect and cause lethal cankers on several eastern oak and possibly other hardwood tree species. A Pest Risk Assessment, conducted by the Canadian Food Inspection Agency in 2005, indicated an overall high risk of this pathogen of becoming established and causing economic impact to oak forests, Christmas tree producers, and the ornamental woody plant industry. In nature, the A2 mating type has been predominantly found in North America whereas the A1 mating type has only been isolated from infected plants in Europe, suggesting two separate introductions of this new invasive pest have occurred. The current status and impact of this disease in North America and Europe will be discussed.

Résumé

L’encre des chênes rouges, attribuable au champignon pathogène *Phytophthora ramorum*, est une nouvelle maladie qui tue des centaines de milliers de chênes, de chênes à tan et de chênes noirs vivants sur plus de 300 km^2 le long de la côte de la Californie et dans le coin sud-ouest de l’Oregon. Le pathogène a par la suite été découvert chez de nombreuses espèces d’arbres sans aucun lien taxinomique ainsi que chez des espèces d’arbustes cultivées et sauvages. En 2004, des camélias d’ornement infectés provenant d’une grande pépinière de la Californie ont été distribués par inadvertance dans différentes pépinières de l’ensemble de l’Amérique du Nord, faisant augmenter le risque d’introduction en milieu naturel dans l’Est du continent. La découverte de foyers d’infection naturelle en Europe, conjuguée aux résultats d’études préliminaires de pathogénicité, ont montré que le pathogène peut infecter et provoquer la formation de chancres mortels sur plusieurs essences de chênes de l’Est et probablement sur d’autres essences feuillues. D’après l’évaluation des risques phytosanitaires effectuée par l’Agence canadienne d’inspection des aliments en 2005, le risque général que ce pathogène réussisse à s’établir et ait des incidences économiques sur les forêts de chênes, les producteurs d’arbres de Noël et l’industrie des plantes ligneuses ornementales est élevé. En milieu naturel, le type sexuel A2 a principalement été observé en Amérique du Nord, tandis que le type sexuel A1 n’a été isolé que chez des sujets infectés en Europe, ce qui laisse supposer deux introductions distinctes de ce nouveau phytoravageur envahissant. La situation et l’impact actuel de cette maladie en Amérique du Nord et en Europe seront examinés.

1993

- Rhododendron and Viburnum leaf spots, blights and shoot dieback reported in Europe - no causal agent identified

1995

- Tanoak and Coastal Live Oak suddenly dying in coastal forest of central California

1999-2000

- EU and US Scientists isolated *Phytophthora ramorum* - the causal agent of both dying oaks and the ornamental leaf blight

SOD Distribution (2004)

- epidemic along approximately 750 km of the central coast of California to southern Oregon
- 10,000's of trees have been killed with over 100,000 dead oak trees reported in the Southern Big Sur Coastal Forests (2005)

Host Symptoms

- Bleeding cankers often associated with dying oak trees
- Cankers can become over 2 m in length

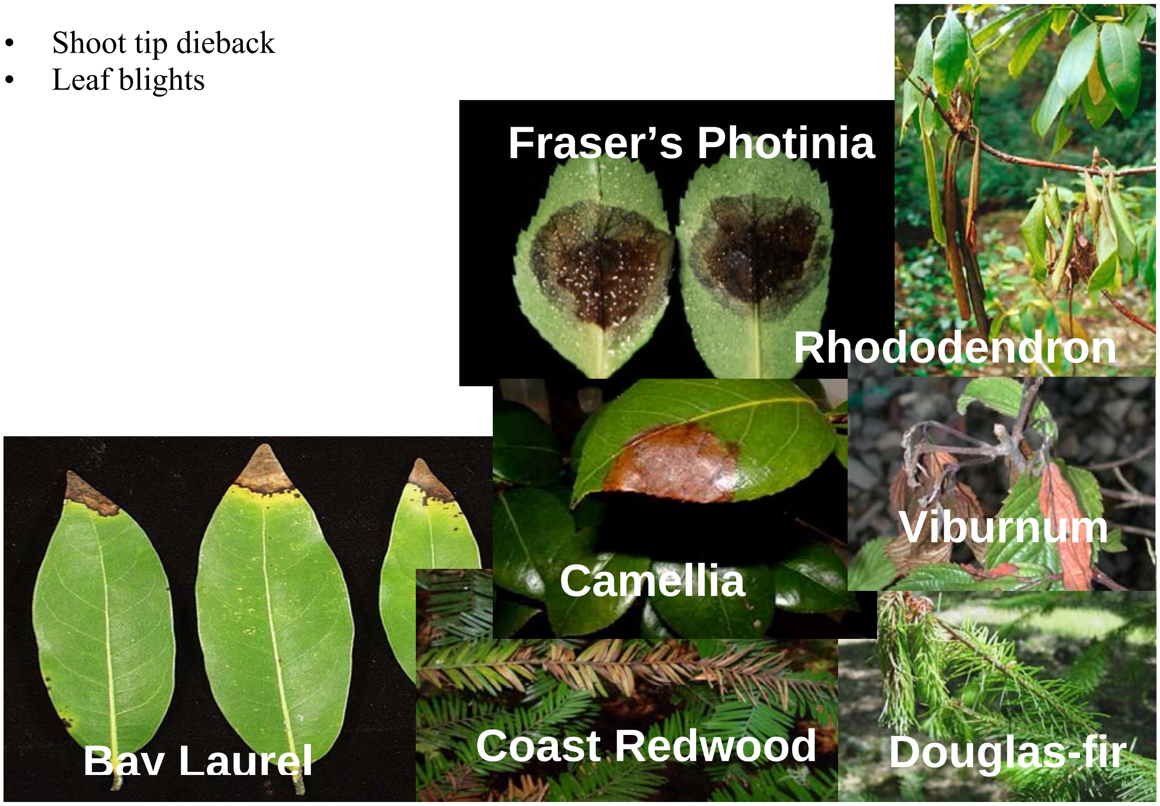
39 Confirmed Hosts

Bigleaf maple	Toyon	Himalaya pieris	Shreve oak
California buckeye	Tanoak	Pieris 'Forest Flame'	California coffeeberry
Madrone	California honeysuckle	Pieris 'Brouwer's Beauty'	Rhododendron (including azaleas)
Manzanita	False Solomon's seal	Japanese pieris	Wood rose
Camellia	Persian Parrotia, irontree	Douglas fir	Coast redwood
Scotch heather	Red tip or Fraser's Photinia	Coast live oak	Lilac
Sweet chestnut	European yew	Canyon live oak	Bodnant Viburnum
European ash	Western starflower	Southern red oak	Doublefile Viburnum
Griselinia	California bay laurel/Oregon myrtle/pepperwood	Holm oak	Laurustinus
Witch hazel	Evergreen huckleberry	California black oak	

50 Associated Hosts

White fir	California wood fern	Southern or Roble beech	Pacific yew
Grand fir	European Beech	Sweet Cicely	Yew
Evergreen maple	Oregon ash	Persian Parrotia (Hamamelidaceae)	California nutmeg
Planetree maple	New Zealand Privet	Chinese Pieris	Poison oak
Maidenhair fern	Chinese witch-hazel	Pieris	Redwood ivy
California maidenhair fern	Mountain laurel	Victorian box	David Viburnum
Horse-chestnut	Sweet bay laurel	Formosa firethorn	Fragrant Viburnum
Strawberry tree	Drooping leucothoe	Sessile oak	Wayfaringtree Viburnum
Spicebush	Star magnolia	Northern red oak	European cranberrybush Viburnum
Andrew's clintonia bead lily	Loebner magnolia	European turkey oak	Burkwood Viburnum
California hazelnut	Saucer magnolia	Cascara	Viburnum
Winter's bark	Michelia	Salmonberry	Prague Viburnum
		Goat willow	Alleghany or Willowood Viburnum

- Shoot tip dieback
- Leaf blights

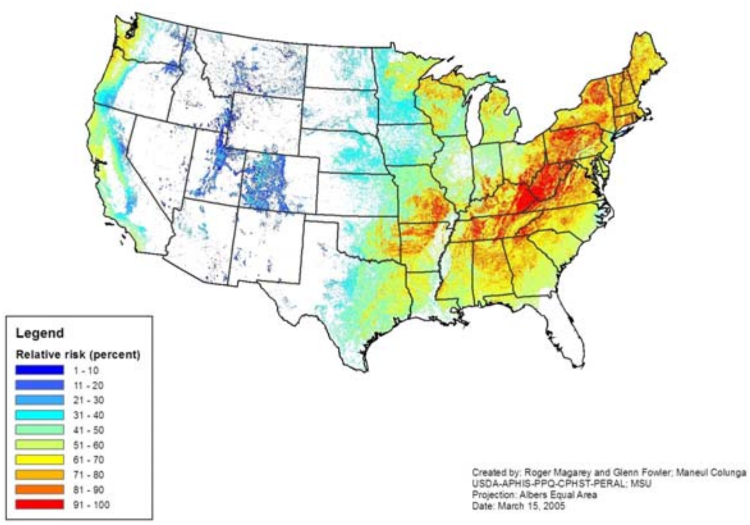


CFIA Pest Risk Assessment for Canada

- Likelihood of Introduction – High
- Consequence of Introduction – BC=High, East=Med
    - Establishment potential – BC=High, East=Med
    - Natural spread – BC=Med, East=Low
    - Potential Economic Impact – High
    - Potential Environmental Impact – BC=High, East=Low
- Level of Uncertainty – Medium
- Overall Risk – BC=High, East=Med

Susceptibility of some Eastern tree species to Sudden Oak Death caused by *Phytophthora ramorum*. (Tooley and Kyde, 2003)

Tree species	n	Lesion area (cm^2)	Lesion area: stem diameter (cm^2)
Chestnut Oak	50	3.20 a	3.29 a
White Oak	50	2.80 b	3.18 a
Northern Red Oak	50	2.16 c	2.08 b
Laural Oak	50	1.76 d	1.62 c
Cherrybark Oak	50	1.55 d	1.82 bc
Willow Oak	50	1.16 e	1.25 d
Water Oak	50	1.15 e	1.26 d
Black Walnut	50	1.10 e	1.16 de
Live Oak	50	1.08 e	1.18 d
Sugar Maple	50	0.94 e	0.91 e
Coast Live Oak	150	0.68 f	1.29 d
Controls	130	0.15 g	0.24 f



Risk analysis based on host and climate parameters in the US (Margery and Fowler 2005)

Pathways :

- wood, bark (firewood) and soil or soil mixes
- “Ornamental Greens” – wreaths, dried flowers etc. made from host material
- non-host plants or plant parts (bulbs, corms etc) with adhering soil
- hiker footwear and tires of recreational vehicles
  - disease spreading along public trails and recreational pathways
- ornamental nursery plants
  - woody and herbaceous ornamental hosts

The Dirty Six - *P. ramorum* spread in nurseries linked to *Kalmia, Lilac, Rhododendron, Viburnum, Pieris,* and *Camellia*

- 173 positive facilities in 22 states most traced to California Camellias (2004)
- 99 positive facilities in 7 US states (November 9, 2005)
- 13 positive BC facilities, 9 traced to California Camellias (2004), 21 landscape sites
- 5 positive BC facilities in 2005 - 1 nursery (positive in 2004) and 4 retails, 11 landscape sites
- none found in Ontario
- 509 sites in UK (2005)

Phytophthora ramorum: Main issues from the 2005 Canadian risk assessment

Phytophthora ramorum : principaux resultants de l'analyse du risque canadienne de 2005

Presented by:

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Abstract

Phytophthora ramorum (Pr) is the causal agent of a disease mainly known as sudden oak death. Following a request by the Canadian Food Inspection Agency, this past year we carried out a risk analysis and some of the most significant findings are presented. For instance, in natural infections, Pr has been observed to affect only plant parts above the soil surface, but recently roots of certain hosts have been successfully infected under laboratory conditions. Recent information about the propagation of this pathogen and its survival under various conditions are also discussed. The overall risk rating for Pr, which is high for British Columbia and medium for certain areas of eastern Canada, could be reduced by improving activities such as inspection and detection procedures and mitigation measures. Research needs are also identified (e.g., in risk-modelling and in assessing the potential of Pr to infect different plant species prevalent in Canada) in order to increase the level of confidence of this risk assessment.

Please note that as the review process of this risk assessment took longer than anticipated, the final version was only completed in May 2006. To find out more, you may obtain a PDF file of the document by contacting D.Rioux at danny.rioux@nrcan.gc.ca

Résumé

Phytophthora ramorum (Pr) est l'agent causal de l'encre des chênes rouges, maladie mieux connue sous le nom de « sudden oak death ». Suivant une demande de l'Agence canadienne d'inspection des aliments, nous avons entrepris au cours de la dernière année une analyse du risque et les principales constatations de ce travail sont présentées. Par exemple, Pr a été décrit comme affectant seulement les parties aériennes des plantes alors que, récemment, une étude a clairement établi en laboratoire qu'il pouvait aussi infecter les racines de certains hôtes. Des informations récentes sur la dissémination de cet agent pathogène et sa survie sous certaines conditions sont aussi abordées. Le risque associé à Pr, qui est élevé pour la Colombie-Britannique et moyen pour certaines parties de l'est canadien, pourrait être réduit en améliorant par exemple certaines procédures d'inspection et de détection ainsi que certaines mesures d'atténuation. Des besoins de recherche sont aussi identifiés (p. ex. en modélisation du risque et pour l'évaluation de la susceptibilité de certaines espèces de plantes communes au Canada) afin d'augmenter le degré de confiance de cette analyse du risque (p. ex., en modéélisation du risque et pour l,évaluation de la sensibilité de certaines espèces de plantes communes au Canada).

Veuillez noter que comme le processus de révision de cette évaluation du risque a été plus long que prévu, la version finale n'a pas été complétée qu'en mai 2006. Pour en savoir plus, il est possible d'obtenir le document en version PDF en contactant D.Rioux à danny.rioux@rncan.gc.ca

Sirex woodwasp is established in North America… Now what?

La guêpe perce-bois est établie en Amérique du Nord…Et maintenant?

Presented by:

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Sirex woodwasp (*Sirex noctilio*) is an aggressive nonnative woodwasp that kills pine trees. An established population of sirex was discovered near Oswego, New York during June 2005. A delimit survey using traps detected adults out to 46 miles from Oswego, thus it appears that sirex is established over a wide area. In the Southern Hemisphere, it has caused up to 80% mortality in unthinned pine plantations.

In its native range of Europe, northern Asia, and the northern tip of Africa, sirex attacks the 2 and 3-needled pines, but it is rarely a pest. In the Southern Hemisphere, it has attacked many of the 2 and 3 needled pines that are native to North America. Sirex is expected to have one generation per year over most of North America, with adult emergence from July through September. Females lay eggs into the wood and also inject a fungus (*Amylostereum areolatum*) and toxic mucus during oviposition. Together, the fungus and mucus kills the tree, and sirex larvae feed on the fungus as they develop.

Unlike Asian longhorned beetle and emerald ash borer, there is a wealth of knowledge about sirex from the research in the Southern Hemisphere. Management of sirex can be accomplished through survey, silviculture, and biological control. Early detection of sirex is critical for successful management. Trap trees are a very efficient and effective monitoring tool in the Southern Hemisphere. Its application in North America will need to be tested due to the native bark beetles and woodborers that may compete for these trap trees. A detection trap may be feasible, but more research in needed on lures (i.e. host volatiles) and trap design. Silvicultural control by on-time thinning will need to be considered in pine plantations and dense fire-regenerated stands.

The key to sirex management is a parasitic nematode (*Deladenus siricidicola*). It is highly density dependent and specific to woodwasps with the fungus *A. areolatum*. This nematode sterilizes the adult female sirex. When an infected adult female emerges from a tree, she lays infertile eggs filled with nematodes into another tree, also likely attacked by fertile females. The nematode is highly density dependent upon the sirex population and regulates the population below the damage threshold. This nematode can be efficiently reared in the laboratory and inoculated into infested trees as sirex establishes in new areas. Host-specificity testing of the nematode on North American woodwasps and potential other non-target organisms will likely be required before a release permit is issued.

For the USDA Forest Service Pest Alert, go to:
www.na.fs.fed.us/spfo/pubs/pest_al/sirex_woodwasp/sirex_woodwasp.pdf
For further information on sirex woodwasp, go to:
www.aphis.usda.gov/ppq/ep/emerging_pests/sirexnoctilio.html

Session VI

Cross-Country Checkup − Ontario and Quebec

Séance VI

Tour d'horizon − L'Ontario et le Québec

Ontario Report – Status of important forest pests in Ontario – 2005

Rapport de l'Ontario : Insectes et maladies des arbres d'importance en Ontario en 2005

Presented by:

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Abstract

In 2005, jack pine budworm (*Choristoneura pinus pinus* Freeman) defoliated 1000 ha in northeastern Ontario for the second consecutive year. About 89,000 ha of defoliation were also reported for the first time in northwestern Ontario. The spruce budworm (*Choristoneura fumiferana* Clem.) population increased from 2004, but only defoliated 39,000 ha in northeastern Ontario. Forest tent caterpillar (*Malacosoma disstria* Hbn) persisted across 470,000 ha of Ontario. The gypsy moth (*Lymantria dispar* L.) remained at low levels in southern Ontario, defoliating 1200 ha; hemlock looper (*Lambdina f. fiscellaria* Gn.) was not evident in 2005. Summer storms resulted in blowdown including 515,746 ha in northwestern Ontario. The aspen decline reported in northeastern Ontario from 2000 to 2004 showed only minimal expansion in 2005. The hickory bark beetle (*Scolytus quadrispinosus* Say) population continued to build in southwestern Ontario and cause tree mortality. Introduced pests of significance included pine shoot beetle (*Tomicus piniperda* L.) on Scots pine (*Pinus sylvestris* L) across Southern Ontario, the pine false webworm (*Acantholyda erythrocephala* L.), which has caused mortality to mature pines, and the larch casebearer (*Coleophora laricella* Hbn.) affecting about 8,000 ha in southern Ontario. Dutch elm disease (*Ophiostoma ulmi* (Buisman) Nannf.) continued to kill elms across the province, and beech bark disease (*Nectria coccinea* var. *faginata*) was commonly reported across southern Ontario. The Asian longhorned beetle (*Anoplophora glabripennis* Motschulsky), and emerald ash borer *Agrilus planipennis* Fairmaire (EAB) remain as concerns, with the EAB expanding into Elgin and Lambton counties, as well as appearing in Michigan close to Sault Ste. Marie, Ontario. A new threat, the Sirex wood wasp (*Sirex noctilio* Fabricus) has appeared within 100 km of the Canadian Border and a cooperative trapping program was initiated with the Canadian Food Inspection Agency in 2005.

Résumé

En 2005, la tordeuse du pin gris (*Choristoneura pinus pinus* Freeman*)* a défolié 1 000 hectares dans le nord-est de l'Ontario, pour une deuxième année consécutive. Quelque 89 000 hectares de défoliation ont aussi été signalés pour la première fois dans le nord-ouest de l'Ontario. La population de la tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana* Clem.) a augmenté comparativement à 2004, mais n'a défolié que 39 000 hectares dans le nord-est de la province. La livrée des forêts (*Malacosoma disstria* Hbn) a persisté sur 470 000 hectares de l'Ontario. Les niveaux de population de la spongieuse (*Lymantria dispar* L.) sont demeurés faibles dans le sud de la province où ce ravageur a défolié 1 200 hectares; l'arpenteuse de la pruche (*Lambdina f. fiscellaria* Gn.) n'était pas apparente en 2005. Des tempêtes estivales ont créé des zones de chablis, y compris 515 746 hectares dans le nord-ouest de l'Ontario. Le déclin du peuplier faux-tremble signalé dans le nord-est de l'Ontario de 2000 à 2004 n'a gagné que très peu de terrain en 2005. La population du scolyte du caryer (*Scolytus quadrispinosus* Say) a continué d'augmenter dans le sud-ouest de la province où elle a causé une mortalité des arbres. Parmi les organismes nuisibles introduits d'importance figurent le grand hylésine des pins (*Tomicus piniperda* L.) qui a ravagé les pins sylvestres (*Pinus sylvestris* L) de l'ensemble du sud de l'Ontario, le pamphile introduit du pin (*Acantholyda erythrocephala* L.) qui a provoqué la mort de pins mûrs, et le porte-case du mélèze (*Coleophora laricella* Hbn.) qui a sévi sur environ 8 000 hectares dans le sud de la province. La maladie hollandaise de l'orme (*Ophiostoma ulmi* (Buisman) Nannf.) a continué de tuer des ormes d'un bout à l'autre de la province, et la maladie corticale du hêtre (*Nectria coccinea* var. *faginata*) a été fréquemment relevée dans l'ensemble du sud de l'Ontario. Le longicorne asiatique (*Anoplophora glabripennis* Motschulsky) et l'agrile du frêne (*Agrilus planipennis* Fairmaire) (AF) sont demeurés préoccupants, l'AF s'étendant aux comtés d'Elgin et de Lambton et faisant également son apparition au Michigan, non loin de Sault Ste. Marie (Ontario). Un nouveau ravageur menaçant, la guêpe perce-bois (*Sirex noctilio* Fabricus), a fait son apparition à moins d'une centaine de kilomètres de la frontière canadienne et a entraîné la mise sur pied en 2005 d'un programme conjoint de piégeage auquel participe l'Agence canadienne d'inspection des aliments.

STATUS OF IMPORTANT FOREST PESTS IN ONTARIO IN 2005

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OVERVIEW

In 2005, jack pine budworm, *Choristoneura pinus pinus* Free., defoliated 1000 ha in northeastern Ontario for the second consecutive year. About 89,000 ha of defoliation were also reported in northwestern Ontario. The spruce budworm, *Choristoneura fumiferana* (Clem.), population increased from 2004, but only defoliated 39,000 ha in northeastern Ontario. Forest tent caterpillar, *Malacosoma disstria* Hbn., persisted across 470,000 ha of Ontario. The gypsy moth, *Lymantria dispar* (L.), remained at low levels in southern Ontario defoliating 1200 ha; hemlock looper, *Lambdina f. fiscellaria* (Gn.), was not evident in 2005. Summer storms resulted in blowdown including 515,746 ha in northwestern Ontario. The aspen decline reported in northeastern Ontario from 2000 to 2004 showed only minimal expansion in 2005. The hickory bark beetle, *Scolytus quadrispinosus* Say, population continued to build in southwestern Ontario and cause tree mortality. Introduced pests of significance included pine shoot beetle, *Tomicus piniperda* (L.), on Scots pine, *Pinus sylvestris* L., across Southern Ontario, the pine false webworm, *Acantholyda erythrocephala* (L.), which has caused mortality to mature pines, *Pinus* spp., and the larch casebearer, *Coleophora laricella* (Hbn.), affecting over 9,000 ha in southern Ontario. Dutch elm disease, *Ophiostoma ulmi* (Buisman) Nannf., continued to kill elms, *Ulmus* spp., across the province and beech bark disease, *Neonectria coccinea* var. faginata (Pers.:Fr.) Fr. Lohman, A.M. Watson, & Ayers, was commonly reported across southern Ontario. The Asian longhorned beetle, *Anoplophora glabripennis* (Motsch.), and emerald ash borer, *Agrilus planipennis* Fairm. (EAB), remain as concerns, with the EAB expanding into Elgin and Lambton counties, as well as appearing in Michigan close to Sault Ste. Marie, Ontario. A new threat, the European wood wasp, *Sirex noctilio* (Fabricus), has appeared within 100 km of the Canadian Border. In response to this finding the Canadian Forest Service (CFS) and the Ontario Ministry of Natural Resources (OMNR) in collaboration with the Canadian Food Inspection Agency (CFIA) established a cooperative trapping program with the result that positive collections were made at six locations in southern Ontario.

MAJOR FOREST INSECTS AND DISEASES

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The overall infested area increased, from 279,824 ha reported in 2004, to a total of 337,485 ha this year, primarily in the Sudbury and North Bay districts of the Northeast Region (Table 1 and Figure 1). Much of this area has been infested for more than a decade; areas of spruce, *Picea* spp., and balsam fir, *Abies balsamea* (L.), mortality were first mapped in 1997. These affected areas have continued to expand as a result of the ongoing spruce budworm infestation. The total area of mortality is now 17,060 ha (Table 2).

The infested area on islands in Lake of the Woods, Kenora District of the Northwest Region recurred and the area remained relatively small (209 ha). In southern Ontario the infested area decreased by about 13,000 ha. Most of this decline in area was in the Bancroft District. Small new areas of infestation were recorded in the Sault Ste. Marie District, west of the city of Sudbury, Sudbury District and in the northwest corner of Algonquin Park, Pembroke District.

Table 1: Gross area of moderate-to-severe defoliation caused by the spruce budworm in Ontario, 2002 - 2005.

Region	Area (ha)			
District	2002	2003	2004	2005
Northwest				
Kenora	0	1 188	138	209
	0	1 188	138	209
Northeast				
North Bay	88 607	158 305	187 854	250 936
Sault Ste. Marie	0	0	0	302
Sudbury	32 734	41 071	40 448	47 768
	121 341	199 376	228 302	299 006
Southern				
Bancroft	439	3 805	6 675	0
Kemptville	2 435	2 117	11 381	9 238
Pembroke	6 908	22 818	32 858	28 988
Peterborough	0	422	470	44
	9 782	29 162	51 384	38 270
TOTAL	131 123	229 726	279 824	337 485

Table 2: Cumulative area of spruce and balsam fir mortality caused by the spruce budworm in Ontario, 2002 - 2005.

Region	Area (ha)			
District	2002	2003	2004	2005
Northeast				
North Bay	3 549	3 549	9 839	11 748
Sudbury	3 920	3 920	3 974	5 312
	7 469	7 469	13 813	17 060
TOTAL	7 469	7 469	13 813	17 060

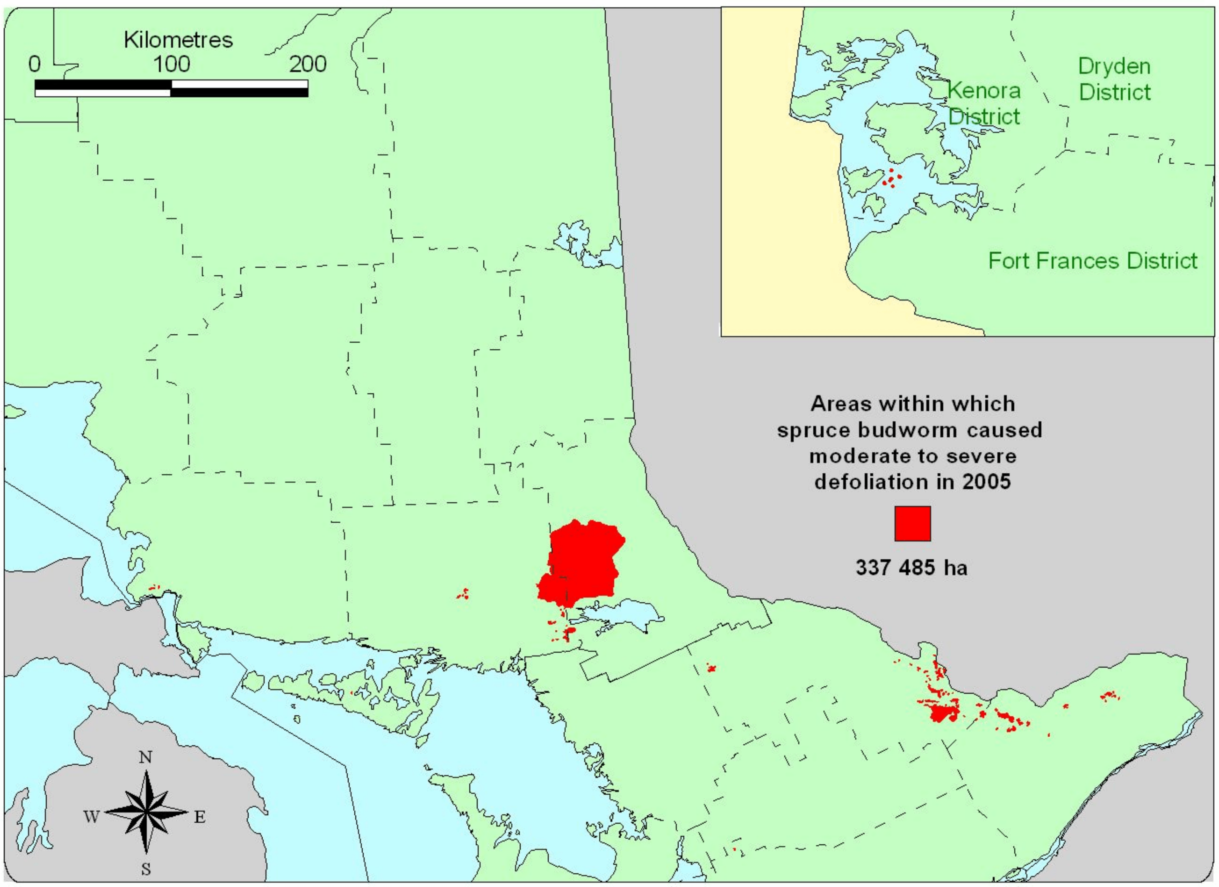

Image 1. Area of spruce budworm defoliation in Ontario in 2005.

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

In the Northwest Region, jack pine budworm caused no detectable defoliation in 2004 but caused moderate-to-severe defoliation to jack pine, *Pinus banksiana* Lamb., over a total of 88,445 ha in 2005. Almost all of this is in three general areas in the western part of the Fort Frances District. There are also relatively small areas affected in the adjacent districts of Kenora and Dryden, 1,134 ha and 1,983 ha respectively, (Table 3 and Figure 2). Population forecasts suggested that there would be some areas of defoliation but an outbreak of this magnitude was not predicted. Defoliation was often severe, sometimes with considerable backfeeding on the old foliage, with the result that in some instances tree tops are now completely bare.

In the Northeast Region, the area of jack pine budworm infestation increased from 851 ha in 2004 to 3,552 ha. The areas infested near the communities of Capreol and Espanola, Sudbury District, first mapped in 2004, recurred and expanded somewhat. There were also new pockets of defoliation reported on the east side of Lake Matinenda and in Sagard Township, Sault Ste. Marie District and also north of Little Current and near Nairn, Sudbury District. In areas that have been defoliated for two years, there are many trees with bare tops. In southern Ontario, a total of 222 ha of jack pine defoliation was mapped in Fraser Township, Pembroke District.

Table 3: Gross area of moderate-to-severe defoliation caused by the jack pine budworm in Ontario, 2004 - 2005.

Region	Area (ha)	
District	2004	2005
Northwest		
Dryden	0	1 983
Fort Frances	0	85 328
Kenora	0	1 134
	0	88 445
Northeast		
Sault Ste. Marie	0	953
Sudbury	851	2 599
	851	3 552
Southern		
Pembroke	0	222
	0	222
TOTAL	851	92 219

Second instar larval surveys performed at 185 locations in the Northwest Region indicate that the outbreak is expected to continue and expand next year. Virtually all of the sampling done within the mapped area of 2005 defoliation has a severe or moderate forecast for 2006. There will be an expanded area of infestation and some of the defoliated areas will likely coalesce next year. In the Northeast Region there are moderate and severe forecasts in the Matinenda Lake area, and in the vicinity of Espanola and Capreol. Light defoliation is forecast for southern Ontario.

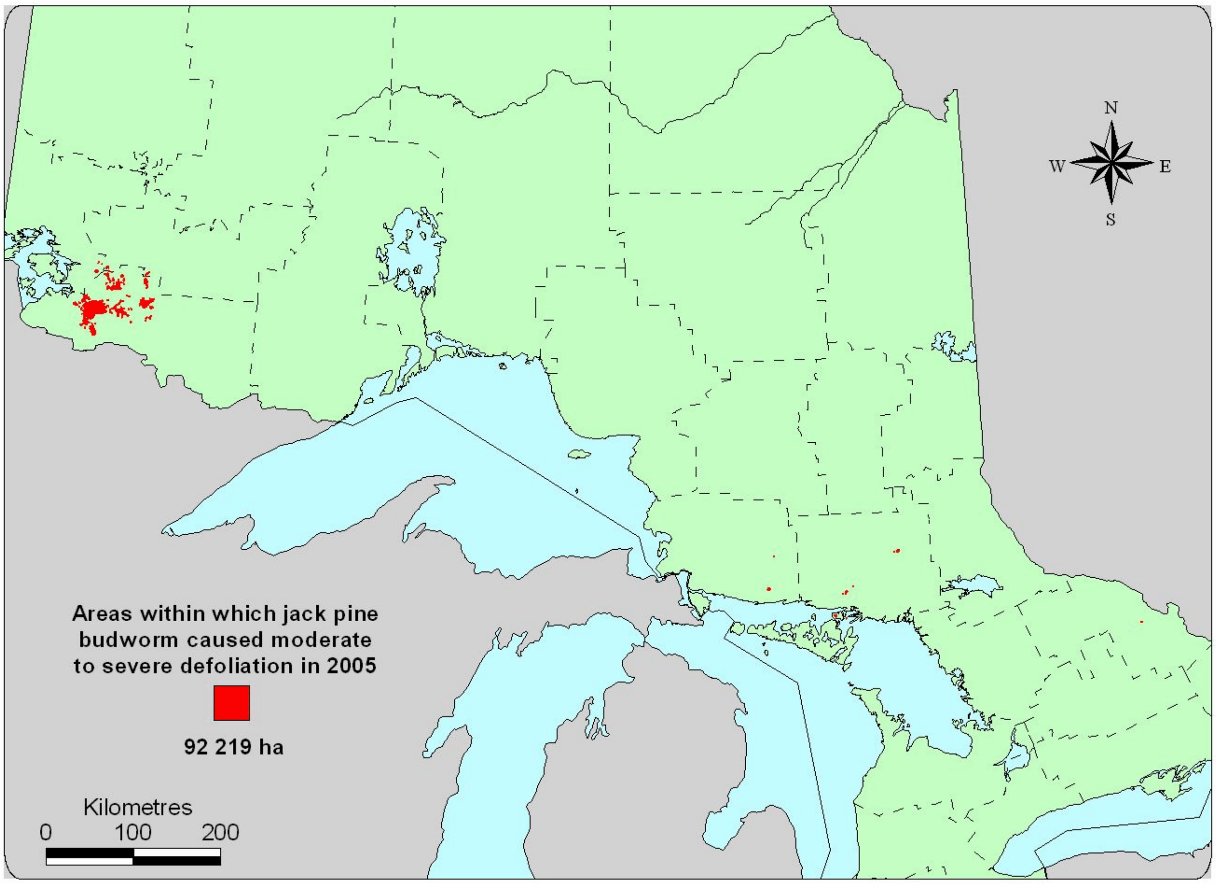

Image 2. Areas of jack pine budworm defoliation in Ontario in 2005.

Gypsy Moth, *Lymantria dispar* (L.)

Areas of gypsy moth damage were recorded in the Aurora, Aylmer and Guelph districts of the Southern Region in 2005. The area of moderate-to-severe defoliation in these districts was 69 ha, 32 ha and 1,141 ha respectively, an increase from the 441 ha recorded in 2004 (Table 4). These areas were all newly infested with gypsy moth because locations that were defoliated last year were free of gypsy moth in 2005.

In most of the stands infested in 2005, larval development was highly successful. Very few diseased larvae were observed giving rise to high numbers of pupae, adults and eggs. Hot and dry weather during the larvae feeding period may have prevented the development of the fungus, *Entomophaga maimaiga* E.M. Humber, Shimazu & Soper, which is often a controlling factor in gypsy moth populations.

Table 4: Gross area of moderate-to-severe defoliation caused by the gypsy moth in Ontario, 2002 - 2005.

Region District	Area (ha) 2002	2003	2004	2005
Northeast				
North Bay	0	0	177	0
Sault Ste. Marie	0	130	0	0
Sudbury	136 878	979	0	0
	136 878	1 109	177	0
Southern				
Aurora	0	0	0	69
Aylmer	0	0	16	32
Bancroft	799	5 216	248	0
Guelph	0	0	0	1 141
Kemptville	364	938	0	0
Midhurst	3 539	11 728	0	0
Parry Sound	7 666	25 732	0	0
Pembroke	2 098	0	0	0
Peterborough	2 330	14 690	0	0
	16 796	58 304	264	1 242
TOTAL	153 674	59 413	441	1 242

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The forest tent caterpillar outbreak, which has been ongoing for several years, continued to decline this year though it persisted in much of the Northeast Region. The area of moderate-to-severe defoliation totalled 469,832 ha and most occurred in Sudbury District (435,399 ha) with smaller areas located in the adjacent districts of North Bay and Parry Sound. There was a complete collapse in other previously infested areas, in Thunder Bay and Nipigon districts, Northwest Region; in Timmins, Kirkland Lake and Hearst districts, Northeast Region; and in Midhurst District of the Southern Region. (Table 5 and Figure 3).

Table 5: Gross area of moderate-to-severe defoliation caused by the forest tent caterpillar in Ontario, 2002 - 2005.

Region	Area (ha)			
District	2002	2003	2004	2005
Northwest				
Dryden	1 389 513	0	0	0
Fort Frances	643 256	6 345	0	0
Kenora	2 685	0	0	0
Nipigon	363 406	857 302	583 505	0
Red Lake	0	0	0	0
Sioux Lookout	530 450	0	0	0
Thunder Bay	2 892 569	1 893 982	22 991	0
	5 821 879	2 757 629	606 496	0
Northeast				
Chapleau	614	0	0	0
Cochrane	10 017	0	0	0
Hearst	175 126	141 690	29 223	0
Kirkland Lake	894 615	418 379	2 549	0
North Bay	300 769	318 330	143 239	28 501
Sault Ste. Marie	11 869	26 549	0	0
Sudbury	809 822	608 301	458 767	435 399
Timmins	168 376	155 477	3 459	0
	2 371 208	1 668 726	637 237	463 900
Southern				
Midhurst	2 356	2 798	1 915	0
Parry Sound	50 522	60 889	31 886	5 932
	52 878	63 687	33 801	5 932
TOTAL	8 245 965	4 490 042	1 277 534	469 832

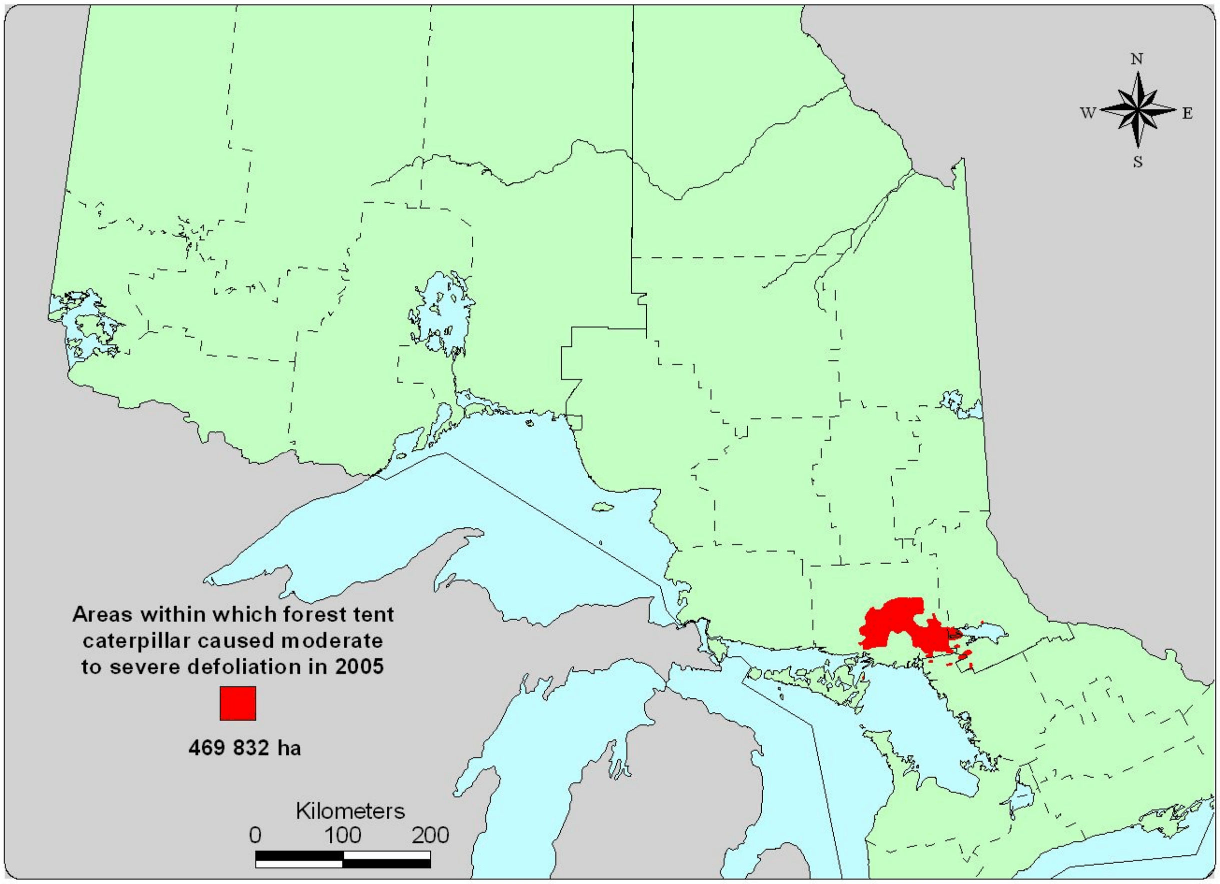

Image 3. Area of forest tent caterpillar defoliation in Ontario in 2005.

Hickory Bark Beetle, *Scolytus quadrispinosus* Say

Since 2001, the hickory bark beetle has caused increasing areas of tree decline and mortality in southwestern Ontario. The area within which decline and mortality occurs is 344,982 ha . Affected counties include Middlesex, Huron, Elgin and Lambton, which fall within the Guelph and Aylmer districts. Bitternut hickory, *Carya cordiformis* (Wangenh.), and shagbark hickory, *C. ovata* (Mill.) K.Koch, are the most commonly affected species and both occur as scattered individuals within hardwood stands in southwestern Ontario. The apparently large increase in the affected area is due to the fact that the mapped area in 2005 encompassed the entire area affected whereas earlier mapping was by individual affected woodlots (Figure 4).

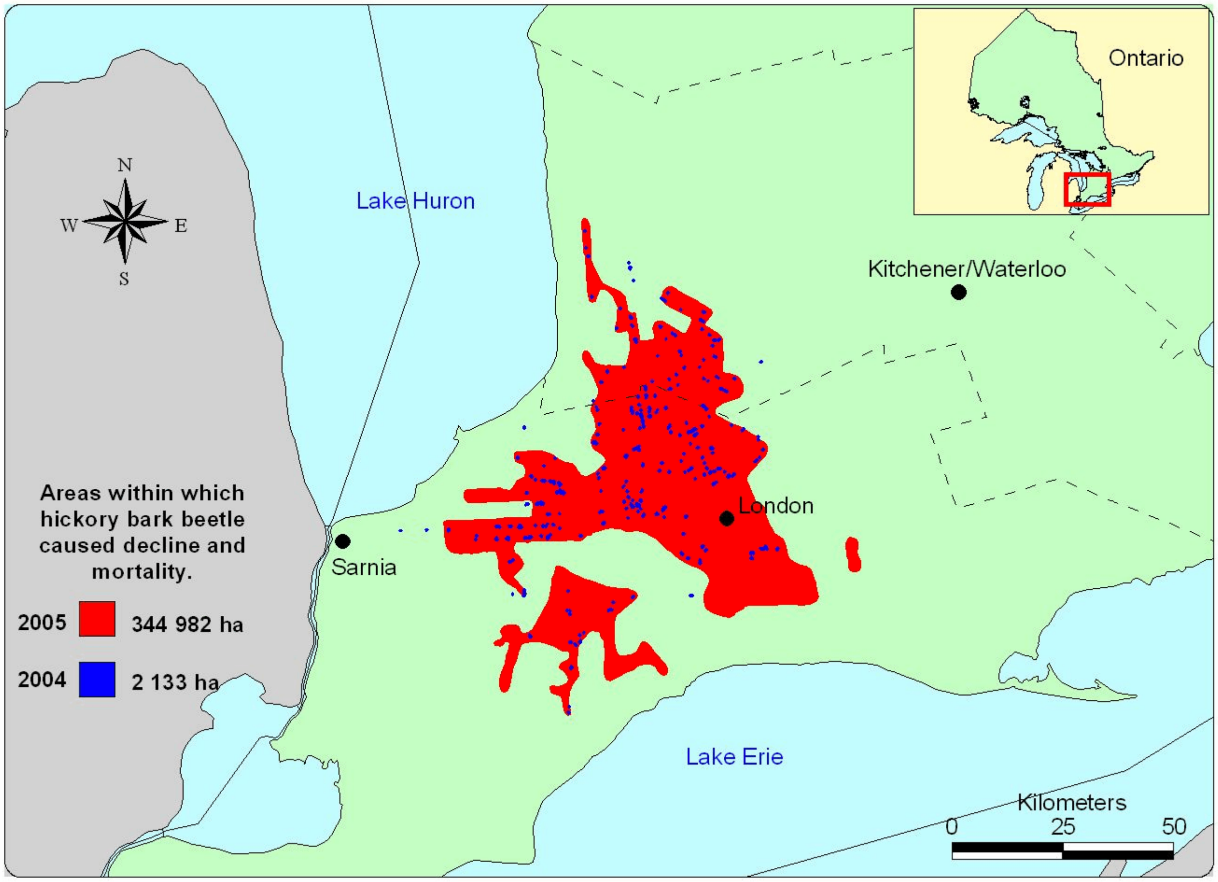

Image 4. Area of decline and mortality caused by the hickory bark beetle in Ontario in 2004 and 2005.

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

The largest area of defoliation caused by this insect occurred to trembling aspen, *Populus tremuloides* Michx., in a large area stretching from the Gowganda area north to the vicinity of Matachewan, Kirkland Lake District. The area of damage was 78,404 ha. There was also a smaller area of 418 ha mapped in the southern part of Hearst District. In the Chapleau and Wawa districts there was a widespread occurrence of the pest but defoliation was generally light.

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

The large aspen tortrix recurred in many of the same areas defoliated in 2004. The total area of moderate-to-severe defoliation, all in the Southern Region, was 7,773 ha. Of this area, 3,997 ha was in the Bancroft District, 2,364 ha in Parry Sound District and 1,412 ha in Pembroke District.

Dutch Elm Disease, *Ophiostroma ulmi* (Buisman) Nannf.

Dutch elm disease continues to cause widespread devastation to second growth elm that has regenerated since the first wave of the disease affected elm in the province. Reports of heavy damage were received from Sault Ste. Marie and across southern Ontario.

Beech Bark Disease, *Neonectria coccinea* (Pers.:Fr.) Fr.var. *faginata* M.L. Lohman, A.M.J. Watson & Ayers

Since the late 1960s, surveys have detected infestations of **beech scale, *Cryptococcus fagisuga* Linding**., in numerous woodlots in southern Ontario; the insect is now known to be distributed across southern Ontario and is moving northward across the range of beech, *Fagus grandifolia* Ehrh. In 1999, ten positive locations with the disease were identified and confirmed in southern Ontario, though evidence suggest the disease has been in the area for at least 10 years prior to that.

In areas of eastern Canada where the disease has been present for a long time, diseased beech trees are identified by the warty appearance on the stem from the numerous cankers. However, in Ontario the disease is in its early stages in most locations and does not always show the classic symptoms typically identified with beech bark disease in more established areas. No surveys were conducted in 2005 but observations suggest the disease is causing mortality and decline at locations where it is well established (Figure 5).

Maple Leafcutter, *Paraclemensia acerifoliella* (Fitch)

Increased populations of the maple leafcutter caused the characteristic 'shot hole' appearance and browning of foliage to sugar maple, *Acer saccharum* Marsh., at many locations throughout the eastern parts of Peterborough and Bancroft districts. The total area of discernable defoliation was 5,549 ha of which 3,479 ha is in Bancroft District and the remaining 2,070 ha in Peterborough District.

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

The pine false webworm caused moderate-to-severe defoliation on 732 ha of plantation forest in southern Ontario in 2005. Most of this damage occurred in Grey County, Midhurst District, while smaller areas of damage were reported elsewhere in the Midhurst District and in the Ganaraska Forest, Peterborough District. Low populations were recorded at a seed orchard in Snowdon Township, Bancroft District. In most instances eastern white pine, *Pinus strobus* L,. was the favoured host. All tree age classes were affected.

In the Northeast Region the pest was recorded in high numbers on ornamentals in the communities of Chapleau and Timmins as well as on natural white pine regeneration along Regional Road 576 in Thorburn Township, Timmins District.

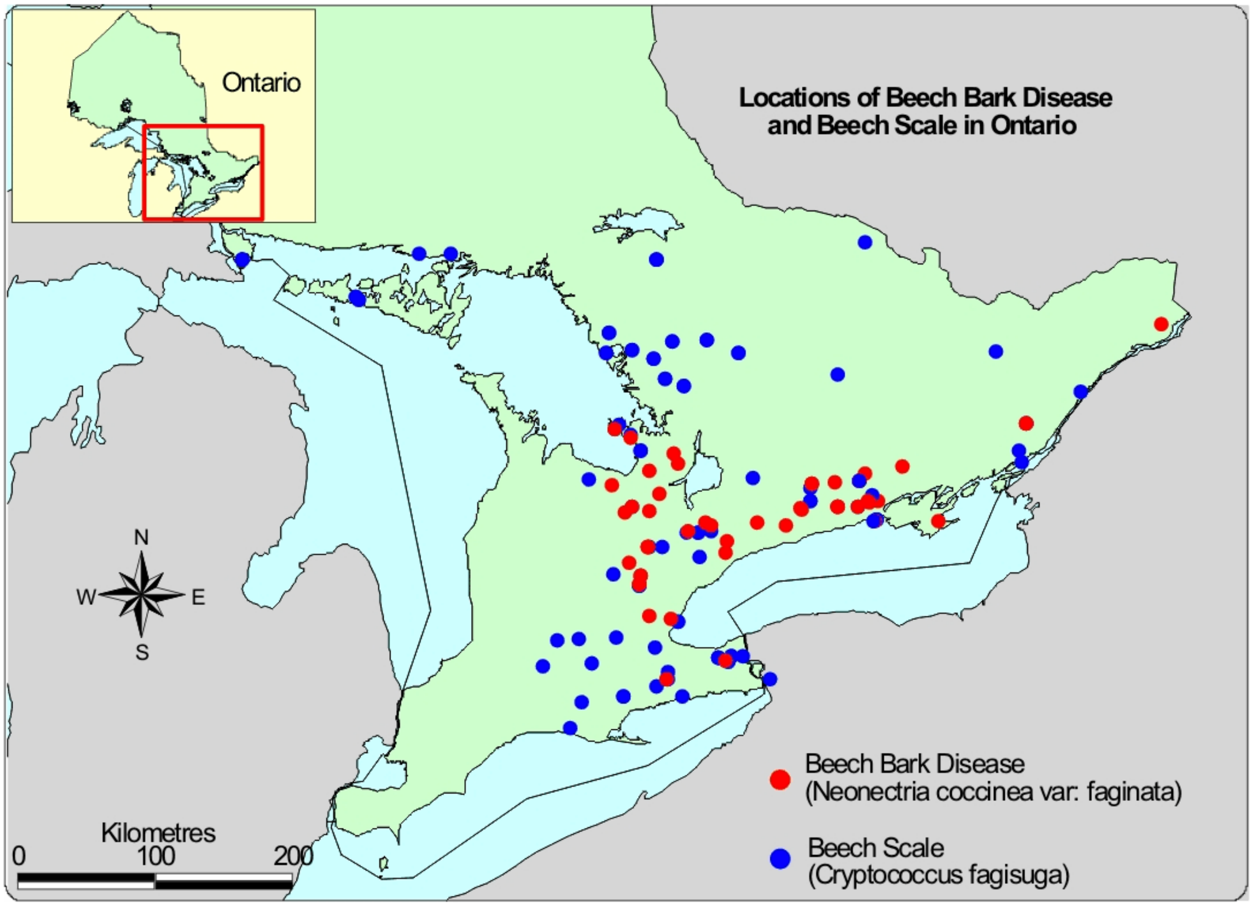

Image 5. Confirmed locations of beech bark disease and beech scale in Ontario.

Cedar Leafminers, *Argyresthia* spp.

This complex of insects, most of which are of the genus *Argyresthia*, are common in southern Ontario. For several years the leafminers have been a problem on eastern white cedar, *Thuja occidentalis* L., in the Kemptville and Pembroke districts. In 2005 the area of moderate-to-severe damage was 27,815 ha. The multiple years of leafmining activity have resulted in many areas of tree top mortality and in some instances heavy whole tree mortality.

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. & Schwein.) De Bary var. *ledi* and *C. ledicola* Lagerh.

The spruce needle rusts caused heavy discolouration of spruce foliage in the Northwest Region, from the town of Red Lake north to Little Vermillion Lake and in the Pikangikum area, Red Lake District as well as north and east of the town of Fort Frances. Moderate damage occurred in Wawa District of the Northeast Region.

Larch Casebearer, *Coleophora laricella* (Hbn.)

There were 9,283 ha of moderate-to-severe defoliation mapped in the Midhurst, Pembroke and Kemptville districts of the Southern Region. Recently dead tamarack, *Larix laricina* (Du Roi) K. Koch, infested with the **eastern larch beetle, *Dendroctenous simplex* LeC.,** were reported in several locations, especially in areas of the Kemptville District, that were formerly infested with casebearer. Eastern larch beetle was also reported in association with dead and dying trees in the Hearst District.

Hemlock Looper, *Lambdina f. fiscellaria* (Gn.)

There were no areas of defoliation in 2005. However, there was an additional 207 ha of eastern hemlock, *Tsuga canadensis* (L.), mortality mapped in the area of previous defoliation. This occurred along the Blue and Killarney ridges in the Sudbury District. The cumulative area of mortality is now 4,277 ha.

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

Feeding damage from adult sawyer beetles was mapped over a large area in the Thunder Bay and Nipigon districts. The damage occurred in numerous pockets and extended from Wabakimi Provincial Park east across the north end of Lake Nipigon as far east as Abamasagi Lake north of Nakina. This area was damaged by heavy snowfalls in 2001 and again in 2003 to a lesser degree. The main host was jack pine and the total area affected was 17,050 ha. Of this area, 11,934 ha was in the Thunder Bay District and 5,116 ha was in Nipigon District. Ground surveys indicated that the damaged area was a breeding site for a number of beetles. In addition to the sawyer beetles, a number of other beetles were involved with the demise of the trees. These included the **striped ambrosia beetle, *Trypodendron lineatum* (Oliv.)**, **pine engraver, *Ips pini* (Say)**, and another **bark beetle, *Hylurgops pinifex* (Fitch)**.

OTHER INSECTS AND DISEASES

DECIDUOUS TREES

Particular to white birch, *Betula papyrifera* Marsh, the **Birch Skeletonizer, *Bucculatrix canadensisella* Cham**., defoliated 5,323 ha in Bancroft and another 1, 298 ha in Peterborough District and was also reported heavy in Kemptville District. Also in southeastern Ontario, the earlier **Birch Casebearer, *Coleophora serratella* (L.)**, caused considerable damage. The **Early Birch Leaf Edgeminer, *Messa nana* (Klug),** caused notable damage in much of south central Ontario; and the **Birch Leafminer, *Fenusa pusilla* (Lep.)**, damaged trees from Sault Ste. Marie to Iron Bridge.

Other significant hardwood defoliating insects in the Southern Region included: the **Elm Spanworm, *Ennomos subsignaria* (Hbn.)**, which defoliated ashes, *Fraxinus* spp., soft maples, *Acer* spp., and other low lying hardwood species on 1,731 ha in the Midhurst District; reduced populations of **Redhumped Oakworm, *Symmerista canicosta* Franc.,** caused moderate-to-severe defoliation on 177 ha in Bancroft District; heavy defoliation was also caused by **Fall Webworm, *Hyphantria cunea* (Drury)**, especially in the far south with reports of exceptionally heavy damage in Point Pelee National Park; and by **Satin Moth, *Leucoma salicis* (L.),** at sporadic locations in the city of Sudbury and points further south in Midhurst, Peterborough and Aurora districts. In northern Ontario the **Early Aspen Leafcurler, *Pseudexentera oregonana* (Wlsm.),** was detected in small localized pockets of infestation in Dempsay Township, Cochrane District.

Beetles that caused damage to hardwoods in 2005 included **Poplar Borer, *Saperda calcarta* Say,** and **Bronze Birch Borer, *Agrilus anxius* Gory**, which were reported from locations in Thunder Bay District; the **Twolined Chestnut Borer, *Agrilus b. bilineatus* (Web.),** was found in large numbers of dead and dying red oak, *Quercus rubra* L., in an area of 35 ha that had been previously infested with defoliating insects in the Midland area, Midhurst District; and new areas of balsam poplar, *Populus balsamifera* L., damaged by **Bronze Poplar Borer, *Agrilus liragus* B. & B.,** were detected in several areas that totalled 306 ha in the Thunder Bay and Nipigon districts.

Some of the deciduous foliar diseases reported in 2005 included: **Ink Spot of Aspen, *Ciborinia whetzelii* (Seaver) Seaver**, which was aerially detected in the White River area of the Wawa District and was also reported from several locations in the adjacent Nipigon District; wet weather in the spring in northwestern Ontario was reported as the reason for increased incidence of **Shoot Blight of Aspen, *Venturia macularis* (Fr.:Fr.) E. Mull. & Arx,** on aspen, *Populus* spp., regeneration throughout northwest Ontario; and it was drought-like conditions in northeastern and southern Ontario in the first half of the summer that were cited for reason for the paucity of the various leaf diseases on hardwoods in those areas.

CONIFEROUS TREES

There were numerous reports of other pests on conifers in 2005. These included the European race of **Scleroderris Canker, *Gremmeniella abietina* (Lagerb.) M. Morelet,** a problem of Scots pine and red pine, *Pinus resinosa* Ait., plantations but the disease was confined to the Parry Sound District; high populations of **Pine Shoot Beetle, *Tomicus piniperda* (L.),** caused localized problems in Scots pine plantations in the Aurora and Guelph districts of the Southern Region; **White Pine Weevil, *Pissodes strobi* (Peck),** was the most commonly reported pest of pine plantations in both southern and northern Ontario; there was heavy damage resulting from feeding damage from **Pine Needleminer, *Exotelia pinifoliella* (Cham.),** in Carling Township, Parry Sound District; and low numbers of the **Eastern Blackheaded Budworm, *Acleris variana* (Fern.),** were observed by field staff from the Hearst District west to the Manitoba border, being particularly evident in the Pickle Lake area, Sioux Lookout District.

The **Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.),** which affects ornamental, hedgerow and plantation spruce, was reported causing heavy damage sporadically in Hearst, Wawa, Sudbury, Timmins, Kirkland Lake, North Bay and Aurora districts; there were high populations of **Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch),** in one area in the Midhurst District that necessitated control actions; the **Balsam Fir Sawfly, *Neodiprion abietis* complex,** caused severe defoliation of balsam fir near Sauble Beach on Lake Huron, at Wasaga Beach on Georgian Bay, Midhurst District and around Gilcrest Bay, Stoney Lake and south of the town of Norwood, Peterborough District; high numbers of **Jack Pine Sawfly, *Neodiprion pratti banksianae* Roh.,** recurred on semi-mature jack pine north of Sturgeon Falls, North Bay District.

ABIOTIC FOREST DISTURBANCES

Aspen Decline/Mortality

There was an area of aspen decline and mortality mapped in 2000 in the Hearst, Cochrane and Timmins districts. The area affected that year was 174 898 ha. The area more than doubled to 441 444 ha in the next two years and extended into Wawa, Chapleau and Kirkland Lake districts. There were relatively small increases in 2003 and 2004 when the total area affected was over half a million hectares. There were no new additional areas within this large area of decline in 2005.

There were however, three areas of mature trembling aspen that displayed symptoms of decline mapped further to the south of this area in the Timmins District. These areas were in Nursey and Halliday townships. The total area affected is 1,984 ha.

Blowdown

During 2005 summer storms were responsible for large areas of blowdown in the Northwest Region. The affected area totalled 515,746 ha. It occurred mostly in Sioux Lookout (312,706 ha), Kenora (93,080 ha), Dryden (67,850 ha) and Red Lake (36,383 ha) districts. Smaller areas of blowdown were recorded in Fort Frances (4,346 ha) and Thunder Bay (1,381 ha) districts (Figure 6).

In the Northeast Region blowdown was reported in Hearst (45 ha); in Kirkland Lake (430 ha); and on scattered trees in the Sault Ste. Marie District. In the Southern Region damage occurred in Guelph (229 ha) and Pembroke (343 ha) districts.

Drought Damage

The largest area of drought damage to trees occurred the Southern Region. There were 49,078 ha of drought mapped in Peterborough District, while Bancroft, Pembroke and Kemptville districts had areas affected of 3,522 ha, 1,878 ha and 502 ha respectively. In the Northeast Region there was 25,000 ha of damage in the Timmins District with lesser amounts in Kirkland Lake (1,171 ha) and Sault Ste. Marie (1,034 ha) districts. Scattered damage was also reported in the Parry Sound and Midhurst districts.

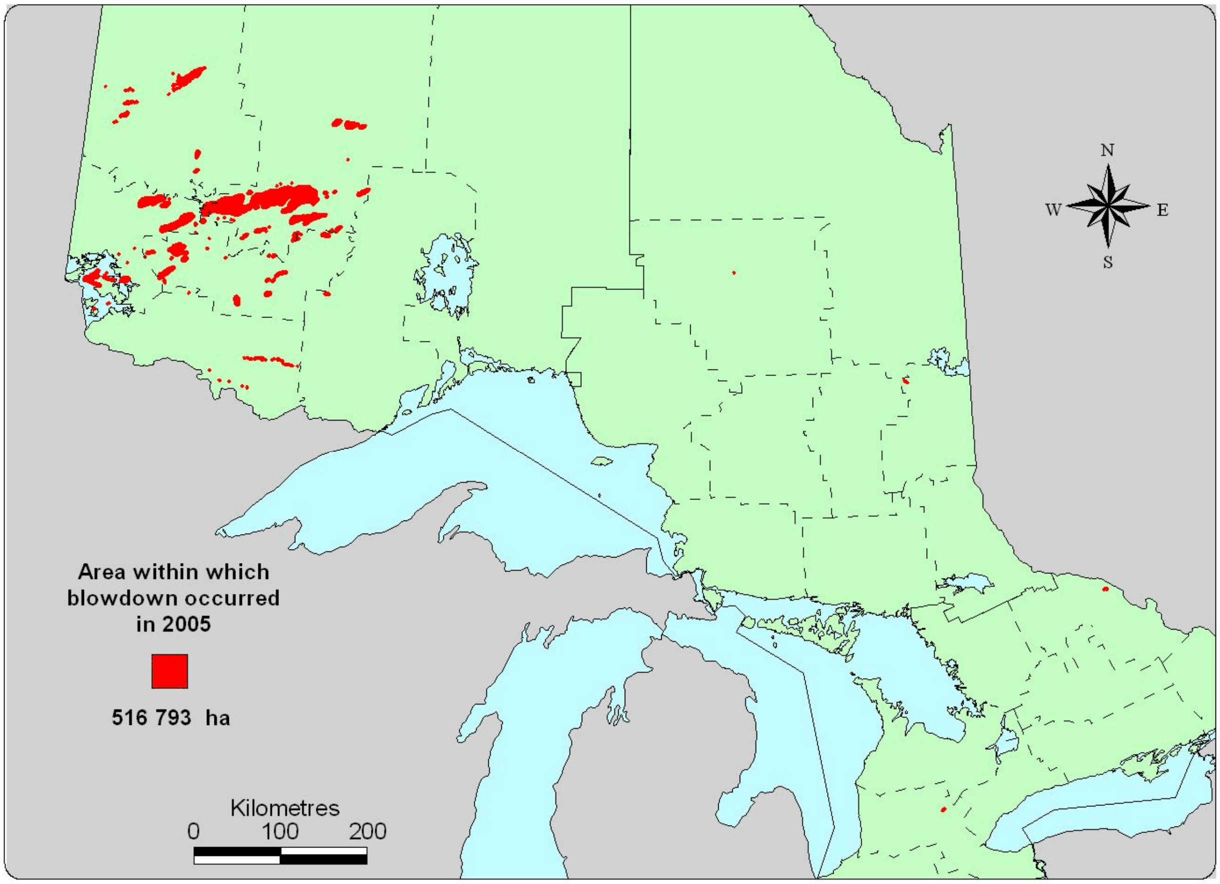

Image 6. Area of blowdown in Ontario in 2005.

White Pine Browning

A foliar browning condition of eastern white pine was prevalent through a large area of northeastern Ontario in 2005. This condition, which caused discolouration and shedding of the needles was mapped over a total of 729,311 ha. The majority of this occurred in the North Bay District with 539,119 ha but there were large areas in the adjoining districts of Kirkland Lake (108,895 ha), Sudbury (59,053 ha) and Timmins (22,244 ha). The condition is not fully understood, but may be related to elevated ground level ozone, drought and foliar diseases.

Other Abiotic Damage

There was other tree damage related to adverse weather conditions in 2005. **Hail Damage** occurred in 959 ha area in the Red Lake District and **Scorch Damage** was reported on various hardwoods in Midhurst and Parry Sound districts of southern Ontario.

INVASIVE FOREST PESTS

Emerald Ash Borer, *Agrilus planipennis* Fairm.

The emerald ash borer was first detected in Canada in Windsor in 2002. Since then it has been encountered throughout Essex County and through many areas of the Municipality of Chatham-Kent. In 2005 additional locations of infestation were found on Walpole Island and in St. Clair Township, Lambton County and in the Municipality of Dutton/Dunwich within Elgin County (Figure 7). CFIA surveys have found approximately 200 infested trees near Dutton and estimate that the insect has been established there for three to five years. Surveys have not detected the insect elsewhere in Elgin County.

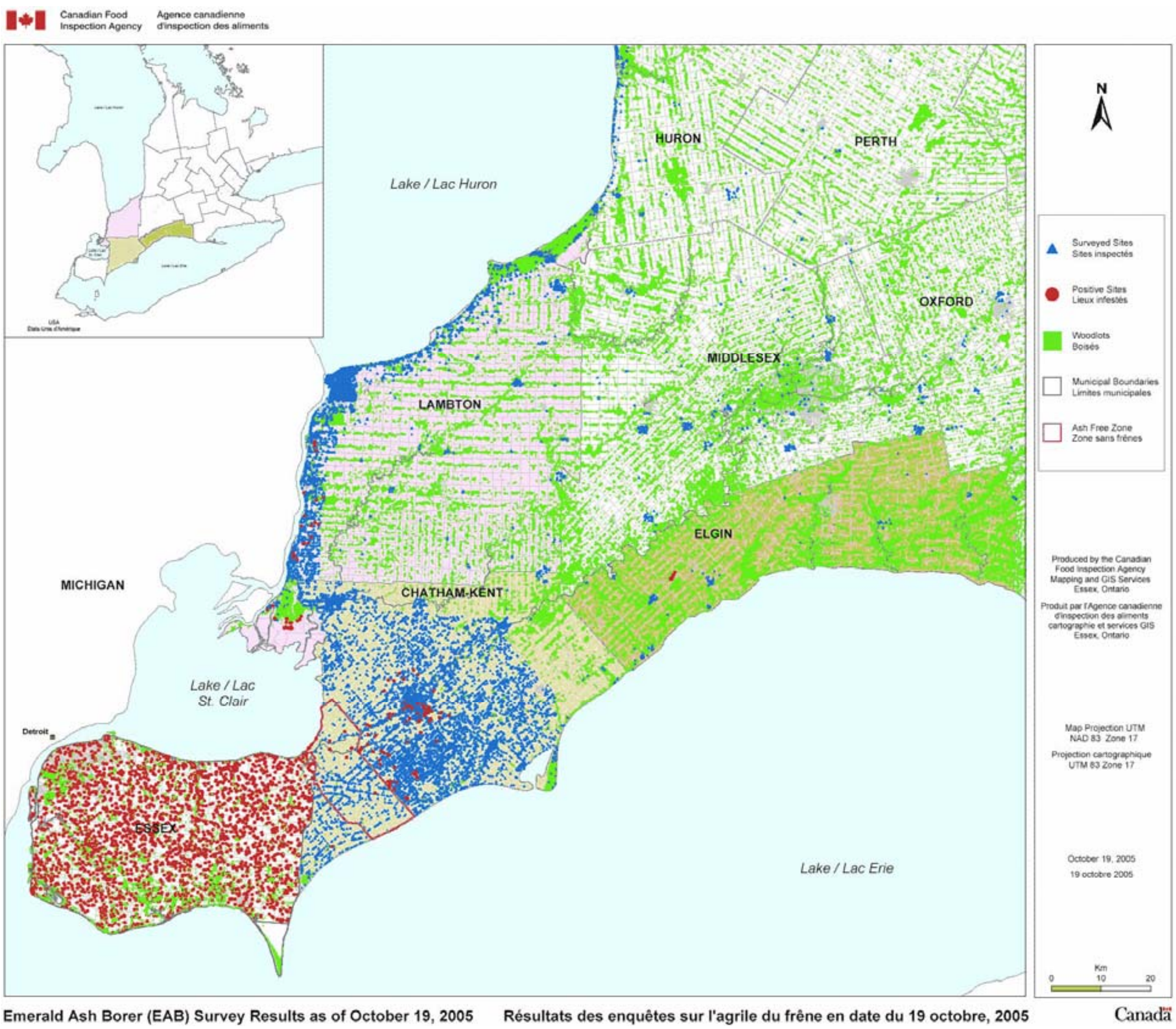

Image 7. Locations of emerald ash borer infestation in Ontario in 2005.

The currently regulated areas include all of Essex County and the Municipality of Chatham-Kent. There are also five kilometre quarantine zones around infested sites along the St. Clair River and in Elgin County at Dutton. At the infested location in Elgin County the CFIA and CFS are collecting information to determine the extent of the infestation and to develop a pest mitigation strategy.

Landscape level damage remains confined to Essex County. This area is to the west of the ash-free zone, the area within which all ash trees were removed between Lake St. Clair and Lake Erie. Aerial mapping of stands damaged by the emerald ash borer was conducted in August. The area affected with obvious damage is 1,985 ha (Figure 8). The area of such damage occurs through almost all of Essex County. Results of ground checks indicate that the level of damage in many of these stands is 100%.

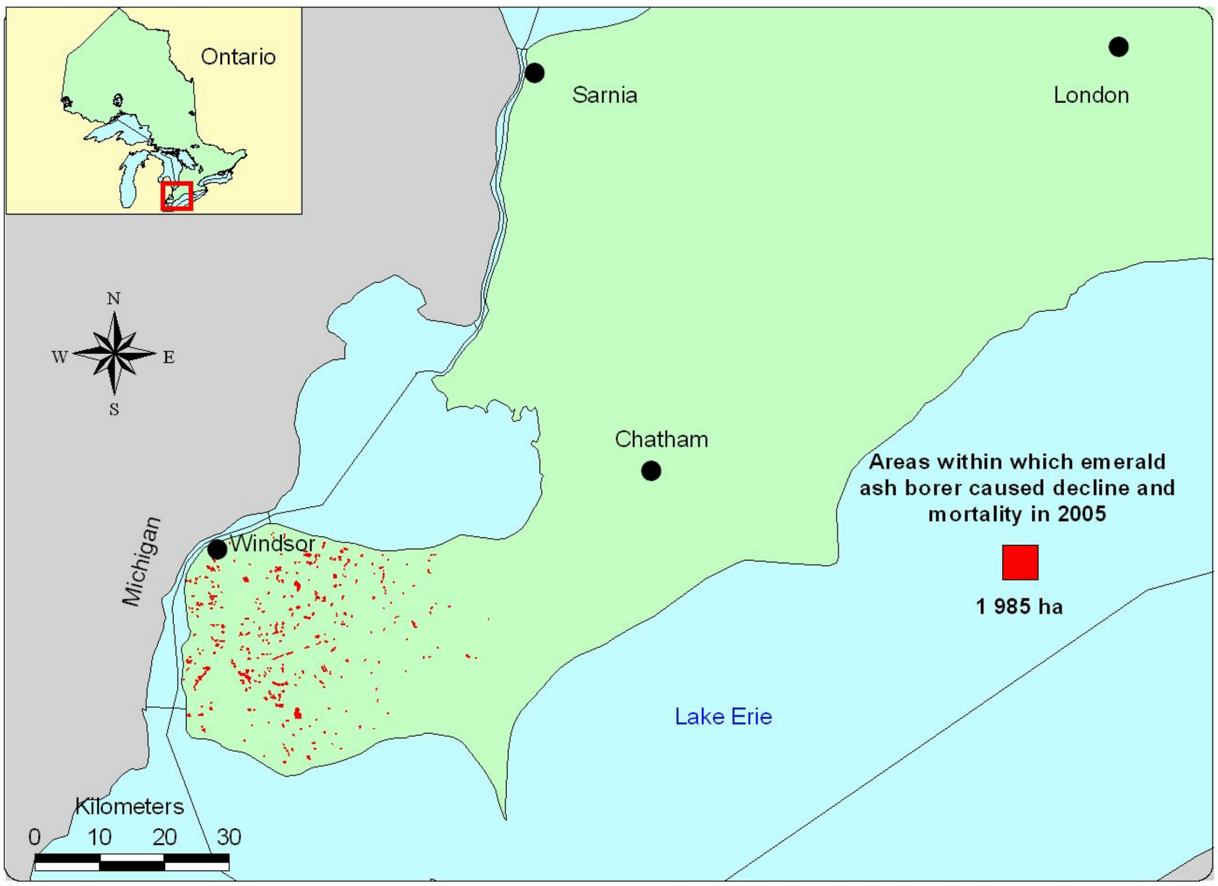

Image 8. Results of aerial survey for areas of emerald ash borer decline and mortality in Ontario in 2005.

Asian Longhorned Beetle, *Anoplophora glabripennis* (Motch.)

A number of Asian longhorned beetle infested trees were detected in both Vaughan and Toronto during 2005. All of these locations were on the periphery of the original area of infestation and are within the regulated area, which was established in February 2004 (Figure 9).

In the continuing effort to eradicate the beetle from this area approximately 11,000 trees were removed during the year. Information continues to be collected on all the infested trees by the CFS and CFIA to strengthen the action and ongoing eradication efforts.

European Wood Wasp, *Sirex noctilio* (Fabricus)

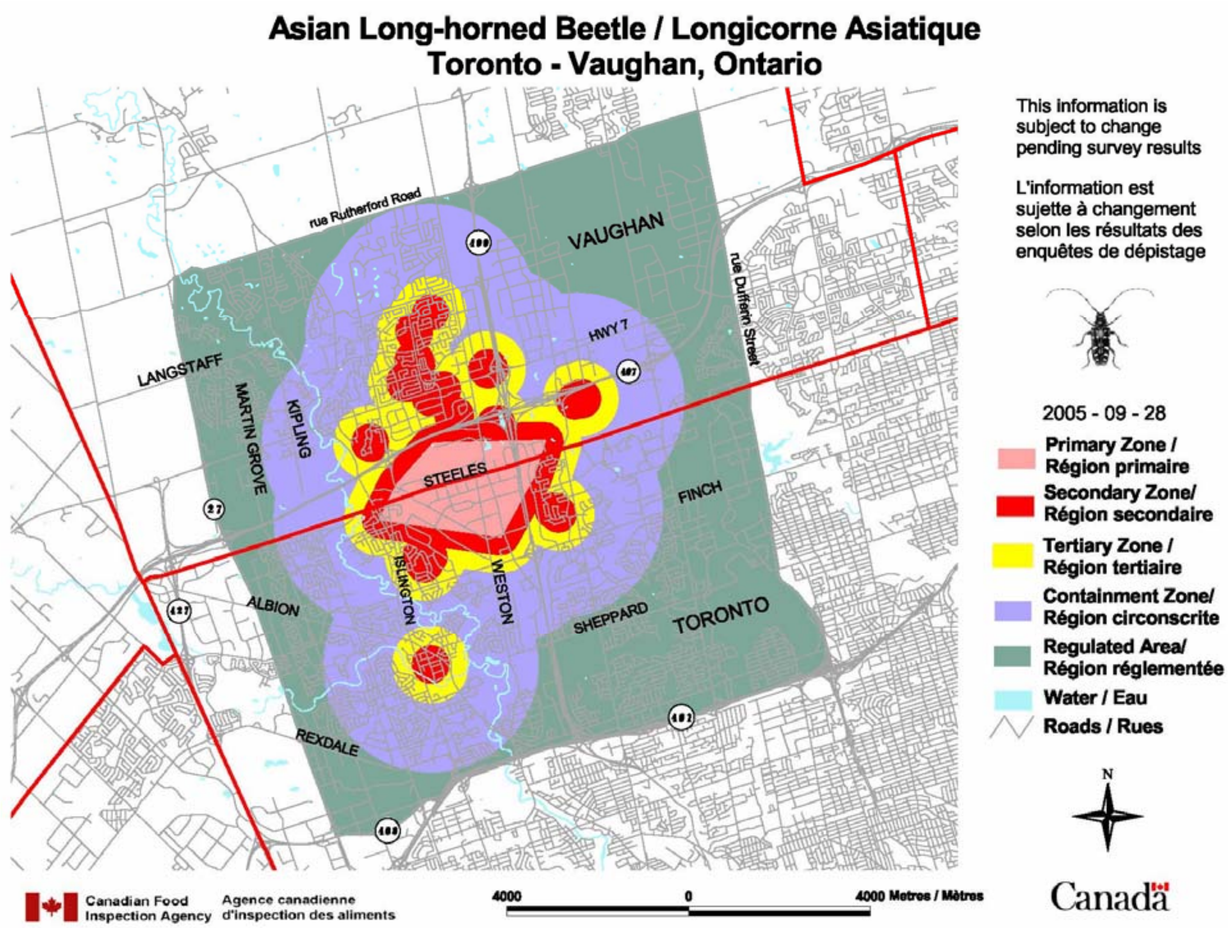

Image 9. Areas of Asian longhorned beetle infestation in Ontario in 2005.

European Wood Wasp. *Sirex noctilio* (Fabricus)

There were six positive collections of the European wood wasp made in Ontario in 2005.

The European wood wasp feeds on many species of pine and is a serious pest of plantations in Australia, South America and South Africa. Based on the climatic conditions in its native range (Europe, Asia and northern Africa), the wood wasp could establish anywhere pine grows in North America. The wasp is rated as a “very high risk” in a risk assessment for North America.

In September of 2004, a single female adult *S. noctilio* was captured near Fulton, New York. On 5 July 2005, the Systematic Laboratory in Beltsville, Maryland confirmed that the European wood wasp, *Sirex noctilio* (Fabricus), had established a reproducing population in pine trees collected from Fulton, which is less than 100 km south of Kingston, Ontario. This is the first report of an established population in North America and represents a very significant and disturbing finding. Survey results reported on 5 August 2005 by US authorities confirmed that wood wasps had been caught at a distance of up to 30 km from the initial find. As of December 2005, US authorities reported finding 85 female *S. noctilio* in delimiting surveys.

The close proximity of Canada to the positive finds in upper New York State and the multiple new discoveries during the summer of 2005 of *S. noctilio* prompted a rapid response survey in Canada. The CFS and OMNR in collaboration with the CFIA established a rapid trap survey of sites along the Canada-US border. Thirty-six sites were sampled from Sandbanks Provincial Park, Prince Edward County east to Cornwall. This area was chosen because it was closest to the known area of *S. noctilio* infestation in New York. Sites contained either two- or three- needle hard pine and included residential and roadside plantings, small plantations, and natural forests. 12-unit Lindgren funnel traps baited with pinene lures were used to capture wood wasps. Traps were deployed between 23 August and 2 September 2005. Collections were made during 19-23 September and again on 10-13 October 2005. Results from the surveys in Ontario indicated the presence of *S. noctilio* at four locations. Three of these sites were in the south half of Prince Edward County while the fourth was along Highway 416, just north of Prescott.

In addition, the CFIA also made positive collections of the European wood wasp at another two locations in southern Ontario. These were near the community of Uxbridge northeast of Toronto and in the city of Cambridge (Figure 10).

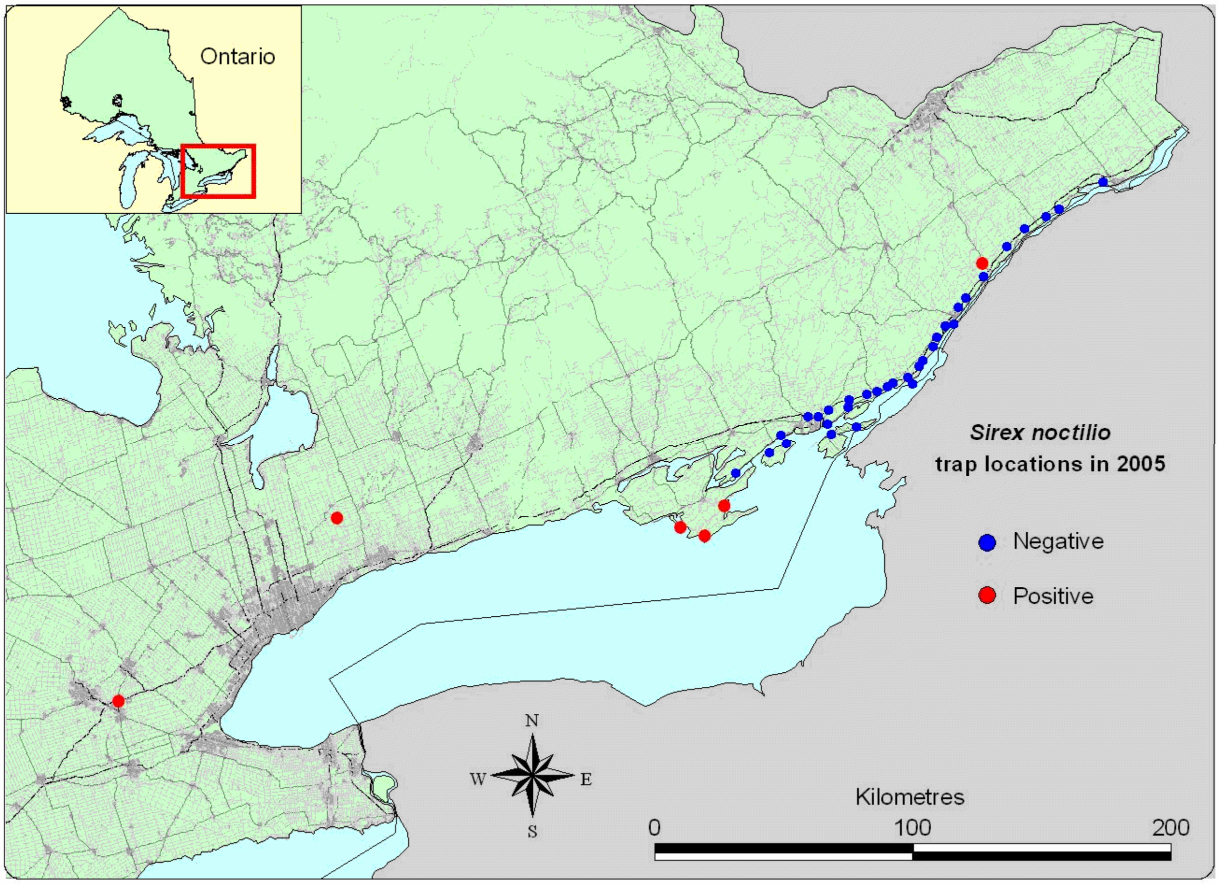

Figure 10. Results of European wood wasp trap survey in Ontario in 2005.

ACKNOWLEDGEMENTS

Many people contributed to the compilation of this report. Much of this information comes from the reports of the field staff. These were Ed Czerwinski, Mike Francis, Wayne Ingram, Dan Rowlinson, Lincoln Rowlinson and Linda Tucker from the OMNR and Bill Biggs, Hugh Evans, Chuck Jones, Al Keizer, Doug Lawrence and Barry Smith from the CFS. Other staff members that had an integral involvement included Taylor Scarr and Richard Wilson of the OMNR as well as Dave Comba, Chuck Davis, Ron Fournier, Kathryn Nystrom, Anthony Hopkin and Peter de Groot of the CFS.

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Quebec Report

Rapport du Québec

Presented by:

Louis Morneau
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FOREST PEST CONDITIONS IN QUEBEC IN 2005

Prepared for the Forest Pest Management Forum 2005

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ABSTRACT

The eastern spruce budworm was the predominant pests of conifers in 2005. Jack pine budworm defoliation was observed for a second consecutive year. In deciduous forests, an infestation of large aspen tortrix was the main entomological problem.

SPRUCE BUDWORM
Choristoneura fumiferana (Clem.)

Eastern spruce budworm infestation occurred in the same areas as the last few years. There was an increase of defoliation mainly in Outaouais. Damage was still present in Saguenay-Lac-Saint-Jean, Mauricie, Laurentides and Centre-du-Québec. Affected areas totalled 48,673 hectares in 2005 compared to 33,743 hectares in 2004 (Table 1).

In Outaouais, defoliations were mainly concentrated inside the area between Maniwaki, Fort-Coulonge and Buckhingham. New defoliations were mostly found southeast of Fort-Coulonge. There was a small decrease in the area of damage in Saguenay–Lac-Saint-Jean in the vicinity of Ville Saguenay. Localised outbreaks persisted in other regions: Mauricie (Parc national de la Mauricie, Saint-Roch-de-Mékinac, Saint-Georges-de-Champlain, Grand-Mère), Centre-du-Québec (Drummondville, Notre-Dame-du-Bon-Conseil), and Laurentides (Kiamika, Notre-Dame-du-Laus, Val-Ombreuse). No defoliation was reported in other regions of Québec.

Table 1. Areas affected by eastern spruce budworm in Québec in 2005 (in hectares).

Administrative regions	***Defoliation levels***			***Total***
	Light	***Moderate***	***Severe***	
Saguenay– Lac-Saint-Jean	323 (350)[1]	356 (639)	934 (1 333)	1 613 (2 322)
Beauce–Estrie	0 (0)	0 (0)	0 (8)	0 (8)
Centre-du-Québec	61 (11)	58 (71)	148 (74)	267 (156)
Mauricie	50 (8)	388 (27)	594 (835)	1 032 (870)
Laurentides	0 (48)	113 (123)	0 (21)	113 (192)
Outaouais	3 688 (2 431)	12 492 (3 585)	29 477 (24 179)	45 657 (30 195)
Total	**4 122** (2 848)	**13 407** (4 445)	**31 153** (26 450)	**48 682** (33 743)

[1] ( ) Areas affected in 2004.

Forecasts for 2006

Overwintering larval surveys (L2) indicated that no major budworm expansion will occur in 2006. Severe defoliations are still expected in the same sectors in Outaouais region. Localised infestations in Centre-du-Québec and Mauricie should be severe again next year. Damage in Saguenay–Lac-Saint-Jean will be found mainly inside Ville Saguenay city limits. Defoliations are expected to slightly stretch farther east and west of the city, along the Saguenay River. In other regions, forecasts based on L2 surveys indicated low spruce budworm populations.

JACK PINE BUDWORM (Tordeuse du pin gris)

Choristoneura pinus pinus Free.

Jack pine budworm defoliation was observed for a second consecutive year in Outaouais on île du Grand Calumet where 562 hectares of severe damage was mapped compared to 151 hectares in 2004. Severe defoliation is expected again next year in the same location.

HEMLOCK LOOPER (Arpenteuse de la pruche)
Lambdina fiscellaria fiscellaria (Guen.)

The two small infestations reported last year in Gaspésie–Îles-de-la-Madeleine region along the Saint Lawrence River decreased to a mere 8 hectares this year. Infested sites are located southeast of Saint-Anne-des-Monts and southwest of Mont-Louis. Forecasts based on egg count surveys and pheromone trapping indicate low population levels for 2006.

LARGE ASPEN TORTRIX (Tordeuse du tremble)
Choristoneura conflictana (Wlk.)

The infestation reported in 2004 in Saguenay–Lac-Saint-Jean, Côte-Nord, and Bas-Saint-Laurent regions continued its progression this year to span over large areas of East Central Quebec. Populations in Outaouais continued to decline and only sparse pockets of defoliation were found. Severe defoliations are expected again next year in Saguenay–Lac-Saint-Jean, Côte-Nord, and Bas-Saint-Laurent regions. However, outbreak should soon start its decline where it has been active for two consecutive years.

FOREST TENT CATERPILLAR (Livrée des forêts)
Malacosoma disstria Hbn.

Forest tent caterpillar population are back at endemic levels across the province except for a couple of spots of very light defoliation in Montérégie.

GYPSY MOTH (Spongieuse)
Lymantria dispar (L.)

This exotic pest has not been a source of concern for many years in Quebec. It was reported this year only in Montérégie in an oak plantation.

CLIMATIC DAMAGE (Dégâts climatiques)

Spring frosts were observed in southwest Outaouais. Young foliage on oak, ash, elm and beech trees was significantly damaged by the cold weather. Strong winds caused noticeable blowdowns in Mauricie, Outaouais, Montérégie and Côte-Nord.

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

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ÉTAT DE SITUATION DES PRINCIPAUX RAVAGEURS FORESTIERS AU QUÉBEC EN 2005

Préparé pour le Forum 2005 sur la répression des ravageurs forestiers

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RÉSUMÉ

La tordeuse des bourgeons de l'épinette est demeurée le principal ravageur des résineux alors que, pour une deuxième année consécutive, on note des défoliations locales par la tordeuse du pin gris. Dans les forêts feuillues, les infestations de tordeuses du tremble se sont étendues dans le centre-est de la province.

TORDEUSE DES BOURGEONS DE L'ÉPINETTE

Choristoneura fumiferana (Clem.)

Les infestations par la tordeuse des bourgeons de l'épinette sont demeurées localisées dans les régions de l'Outaouais, des Laurentides, de la Mauricie, du Centre-du-Québec et du Saguenay–Lac-Saint-Jean. Les superficies ont totalisé 48 673 ha en 2005 comparativement à 33 743 ha l'année dernière (Tableau 1).

L'infestation a progressé principalement dans la région de l'Outaouais. Les dégâts demeurent toutefois concentrés encore majoritairement à l'intérieur du périmètre où on enregistre des défoliations depuis plusieurs années, soit la zone comprise entre Fort-Coulonge, Maniwaki et Buckingham. Les infestations relevées dans les Laurentides (Kiamika, Notre-Dame-du-Laus, Val-Ombreuse) et au Centre-du-Québec (Drummondville, Notre-Dame-du-Bon-Conseil) demeurent locales alors que le foyer localisé en Estrie (Compton) n'existe plus suite à la récolte de la plantation affectée. En Mauricie, les superficies affectées par la tordeuse ont légèrement augmenté par rapport à l'année dernière mais elles demeurent localisées dans les mêmes secteurs (Parc national de la Mauricie, Saint-Roch-de-Mékinac, Saint-Georges-de-Champlain et Grand-Mère). La défoliation y est toutefois moins intense qu'en 2004. Au Saguenay−Lac-Saint-Jean, l'étendue des dégâts a diminué cette année et ceux-ci demeurent confinés dans les limites de la ville de Saguenay. Aucune défoliation n'a été signalée dans les autres régions du Québec.

Tableau 1. Superficies affectées par la tordeuse des bourgeons d'épinette en 2005 (en hectares).

Régions administratives	***Niveaux de déoliation***			***Total***
	Léger	***Modéré***	***Grave***	
Saguenay– Lac-Saint-Jean	323 (350)[1]	356 (639)	934 (1 333)	1 613 (2 322)
Beauce–Estrie	0 (0)	0 (0)	0 (8)	0 (8)
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[1] ( ): Superficies affectées en 2004.

Prévisions pour 2006

Le relevé des larves en hibernation (L2) indique qu'aucune expansion majeure de la tordeuse ne se produira en 2006. De la défoliation grave est toujours attendue dans les mêmes secteurs de la région de l'Outaouais. Les foyers d'infestation dans les régions du Centre-du-Québec et de la Mauricie seront encore actifs l'année prochaine. Les dommages dans la région du Saguenay–Lac-Saint-Jean devraient se retrouver principalement dans les limites de Ville Saguenay bien que les défoliations pourraient s'étendre légèrement à l'est et à l'ouest de la ville, le long de la rivière Saguenay. Dans les autres régions de la province, les relevés des L2 montrent de faibles populations de tordeuse des bourgeons de l'épinette.

TORDEUSE DU PIN GRIS

Choristoneura pinus pinus Free.

La tordeuse du pin gris a causé de la défoliation pour une deuxième année consécutive dans la région de l'Outaouais. Les superficies infestées sont situées principalement sur l'île du Grand Calumet. Elles totalisent 562 hectares comparativement à 151 hectares en 2004. De la défoliation grave est encore attendue au même endroit l'année prochaine.

ARPENTEUSE DE LA PRUCHE
Lambdina fiscellaria fiscellaria (Guen.)

Les deux foyers d'infestation observés l'année dernière dans la région de la Gaspésie–Îles-de-la-Madeleine ont diminué pour ne couvrir qu'une dizaine d'hectares cette année. Les sites infestés sont localisés au sud-est de Saint-Anne-des-Monts et au sud-ouest de Mont-Louis. Les prévisions basées sur le relevé des œufs et les captures d'adultes à l'aide de phéromones indiquent de faibles niveaux de population pour 2006.

TORDEUSE DU TREMBLE
Choristoneura conflictana (Wlk.)

L'infestation de tordeuse du tremble rapportée en 2004 dans les régions du Saguenay–Lac-Saint-Jean, de la Côte-Nord et du Bas-Saint-Laurent a continué sa progression cette année pour s'étendre sur un large territoire du centre et de l'est du Québec. En Outaouais, les populations ont poursuivi leur déclin et seulement quelques îlots de défoliation ont été observés. Des défoliations importantes sont encore attendues l'année prochaine dans le Saguenay–Lac-Saint-Jean, la Côte-Nord et le Bas-Saint-Laurent. L'épidémie devrait toutefois commencer à s'atténuer aux endroits où elle a été active durant les deux dernières années.

LIVRÉE DES FORÊTS
Malacosoma disstria Hbn.

Les populations de la livrée sont endémiques partout dans la province sauf à quelques endroits dans la région de la Montérégie où la défoliation a été très légère.

SPONGIEUSE
Lymantria dispar (L.)

Au Québec, ce ravageur exotique n'est pas préoccupant depuis plusieurs années. En 2005, des dommages n'ont été rapportés que dans une plantation de chênes en Montérégie.

DÉGÂTS CLIMATIQUES

Des gelées printanières ont été observées dans le sud-ouest de l'Outaouais. Le jeune feuillage de chênes, frênes, ormes et hêtres a été significativement endommagé par la température froide. De forts vents ont aussi causé des chablis importants dans les régions de la Mauricie, de l'Outaouais, de la Montérégie et de la Côte-Nord.

Rapports sur les ravageurs forestiers au 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

Session VII

Intensive Forest Management (IFM) and Forest Pests

Séance VII

L'aménagement forestier intensif et les ravageurs forestiers

Poplar productivity perils

La productivité du peuplier et ses risques

Presented by:

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Abstract

The risk structure of disturbances that affect yields of fast-growing species plantations established in afforestation programs in Canada is described. Experts in various disciplines from CFS Centres across Canada provided estimates, derived from the Forest Insect and Disease Survey of Canada information, for the probability of occurrence and impacts of these disturbances. Significant sources of variation in risk include the species and/or clone used in plantations, the ecozone in which plantations may be established, stand age, and the nature of impacts (whether growth reductions or tree mortality). The major disturbances considered are extreme weather events (mainly drought), stand replacing mortality due to fire, and insect and disease pests of the fast-growing tree species used in plantation culture since 1990 in Canada. A Monte Carlo model that could simulate effects of multiple disturbance agents simultaneously was developed to explore the mean changes in yield and uncertainty in this estimate. Exploration of multiple disturbance scenarios suggested that one might expect a 27% mean reduction from the maximum yield of hypothetical 30 year-old white spruce plantations affected by the spruce budworm. Similarly, there was a 33% reduction in the mean yield from low drought tolerant hybrid poplar plantations at age 30 in semi-arid prairie environments. Management actions to control spruce budworm would boost yields by 18%. Drought tolerant hybrid poplar plantations would be expected to improve yields 20% above those of drought sensitive clones. There are obvious applications of this approach to assessing economic opportunities and optimizing harvest strategies, not the least of which is determining the optimum rotation age when marginal growth rates decline to a realistic discount rate. These explorations may also be used to assess the contribution research might make in improving yields. A preliminary estimate suggests that these opportunities amount to some 23% in yield improvement. Work required to make this information useful to practitioners is described.

Résumé

La présentation décrit la structure de risque des perturbations qui peuvent influer sur les rendements des plantations d'essences à croissance rapide établies dans le cadre de programmes de boisement au Canada. Des experts de diverses disciplines de Centres du SCF de tout le Canada ont utilisé les données du Relevé des insectes et des maladies des arbres au Canada pour fournir des estimations de la probabilité de survenue et des impacts de ces perturbations. Parmi les sources importantes de variation du risque figurent l'essence et/ou le clone utilisé dans les plantations, l'écozone où les plantations peuvent être établies, l'âge du peuplement et la nature des impacts (que ce soit des réductions de croissance ou la mortalité d'arbres). Les principales perturbations prises en compte sont les phénomènes climatiques extrêmes (principalement la sécheresse), la mortalité causée par le feu et entraînant le renouvellement d'un peuplement ainsi que les insectes et les maladies des essences à croissance rapide utilisées dans les plantations établies au Canada depuis 1990. On a élaboré un modèle de Monte Carlo capable de simuler simultanément les effets de multiples agents de perturbation afin d'explorer la moyenne des changements du rendement et le degré d'incertitude de cette estimation. D'après les résultats de l'exploration de scénarios de perturbations multiples, il faudrait s'attendre à une réduction moyenne de 27 % du rendement maximal de plantations hypothétiques d'épinettes blanches de 30 ans affectées par la tordeuse des bourgeons de l'épinette. De même, il y aurait une réduction de 33 % du rendement moyen de plantations de peupliers hybrides de 30 ans peu résistants à la sécheresse, établies dans des milieux semi-arides des Prairies. Des mesures de lutte contre la tordeuse des bourgeons de l'épinette feraient augmenter les rendements de 18 %. Il faudrait s'attendre à ce que les plantations de peupliers hybrides résistants à la sécheresse présentent un rendement 20 % plus élevé que celui de plantations composées de clones sensibles à la sécheresse. Il est évident que cette approche peut être utilisée pour évaluer les possibilités économiques et optimiser les stratégies de récolte, notamment pour déterminer l'âge d'exploitabilité optimale auquel le taux de croissance marginale diminue jusqu'à un taux d'actualisation réaliste. Ces travaux exploratoires peuvent également servir à évaluer quelle pourrait être la contribution de la recherche à l'amélioration des rendements. Selon des estimations préliminaires, les possibilités d'amélioration du rendement se chiffreraient à 23 %. Cette présentation décrit les étapes à franchir pour rendre cette information utile aux praticiens.

A framework for poplar plantation risk assessments

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A tool for evaluating risk, adapting management and optimizing benefits from plantations.

The native poplar (*Populus* spp.) resources of Canada are the largest of any country. Of the 80 million hectares occupied by poplars worldwide, 28.3 million hectares (35 percent) are in Canada (FAO, 2004). Until recently, this bounty and the high quality of wood derived from native poplar species precluded the economic development of poplar plantation culture in Canada, but the area of planted poplars is likely to grow with increasing remoteness of native stands from mills and markets, pressures to protect native forests and afforestation opportunities for carbon sequestration in meeting Canada's commitments under the Kyoto Protocol. At present, committed poplar plantations and amenity plantings cover only 14 300 ha, generating some 43 000 m^3 of forest products annually (van Oosten, 2004).

Because of the limited area planted with poplars in Canada, experience with this culture is limited, and uncertainty about risks to plantations could frustrate potential investors. A group of specialists therefore convened to develop a framework for identifying and addressing the uncertainties associated with disturbances and their impacts on fast-growing tree plantations of *Populus* or *Salix* cultivars, among other species, in Canada.

The framework was based on the best information available for assessing losses that plantation ventures might incur from weather-related impacts (mainly drought), fire and pests (including insects, tree diseases and vertebrates). The effects of multiple risk agents were then assessed using Monte Carlo simulation, which involves running a model many times over, each time using values for random variables selected from their probability distributions. No attempt was made to model interactions among disturbances.

Clonal poplar nursery in Quebec: the model for assessing risk indicates that with appropriate planting stock, sound site-clone matching and proper management, plantation culture of poplars in Canada is feasible

J. CARLE

CHARACTERISTICS OF THE FRAMEWORK

The framework was developed for unforested areas along Canada's southern border and the zones adjacent to the prairies of western Canada. The cultivars considered were aspen (*Populus tremuloides*), hybrid *Populus* sp. × sp. and balsam poplar (*Populus balsamifera*), used in afforestation trials since 1990. All projections were limited by a maximum 60-year time horizon, because this was thought to be the extreme harvest age for plantations in Canada.

The framework takes into account both biological and abiotic disturbances that have caused growth loss and partial or stand-replacing mortality in native stands. Abiotic influences include weather events, whose frequencies and impacts are generally correlated with ecozone, and uncontrolled fire, whose occurrence is also correlated with ecozone but modified by vegetation management practices used in plantation development. Biotic factors include mammalian, fungal and insect pests. Whereas the abiotic disturbances will affect all tree species, pests tend to be more species specific, although some might affect several species.

The response to any specific disturbance differs among tree species and this must be accounted for in the assessment of risk. Disturbances may be categorized as annual events; cyclical events, which recur at least quasi-periodically; and chronic disturbances which, once established, affect the plantation for extended periods. In some cases the occurrence of certain diseases on a site from a previous forest crop may preclude planting its host tree species in the next rotation.

An attempt was made to capture the characteristic temporal distribution of the disturbance, the statistical distribution of its occurrence in time, and whether its effects would linger and affect plantation productivity for several years. The analysis was based on the assumption that plantations will be properly managed.

Although climate change is another factor likely to affect plantation yields, the assessments did not take it into consideration because a separate process would have been required to incorporate this concern. However, comparisons can be made by using parameters for dryer or warmer ecozones.

Data quality

The data used in the model came from peer-reviewed literature, anecdotal or survey information or extrapolation by experts, and were not based on specific studies on any one agent. Thus the framework represents a synthesis of the understanding of the experts involved in its development. No undertaking is without risk, and a data quality rating could be used in determining risks associated with uncertainty and/or erroneous information.

DEVELOPMENT OF THE FRAMEWORK

Weather impacts

A simple model was developed to capture all aspects of weather-induced mortality and growth reductions on plantations. Drought is given as an example here as it was assumed to be the most important type of event causing regional-scale impacts on plantations established on non-forested land.

The model encompasses a large number of combinations in that it considers four climate zones (according to drought risk), three categories of drought tolerance for tree species, two types of impact (growth reduction and mortality) and three stages of tree development: seedlings, established trees and older trees.

First, the geographic variation in the probable risks and impacts of drought-induced damage was captured by defining four broad vegetation zones (Table 1) for those areas of Canada where afforestation is likely to occur, based approximately on the climate moisture index (CMI) of Hogg (1994, 1999).

The second step was to classify the candidate cultivars according to their overall tolerance to drought damage and mortality – high, medium or low – based on expert judgment. “Tolerance” refers only to the ability of the tree to survive following extreme weather events.

The third step was to estimate probabilities of drought and other extreme weather events and their impacts on tree growth for each of the four vegetation zones (Table 2). Growth reductions were expressed as a decrease in growth as a percentage of expected normal growth. It was assumed that extreme events affect growth of all tree species in all vegetation zones equally, leading to a cumulative growth loss equivalent to 35 percent of total growth, spread over two years following the event (20 percent growth loss in the year of occurrence, 10 percent in the first year thereafter and 5 percent in the following year).

For example, for species growing in the boreal forest the annual probability of a drought event leading to growth reduction was estimated as 8 percent. This would cause a growth reduction of 20 percent in the year of the drought, followed by 10 and 5 percent growth reductions in the two subsequent years. For the trees growing in the prairies (parkland/montane), the annual probability of such a growth reduction is 12 percent.

Mortality rates were assigned based on the cultivar's drought tolerance; higher mortality rates were assigned for species with low drought tolerance and lower rates for more tolerant species.

TABLE 1. Preliminary classification of ecozones and vegetation zones according to risk of damage to plantations by drought

CMI	Ecozone	Vegetation zone
Low risk (> +15)	Taiga plains	Moist boreal
	Boreal shield	Moist boreal
	Boreal plains	Moist boreal
	Montane cordillera[a]	Moist cordilleran
Medium risk (0 to +15)	Taiga plains	Dry boreal
	Boreal shield	Dry boreal
	Boreal plains	Dry boreal
	Montane cordillera[a]	Dry cordilleran
High risk (-15 to 0)	Prairies	Parkland
	Montane cordillera[a]	Upper montane
Very high risk (<-15)	Prairies	Grassland
	Montane cordillera[a]	Lower montane

[a] Not easily defined in terms of ecoregions because of mountainous terrain; overall risk can be considered the same as for "dry boreal".

TABLE 2. Estimated annual probabilities and impacts of severe climate events leading to growth reductions and mortality (for plantations >3 years old)

Zone	Probability of severe events*(%)*	Annual probability of extreme events leading to growth reductions*(%)*	% Mortality by species drought tolerance class[a]		
			High	Medium	Low
Moist forests	1	4	8	10	12
Dry boreal/ cordilleran forests	2	8	8	12	15
Parkland/montane	5	12	10	15	20
Grassland/ semi-arid	10	20	20	30	40

[a] Values given are the estimated total % mortality caused by the extreme event, but the timing of mortality may be delayed for a few years following the event.

Fire impacts

Fire cycle periods are calculated by dividing the total burnable area (TBA) by the average annual area burned (AAB). The reciprocal of this function provides the percent annual area burned (PAAB), which was taken to represent the probability of fire occurrence in plantations. At the national scale, and using area burned data over a long period of time, the PAAB can be considered a rough estimate of the probability of a random point being burned in a given year. The derived probabilities are generally appropriate at very large scales, but they ignore many factors that are important at smaller scales including weather, fuel, topography and cause of fire (human versus lightning ignitions). Given the large variations in area burned from year to year, the numbers of years of data, the quality of the data and the specific period over which data are collected can have a substantial impact on the estimate of the probability of fire occurrence.

The PAAB values used probably overestimate the fire risk to plantations because many plantations will be established in landscapes outside forested areas, meaning that fire is less likely to spread, and because plantation management generally includes better surveillance and emergency response than is likely in natural forest.

In the risk evaluation framework, fires are considered to cause stand-replacing mortality in all ecozones for all poplar plantations.

The estimated PAAB ranges from 0.001 percent in the mixed wood plains (and the prairies in Alberta) to 1.499 percent in the boreal shield of Saskatchewan. The low value in the prairies of Alberta illustrates the problem with the data used to generate these estimates. Historically no forest fires have been reported from this area.

Pest impacts

Pest risks were derived from experience with pest behaviour in native stands, although plantations of hybrid poplar clones may be more susceptible to insects and diseases than unimproved species. From the literature, the experts tabulated information on those pests that they agreed could significantly reduce yields in fast-growing tree plantations (Table 3). A detailed database is being developed so that it can be consulted for specifics on any particular agent operating on stands of a given kind in a particular ecozone.

In estimating impacts from biotic agents, the variation in behaviour over the life of stands, ecozones and time-specific risk rates present special challenges. For each pest, an attempt was made to obtain information on the epidemiology of the agent involved and to take account of variations by ecozone. The temporal distribution of outbreaks of pests modeled with annual probabilities of occurrence was, for the most part, considered to be uniform. Their impacts, whether growth reduction or mortality, were apportioned over varying times, depending on the nature of the damage and the life cycle of the agent, in a process similar to that used for impacts of drought. The maximum impact was reported as percentage mortality of the standing volume at the beginning of the year being considered.

The cottonwood leaf beetle (*Chrysomela scripta*) is an occasional pest on poplars, so it is modelled with an annual probability of occurrence (Table 3). The pest only affects stands that are less than 15 years of age; mortality occurs in the year after infestation and amounts to 20 percent in each of the two following years for a total of 40 percent per event. The probability of an outbreak of this pest occurring is 1 percent.

Agents known to have cyclical dynamics were handled similarly except that the time of initiation and development of damage was linked to conditions of outbreak development current in the ecozone. Parameters used in this framework were the length of the outbreak when trees are at risk, the period between damaging population densities when trees are not at risk, the beginning of the current cycle and the probability of a stand becoming infested once the outbreak cycle begins. The temporal pattern of damage, whether growth reduction or mortality, was linked to the appropriate time in the outbreak period and was used to calculate time-specific impacts. For example, the forest tent caterpillar (*Malacosoma disstria*) is an example of a cyclic insect pest that causes mortality and growth loss in trembling aspen stands in the prairies, boreal plains, and boreal shield ecozones of Canada. This insect affects stands that are 20 years or older. Mortality occurs in years 1 to 13 after outbreak initiation and amounts to 20 percent of the initial volume (10 percent for two years). Surviving trees have reduced growth for six years, with a maximum impact of 90 percent of the expected annual growth.

Agents known as chronic problems in plantations were described by the probability of infestation and the pattern of damage development. For example, the poplar borer (*Saperda calcarata*) causes tree mortality after stands reach the age of 15 years, and mortality begins two years after its occurrence in the stand. This mortality is 0.5 percent in infested stands and lasts for the life of the stand. After age 15, the annual probability of infestation is 0.1 percent throughout the life of the stand.

Because several agents will affect a stand over its lifetime, an attempt was made to model multiple impacts; consequently, only mean stand performance volumes can be compared under different disturbance scenarios.

A note on alien pests. The framework includes several introduced pests known to threaten plantations, but it does not include potential invaders from outside Canada except for one example, *Platypus mutatus*, which has recently risen to prominence in European poplar culture. Further research would be necessary, including a review of listings of interceptions at ports, if all potential introductions of foreign pests were to be assessed.

TABLE 3. Risk agents affecting poplars and their hybrids

Risk agent	Host range	Agent range	Impact	Temporal pattern	Probability of impact (%)	Maximum impact (growth loss or mortality) (%)
Disease						
Cytospora canker	*Populus* spp.	All	Mortality	Chronic	60.00	100
Marsonnina leaf spot	*Populus* spp.	Boreal Shield	Growth loss	Annual	10.00	40
Melampsora rusts	*Populus* spp.	All	Growth loss	Annual	10.00	40
Mycosphaerella/Septoria leaf spot and canker	Exotic poplars and hybrids	All	Mortality	Annual	7.00	85
Venturia/Pollacia leaf and shoot blight	*Populus* spp.	All	Growth loss Mortality	Annual	10.00 5.00	50 85
Insect pest						
Choristoneura conflictana	*Populus tremuloides*	Boreal Plains	Growth loss	Cyclic	40.00	60
Chrysomela scripta	*Populus* spp.	All	Mortality	Annual	1.00	40
Cryptorhynchus lapthi[a]	*Populus* spp.	All	Mortality	Annual	0.10	45
Malacosoma disstria	*Populus tremuloides*	Prairies, Boreal Plains, Boreal Shield	Growth loss Mortality	Cyclic	80.00 80.00	90 10
Platypus mutatus[b]	*Populus* spp.	Pacific Maritime, Atlantic Maritime, Mixed Wood Plains	Mortality	Chronic	0.01	40
Saperda calcarata	*Populus* spp.	All	Mortality	Chronic	0.10	20

[a] Introduced from Europe, established.

[b] Potential pest of poplars and willow, not yet established in North America.

PUTTING IT ALL TOGETHER

The following hypothetical scenarios are presented to illustrate the nature of outputs derived from the model. In both scenarios, stands were replanted after failure, with no planting delay.

Scenario 1: hybrid poplar in the prairies ecozone, with low drought tolerance clone

This example (Figure 1) was derived from the model through 256 Monte Carlo simulation runs using the following inputs:

- Fire: 0.01 percent annual probability; all stand ages eligible;
- Low drought tolerance clone in a high drought risk zone;
- Growth-reducing drought: 12 percent annual probability of growth reducing drought for plantations greater than 3 years old; growth reductions for the year of the drought and two subsequent years are 20, 10 and 5 percent, respectively.
- Mortality-causing drought: 5 percent annual probability of mortality-causing drought for plantations more than three years old. Mortality pattern: 8 percent, 8 percent and 4 percent for year of the drought and two subsequent years;
- Chronic growth-reducing drought: 12 percent probability of a chronic 40 percent growth-reducing disturbance that lasts the life of the stand, which can occur when stand is less than three years of age;
- Aspen defoliators (forest tent caterpillar and large aspen tortrix, *Choristoneura conflictana*): outbreak started in 2002, lasting two to four years during which the annual probability of occurrence is 5 percent on stands older than 20 years; this will cause 10 percent mortality in the year in which it occurs and substantial growth reduction over the next six years (70, 90, 90, 90, 75 and 15 percent), followed by 9 to 11 years of no risk;
- Cotton leaf beetle: 1 percent annual probability of two years of 20 percent mortality when the stand is less than 15 years of age;
- Poplar borer: After age 15, a 0.1 percent annual probability of a chronic mortality of 0.5 percent per year for the rest of the life of the stand.

The expected growth continues to rise over the period modelled, but the mean simulated volume levels out after about year 30 as the influence of the combined disturbances negates the expected increases in yield. Until age 5 the average simulated growth is about the same as the expected yield, but by age 10 there is a discernible difference. At age 15 even the top 16 percent of stands (those one standard deviation above the mean) start to deviate markedly from the expected yield curve. At age 30, the mean simulated yield is 37 percent lower than the expected yield.

The results indicate that most plantations should be harvested between ages 20 and 35 to maximize yields. Growth culminates at age 21 with a yield of 320 m^3.

Figure 1 : ***Growth of a plantation of a low drought tolerance hybrid poplar clone in the prairies ecozone of Canada (a drought-susceptible region), generated from 256 Monte Carlo simulations of risk agents***

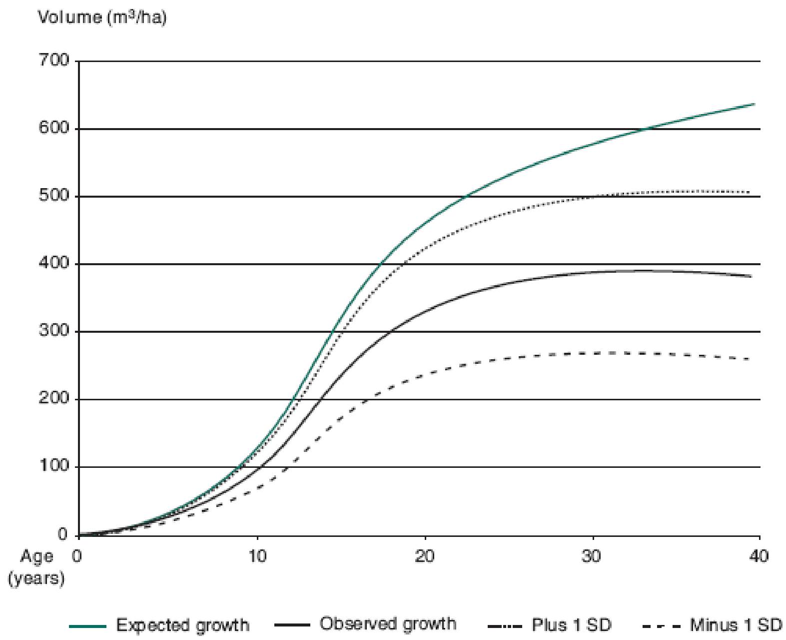
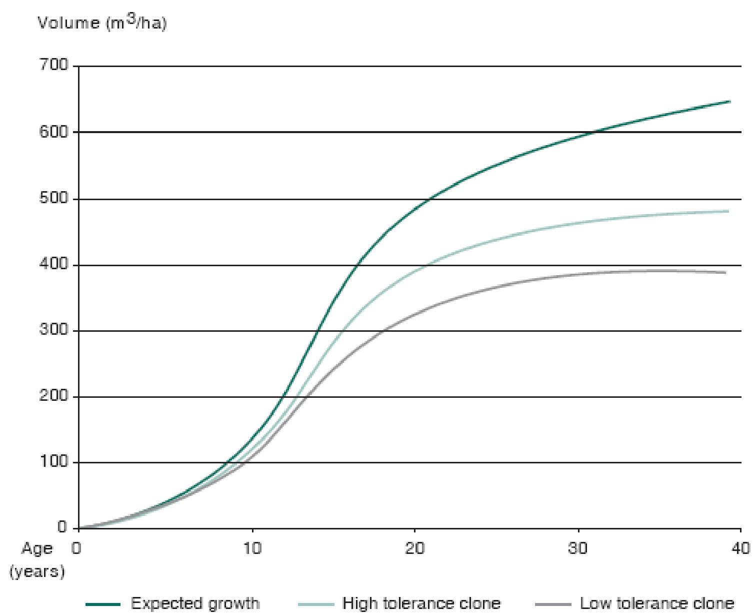


Figure 2 : ***Expected mean growth of low versus high drought tolerance hybrid poplar clones in the prairies ecozone***



Scenario 2: Hybrid poplar in the prairies ecozone, with high drought tolerance clone

In this example the risk agents and probabilities are the same as in the first example except that a clone with high drought tolerance is planted. This influences the drought probabilities and impacts as follows :

- Growth-reducing drought: unchanged;
- Mortality-causing drought: 5 percent annual probability of a drought causing 4, 4 and 2 percent mortality when the plantation is older than three years, i.e. mortality reduced from 8, 8 and 4 percent;
- Chronic growth-reducing drought: 12 percent probability of a chronic 20 percent growth-reducing disturbance (reduced from 40 percent for the low tolerance clone) that lasts the life of the stand, which can occur when the stand is less than three years of age.

In this scenario, the effect of choosing the right genetic material for the conditions raises the yields by 13 percent at age 30 (Figure 2). The simulated yield culminates at age 35, when it is 7 percent higher than at age 30. The yield at this point is 20 percent greater than for plantations of cultivars with low drought tolerance. The mean annual increment reaches a maximum at age 21 in both scenarios, but the yield in the second case is 18 percent greater at that age, at 380 m^3.

CONCLUSIONS

In summary, the model indicated that the probability of extreme weather events in poplar plantations in Canada ranges from 4 percent in moist forests to 20 percent in the semi-arid grasslands. The resulting mortality may range from 16 percent in moist forests to 80 percent in grasslands (for the least tolerant species). The risk of stand-replacing fire (100 percent tree mortality) varies from 0.01 to 1.499 percent. Pest impacts may reach 80 percent growth reduction during outbreaks and 100 percent mortality from chronic disease infections. Despite these extreme impacts, the analysis indicates that plantation culture is feasible, given a well-executed management plan including tending and pest management, sound site/species-clone matching and appropriate planting stock.

A tree plantation is a long-term investment whose success is critically dependent on an establishment strategy where risks can be eliminated or minimized through prediction, prevention and preparedness. Many of these concerns can be mitigated by including the following components in plantation establishment :

- a genetics programme to select, develop and use appropriate planting material, addressing concerns such as pest resistance and climatic tolerances appropriate to the site, as well as productivity and end use;
- a silviculture programme that will ensure maximum productivity, with an appropriate schedule of stand tending, fertilization and vegetation management where required;
- pest management will be an integral part of the plantation management system from its conception through to final harvest.

The scenarios derived from Monte Carlo simulations suggest that the model may be used to explore the savings that might be expected from different management interventions and harvesting plans. Better information on yield curves would improve the model further. For example, the time at which marginal growth increments fall below the discount rate could be explored to optimize harvest schedules. The return on investments from pest control or genetic selection work could be more objectively evaluated. Other inputs, such as weed control, site protection and silvicultural inputs could be built into scenarios to explore their impacts on yield, carbon sequestration and, ultimately, the viability of these projects. In the current simulator, the suggestion is that, with the best hybrid poplar selection now available for the prairies, yields are still 23 percent below what they could be when yields culminate at age 30.

Constraints to be addressed in using the model include uncertainties in the data used to estimate the probability of occurrence of disturbances and uncertainties about the sensitivity of the model and its performance with respect to many of the assumptions. Many of the pest attributes were derived from data or experience with conditions in natural forests and may not apply to plantation conditions. A research programme on plantations is needed to acquire the understanding and information required to make more informed choices in plantation management.

The model, which was originally developed to deal with all tree species planted in Canada since 1990, may be applied wherever the disturbance regime of a region can be quantified. The data requirements may appear daunting at first, but experienced personnel can make conjectures about the epidemiology and impacts of the pests or about the probabilities and impacts of drought and fire. Management choices will ultimately depend on how risk averse or tolerant the user is. The framework provides a decision tool to help planners document their choices of parameter values explicitly so that outcomes can be evaluated objectively. More importantly, it codifies the understanding that goes into plantation development and provides a means for ranking alternatives. It should be better than rolling dice!

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Pest surveys in managed renewed forests of Manitoba

Études des parasites dans des renouvellements forestiers gérés du Manitoba

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Abstract

Manitoba Conservation has been surveying for forest pests in renewed stands since the early 1990s. Results from the initial surveys determined the major pests causing severe damage and mortality in the major commercial tree species. A forest health component that included these damaging pests was incorporated into three Silviculture surveys: 1) Regeneration conducted at age seven, 2) Free To Grow conducted at age 14, and 3) Pre-Harvest conducted at >60 years of age. Results, including pest occurrence, abundance and distribution throughout the province, will be presented for the initial pest survey and for the forest health component of each Silviculture survey. Future objectives will also be discussed.

Résumé

Conservation Manitoba a étudié les parasites forestiers dans les peuplements de renouvellement depuis le début des années 1990. Les études préliminaires ont permis d'identifier les principaux parasites causant des dégâts sérieux ou provoquant la mort des principales essences commerciales. Un volet sur la santé des arbres qui comprenait ces parasites destructeurs a été ajouté aux trois études sylvicoles suivantes : 1) Étude de la régénération à sept ans; 2) Étude de l'établissement à 14 ans; 3) Étude en pré-récolte à 60 ans et plus. Les résultats de l'étude initiale et des études sylvicoles avec un volet sur la santé des arbres sont présentés, notamment la présence, l'abondance et la distribution des parasites dans l'ensemble de la province. Les objectifs et les méthodes futurs pour détecter des problèmes parasitaires sont également envisagés.

Pests in forest plantations: lessons and challenges

Les ravageurs des plantations forestières : leçons du passé, défis du futur

Presented by:

Louis Morneau
Ministère des Ressources naturelles et de la faune du Québec

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Session VIII

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New Brunswick Report

Rapport du Nouveau-Brunswick

Presented by:

Nelson Carter
New Brunswick Department of Natural Resources

Preliminary Summary of Forest Pest Conditions in New Brunswick in 2005 and Outlook for 2006

Prepared for the Annual Forest Pest Management Forum
(Ottawa, Dec. 6 – 8, 2005)

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November, 2005

Preliminary Summary of Forest Pest Conditions in New Brunswick in 2005 and Outlook for 2006

SUMMARY

Spruce Budworm: In 2005, 81% of the pheromone traps were positive and this is the highest percentage since pheromone trapping started in 1995. Also, the mean Provincial trap catch doubled from 1.9 moths/trap in 2004 to 3.8 moths/trap in 2005. Over wintering larvae remain at barely detectable levels (only 5 larvae from 3 positive plots). 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, endemic populations have persisted in the Province.

Hemlock Looper: No defoliation was detected in 2005. Hemlock looper had reached outbreak levels for the first time in NB from 1989-1993 resulting in aerial control programs in three of those years followed by a return to low-level populations. In 2000, a population flair-up was detected when pheromone trap catches increased 3.3 fold and defoliation was mapped over 760 ha in 2001. Trap catches had returned to low levels, but in 2004, there was a Province-wide 2.5-fold increase in mean trap catch that again raised concerns and led to a follow-up egg survey. The survey detected eggs at a number of locations but not at levels high enough to expect defoliation (which proved to be correct). In 2005, mean and maximum trap catch decreased from 2004 levels suggesting last year's increases were part of normal population fluctuations.

Gypsy Moth: Following three consecutive years (2001 to 2003) of defoliation, no defoliation was mapped in 2004 or 2005 and none is expected in 2006. Population declines are related to two consecutive extremely cold winters that greatly reduced egg survival, followed by larval mortality due to diseases and other natural factors in succeeding summers. Surveys indicate that low-density populations persist in known infested areas in southern New Brunswick and at some sites distant from them. The recent high populations increased the risk of long-range spread of gypsy moth by humans hence finding new positive sites is 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. In 2005, evidence of new populations was found in Moncton, Memramcook and Bouctouche, extending the distribution of gypsy moth farther eastward in the Province. These new positive sites may result in two more counties being regulated by the CFIA in 2006.

Whitemarked Tussock Moth and **Rusty Tussock Moth:** Increases in both the percent of traps positive and number of moths caught over 2004 were detected in pheromone traps for both insects**,** whereas trap catches for **Jack Pine Budworm** were very similar to 2004. These pests are all at very low levels.

Forest Tent Caterpillar: Populations remain at low levels according to pheromone trap catches from 2002 to 2005. The last two outbreaks were recorded in 1979-84 and 1991-96, and another one is anticipated soon if the past pattern repeats.

Balsam Twig Aphid: Populations remained at a low-moderate level similar to last year, and seem to be following a generally declining trend from the peak in 2001. Survey data suggest a cyclical trend in populations but given its irregularity, current populations might not decline over the next few years since they rebounded from similar levels in 1990 and 2000.

Balsam Gall Midge: Populations remain very low and have been for several years, following a declining trend from the peak in 1998. Survey data since 1984 suggest a cyclical trend in populations and because populations have been low for a few years, they may start to increase in the next year or two if the past trend repeats itself.

Balsam Woolly Adelgid: Symptoms of attack are common on balsam fir throughout southern NB; however, some recovery has been noted due to several recent extremely cold winters conducive to adelgid mortality.

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.

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.

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).

Pine Leaf Adelgid, Introduced Pine Sawfly, Greenstriped Mapleworm, Orangehumped Mapleworm and **Fall Webworm** were reported from some local areas.

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 2005 and Outlook for 2006

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 evenly distributed around the Province. Pheromone trap catches were lowest in 1997, followed by four consecutive years with increases in the proportion of traps that caught moths, and corresponding slight increases in mean number of moths/trap (Table 1). This trend did not continue in 2002; though mean trap catch was still above 1997 levels. In 2003 and 2004, mean trap catch was greater than in 2002, but was not as high as in 2001. Nevertheless by 2005, trap catches increased substantially with 81% of the traps being positive. Moreover, mean trap catch was about twice that of the past two years and 1.3 times higher than in 2001. Although the number of moths being caught is still low, the general trend of increasing populations since 1997 is continuing.

Table 1. Summary of spruce budworm pheromone trap surveys conducted by DNR in New Brunswick, 1995 - 2005.

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

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 50 plots, where 3 trees/plot are sampled; and another 25 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 2005, L2 surveys 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). Positive locations have been widely distributed within each quadrant of the Province, though more frequently within the western half. A salient feature seeming to unfold is a general agreement in Province-wide trends within endemic populations somewhat similar to that reported in the literature for epidemic populations over the last major outbreak. This seems more evident in the pheromone trap data that show an apparent increase in populations as noted above. The increase is less clear in 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 DNR in New Brunswick, 1995 – 2005. (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
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

In addition to DNR's pheromone trap and L2 surveys, JD Irving, Limited conducts similar surveys on freehold limits in their Districts of Black Brook, Deersdale, and Sussex, and submits samples to DNR for processing. Their pheromone trap results were similar to DNR's provincial survey, as are preliminary (incomplete) L2 results.

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. Moth catches have remained low since then.

Table 3. Summary of jack pine budworm pheromone trap surveys conducted by DNR in New Brunswick, 1997 - 2005.

Year	Number of traps	% of traps positive	Number traps in each class of moths/trap					Moths/trap (range)	Mean trap catch
			0	1-10	11-20	21-40	>40		
1997	46	0%	46	0	0	0	0	0	0.00
1998	52	42%	30	22	0	0	0	0 – 8	1.42
1999	51	55%	23	23	4	0	1	0 – 41	3.25
2000	51	27%	37	13	1	0	0	0 – 17	1.45
2001	51	57%	22	24	1	4	0	0 – 30	1.51
2002	51	41%	30	18	2	1	0	0 – 22	1.92
2003	50	26%	37	12	1	0	0	0 – 14	1.12
2004	50	34%	33	17	0	0	0	0 – 10	1.46
2005	49	39%	30	19	0	0	0	0 – 10	0.82

In 2004, it was decided to switch from the Delta traps to the Multi-Pher1® traps with Vaportape ll® killing strip to improve the quality of samples collected and facilitate more accurate moth identification. Recent research had demonstrated that a "purified" lure catches more moths, but although a 'better' lure might catch more moths, it is uncertain whether that would be significantly more likely to provide evidence of an impending problem sooner than the lure currently in use. Survey results in 2005 indicate that jack pine budworm remain at endemic levels in the Province (Table 3).

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 and supplementary egg surveys when 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). 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.

Branch sampling at pheromone trap locations with higher moth catches in 2004 confirmed low larval densities.

In 2005, the operational pheromone trapping survey was maintained throughout the Province. Mean and maximum trap catch decreased from 2004 levels suggesting last year's increases were part of normal population fluctuations. Nonetheless, such increases are worthy of attention to ensure prompt detection of an outbreak. Results are not yet available from traps placed out by JD Irving, Limited on their freehold limits (but preliminary data are similar to DNR's Provincial survey).

Table 4. Summary of hemlock looper pheromone trap surveys conducted by DNR in New Brunswick, 1997 - 2005.

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	98	>99	115	0 – 723

** 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.*

Whitemarked Tussock Moth

The last outbreak of this pest occurred in the 1970s in both New Brunswick and Nova Scotia. In 1975, the area defoliated in New Brunswick 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 (Table 5) and occasional egg mass searches have not revealed any significant populations in this Province. No defoliation was expected in 2005 and none was detected.

There is a concern, however, about the efficacy of the lure currently in use and in 2005 DNR assisted the CFS in a research trial to see if a better lure might be developed for monitoring this insect. Interestingly, the operational trap data suggest a general increasing trend in percent of traps positive and mean trap catch, but at these endemic levels this may well be within normal population fluctuation. Nonetheless, a follow-up survey was done at 39% of the plots to look for egg masses or evidence of other life stages. Very low populations were detected in some plots (i.e., a few egg masses and pupae). It will be interesting to see if higher numbers become detectable in 2006, though no defoliation is anticipated.

Table 5 Summary of adult whitemarked tussock moths caught in pheromone trap surveys conducted by DNR in New Brunswick, 1998 - 2005.

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

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 DNR in New Brunswick, 1998 - 2005.

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

In 2005, the mean trap catch was the highest yet, and the data suggest an increasing trend, but overall results were not significantly beyond levels seen in the past. And, so far no defoliation has been detected, thereby suggesting that the numbers of moths being caught are below the threshold of impending detectable feeding due to this insect, and hence below an indication of when an egg survey might be needed. No defoliation is expected in 2006.

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).

Since 1984, the data suggest a cyclical trend in populations but given its irregularity, current populations might or might not decline over the next few years since they appeared to rebound from similar levels in 1990 and 2000 (Figure 1). 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.

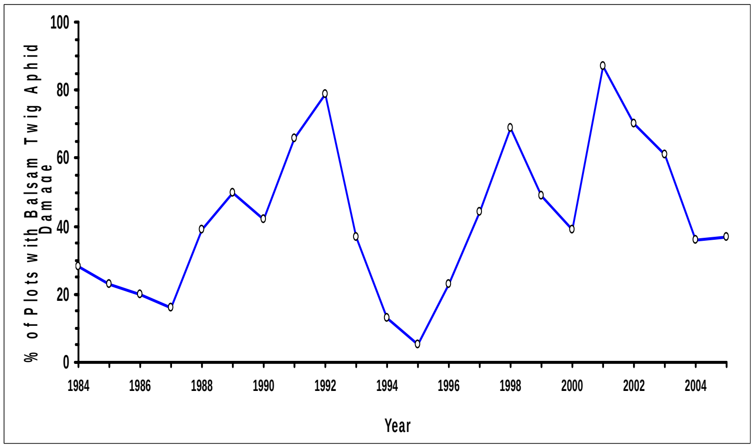

Figure 1. ***Provincial changes in populations of balsam twig aphid from 1984 to 2005.***

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 (Figure 2). In this case, because balsam gall midge populations have been low for a few years, they may start to increase in the next year or two if the past trend repeats itself. And 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.

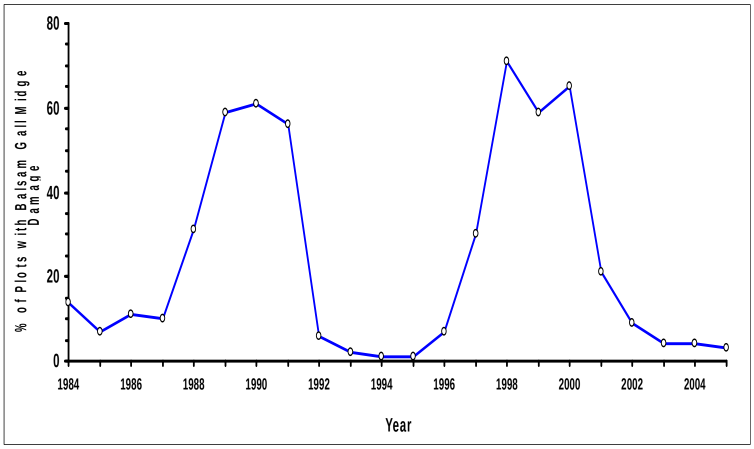

Figure 2. Provincial changes in populations of balsam gall midge from 1984 to 2005.

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*. The insect sucks nutrients from trees and severe attack can cause growth loss, dead tops, tree mortality, and the production of compressed wood which reduces its quality for pulp and lumber. Attack can be recognized by one or a combination of symptoms including: (a) abnormal swelling of nodes on branches causing a "gouty" appearance, (b) dead or abnormal, flattened tree tops, or (c) patches of a white wool-like substance, secreted by the insect covering their bodies wherever they occur. 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.

In 2002, a survey of 260 locations in southern New Brunswick showed 85 plots (32.7%) to be positive. In 2004, a larger Province-wide survey at 221 plots also only detected adelgid attack throughout southern New Brunswick below an irregular line drawn in a general north-easterly direction from about Nackawic in the west to Miramichi City 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). To examine more precisely how far north symptoms of attack could be detected, a survey was conducted in 2005 by traversing roads across the Province along the boundary between where symptoms were and were not found. Results were similar to the pattern found in 2004 with no significant detections north of this line. 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 13 locations in the southern region of the Province in the spring of 2003. Mid-crown 45-cm branch tips from five selected balsam fir trees are sampled at each location and returned to the lab to determine relative population levels. In 2003, the presence of many dead nymphs had indicated that over wintering populations could have been substantially reduced due to the extremely cold temperatures during the winter of 2002-2003. These plots were re-sampled in the spring of 2004 (one plot had since been cut). Results indicated that populations appeared to be lower at 7 inland plots, about the same at 1 inland plot, and higher at 4 plots closer to the Bay of Fundy. In the spring of 2005, differences between inland or coastal plots were less evident. Consequently, depending on future weather conditions, trees in some areas will probably have a period of recovery from attack, while others will continue to be attacked. This variability in survival may partly explain the variability in the severity of attack throughout the infested area.

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 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.

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. Twenty-five sites were monitored in 2005 (all were negative).

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.

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). Current 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 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 DNR's pheromone trap survey for spruce budworm, a few gray spruce looper adults have typically been found in these traps, but this year 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 DNR 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. Surveillance will be maintained in the near future in case numbers increase to unprecedented levels and cause damage.

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.

In New Brunswick, the CFIA has been checking nurseries since 2001 (with negative results) but no survey of natural stands had been done. In 2005, DNR conducted a detection survey by sampling hemlock stands mostly within a southwestern geographic area bounded from Fredericton to Hoyt, to McAdam, to Forest City, to Nackawic and back to Fredericton (25 stands), as well as in the east at 3 stands near Ford Mills and 2 near Albert Mines, north and south of Moncton, respectively. The GIS database was used to identify stands with at least 40% hemlock for sampling. No evidence of the insect was found.

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 1997, 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 being mapped over 1164 ha in 2001, 2061 ha in 2002, and 1504 ha in 2003. Populations dramatically subsided, however, due to extremely cold winter temperatures in 2002-03 (estimated 44 - 79% egg mortality) and in 2003-04 (estimated 77 - 99% egg mortality); and build-up of larval diseases (i.e., nuclear polyhedrosis virus and *Entomophaga maimaiga*), especially in the summer of 2003, along with other natural bio-controls. Although some private landowners had some of their property aerially sprayed with *B.t.* in 2002 and 2003, no aerial spraying was done in 2004 or 2005.

No defoliation was mapped in 2004 or 2005, and no defoliation is expected in 2006. 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. These new positive sites may result in Westmorland and Kent Counties being added as regulated areas by the CFIA in 2006.

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. So far, there appears to be no evidence of an impending outbreak.

In fact, the trap catch data imply declining populations according to annual decreases in the percent of positive traps, as well as lower maximum and mean trap catch (Table 7). At these levels, however, 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 DNR in New Brunswick, 2002 - 2005.

Year	Number of traps	% of traps positive	Number of Moths/Trap (range)						Maximum catch	Mean catch
			0	1-10	11-25	26-50	51-100	>100		
2002	**128**	**88**	**16**	**78**	**30**	**3**	**1**	**0**	**51**	**7.8**
2003	**125**	**77**	**29**	**77**	**16**	**3**	**0**	**0**	**41**	**5.2**
2004	**130**	**76**	**31**	**92**	**7**	**0**	**0**	**0**	**23**	**2.7**
2005	**137**	**59**	**56**	**79**	**2**	**0**	**0**	**0**	**16**	**1.7**

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.

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.

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 incidental reports, seemingly less than the year before.

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*.

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. The jack pine orchards produced a considerable number of cones, but were not harvested because Tree Improvement has a good supply on hand. At Kingsclear, cone production in spruce orchards was limited to two black spruce stands that had been treated with gibberellic acid in 2004. Egg sampling for spruce cone maggot in these stands revealed low numbers not requiring any treatment. Yellowheaded spruce sawfly numbers in the black spruce stands continued to decline in 2005 and no treatments were necessary. One field of young white spruce grafts did harbour sawfly populations and larvae were manually removed.

At Wheeler Cove, yellowheaded spruce sawfly numbers on black spruce were low. Likewise, none were seen in the white spruce and red spruce stands at Queensbury, where a small number of Norway spruce had their leaders killed by white pine weevil. Spruce budworm and jack pine budworm numbers remained low in all spruce and jack pine stands respectively.

There were no significant pest enquiries from DNR's Kingsclear forest tree nursery in 2005.

Nova Scotia Report

Rapport de la Nouvelle-Écosse

Presented by:

Walter Fanning
Nova Scotia Department of Natural Resources

This presentation is not available

Newfoundland Report

Rapport de Terre-Neuve

Presented by:

Nelson Carter for:

Hubert Crummey
Newfoundland Department of Natural Resources

This presentation is not available

Session IX

Regulatory Affairs

Chair: Greg Stubbings

Canadian Food Inspection Agency, Plant Products Directorate

Séance IX

La réglementation

Président : Greg Stubbings

Agence canadienne d'inspection des aliments, Direction générale des produits végétaux

PMRA: Going forward with a strategic agenda

ARLA : Aller de l’avant avec un plan stratégique

Presented by:

Karen L. Dodds
Pest Management Regulatory Agency, Health Canada, Ottawa, Ontario

Abstract

Health Canada’s Pest Management Regulatory Agency (PMRA) is responsible for pesticide regulation and registration. Pest management and responsible pesticide use are critical for many resource areas, including forestry and lumber.

PMRA has made significant progress: eliminating the backlog of pesticide submissions; implementing performance standards for submission review; implementing a re-evaluation program for older pesticides; and developing strong, collaborative relationships with the U.S. Environmental Protection Agency and with other pesticide regulators through the OECD Working Group on Pesticides.

With a new Pest Control Products Act to implement, a Government commitment to “Smart Regulations,” and other pressures, PMRA has recently developed a Strategic Agenda. This agenda identifies goals and priorities for the next 12-24 months, beyond PMRA’s core work reviewing pesticides.

The presentation will note some of the critical issues in today’s environment and describe how PMRA is responding through discussion of specific initiatives in the PMRA Strategic Agenda. These include: implementation of the new Act, improving communications and stakeholder engagement, and reviewing decision-making in PMRA. Where possible, implications for the forest sector will be outlined

Résumé

L'Agence de réglementation de la lutte antiparasitaire (ARLA) de Santé Canada est chargée de la réglementation et de l'homologation des pesticides. La lutte antiparasitaire et l'utilisation judicieuse des pesticides revêtent une importance capitale pour de nombreux secteurs liés aux ressources, y compris le secteur de l'exploitation des forêts et du bois de sciage.

L'ARLA a réalisé des progrès importants : elle a éliminé les demandes d'homologation de pesticides accumulées, a mis en œuvre de normes de rendement concernant l'examen des demandes ainsi qu'un programme de réévaluation des pesticides plus anciens et a noué des liens de travail plus étroits avec la United States Environmental Protection Agency et avec d'autres organismes de réglementation des pesticides par l'entremise du Groupe de travail de l'OCDE sur les pesticides.

Sous l'effet de la nouvelle Loi sur les produits antiparasitaires à mettre en application, de l'engagement du gouvernement envers une « réglementation intelligente » et d'autres pressions, l'ARLA a récemment élaboré un Plan stratégique qui énonce les objectifs et priorités de l'Agence pour les prochains 12 à 24 mois, outre sa tâche principale d'examen des pesticides.

La présentation soulignera certains enjeux majeurs liés à l'environnement contemporain et décrira comment l'ARLA y réagit et, à cette fin, examinera des initiatives particulières du Plan stratégique de l'ARLA. Parmi ces enjeux figurent la mise en application de la nouvelle loi, l'amélioration des communications et de l'implication des intervenants et l'examen du processus décisionnel de l'ARLA. Les incidences pour le secteur forestier seront décrites brièvement, le cas échéant.

PMRA: Going Forward with a Strategic Agenda

Forest Pest Management Forum
December 2005
Dr. Karen Dodds

Health Canada Santé Canada

Context

- New *Pest Control Products Act*
- Sustainability - Health and the Environment
- Smart Regulations
- Gomery – accountability
- Transparency
- Collaboration across federal government, with provinces and territories, internationally
- Pressures on science-based regulators

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Health Canada / Santé Canada

Stakeholder Expectations

- A federal pesticide regulatory system that is:
  - Open and transparent
  - Responsive, yet predictable
  - Credible, science-based
  - Connected across federal government, with provincial partners, with stakeholders and internationally

PMRA ARLA

Health Canada / Santé Canada

Why a Strategic Agenda?

- Build on progress of Agency to date
- Respond to concerns, issues raised externally and internally
- Meet stakeholder expectations
- Set priorities, resource them
- Set out PMRA's vision and path forward

PMRA ARLA

Health Canada Santé Canada

What is our Strategic Agenda?

- Our goals and priorities for next 12-24 months beyond our core work
- Combination of issues, both content and process – new Act, decision-making
- Those issues PMRA needs to address to ensure support for and relevance of our core work
- Consistent with Strategic Plan, but with specific guidance

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PMRA ARLA

Health Canada Santé Canada

A Strategic Agenda

- Implementation of new Pest Control Products Act
- Improved communications
- Stakeholder engagement
- Decision-making
- Science
- Evaluation of Cost Recovery Initiative
- Review, re-evaluation performance

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PMRA ARLA

Implementation of new Pest Control Products Act

- Strengthens health and environmental protection – risk reduction
- Requires and supports greater transparency
- Strengthens post-registration controls, reporting
- Requirements re risk assessments, consultation

Improved Communications

- Effective communications are key:
  - To enhancing understanding, confidence and input into the federal pesticide regulatory system
  - To demonstrate that the agency is meeting Government commitments and the needs of Canadians for clear, understandable information relating to pesticides

Health Canada Santé Canada

Stakeholder Engagement

- Essential to understanding issues
- Wide variety of stakeholders affected
- PMAC, F/P/T Committee, CHC, CropLife, Minor Use, etc
- Need to examine when we consult, how we consult, who we consult and identify gaps and areas for improvement
- Open, accessible, responsive

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PMRA ARLA

Health Canada Santé Canada

Decision-making

- A transparent, consistent and efficient decision-making process to ensure decisions are:
  - Supportive of our mandate and objectives
  - Consistent with federal policies
  - Taken in the broader context of sustainability
  - Commensurate with level of concern
  - Well documented, understood, supported

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PMRA ARLA

Health Canada Santé Canada

Science

- Science is a key component of regulatory decisions, and the foundation of the PMRA
- Scientific methodologies must remain up to date and on-par internationally
- Critical to PMRA being able to respond to new issues as they arise

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PMRA ARLA

Health Canada Santé Canada

Evaluation of Cost Recovery

- Broad range of recommendations – level of cost recovery – revised framework for fees
- Final Evaluation, including action plan, will be public after government approvals

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PMRA ARLA

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Review, re-evaluation performance

- Our core work
- Recognize commitment, interest
- Expected to benefit from other work
- Open to suggestions for improvement

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PMRA ARLA

Health Canada Santé Canada

PMRA & the forest sector

- With NRCan, developing, facilitating use of reduced risk pesticides, biopesticides for forestry
- Collaboration on research
- Understanding needs, responding – emergency registrations, registration process

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PMRA ARLA

Health Canada Santé Canada

PMRA & the forest sector

- Forestry sector is important to Canada
- Pest management is important to the sector
- Common interests – sustainability and more

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PMRA ARLA

PRMA update: The 3 Rs: re-evaluation, registrations and research permits

Des nouvelles de l'ARLA et de trois de ses secteurs d'activités : réévaluation, homologations et permis de recherche

Presented by:

Terry Caunter
Project Manager
Alternative Strategies Section
Efficacy & Sustainability Assessment Division
Pest Management Regulatory Agency (PMRA), Health Canada

1) Re-evaluation

- Target: to conduct re-evaluations of over 400 active ingredients by 2007
- To date, ~50% of the active re-evaluations have been either completed, discontinued or reached public consultation stages
- Updates & Publications
  http://www.pmra-arla.gc.ca/

Pesticides of Interest to Forestry

Acephate

- Proposed to be acceptable with mitigation in 2004
- Decision Document being prepared

Antisapstains

- Assessments continuing

Azinphos-methyl

- Products being phased out
- Cannot be used in Forests after 2005
  Bacillus thuringiensis group

- Proposed Acceptability for Continuing Registration (PACR) document expected soon

Bronopol

- *Re-evaluation of Bronopol* PACR2005-06
- Biocide and preservative – pulp & paper mills
- Acceptable provided that proposed mitigation measures to further protect workers & the environment are adopted

Carbaryl

- Review continuing

Chlorpyrifos

- Decision soon
- Elm bark beetle uses to be continued

Diazinon

- Re-evaluation Note REV2005-06
- Preliminary Risk and Value Assessments of Diazinon for agricultural & forestry uses

Dichlobenil

- *Re-evaluation of Dichlobenil* PACR2005-10
- Acceptable provided that proposed mitigation measures to further protect workers & the environment are adopted
- Woody ornamentals in nurseries, shelterbelts, hedgerows,windbreaks, poplar plantations, land holding containers of nursery stock

Dichlorvos

- Continuing

Diflubenzuron

- Proposed to be acceptable with mitigation in 2004
- Decision document expected soon

Dimethoate
- Review is continuing

Disodium Cyanodithioimidocarbonate

- Re-evaluation Decision Document RRD2005-04
- Slimicide in papermills
- Acceptable provided that proposed mitigation measures to further protect workers & the environment are adopted

Fenitrothion

- Discontinued by registrant

Methomyl

- Proposed Acceptability for Continuing Registration (PACR) document expected soon
- Nuclear polyhedrosis virus of red-headed pine sawfly
- Review is continuing

Monosodium methane arsonate Herbicide

- Used as Insecticide on Conifers (trap trees)
- Glowon MSMA, Registration No. 10892
- Use expiring 31 Dec. 2008

Nuclear polyhedrosis virus of Douglas-fir tussock moth

- Proposed to be acceptable with mitigation in 2004
- Decision document expected soon

Paraquat Dichloride

- *Re-evaluation of Paraquat Dichloride* PACR2004-41, dated, October 22, 2004
- Proposed to be acceptable with mitigation

Trichlorfon

- Review continuing

2,4D

- *Re-evaluation of the Lawn and Turf Uses of (2,4-Dichlorophenoxy)acetic Acid [2,4-D]* PACR 2005-01
- Agriculturual & forestry review continuing

Re-evaluation Note REV2005-04

- Targets - PMRA Re-evaluation Program
- (April 2005 to June 2009)

2) Registrations

Tebufenozide

- Full registration to be granted for Mimic 240LV Forestry Insecticide, Reg. No. 24502, once final labels are submitted
- Buffer zones for aerial application
  - Maximum buffer zones were determined to be 90 M or less for water depths less than 1 metre; greater than 1 metre – 0 metres
  - Discussion continuing with Dow regarding buffer zone information to be listed on the label
- Buffer zones for ground application
  - Maximum buffer zones were determined to be 1 M or less for water depths less than 1 metre

Neodiprion abietis nucleopolyhedrovirus (NPV)

- ABIETIV Flowable Biological Insecticide
- For control of Balsam Fir Sawfly
- Natural Resources Canada (CFS)
- Review continuing
- Decision expected by end of February, 2006

Mountain Pine Beetle Anti-aggregation Pheromone

- Verbenone Pouch
- Mountain pine beetle (*Dendroctonus ponderosae*) pheromone slow release device for use on pine trees and in pine stands
- Decision early in 2006

3) Research Permits

Alder, raspberry in spruce stands

- Glyphosate
  - 1 research permit by private industry

Balsam fir sawfly in balsam fir

- ABIETIV (Balsam Fir Sawfly NPV)
  - 1 research permit by Federal Gov (CFS)

Black headed budworm in Forest stands

- *Bacillus thuringiensis*
  - 3 research permits by Federal Gov (CFS)

Eastern spruce budworm in balsam fir and white spruce

- *Bacillus thuringiensis*
  - 1 research permit by private
- Spruce budworm pheromone
  - 1 research permit by Federal Gov (CFS)

Elm spanworm on Norway maple & Linden beech trees

- Acephate
  - 1 research permit by private

Emerald ash borer in Ash trees

- Acephate
  - 1 research permit by Federal Gov (CFS)
- Azadirachtin
  - 1 research permit by Federal Gov (CFS)
- Imidachloprid
  - 3 research permits by Federal Gov (CFS)
  - 2 research permits by private

Heterobasidion annosum on Red pine stumps

- *Phlebiopsid gigantea*
  - 2 research permits by private
  - 1 research permit by Federal Gov (CFS)

Mold/mildew in Canadian softwood species

- Octhilinone
  - 1 research permit by private

Pale winged gray moth Anacamptode ephyaria in forest stands

- *Bacillus thuringiensis*
  - 1 research permit by Federal Gov (CFS)

Pine false webworm on conifers

- Spinosad
  - 1 research permit by private

The Cottony Ash Psyllid, Psyllopsis discrepans on Ash trees

- Imidachloprid
  - 1 research permit by municipal government

Raspberry & alder in Spruce forests

- Glyphosate
  - 1 research permit by private

Surface molds & mildews on pressure treated softwood

- Kathon®
  - 1 research permit by private

Yellowheaded spruce sawfly in conifers

- Spinosad
  - 1 research permit by private

4) New Documents of Interest

Found at http://www.pmra-arla.gc.ca/

Agricultural Buffer Zone Strategy Proposal
(PRO2005-06) November 2, 2005

Proposed Revisions to the Pest Control Products Regulations (revised)
(NOI2005-02) September 26, 2005

Confidential Business Information Designation and Segregation Part 1: Submission of Test Data (PRO2005-03) September 19, 2005

Confidential Business Information Designation and Segregation Part 2: Previously Provided Test Data
(PRO2005-05) October 31, 2005

Requirements for Submitting Data Index, Documents and Forms
(PRO2005-02) September 19, 2005

Harmonization of Guidance for Terrestrial Field Studies of Pesticide Dissipation under the North American Free Trade Agreement
(PRO2005-01) June 15, 2005

List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern under the New Pest Control Products Act
(NOI2005-01) June 13, 2005

Fact Sheet on the Pesticide Risk Reduction Program
September 2005

Harmonization and International Regulatory Cooperation
February 11, 2005

Roles of the Three Levels of Governments Regarding Pesticides in Canada
January 11, 2005

5) New Directions - FAST

FAST IPM

- Facilitating Access to Sustainable Technologies in Pest Management
- A stakeholder support section of the Pest Management Regulatory Agency, Health Canada
- One Single Objective - Sustainability in its three forms:
  - Economic
  - Human Safety
  - Re-usable resources (environment)
- Rationale:
  - Save time and money now and tomorrow
- The task of the PMRA is to facilitate the step by step approach logistically and technically supporting the Steering Committee(s) representing the Stakeholder Group(s)
- Processes
  - Current identification & creation of National and International lists of sites, pests, registered uses and requested uses as well as IPM practises
  - Identification of potential alternatives, such as potential new uses for existing products, upcoming new products from manufacturers, new practices and substances from academia and forestry researchers
  - Identify gaps & what to do about them
  - Agree on a plan with clear deliverables:
    - who does it
    - with what ($)
    - and for when
  - Carry out the agreed plan & showcase it

- Confused?
- Need help?
- Scared of the PMRA?
- Thinking of a new forest pest management tool?
- Who are you going to call?

Terry Caunter
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Role is to facilitate regulatory matters with the Forestry Sector

Update on *Sirex noctilio* in the US, and Canada's policy

Présence du *Sirex noctilio* aux États-Unis : état de la situation et politique du Canada à l'égard du ravageur

Presented by:

L. Shields[1], *S. Sela*[1], *D. Watler*[2], *D.A. Haugen*[3], *E.R. Hoebeke*[4]
[1]*Canadian Food Inspection Agency, Forestry Section,*
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[4]*E.R Hoebeke, Department of Entomology, Cornell University, Ithaca, NY*

Abstract

The Sirex wood wasp, (*Sirex noctilio* Fabricus) is an exotic wood wasp that is commonly intercepted in wood packaging materials at U.S ports of entry. This past year, however, the Sirex wood wasp has been detected outside of the port of Oswego, New York, confirming the ability of this pest to survive and potentially become established in North America. Although the species most at risk to the introduction of this exotic pest include pine, the host range also includes spruce, fir, Douglas fir and larch.

In its native range, Sirex Wood Wasp is considered a secondary pest. The pest risk assessment completed by the Pest Risk Assessment Unit of the CFIA has concluded that Sirex wood wasp could cause severe damage to plantation trees. Female wood wasps are vectors of the fungal pathogen *Amylostereum areolatum*, which can rapidly weaken and kill host trees.

The USDA and the New York State Department of Agriculture and Markets initiated a trapping program during this past summer to determine the extent of the infestation. The CFIA and the Canadian Forest Service jointly established a surveillance program along the St. Lawrence Seaway.

During the past several months, the CFIA has been working with the USDA and New York State Department of Agriculture and Markets to keep abreast of the latest survey results, new scientific information and emerging regulatory policies to mitigate the spread of this pest.

Résumé

La guêpe perce-bois (*Sirex noctilio* Fabricus) figure parmi les insectes qui sont couramment interceptés dans les matériaux d'emballage en bois dans les ports d'entrée aux États-Unis. Toutefois, au cours de la dernière année, le ravageur a été trouvé à l'extérieur du port d'Oswego (New York). Cette découverte confirme qu'il peut survivre en Amérique du Nord et risque même de s'y établir. Si ce scénario devait s'avérer, le pin serait l'essence la plus menacée, même si l'épinette, le sapin, le douglas et le mélèze sont également infestés par le ravageur.

Dans son aire d'origine, la guêpe perce-bois est considérée comme un ravageur secondaire. Selon l'évaluation des risques sanitaires réalisée par le Module d'évaluation des risques sanitaires de l'ACIA, le ravageur pourrait infliger des dommages importants aux plantations d'arbres. Les femelles sont vectrices de l'*Amylostereum areolatum*, un champignon pathogène qui affaiblit et tue rapidement les arbres hôtes.

L'été dernier, l'USDA et le New York State Department of Agriculture and Markets ont entrepris une campagne de piégeage afin d'évaluer l'ampleur de l'infestation. L'ACIA et le Service canadien des forêts ont mis en place un programme conjoint de surveillance le long de la Voie maritime du Saint-Laurent.

Au cours des derniers mois, l'ACIA a travaillé en étroite collaboration avec l'USDA et le New York State Department of Agriculture and Markets afin de se tenir au courant des résultats des enquêtes en cours, des données scientifiques nouvelles et des politiques de réglementation récentes visant à prévenir la propagation du ravageur.

Sirex noctilio in North America, 2005

Sirex noctilio, (Sirex woodwasp) is a woodwasp which belongs to the Siricidae family. This woodwasp is native to Europe, Asia and Africa, where it is generally considered a secondary pest. Pine is the preferred host, but current literature implicates other conifers as hosts also.

Once introduced into a new environment, the establishment potential of the Sirex woodwasp is thought to be high for several reasons. It has been documented that this woodwasp can adapt to new pine hosts. *S. noctilio* has severely impacted plantations of Monterey pine in Australasia, a pine species which does not occur in its native range. This shows it's adaptability to new pine hosts. It has also been recorded from spruce, larch and Douglas fir. *S. noctilio* has been reported in the cold temperate boreal zones of Siberia, showing its adaptability to cold climates. The adults are considered strong fliers. The larval stages can easily survive the movement of wood packing material as long as the moisture content of the wood is suitable for the fungal growth that this woodwasp uses for its food source.

It is believed that the Sirex woodwasp will complete one generation per year in North America, but this may take up to two years in northern climates. The female woodwasps are attracted to stressed trees. During the oviposition process, a symbiotic fungus (*Amylosterum areolatum*) and a toxic mucus are injected into the tree. These two components act together to kill the tree and and provide the necessary conditions for larval development.

US Survey Results - 2005

Sirex noctilio was first identified in North America in 2004 in a sample which was collected in Fulton, New York as part of the New York State Cooperative Agricultural Pest Survey National Exotic Wood Borer and Bark Beetle survey. As a follow up to this confirmation, pine trees in this general area were surveyed in the spring of 2005 for the symptomatic features of *S. noctilio*. Eight trees were tagged as showing possible signs of *S. noctilio* infestation. Two were left for monitoring, and the other six trees were removed for analysis. Sections were chosen at random for larval extraction. A trapping survey commenced in July of 2006 and was expanded to a radius of 70 miles from the port of Oswego. A total of 576 traps were deployed. In summary, 46 positive sites were identified with a total of 85 *Sirex noctilio* females collected. There are currently five counties in New York state where *Sirex noctilio* has been confirmed. There are currently no regulatory measures in affect which restrict movement of hosts materials.

Canadian Survey Results - 2005

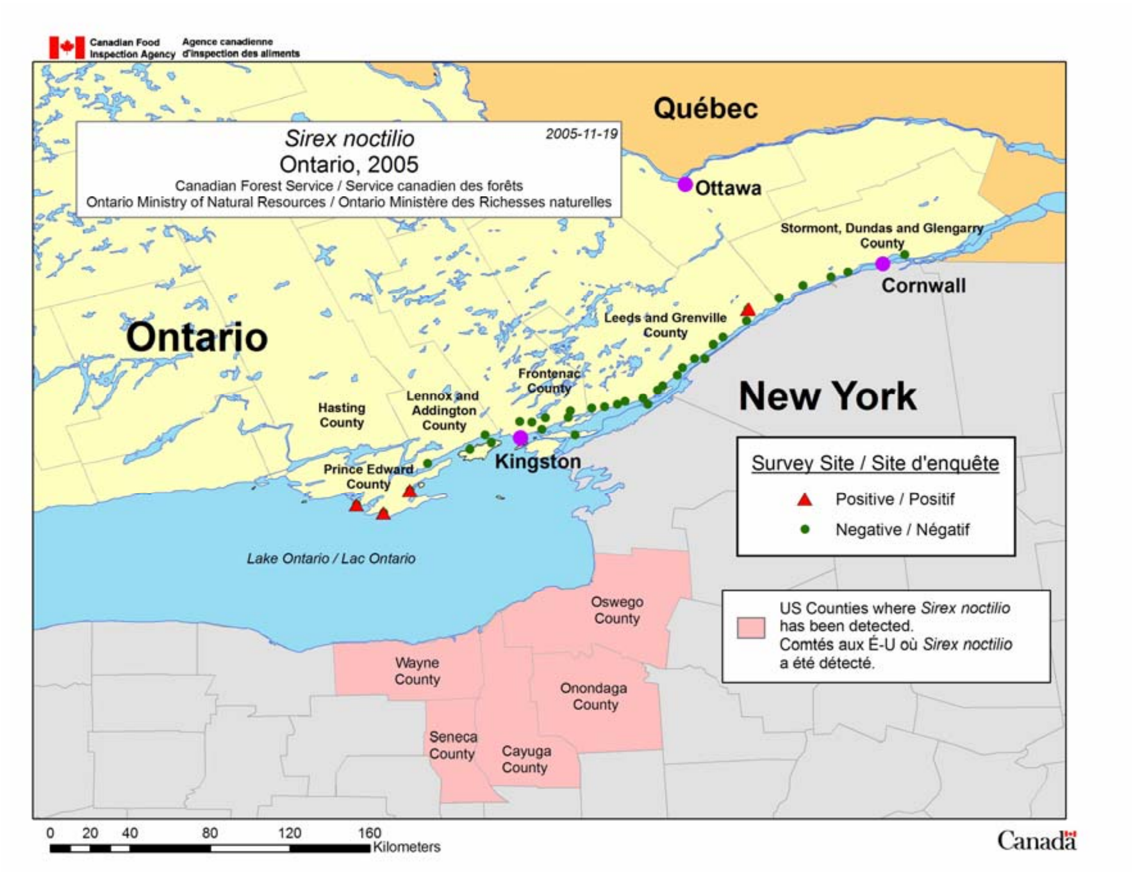
A Canadian survey for *S. noctilio* was quickly initiated in late August after it became evident that there was indeed a reproducing population of *S. noctilio* in New York state. The survey was conducted cooperatively by the Ontario Ministry of Natural Resources, the Canadian Forest Service and the Canadian Food Inspection Agency. Twelve unit Lindgren funnel traps were deployed at 36 sites along the Canada-US border stretching from Belleville to Cornwall.

To summarize the Canadian survey results, 3 positive locations were identified in Prince Edward county, and one other positive location approximately 120 kilometers to the east in Leeds Grenville county. Native siricids were also trapped, and these consisted of Urocerus cressoni, Sirex nigricornis, Sirex juvencus, Sirex edwardsii, Tremex columba and Sirex behrensii.

Strategies

A Canadian Technical Panel has been formed for Sirex noctilio. The membership includes experts from the Canadian Forest Service, Ontario Ministry of Natural Resources, Ministere des Ressources Naturelles de la Faune et des Parcs Quebec and the Canadian Food Inspection Agency. The purpose of the panel is to bring together the expertise in Canada, identify and prioritize the research gaps, and update the pest risk assessment. Panel members will be participating in a US Sirex Science Panel workshop in Annapolis Maryland in January, 2006.

Sirex noctilio Detections, 2005



Information on the hemlock woolly adelgid (*Adelges tsugae* Annand) and the CFIA's policy proposal

Information sur le puceron lanigère de la pruche (*Adelges tsugae* Annand) et sur le projet de directive de l'ACIA

Presented by:

G. Henry[1], ***K. Inouye*[1]** *and K. Marchant*[2]
[1]*Canadian Food Inspection Agency – National Headquarters, Ottawa, Ontario*
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Abstract

The hemlock woolly adelgid (HWA) is a small, aphid-like insect that feeds at the base of needles on hemlock trees and susceptible spruce trees, thereby removing plant fluids and injecting its toxic saliva into the tree, which can cause the death of infested trees. HWA is native to Asia, and it currently infests the province of BC and twenty-one American states. As it has spread through the eastern US, HWA has killed or severely damaged large areas of hemlock trees. Because of the threat HWA poses to both the environment and economy of Canada, the CFIA has prepared draft directive D-05-01 to prevent the introduction of HWA into non-infested areas of Canada by regulating the movement of hemlock (*Tsuga* spp.), Yeddo spruce (*Picea jezoensis*), and Tiger-tail spruce (*Picea polita*) plants for planting, plant parts and wood products with bark attached from areas of Canada and the US infested with HWA.

Résumé

Le puceron lanigère de la pruche (PLP) est un petit insecte qui s'alimente à la base des aiguilles des pruches et des épinettes sensibles. Il peut causer la mort de l'hôte en se nourrissant de ses liquides et en lui injectant sa salive toxique. Originaire d'Asie, ce ravageur infeste actuellement la Colombie-Britannique et 21 États des États-Unis. Durant sa propagation dans l'est des États-Unis, il a dévasté ou gravement endommagé de vastes superficies de pruche. Consciente de l'ampleur de la menace que représente le PLP pour l'environnement et l'économie du Canada, l'ACIA a élaboré l'ébauche de directive D-05-01 afin de prévenir l'introduction du ravageur dans les régions non infestées du Canada en réglementant le déplacement de pruches (*Tsuga* spp.), d'épicéas de Yezo (*Picea jezoensis*) et d'épicéas du Japon (*Picea polita*), sous forme de plants entiers destinés à la plantation, de parties de plants ou de produits non écorcés, en provenance de régions infestées du Canada et des États-Unis.

Canada’s adoption of ISPM 15 for wood packaging materials

Adoption par le Canada de la NIMP no 15 sur les matériaux d’emballage en bois

Presented by:

M. Dawson and ***T. Yu***
Canadian Food Inspection Agency, Forestry Section
Agence canadienne d’inspection des aliments, Section des forêts

Abstract

It is internationally understood that untreated wood packaging poses a high risk of spreading harmful plant pests in international trade on the basis of data indicating increased interceptions of infested wood packaging materials worldwide. As a result, Canada, along with over 120 member countries of the International Plant Protection Convention (IPPC), has endorsed the IPPC adopted International Standard for Phytosanitary Measures (ISPM) No. 15 *Guidelines for regulating wood packaging in international trade*. As members of the North American Plant Protection Organization (NAPPO), Canada, the US and Mexico have recently agreed to phase in the enforcement of this standard, with the intention of full enforcement in mid-2006 to allow a transition period for industry to adjust to the new standard. Canada continues to target and inspect shipments based on specific risk factors known to indicate the presence of potentially infested wood packaging. During the initial phase, enforcement is based on pest freedom as determined by visual inspection. The staged enforcement leading up to strict enforcement of this standard by NAPPO members will require wood packaging manufacturers to treat and mark wood packaging in compliance with ISPM 15. It is anticipated that increased compliance with the standard will result in a reduction of plant pest spread globally. To facilitate Canadian exports, the Canadian Food Inspection Agency has developed and implemented a Canadian Wood Packaging Certification Program (CWPCP) requiring wood packaging to be made from wood which has undergone heat treatment and marking consistent with ISPM 15. To date more than 500 facilities are registered on the CWPCP.

Résumé

Les risques phytosanitaires inhérents au transport international de matériaux d'emballage à base de bois non traité sont largement reconnus à l'échelle internationale. L'augmentation de la fréquence des interceptions de matériaux d'emballage en bois infesté à l'échelle mondiale atteste de l'ampleur du problème. En conséquence, le Canada et plus de 120 pays membres de la Convention internationale pour la protection des végétaux (CIPV) ont adopté la norme internationale pour les mesures phytosanitaires (NIMP) n^{o} 15, *Directives pour la réglementation de matériaux d'emballage à base de bois dans le commerce international*. À titre de pays membres de l'Organisation nord-américaine pour la protection des plantes (NAPPO), le Canada, les États-Unis et le Mexique ont récemment convenu d'échelonner la mise en œuvre de cette norme en vue d'une application intégrale au milieu de 2006, afin de laisser le temps à l'industrie de s'ajuster aux nouvelles exigences. Le Canada continue de cibler et d'inspecter les cargaisons en se fondant sur les facteurs de risque reconnus comme indiquant la présence de matériaux d'emballage en bois potentiellement infestés. Durant l'étape initiale, l'examen des cargaisons reposera sur une inspection visuelle. Durant la période de transition menant à l'application intégrale de la norme par les pays membres de la NAPPO, les fabricants de matériaux d'emballage en bois devront traiter leurs produits et les marquer d'une estampille certifiant qu'ils satisfont aux exigences de la NIMP n^{o} 15. L'application de cette norme devrait contribuer à prévenir la propagation des phytoravageurs à l'échelle mondiale. Afin d'aider les exportateurs canadiens, l'Agence canadienne d'inspection des aliments a élaboré et mis en œuvre le Programme canadien de certification des matériaux d'emballage en bois (PCCMEB). En vertu de ce programme, les producteurs de matériaux d'emballage en bois devront utiliser uniquement du bois ayant subi un traitement thermique et marquer leurs produits d'une estampille certifiant qu'ils satisfont aux exigences de la NIMP n^{o} 15. À ce jour, plus de 500 producteurs et établissements sont accrédités en vertu du PCCMEB.

Session X

Molecular diagnostics − Potential Applications and Issues

Chair: Greg Stubbings

Canadian Food Inspection Agency, Plant Products Directorate

Séance X

Le diagnostique moléculaire − Applications potentielles et enjeux

Président : Greg Stubbings

Agence canadienne d’inspection des aliments, direction générale des produits végétaux

Molecular diagnostic: From Pasteur to PCR

Diagnostic moléculaire : de Pasteur à la réaction en chaîne de la polymérase (PCR)

Presented by:

Richard C. Hamelin
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Abstract

In the past 15 years there has been a revolution in the way life forms are identified. This revolution is based on methods that allow DNA to be sequenced, amplified from minute amounts, and characterized using specific probes. A new initiative that aims to develop DNA bar-codes for all major groups of life (www.barcodinglife.org) was launched last year. Molecular diagnostic can be particularly important in pest management in preventing introduction and spread of exotic species, and in helping identify sources or epidemics and monitor spread or efficiency of treatments. Nevertheless, molecular diagnostic assays are only beginning to be used in operational settings. This is due to several factors, including the cost of equipping diagnostic labs, the cost of running the assays, and the rarity of properly validated diagnostic assays. There are also some questions as to what constitutes a positive result. This is important given the extreme sensitivity of PCR assays, which can lead to high rates of false positives. Molecular diagnostic of the causal agent of Sudden Oak Death, *P. ramorum*, represents a good case-study. Several PCR assays have been developed against the pathogen and a few have been developed into operational assays. Currently a worldwide Ring Trial of the most widely used assays is underway with the aim of identifying those with the lowest rates of false positives and false negatives. The importance of comparing various assays using a common set of samples representing a broad range of species in the targeted taxa as well as a broad geographical and ecological sampling within taxa are crucial to developing reliable assays

Résumé

Au cours des 15 dernières années, on a assisté à une révolution en matière d'identification des formes de vie. Cette révolution est basée sur des méthodes qui permettent de séquencer l'ADN, de l'amplifier à partir de quantités infimes et de le caractériser à l'aide de sondes spécifiques. Une nouvelle initiative qui vise à déterminer les codes-barres génétiques de tous les grands groupes de formes de vie (www.barcodinglife.org) a été lancée l'an dernier. Le diagnostic moléculaire peut être un outil particulièrement important en lutte antiparasitaire pour empêcher l'introduction et la propagation d'espèces exotiques et pour aider à identifier les sources ou les infestations et à surveiller la propagation ou l'efficacité des traitements. Toutefois, on ne fait que commencer à utiliser des épreuves diagnostiques moléculaires dans un cadre opérationnel et ce, pour plusieurs raisons, y compris le coût d'aménagement de laboratoires de diagnostic, le coût d'exécution des épreuves et la rareté d'épreuves diagnostiques correctement validées. On s'interroge aussi sur ce que constitue un résultat positif. Ces questions sont importantes compte tenu de la sensibilité extrême des épreuves par PCR, qui peuvent donner un pourcentage élevé de faux positifs. Le diagnostic moléculaire de l'agent responsable de l'encre des chênes rouges, le *P. ramorum*, constitue une bonne étude de cas. On a élaboré plusieurs épreuves par PCR contre ce pathogène, dont quelques-unes sont devenues opérationnelles. À l'heure actuelle, un essai circulaire mondial des épreuves les plus utilisées est en cours dans le but de déterminer celles ayant les plus faibles pourcentages de faux positifs et de faux négatifs. Pour mettre au point des épreuves fiables, il est capital de comparer diverses épreuves à l'aide d'une série commune d'échantillons représentatifs d'une large gamme d'espèces appartenant au taxon visé ainsi que d'échantillons du taxon prélevés à une grande échelle géographique et écologique.

The need for validation of molecular assays

L'importance de la validation dans le diagnostic moléculaire

Presented by:

<u>Marie-Josée Côté</u>
Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

The Canadian Food Inspection (CFIA) Agency laboratories have been increasingly using molecular methods to help with the identification of plant and forest pests. Molecular methods have been used as a confirmatory test after morphological identification or as an alternate method when the life stage of the sample does not allow complete morphological identification or when the quality of the sample is compromised, preventing complete morphological identification. Molecular methods are required also when the identification is needed at the subspecies, type, or race level. The choice of type of molecular method depends on the level of identification needed; species, subspecies, type or races and also on the number of samples to be analysed. A molecular diagnostic method has to be robust in order to compensate for variation in reagents, human, equipment and environmental factor as well as DNA quality and quantity variations. In summary, a diagnostic molecular laboratory will use the simplest, most reliable and rapid method available that responds to the identification need at the specificity level requested.

In order to initiate the development of a molecular method at CFIA, the need has to be identified by the CFIA Plant Health Program and the CFIA diagnostic/identification laboratory. To establish or develop the molecular method, a collection of reference specimens (pest material or DNA) is essential. This material will be then used for the generation of information necessary for the development of the molecular method and/or used for the validation of the method. The validation will determine if the method or marker fits the purpose. All work is carried out under a stringent Quality System. The Ottawa laboratory Fallowfield and other Canadian Food Inspection Agency laboratories have a ISO/IEC 17025 compliant quality system that has been accredited to each lab by the Standards Council of Canada (SCC). The scope of the accreditation covers routine diagnostics, technology development and non routine testing. Therefore, all procedures are validated and outlined as Standard Operating Procedures (SOPs) that are revised periodically therefore assuring quality of laboratory results.

The establishment of the Gypsy moth genotyping method currently used by the CFIA laboratory will be described to demonstrate more specifically the steps involved in the development and/or validation of a molecular method. Asian gypsy moth (*Lymantria dispar*) is more invasive than the established North American gypsy moth justifying a different regulatory action therefore the need to differentiate Asian from North American gypsy moth. Specimens of an established North American population and those originating from East Asia were gathered and used for the generation of information needed for the design of molecular methods. This information is generally in the form of DNA sequences. For gypsy moth, two U.S. laboratories (Cornell University and U.S. Forest Service) and a Canadian University lab (University of B.C.) had developed methods based on classical PCR and microsatellite markers. Methods are generally validated by the developing lab according the purpose for which the method was developed for. The developing lab would validate the method by going back to the original material and other relevant material if possible or necessary. For the gypsy moth method a U.S. lab would mainly verify established U.S. specimens and Asian specimens. Validation of the method has to be performed by the diagnostic lab as well, as the method has to fit the specific purpose of the diagnostic lab. For the validation of gypsy moth methods, the CFIA laboratory used specimens representative of 18 Canadian gypsy moth populations trapped in infested area and a collection of Eurasian specimens. These specimens allowed the establishment of a set of baseline data for the PCR and microsatellite markers developed elsewhere. Validation data were analysed following set acceptance criteria. And in the end, 2 classical PCR and 4 microsatellite markers were retained and when combined, generate the information necessary for the differentiation of Asian from North American genotype. The method has been used since 1998 and is still currently used by CFIA for the determination of gypsy moth genotypes. The method is very reliable and robust due to a proper development and validation.

Designing a reliable molecular assay

La mise au point d’un test moléculaire fiable

Presented by:

Kurt Zeller
United States Department of Agriculture − Animal and Plant Health Inspection Service

This presentation is not available

From biological collections to the monitoring of life forms

Des collections biologiques à la surveillance des formes de vie

Presented by:

C.A. Lévesque
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Abstract

The development of diagnostic tools for identification and detection of pathogens and pests has a basic number of steps that must be followed to in order to minimize false negatives and false positives in the final outcome. A collection covering a wide diversity of the target organism and all its close relatives must be obtained, this collection must be validated by taxonomists and through phylogenetic analyses, and a "library" must be built up from which a test is selected. This "library" can be a phylogenetic sequence database, a plasmid library of random DNA fragments from the target organism or a collection of monoclonal antibody cell lines. Screening and validation must proceed with a broad collection of the target organism to eliminate false negative assays and with a collection of all the closely related species to eliminate false positive assays. Validation with a range of field samples is also required. Having a comprehensive and properly identified biological collection right from the start can reduce a lot of problems in the implementation of a test. Maintaining taxonomically diverse and extensive national collections can reduce drastically the turn around time for the development of a new assay simply by having the essential species and strains readily available. Significant technological advances in DNA sequencing, PCR and DNA array hybridization are common. The main bottleneck in the development of reliable biological assays is now the availability of the relevant specimens/strains to do the work properly.

Résumé

Pour élaborer des outils de diagnostic permettant d'identifier et de détecter des pathogènes et des ravageurs, il faut franchir un certain nombre d'étapes afin que le résultat final comporte un minimum de faux négatifs et de faux positifs. Il faut obtenir une collection très diversifiée d'organismes cibles, puis la faire valider par des taxinomistes et des analyses phylogénétiques, et ensuite constituer une « banque » à partir de laquelle une épreuve est choisie. Cette « banque » peut être une base de données sur les séquences phylogénétiques, une banque plasmidique

composée de fragments d'ADN aléatoires de l'organisme cible ou une collection de lignées cellulaires d'anticorps monoclonaux. Le criblage et la validation doivent se faire à l'aide d'une vaste collection de l'organisme cible afin d'éliminer les faux-négatifs et à l'aide d'une collection de toutes les espèces étroitement apparentées afin d'éliminer les faux-positifs. Une gamme d'échantillons de terrain est également nécessaire à la validation. Le fait de disposer dès le départ d'une collection biologique exhaustive et dont les spécimens sont bien identifiés peut rendre la mise en œuvre d'une épreuve beaucoup moins compliquée. Des collections nationales diversifiées et détaillées sur le plan taxinomique peuvent permettre de réduire considérablement le temps nécessaire à la mise au point d'une nouvelle épreuve du seul fait que des espèces et les souches essentielles sont facilement disponibles. Les percées technologiques importantes en matière de séquençage de l'ADN, de réaction en chaîne de la polymérase et d'hybridation sur puce à ADN sont courantes. Le principal obstacle à la mise un point d'une épreuve biologique fiable est maintenant la disponibilité de spécimens/souches utilisables pour mener à bien cette tâche.

Session XI

Globalization − United States Report

Chair: Greg Stubbings

Canadian Food Inspection Agency, Plant Products Directorate

Séance XI

La mondialisation − Rapport des États-Unis

Président : Greg Stubbings

Agence canadienne d’inspection des aliments, Direction générale des produits végétaux

Overview of forest pests in the US and the Forest Health Technology Enterprise Team

Survol des organismes nuisibles des forêts aux États-Unis et de la Forest Health Technology Enterprise Team

Presented by:

Marla Downing, *United States Department of Agriculture − Forest Service*

This presentation is not available

Science and Technology à la carte

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

Science et Technologie à la carte

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

Application of *Phlebiopsis gigantea* for the control of the *Heterobasidion annosum*

Application de *Phlebiopsis gigantea* pour le contrôle de *Heterobasidion annosum*

Presented by:

M.T. Dumas[1] *and G. Laflamme*[2]
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[2]*Natural Resources Canada, Canadian Forest Service – Laurentian Forestry Centre 1055 du P.E.P.S., P.O. Box 10380, Stn. Sainte-Foy, Quebec, Quebec G1V 4C7*

Abstract

In order to proceed with the registration of a biological control product in Canada, efficacy of the agents must be demonstrated under field conditions. The efficacy trial of different *Peniophora gigantea* isolates and formulations for the control of *Heterobasidion annosum* was performed in 4 red pine plantations in the Ontario counties of York, Dufferin and Simcoe that had the disease present or were adjacent to diseased stands. Trees were harvested the last week of August (York, Dufferin) and the second week of September (Simcoe). In each plantation, 2 randomized block design trials consisting of 90 red pine stumps were treated with 6 treatments. Applications of the formulations containing the biocontrol agent or the formulations only were done within 5 minutes of felling. Thirty stumps were left untreated to determine the populations of these 2 fungi in the stands. Discs cut from the top of the stumps were sampled after 2 months to confirm the presence of *P. gigantea* and *H. annosum*.

Résumé

Dans le processus d’homologation de produit pour le contrôle biologique au Canada, l’efficacité des agents de lutte doivent être démontrée en conditions naturelles. L’efficacité de différents isolats et formulations de *Peniophora gigantea* pour le contrôle de *Heterobasidion annosum* fut testée dans 4 plantations de pin rouge de l’Ontario localisées dans les comtés de York, Dufferin et Simcoe. La maladie était présente dans ou près de ces plantations. Les arbres ont été récoltés à la dernière semaine d’août (York, Dufferin) et à la seconde semaine de septembre (Simcoe).

Dans chaque plantation, 2 blocs aléatoires de 90 souches de pin rouge chacun ont subi 6 différents traitements. Les applications des formulations avec ou sans agent de biocontrôle ont été faites en dedans de 5 minutes après l'abatage. Trente souches ont été laissées comme témoins pour déterminer les populations de ces deux champignons dans les peuplements. Des rondelles coupées sur le dessus des souches ont été échantillonnées 2 mois plus tard afin de vérifier la présence de *P. gigantea* et *H. annosum*.

Ammonium lignosulfonate enhances oidia germination and growth of *Phlebiopsis gigantea*

Le lignosulfonate d'ammonium améliore la germination des oïdies et la croissance de *Phlebiopsis gigantea*

Presented by:

M.T. Dumas[1] *and R. Wilson* [2]
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[2] *Ontario Ministry of Natural Resources, Forest Health & Silviculture Section, 70 Foster Drive, Sault Ste. Marie, Ontario P6A 3V1*

Abstract

Ammonium lignosulfonate (ALS), a byproduct of the acid sulfite process, from the pulp and paper industry, significantly promoted the germination rates and growth of *Phlebiopsis gigantea* oidia when compared to water at all temperatures tested (10°C, 15°C, 20°C, 25°C, 30°C). At 20°C, 25°C, 30°C germination was initiated after only 8 hours when incubated in ALS solutions whereas it took 24 hours in water. At 10°C and 15°C germination started after 24 hours in ALS but after 36 hours at 15°C and in excess of 48 hours at 10°C respectively in water. Germ tube lengths were significantly longer in ALS than in water. Oidia germination and growth were dependent on ALS and incubation period but not on the concentrations of ALS. Results were similar when applied to red pine wood.

Résumé

En comparaison de l'eau, le lignosulfonate d'ammonium (LSA), un sous-produit du procédé au bisulfite utilisé dans l'industrie des pâtes et papiers, a considérablement stimulé la germination et la croissance des oïdies de *Phlebiopsis gigantea*, peu importe la température expérimentale (10, 15, 20, 25 et 30 °C). À 20, 25 et 30 °C, la germination s'amorçait après seulement huit heures dans des solutions de LSA, tandis qu'elle prenait 24 heures dans l'eau. À 10 et 15 °C, elle débutait après 24 heures dans le LSA, alors que dans l'eau, elle débutait après 36 heures à 15 °C et après plus de 48 heures à 10 °C. Les tubes germinatifs étaient considérablement plus longs dans le LSA que dans l'eau. La germination et la croissance des oïdies dépendaient du LSA et de la période d'incubation mais non pas des teneurs en LSA. Des résultats similaires ont été obtenus lorsque le produit était appliqué sur du bois de pin rouge.

Canadian Nursery Certification Program

Programme canadien de certification des pépinières

Presented by:

Douglas Panzer *and Barbara Peterson*
Canadian Food Inspection Agency - Ottawa, Ontario

Abstract

International trade in nursery stock is considered a high-risk pathway for the spread of plant pests around the world. Traditionally, phytosanitary certification of nursery stock has been based upon visual inspection of plants prior to shipping. Although visual inspection remains the primary tool of regulatory agencies, it does have limitations as evidenced by several recent introductions of quarantine plant pests, believed to have been associated with propagative plant material certified in the country of export.

The Canadian Nursery Certification Program (CNCP) is a phytosanitary certification program for Canadian nurseries and greenhouses that ship nursery stock to the United States (US), or within Canada. The CNCP offers an alternative to traditional phytosanitary certification, which is based on final product inspection immediately prior to shipping. The CNCP uses a systems approach to mitigate pest risk. It has several components, including documenting the production and pest management practices, auditing and reviewing the system, and determining pest prevalence during production.

In the future, CFIA intends to require participation in the CNCP as a pre-requisite for the export and domestic movement of high risk nursery stock and as a pre-requisite for the importation of nursery stock from new, off-continent sources. The United States Department of Agriculture is currently developing a Nursery Certification Program based on the CNCP and is in the process of approving the first nurseries under that program.

Résumé

Le commerce international du matériel de pépinière est considéré comme une filière à risque élevé de propagation d'organismes nuisibles aux végétaux. Jusqu'à maintenant, la certification phytosanitaire du matériel de pépinière a été fondée sur une inspection visuelle des végétaux avant leur expédition. L'inspection visuelle demeure le principal outil des organismes de réglementation, mais elle a des limites comme l'ont montré plusieurs cas récents d'introduction d'organismes de quarantaine, qui semblaient avoir été associés à du matériel végétal de multiplication certifié dans le pays d'exportation.

Le PCCP est un programme de certification phytosanitaire pour les pépiniéristes et les serriculteurs qui expédient du matériel de pépinière vers les États-Unis ou en territoire canadien. Le PCCP est une solution de rechange à la certification phytosanitaire classique fondée sur l'inspection du produit fini juste avant son expédition. Le PCCP fait appel à une approche systémique pour atténuer le risque d'infestation. Ses diverses composantes visent notamment à mettre sur papier les pratiques de production et de lutte antiparasitaire de l'établissement, à assurer un audit et un examen du système et à établir la fréquence des organismes nuisibles présents durant la production.

Dorénavant, l'ACIA a l'intention d'exiger la participation au PCCP comme condition préalable à l'exportation et au transport en territoire canadien de matériel de pépinière à risque élevé et à l'importation de matériel de pépinière provenant de sources nouvelles hors de la zone continentale des États-Unis. Le département de l'Agriculture des États-Unis (USDA) élabore actuellement un programme de certification des pépinières fondé sur le PCCP. Il se prépare à approuver les premières pépinières dans le cadre de ce programme.

Molecular screening for the discovery of biocontrol agents against root rots in conifer nurseries

Recherche par dépistage moléculaire d'agents de lutte biologique efficaces contre les agents de la pourriture des racines dans les pépinières de conifères

Presented by:

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Abstract

Large scale conifer seedling production can be severely affected by root rot fungal pathogens like *Cylindrocladium floridanum.* In the perspective of a reduction of the use of fungicides, it is imperative to develop new biocontrol agents adapted to conifer rhizosphere. We screened the population of *Pseudomonas* spp. from the rhizosphere of black and white spruce isolated in nurseries and natural forests using DNA probes targeting genes involved in antibiotic production. We isolated several strains producing antibiotics like 2, 4-diacethylphloroglucinol, pyrrolnitrin, and phenazines. Genetic analysis showed that the population structure of antibiotic-producing *Pseudomonas* is different between the nurseries and natural forest. Strains isolated in nurseries could produce only 2,4-diacethylphloroglucinol, and were not effective to inhibit C. *floridanum*. However, the natural forest seedlings yielded three different phenazine producing strains as well as strains producing both 2, 4-diacethylphloroglucinol and pyrrolnitrin. The latter strongly inhibited the growth of C. *floridanum*, and represent promising biocontrol agents.

Résumé

La production à grande échelle de semis de conifères peut être gravement compromise par divers champignons pathogènes tels que le *Cylindrocladium floridanum*. Dans une perspective de réduction de l'utilisation des fongicides, il est impératif de mettre au point de nouveaux agents de lutte biologique adaptés à la rhizosphère des conifères. Nous avons étudié les populations de *Pseudomonas* spp. de la rhizosphère d'épinette noire et d'épinette blanche isolées dans des

pépinières et des forêts naturelles à l'aide de sondes d'ADN ciblant les gènes intervenant dans la synthèse d'antibiotiques. Nous avons isolé plusieurs souches produisant des antibiotiques tels que le 2,4-diacéthylphloroglucinol, la pyrrolnitrine et les phénazines. Des analyses génétiques ont révélé que la structure des populations de *Pseudomonas* produisant des antibiotiques diffère d'une pépinière et d'une forêt naturelle à une autre. Les souches isolées dans les pépinières produisaient uniquement le 2,4-diacéthylphloroglucinol et étaient inefficaces contre le C. *floridanum*. Dans les forêts naturelles, nous avons toutefois isolé de semis trois souches différentes produisant des phénazines, ainsi que des souches produisant à la fois du 2,4-diacéthylphloroglucinol et de la pyrrolnitrine. Ces dernières souches ont fortement inhibé la croissance du C. *floridanum* et représentent des agents de lutte biologique prometteurs.

Fungal protocols and preliminary results for the CFS-Atlantic Exotic Beetles and Associated Fungi Project 2002-2005

Protocoles et résultats préliminaires d'analyse des champignons dans le cadre du projet de 2002-2005 du SCF-Atlantique sur les coléoptères exotiques et leurs champignons associés

Presented by:

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Abstract

Recent literature has highlighted the risk of introduction of invasive species of insects and their associated fungi into Canada. These ophiostomatoid fungi are often bluestains that cause "deep staining" of wood products and make them unmarketable as exports. The fungi are known associates of various species of invasive Scolytids (bark and ambrosia beetles), Cerambycids (longhorn beetles) and Buprestids (metallic wood boring beetles) so the discovery of any of these fungi may be the first indication that the tiny associated beetles (quarantine pests) have arrived in Atlantic Canada. Preliminary fungal results are presented for the thirteen sample locations located in forested areas of the Atlantic Provinces.

Résumé

La littérature récente a mis en évidence le risque d'introduction au Canada d'espèces envahissantes d'insectes et de leurs champignons associés. Les champignons ophiostomatoïdes sont souvent des champignons responsables du bleuissement qui provoquent une " coloration en profondeur " des produits ligneux et les rendent inexportables. Les champignons sont connus pour être associés à diverses espèces de Scotylidés (scolytes du bois et perce-bois), de Cérambycidés (longicornes) et de Buprestidés (perce-bois à livrée métallique, tels les buprestes) de sorte que la découverte de l'un ou l'autre de ces champignons pourrait être un premier signe que les minuscules coléoptères qui leur sont associés (ravageurs justiciables de quarantaine) sont arrivés au Canada atlantique. Nous présentons les résultats préliminaires d'analyse des champignons présents dans les échantillons prélevés dans 13 endroits situés dans des régions forestières des provinces de l'Atlantique.

New perspectives on white pine blister rust

Nouvelles perspectives dans la lutte contre la rouille vésiculeuse du pin blanc

Presented by:

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Abstract

After a full century since its introduction in North America, the white pine blister rust (WPBR) outbreak, after having nearly eliminated eastern and western white pines as commercial species, is now threatening key ecological species such as limber and whitebark pines. Molecular epidemiology has revealed a high genetic differentiation between eastern and western populations. Preventing a genetic bridge between these two units has important implications on white pine improvement programs. Analysis of worldwide collections revealed higher diversity outside America, possibly including both pine-to-Ribes and pine-to-pine species. The recent discovery of a hybrid rust between WPBR and comandra blister rust is a cause for concern. Interspecific hybridization has served as an alternative for rapid evolution of devastating forest pathogens such as Annosus root rot, Dutch elm disease, Phytophthora disease of alder, and poplar leaf rusts. New genomics research in WPBR is focusing on resistance mechanisms present in white pines. Association studies will allow the identification of candidate genes involved in host-pathogen interaction and resistance response.

Résumé

Un siècle après avoir été introduite en Amérique du Nord et avoir par la suite presque complètement éliminé le pin blanc et le pin argenté comme essences commerciales, la rouille vésiculeuse du pin blanc (RVPB) menace aujourd'hui des essences d'une importance écologique critique comme le pin flexible et le pin à blanche écorce. L'étude de l'épidémiologie moléculaire de la rouille a révélé l'existence d'une importante différenciation génétique entre les populations orientales et occidentales. Les efforts visant à prévenir l'établissement d'un pont génétique entre ces deux unités ont un profond retentissement sur les programmes d'amélioration du pin blanc. L'analyse de collections constituées dans diverses régions du monde a fait ressortir l'existence

d'une diversité plus élevée en dehors de l'Amérique, incluant des espèces à cycle de transmission pin à *Ribes* et pin à pin. La découverte récente d'une rouille hybride entre la RVPB et la rouille-tumeur oblongue constitue une source de préoccupation additionnelle. L'hybridation entre espèces différentes a favorisé l'évolution rapide de divers agents pathogènes forestiers particulièrement dévastateurs comme les agents de la maladie du rond, de la maladie hollandaise de l'orme, de l'infection à *Phytophthora* du frêne et des rouilles des feuilles du peuplier. Les nouvelles études en génomique consacrées à la RVPB portent sur les mécanismes de résistance présents chez le pin blanc. Des études d'association permettront d'identifier les gènes candidats qui interviennent dans l'interaction entre l'hôte et les agents pathogènes et l'acquisition d'une résistance.

Control of the white pine weevil with *Beauveria bassiana*

Lutte contre le charançon du pin blanc à l'aide du *Beauveria bassiana*

Presented by:

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Abstract

Laboratory experiments were conducted in order to document the insecticide potential of different isolates of *Beauveria bassiana* against the white pine weevil. Studies were realized on the screening of different isolates of *B. bassiana* on white pine weevils and the determination of LC-50 and LT-50 of the most efficient isolates. We also documented the insecticide potential of the most efficient isolates following an exposition to a cold treatment (5 months at 2°C) after weevils were sprayed. Finally, we verified the impact of spraying the feeding and egg laying substrate (terminal leaders) on the adults and offspring survival.

Résumé

Des essais en laboratoire ont été effectués afin de documenter le potentiel insecticide de différents isolats de *Beauveria bassiana* contre le charançon du pin blanc. Des études visant la sélection de différents isolats du *B. bassiana* ont été réalisées et la CL 50 et le TL 50 des isolats les plus efficaces contre le charançon du pin blanc ont été établis. Nous avons aussi documenté le potentiel insecticide des isolats les plus efficaces qui avaient été exposés au froid (traitement de 5 mois à 2°C) après la pulvérisation des charançons. En dernier lieu, nous avons vérifié l'impact de la pulvérisation du substrat d'alimentation et de ponte (flèches) sur la survie des adultes et de la progéniture.

Lecanicillium, a fungal parasite of the white pine weevil (*Pissodes strobi*)

Presented by:

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Abstract

A previous study reporting on pathogenicity to white pine weevil (*Pissodes strobi* Peck) caused by entomopathogenic isolates of *Lecanicillium* W. Gams & Zare (formerly *Verticillium*), suggest that they are potential biocontrol agents. Here we report on the identification of *Lecanicillium* isolates and their pathogenicity, the effect of temperature and moisture regimes on pathogenicity to adult weevils *in vitro*, and pathogenicity to weevil larvae *in situ*. Twenty-eight isolates were identified either as *L. longisporum, L. muscarium* and *Lecanicillium* sp. based on microscopic characteristics. Pathogenicity varied widely between isolates with higher mortality rates caused by *L. longisporum* than *L. muscarium*. *In vitro* environmental conditions of different water activity (0.99 and 0.85 aw) and temperature (25, 20, 15, and 10°C) combinations, found certain xerophilic (0.85aw) and/or psychrophilic (10°C) isolates causing high levels of weevil mycosis. Those isolates with a wide range of environmental tolerances can be better fitted to the expected environmental parameters of the host. The inoculation with *Lecanicillium* conidial suspensions, of weevil larvae infested spruce leaders, found higher pathogenicity rates than the control. The presence of *Lecanicillium* in soils in British Columbia suggests that the fungus is well adapted to survive and multiply in a forest environment. Its ability to be pathogenic to adult and larval stages of *P. strobi* makes it an ideal candidate for further research as a biocontrol.

Beauveria bassiana for control of the brown spruce longhorn beetle, *Tetropium fuscum* (Fabr.) (Coleoptera: Cerambycidae)

Presented by:

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Abstract

Beauveria bassiana is a soil-borne fungus that occurs naturally throughout the world and infects a wide variety of insects but is not toxic to mammals, birds, or plants. *Beauveria*-based pest control products are commercially available in the U.S. and other parts of the world, but not Canada. We are investigating *B. bassiana* as a means of suppressing populations of the exotic wood boring beetle, *Tetropium fuscum* (Fabr.). In laboratory bioassays, adult *Tetropium* spp. were susceptible to *B. bassiana* isolates from Quebec and Nova Scotia. Field trials were conducted in 2004 to test the efficacy of *B. bassiana* for infecting foraging adult beetles. Two methods were used: 1) *Beauveria*-impregnated polyester bands on live tree trunks; and 2) spore suspensions applied to spruce bait logs. Polyester bands captured 24 *T. fuscum* and 93 nontarget beetle species. Percent infection of pooled beetle species was significantly greater on treated bands (37%) than untreated bands (7%). Efficacy of bait-log treatments will be determined this winter by comparing the density of *T. fuscum* adults that emerge from *Beauveria*-treated vs. control logs. Results suggest that *T. fuscum* is susceptible to *B. bassiana* under field conditions.

Suppression of field populations of balsam fir sawfly with aerial Applications of its nucleopolyhedrovirus

Suppression des populations du diprion du sapin à l'aide d'applications aériennes de son virus de la polyédrose nucléaire

Presented by:

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Abstract

The intensity and duration of balsam fir sawfly (*Neodiprion abietis* [Harris]) outbreaks have recently increased in managed balsam fir (*Abies balsamea* [L.] Mill) forests in western Newfoundland. A nucleopolyhedrovirus (*NeabNPV*) is responsible for the collapse of balsam fir sawfly populations in natural conditions and may provide an efficacious yet environmentally-friendly tactic to suppress epidemic populations of this insect. This study examines the effects of aerial applications of *NeabNPV* on increasing, peaking and declining populations of its host. Results indicate that balsam fir sawfly densities were distinctly lower in the generation following an aerial application of *NeabNPV*, but only when treatments were directed against increasing or peaking populations. When directed against declining populations, *NeabNPV* applications apparently did not influence the natural collapse of outbreaks. Outbreaks of the balsam fir sawfly may be successfully suppressed by aerial applications of its nucleopolyhedrovirus at rates as low as 1x109 polyhedral inclusion bodies per hectare.

Résumé

L'intensité et la durée des pullulations du diprion du sapin (*Neodiprion abietis* [Harris]) ont récemment augmenté dans les forêts aménagées de sapins baumiers (*Abies balsamea* [L.] Mill) de l'ouest de Terre-Neuve. En milieu naturel, un virus de la polyédrose nucléaire du diprion du sapin (VPN*Neab*) est à l'origine de l'effondrement des populations de ce ravageur et pourrait constituer une méthode à la fois efficace et écologique de suppression des populations en période de pullulation. La présente étude examine les effets des applications aériennes du VPN*Neab* sur

les populations à la hausse, maximales et à la baisse du ravageur. D'après les résultats obtenus, les densités du diprion du sapin étaient nettement plus basses chez les générations postérieures à une application aérienne du VPN*Neab* mais uniquement lorsque les traitements avaient ciblé des populations à la hausse ou maximales. Les applications du VPN*Neab* qui avaient ciblé des populations à la baisse n'ont apparemment pas eu d'effet sur l'effondrement naturel des populations. Des applications aériennes du virus de la polyédrose nucléaire du diprion du sapin, à des doses aussi faibles que 1 x 109 corps d'inclusion polyédriques par hectare, peuvent permettre de supprimer efficacement les populations de ce ravageur en période de pullulation.

Preliminary studies on the bacteria associated with the pine false Webworm, *Acantholyda erythrocephala* (Hymenoptera, Pamphiliidae)

Études préliminaires des bactéries associées au pamphile introduit du pin (*Acantholyda erythrocephala*) (Hymenoptera : Pamphiliidae)

Presented by:

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Abstract

We investigated the diversity of bacteria associated with the different life stages of *Acantholyda erythrocephala* (pine false webworm) using culture and culture-independent [16S rRNA gene fragment polymerase chain reaction - denaturing gradient gel electrophosesis (DGGE)] methods. Identification of bacteria revealed a more complex microflora associated with the eonymph and pronymph compared to other life stages. Culturable isolates most frequently recovered were *Pseudomonas* spp. and *Bacillus* sp. but colonies identified as *Stenotrophomonas maltophilia* and *Paenibacillus* spp. were also frequently isolated. The results of DGGE analysis revealed the presence of bacterial species not detected by culture methods including *Eubacterium* sp., *Leptotrichia* sp., *Flavobacterium* sp. and *Nocarda ignorata*. *Chryseobacterium* sp. was a dominant band in DGGE gels from all samples with the exception of the those from internal tissues of adult males and from frass.

Résumé

Nous avons étudié la diversité des bactéries associées aux différents stades évolutifs de l'*Acantholyda erythrocephala* (pamphile introduit du pin) à l'aide de méthodes de culture et de techniques tout à fait différentes [réaction en chaîne de la polymérase de fragments d'ARNr 16s - électrophorèse en gel de gradient dénaturant (DGGE)]. L'identification des bactéries a révélé que la microflore associée aux stades d'éonymphe et de prénymphe était plus complexe que celle associée à d'autres stades évolutifs. Les isolats cultivables les plus fréquemment récupérés étaient des espèces des genres *Pseudomonas* et *Bacillus* mais des colonies de *Stenotrophomonas*

maltophilia et des plusieurs espèces du genre *Paenibacillus* ont aussi été souvent isolées. Les résultats de l'analyse effectuée par DGGE ont révélé la présence d'espèces de bactéries que les méthodes de culture n'avaient pas permis de détecter, notamment le *Nocarda ignorata* et des espèces des genres *Eubacterium, Leptotrichia* et *Flavobacterium*. Les espèces de *Chryseobacterium* formaient une bande dominante dans les gels de la DGGE de tous les échantillons, exception faite de ceux provenant de tissus internes de mâles adultes et d'excréments.

The role of contemporary coevolution in the retention of a host range in baculoviruses

Rôle de la co-évolution contemporaine dans le maintient d'un éventail d'hôtes chez les baculovirus

Presented by:

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Abstract

The uptake of occlusion bodies from a baculovirus can induce mortality in other species than the one from which they were isolated, possibly due to dynamic coevolution between the baculovirus and its hosts. We fed a hymenopteran baculovirus to sawfly species that have been spatially separated for a long evolutionary time from this virus to examine the role of coevolution in mechanisms of cross-infection.

Résumé

L'ingestion de corps d'inclusion d'un baculovirus peut induire de la mortalité chez d'autres espèces que celle dont il fut isolé, possiblement en raison d'une co-évolution active entre le baculovirus et ses hôtes. Nous avons fait ingérer un baculovirus hyménoptère à des espèces de diprion qui furent séparées de ce virus pour une longue période évolutive afin d'examiner le rôle de la co-évolution dans les mécanismes d'infection croisée.

Scolytid abundance increases following habitat loss due to altered predator-prey interactions

Augmentation de l'abondance des Scolytidés suite à la perte d'habitat due à des modifications des interactions prédateur-proie

Presented by:

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Abstract

Theoretical models predict that habitat loss can alter predator-prey interactions. We sampled *Ips pini* and its predators in ten landscapes with varying amounts of habitat using funnel traps and trap logs. Predator:prey ratios were significantly reduced in areas with low vs. high amounts of habitat, with prey populations increasing in landscapes with less habitat. Results suggest reduced predation levels prior to and during reproduction lead to this increased prey abundance.

Résumé

Les modèles théoriques prédisent qu'une perte d'habitats peut changer les interactions prédateurs-proies. Nous avons échantillonné *Ips pini* et ses prédateurs dans dix paysages, caractérises par des quantities variables d'habitats, en utilisant des pièges entonnoirs et des rondins de bois. Les proportions prédateurs : proies ont été significativement réduites dans les secteurs montrant peu d'habitats, a cause d'une augmentation des populations de proies dans les paysages avec moins d'habitats. Les resultants suggèrent qu'une reduction des niveaux de predation avant et pendant la reproduction mène a cette abondance accrue de proies.

Parasitism of the brown spruce longhorn beetle, *Tetropium fuscum* (Fabr.) (Coleoptera: Cerambycidae) in Halifax, Nova Scotia

Parasitisme du longicorne brun de l'épinette, *Tetropium fuscum* (Fabr.) (Coleoptera: Cerambycidae) à Halifax, Nouvelle-Écosse

Presented by:

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Abstract

Tetropium fuscum (Fabr.) (Coleoptera: Cerambycidae), native to Europe and established near Halifax, NS, since at least 1990, were sampled to determine incidence of parasitism. Two nearctic species commonly parasitized *T. fuscum* and the native *Tetropium cinnamopterum* (L.); both species emerge as larvae from host prepupae. Mean (SE) percent parasitism of *Tetropium* spp. in 2000 was 22 (3.9) for *Rhimphoctona macrocephala* (Prov.) (Hymenoptera: Ichneumonidae) and 16 (3.3) for *Wroughtonia occidentalis* Cresson (Hymenoptera: Braconidae).

Résumé

Le *Tetropium fuscum* (Fabr.) (Coleoptera: Cerambycidae), insecte originaire d'Europe établi dans la région d'Halifax (N. É.) depuis au moins 1990, a fait l'objet d'un échantillonnage visant à déterminer l'incidence du parasitisme dont il est l'objet. Deux parasitoïdes néarctiques ont été trouvés communément associés au *T. fuscum* et à son congénère indigène, *le Tetropium cinnamopterum* (L.). Ces deux parasitoïdes émergent à l'état larvaire des prénymphes de l'hôte. En 2000, le taux moyen (É. T.) de parasitisme des *Tetropium* spp. s'établissait à 22 % (3,9 %) pour le *Rhimphoctona macrocephala* (Prov.) (Hymenoptera: Ichneumonidae) et à 16 % (3,3 %) pour le *Wroughtonia occidentalis* Cresson (Hymenoptera: Braconidae).

Monitoring budworm health: improved management decisions?

La surveillance de la santé de la tordeuse des bourgeons de l'épinette peut-elle améliorer la prise de décisions sur la lutte contre ce ravageur?

Presented by:

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Abstract

Spruce budworm decision support systems do not take into account the health of outbreak populations. *Nosema fumiferana* is a microsporidian (Protozoa) parasite that usually increases during an outbreak and can be associated with population collapse. Because the parasite overwinters in second instars, its prevalence can be estimated in conjunction with operational L2 surveys. The current outbreak in Saskatchewan offered an opportunity to see if we can develop an operational method for monitoring budworm health and if such information can be used to refine spray decision making. Examination of the distribution of infected spruce budworm larvae throughout the spruce crown and within branches indicated that the standard L2 sample unit (45-cm tip from mid-crown) was appropriate for estimating *Nosema* prevalence. Prevalence in 97 L2-survey plots that were sampled in the fall of 2003 ranged from 0 to 54% and was highest in the oldest part of the outbreak (Central region). A subsample of 25 plots was selected across a gradient of L2 infection and was sampled during June 2004 just before onset of spraying operations. *Nosema* prevalence, estimated from ~100 larvae per plot, ranged from 10 to 57%. Prevalence in pre-spray larval populations was positively correlated with prevalence in overwintering larvae and was best described by a model that included defoliation at the end of the previous season. However, the fit of the model was not good enough to be operationally useful. Extreme spatial heterogeneity in spruce budworm populations on white spruce superimposed on patchy disease processes may pose a problem in operational monitoring of budworm health.

Résumé

Les systèmes d'aide à la décision sur la tordeuse des bourgeons de l'épinette ne tiennent pas compte de la santé des populations en période de pullulation. Le *Nosema fumiferana* est une microsporidie parasite (protozoaire) dont l'effectif augmente habituellement lors d'une pullulation et qui peut être associée à l'effondrement des populations de la tordeuse. Puisque le parasite hiberne au deuxième stade larvaire, il est possible d'estimer sa prévalence en même temps que les relevés opérationnels du stade L2. L'infestation qui sévit actuellement en Saskatchewan nous a donné l'occasion de vérifier s'il était possible d'élaborer une méthode opérationnelle de surveillance de la santé de la tordeuse des bourgeons et si ce type de renseignements pouvait servir à améliorer la prise de décisions sur les pulvérisations. Un examen de la répartition de larves parasitées de la tordeuse des bourgeons de l'épinette dans l'ensemble du houppier et dans les branches a montré que l'unité normalisée d'échantillonnage des L2 (extrémité de branche de 45 cm prélevée à mi-hauteur du houppier) convenait à l'estimation de la prévalence du *Nosema*. Dans les 97 parcelles de relevés L2 qui ont été échantillonnées durant l'automne 2003, la prévalence variait de 0 à 54 % et était la plus élevée dans la partie la plus ancienne de l'infestation (région centrale). Un sous-échantillon de 25 parcelles a été sélectionné parmi un gradient d'infection des L2 et a été échantillonné en juin 2004, immédiatement avant que ne débutent les opérations de pulvérisation. La prévalence du *Nosema*, estimée à partir de ~100 larves par parcelle, variait de 10 à 57 %. Chez les populations larvaires pré-traitement, la prévalence était positivement corrélée à celle observée chez les larves en hibernation. Un modèle qui tenait compte de la défoliation à la fin de la saison précédente donnait la meilleure représentation de la prévalence. Le modèle n'avait toutefois pas un ajustement assez bon pour avoir une utilité opérationnelle. L'hétérogénéité spatiale extrême des populations de la tordeuse des bourgeons de l'épinette infestant l'épinette blanche, combinée à la nature éparse des processus morbides, peut rendre difficile la surveillance opérationnelle de la santé de la tordeuse des bourgeons de l'épinette.

Root disease damage in treated second-growth conifer stands

Presented by:

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Abstract

The hidden enemy of boreal spruce-balsam fir forests goes unnoticed underground in the form of root and butt rots. The result is growth loss, tree mortality, windthrow and butt cull which affect stand productivity and carbon biomass. Current research at CFS-Atlantic is studying; the effects of stand treatments, particularly partial cutting and thinnings, on root diseases, the impacts of root disease on stand productivity, the identity and importance of the causal root fungi, and the influence site types and tree species has upon the variability of root disease in forest stands.

Forum 2005 Special Feature

Science for enhanced pest management in Canada

Événement spécial du Forum 2005

La science et l'amélioration de la lutte contre les ravageurs au Canada

Morning Session

Chair: Anne Bordé

Natural Resources Canada, Canadian Forest Service

Séance du matin

Président : Anne Bordé

Ressources naturelles Canada, Service canadien des forêts

Advanced methods of monitoring impacts of pest control products on key microbial communities of forest soils

Méthodes avancées de surveillance des impacts des produits antiparasitaires sur les principales communautés microbiennes des sols forestiers

Presented by:

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Abstract

Soil microorganisms are key participants in nutrient generation and recycling processes and consequently forest productivity. Disturbance of these communities may negatively impact the ability of the soil to sustain rapid, renewed forest growth and therefore changes in these communities may be an important consideration for optimizing forest management strategies. Key indicators of these changes may be particularly useful when assessing the environmental safety of biocontrol agents or other pest control products. Most soil microbes have yet to be cultured and described physiologically, which complicates the search for microbial indicators of forest management impacts. However, microbial genotypes present within a soil sample can be profiled using techniques such as denaturing gradient gel electrophoresis (DGGE), which separates polymorphic DNA fragments generated by Polymerase Chain reaction (PCR) amplification of a particular gene of interest, as each fragment may represent a unique genotype. We have used PCR-DGGE analysis to profile 16S rDNA genotypes as well as genotypes involved in nitrogen cycling in forest soils, specifically nitrite reductase (*nir K*) and nitrogenase (*nif H*) genes. We have compared genotype profiles of forest soils under different forestry management practices such as variable retention harvesting and biopesticide (*Chondrostereum purpureum*) treatment, and have observed specific changes in soil genotype profiles. Principal tasks for the immediate future include characterizing the specific function of the microbial indicators, establishing the detection limits of the PCR-DGGE method, and developing a database to facilitate indicator analysis.

Résumé

Les microorganismes présents dans le sol sont des participants clés de la formation des nutrients, des processus de recyclage de la matière organique et donc de la productivité des forêts. Toute perturbation infligée à ces communautés peut avoir un impact négatif sur la capacité du sol à soutenir la croissance rapide des arbres. L'évolution des communautés en question doit donc être prise en compte sérieusement lors de l'optimisation des stratégies de gestion forestière. Des indicateurs clés révélant ces changements pourraient être particulièrement utiles lors de l'évaluation des effets environnementaux des agents de contrôle biologique et d'autres produits de lutte contre les organismes nuisibles. La plupart des microbes présents dans le sol n'ont jamais été cultivés ni décrits physiologiquement, ce qui complique la recherche d'indicateurs microbiens des impacts de la gestion forestière. Les génotypes microbiens présents dans un échantillon de sol peuvent cependant être profilés à l'aide de techniques telles que l'électrophorèse en gel de gradient dénaturant (DGGE), qui permet de séparer les fragments polymorphiques d'ADN générés par amplification de la polymérase d'un gène spécifique, chaque fragment pouvant représenter un génotype unique. Nous avons effectué des analyses PCR-DGGE pour profiler des génotypes d'ADNr 16S ainsi que des génotypes participant au cycle de l'azote dans les sols forestiers, en particulier les gènes produisant la nitrite réductase (*nir K*) et la nitrogénase (*nif H*). Nous avons comparé des profiles génotypiques de sols forestiers soumis à différentes pratiques de gestion forestière telles que la coupe avec réserve variable de tiges et le traitement à l'aide d'un biopesticide (*Chondrostereum purpureum*) et nous avons observé des changements spécifiques dans les profiles génotypiques. Dans l'avenir immédiat, les travaux devront consister à caractériser la fonction spécifique des indicateurs microbiens, à établir la limite de détection de la méthode PCR-DGGE et à mettre sur pied une base de donnée qui facilitera l'analyse des indicateurs.

Development and validation of SprayAdvisor DSS for aerial herbicide applications in Canada

Élaboration et validation du SAD SprayAdvisor pour les applications aériennes d'herbicide au Canada

Presented by:

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Abstract

SprayAdvisor is an advanced decision support system (DSS) being developed under an international collaborative venture with researchers in New Zealand and the United States. In this project, the primary objective is to validate the DSS for optimizing aerial herbicide application in Canadian forest management. The SprayAdvisor DSS incorporates a fully integrated spray dispersal model (AGDSIP) and embedded dose-response relations to predict spray deposition and effects under the interactive influence of numerous aircraft, dispersal system, meteorological and site variables. The most recent version is built on ARC GIS platform and allows for direct input of spatial data as well as AGNAV electronic guidance file data. To date, the validation process has involved collection of application parameter, meteorological, spatial, chemical deposition, vegetation response and remote sensing data from 12 site-specific cases (9 fixed-wing/ 3 rotary-wing) in northern Ontario. These data comprise a major portion of the empirical data set against which predictions derived from the DSS system can be assessed. In addition to these operational monitoring studies, a ground-based experiment was initiated in 2005 to provide required dose-response data for key species of competing vegetation exposed to 10 different levels of glyphosate-based herbicides Vision and Vision-Max. Currently available results demonstrate that :

- electronic guidance systems effectively reduce variation in chemical deposition across spray blocks
- electronic guidance facilitates realization of either silvicultural or environmental exclusions within spray blocks, thus
- off-target deposition declines dramatically with distance from the spray block boundary, such that glyphosate deposits within buffers and riparian zones are below

biological effect thresholds for most sensitive non-target plant or animal species, and that

- remote sensing with either near infrared satellite or digital image capture, provides an excellent method for quantitative determination of efficacy and for establishing non-target phytotoxicity contours at the block level of spatial resolution.

Upon completion of this project, the SprayAdvisor DSS system should provide an effective mechanism for synthesis and incorporation of a substantial body of scientific and experiential knowledge into operational practice, thereby enhancing forest regeneration success and mitigating against potential deleterious effects on non-target organisms. As such the project directly addresses the Enhanced Pest Management Methods program objective of monitoring pesticides in the forest environment and the over-arching Canadian Forest Service goals of sustainable forest development and protection of ecological integrity.

Résumé

Le SprayAdvisor est un système d'aide à la décision (SAD) évolué qui est actuellement élaboré dans le cadre d'une initiative de recherche conjointe entre des chercheurs de la Nouvelle-Zélande et des États-Unis. L'objectif principal du présent projet est de valider le SAD afin de permettre des applications aériennes optimales d'herbicide dans le cadre des activités d'aménagement des forêts du Canada. Le SAD SprayAdvisor allie modèle de dispersion entièrement intégré (AGDSIP) et relations doses-effets pour prévoir le dépôt et les effets des gouttelettes sous l'effet de l'interaction de nombreuses variables liées à l'aéronef, au système de dispersion, aux conditions météorologiques et au site. La version la plus récente utilise une plate-forme ARC GIS et permet la saisie directe de données spatiales ainsi que de données du fichier de guidage électronique AGNAV. Jusqu'à maintenant, le processus de validation a consisté à compiler des données sur les paramètres d'application, les conditions météorologiques, le dépôt de produits chimiques, les réactions de la végétation ainsi que des données spatiales et de télédétection provenant de 12 cas concrets spécifiques à un site (9 aéronefs à voilure fixe/ 3 aéronefs à voilure tournante) du nord de l'Ontario. Ces données constituent une part importante de l'ensemble de données empiriques à partir duquel les prévisions établies par le SAD peuvent être évaluées. Outre ces études de surveillance opérationnelles, un essai au sol a été entrepris en 2005 afin d'obtenir les données nécessaires sur les doses-effets chez des espèces végétales concurrentes clés exposées à dix doses différentes de Vision et de Vision-Max, des herbicides à base de glyphosate. Selon les résultats actuellement disponibles :

- les systèmes de guidage électronique réduisent efficacement les variation au niveau du dépôt d'herbicides sur les surfaces traitées,
- le guidage électronique facilite l'exclusion à des fins sylvicoles ou environnemen–tales de certains secteurs des surfaces traitées et, par conséquent,
- le dépôt hors cible diminue considérablement à mesure que l'on s'éloigne des limites de la surface traitée, de sorte que les dépôts de glyphosate dans les zones tampons ou riveraines sont inférieurs aux seuils d'effets biologiques établis pour les espèces animales ou végétales non visées les plus sensibles, et

- les données de télédétection provenant d'images satellitaires dans le proche infrarouge ou d'images numériques sont un excellent outil pour quantifier l'efficacité et établir les contours de la phytotoxicité pour les organismes non visés à l'échelle de résolution spatiale de la surface traitée.

À l'issue de ce projet, le système d'aide à la décision SprayAdvisor devrait fournir un outil efficace de synthèse d'une somme importante de connaissances scientifiques et expérimentales ainsi que d'intégration de celles-ci aux pratiques opérationnelles, améliorant ainsi le succès de la régénération des forêts et atténuant les effets néfastes potentiels sur les organismes non visés. À ce titre, le projet aborde directement l'objectif de surveillance des pesticides en milieu forestier du programme sur les méthodes améliorées de lutte antiparasitaire et les objectifs primordiaux du service canadien des forêts d'assurer l'aménagement durable des forêts et de protéger l'intégrité écologique.

Introduction to ECOBIOM ** – Biological control against forest pests (insects and pathogenic microorganisms) in Canada

Introduction au Groupe de recherche ECOBIOM ** – la lutte biologique contre les ravageurs forestiers (insectes et microorganismes pathogènes) au Canada

Presented by:

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Abstract

Three years ago, a group of scientists was formed based on their interest in developing the use of fungi to control forest pests (insects and microorganisms). During this period, ECOBIOM (insects) group worked on the evaluation of the insecticide potency of natural-occurring fungi, such as *Beauveria* and *Lecanicillium,* which are pathogens for insects and are environmentally acceptable. These fungi are already used in other countries like France, China, and the United States. The strategy proposed by ECOBIOM group is based on the use of naturally occurring fungi. This is an augmentative approach that does not promote the introduction of exotic microorganisms.

** ECOBIOM - **E**xtended **CO**llaboration on **B**iological control of forest **I**nsects **O**r pathogenic **M**icroorganisms

Résumé

Il y a trois ans des chercheurs ont uni leurs efforts dans l'objectif de démontrer le potentiel des champignons microscopiques pour lutter contre certains insectes et microorganismes nuisibles des forêts. Durant cette période, le groupe ECOBIOM (insectes) s'est attardé à l'évaluation du potentiel insecticide des champignons entomopathogènes indigènes, notamment *Beauveria* et *Lecanicillium.* Le but de nos travaux de recherches est de démontrer les bénéfices associés à l'utilisation des mycoinsecticides comme agent de contrôle sécuritaire et non-nuisible pour l'environnement. Bien que ces deux agents microbiens de lutte biologique soient déjà utilisés avec succès dans d'autres pays comme la France, la Chine et les États-Unis contre certains insectes nuisibles, l'approche développée par le groupe ECOBIOM vise l'emploi de nouveaux isolats retrouvés naturellement dans les populations d'insectes ciblés. Il s'agit donc d'une stratégie augmentative puisqu'elle ne préconise pas l'introduction d'organismes exotiques.

** ECOBIOM - **E**ffort **CO**ncerté de lutte **B**iologique contre les **I**nsectes **O**u les **M**icroorganismes pathogènes des forêts

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ECOBIOM* – Le contrôle biologique des organismes nuisibles aux forêts (insectes et microorganismes pathogènes) au Canada – Introduction & Conclusion

Introduction

Il y a trois ans, des chercheurs ont uni leurs efforts dans l'objectif de démontrer le potentiel des champignons pour lutter contre certains insectes et microorganismes nuisibles des forêts. Durant cette période, le groupe ECOBIOM (insectes) s'est attardé à l'évaluation du potentiel insecticide des champignons entomopathogènes indigènes, notamment *Beauveria* et *Lecanicillium.* Le but de nos travaux de recherches est de démontrer les bénéfices associés à l'utilisation des mycoinsecticides comme agent de contrôle sécuritaire et non-nuisible pour l'environnement. Par ces travaux, nous voulons aussi contribuer à favoriser l'homologation de nouveaux produits de lutte antiparasitaire au Canada. Bien que ces deux agents microbiens de lutte biologique soient déjà utilisés avec succès dans d'autres pays comme la France, la Chine et les États-Unis contre certains insectes nuisibles, l'approche développée par le groupe ECOBIOM vise l'emploi de nouveaux isolats retrouvés naturellement (écozone) dans les populations d'insectes ciblés. Il s'agit donc d'une stratégie augmentative puisqu'elle ne préconise pas l'introduction d'organismes exotiques. Les insectes qui sont ciblés par cette étude sont le charançon du pin blanc (*Pissodes strobi*), le grand hylésine (*Tomicus piniperda*) des pins et le longicorne brun de l'épinette (*Tetropium fuscum*). Comparativement aux bactéries et aux virus, l'utilisation des champignons pour lutter contre les insectes demeure cependant marginale. Dans un contexte où l'utilisation des insectes chimiques deviendra de plus en plus limitée il est essentiel d'offrir à la population canadienne des alternatives qui soient à la fois efficaces et respectueuses de l'environnement.

L'utilisation des champignons est cependant plus complexe que des produits passifs comme les insecticides de synthèse car les champignons sont des organismes vivants. Leur utilisation nécessite de tenir compte de leurs besoins spécifiques de même que des caractéristiques de leurs hôtes et du milieu où ils seront introduits. Et c'est par des recherches minutieuses dans le milieu naturel (écozone) qu'on retrouvera les champignons qui pourront être testés pour être éventuellement utilisés dans des programmes de lutte. Ce travail est assez laborieux car il faut d'une part trouver ces champignons, en faire la culture, confirmer leur identité (méthodes traditionnelle et moléculaire), produire de l'inoculum en quantité suffisante pour les différents tests et finalement en démontrer la virulence.

Contrairement aux bactéries et aux virus, les champignons ont la particularité de pouvoir infecter leurs hôtes sans être ingérés. En effet, en autant que la spore puisse se retrouver en contact avec la cuticule de l'insecte, elle germera et pénètrera le corps de l'insecte. Les conséquences seront une réduction de l'alimentation, de la ponte, une survie hivernale réduite et ultimement la mort de l'insecte.

Nos travaux visent à trouver des champignons qui seront les plus spécifiques aux insectes cibles sans affecter les insectes utiles. Il est alors important de comprendre la notion de spécificité des champignons. Ainsi, certains isolats du champignon *Beauveria bassiana* auront un spectre d'action plus restreint que d'autres. Ce sont ces isolats, qui une fois identifiés et caractérisés deviendront des souches qui seront utilisées contre des insectes nuisibles tout en ayant un effet minimal sur les insectes utiles (ex : coccinelle).

Conclusion

Les champignons entomopathogènes demeurent à ce jour des agents de contrôle biologique sécuritaires pour les humains. Il n'y a pas eu de cas d'effet négatif observé sur les humains. De même, les champignons représentent un risque très faible d'infecter des insectes pollinisateurs. Et dans certains cas, les champignons sont même véhiculés par des insectes pollinisateurs.

Les avantages des champignons entomopathogènes sont nombreux. D'une part ils se reproduisent asexuellement ce qui facilite leur production. Aussi, ils produisent de grandes quantités de conidies. Ils peuvent avoir un spectre relativement restreint d'insectes cibles. Il n'y a pas de eu de cas de rapporté démontrant une toxicité pour les mammifères. Finalement, par leur mode d'action, la possibilité que des insectes développent une résistance aux champignons est réduite.

Les champignons entomopathogènes pourraient être utilisés là où actuellement les insecticides chimiques sont en voie d'être bannis. Et il est évident qu'il faudra tôt ou tard développer des alternatives aux insecticides chimiques. Et c'est dans ce but que s'effectuent les travaux du groupe ECOBIOM.

* ECOBIOM - **E**ffort **CO**ncerté de lutte **B**iologique contre les **I**nsectes **O**u les **M**icroorganismes pathogènes des forêts

** ECOBIOM - **E**xtended **CO**llaboration on **B**iological control of forest **I**nsects **O**r pathogenic **M**icroorganisms

Field efficacy of *Beauveria bassiana*-treated polyester tree bands for trapping and infecting the brown spruce longhorn beetle in Nova Scotia

Efficacité au champ de bandes de polyester imprégnées de spores de *Beauveria bassiana* et utilisées pour piéger et infecter le longicorne brun de l'épinette en Nouvelle-Écosse

Presented by:

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Abstract

Beauveria bassiana was field-tested for infection of the brown spruce longhorn beetle, *Tetropium fuscum* (Fabr.), (Coleoptera: *Cerambycidae)* in Halifax, Nova Scotia, in 2005. Strips of polyester quilt batting (4 cm thick x 20 cm wide x 164 cm long), impregnated with about 4 x 10^{10} *B. bassiana* conidia (Nova Scotia isolate) were wrapped around spruce trees at breast height to trap and infect foraging adult *T. fuscum*. We compared two formulations (mineral oil vs. water with 0.05% Tween 80) and either replaced the bands with freshly-impregnated bands after 4 weeks or not at all. The polyester bands were effective at trapping large numbers of *T. fuscum* on spruce trunks, with a total of more than 570 beetles recorded on 180 trees. Mean (± SE) percent infection of *T. fuscum* adults was significantly greater on *Beauveria*-treated bands (65.6 ± 2.5%) than on untreated bands (13.9 ± 2.4%) but did not differ between formulations or between replaced vs. non-replaced bands.

Résumé

Nous avons effectué des essais sur le terrain à Halifax (Nouvelle-Écosse) en 2005 afin d'étudier l'infection du longicorne brun de l'épinette (*Tetropium fuscum* (Fabr.)), (Coleoptera: Cerambycidae) par le *Beauveria bassiana*. Des bandes d'ouatine matelassée de polyester (4 cm d'épaisseur x 20 cm de largeur x 164 cm de longueur), imprégnées d'environ 4 x 10^{10} conidies de *B. bassiana* (isolat de la Nouvelle-Écosse), ont été fixées à hauteur de poitrine tout autour de

troncs d'épinettes afin de piéger et d'infecter des *T. fuscum* adultes en quête de nourriture. Nous avons comparé deux formulations (huile minérale vs. eau avec 0,05 % de Tween 80) et nous avons remplacé les bandes après quatre semaines avec d'autres fraîchement imprégnées ou nous ne les avons pas remplacées du tout. Les bandes de polyester ont permis de capturer un grand nombre de *T. fuscum* sur les troncs d'épinettes, le total des captures dépassant 570 coléoptères sur 180 arbres. Le pourcentage moyen (± écart-type) d'infection des *T. fuscum* adultes était significativement plus élevé sur les bandes imprégnées de *Beauveria* (65,6 ± 2,5 %) que sur les bandes non traitées (13,9 ± 2,4 %), mais ne différait pas d'une formulation à l'autre ou entre les bandes remplacées et non remplacées.

The use of *Beauveria bassiana* as a potential control method against the white pine weevil (*Pissodes strobi*) and the pine shoot beetle (*Tomicus piniperda*)

L'utilisation de *Beauveria bassiana* comme méthode de lutte contre le charançon du pin blanc (*Pissodes strobi*) et le grand hylésine des pins (*Tomicus piniperda*)

Presented by:

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Abstract

Laboratory experiments were conducted in order to document the insecticide potential of an entomopathogenous fungus, *Beauveria bassiana,* against the white pine weevil. Screenings of different isolates of *B. bassiana* on white pine weevils were performed and the LC-50 and LT-50 were estimated for the most efficient isolates. We also monitored the insecticide potential of the most efficient *B. bassiana* isolates against the white pine weevil populations exposed to cold conditions (5 months at 2°C). Finally, we verified the impact of *B. bassiana*-sprayed terminal leader sections used as feeding and egg-laying substrate on adult survival and oviposition success.

We have also conducted a field experiment in order to determine the susceptibility of the pine shoot beetle to *B. bassiana* on the bark of their host plant. Three concentrations of 2 different isolates of *B. bassiana* were sprayed on 30 cm logs sections. Each log was caged in a plastic container into which 5 males and 5 females were introduced. After 2 months, at the end of the new brood development, logs were observed to determine the length of oviposition galleries under the bark and the number of emerging holes. Additional laboratory experiments were conducted on the screening of different isolates of *B. bassiana* on pine shoot beetles and also the determination of their LC-50 and LT-50.

Résumé

Des expériences de laboratoire ont été réalisées dans le but de documenter le potentiel insecticide d'un champignon entomopathogène, *Beauveria bassiana*, contre le charançon du pin blanc. Ces expériences ont portées sur le criblage de différents isolats de *B. bassiana* sur le charançon du pin blanc et sur la détermination des CL-50 et TL-50 des isolats les plus efficaces. Nous avons aussi documenté le potentiel insecticide des meilleurs isolats suite à une exposition au froid (5 mois à 2°C), suivant la pulvérisation des charançons. Finalement, nous avons vérifié l'impact de la pulvérisation de sections de pousse terminales, servant à l'alimentation et la ponte du charançon, sur la survie des adultes et la ponte des femelles.

Une expérience de terrain a aussi été réalisée dans le but de déterminer si le grand hylésine des pins peut être affecté par des applications d'une suspension de spores de *B. bassiana* sur l'écorce de leur hôte. Des bûches de 30 cm de long, ont été pulvérisées avec 2 isolats de *B. bassiana* à 3 différentes concentrations. Chaque bûche a été placée dans un contenant de plastique, dans lequel 5 mâles et 5 femelles ont été introduits. Après 2 mois, à la fin du développement des stades juvéniles, les bûches ont été observées afin de déterminer la longueur des galeries de ponte sous l'écorce et le nombre de trous d'émergence. Des expériences de laboratoire additionnelles ont été réalisées sur le criblage de différents isolats de *B. bassiana* sur le grand hylésine des pins et sur la détermination de leurs CL-50 et TL-50.

A biological control option for white pine weevil (*Pissodes strobi*) in British Columbia

Une méthode potentielle de lutte biologique contre le charançon du pin blanc (*Pissodes strobi*) en Colombie-Britannique

Presented by:

***Harry Kope*[1]**, *René Alfaro*[1], *Isabel Leal*[1], *Robert Lavallée*[2], *Richard Trudel*[3], *Claude Guertin*[3], *Chantal Côté*[2], *Pierre Desrochers*[2,] *Peter de Groot*[4], *Jon Sweeney*[5], *Graham Thurston*[5]

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Abstract

The control of insect pests in forests is beset with the problems of timing, environment and scale. Chemical insecticidal sprays are ineffective against tree-boring insects since most of the life stages are present deep inside the host trees. Viral and bacterial diseases are rare among beetles, whereas, fungal diseases of coleopteran forest pests are common and widespread and can often result in spectacular epizootics. Using entomopathogenic fungi as a biocontrol agent could be a viable option. Our research in British Columbia focused on the white pine weevil (*Pissodes strobi*), an insect pest affecting young pine and spruce species in Canada. We established pathogenicity of the hyphomycetous fungus *Lecanicillium* to the weevil, *in vitro* and *in situ*, suggesting its potential as a biocontrol agent for this forest pest.

Résumé

Des difficultés de synchronisation, d'environnement et d'échelle compliquent la lutte contre les insectes forestiers ravageurs. Les pulvérisations d'insecticides chimiques sont inefficaces contre

les insectes perceurs dont la majeure partie du cycle vital se déroule bien à l'abri, à l'intérieur des arbres hôtes. Les maladies virales et bactérienne sont rares chez les coléoptères, tandis que les maladies fongiques sont courantes et répandues chez les coléoptères forestiers ravageurs et peuvent souvent provoquer des épizooties spectaculaires. L'utilisation de champignons entomopathogènes comme agents de lutte biologique pourrait être une option viable. Nos recherches en Colombie-Britannique portent sur le charançon du pin blanc (*Pissodes strobi*), un insecte ravageur des jeunes pins et épinettes au Canada. Nous avons démontré *in vitro* et *in situ* le pouvoir pathogène du champignon hyphomycète *Lecanicillium* sur le charançon, ce qui semble indiquer que ce champignon pourrait être prometteur comme agent de lutte biologique contre ce ravageur forestier.

Afternoon Session

Séance de l'après-midi

Environmental fate and ecological impacts of systemic insecticides for the control of exotic wood boring insect pests

Devenir dans l'environnement et effets écologiques d'un insecticide systémique contre des insectes xylophages exotiques

Presented by:

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Abstract

A series of field and laboratory microcosm experiments is being conducted to investigate the efficacy, translocation behaviour, environmental fate and non-target effects of imidacloprid as a potential systemic insecticide for control of exotic insect pests such as Emerald Ash Borer and Asian Longhorned Beetle. In field trials, imidacloprid stem injections at dosages as low as 0.04gAI/cm dbh were effective in protecting against Emerald Ash Borer in green ash trees (90% reductions in galleries; treated trees averaged 65% crown density, untreated trees averaged 10% crown density). Foliar and soil samples were taken periodically following treatments at all field sites and analyzed by HPLC to determine the uptake, translocation and persistence of imidacloprid in ash, sugar maple and silver maple as representative tree species. Results available to date demonstrate rapid uptake and translocation following stem injections with residue levels persisting above toxicity thresholds for at least one-year post-treatment. Formulation type and tree species influence maximum levels and temporal trends in foliar residues following stem injections. The laboratory microcosm studies are being conducted under Standards Council of Canada (SSC) certification for compliance with OECD Good Laboratory Practices (GLP). The accompanying study specific GLP-compliant training, documentation, verification procedures, data tracking systems, and archival preparations have been completed and the SCC has audited and verified that the microcosm study is on track for GLP compliance. Aquatic and terrestrial microcosm experiments are underway to mimic conditions under which imidacloprid may be used in green ash trees for control of Emerald Ash Borer. Microcosm experiments are focusing on evaluating effects of residual imidacloprid in leaves of treated trees on decomposer organisms and processes. Supplementary experiments will evaluate fate and

effects of imidacloprid applied directly to the microcosms to simulate soil injection and leaching scenarios. The microcosm experiments are in progress; preliminary results from early experiments will be presented.

Résumé

Une série d'essais en microécosystèmes sont actuellement effectués sur le terrain et en laboratoire afin d'étudier l'efficacité, le comportement de translocation, le devenir dans l'environnement et les effets non désirés de l'imidaclopride, un insecticide systémique potentiel contre des insectes ravageurs exotiques comme l'agrile du frêne et le longicorne asiatique. Lors d'essais sur le terrain, des injections d'imidaclopride dans les tiges, à des doses aussi faibles que 0,04 g de matière active par cm de dph, ont permis de protéger efficacement des frênes verts contre l'agrile du frêne (réduction de 90 % du nombre de galeries; la densité moyenne de la cime était de 65 % chez les arbres traités, alors qu'elle n'était que de 10 % chez les sujets non traités). Des échantillons de feuillage et de sol ont été prélevés périodiquement après les traitements dans tous les sites d'essai sur le terrain et analysés par CLHP afin de déterminer l'assimilation, la translocation et la persistance de l'imidaclopride chez le frêne, l'érable à sucre et l'érable argenté, des essences représentatives. Selon les résultats disponibles jusqu'à maintenant, l'assimilation et la translocation du produit se font rapidement après les injections, et les concentrations de résidus demeuraient supérieures aux seuils de toxicité pendant au moins un an après le traitement. Le type de préparation et l'essence influaient sur les concentrations maximales et les tendances temporelles des résidus foliaires à la suite des injections dans les tiges. Les essais de laboratoire en microécosystèmes sont effectués dans le respect des principes accrédités par le Conseil canadien des normes (CCN) conformément aux Bonnes pratiques de laboratoire (BPL) de l'OCDE. La formation, la documentation, les méthodes de vérification, les systèmes de suivi des données et la préparation des archives qu'exigent les BPL à l'égard de l'étude s'y rattachant sont terminés, et le CCN a soumis l'étude en microécosystèmes à une vérification et s'est assuré qu'elle était en bonne voie en ce qui concerne la conformité au BPL. Les essais en microécosystèmes aquatiques et terrestres sont en cours afin de simuler les conditions dans lesquelles l'imidaclopride peut être utilisé chez le frêne vert pour lutter contre l'agrile du frêne. Les essais en microécosystèmes se focalisent sur l'évaluation des effets des résidus foliaires d'imidaclopride sur les décomposeurs et les processus de décomposition. D'autres essais évalueront le devenir et les effets de l'imidaclopride appliqué directement sur les microécosystèmes afin de simuler l'injection dans le sol et des scénarios de lessivage. Les essais en microécosystèmes sont en cours, et les résultats préliminaires d'essais antérieurs seront présentés.

Environmental fate and ecological impacts of a systemic insecticide for the control of exotic wood boring insect pests

(Extended Abstract)

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Imidacloprid has been shown to be effective against several forest insect pests including Emerald Ash Borer and Asian Longhorned Beetle when applied as a systemic insecticide. Systemic applications may be well suited to environmentally sensitive areas where broad-scale pesticide applications or tree-removal approaches are not acceptable (e.g., riparian forests of municipal watersheds, shoreline areas of "cottage country", high-value stands, urban forests, conservation areas, public parks and other recreational areas). However, when applied as stem injections to riparian trees, foliar residues of imidacloprid can enter forest floor litter or adjacent water bodies when trees lose their leaves in autumn. When applied as soil injections, imidacloprid concentrations can directly contaminate forest soil or litter, or leach to nearby water bodies. Either route of exposure may pose a risk of harm to non-target decomposer organisms. To evaluate the translocation dynamics, efficacy and environmental fate of systemic imidacloprid in ash trees, and to determine the risk of harm to decomposer organisms, we are conducting a series of field and laboratory microcosm experiments.

This study is ongoing, and the following is a brief summary of activities and results to date. The presentation will focus on the laboratory microcosm component of the study, although some results of the field trials are given. The components of the study currently ongoing are examining imidacloprid in the context of systemic treatment of green ash trees for control of Emerald Ash Borer (EAB). Imidacloprid is clearly effective against EAB at low concentrations. Stem injections to green ash trees at rates of 0.25 g imidacloprid per cm dbh provided nearly complete foliage protection, and persisted for two seasons at concentrations sufficient to provide good control of EAB. There was evidence that annual injections at 0.1 g imidacloprid / cm dbh or less will provide effective control of EAB. Spring injections provided an additional benefit of controlling adults feeding on ash leaves in the first season. Further efficacy trials are continuing.

Stem-injected imidacloprid is rapidly taken up by ash trees. Maximum residues in leaves were attained within a few days of injection, reached concentrations of 15-22 ppm, and declined exponentially over time. By autumn senescence (about 75 d after treatment), foliar concentrations were approximately 1 ppm. Similar concentrations (near 1 ppm) were measured in leaves of treated trees in the following spring. Further translocation experiments and residue sample analyses are underway.

To determine if imidacloprid in leaves that fall from treated 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 natural surface 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 shredder aquatic insects (stonefly *Pteronarcycs* sp., and cranefly *Tipula* sp.), 4) feeding rates of aquatic insects, 5) microbial decomposition rates, and 6) microbial respiration rates over a 14-day experimental period. Results to date indicate leaves from both stem and soil-injected trees contained imidacloprid concentrations of about 0.9-1.5 ppm at leaf fall, and these did not result in significant adverse effects on shredder insect survival, feeding rates, microbial respiration or microbial decomposition rates. Leaves from intentionally over-dosed trees contained concentrations of about 60 ppm, and exposure to these leaves resulted in 89% mortality among stonefly shredders (*Pteronarcys*), and 13% mortality and 91% immobilization among survivors of cranefly shredders (*Tipula*). Microbial respiration and decomposition tended to be higher on high-dose treated leaves than on control leaves. Imidacloprid applied directly to aquatic microcosms was at least 10 X more toxic to shredder insects as aqueous concentrations than as foliar concentrations. Direct applications at approximately 1.3 ppm caused near complete mortality among both taxa. At a test concentration of about 0.13 ppm, there was 94% mortality among stonefly shredders, and 33% mortality and 100% immobilization among survivors of cranefly shredders. There was no significant mortality of either taxa at a test concentration of 0.01 ppm, but there were measurable reductions in feeding rates. Further tests and analyses in aquatic microcosms are ongoing.

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 earthworms (*Eisenia fetida*), 4) growth of earthworms, 5) cocoon production by earthworms, 6) leaf decomposition, and 7) microbial decomposition rates over a 35-day experimental period. There were no significant adverse effects on any response variables after leaves from treated trees at any concentration were added to terrestrial microcosms. There did not appear to be any direct feeding by earthworms on leaves added to the microcosms. Based on observations from our holding facilities and on information in the literature, these litter-dwelling earthworms do not feed on freshly-fallen litter but rely on several weeks of microbial conditioning on leaf surfaces before feeding on the material. This would reduce the risk of adverse effects of foliar imidacloprid concentrations on litter-dwelling earthworms. In contrast, imidacloprid added directly to the microcosms to mimic a soil application scenario caused complete mortality at a test concentration of approximately 142 ppm and above. There were no effects on earthworm survival at 14.2 ppm and below. Further tests and analyses of response measurements from terrestrial microcosms are ongoing.

Next steps in the project will include completion of terrestrial microcosm experiments and measurements, completion of residue sample analyses, data analyses and reporting, follow up on field trials next field season, and the initiation of a second series of microcosm experiments under an Asian Longhorn Beetle use scenario.

From these preliminary results it appears that :

1. Imidacloprid applied as a systemic insecticide can be an effective control agent for Emerald Ash Borer, and other wood boring insect pests.
2. Translocation properties of the experimental formulation of imidacloprid are such that uptake is rapid and distribution is adequate to provide good EAB control, with effective residual concentrations into the second season from stem injections at rates of about 0.25 g/cm dbh. Good control of EAB is achieved with annual applications of 0.1 g/cm dbh or less.
3. Leaves from ash trees treated at levels to control EAB will pose little risk of harm to "shredder" aquatic insects, aquatic microbial communities, earthworms, terrestrial microbial communities, or decomposition processes.
4. Residual concentrations from direct applications to soil and potential leaching to nearby water will pose greater risk of harm (at least 10X more toxic) to aquatic insects in particular, and to a lesser extent, earthworms.
5. When imidacloprid is used as a systemic insecticide, it will be highly effective against EAB and will pose less risk of harm to decomposer organisms when applied as stem injections than when applied as soil injections.
6. To facilitate efficient tree injections, a rapid stem-injection system (EcoJect™) has recently been developed (www.bioforest.ca).

Effect of *Phlebiopsis gigantea* treatment on the microbial diversity of red pine stumps

Effet du traitement par *Phlebiopsis gigantea* sur la diversité microbienne des souches de pin rouge

Presented by:

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Abstract

The microbial diversity of red pine stumps was determined following treatments with 2 strains of *Phlebiopsis gigantea* in 2 different formulations against untreated controls after 6 weeks. The populations and diversity of prokaryotes inhabiting the treated stumps were similar to the untreated control stumps. In total 40 different species of bacteria were identified from red pine stumps using PLFA analysis. Species of *Pseudomonas* were the most common bacteria isolated. The fungus *P. gigantea* was recovered from all treated stumps while *Hormonema dematioides* was the dominant fungus on control stumps. Of the approximately 35 different fungal species identified, the most frequent ones isolated were *Alternaria alternata*, *Phacidiopycnis* sp., *Cladosporium cladosporoides*, *Penicilium* spp., *Bjerkandera adusta* and *Mortierella isabellina*. A second sampling one year after inoculation is in progress.

Résumé

La diversité microbienne des souches de pin rouge fut déterminée suite au traitements avec 2 isolats de *Phlebiopsis gigantea* formulés différemment et comparés après 6 semaines aux souches témoins non traitées. Les population et la diversité des procaryotes colonisant les souches traitées étaient semblables à celles non traitées. Au total, 40 espèces différentes de bactéries furent identifiées en utilisant l'analyse des acides gras phospholipides. Des espèces de *Pseudomonas* étaient parmi les bactéries les plus communément isolées. Le champignon *P. gigantea* a été isolé de toutes les souches traitées alors que *Hormonema dematioides* était le

champignon dominant dans les souches témoins. Sur près de 35 différentes espèces fongiques identifiées, les plus fréquemment isolées furent *Alternaria alternata*, *Phacidiopycnis* sp., *Cladosporium cladosporoides*, *Penicilium* spp., *Bjerkandera adusta* and *Mortierella isabellina*. Un second échantillonnage une année après le traitement est en cours.

ARSENAL™ (imazapyr) herbicide for forest vegetation management

Emploi de l'herbicide ARSENAL™ (imazapyr) à des fins de gestion de la végétation forestière

Presented by:

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Abstract

ARSENAL™ (imazapyr) is currently registered in Canada for use on railroad ballasts and industrial sites. The use of ARSENAL™ for integrated forest vegetation management may be an important component of future sustainable forest management resulting in decreased pollution/risk, contribute significantly to an overall reduction in forest herbicide use, provide a valuable tool for mixedwood management, enhance biodiversity and reduce off-site movement associated with alternative herbicides. The goal of this project is to generate efficacy and crop tolerance data for a User Requested Minor Use Label Extension registration for forest vegetation management use pattern. In 2001, a risk assessment was completed and submitted to PMRA. During 2002-2005, 42 research trials were conducted in Alberta, Ontario and New Brunswick to evaluate crop tolerance and efficacy related to seven conifer species, two timings of applications and various weed species. A submission for a URMULE (white spruce) will occur in 2005; additional submissions will occur in subsequent years as trials are completed on other crop and weed species.

Résumé

L'emploi d'ARSENAL™ (imazapyr) est actuellement homologué au Canada pour les ballasts de voies ferrées et les zones industrielles. Son emploi à des fins de gestion intégrée de la végétation forestière pourrait constituer une composante importante des activités futures d'aménagement durable des forêts où elle se traduira par une réduction de la pollution/des risques. Il peut aussi contribuer énormément à réduire l'utilisation générale des herbicides forestiers, fournir un outil très utile à l'aménagement des peuplements mixtes, améliorer la biodiversité et réduire la migration hors site associée aux herbicides de rechange. Ce projet a pour objectif de produire des données sur l'efficacité du produit et la tolérance des essences d'avenir afin de les soumettre au Programme d'extension du profil d'emploi pour les usages limités demandés par les utilisateurs (PEPUDU) et de faire homologuer son emploi à des fins de gestion de la végétation forestière. En 2001, une évaluation des risques a été effectuée et ses résultats ont été présentés à l'ARLA. En 2002-2005, 42 essais, portant sur sept essences de conifères, deux périodes d'application et diverses espèces indésirables, ont été effectués en Alberta, en Ontario et au Nouveau-Brunswick afin d'évaluer l'efficacité du produit et la tolérance des essences d'avenir. Une demande sera présentée au PEPUDU (épinette blanche) en 2005; d'autres demandes seront présentées au cours des années ultérieures, à mesure que seront terminés les essais avec d'autres essences d'avenir et espèces indésirables.

Imazapyr Herbicide for Forest Vegetation Management

Milo Mihajlovich, Incremental Forest Technologies Ltd
Doug Pitt, Canadian Forest Service – GLFC
Len Lanteigne, Canadian Forest Service – AFC
Michael Irvine, Ontario Ministry of Natural Resources

Our goal in this project is to generate efficacy and crop tolerance data for a User Requested Minor Use Label Expansion (URMULE) registration of Arsenal™ (imazapyr) for forest vegetation management. Imazapyr is already registered in Canada for industrial use, and is the most widely used forest herbicide in USA. It is effective in controlling herbaceous and woody competitors.

To support this proposed forestry use, a risk assessment completed and submitted to Pest Management Regulatory Agency (PMRA) in 2001. It described the ecological profile of proposed use pattern, the human toxicological assessment, and compared imazapyr to registered forest herbicides. After receiving the data code tables from PMRA, we are proceeding with trials:

- Testing suitability of this herbicide for site preparation and conifer release
- Testing various conifer species for tolerance
- Determining efficacy - grass, herbs, woody species

- Test locations have been established in Alberta, Ontario and New Brunswick

Results so far indicate that this herbicide is effective for site preparation, with efficacy on most herbaceous and woody species. *Rubus* and *Viburnum* spp are not well controlled with this herbicide.

A data package has been submitted to PMRA for site preparation for white spruce. We will be seeking a research permit for larger scale evaluation in 2006.

We wish to thank our supporters in this project:

- Canadian Forest Service (EPM, AFC, GLFC)
- Ontario Ministry of Natural Resources
- ANC Timber Ltd.
- Blue Ridge Lumber (1981) Ltd.
- Canadian Forest Products Ltd.
- Millar Western Forest Industries Ltd.

Pheromone formulations for use in early intervention pest management strategies of the spruce budworm

Formulations de phéromone utilisables dans le cadre de stratégies d'intervention précoce contre la tordeuse des bourgeons de l'épinette

Presented by:

Ed Kettela
Natural Resources Canada, Canadian Forest Service, Atlantic Forestry Centre, Fredericton, New Brunswick

ABSTRACT - Spruce Budworm Pheromone - 2006

Title : **Component 1 - Year 6 - E.G. Kettela, P.J. Silk**

Project 95/07 : **To Develop and Test Pheromone Formulations for Use in Early Intervention Management Strategies of the Spruce Budworm.**

The spruce budworm is one of the most economically significant forest pests of in North America. During periods of infestation (15 to 20 years every 30 years), millions of hectares of wood are defoliated and millions spent on coping with this pest. During the last epidemic cycle, 1970's to 1980's, New Brunswick alone spent 10's of millions of dollars on management of this pest. It has been recognized for some time by agencies responsible for forest management and protection and by the forest industry that, considering the current and future demand for forest products and the available wood supply, there is no room for loss of wood due to the spruce budworm without serious economic impact. At present, a number of *B.t* products and Mimic 240 LV are the only control products commercially available. It is necessary and prudent to have additional, complimentary and/or alternative pest management technologies in place that can provide the necessary flexibility to forest managers before the next epidemic in eastern Canada. With this in mind, we have been attempting to develop a spruce budworm population control technology that includes the use of a sex pheromone in a commercially available carrying system as either a stand-alone product or as part of an integrated management strategy with *B.t.* or Mimic.

In 1997, we demonstrated that an application of 100 gai/hectare in a microencapsulated formulation suppressed mating of caged moths for up to 2 weeks. We concluded that the effective life of the formulation in the field needed to be extended for future practical development. With this in mind, new formulations were prepared (by 3M) and evaluated for active release characteristics under laboratory conditions (winter 1999). This showed that one of the formulations had an extended field life of 4 weeks and the other a life of 6 weeks. Based on these encouraging results, an aerial spray trial (4 ha) was conducted in New Brunswick in June 2000 to evaluate one of these formulations. Caged moths were used as biological efficacy indicators. The results showed a clear difference in mating status of female budworm moths between the treated and unsprayed control. This very encouraging effect resulted in year 2 of the proposal proceeding as planned.

In 2001, 2 spray blocks, each 5 ha, and an unsprayed control site were established in the Acadia Research Forest east of Fredericton, New Brunswick. Two spray blocks were treated, one with a high dosage of 75 g/ha in a total of 30 L/ha and the other at a low dosage of 25 g/ha in 10L/ha. Two lines with 6 sample stations each were established in the treated and non-treated sites, and sleeve cages were suspended at eye level at each station. Shortly after spray application, 2 male and 2 female budworm moths were placed in each cage. They were left in the field for 48 hours, collected, frozen, and saved to determine mating status. This procedure was repeated 7 times to span a 15-day post spray period. Concurrent with this activity, foliage samples were collected for GC-EAD analysis. The spruce budworm adults were obtained by rearing laboratory stock (Sault Ste. Marie) on McMorran diet. The results show significant reduction in mating to day 15.

In 2002, no trials were conducted because of funding uncertainty from manufacturers. Implementation of this proposal was then advanced to 2003-05.

In 2003, funding was received from OMNR, FPL and the CFS-Enhanced Pest Management Fund. The EPM funds were used to scope out potential test areas for 2004, calibrate potential sites, and find an industrial partner. Some 54 sites were examined, and only 3 of these met the stringent requirements of the project. During 2003 and early 2004, Hercon was the only industrial partner to show any real interest in the development of the budworm pheromone. This led to a collaborative program in 2004 that involved Hercon, FPL, SOPFIM, CFS, AFC, Manitoba, Saskatchewan, and the CFS Enhanced Pest Management Fund. PMRA was consulted, permits obtained, calibration trials conducted and after much hand wringing, we finally applied the pheromone/flake product on 2 test blocks in Balsam Lake Park in Ontario.

In 2004 we field tested two dosage rates of spruce budworm pheromone formulated in Hercon disrupt microflakes. Fifty ha of white spruce plantation were treated at 50 gr/ha and 30 ha was treated at 15 gr. a.i./ha. These were isolated stands in Balsam Lake Park in southern Ontario.

Prior to treatment FPL conducted extensive trials with blank flakes to optimize the application. The mix was water, flakes, gelva sticker and guar gum as a suspending agent.

1) The field life of the product is about 15 days.
2) We achieved excellent deposit of the flakes in both treatment blocks.

3) 24 hours after treatment, trap catch of male budworm moths was shut down, indicating pheromone presence.
4) Timing of the application took place prior to any egg laying.
5) Mixing up the formulation (flakes, gelva, guar gum and water) and applying it is a problematic exercise.
6) Mating status of females in the 50 gr. block was reduced by 90% and approximately 40% in the 15g/ha block. This is based on a sample of 200 female moths per treatment.

2005 Pheromone Application Trial :

In 2005 we set out to treat replicated blocks at 50gr/ha. However we were only able to treat one small block of 8.2 ha located in Simcoe County near Craighurst, Ontario because of problems securing sufficient pheromone a.i.

Considerable effort was expended in installing and calibrating the POD's on the Cessna 188. However this goal was not achieved prior to application so we reverted to the flake/gelva/water tank mix used in 2004. Application trials with the boom and open pipe system were run with blank flakes/ gelva and water.

Further complications were encountered in having the product shipped from the USA to Canada and the material was tied up in customs for over 5 days. By the time the product was liberated (Sunday 3 July, 05) moth eclosion and egg laying were well underway. I decided to proceed with the application. This took place on 3 July, 05 from 20:37 to 21:10. Meteorlogical conditions were excellent. In all 8.2 ha were treated with the Cessna 188. The aircraft was calibrated to emit 50L/min with a 20m track spraying.

The test site was a 36 year old white spruce plantation with trees 10-15 meters tall, and the untreated site, located 10k away was similar, (38 years old and 12-18 meters in height. Spruce budworm populations in the treated site averaged 1.9 L/per branch and 1.5 in the control site.

Mid way through the application the boom started to plug up an we were only able to get about ½ of the material out. Depositon of flakes on foliage was not uniform but did average out at 0.5 flakes per branch. We estimate that the minimal applied dosage was 25 g/ha.

In spite of these setbacks we do have positive results to report.

1) The application did impact on the capture of male moths in multipher traps going from 29.9/trap on 29 June to 1.4 moths/trap on 6 July compared to 32.8 and 11.5 in the untreated site.
2) In the mating cages 82% of the females were unmated compared to 5% in the untreated site.

   For this portion of the trial we used moths reared from spruce budworm pupae collected from Balsam Lake Park.

Supply of Active Material, 2005 :

Since the active material last year was a substantial cost component, a cheaper source was sought. Materia Inc., Pasadena CA was recommended, and the order was placed with this company for several kilograms at a much cheaper price (ca. 40 %) than last year. Unfortunately, because of unforeseen technical difficulties with the metathetic process, Materia could only produce 479 g at 85 % purity (see Appendix 1). The remaining material, 165 g, was finally purchased from Bedoukian (98 % pure) and blended with the other material to make a total of 644 g. This was delivered to Hercon for formulation as before (1 x 3 mm plastic laminate flakes) where a total of ca 12 Kg of flake was manufactured at 5 % loading.

Estimate of Field Half Life of Hercon Flakes, 2005 :

Flakes were coated with Gelva and placed on window mesh screens in the field at two separate locations; Balsam Lake Park and Dunsmore (site of 2005 pheromone application). Thirty to 40 flakes were then sampled at set time intervals from the 4-13 July and kept frozen for later analysis at the Fredericton laboratory. Twenty flakes were then selected from each date and left overnight to soak in 2.0 ml hexane. These extracts were then analyzed by GC/MS and quantified against a series of standards. Analysis was carried out on HP 5971 MS with 5890 GC equipped with splitless injection on a 30 m SPB-5 capillary column (0.25 µm). Injections (2 ml) were made at 70°C with the injector at 220°C. It was then temperature programmed from 70°C after 3 minutes to 220°C at 15°C/min. and held for 10 mins.

The first standard curve comprised from 0.1 - 0.6 mg/ml of E11-tetradecenal (analytical standard; Bedoukian). The curve is shown in Figure 1 (R^2 =1). This curve was then used to estimate the release characteristics of the flakes at the Dunmore site close to where the application took place. This data is shown in Figure 2. The half-life here is similar to last year under these environmental conditions and estimated at ca.13 days.

Plans for 2006, 2007 :

We need to do another small scale trial but with the POD system. These technical problems need to be worked out in preparation for a proposed large scale trial (1000+ ha) planned for 2007. The registration package is being submitted by Hercon Environmental.

Figure 1: Standard curve of E11-14:Ald by GC/MS

E/Z 11-14 Ald Standard(09/14/05)					
Sample number	Content (ug)	Peak Area 1	Peak Area 2	Peak Area 3	Peak Area Average
1	0.101	14799229	14124395	14365933	14429852
2	0.201	29789578	29818016	29714672	29774089
3	0.302	46053963	42769233	44232909	44352035
4	0.402	60371409	60677103	58310106	59786206
5	0.603	91592533	91729999	88806906	90709813

Figure 2:

Dunsmore Pheromone Test(09/21/05)								
Sample	1	2	3	Average	amount	log10	Time	**t1/2**
4-Jul	140520315	132287007	134091425	135632916	0.433	-0.363	0	13
6-Jul	98645310	100154031	95257510	98018950	0.314	-0.503	2	**loss**
11-Jul	73566904	73797986	70994120	72786337	0.234	-0.631	7	74.97%
12-Jul	53139157	55149130	52153155	53480481	0.173	-0.763	8	
13-Jul	32069293	33906734	33584346	33186791	0.108	-0.965	9	