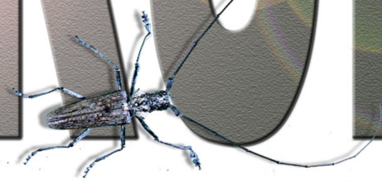
Forest Pest Management

FORUM 2003



sur la répression des ravageurs forestiers

Ottawa Congress Centre/Centre des congrès d'Ottawa
Ottawa, ON

December 2-4 décembre 2003

NOT FOR PUBLICATION / NE PAS DIFFUSER

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

Canada

2003 FOREST PEST MANAGEMENT FORUM PROCEEDINGS

Ottawa Congress Centre
Ottawa, ON
December 2-4, 2003

The Forest Pest Management Forum is annually sponsored 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, 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.

Ariane Plourde
Natural Resources Canada / Ressources naturelles Canada
Canadian Forest Service / Service canadien des forêts
Sainte-Foy, Québec / Sainte-Foy (Québec)
May 2004 / mai 2004

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FORUM 2003 CORPORATE SPONSORS

The Forest Pest Management Forum Committee wishes to acknowledge and thank our Corporate Sponsors for their continuing support of this prestigious, annual international Pest Forum.

COMMANDITAIRES DU FORUM 2003

Le Comité du Forum sur la répression des ravageurs forestiers désire reconnaître et remercier les commanditaires pour leur appui continuel à ce prestigieux forum annuel et international sur les ravageurs forestiers.

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Acknowledgements / Remerciements

The 2003 Forest Pest Management Forum was a success thanks to the contribution of many people. First of all, we thank the speakers who shared their knowledge on the topic and were willing to provide a summary for these proceedings.

We also acknowledge the people who participated in the panel session, the poster session and logistical support.

We also thank the participants who came from different regions across Canada and the United States.

The 2003 Forum Organizing Committee

Le Forum 2003 sur la répression des ravageurs forestiers a connu un grand succès grâce à la contribution de plusieurs personnes. Tout d'abord, nous remercions les 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 la session d'échange d'idées, à la séance d'affichage et au soutien logistique.

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

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PROGRAM
OTTAWA CONGRESS CENTRE

TUESDAY DECEMBER 2, 2003

8:00 - 8:30 Registration and Continental Breakfast Capital Hall 1B-2B

8:30 **Welcoming Remarks –** *Geoff Munro* Capital Hall 3B-4B

CHAIR: *[ARIANE PLOURDE, CANADIAN FOREST SERVICE, LAURENTIAN FORESTRY CENTRE]*

SESSION I: WESTERN CANADA ROUND-UP

8:45 Pest Conditions Report from British Columbia
Tim Ebata, British Columbia Ministry of Forests

9:05 An Introduction to NRCan's Mountain Pine Beetle Initiative
Dr. Bill Wilson, Canadian Forest Service, Pacific Forestry Centre

9:25 Important Forest Pest Conditions in Alberta in 2003
Hideji Ono, Alberta Environment, Land and Forest Service

9:45 Forest Pest conditions in Saskatchewan 2003
Rory McIntosh, Saskatchewan Environment and Resource Management

10:05 **Break** Capital Hall 1B-2B

10:35 Forest Pest Management in Manitoba in 2003
Keith Knowles, Conservation Manitoba

SESSION II - IN PUBLIC VIEW – ECOSYSTEM MANAGEMENT AND PUBLIC AWARENESS IN NATIONAL PARKS

11:00 Introduction

11:10 Ecosystem-based Mountain Pine Beetle Management in Canada's Mountain National Parks: Beetles, Wolves, Elk, Aspen, Fire and Public Involvement
Jane Park and Tom Hurd, Banff National Park, Mountain Parks Group, Banff, AB

11:50 Discussion

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

13:00 Short-horned oakworm infestation in St. Lawrence Islands National Park
Ralph (Bud) Andress, Park Warden

13:30 Discussion

TUESDAY DECEMBER 2, 2003

SESSION III - CROSS-COUNTRY CHECK-UP ONTARIO & QUEBEC

14:00 Ontario
Anthony Hopkin, Canadian Forest Service, Great Lakes Forestry Centre

14:20 Quebec
Denise Moranville, Ministère des ressources naturelles du Québec

SESSION IV- GLOBALIZATION AND FOREST PESTS

14:40 Student Presentation: Molecular diagnosis of the causal agent of sudden oak death, *Phytophthora ramorum,* by real-time PCR
Guillaume Bilodeau, Canadian Forest Service, Laurentian Forestry Centre

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

15:30 Invasive Species in the United States 2003
David Thomas, Forest Health Protection Staff, United States Forest Service

16:00 International Forestry Quarantine Research Group: coordinating research through International Union of Forest Research Organizations and Food and Agriculture Organization (UN)
Eric Allen, Canadian Forest Service, Pacific Forestry Centre

16:20 CFIA Forestry Report
Jean-Guy Champagne, Canadian Food Inspection Agency

Marché
Marketplace

The place for networking and information exchange

December 2 décembre, 2003 @ 17:00-21:00
cash bar, hors d'oeuvres, bar payant

17:30 Pest Forum Steering Committee Executive Suite

Wednesday December 3, 2003

8:00 – 8:30 Continental Breakfast Capital Hall 1B-2B

MORNING CHAIR: [*DENIS OUELLET, CANADIAN FOREST SERVICE, LAURENTIAN FORESTRY CENTRE*]

SESSION V - CROSS-COUNTRY CHECK-UP – ATLANTIC CANADA

08:30 Status of Forest Pests in New Brunswick in 2003
Nelson Carter, New Brunswick Department of Natural Resources and Energy

08:50 Nova Scotia Report

09:10 Newfoundland and Labrador: Status of Forest Insect Activity in 2003 and Preliminary Outlook for 2004
Hubert Crummey, Newfoundland Department of Forest Resources and AgriFoods

Futures and Options Ideas Exchange
– What does Canada need? What does forest pest management have to offer?

09:30 Introduction
Hans Ottens and Jacques Drolet

09:40 Volume Optimization and Forest Health Management in Canada: are we losing too much volume to be competitive?
Joe Meating, Bioforest Technologies Inc.

09:55 IPM Options – Are we ready or is it a case of 'Old Mother Hubbard'?
Christopher Lucarotti, Canadian Forest Service, Atlantic Forestry Centre

10:15 **Break** Capital Hall 1B-2B

10:45 Ideas Exchange (full participation)
Guy Smith, facilitator, Canadian Forest Service, Great Lakes Forestry Centre

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

13:00 **Futures and Options – Actions – Reports from 'Ideas Exchange'**

AFTERNOON CHAIR: [*JOHN RICHARDS, CANADIAN FOREST SERVICE, ATLANTIC FORESTRY CENTRE*]

SESSION VI -URBAN / MUNICIPAL PERSPECTIVE

13:20 Urban Forests: Canada's 9th Forest Region
Michael Rosen, Vice-President, Tree Canada Foundation

WEDNESDAY DECEMBER 3, 2003

SESSION VII - Operational Perspective – IPM tools, technologies and strategies

14:00 Phero Tech Inc., *Jennifer Burleigh and John Borden*
14:10 Hercon Environmental, *Steve Burke*
14:20 Dendron Resource Surveys, *Carol Hopkins*
14:30 Dow Agrosciences, *Craig English*
14:40 Assessing climate impacts on insects and diseases, *Dan McKenney, Canadian Forest Service*

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

SESSION VIII - REGULATORY AFFAIRS UPDATE

15:30 PMRA Update, *Terry Caunter, Pest Management Regulatory Agency*

15:50 Minor Uses **-** Making the case for more options, *Michael Irvine, Ontario Ministry of Natural Resources*

Banquet Speaker

Capital Hall 5B

Hosted by Canadian Institute of Forestry and Forest Pest Management Forum

17:00 Cocktails
18:00 Dinner
19:00 Introductory Remarks:
Jeff Young, Canadian Institute of Forestry

Guest Speaker: Julie Gelfand
President, Canadian Nature Federation

'The Role of the Federal Government and Civil Society in Nature Conservation: an NGO Perspective'

Concluding Remarks: *John Richards, Canadian Forest Service*

Julie Gelfand has been President of the Canadian Nature Federation (CNF) since 1992.

Before joining the CNF, she was Executive Director of the Rawson Academy of Aquatic Sciences, an association of academics and professionals concerned with water-related environmental issues. Julie spent several years working on policy development at Parks Canada before joining the Canadian Wildlife Federation, where she was responsible for the education, conservation and communications departments. She has sat on the Board of Directors of Wildlife Habitat Canada, and has been a member of the Advisory Committee on Environmental Protection, the Biodiversity Convention Advisory Committee, and other multi-stakeholder groups. She was a founding member of Mining Watch Canada, and currently sits on the Global Council of BirdLife International. Julie is also Chair of the Green Budget Coalition, an unprecedented alliance of fifteen national environmental NGOs working to achieve ecological fiscal reform. A graduate of the University of Ottawa, Julie holds an Honours degree in Biology and Social Sciences, and a Masters in Business Administration. She is very interested in helping industry understand ecological principles, and in assisting non-profits with the adoption of sound business strategies. She has provided consulting services for both non-governmental agencies and small businesses in the environmental field.

Thursday December 4, 2003

SPECIAL FEATURE

Invasive Species – the Threats and the Response
A special information session for landowners and municipal representatives

08:00 **Coffee**

08:30 Introductions
Moderators: Roxanne Comeau, Canadian Institute of Forestry, Brian Barkley, Eastern Ontario Model Forest

08:40 Welcome and Introduction
Brian Emmett, Assistant Deputy Minister, Natural Resources Canada, Canadian Forest Service

09:00 Report from the front line
Beth McEwan, City of Toronto

09:20 Emerald Ash Borer and Asian Longhorn Beetle
Kenneth R. Marchant, Canadian Food Inspection Agency

09:50 **Break**

10:20 Response Mechanisms - the importance of interagency cooperation

- CFIA Task Group
  Ken Marchant, Canadian Food Inspection Agency

- National Plan on Invasive Alien Species
  Mark Hovorka, Environment Canada

11:00 Panel presentations
Craig Huff, Forester, City of Ottawa
Hanna Fraser, Ontario Ministry of Agriculture and Food
Ray Fortune, Maple Syrup Producers

11:30 Questions and Discussion

12:00 Conclusion and thanks
Roxanne Comeau, Canadian Institute of Forestry, Brian Barkley, Eastern Ontario Model Forest

PROGRAMME
CENTRE DES CONGRÉS D'OTTAWA

MARDI 2 DÉCEMBRE 2003

8 h Inscription et petit déjeuner continental Salle de la capitale 1B-2B

8 h 30 **Mot de bienvenue -** *Geoff Munro* Salle de la capitale 3B-4B

PRÉSIDENTE : [*ARIANE PLOURDE, SERVICE CANADIEN DES FORÊTS, CENTRE DE FORESTERIE DES LAURENTIDES*]

SÉANCE I : LE POINT SUR L'OUEST CANADIEN

8 h 45 Rapport de la Colombie-Britannique sur la situation des ravageurs
Tim Ebata, ministère des Forêts de la Colombie-Britannique

9 h 05 Une introduction au Programme sur le dendroctone du pin de RNCan
Dr Bill Wilson, Service canadien des forêts, Centre de foresterie du Pacifique

9 h 25 Principaux ravageurs forestiers en Alberta en 2003
Hideji Ono, ministère de l'Environnement de l'Alberta, Service des terres et des forêts

9 h 45 Ravageurs forestiers (Insectes et maladies des arbres) en Saskatchewan en 2003
Rory McIntosh, ministère de l'Environnement de la Saskatchewan

10 h 05 **Pause** Salle de la capitale 1B-2B

10 h 35 Lutte contre les organismes forestiers nuisibles au Manitoba en 2003
Keith Knowles, Conservation Manitoba

SÉANCE II - SUR LA SCÈNE PUBLIQUE – LA GESTION DES ÉCOSYSTÈMES ET LA SENSIBILISATION DU PUBLIC DANS LES PARCS NATIONAUX

11 h Introduction

11 h 10 Lutte contre le dendroctone du pin ponderosa à l'échelle de l'écosystème dans les parcs nationaux canadiens des Rocheuses : dendroctones, loups, wapitis, trembles, incendies et participation du public
Jane Park et Tom Hurd, Groupe des parcs des Rocheuses,
Parc national Banff, Banff, AB

11 h 50 Discussion

12 h **Déjeuner** Salle de la capitale 1B-2B

13 h Infestation de l'anisote de Finlayson dans le Parc national des Îles-du-Saint-Laurent
Ralph (Bud) Andress, guardien du parc

13 h 30 Discussion

MARDI 2 DÉCEMBRE, 2003

SÉANCE III - BILAN NATIONAL – L'ONTARIO ET LE QUÉBEC

14 h Ontario
Anthony Hopkin, Service canadien des forêts, Centre de foresterie des Grands Lacs

14 h 20 Québec
Denise Moranville, ministère des Ressources naturelles du Canada

SÉANCE IV - LA MONDIALISATION ET LES RAVAGEURS FORESTIERS

14 h 40 Exposé donné par un étudiant : Diagnostic moléculaire de l'agent causal de l'encre des chênes rouges
Guillaume Bilodeau, Service canadien des forêts, Centre de foresterie des Laurentides

15 h **Pause** Salle de la capitale 1B-2B

15 h 30 Les espèces envahissantes aux Etats-Unis en 2003
David Thomas, membre du personnel de la Forest Health Protection, United States Forest Service

16 h Groupe international de recherche sur les forêts et la mise en quarantaine : coordonner la recherche par l'entremise de l'Union internationale des instituts de recherches forestières et de l'Organisation des Nations Unies pour l'alimentation et l'agriculture
Eric Allen, Service canadien des forêts, Centre de foresterie du pacifique

16 h 20 Le rapport 03 de l'ACIA, Foresterie
Jean-Guy Champagne, CFIA,
http://www.inspection.gc.ca/francais/plaveg/for/forf.shtml

Marché
Marketplace

The place for networking and information exchange

December 2 décembre, 2003 @ 17:00-21:00
cash bar, hors d'oeuvres, bar payant

17 h 30 Réunion du comité d'orientation du Forum sur les ravageurs forestiers Salle exécutive

MERCREDI 3 DÉCEMBRE 2003

8 h – 8 h 30 Petit déjeuner continental Salle de la capitale 1B-2B

PRÉSIDENT DE LA MATINÉE : [*DENIS OUELLET, SERVICE CANADIEN DES FORÊTS, CENTRE DE FORESTERIE DES LAURENTIDES*]

SÉANCE V - BILAN NATIONAL – LE CANADA ATLANTIQUE

8 h 30 État des organismes forestiers nuisibles au Nouveau-Brunswick en 2003
Nelson Carter, ministère des Ressources naturelles et de l'Énergie du Nouveau-Brunswick

8 h 50 Rapport de la Nouvelle-Écosse

9 h 10 Terre-Neuve et Labrador : Bilan des ravageurs forestiers en 2003 et prévisions préliminaires pour 2004
Hubert Crummey, ministère des Richesses forestières et de l'Agro-alimentaire

Échange d'idées – Avenir et possibilités
– De quoi a besoin le Canada? Que propose la lutte contre les ravageurs forestiers?

9 h 30 Introduction
Hans Ottens et Jacques Drolet

9 h 40 L'optimisation du volume et la gestion de la santé des forêts au Canada : Perdons-nous trop de volume pour être concurrentiels?
Joe Meating, Bioforest Technologies

9 h 55 Les possibilités en matière de lutte intégrée – Sommes-nous prêts ou s'agit-il d'une «autre histoire de grand-mère… »?
Chris Lucarotti, Service canadien des forêts, Centre de foresterie de l'Atlantique

10 h 15 **Pause** Salle de la capitale 1B-2B

10 h 45 Échange d'idées (pleine participation)
Guy Smith, animateur, Service canadien des forêts, Centre de foresterie des Grands Lacs

12 h **Déjeuner** Salle de la capitale 1B-2B

13 h **Avenir et possibilités – Mesures à prendre – Comptes rendus de l'« échange d'idées »**

PRÉSIDENT DE L'APRÈS-MIDI : [*JOHN RICHARDS, SERVICE CANADIEN DES FORÊTS, CENTRE DE FORESTERIE DE L'ATLANTIQUE*]

SÉANCE VI - PERSPECTIVE URBAINE ET MUNICIPALE

13 h 20 Les forêts urbaines : la 9^{e} région forestière du Canada
Michael Rosen, vice-président de La Fondation canadienne de l'arbre

MERCREDI 3 DÉCEMBRE 2003

SÉANCE VII - PERSPECTIVE OPÉRATIONNELLE – UTILISATION DES OUTILS, DES TECHNIQUES ET DES STRATÉGIES DE LUTTE INTÉGRÉE CONTRE LES RAVAGEURS

14 h Phero Tech Inc, *Jennifer Burleigh et John Broden*
14 h 10 Hercon Environmental, *Steve Burke*
14 h 20 Dendron Resource Surveys, *Carol Hopkins*
14 h 30 Dow Agrosciences, *Craig English*
14 h 40 Évaluer les impacts du climat sur les insectes et les maladies, *Dan McKenney, Service canadien des forêts*

15 h **Pause** Salle de la capitale 1B-2B

SÉANCE VIII - MISE À JOUR SUR LES AFFAIRES RÉGLEMENTAIRES

15 h 30 Mise à jour de l'ARLA, *Terry Caunter, Agence de réglementation de la lutte antiparasitaire*

15 h 50 Utilisations mineures – Plaider la nécessité de trouver d'autres solutions, *Michael Irvine, ministère des Richesses naturelles de l'Ontario*

Banquet Exposé

Salle de la capitale 5B

Organisé par l'Institut forestier du Canada et les responsables du Forum sur la répression des ravageurs forestiers

17 h Cocktails
18 h Diner
19 h Mot d'ouverture *: Jeff Young, Institut forestier du Canada*

Exposée : Julie Gelfand, *présidente de la Fédération canadienne de la nature (FCN)*

«Le rôle du gouvernement fédéral et de la société civile dans la conservation de la nature : une perspective d'une ONG»

Julie Gelfand siège comme présidente de la Fédération canadienne de la nature (FCN) depuis 1992. Avant de joindre la FCN, elle a été directrice administrative du Rawson Academy of Aquatic Sciences, une association d'universitaires et de professionnels concernés avec les questions environnementales liées à l'eau. Julie a œuvré durant quelques années sur le développement de politiques au sein de Parcs Canada avant de joindre la Fédération canadienne de la nature, où elle s'occupait des départements de l'éducation, de la conservation et des communications. Elle a siégé sur le conseil d'administration d'Habitat faunique Canada et a été membre du comité consultatif sur la protection environnementale, le comité consultatif sur la convention de la biodiversité, et d'autres groupes multilatéraux. Elle est une des membres fondatrices de Mines alerte Canada, et siège présentement sur le conseil global de BirdLife International. Julie est la chaire du Green Budget Coalition, une alliance sans précédent de quinze ONG environnementales qui travaillent ensemble pour arriver à une réforme fiscale écologique. Finissante de l'Université d'Ottawa, Julie détient un diplôme universitaire obtenu avec mention en biologie et en sciences sociales, ainsi qu'une maîtrise en administration des affaires. Elle s'intéresse beaucoup à faire connaître les principes écologiques à l'industrie, puis à assister les organismes à but non lucratif à adopter des stratégies d'entreprise judicieux. Elle a offert ses services de consultantes pareillement aux agences non-gouvernementales et aux petites entreprises dans le domaine environnemental.

Mot de la fin : *John Richards, Service canadien des forêts*

Jeudi 4 Décembre 2003

SÉANCE SPÉCIALE

Les espèces envahissantes – Les menaces et l'intervention
Séance spéciale à l'intention des propriétaires fonciers et des représentants municipaux

8 h - 8 h 30 Café

8 h 30 Introduction
Médiateurs : Roxanne Comeau, Institut forestier du Canada et Brian Barkley, Forêt modèle de l'Est de l'Ontario

8 h 40 Bienvenue et introduction
Brian Emmett, sous-ministre adjoint, Ressources naturelles Canada, Service canadien des forêts

9 h Rapport de la première ligne
Beth McEwan, Ville de Toronto

9 h 20 L'agrile du frêne et le longicorne asiatique
Kenneth R. Marchant, Agence canadienne d'inspection des aliments

9 h 50 **Pause**

10 h 20 Mécanisme réactionnel – l'importance de la coopération entre les agences

- Groupes de travail de l'ARLA
  Ken Marchant, Agence de réglementation de la lutte antiparasitaire

- Plan national sur les espèces exotiques envahissantes
  Mark Hovorka, Environnement Canada

11 h Présentations par un groupe d'experts
Craig Huff, Forestier pour la Ville d'Ottawa
Hanna Fraser, ministère de l'Agriculture et de l'Alimentation de l'Ontario
Ray Fortune, Maple Syrup Producers of Ontario

11 h 30 Questions et discussions

12 h Conclusion et remerciements
Roxanne Comeau, Institut forestier du Canada, Brian Barkley, Forêt modèle de l'Est de l'Ontario

SESSION I -

WESTERN CANADA ROUND-UP

Chair: Ariane Plourde
Natural Resources Canada

SÉANCE I -

LE POINT SUR L'OUEST CANADIEN

Présidente : Ariane Plourde
Ressources naturelles Canada

Pest Conditions Report from British Columbia

Rapport de la Colombie-Britannique sur la situation des ravageurs

Presented by:
Tim Ebata, Forest Health Project Specialist, Forest Practices Branch, BCMOF

Visit our Web site at: HTTP://www.for.gov.bc.ca/hfp/hfp.htm

The PDF version of 2003 aerial overview survey report for B.C. has been posted on the Web at: http://www.for.gov.bc.ca/hfp/forsite/overview/overview.htm

Abstract

Pest damage conditions in British Columbia were dominated by the massive mountain pine beetle outbreak throughout the province's central interior. Lodgepole pine mortality was recorded covering an area of approximately 4.2 million ha representing a doubling of the area infested since 2002. Significant increases in area of damage caused by other bark beetles, particularly, Douglas fir beetle and spruce beetle, were also recorded. Defoliation caused by western spruce budworm increased in 2003 while western hemlock looper, eastern spruce budworm and other budworm species declined. Changing weather patterns have resulted in increasing damage not only from bark beetles but also by needle diseases. The most notable is redband (Dothistroma) needle blight, (*Mycosphaerella pini*) which is causing significant plantation mortality in Northwest B.C. More detailed descriptions of forest health conditions are available in the report "2003 Summary of Forest Health Conditions in British Columbia" (available March, 2004) and on the Forest Practices Branch web site at www.for.gov.bc.ca/hfp/forsite/overview/overview.htm

Résumé

Les dommages causés par les ravageurs en Colombie-Britannique ont principalement été dus à l'infestation massive du dendroctone du pin ponderosa partout dans le centre intérieur de la province. En outre, la mortalité du pin de Murray a été signalée sur une superficie couvrant environ 4,2 millions d'hectares, soit le double de la région infestée depuis 2002. On a également noté une augmentation considérable de la zone ayant subi des dommages attribuables à d'autres types de scolytes, notamment au dendroctone du Douglas et au dendroctone de l'épinette. Par ailleurs, la défoliation causée par la tordeuse occidentale de l'épinette s'est accrue en 2003, tandis que celle qu'on doit à l'arpenteuse de la pruche de l'ouest, à la tordeuse des bourgeons de l'épinette et à d'autres espèces de tordeuses des bourgeons a perdu du terrain. En revanche, les changements climatiques ont aggravé les dommages attribuables non seulement aux scolytes, mais aussi aux maladies des aiguilles, dont la plus remarquable est la brûlure en bandes rouges (Dothistroma), *Mycosphaerella pini*, qui cause un taux élevé de mortalité au sein des plantations du nord-ouest de la Colombie-Britannique.

On peut trouver des descriptions plus détaillées de l'état de santé des forêts dans le rapport intitulé 2003 Summary of Forest Health Conditions in British Columbia (disponible en mars 2004) et sur le site Web de la Forest Practices Branch à l'adresse suivante :
www.for.gov.bc.ca/hfp/forsite/overview/overview.htm

Introduction

The big story in B.C. continues to be the mountain pine beetle epidemic occurring throughout the Central Interior of the province. This report covers the status of this outbreak as well as other notable pest conditions as recorded by the annual provincial aerial overview survey that is carried out by the BC Ministry of Forests.

The aerial overview survey recorded just under 4.1 million ha of red attacked lodgepole pine throughout the province. This represents slightly less than half of the 9 million ha of mature lodgepole pine in B.C. Compared to 2002, the 2003 area under attack doubled and now represents the largest mountain pine beetle infestation ever recorded. The outbreak is expected to expand for at least another 5 years before eventually collapsing from host depletion. It could collapse sooner if lethal winter temperatures occur. The Ministry of Forests Aerial Overview web site (http://www.for.gov.bc.ca/hfp/FORSITE/overview/overview.htm) has several graphics showing the growth of the mountain pine beetle infestation over time.

The Chief Forester released a Timber Supply Impact Report in October 2003 for 12 timber supply units in the most heavily affected areas. Some assumptions were that on average trees killed could be salvaged for up to 15 years and that during the course of the outbreak, 50% of all of the susceptible pine would be killed within the first 3 years. The outcome of the analysis showed that there would be at least 200 million cubic meters of unharvested beetle killed pine after 15 years. It also showed that the AAC would drop to 18.7 million cubic meters per year from a pre-uplift level of 23.2 million cubic meters per year, a 19% drop. The full text of this report is available at http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/.

The level of mortality and magnitude of the unsalvaged losses has impacts on wildlife habitat values, fire danger, recreation, First Nations treaty negotiations, community stability, and many other socio-economic and environmental values. The provincial government is developing a high-level strategy to deal with lessening the impact on communities, industry, the environment and provincial revenues.

There are many issues that have arisen from this catastrophe. The most significant is the lack of data on the "shelf life" of dead lodgepole pine. It is not clear how long sawlogs and pulp can be recovered from snags. The implications of this data are huge as they affect harvest planning, revenue estimates, community stability, unsalvaged loss estimation and rehabilitation planning. There also may be the opportunities for alternative uses for dead, dry wood such as bio-fuel production and co-generation of electricty.

These opportunities are being explored. Another concern is the expansion of the infestation into Alberta and beyond into the Boreal forest if climate conditions continue to change to favour the beetle. Another issues include determining the risk of exporting dead wood that contain woodborers, fungi and other organisms.

Other forest health concerns in B.C. include foliar diseases like redband needle blight (Dothistroma) that has unexpectedly destroyed plantations of lodgepole pine in the Northwest portion of the province. This damage is a direct result of a legacy of planting a single species (lodgepole pine) and climate change. Funding for rehabilitation of these stands has begun and will reforest with less susceptible species.

The North American strain of the European gypsy moth has been detected in several areas in the southern part of the province, mainly on the coast, by monitoring conducted by CFIA. Two areas, North Delta and Saanich, will require eradication treatments with aerial spraying of Btk in the spring of 2004. The province, along with its U.S. counterparts, continues to conduct eradication treatments to prevent the establishment of gypsy moth in western North America.

A native defoliator, western spruce budworm, has increased due to favourable weather conditions. This defoliator causes significant damage to regenerating interior Douglas-fir and has been subjected to numerous aerial treatments for Btk. Another application of approximately 30,000 ha is planned for the spring of 2004 in the Kamloops and Cariboo regions in the southern interior.

There are several major forest health related activities ongoing in the province. First, is the Provincial Bark Beetle strategy mentioned above that is formulating an action plan to address lessening the impact of the mountain pine beetle outbreak. Complicating matters are government initiatives to revise forest management to become more “results based” by having industry deliver forest management practices in line with stated government objectives. The province will also be relying on industry to deliver more forest health activities through Defined Forest Area Management. On top of this, to meet US Lumber Trade demands, a more market based pricing system is being installed. In general, forest policy and forest health are undergoing monumental changes whose outcome will hopefully improve the state of the forest in the long-run.

A more detailed provincial summary of 2003 forest health conditions in B.C. is available on-line on the Aerial Overview Survey home page (URL provided above).

An Introduction to NRCan's Mountain Pine Beetle Initiative

Une Introduction au Programme sur le dendroctone du pin de RNCan

Presented by:
Dr Bill Wilson, Directeur - Programme de recherche de l'industrie, du commerce et de l'économie, Service canadien des forêts, Centre de foresterie du Pacifique

Abstract

The mountain pine beetle (*Dendroctonus ponderosae*) is endemic to western North American lodgepole pine (*Pinus contorta*) forests and is an integral component of these forest ecosystems. Unfortunately, the standard system of ecosystem checks and balances may be destabilized in the current MPB epidemic in west-central British Columbia. The scale of the infestation rivals any natural forest pest recorded in North American forests. The infestation is spread across an estimated 4.2 million hectares of forestland.

Key factors serving to alter the Pl ecosystem equilibrium are a public policy commitment to containment of forest wildfires for much of the past half-century and a moderating trend in temperature extremes. Historically, Pl ecosystems are a product of beetle and fire events producing an age class mix across the landscape. These have combined to create an abundance of mature Pl, the food source, and a reduced frequency in cold temperature events required to knock back beetle populations to endemic or to incipient levels. Vulnerability to MPB attack increases markedly with timber age class and British Columbia's Pl forests are largely mature stands. It is estimated about 60-70% of British Columbia's Pl is vulnerable to the MPB – about 1 billion cubic meters of timber. Additional confounding factors include a lack of early control and a large number of inaccessible 'hot-spots'.

The current epidemic will serve to alter the fundamental structure and performance of British Columbia's interior forestry. In the absence of a beetle-killing cold weather event, the bulk of mature Pl within the historical range of the MPB will be hit within the next five years. Timber supply, community stability and the environmental character of interior forest ecosystems will be affected. Based on weather trends and global circulation models (a central analytical tool in climate change research) the probability for such a beetle-kill event is not high. The sector and region are facing major changes in the medium to long-term. Although at the outbreak level mitigation from direct intervention is limited, comprehensive and rigorous examination of the impacts and options can produce substantial dividends to accommodating these changes.

This presentation will outline the status of MPB in British Columbia, provide an overview on factors contributing to and consequences of the epidemic, and outline the federal government's Mountain Pine Beetle Initiative with a focus on the research program.

Résumé

Le dendroctone du pin ponderosa (*Dendroctonus ponderosae*) est une espèce endémique dans les forêts de pin tordu latifolié (*Pinus contorta*) de l'ouest de l'Amérique du Nord et est une composante intégrale de ses écosystèmes forestiers. Malheureusement, le système standard d'automatismes régulateurs dans l'écosystème pourrait être déstabilisé lors de l'épidémie courante du DPP dans la région centrale-ouest de la C.-B. L'échelle de l'infestation rivalise toute autre par des ravageurs naturels forestiers relevée dans les forêts nord-américaines. L'infestation est étendue sur ce qu'on estime être 4,2 millions hectares de terres forestières.

Des facteurs clés servant à modifier l'équilibre de l'écosystème Pl incluent un engagement dans l'ordre public en faveur d'un confinement des feux de forêts pour la la majeure partie du dernier demi-siècle ainsi qu'une tendance modérée en ce qui a trait aux températures extrêmes. Historiquement, les écosystèmes Pl étaient un produit d'évènements liés aux coléoptères et aux feux; ceux-ci produisaient un mélange de classes d'âges sur l'étendue du paysage. Ceux-ci se sont combinés pour créer une abondance de Pl mature, la source alimentaire et une fréquence réduite d'évènements de températures froides qui sont requis pour rabattre les populations de coléoptères aux niveaux endémique ou naissant. La vulnérabilité aux attaques de DPP augmente d'une façon marquée avec la classe d'âge des arbres, et les forêts Pl de la Colombie-Britannique sont largement composées de peuplements matures. On estime qu'environ 60-70 % du Pl en Colombie-Britannique est vulnérable au DPP – environ 1 milliard mètres cubes de bois. Des facteurs en-sus qui ajoutent à la confusion incluent un manque de contrôle au début de l'évènement et un grand nombre de points névralgiques inaccessibles.

L'épidémie courante va changer la structure fondamentale et la performance de la foresterie de l'intérieure de la Colombie-Britannique. En absence d'un évènement de température froide qui tuera les coléoptères, le gros du Pl mature dans le champ historique du DPP sera touché dans les prochains cinq ans. La réserve de bois, la stabilité communautaire et le caractère environnemental de l'écosystème forestier de l'intérieur seront affectés. Selon les tendances météorologiques et les modèles de circulation globale (un outil analytique central qui sert dans l'étude des changements climatiques), la probabilité d'une telle destruction occasionnée par les coléoptères est basse. Le secteur et la région font face à des changements majeurs qui s'étendent de moyen à long terme. Bien qu'au début, l'atténuation occasionnée par une intervention directe est limitée, l'examen exhaustif et rigoureux des impacts et des options pourrait produire des dividendes substantiels pour accommoder ces changements.

Cette présentation va résumer la situation du DPP en Colombie-Britannique, produire un survol des facteurs qui contribuent aux conséquences de l'épidémie et décrire le Programme sur le dendroctone du pin du gouvernement fédéral, en faisant le point sur le programme de recherche.

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The abundant inventory of mature timber in Canadian forests is a mixed blessing. Mixed because it attracts premium prices due to relatively outstanding product performance characteristics (albeit increasingly mitigated by processing technologies) and cost advantages from operating in an extensive natural timber endowment. However, the mature age class also means these stands are more vulnerable to a variety of forest health threats. Securing the wealth in publicly owned forests requires investment in effective monitoring and delivery in controlling a host of forest pests. The paper discusses the emergence of the mountain pine beetle to epidemic proportions in British Columbia, major factors contributing to this epidemic, impacts of the epidemic and outlines the efforts of the federal government to assist in responding to the epidemic.

Introduction

The mountain pine beetle (*Dendroctonus ponderosae*) is endemic to western North American lodgepole pine (*Pinus contorta*) forests and is an integral component of these forest ecosystems (Safranyik, 1978; Koch, P., 1996; McMullen, Safranyik and Linton, 1986). Unfortunately, the standard system of ecosystem checks and balances appears to have become destabilized in the current mountain pine beetle (MPB) epidemic in west-central British Columbia (BC). The scale of the current infestation, spread across an estimated 4.2 million hectares of forestland, rivals any natural forest pest recorded in North American forests.[1]

The main factors held to have altered the lodgepole pine (Pl) ecosystem equilibrium are a near half-century of public policy committed to containment of forest wildfires and a moderating trend in temperature extremes. Historically, Pl ecosystems are a product of beetle and fire events interacting to produce a mixed age class across the timber landscape. In the main, fire has been removed from this balance. Fire control and relatively benign weather, combined with a series of major fires in the early 1900's, to produce a large inventory of mature Pl (see figure 1). This inventory of mature pine, the ideal food source for mountain pine beetle and a reduced frequency in the cold temperature events required to knock back beetle populations to endemic or to incipient levels led to the current epidemic.

Vulnerability to MPB attack increases markedly with timber age class and BC's Pl forests are largely mature stands (see table 1). It is estimated about 70% of British Columbia's Pl inventory is vulnerable to the MPB – about 1 billion cubic metres of timber. Additional confounding factors to the epidemic include a lack of early direct beetle control and a large number of inaccessible beetle 'hot-spots'.

Not unexpectedly the current epidemic will alter the fundamental structure and performance of BC's interior forestry. In the absence of a beetle-killing cold weather event, the bulk of mature Pl within the historical range of the MPB will be hit within the next five years. Based on weather trends and global circulation models (a key

[1] This estimate is based on the aerial survey results of post-2002 beetle flight. The 2003 flight is expected to add considerably to the area of infestation.

analytical tool in climate change research) the probability for such a beetle-kill event is not high (see figure 2).

It is important to recognize, given the current scale of the epidemic, even with a major cold-weather event producing beetle mortality rates necessary to crash the population, the timber supply, community stability and environmental character of interior forest ecosystems will be greatly affected. Thus, the sector and region are facing major changes in the medium to long-term. A comprehensive and rigorous examination of the impacts and options can reduce the unnecessary loss in responding to these changes.

The Mountain Pine Beetle Initiative – What is it?

The BC government requested federal assistance in responding to the infestation and in October 2003 the federal government announced the Mountain Pine Beetle Initiative (MPBI) within a suite of federal programs intended to assist the forest sector. [2] The federal program response is consistent with the content contained in the provincial request – with one exception. The programs are not providing assistance for forest rehabilitation on provincial Crown lands. Investing to secure the value of provincial forests remains the responsibility of the landowner and licensees.

Table 1: Age Class and MPB Vulnerability

Years	MPB Risk Factor
</= 60	0.1
61 – 80	0.6
>/= 81	1.0

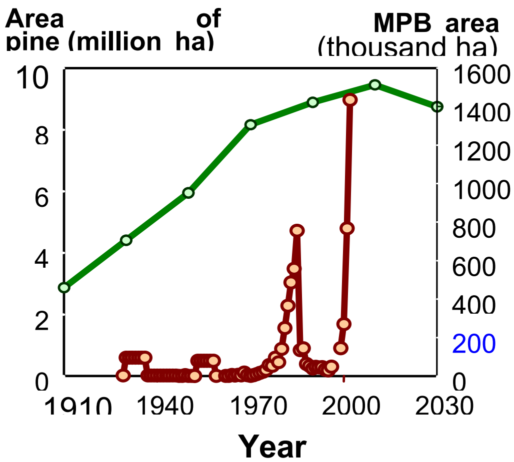
Source: Shore and Safranyik, c. 1992, Canadian Forest Service

The MPBI is a six-year package of programs with a total budget of $40 million. The objectives are to reduce the impacts of the current MPB epidemic and to reduce the risk of future beetle epidemics. The Initiative includes the following programs:

- MPB Epidemic Risk Reduction and Value Capture Research & Development;
- Federal Forestlands Rehabilitation Program; and
- Private Forestlands Rehabilitation Program.

[2] The major focus was to assist the sector in response to a U.S. trade action on softwood lumber imports. The package now includes MPBI, the Canada Wood Export Program and the Softwood Industry & Community Adjustment Fund and the Value-added Research Initiative for Wood Products.

Figure 1: Trends in Pl Inventory and Estimated MPB Infestation Area



Source: Taylor and Carroll 2003.

Land-Based Programs

At the operational level the MPBI is designed to assist private forestland owners and federal forestlands in responding to the beetle attack. Federal forestlands include First Nations reserve lands, the Chilcotin Military Reserve and the Dominion Coal Blocks and the national parks in the Rocky Mountains. The focus is on the controlling beetle spread and rehabilitation of beetle-kill forestlands. [3] The specific program criteria in the private and First Nation's program elements were developed in collaboration with advisory committees drawn from respective stakeholders (for program detail see www.mpbi.cfs.nrcan.gc.ca).

Forest health challenges are indifferent to institutional boundaries and the parks in the Rocky Mountains, a world heritage area, have MPB infestations and an abundance of mature Pl timber. Beetle control efforts are underway. In addition, these protected areas afford an opportunity to research aspects of beetle attack, control and impacts not available in forests elsewhere. Research related to beetle surveillance, monitoring, risk management decision-support systems and control are being deployed and tested in the national parks. An additional objective is to demonstrate beetle management options to other managers of protected areas.

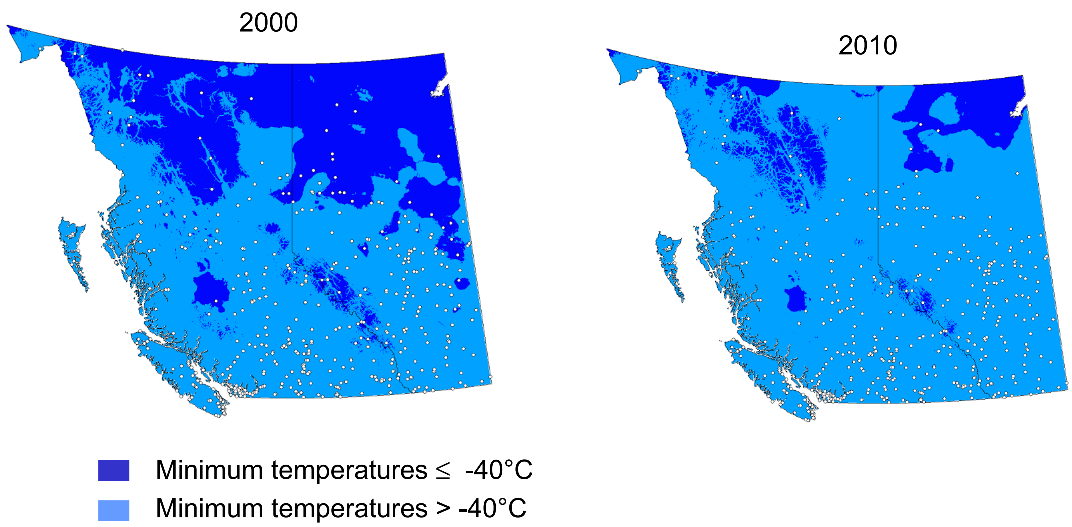
[3] The Chilcotin Military Reserve lands total about 40,000 ha and are located near Williams Lake. The Dominion Coal Blocks totals about 20,000 ha in two main blocks and are situated in southeastern British Columbia.

Research Program

The scale of the current beetle infestation overwhelms any direct control in the heavily infested areas - at least any acceptable form of control. The MPB will work through a major volume of BC's mature Pl. However, focussed research will provide information on the range of impacts, options to mitigate, and systems to reduce the risk of future beetle epidemics. The MPBI research program is a partnership among stakeholders in terms of identifying information needs and in developing this information through research.

MPBI research identified within a strategic response to the beetle epidemic in pursuit of the Initiative's two objectives: reducing the impact of the current epidemic and reducing the risk of future beetle epidemics. Research will address economic, ecological and social information needs. Following is a summary of the MPBI research strategy flowing from forestlands, harvesting, processing and marketing.

Figure 2: Climate Patterns & Forecast: 2000 versus 2010



Source: Régnière J, Logan JA, Carroll AL, Safranyik L. 2003. Phenological modeling of climate change impacts on North American forest insects. *Unpublished*

1. Forestlands & ecosystems

This focus is on incorporating beetle risk into forestland management and determining the character of a post-beetle forest ecosystem. Key projects include the operational evaluation of beetle risk reduction through stand thinning, assessing beetle management implications at landscape levels, modeling of beetle spread and the consequences of climate change on beetle spread, assessing the potential for remote sensing techniques to improve forest health monitoring, and integrating silvicultural control of MPB with sustainable forest management objectives. Existing fire risk rating systems are being modified to better incorporate beetle parameters and to upgrade control-burn models for fuel reduction use.

Reducing the risk of future beetle epidemic events, indeed most forest health shocks, will require effective monitoring, direct control at the incipient stage[4], and forest landscape modification to increase species and/or age class diversity.

2. Harvesting & processing

This focus is on examining the impacts of beetle-kill on timber quality, the timeframe for harvesting 'grey attack' timber, phytosanitary risks, the impacts of increased beetle recovery fibre on pulping, lumber and panel production, and assessing the economic and socio-economic impacts of communities located within the beetle zone.

3. Markets & Products

This focus is to provide information on beetle zone product performance and to assess potential options to utilize salvage timber. The lodgepole pine harvest, the dominant commercial species for the interior region, will increasingly include salvage timber characterized by high desiccation rates, increased sap and bluestain. Capture of lumber value from beetle zone timber is largely dependent on moving product into established export markets – primarily the United States because the Japanese market, which has emerged as a significant export destination for interior lumber, has zero tolerance for bluestain. Unfortunately, the US market for Canada's softwood lumber is currently encumbered with a duty package near 28% and a rapidly appreciated Canadian dollar.

The capability to respond to the volume of beetle zone timber will be constrained by the ability to market timber in some form. There is a examine potential market concerns about beetle legacies and to assess product options beyond traditional forest products.

The focus is on assessing the potential impacts of beetle salvage on established products and markets. In addition, research will be completed on non-traditional product options.

[4] The infestation cycle is endemic population, incipient population, outbreak and the outbreak collapse.

Conclusions

The year 2003 was a tough one for British Columbia. Events bring to mind the riders of the apocalypse – pestilence, drought, fire, and floods. The US trade action is a bonus whack.

The suite of MPB natural controls (i.e., host resistance, natural enemies, weather and competition for food and space) has been overwhelmed by the infestation's scale. The MPB prevention tools (stand density management, species/age class mix, and harvesting at maturity) are under-deployed and direct management options (baiting/repellents, fall and burn, pesticides, mosaic burns, and harvesting) are of limited use and near totally inadequate at an epidemic stage (Safranyik, Shrimpton and Whitney, 1974). As a consequence the MPB will run through much of the mature Pl stands in the heavily infested and threatened areas – short of a major killing weather event.

The pest control focus might be best placed on new outbreaks including other bark beetles actively chewing through stands elsewhere in British Columbia. Competitive and over-supplied forest product markets will constrain efforts on fibre recovery from the beetle zone not processing capacity (Rogers, 2001). The social and economic impacts can be expected in the medium to long-term after fibre supply and costs reflect beetle impacts on timber and 'grey attack' shelf-life is expiring.

Post-beetle epidemic the interior forests will be different and the economic and social basis and structure for many of the region's communities will be challenged. There is no option in which this transition can be avoided. However, the transition path can be improved via a thorough assessment of MPB epidemic impacts and options to work with these. The Mountain Pine Beetle Initiative is a federal assist to delivering this necessary assessment.

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Important Forest Pest Conditions in Alberta in 2003

Principaux ravageurs forestiers en Alberta en 2003

Presented by:
Hideji Ono, Sunil Ranasinghe, Christine Kominek, Mike Maximchuk, Mike Undershultz, Erica Lee, Dan Lux, and Cody Crocker, Tom Hutchison

Abstract

The spruce budworm, *Choristoneura fumiferana* (Clemens), was the major conifer defoliator in 2003. This pest was predominantly found in northern Alberta. The extent of spruce budworm was similar but the severity of defoliation was less compared to those in 2002. The net area defoliated by this pest is being calculated. The yellowheaded spruce sawfly, *Pikonema alaskensis* (Rohwer), defoliated some spruce plantations in northeast Alberta.

The large aspen tortrix, *C. conflictana* (Walker), was the major broadleaf defoliator in the province. There was a notable eastward shift of tortrix infestations in 2003. The gross area of large aspen tortrix defoliation was 5 447 091 ha; defoliation was light over 195 016 ha, moderate over 4 510 397 ha and severe over 741 678 ha.

Four gypsy moths, *Lymantria dispar* (L.), were trapped at two locations in the City of Edmonton.

The Department of Sustainable Resource Development, in collaboration with other public and private agencies, removed all the mountain pine beetle-infested trees detected in 2002-03 within and around the Town of Canmore and Kananaskis Country. Similarly, Banff National Park implemented a wildlife habitat improvement program that removed many mountain pine beetle-infested trees in the eastern part of the Park. These control programs together with the use of pheromone baits to trap the beetle in the Park considerably reduced the mountain pine beetle threat in the forested Crown land in Alberta. The mountain pine beetle also attacked a few trees in Jasper National Park and in Willmore Wilderness Park. Mountain pine beetle was trapped in 2003 in pheromone-baited trees located further north than ever before.

Alberta remains free of Dutch elm disease, *Ophiostoma novo-ulmi* Brasier, although the vector beetles continue to be caught in pheromone-baited traps.

Résumé

La tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana* (Clemens)) a été le principal défoliateur des conifères en 2003. Ce ravageur sévissait surtout dans le nord de l'Alberta. La superficie défoliée par la tordeuse des bourgeons de l'épinette était similaire, mais la gravité des dégâts était moindre qu'en 2002. On calcule actuellement la superficie nette défoliée par ce ravageur. La tenthrède à tête jaune de l'épinette (*Pikonema alaskensis* (Rohwer)) a défolié les épinettes de certaines plantations dans le nord-est de l'Alberta.

La tordeuse du tremble (*C. conflictana* (Walker)) a été le principal défoliateur des feuillus dans la province. On a relevé une nette progression vers l'est des infestations de cette tordeuse en 2003. La superficie brute défoliée par ce ravageur était de 5 447 091 ha; la défoliation était légère sur 195 016 ha, modérée sur 4 510 397 ha et grave sur 741 678 ha.

Quatre spongieuses (*Lymantria dispar* (L.)) ont été capturées à deux endroits dans la ville d'Edmonton.

Le ministère du Développement durable des ressources, en collaboration avec d'autres organismes du secteur public et privé, a éliminé tous les arbres infestés par le dendroctone du pin ponderosa qui avaient été détectés en 2002-2003 dans la ville de Canmore et la région de Kananaskis et autour de celles-ci. De même, le parc national Banff a mis en œuvre un programme d'amélioration de l'habitat faunique qui a permis d'éliminer nombre d'arbres infestés par le dendroctone dans sa partie est. Ces programmes de lutte, conjugués à l'emploi de pièges à phéromone pour capturer les dendroctones dans le parc, ont considérablement réduit la menace que faisait planer ce ravageur sur les terrains forestiers publics de l'Alberta. Le dendroctone du pin ponderosa a également attaqué quelques arbres dans le parc national Jasper et dans le parc naturel Willmore. Des spécimens de ce ravageur ont été capturés en 2003 beaucoup plus au nord qu'auparavant dans des arbres appâtés à l'aide de phéromones dans des secteurs.

L'Alberta est toujours épargnée par la maladie hollandaise de l'orme causée par *l'Ophiostoma novo-ulmi* Brasier, même si des spécimens du scolyte qui lui sert de vecteur ont de nouveau été capturés dans des pièges à phéromone

Summary

Spruce budworm (*Choristoneura fumiferana* (Clemens) defoliated a net area of 124 815 ha in 2003, compared to 159 476 ha defoliated in 2002. An ongoing spruce budworm outbreak in Wood Buffalo National Park was surveyed this year for the first time. The analysis of the moth counts in pheromone-baited traps showed that the risk of new spruce budworm occurring in 2004 in northern Alberta has decreased. Yellowheaded spruce sawfly (*Pikonema alaskensis* (Rohwer) outbreaks in young white spruce plantations in northeastern Alberta were successfully controlled by pesticide applications.

Large aspen tortrix (*C. conflictana* (Walker) was the predominant defoliator of aspen stands in the province. The large aspen tortrix defoliated aspen stands scattered over an estimated 5.4 million ha across the province. This infestation continued its eastward movement in 2003. Forest tent caterpillar (*Malacosoma disstria* Hübner) defoliated some aspen stands in southwestern Alberta. Aspen two-leaf tier, *Enargia* decolor (Walker), an occasional pest of aspen, was common in northern Alberta. This moth was attracted in large numbers to pheromone-baited traps deployed to monitor the forest tent caterpillar. Four gypsy moths (*Lymantria dispar*(L.), were detected in the pheromone-baited traps set up in 2003 by the City of Edmonton but none was found in the traps deployed elsewhere in the province by the Department of Sustainable Resource Development.

Aerial overview surveys, ground surveys and pheromone-baited trees were used to monitor mountain pine beetle (MPB), (*Dendroctonus ponderosae* Hopkins), activity along the eastern slopes in Alberta. During aerial overview surveys, 17 red-attacked trees symptomatic of MPB attack were detected in the Bow River Valley and another 10 red-attacked trees were detected in Willmore Wilderness Park. In 2002/03, 1013 green-attack trees were detected in the forested Crown land and another 303 green-attack trees were found in the Town of Canmore. An estimated 6950 green-attack trees were found in Banff National Park in 2002/03, a significant decrease from the 9000 attacked-trees found in 2001/02. Twelve MPB-killed trees were detected in Jasper National Park. The beetle-hits on pheromone-baited trees indicated increased MPB activity in the eastern slopes along southwestern Alberta and low-level activity in Cypress Hills Provincial Park in southeastern Alberta.

Alberta remains free of Dutch elm disease although a vector of the pathogen, the smaller European elm bark beetle (*Scolytus multistriatus* (Marsham), continued to be caught in pheromone-baited traps. The trap catches of this beetle increased in 2003, compared to 2002.

This year, an MPB management program was undertaken, as mandated, by the Department of Sustainable Resource Development. This program was successful in removing 98% of the green-attack trees in the forested Crown area. All the green-attack trees in the Town of Canmore were removed. Banff National Park (BNP) initiated a restoration program by burning 4420 ha of MPB-prone stands. As well, 2725 green-attack trees were removed from the MPB management zone in BNP.

A study on the woodborer damage vs. checking impact on fire-killed timber showed that checking has more impact than woodborer damage on the grades of lumber produced from fire-killed timber in the first year after fire. Forest Health Section personnel participated in a project by the Foothills Model Forest to develop an MPB dispersal and spread model.

1.0 INTRODUCTION

This is a summary report on noteworthy forest insect and disease pest conditions found in Alberta in 2003. The details of provincial forest pest conditions (including details about invasive exotic plants) will be published in the "2003 Annual Report: Forest Health in Alberta."

The Department of Sustainable Resource Development (SRD) deals with forest health concerns in the forested Crown land in Alberta. In 2003, the forested Crown land comprised of 10 *Corporate Areas* organized into three *Corporate Regions* (Figure 1). The Department of Community Development handles forest health issues in provincial parks. Municipal governments look after forest pest concerns within the settled area of the province. Forest health concerns in the national parks are a federal government responsibility.

The Forest Health Officers (FHO) — Tom Hutchison, Northeast Corporate Region (NE), Daniel Lux and Erica Lee, Southwest Corporate Region (SW) and Mike Maximchuk, Northwest Corporate Region (NW) — provided pest information in the managed forested area. Janet Feddes-Calpas (Alberta Agriculture, Food and Rural Development) and Christopher Saunders (The City of Edmonton) provided the urban forest pest information. Leo Unger (Canadian Forest Service, Pacific Forestry Centre), Roger Brett (Canadian Forest Service, Northern Forestry Centre), Christina Kaeser (Wood Buffalo National Park), Jane Park (Banff National Park) and Dave Smith (Jasper National Park) provided information on forest pests in national parks. Les Weekes provided information on forest health conditions in Cypress Hills Provincial Park.

Figure 1. Corporate regions and areas of the Public Lands and Forests Division, Alberta Department of Sustainable Resource Development, 2003

2.0 FOREST PEST CONDITIONS IN 2003 AND FORECASTS FOR 2004

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 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. Results of the aerial overview surveys on spruce budworm defoliation in Alberta, 2002 vs. 2003[a]

CORPORATE REGION	DEFOLIATION (ha)				REMARKS
	2002		2003		
	Moderate	Severe	Moderate	Severe	
Northwest	**14 324**	**97 107**	**25 026**	**81 078**	**Net Area [b]**
Northeast	**35 108**	**12 917**	**12 235**	**6476**	**Net Area [b]**
	8938	**14720**	**3077**	**30 366**	**Gross Area [c]**
PROVINCIAL	**49 432**	**110 024**	**37 261**	**87 554**	**Net Area [b]**
	8938	**14 720**	**3077**	**30 366**	**Gross Area [c]**

[a] excluding Wood Buffalo National Park

[b] net area of spruce budworm defoliation in inventoried forest land

[c] gross area of spruce budworm defoliation in non-inventoried forest land

In 2003 spruce budworm defoliation was confined to the Northwest and Northeast corporate regions in Alberta. The net area of spruce budworm defoliation in the inventoried forested land of the province was estimated at 124 815 ha. In addition, spruce budworm defoliation was scattered over a gross area of 33 443 ha of forested land that has not been inventoried (Table 1).

Spruce budworm defoliated area in the province increased in the three years following the 1999 discontinuation of the aerial spray program to control this pest (Figure 2). Tree-kill due to spruce budworm damage has been observed in several spruce stands repeatedly defoliated during this period. Most of these stands had eight or more consecutive years of defoliation.
However, in 2003 there was a decline in the severity and extent of spruce budworm defoliation in the inventoried forested land (Figures 3 and 4).

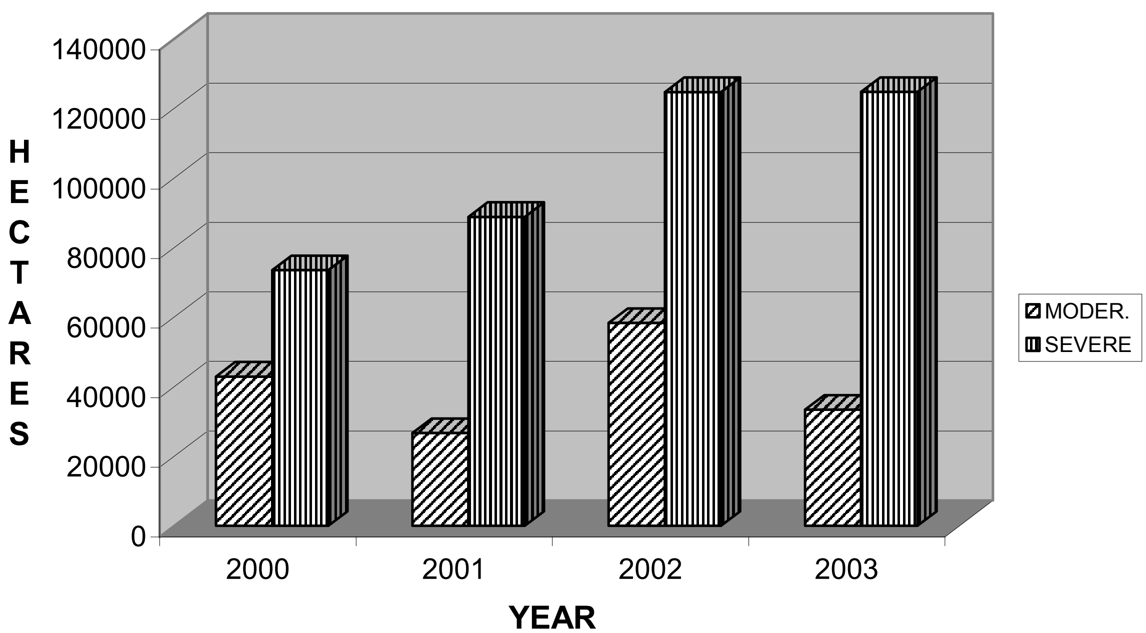

Figure 2. Number of hectares defoliated and severity of spruce budworm defoliation in Alberta, 2000-2003.
(Note: Combined gross and net area values, except those from Wood Buffalo National Park, were used in this graph).

Compared to 2002, the extent of moderate defoliation declined by 24.6% and the extent of severe defoliation declined by 20.4% in 2003. In the non-inventoried forested land the moderately defoliated area declined by 65.6% but the severely defoliated area increased by 106% (Table 1).

In the Northwest Corporate Region, the spruce budworm defoliation covered a net area of 106 104 ha in 2003, i.e., a 4.8% decrease compared to the area defoliated in 2002. (Figures 3 and 4). Most (76.4%) of the infested area was severely defoliated and the remainder (23.6%) was moderately defoliated. In comparison, 87.1% of the infested area was severely defoliated in 2002.

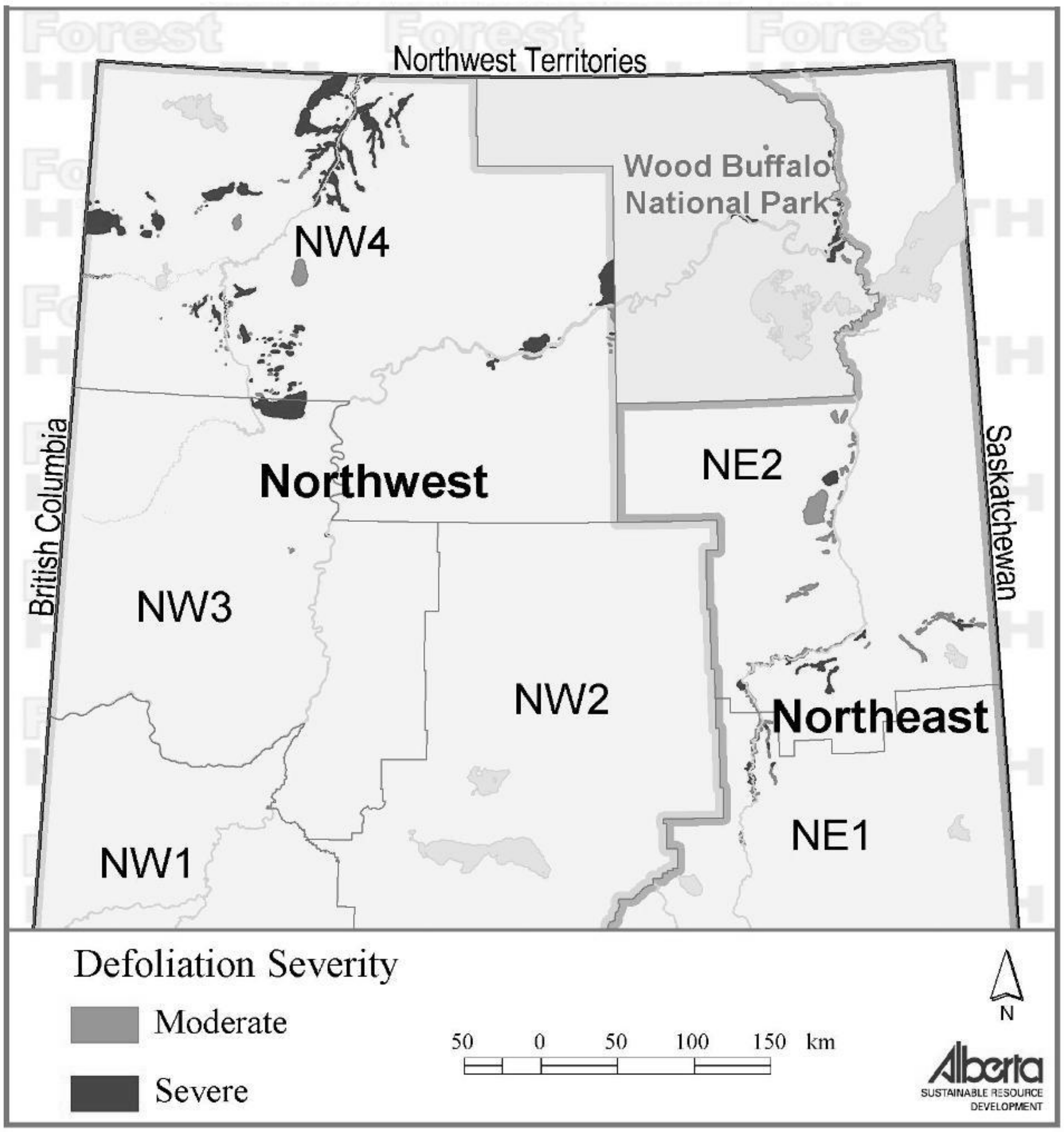

Figure 3. Spatial distribution of moderate and severe spruce budworm defoliation in Alberta,2002.

In the Northeast Corporate Region, the net defoliation was estimated to cover 18 711 ha in the forest stands located within the inventoried area south of 58º N latitude. This is a 61% decrease compared to the area defoliated in 2002. Most of the defoliation was moderate (65.4%) and the remainder was severe. Because of the lack of inventory data, only gross figures of defoliation are available for the area north of latitude 58º N and for some areas south of latitude 58º N. In this non-inventoried area, spruce budworm defoliation was scattered over an estimated 33 443 ha (Table 1). Most of this defoliation (90.8%) was severe. In the Southwest Corporate Region there was no spruce budworm defoliation in 2002.

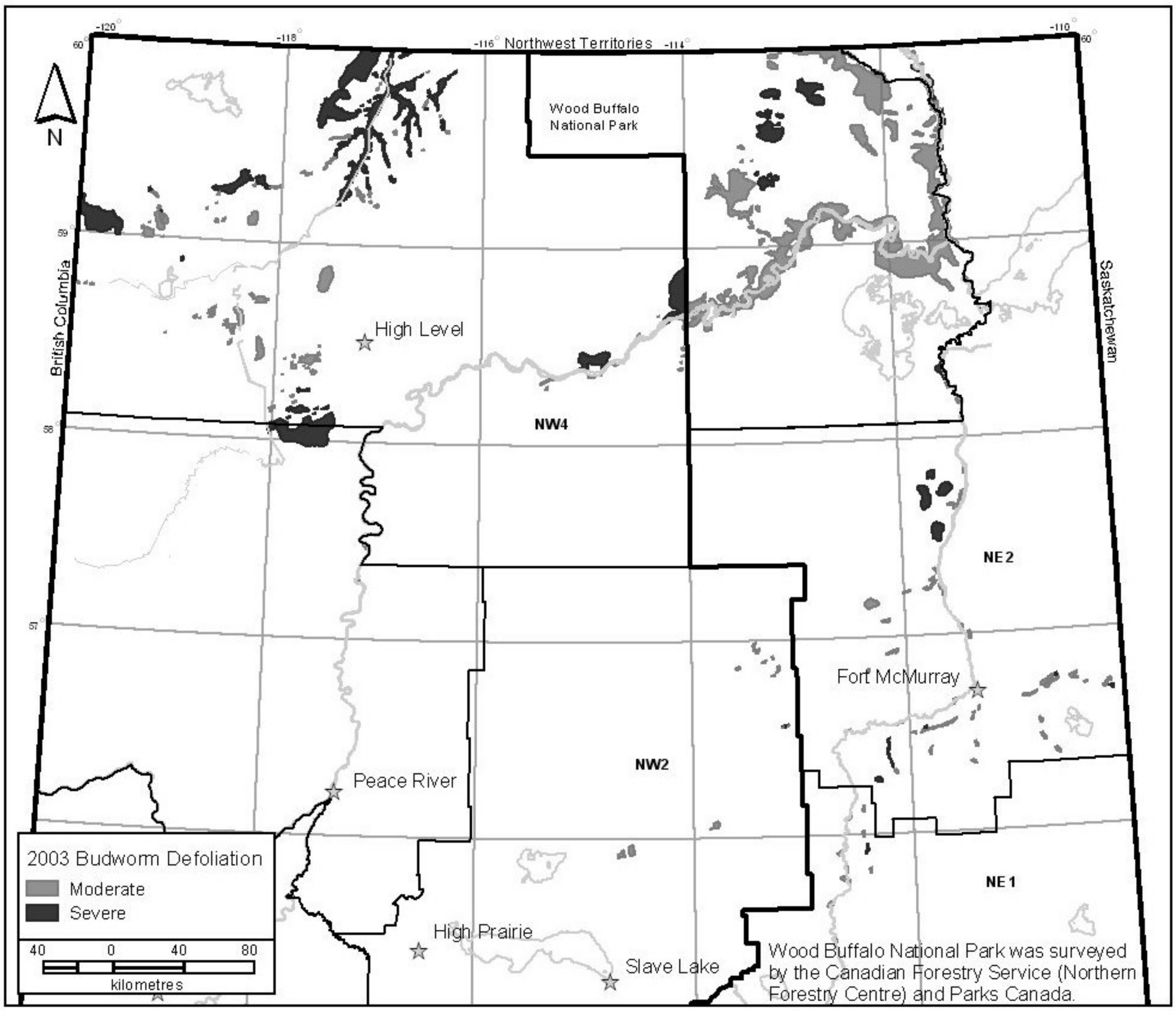

Figure 4. Spatial distribution of moderate and severe spruce budworm defoliation in Alberta, 2003.

Wood Buffalo National Park in northeastern Alberta has had an ongoing spruce budworm infestation during the past few years. In 2003, Roger Brett from the Northern forestry Centre of Canadian Forest Service and Christina Kaesar from Wood Buffalo National Park surveyed this infestation from the air. The resulting defoliation was found scattered over an estimated gross area of 422 837 ha mostly along the Peace and Slave rivers (Figure 4). Most of this defoliation was of moderate intensity.

Forecast for 2004 Based on Pheromone Trap Catches in 2003

The 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 the moth catches in pheromone-baited traps are shown in Figure 5.

In the Northeast Corporate Region, traps were set in 50 plots. Two of these plots were dropped from further consideration because the traps were disturbed. In general, the trap catches in 2003 were lower than in 2002. Based on the average moth catches per trap, the risk of new spruce budworm outbreaks occurring in 2004 was high in nine plots (18.7%), moderate in 20 plots (41.7%) and low in 19 plots (39.6%). The average moth catches per trap ranged from 44-485 in low plots, 540-1903 in moderate plots and 2072-3130 in high plots. In this region, the risk of outbreaks occurring in 2004 is lower than that in 2003. In the Northwest Corporate Region, traps were set up in 70 plots in 2003. The moth catches indicated that the risk of new outbreaks occurring in 2004 is low in 55 plots (74.3%), moderate in 11 plots (14.9%) and high in 6 plots (10.8%). The average moth catches per trap ranged from 4-492 in low-risk plots, 568-1940 in moderate- risk plots and 2016-3100 in high-risk plots. The percent of plots with high risk of outbreaks occurring in 2004 is about the same as in 2003. In the Southwest Corporate Region, 29 plots were established; both traps in one plot were disturbed and were removed from further consideration. The average trap catches indicated that the risk of new budworm outbreaks occurring in 2004 is nil in one plot (3.6%) and low in the other 27 plots (96.4%). The average moth catches ranged from 0-438 per trap. This region is infested with the two-year cycle budworm, *C. biennis* Free., the populations of which peak in even years. The relatively low moth catches in 2003 indicate a nil-low risk of an outbreak occurring in this region in 2005.

Yellowheaded Spruce Sawfly

The yellowheaded spruce sawfly (YHSS) severely defoliated some young white spruce plantations int he Northeast Corporate Region. Open grown white spruce planted at oil and gas reclamation sites were particularly vulnerable to this attack. Some of these plantations had up to 40% tree kill.

In 2003, several oil and gas companies carried out programs to control this pest on reclamation sites. Suncor and Syncrude, both located in Fort McMurray, carried out aerial applications by using a helicopter. Suncor and Syncrude treated 32 and 87 ha respectively with Dylox®. They achieved 90-95% efficacy in YHSS control. Imperial Oil Resources treated their YHSS-infested stands with Permethrin. The efficacy of this treatment has not been reported. Suncor is planning to continue these field applications.

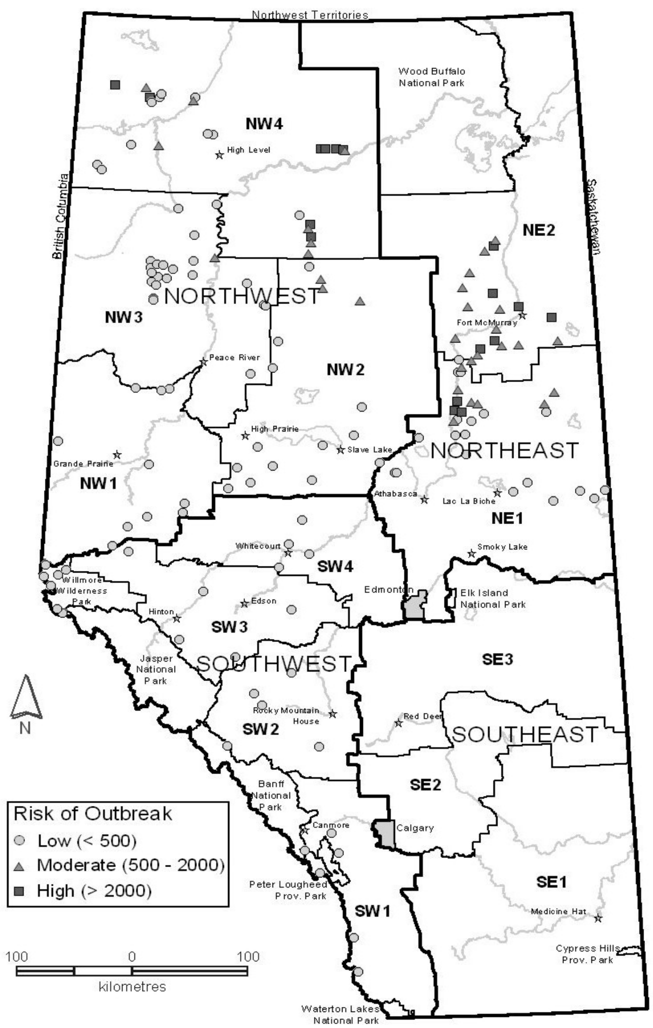

Figure 5. Forecast on risk of new spruce budworm outbreaks occurring in 2004, based on the moth catches in pheromone-baited traps in 2003 in Alberta.

2.1.2 Aspen Defoliators

The extent of aspen defoliation by insect pests is estimated during aerial overview surveys carried out in the summer. The survey procedures are described in the "Forest Health Aerial Survey Manual" (Ranasinghe and Kominek, 1999). The surveyors categorize aspen defoliation severity as light (< 35% defoliation), moderate (35 – 70% defoliation) or severe (>70% defoliation). The results of these surveys are shown on Table 2.

Table 2. Results of the aerial overview surveys on aspen pest defoliation in Alberta, 2002 vs. 2003

Corporate Region	Gross area of defoliation (ha)[a]					
	2002			2003		
	Light	Moderate	Severe	Light	Moderate	Severe
Northeast	1489	109 691	15 733	74 548	323 640	176 999
Northwest	74 165	2 612 780	908 006	44 491	4 399 735	0
Southwest	141 324	252 594	83 827	76 020	163 094	155 749
Provincial Total		4 199 609			5 414 276	

[a] Gross area, i.e., total area covered by the polygons containing defoliation, except those of Wood Buffalo National Park.

Large Aspen Tortrix, *Choristoneura conflictana* (Walker)

In 2003, the large aspen tortrix (LAT) continued its eastward movement in Alberta. This year, LAT defoliation extended to the Saskatchewan border in the northeast. Correspondingly, there was an eastward shift of the defoliated area in the northwest (Figures 6 and 7). The LAT defoliation in 2003 was scattered over an estimated 5 414 276 ha of aspen forest in Alberta. This is a 28.92% increase in the gross area of defoliation compared to 2002.

In the Northeast Corporate Region this defoliation increased dramatically over an estimated gross area of 575 187 ha; this is an increase of 353% compared to the defoliation recorded in 2002. About 13% of this defoliation was light, 56% was moderate and 31% was severe in intensity (Table 2). The bulk of the defoliation was observed in the Waterways Area (Figure 7).

In the Northwest Corporate Region, LAT defoliation was scattered over a gross area of 4 444 226 ha. This is a 24 % increase compared to the area defoliated in 2002. Most of this defoliation (99%) was moderate and the remainder 1 % was light in intensity. In the Southwest.

Figure 6. Spatial distribution of insect pest-caused aspen defoliation in Alberta, 2002.

Figure 7. Spatial distribution of insect pest-caused aspen defoliation in Alberta, 2003.

Corporate Region, LAT defoliation was scattered over a gross area of 394 863 ha. This is a 17% decline in the gross defoliated area compared to the 477 745 ha defoliated in 2002. About 19% of this defoliation was light, 41% was moderate and 40% was severe in intensity. In the southern section of this region, defoliation caused by the LAT and the forest tent caterpillar was mixed.

An ongoing LAT infestation in Wood Buffalo National Park was aerially surveyed in 2003 by Roger Brett (Canadian Forest Service, Northern Forestry Centre) and Christina Kaesar (Wood Buffalo National Park). The spatial distribution of defoliation is shown on Figure 6. This defoliation was scattered over an estimated gross area of 360 683 ha. Most of the defoliation was observed along the Peace and Slave rivers.

Forest Tent Caterpillar, *Malacosoma disstria* Hűbner

In 2003, the forest tent caterpillar (FTC) defoliated some forest stands in the southern section of the SW Corporate Region; however, there was no forest tent caterpillar defoliation detected in the northern section of this region. Some forest tent caterpillar larvae were observed during the ground surveys along the Chinchaga River in the NW Corporate Region. In most cases, the damage caused by the FTC and LAT was indistinguishable and was ascribed to the predominant defoliator, the large aspen tortrix. There was some forest tent caterpillar defoliation in 2003 in the NE Corporate Region. This damage was mixed with damage caused by the aspen two-leaf tier, *Enargia decolor.*

Survey with Pheromone Traps

In the NE Corporate Region, Unitraps® baited with pheromone lures (Phero Tech Inc., B.C.) were deployed in 25 plots to monitor the forest tent caterpillar moth populations The average trap catch in the plots varied from 8 – 137 moths per trap. There was no defoliation in any of the plots. In the Northwest Corporate Region, 10 plots were established. The tent caterpillar moth counts ranged from 0 – 47 per trap. No defoliation was reported from these plots.

Gypsy Moth, *Lymantria dispar* (L.)

The Public Lands and Forests Division set up 75 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 75 traps that were deployed in July-August at high-risk areas such as the truck stops, railway yards, campgrounds etc. However, in 2003 four gypsy moths were trapped in two traps deployed in Edmonton by the city working under the CFIA program[5]. No gypsy moth egg masses were found in a follow-up survey. The City of Edmonton is planning to intensify the gypsy moth detection plan in 2004.

[5] Chris Saunders, Parks and Community Services, City of Edmonton, Personal communication

Aspen two-leaf tier, *Enargia decolor* (Walker)

This occasional pest was widespread in the Northeast Corporate Region in 2003. These moths were attracted to the pheromone traps; up to 873 moths were caught in the FTC pheromone traps. However, there was no large-scale damage caused by this pest. In the Northwest Corporate Region, aspen two-leaf tier moths ranging from 1–200 per trap were found in the FTC pheromone-baited traps but no defoliation was observed[6].

2.2 Bark Beetles

2.2.1 Conifer

Mountain Pine Beetle, *Dendroctonus ponderosae* Hopkins

Aerial Overview Surveys

In the fall of 2003, the forested Crown land was surveyed to detect mountain pine beetle (MPB) infestations. The Regional Forest Health Officers in the Southwest Corporate Region used rotary-wing aircraft for these surveys. The surveys mainly covered the river valleys in the foothills bordering B.C., Willmore Wilderness Park and Waterton National Park. The results of these surveys are shown on Figure 8.

In the Southwest Corporate Region 17 red-attacked trees symptomatic of MPB attack were observed from the air in the Bow Valley. In Willmore Wilderness Park two patches with suspected MPB-killed trees were observed. One patch of two trees was located near Beaverdam/Avalanche Creek area and the other with eight trees was located at Meadowland Creek.

Ground Surveys

Forested Crown Land

Following aerial surveys, ground surveys were carried out to detect the "green-attack" trees, i.e., trees successfully attacked in the current year but still retaining beetles and green crowns. Two types of ground surveys, i.e., walk-through surveys and transect surveys, are carried out to detect the green-attack trees. Extensive walk-through surveys delineate the general area of infestation. The results of the walk-through surveys are used to plan for more intensive and systematic transect surveys. The results of 2002/2003 surveys are reported here. The 2003/2004 surveys are still ongoing and will be reported in 2004.

[6] Usually this pest co-occurs with *E. infumata*, which is similar in appearance and dissections of specimens are necessary to separate the two species. Personal communication, Greg Pohl, Insect ID Officer, Northern Forestry Centre, Canadian Forest Service. Due to limited facilities the specimens were not dissected in the field.

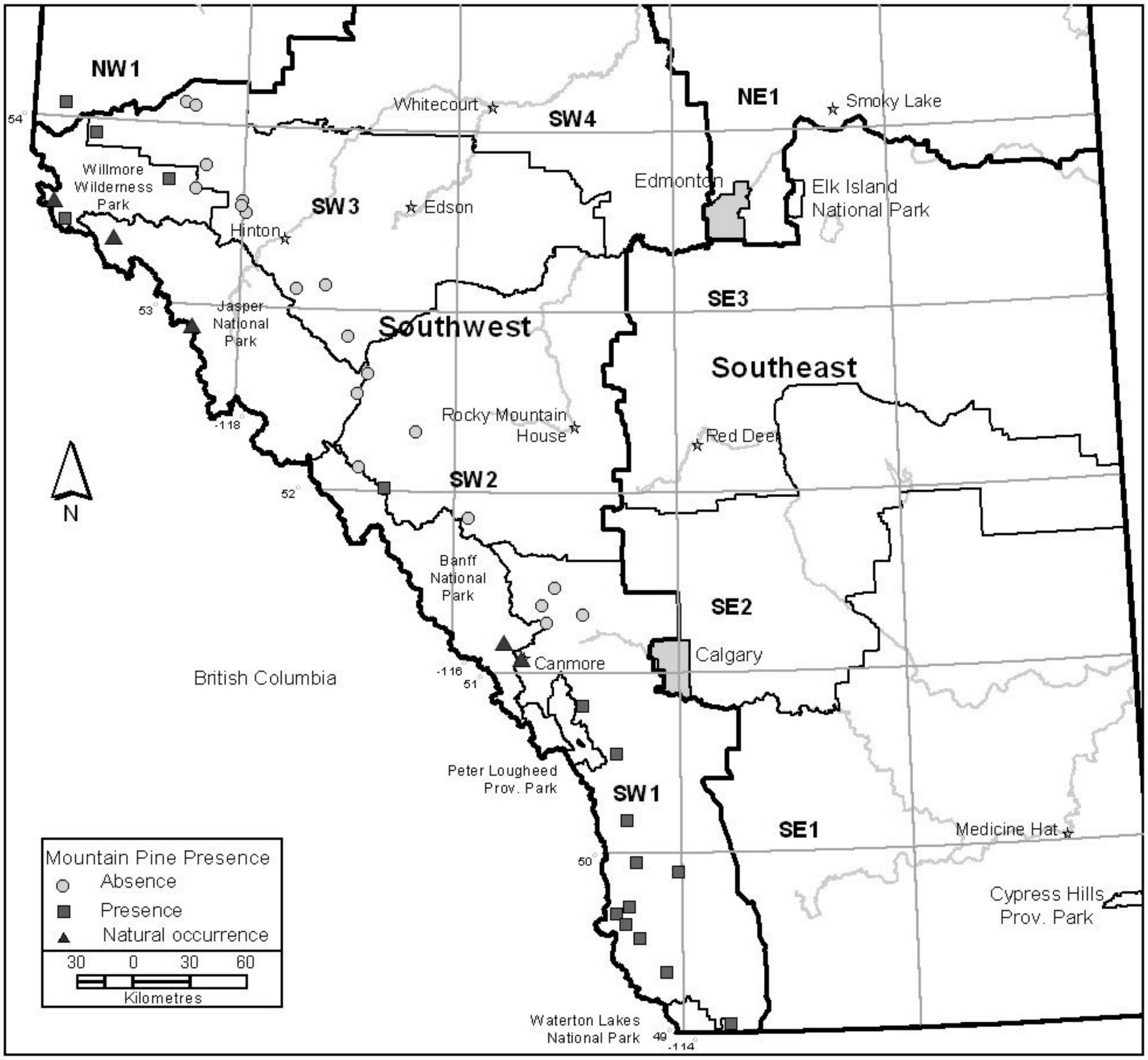

Figure 8. Natural occurrence of mountain pine beetle infestations and presence/absence of beetle-hits in pheromone-baited plots in Alberta, 2003.

A walk-through survey was conducted around the Town of Canmore and in the Bow Valley Wildland Park in 2002/2003. The areas to be surveyed were pre-determined based on the mountain pine beetle hazard rating system and the proximity to red-attacked trees detected during the aerial surveys.

The walk-through survey was followed by a transect survey. This survey was carried out from November 2002 through January. The transect survey areas were based on the results of the aerial surveys and walk-through surveys. The goal of the survey was to detect all the green-attacks by systematically surveying 100% of the selected area. A baseline was established through the selected survey area and transect lines were established perpendicular to the baseline at 50m intervals. The surveyors systematically surveyed every potential beetle host tree within 25m either side of each transect line. All the suspected green-attack trees were flagged and their locations were recorded by using the GPS. The process was repeated until all the survey areas were covered.

The results of these ground surveys are summarized in Table 3. Originally, 1253 trees purportedly attacked by the beetle were identified during the ground surveys carried out in Canmore area. However, upon closer examination, some of these trees were found to be attacked by other bark beetles such as the red turpentine beetle, *D. valens* LeConte and the lodgepole pine beetle, *D. murrayanae* Hopkins. Following ground truthing, only 1013 beetle-attacked trees were found in this area.

Table 3. Mountain pine beetle survey and control statistics for Alberta, 2002-2003

Location	Green-attacks	Number removed	Number left	Control	Remarks[1]
BANFF NAT. PARK					
Fairholme Range	3000	1853	1147	65.1%	Mgt. Zone
Tunnel Mountain	1150	872	278	75.8%	Mgt. Zone
Brewster Creek	50	0	50	0%	Mon. Zone
Healy Creek	1650	0	1650	0%	Mon. Zone
Mount Norquay	1100	0	1100	0%	Mon. Zone
CANMORE					
Town of Canmore	33	33	0	100%	
Silver Tips	180	180	0	100%	Golf Course
Three-Sisters	90	90	0	100%	Resort
Grassi Lake	1013	1009	4	99 %	Prov. Park
TOTAL	8282	4037	4229		

[1] Mgt. Zone = Management Zone and Mon. Zone = Monitoring Zone

Survey with Pheromones

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 plot locations were readjusted in 2003 to better represent the MPB-susceptible lodgepole pine forest in the province. The procedure for deploying these pheromone baits is described in “Mountain Pine Beetle Management Guide 1999” (Kominek, 1999).

Thirty-five plots with pheromone-baited trees were established to monitor mountain pine beetle activity in southwestern Alberta. The results of this survey are shown on

Figure 8. In the Southern Section of the Southwest Corporate Region, 11 of the 15 plots had beetle-hits on baited-trees. The number of hits per baited tree ranged from 1 to 100. At four of these plots the non-baited trees in the vicinity were also attacked. The beetle-hits on non-baited trees varied from 2-70 per tree. In comparison, none of the non-baited trees was attacked in 2002. These figures indicate an increasing trend in beetle activity in this corporate area during the past few years. In the Foothills Corporate Area (SW3) 13 plots were established. One plot located on the outskirt of Willmore Wilderness Park and two plots within the park had beetle attacks. The infested trees will be cut and burned before beetle emergence in 2004.

In Kakwa Wildland Provincial Park in the Northwest Corporate Region, a new plot was set up along the Lower Kakwa River. All three baited trees in this plot were attacked. These trees had 74 to 97 beetle hits. This finding is significant because this is the northernmost record of the presence of MPB to date in the province.

In Cypress Hills Provincial Park, mountain pine beetles attacked trees at 10 out of 13 plots with pheromone-baited trees[7]. The number of beetle hits per baited tree was relatively low (1-11 per tree). Overall, the MPB population in this park is still rather low.

National Parks

Aerial Overview Surveys

Approximately 4880 “red-attacked” trees, i.e., lodgepole pines killed in 2002 and turning red colour in 2003, were mapped during an aerial survey of Banff National Park[8]. The estimated numbers of red-attacked trees are as follows: Brewster Creek (30); Healy Creek (1000); Mount Norquay, Stony Squaw and Forty-mile Creek (1500); Tunnel Mountain (300); Lake Minnewanka, Cascade and Two Jack Lake (200); Mount Cory along Helena Ridge from Castle Junction to Johnson Canyon (150) and Fairholme Range (1700).

Ground Surveys

The estimated number of green-attack trees found in Banff National Park in 2002/2003 is shown in Table 3. About 60% of the 6950 green-attack trees in the park were found in the “Management Zone” where action taken by the park authorities helped to control the MPB infestation. The remainder of the green-attack trees were found in the “Monitoring Zone” where no management action was taken.
Twelve MPB-killed trees were observed in Miette Valley near the west gate of Jasper National Park. Beetles produced broods in two trees. Most of the other attacked trees had *Ips* sp., which prevented further MPB attacks. The MPB

[7] Les Weekes, Park Forest Officer, Cypress Hills Inter-Provincial Park, Alberta
[8] Leo Unger, Forest Health Technician, Pacific Forestry Centre, Canadian Forest Service, 506 West Burnside Road, Victoria, B.C. V8Z 1M5 and Jane Park (Banff National Park)

infestation along the Smoky River drainage within this park did not expand in 2003[9]. However, many beetle-killed trees were observed along the highway during aerial surveys between the western boundary of this park and Mount Robson Park in B.C.

No faders due to MPB-killed trees have been reported from Waterton National Park in 2003.

2.2.2 Broadleaf

Smaller European Elm Bark Beetle, *Scolytus multistriatus* (Marsham)

Alberta does not have any native elm tree species. The smaller European elm bark beetle (SEEBB), a vector of Dutch elm disease, has been found recurrently in Calgary since 1994; in Edmonton since 1995; and in Medicine Hat since 1998. This beetle has been trapped in the past near Balzac, in Coutts, High River, Killam, Lethbridge, Lloydminster, Red Deer, St. Albert, Strathcona County, Taber, Vauxhall, and in Wainwright.

Sticky panel traps baited with the pheromones were placed in 117 municipalities, 52 provincial and 28 nurseries. In 2003, the number of SEEBB trapped in pheromone-baited traps increased compared to the previous years. Thirty-nine beetles—a new record— were trapped in the greater Edmonton area. Multiple catches on individual traps as well as the trapping of beetles over several months suggest that they are established in Edmonton. Thirty beetles were trapped at 18 locations in Calgary. The trap catches over the years suggest the presence of endemic SEEBB populations in Alberta. However, there is still no conclusive evidence of their establishment, i.e., SEEBB galleries with live beetle larvae in elm in Alberta.

No native elm bark beetles, *Hylurgopinus rufipes* (Eichoff), have been trapped in Alberta.

2.3 Diseases and Disorders

Dutch Elm Disease (DED), *Ophiostoma ulmi* (Buis.) Nannf.

Although elm trees are not native to Alberta, a relatively large American elm population is found in the province. To date the only confirmed record of Dutch elm disease (DED) in Alberta was from samples collected in 1998 from an elm tree in Wainwright. No new cases of DED were reported in 2003 in Alberta.

[9] Dave Smith, Fire and Vegetation Specialist, Jasper National Park, Jasper, Alberta

In 2003, the Society to Prevent Dutch Elm Disease (STOPDED) monitored municipalities, provincial or municipal parks, plant nurseries, and all of the ports-of-entry at Alberta–Montana border for one of the vector species of this disease, the smaller European elm bark beetle (SEEBB). Large volume of elm firewood was also confiscated at the Alberta-Montana ports-of-entry.

For further details about DED in Alberta, please visit the Web site: www.agric.gov.ab.ca/navigation/pests/trees/index.html

Dothiorella Wilt Disease of Elm, *Dothiorella ulmi* Verall & May

Since 1996, a vascular wilt disease caused by the fungus, *Dothiorella ulmi*, has affected American elm trees growing in Edmonton. This disease results in progressive die back and eventual tree mortality. In 2003, another 60 elms with wilt symptoms were observed in the city. Samples from all these wilted trees were submitted to the University of Alberta's plant pathology laboratory, which confirmed Dothiorella wilt on 56 of the samples. This disease has affected over 200 elms in the city since 1996.

Drought

The effects of drought adversely affected many forest trees. In addition to the direct effect, drought-weaken trees also became more susceptible to other pests. The City of Edmonton lost nearly 4000 trees of an introduced species, black ash, due to 2003 drought. Drought killed many forest trees in the Northeast Corporate Region. Many birch trees had chlorosis. Stress-induced cone crops were common on white spruce, which also suffered some tree mortality.

2.4 Other Minor Pests

Ash leaf cone caterpillar (ALCC), *Caloptila fraxinella* (Ely), was first reported on black ash in Edmonton in 1999. This pest still occurs at outbreak levels in the City of Edmonton. Measures to use an *Apantales* sp. for biological control of this pest are yet to pick up speed. Most trees in the city are under drought stress and this seems to make them more prone to ALCC attack. Similar damage was reported from ash trees growing around Wandering River Ranger Station and in Fort McMurray in the NE Corporate Region. The pest damage at these locations was less severe compared to last year and no further spread has been reported.

In Edmonton, the continuing drought conditions weakened many trees that became prone to other pests. The citywide occurrence of the cottony psyllid, *Psyllopsis discrepans* (Flor), on black ash was overtaken by the leafhopper, *Gyponana* sp. The western ash bark beetle, *Hylesinus californicus* (Swaine), attacked the black, Manchurian and green ash trees in Edmonton. The spiny ash sawfly, *Eupareophora parca* (Cresson), was found on many parts of the city.

In 2002, the red elm weevil, *Magdalis armicollis* (Say infested drought-weakened elms of Edmonton. The drought conditions in these areas exacerbated weevil damage on elm trees.

3.0 MOUNTAIN PINE BEETLE PEST MANAGEMENT PROGRAMS

3.1 Introduction

The current mountain pine beetle (MPB) outbreak in Alberta was detected in 1997 when beetle-killed trees were reported during a survey carried out over Banff National Park (BNP). Facilitated by the mild winters and warm, dry summers, the MPB population in Banff National Park increased rapidly. In 2002, MPB-killed trees were detected in forested Crown land adjacent to BNP. As stipulated in the departmental business goals, a management program was undertaken in 2002/2003. The provincial MPB management strategy is described in the "Mountain Pine Beetle Management Strategy" (Alberta Sustainable Resource Development, 2002).

Parks Canada also undertook a mountain pine beetle initiative to limit the eastward spread on MPB across the continental divide region of the Mountain District National Parks. This program, aimed at reducing forest susceptibility to MPB, provided for coordination with similar programs on adjacent provincial lands.

3.2 Prevention

Restrictions of Movement of Pine Logs and Products

Alberta's *Timber Management Regulations* under the *Forests Act* stipulate that imported shipments of coniferous logs or forest products with bark attached must accompany written authorization from the Minister. Authorizing the importation of specific shipments is based on the product having a low risk of either causing or increasing the damage to forest growth by insects or diseases. The Ministerial Order 12/2003, prohibited the transportation within Alberta of pine logs and forest products with bark attached, between June 1st and October 1st, 2003.

With the assistance of Alberta Transportation - Inspection Services, SRD monitored importation of unauthorized shipments of pine with bark attached through regular vehicle inspections and random checkstops. Between May 1 and October 31, 2003, no unauthorized shipments were intercepted. In comparison, 18 unauthorized shipments were intercepted in 2002.

3.3 Mountain Pine Beetle Control

3.3.1 Forested Crown Land

2002/2003 Surveys

In the Bow Valley in the southern section of the Southwest Corporate Region 1253 green-attack trees were identified during the initial ground surveys. However, some of these trees were found to be killed by other bark beetles such as the red turpentine beetle, *D. valens* LeConte, and the lodgepole pine beetle, *D. murrayane* Hopkins. Consequently, a ground truthing was carried out; this narrowed down the number of green-attack trees to 1013.

Control Plan

Once the survey was completed, an MPB control plans was developed in consultation with the Department of Community Development that has jurisdiction over provincial parks. Wide publicity to the proposed control plan was provided through mass media (newspapers, radio talks, television presentations, leaflets and telephone interviews). The control plan was implemented once the stakeholders' review was over. The infested area was divided in to five Beetle Management Units (BMU) (Figure 9). Cut and burn and sanitation harvesting were identified as control treatments. One of these two treatments was identified as the chosen method of control in a given BMU.

Control Action

Due to close proximity to trails, salvage harvesting was used in Grassi Lakes “A” BMU to remove the infested trees. The salvage plan was formulated by Community Development in consultation with Sustainable Resource Development and the Nordic Centre. This operation was combined with the removal of trees that posed either a high hazard or interference with the trails. Altogether, 224 infested trees and 173 other trees were removed between March 24-28 from this area. The trees were mechanically felled, delimbed and the logs were moved to a loading area by using a grapple skidder. The debris was burned on site.

Grassi Lakes “B” BMU included the infested trees scattered outside the sanitation block in Grassi Lakes “A.” Cutting and burning was the chosen method of MPB control in this BMU. A qualified contractor felled and burned 40 infested trees in this area.

Cutting and burning was prescribed for infested trees in BMUs of Canmore Southeast, Canmore North and Nordic Centre. The crews were directed to survey one hectare around each infested tree. Any additional infested trees found by the crews were tallied, measured and burned similarly.

Altogether 785 infested trees were cut and burned in the forested Crown land in Canmore area. All the control operations were completed by March 30, 2003. During the aerial surveys carried out in the fall, only 19 faders trees were detected in the control area and none was found outside the control area in the Bow Valley. Thus, the control program achieved a 98% success in detecting and removing the beetle-infested trees. The Town of Canmore and the developers treated 100% of the green-attack trees found within their landbases. (Table 3).

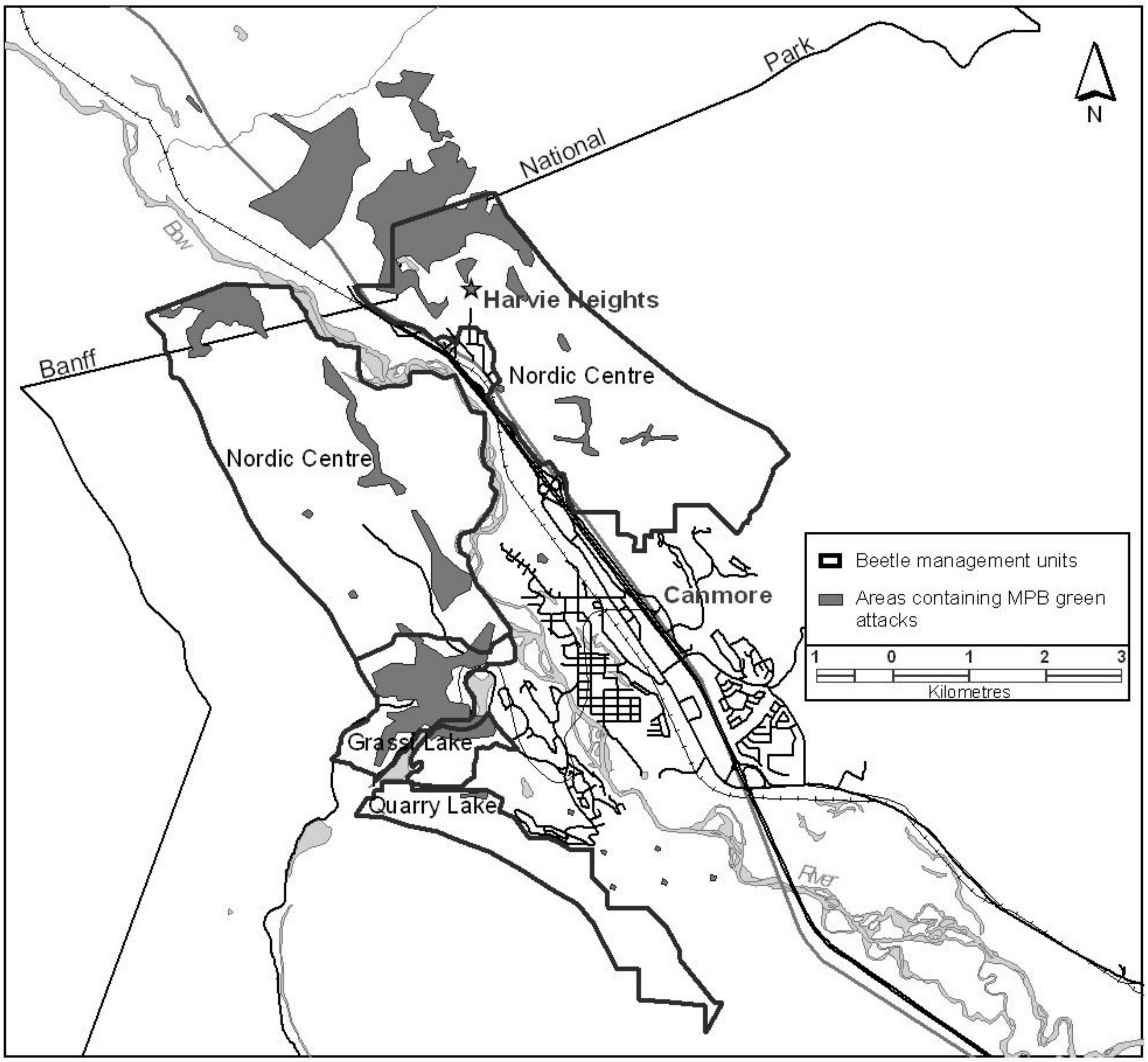

Figure 9. Mountain pine beetle management units in southern Alberta, 2002/2003.

3. 3.2 National Parks

Forest fire suppression in the past has increased the susceptibility of forest in mountain parks to mountain pine beetle. In view of this, the Mountain District of Parks Canada has undertaken a long-term plan to restore a representative stand structure and reduce forest susceptibility to the MPB. This project is closely coordinated with the MPB management programs on adjacent provincial lands.

Banff National Park
The MPB-infested area within Banff National Park (BNP) is divided into a monitoring zone and a management zone. Beetle management action is confined to the management zone (Figure 10).

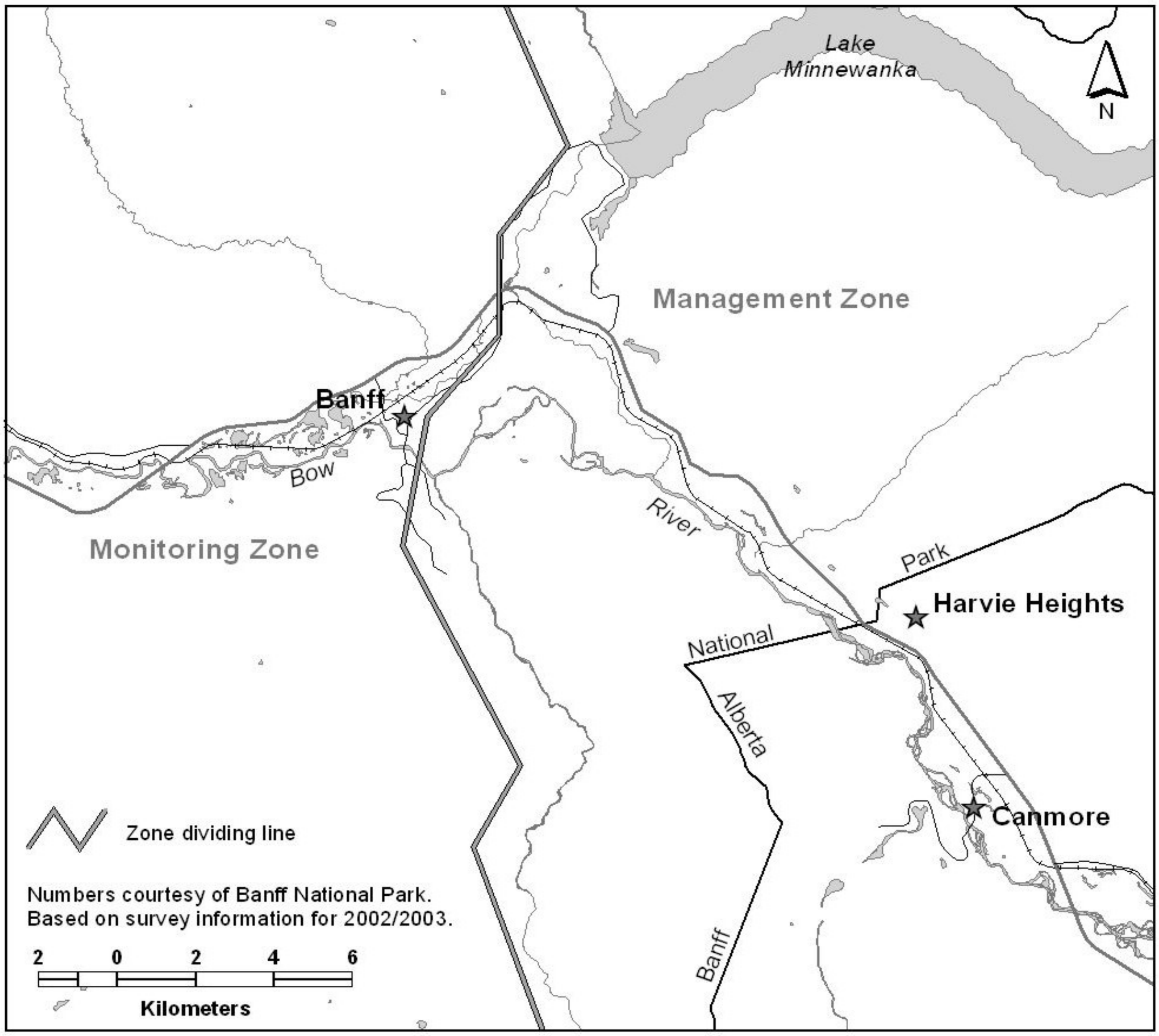

Figure 10. Mountain pine beetle management zones and monitoring zones in Banff National Park in Alberta, 2003.

In 2002/2003, crews burned 4420 hectares of beetle-susceptible forest stands within the management zone of BNP. During this period, 4150 green-attack trees were detected in the MPB management zone of BNP. Under the management program, 1853 (65.1%) of the estimated 3000 green-attack trees were removed from Fairholm Range in 2002/2003. As well, 872 (75.8%) of the estimated 1150 green-attack trees in Tunnel Mountain were removed. In addition, 524 pheromone baits were deployed in Fairholm Range to contain the beetles for the 2003/2004 treatment program Table 3).

4.0 RESEARCH AND DEVELOPMENT

4.1 Woodborer Impact Study

In 2002, the Forest Health Section initiated a two-year field study to compare the incidence and impact of woodborer vs. checking damage (splitting) in fire-killed timber. Three one-hectare blocks each representing a light, moderate or a severe burn were selected in the burned area by the House River Fire. Four plots were laid out in each block.

Half of these trees were harvested in 2003 winter and the logs from each plot were piled separately in a mill yard. Once the pre-selected trees have been sampled, the logs were cut into merchantable sizes and debarked to assess the incidence of woodborer and checking. Later the logs were processed at a small sawmill and the resulting lumber was graded based on the 'worm-holes' and checking damage. This process will be repeated for the other half of the trees in the plots in 2003/2004 winter.

Results to date indicate that at the end of the first year after fire:

- Woodborer damage is common in dimension lumber cut from fire-killed trees within one year of the fire.
- Woodborer damage is most prevalent in moderately burned timber where as checking is most prevalent in severely burned timber.
- The impact of woodborer damage on the commercial grades is low (Table 4) except in one-inch thick dimensional lumber used for cosmetic purposes. In one-inch thick lumber pieces, the "worm-holes" degrade the commercial value more readily than in structural lumber (two or more inches thick).
- Checking has a bigger impact on the grade of dimensional lumber that is thicker than one inch.

Table 4. Frequency of occurrence of woodborer vs. checking damage and their impact on grade of lumber cut within the first year from fire-killed timber.

Burn intensity	# of Pieces	Woodborer Damage		Checking Damage	
		Damage	Impact	Damage	Impact
Light	250	10%	0%	19%	9%
Moderate	182	71%	2%	31%	13%
Severe	167	38%	4%	49%	15%

4.2 Mountain Pine Beetle Dispersal and Spread model

Hideji Ono, Erica Lee and Cody Crocker of the Forest Health Section participated in a project by the Foothills Model Forest (FMF) to develop a model to predict the spread of the mountain pine beetle (MPB). This model was developed by research scientists from the Pacific Forestry Centre of Canadian Forest Service and Gowlland Technologies Ltd.

The model was developed to assess the potential impacts of the mountain pine beetle (MPB) on pine resources within the FMF. The main goal of this project was to determine under what conditions would an MPB outbreak occur. The MPB management activities in the different management areas within the FMF were evaluated for their effectiveness at minimizing the potential for an outbreak.

The project involved inputting geographic, forest inventory, weather and mountain pine beetle infestation data for the study area into the system and projecting it using the Spatially Explicit Landscape Event Simulator (SELES), a landscape modeling tool, to evaluate potential MPB activity, primarily in terms of areas affected and volumes killed by the beetle. During the modeled outbreak, various management scenarios were tested for effectiveness. The modeled outbreak continued for 20 years with impacts assessed on year 10 and year 20.

Outputs of the model included a susceptibility map of the entire FMF area, which identifies stands that are more likely to be attacked and sustain damage due to their characteristics. As the beetles develop and disperse over the landscape over time, the most likely dispersal pattern is mapped over a 20-year period. The number of hectares affected and, the volume and percent of trees killed are summarized.

Various scenarios were run to assess the conditions under which an outbreak may occur. Ninety-six scenarios were developed and tested based on factors such as warmer weather conditions, increased or decreased beetle presence, increased or decreased immigration of beetles, and increased or decreased beetle management.

Conclusions reached by the model are as follows:

- The potential for an outbreak is present and could increase provided the weather conditions are conducive to beetle development and there are moderate to high levels of MPB pressure (immigrating beetles)
- Vigilant spot detection and adequate levels of cut and burn treatments are likely to be critical to minimizing the development of an outbreak. If an outbreak reaches the size beyond which cut and burn treatments are ineffective, other larger scale treatments may need to be considered.
- An outbreak is unlikely to reach the Weldwood Forest Management Area within 10 years, although, under certain conditions the potential exists. A focus on reducing the susceptibility while monitoring for spots both within the FMA and in nearby areas is warranted.

4.3 Forest Health Monitoring System

The implementation of the forest health monitoring system in the Northwest Corporate Region was initiated in 2003. In addition to SRD, four forest companies are participating in this project. These industry participants complete growth and yield measurements within their permanent sampling plot networks. A contractor will collect and store required forest health data database. This is a long-term project to find the impact of forest pests in this region.

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Forest Pest Conditions in Saskatchewan 2003

Ravageurs forestiers (Insectes et maladies des arbres) en Saskatchewan en 2003

Presented by:
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Abstract

The eastern spruce budworm *Choristoneura fumiferana* remains the most significant insect pest in Saskatchewan's Boreal Forest. Since 1981, 3.1 million ha have been severely defoliated. Systematic aerial surveys conducted in 2002 revealed 669,591 ha of moderate to severe defoliation. Blocks selected for treatment in 2003 were located in three main geographic areas: Amisk lake, Big River and around Lac LaRonge. Commencing May 31, 2003, an area of approximately 41,000 ha of severely defoliated forest was treated with single or double applications of *Bacillus thuringiensis* var. *kurstaki* (Foray 76B). The SBW-DSS was implemented in Saskatchewan to plan an operational program for the first time since its development over a decade ago. The DSS was used to optimize operational planning and spray block selection, and to assign ranking to determine application and treatment priorities. Spray deposit, as measured by ADAM kits, was on average moderate to low. Post-treatment population reduction was good in most areas. Percent defoliation reduction in spray versus control blocks was highly variable, however this may be attributed to the fact that in 2003 there were a high proportion of blocks receiving treatment for the first time. The intensive study to determine the potential impact of *B.t.k.* on non-target songbirds continued for the second and final year.

Forest tent caterpillar *Malacosoma disstria* populations were low and no areas of severe defoliation were detected in the aerial surveys over the provincial forest. However, FTC populations continue to build along the Saskatchewan-Manitoba border. Aspen defoliation in the 215 ha of Aspen in the core area of Good Spirit Provincial Park treated with one application of Foray 48B was as low as 22% as compared to 76% in control blocks. In 2004 predicted defoliation levels around the park, range from moderate to moderate-severe. In 2003, Dutch elm disease (DED) *Ophiostoma novo-ulmi* continued to spread slowly in the province. Two new communities had infections, however, overall fewer trees (63) were removed from communities and a further 302 were removed in buffer zones for a grand total of 365. Lodgepole pine dwarf mistletoe *Arceuthobium americanum* remains the most significant pest of Jack pine. Management, through silvicultural sanitation is ongoing. Draft Provincial standards and guidelines are in preparation and should be complete by 2004. In 2002, drought caused significant mortality in Jack pine plantations in the Nisbet forest in the Aspen Parkland EcoRegion. An area estimate is to be determined. Mountain pine beetle *Dendroctonus ponderosae* remains a major concern and import restrictions continue. Long-term strategic approaches are being explored and management activities, to reduce the hazard in some high-risk

areas, are ongoing. Other forest health issues of interest in the province include: Damage from Yellowheaded spruce sawfly *Pikonema alaskensis*, the Larch bark beetle *Dendroctonus simplex*, and the Poplar borer *Saperda calcarata,* continues to increase in 2003. In addition, the spruce weevil *Pissodes strobi*, Jack pine budworm *Choristoneura pinus pinus,* are considered significant forest insect pests. In 2003, routine CFIA Gypsy moth *Lymantria dispar* survey activities were expanded to include an additional 25 traps deployed by Saskatchewan Environment in and around parks throughout the Province. At this time, none are confirmed positive.

Résumé

La tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana*) est le plus important insecte ravageur dans la forêt boréale de la Saskatchewan. Depuis 1981, 3,1 millions d'hectares ont été gravement défoliés. Les relevés aériens systématiques effectués en 2002 ont révélé la présence de 669 591 ha de défoliation modérée à grave. En 2003, les zones de traitement sélectionnées se trouvaient dans trois grandes régions géographiques, soit le lac Amisk, la rivière Big et les environs du lac La Ronge. Une superficie d'à peu près 41 000 ha de forêt gravement défoliée a reçu des applications uniques ou doubles de *Bacillus thuringiensis* var. *kurstaki* (Foray 76B) qui ont débuté le 31 mai 2003. La Saskatchewan a eu pour la première fois recours au SAD-TBE, un système d'aide à la décision pour la tordeuse des bourgeons de l'épinette mis au point il y a plus d'une décennie, pour planifier son programme opérationnel. Le SAD a servi à optimaliser la planification des opérations et la sélection des zones à traiter ainsi qu'à effectuer un classement pour fixer l'ordre de priorité des applications et des traitements. Le dépôt de l'insecticide pulvérisé, tel que mesuré par les trousses ADAM, était en moyenne modéré à faible. La réduction des populations observée après les traitements était bonne dans la plupart des secteurs. La diminution du pourcentage de défoliation dans les secteurs traités par rapport aux parcelles témoins était très variable, une situation qui peut toutefois être due à la proportion élevée de parcelles traitées pour la première fois en 2003. L'étude intensive menée pour cerner l'impact potentiel du *B.t.k.* sur les oiseaux chanteurs s'est poursuivie pour une deuxième et dernière année.

Les populations de la livrée des forêts (*Malacosoma disstria* (Hübner)) ont été faibles, et aucune zone gravement défoliée n'a été détectée lors des relevés aériens des forêts provinciales. Les populations de ce ravageur n'en continuent pas moins d'augmenter le long de la frontière Saskatchewan-Manitoba. La défoliation des peupliers faux-trembles des 215 ha de tremblaie de la zone centrale du parc provincial Good Spirit ayant reçu une seule application de Foray 48B était descendue jusqu'à 22 % comparativement à 76 % dans les parcelles témoins. En 2004, la défoliation prévue autour du parc va de modérée à modérée-grave. En 2003, la maladie hollandaise de l'orme, causée par l'*Ophiostoma novo-ulmi*, a continué de se propager lentement dans la province. Des foyers d'infection ont été découverts dans deux nouvelles collectivités, mais, dans l'ensemble, un moins grand nombre d'arbres (63) a été abattu dans les différentes collectivités et 302 autres l'ont été dans des zones tampons, pour un total de 365. Le faux-gui

(*Arceuthobium americanum*) demeure la plus grand ennemi du pin gris et des mesures sanitaires sont actuellement en cours pour le réprimer.

Des projets de normes et de directives provinciales sont en cours d'élaboration et devraient être prêts d'ici 2004. En 2002, la sécheresse a provoqué une mortalité importante dans les plantations de pin gris de la forêt Nisbet, dans l'écorégion de la tremblaie-parc. Une estimation de la superficie touchée sera établie. Le dendroctone du pin ponderosa (*Dendroctonus ponderosae*) demeure une grande préoccupation et les restrictions concernant l'importation de bois de pin sont toujours en vigueur. Des approches stratégiques à long terme sont à l'étude, et des opérations d'aménagement sont en cours pour réduire les risques dans certains secteurs très vulnérables. Parmi les autres ravageurs préoccupants dans la province figurent la tenthrède à tête jaune de l'épinette (*Pikonema alaskensis*), le dendroctone du mélèze (*Dendroctonus simplex*) ainsi que la saperde du peuplier (*Saperda calcarata*) dont les dégâts et les populations ont continué d'augmenter en 2003. De plus, le charançon de l'épinette (*Pissodes strobi*) et la tordeuse du pin gris (*Choristoneura pinus pinus*) sont considérés comme des insectes ravageurs importants. En 2003, l'ACIA a intensifié ses relevés réguliers de la spongieuse (*Lymantria dispar*) et a ajouté 25 nouveaux pièges qui ont été déployés par le ministère de l'Environnement de la Saskatchewan dans et autour de parcs situés un peu partout dans la province. À ce jour, aucun de ces pièges n'a permis de capturer de spongieuse.

Introduction

The spruce budworm *Choristoneura fumiferana* remains the most significant insect pest in Saskatchewan's Boreal Forest. Since 1981, 3.1 million ha have been severely defoliated. 2002 aerial surveys revealed 669,591 ha of moderate to severe defoliation. Commencing May 31, 2003, an area of approximately 43,095 ha of severely defoliated forest was treated with single or double applications of *Bacillus thuringiensis* var. *kurstaki* (Foray 76B) in three geographic areas: Amisk lake, Big River and around Lac LaRonge. The Spruce budworm Decision Support System (SBW-DSS) was implemented in Saskatchewan to plan an operational program for the first time since its development in Canada over a decade ago. Post-treatment population reduction was good in most areas. Overall, mean defoliation in treatment blocks was significantly lower than controls ($P<0.001$) however defoliation rates were highly variable. Variability might be attributed to the high proportion of blocks receiving treatment for the first time in 2003. The intensive study to determine the potential impact of *B.t.k*. on non-target songbirds continued for the second and final year.

Forest tent caterpillar *Malacosoma disstria* populations were low and no areas of severe defoliation were detected in the aerial surveys over the provincial forest. FTC populations continue to build along the Saskatchewan-Manitoba border. Aspen defoliation in 215 ha of Aspen in the core area of Good Spirit Provincial Park was treated with one application of Foray 48B. Defoliation in treated areas was 22% as compared to 76% in control blocks. In 2004 predicted defoliation levels around the park, range from moderate to moderate-severe. In 2003, Dutch elm disease (DED) *Ophiostoma novo-ulmi* continued to spread slowly in the province. Two new communities had infections, however, overall fewer trees (63) were removed from communities and a further 302 were removed in buffer zones for a grand total of 365. Lodgepole pine dwarf mistletoe *Arceuthobium americanum* remains the most significant pest of Jack pine. Management, through silvicultural sanitation is ongoing. Draft Provincial standards and guidelines are in preparation and should be complete by 2004. In 2002, drought caused significant mortality in Jack pine plantations in the Nisbet forest in the Aspen Parkland EcoRegion. Mountain pine beetle *Dendroctonus ponderosae* remains a major concern and import restrictions continue. Long-term strategic approaches are being explored. Other forest insect pests including: Yellow headed spruce sawfly *Pikonema alaskensis*, the Larch bark beetle *Dendroctonus simplex*, and the Poplar borer *Saperda calcarata,* continued to increase in 2003. In addition, the spruce weevil *Pissodes strobi*, Jack pine budworm *Choristoneura pinus pinus,* are considered significant forest insect pests. In 2003, Saskatchewan Environment expanded routine CFIA Gypsy moth *Lymantria dispar* survey activities. At this time none are confirmed positive.

This report can be seen at:
http://www.se.gov.sk.ca/forests/reports_publications.htm

The spruce budworm *Choristoneura fumiferana* (Clemens)

The spruce budworm *Choristoneura fumiferana* (Clemens) (Figure 1) is the most significant pest of Saskatchewan's Boreal Forest. Host trees include white spruce (*Picea glauca* (Moench) Voss.), upland black spruce (*Picea mariana* (Mill.) B.S.P.) and balsam fir (*Abies balsamea* (L.) Mill.). The outbreak began in the early 1980's and has been increasing since then. By the 2003 spray season, 5,097,850 ha of spruce and fir forests had sustained moderate or severe defoliation. Aerial surveys in 2003 showed moderate to severe defoliation in 511,780 ha. This area of forest is lower than in 2002 (Figure 2).

Figure 1. Spruce budworm larva

The outbreak is located predominantly in three major geographic regions: the Prince Albert National Park area, around Lac LaRonge in north central Saskatchewan and Creighton in northeastern Saskatchewan (Figure 3). Aerial defoliation surveys in late summer and subsequent overwintering larval surveys conducted in the fall of 2002 indicated that spruce budworm (SBW) populations would likely remain high throughout most of the infested area and that the forest would continue to suffer moderate to severe levels of defoliation in 2003.

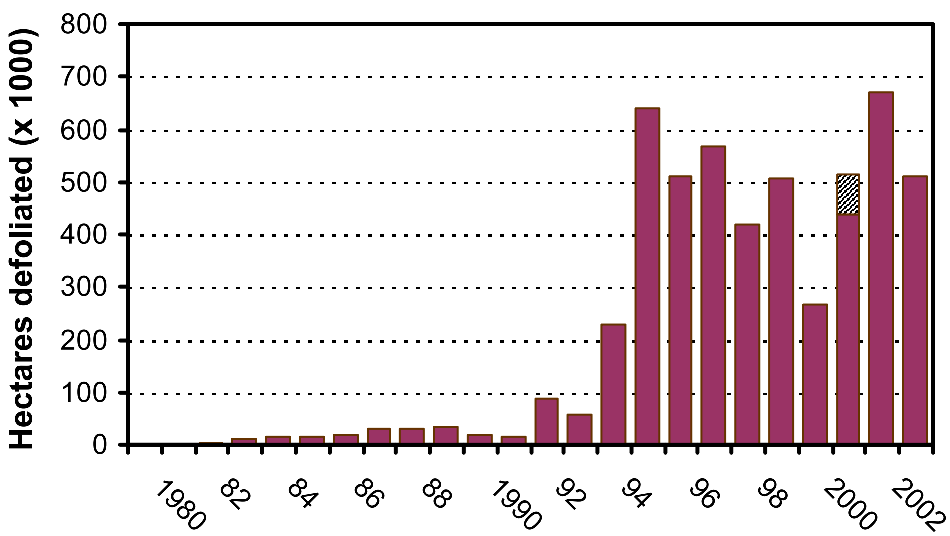


Figure 2. Area of moderate to severe defoliation caused by the spruce budworm *Choristoneura fumiferana* 1980-2003.

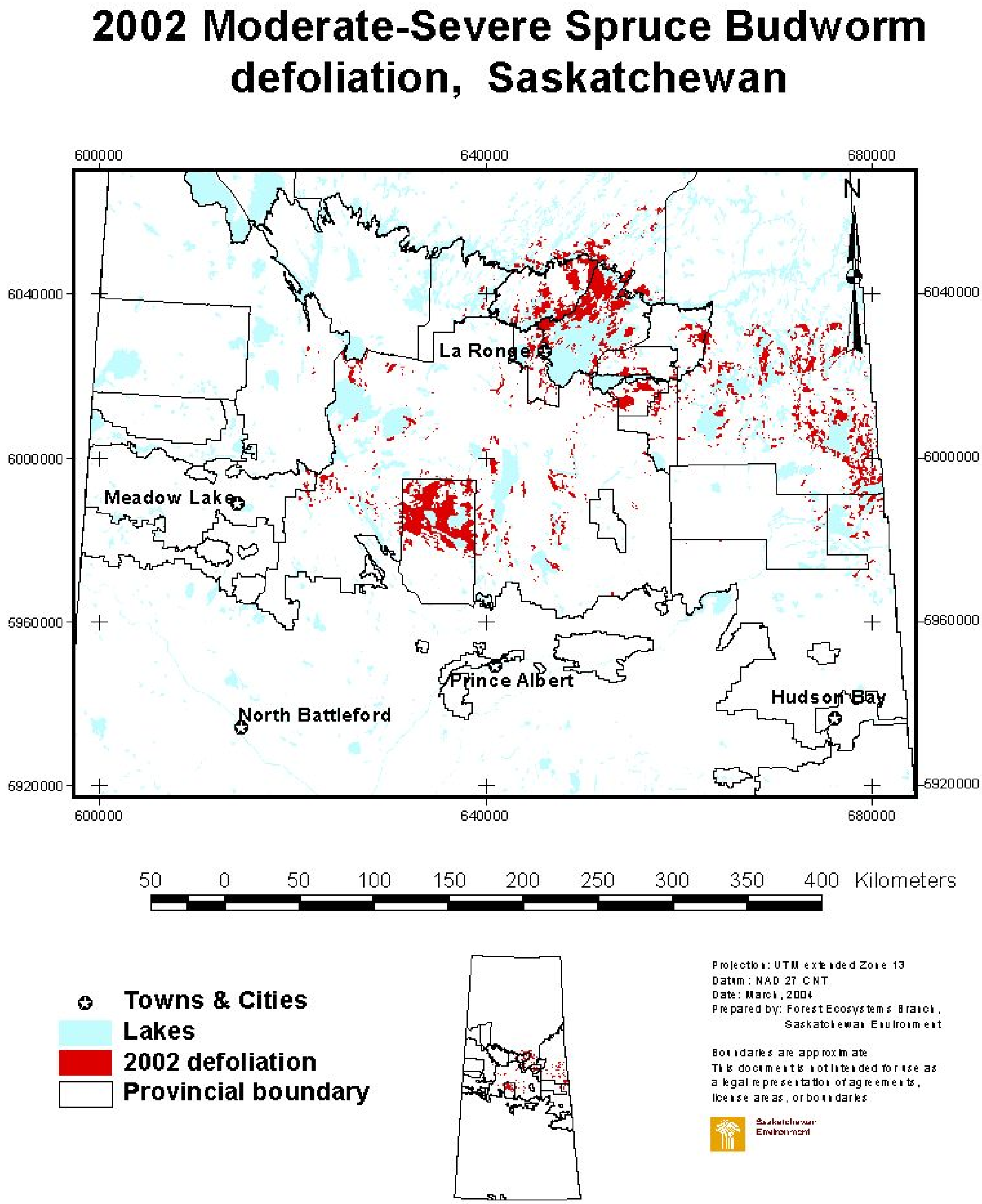


Figure 3. Geographic extent of moderate to severe spruce budworm *Choristoneura fumiferana* defoliation as determined through systematic aerial surveys conducted in Saskatchewan in 2002.

Operational Spray Program

Saskatchewan Environment (SE) has conducted a successful foliage protection program against the SBW over the past seven years. Using historical SBW defoliation records, 2002 L2 forecasts, and forest management plans; SE developed an aerial spraying program to spray 43,095 hectares in 2003. All 2003 treatment areas were planned and prioritized through implementation of the Spruce budworm Decision Support System (SBW-DSS) developed by MacLean *et al.* (2000). This is the first implementation and use of the SBW-DSS to plan an operational program since its development in Canada over a decade ago. 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%.

Methods

In 2003, SE conducted operational spraying over 43,095 hectares of moderate to severely defoliated white spruce and mixed-wood forest (Table 1). Most of the operational spray blocks were treated with two applications of Foray 76B (Valent BioSciences) *Bacillus thuringiensis* var. *kurstaki* (*Btk*) with three to five days separating applications. Standard operational blocks received 2 applications of Foray 76B @ 30BIU/1.5L/ha. Songbird research study blocks received the same.

The 2003 operational spray blocks were treated from three airstrips: Big River (Norton IBR and Green Lake blocks); LaRonge (Weyakwin blocks); and Bakers Narrows (Baker and Deschambault Lake blocks) (Table 1). The songbird research study was continued in the two geographically separate locations: southeast of Deschambault Lake and East of Amisk Lake in the Creighton area.

Table 1. Summary of the Saskatchewan spruce budworm operational spray program, 2003.

	Airbase			
	Big River	**LaRonge**	**Bakers Narrows**	Total Area (ha)
Start date	May 30	June 1	June 2	
Termination date	June 4	June 9	June 10	
Area sprayed (ha)				
2 x 30 BIU	9,511	13,107	13,372	35, 990
1 x 30 BIU	1,301	3,053	2,751	7,105
Total Area sprayed (ha)	10,812	16,160	16,123	43,095

Aircraft
In total, 5 spray aircraft provided by Battlefords Airspray and Wetaskiwin Aerial Applicators Ltd. were used in the 2003 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 Big River, LaRonge and Bakers Narrows (Manitoba) airstrips. One observer aircraft was used to monitor the operational treatments at each active airbase.

Weather
From March 1, 2002, climate information was obtained from Saskatchewan Environment and Atmospheric Environment Services, Environment Canada stations in Prince Albert, Big River 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. During the operational spray program, local weather data (temperature, relative humidity, precipitation, wind speed and 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
As in previous years, the 2003 SBW aerial spray 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 regularly at locations distributed throughout the spray area. On each sample date, SBW larvae (n>50) were collected from host white and black spruce to determine the LDI using the procedure described by Dorais and Kettella (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 at each plot. Augers' Balsam-fir bud classification system was used to evaluate bud flush and shoot elongation. 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 at 57 locations in the Amisk Lake and Big River areas. Accurate Deposit Assessment Methodology (ADAM) field kits, supplied by Valent BioSciences, were used to provide an estimate of *Btk.* protein deposition in ng/mL. Mid-crown foliage samples were collected from a total of 301 spruce trees within 24 hours of application. All samples were stored at 4ºC until they could be processed in Prince Albert. Several new shoots were removed from each branch sample for processing. Results were coded and a Deposit Index (DI), ranging from 1 (Nil) to 4 (high), was calculated for each sample. Mean DI per block was used to rate and compare spray deposit within and between blocks.

Deposit Index
1 = Nil (0 ng *Btk*)
2 = Low (<20 ng *Btk*)
3 = Moderate (20-100 ng *Btk*)
4 = High (> 100 ng *Btk*)

Spray Efficacy Assessment
In total, 27 spray assessment plots (six white spruce per plot) were established in treatment blocks. A further 27 plots (19 white spruce and 7 black spruce) were established in the birds study areas. Overall, 38 plots (31 white spruce and 7 black spruce) were assessed in unsprayed control areas to compare with treatment blocks. A single mid-crown branch (45 cm) was collected from each dominant or co-dominant sample tree for pre-spray and post-spray evaluation. The focus of the assessment was on foliage protection, but estimates of population reduction attributable to the treatment were also determined. Analysis of variance procedures (*ANOVA*) were used to determine differences between defoliation measures in treatment and control blocks.
Population Measures
Pre-spray samples were collected from May 27 and June 3 from each assessment block. Post-spray samples were collected between June 22 and June 26, on termination of spruce budworm feeding activity. All samples were stored at 4ºC until processed at the foliage mill in Prince Albert. A correction factor was calculated and applied to the remaining branches. Population estimates were made on a per-branch and per-bud basis.
Defoliation Assessment
Pre- and post-spray defoliation was assessed in all plots during pre-spray (May 27-June 3,) and post-spray (June 22-26) collection periods. Defoliation was quantified on all sample trees in each sample plot using the detailed Fettes method (Fettes 1950).

Research- Bird Study
In 2003, each of the six treatment blocks was treated with two applications of Foray 76B at an application rate of 30BIU/1.5L/ha with three days separating each application. The spray was delivered using an Air Tractor AT 502B, equipped with SatLoc GPS Guidance Systems and six AU 4000 Micronaire atomizers and Crophawk flow systems. Deposit was measured using ADAM field kits and pre-spray and post-spray SBW population and defoliation data were collected in treatment and control blocks.

Recording:
All songbird recordings commenced 30 minutes before published dawn (approximately 04:00) and ended at 08:00 using protocols developed by the Canadian Wildlife Service and as described by Hobson *et al.* 2000. In each of the 12 study blocks, crews using 3 CVX 360 omnidirectional microphone systems recorded at 3 locations in each block within a 100 m edge buffer. CVX microphones were deployed such that all songbirds calling within 60-80 m of each study block were recorded. Recordings were conducted pre-spray and approximately 4 days following each of the two subsequent spray treatments. Pre-spray recordings were completed May 29-30 and June 1, in McMurdo Lake and Deschambault Lake areas respectively. All subsequent post-spray recordings were completed by June 18, 2003 (Table 2). Bird calls were recorded digitally to an MZ-N type R portable Sony® mini disc recorder[10] and stored to CD-ROM for later review by an experienced ornithologist.

Table 2. Summary of pre and post-spray songbird recording dates (shaded rows) as compared to Foray 76B spray treatment dates in the McMurdo Lake and Deschambault Lake study areas, Saskatchewan 2003.

Recordings		**Study Area**	
	Spray Treatments	**McMurdo Lake**	**Deschambault Lake**
Pre-spray		May 29 and 30	June 1
	Spray #1	June 4	June 7
Post-spray 1		June 8	June 10
	Spray #2	June 9	June 10
Post-spray 2		June 16	June 18

Data Analysis:
Measures of species richness and diversity will be determined using the appropriate alpha- and beta-diversity indices. Mean numbers of species and individuals calling pre- and post-spray in each of the two study areas in each of the two years of study will be compared. Differences between means will be analyzed using analysis of variance (*ANOVA*). Multiple comparison tests will be used to determine differences between treatment means. In all cases $\alpha = 0.05$.

[10] River Forks Research Corporation. SIAST - Woodland Campus, Box 3003, Prince Albert, SK S6V 6G1

Results

Operational Spray Program

Spray Timing

The warmer than normal temperatures experienced in Saskatchewan in 2003 resulted in heat sum accumulations 10-20 days ahead of the normals. In 2003 the aerial spraying program in northeastern Saskatchewan was completed on June 10, four days earlier than the start of the 2002 program. The Green Lake and Norton spray blocks in the Big River area were open to treatment on May 30 and 31 when the HDI reached 4.0 (Figure 4A) and the LDI was between 4.4 (Norton) and 4.9 (Green Lake) as shown in Figure 4B.

A. Host Development Indices (HDI) **B. Larval Development Indices (LDI)**

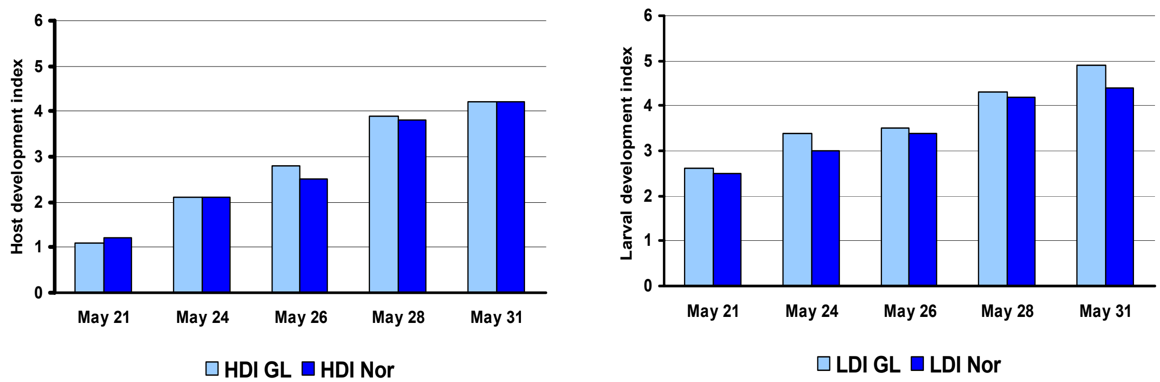


Figure 4. A. Host development indices (HDI); and B. spruce budworm larval development indices (LDI) in white spruce in the Green Lake (light shading) and Norton (dark shading) areas treated with Foray 76B (30BIU/1.5L/ha), Saskatchewan 2003.

The Weyakwin blocks in the LaRonge Area were open to the first application on May 31 when the HDI reached 4.3. The LDI was 4.6 indicating a high proportion of L4 to L5 instar larvae (Figure 5).

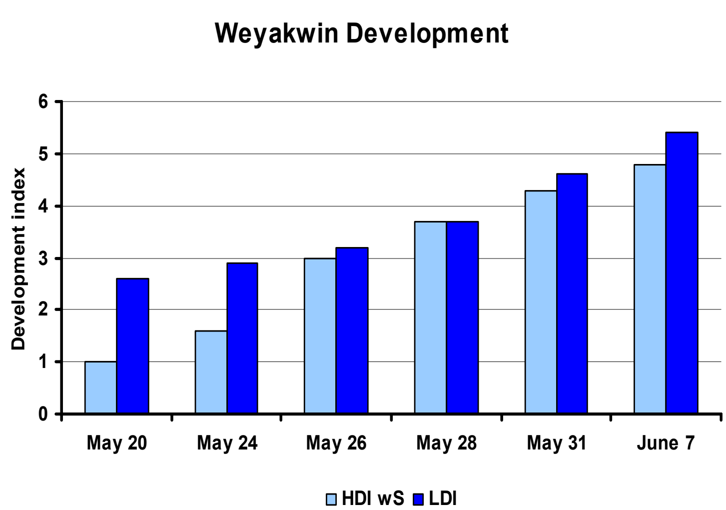
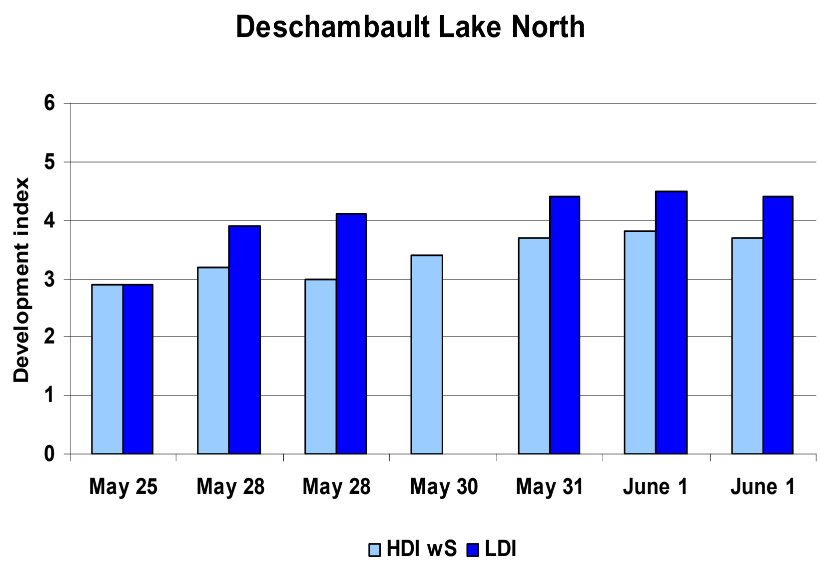


Figure 5. Host (light shading) and spruce budworm larval development (dark shading) indices in white spruce in the Weyakwin blocks treated with Foray 76B (30BIU/1.5L/ha), Saskatchewan 2003.

The Baker 3 and 4 blocks around Deschambault Lake in the Bakers Narrows operational area were open to the first application on June 3-4 respectively. At this time, when the HDI was well above 4.0 and the LDI was nearly 5.0 indicating a high proportion of L5 and even some L6 instar larvae (Figure 6).



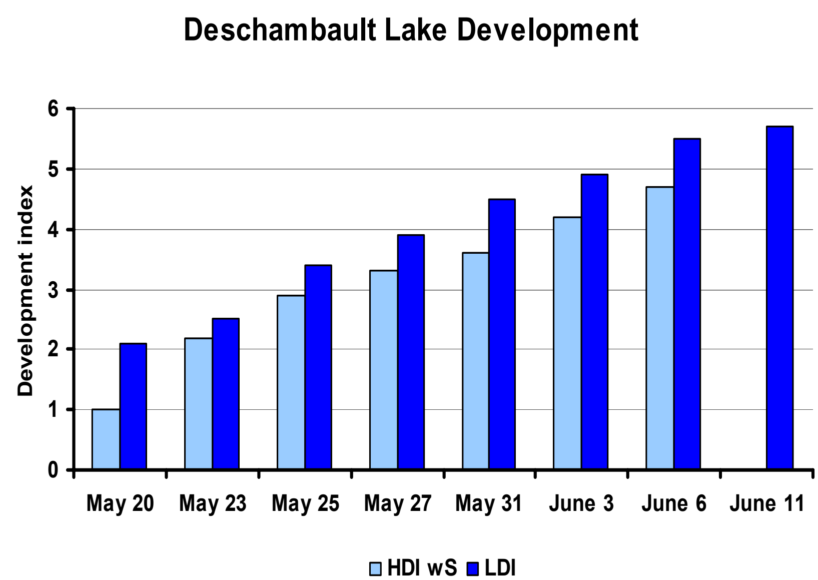


Figure 6. Host (light shading) and spruce budworm larval development (dark shading) indices in white spruce in the Deschambault Lake blocks treated with Foray 76B (30BIU/1.5L/ha), Saskatchewan 2003.

Spray Deposit
Overall, ADAM field kit results showed *Btk* deposit in 2003 was ***moderate***, and lower than in 2002. Deposit indices ranged from 2.0 – 3.0 and, in most cases, was higher in the second application than the first (Figure 7).

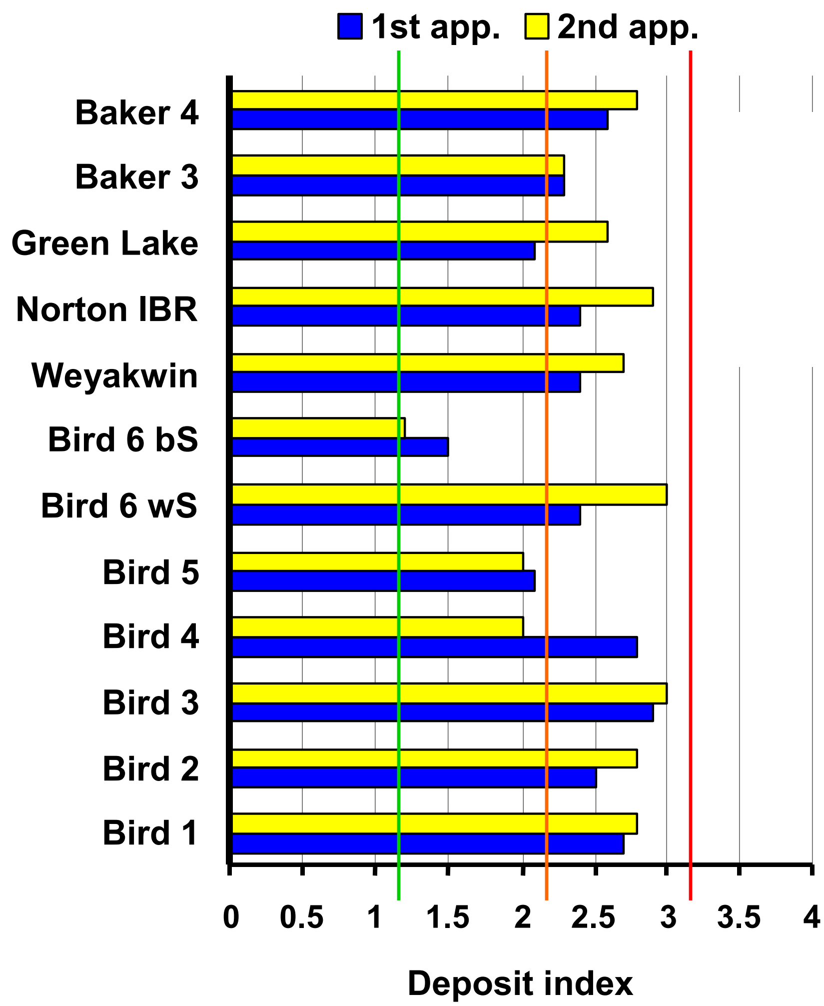


Figure 7. Deposit indices for each of two applications of Foray 76B, (30BIU/1.5L/ha) on white spruce foliage collected in Saskatchewan, 2003. (Note: Bird 6 blocks show deposit on white spruce (ws) and black spruce (bs).

Foliage Protection
Overall defoliation rates in the Big River spray blocks were significantly lower than in the unsprayed controls (*ANOVA*, *P*<0.001). Host defoliation was lowest in the Norton block followed by the Green Lake and Control blocks (Figure 8). Defoliation target of 40% was achieved in the Norton Block but exceeded in the Green Lake block.

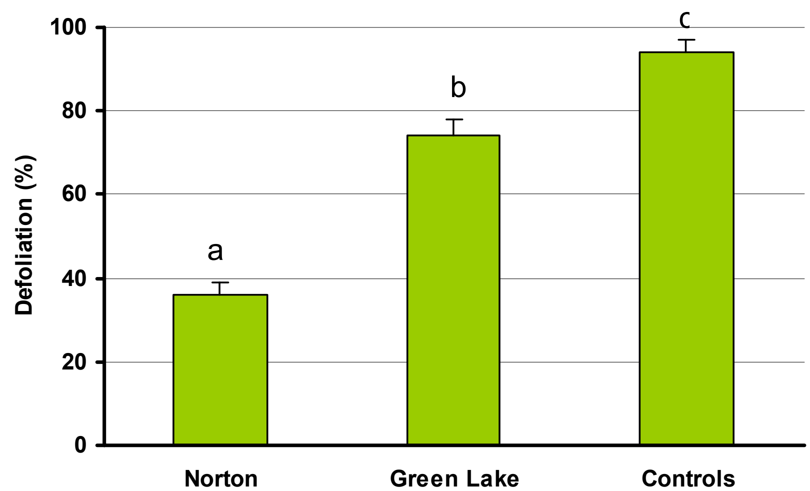


Figure 8. Mean percent (± SE) defoliation caused by spruce budworm on white spruce in the Big River area blocks treated with Foray 76B (2 x 30BIU/1.5L/ha) in Saskatchewan, 2003. Note: treatment means followed by same letter are not significantly different (Tukey's test, $P>0.05$).

Foliage protection in the Weyakwin block was minimal. Although defoliation in treatment (83%) was slightly lower ($P=0.03$) than controls (99%), defoliation rates exceeded the 40% operational target.

Foliage protection in the blocks around Deschambault Lake (Baker 3 and 4) showed that mean % defoliation was significantly lower in Baker 3 as compared to Baker 4 and the controls; however, there was no significant difference between Baker 4 and the controls.

Research - Bird Study

Recordings

An experienced ornithologist has reviewed these recordings and has listed the species present and number of individuals by species in each of the treatment and control blocks during each of the pre-spray and post-spray recording events. These data are currently under analysis.

Spray Deposit: Bird Study Blocks

Results of the ADAM Kit analyses of foliage samples in the Bird Study blocks showed moderate coverage in the spray blocks and high levels of deposit on the foliage. A majority of the deposit ranked between 2.5 to 3.0 on the DI (see Figure 7). As expected, the deposit on black spruce was lower than on white spruce. The operations are timed based on the development of the majority of the target host trees in the area (i.e. white spruce). When the HDI for white spruce has been reached, black spruce development is generally behind 8-10 days.

Foliage Protection – Bird study blocks

White spruce defoliation (Figure 9A) in each of the treatment blocks was significantly lower than in the controls (*ANOVA*, *P*<0.001). Defoliation targets were met in Blocks 1,2 and 3; however, these targets were exceeded in blocks 4 and 6. Defoliation levels in the black spruce treatment blocks were reduced significantly (*ANOVA*, *P*<0.001) as compared to controls (Figure 9B) and black spruce defoliation rates in the Bird Study spray blocks were significantly lower than defoliation rates observed in the controls (*ANOVA*, *P* = 0.05) (Table 3). Target defoliation rates of 40% on white spruce were not achieved in any of the five spray blocks assessed. Pre-spray budworm populations on the white spruce were somewhat higher in the spray blocks (avg. = 58.5 larvae per branch) than in the controls (avg. = 46.7 larvae per branch). Overall, white spruce defoliation averaged 73 percent in the spray blocks compared to 96 percent in the controls. Pre-spray budworm populations on black spruce were similar in the spray and control plots. Black spruce defoliation averaged 33 percent in the spray blocks compared to 69 percent in the controls.

A. White Spruce **B. Black Spruce**

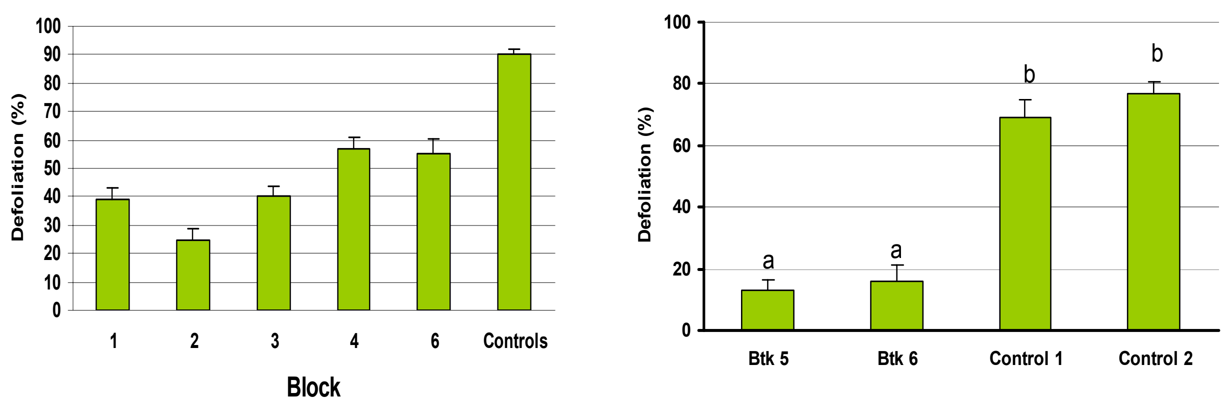


Figure 9. Mean percent spruce budworm defoliation (± SE) in white spruce (A) and black spruce (B) in the Bird Study blocks treated with two applications of Foray 76B (30 BIU/1.5L/ha) in Saskatchewan, 2003. Note: treatment means followed by same letter are not significantly different (Tukey's test, *P*>0.05).

Summary of Spruce Budworm Operational Spray Program 2003

- The area of moderate to severe defoliation by spruce budworm in Saskatchewan decreased from 669,591 ha in 2002 to 511,780 ha in 2003. However, some of this reduction might be attributed to rain creating poor mapping conditions at the time of the 2003 Aerial survey.
- Operational spray planning incorporated the use of the Spruce Budworm Decision Support System. This was the first operational use of this system since its development over a decade ago.
- In total, 43,095 ha of moderate to severely defoliated forest were treated with either a single or double application of the biological insecticide Foray 76B (*Bacillus thuringiensis* var. *kurskaki*). 35, 990 ha received a double treatment while 7,105 ha received a single treatment. All treatments were at a rate of 30BIU/1.5L/ha.

- Battlefords Airspray and Wetaskiwin Aerial Applicators conducted aerial spray services. Between May 30 and June 10, Five 502B Air Tractors flew loads out of LaRonge, Big River and Bakers Narrows (MB) airstrips.
- In 2003, weather records showed that temperatures across the spray area were warmer than normal. Heat sum accumulation above 2.8ºC was 10-20 days ahead of normal. Consequently, the 2003 aerial spraying program began on May 30 and ended June 10, more consistent with timing experienced in the 2001 program.
- Spray deposit was assessed using the ADAM Field kit supplied by Valent BioSciences. Results showed that deposit in 2003 was overall lower than deposit rates in 2002. In 2003, deposit was moderate, indices ranged from 2.0-3.0. There are no simple explanations for the difference in deposit between years. Field crews reported in at least one location that foliage collected for deposit assessment was still wet from the precipitation the previous day. Similarly, deposit levels in 2002 were unusually high.
- Overall, post-spray budworm larval populations in Saskatchewan, measured on a ***per bud*** basis, were significantly lower in sprayed blocks than in unsprayed controls ($P<0.001$).
- Investigations into the potential environmental impact of *B.t.k* applications on non-target songbirds continued for a second year. Analysis of variance showed that defoliation on white and black spruce in each of the treatment blocks was significantly lower than in the controls ($P<0.001$).
- On average, defoliation rates in the treatment blocks were significantly lower than controls ($P<0.001$) at all population densities.

Spruce Budworm Forecast for 2004

Budworm overwintering larval surveys (L2) were conducted in September and October. All foliage samples were processed by BioForest Technologies at the L2 washing facility in Sault Ste. Marie, Ontario. Based on 2003 aerial defoliation surveys and the results of the L2 survey, it is anticipated that populations will remain high in the Amisk area in the Mid-Boreal lowland and Churchill Upland Ecozones, as well as building populations in the Big River area in the Mid-Boreal Upland EcoRegion of Saskatchewan.

FOREST TENT CATERPILLAR *Malacosoma disstria* Hübner

Outbreaks of the forest tent caterpillar *Malacosoma disstria* (FTC) occur about every ten years within the range of the preferred hosts such as poplar, white birch, hard maple and species of oak (Figure 10). 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.

Figure 10. Forest Tent Caterpillar

The 2002 aerial surveys did not detect defoliation in any of the commercial forest regions of Saskatchewan. However, FTC populations continue to build in eastern parts of the Aspen Parkland EcoRegion in particular in the Good Spirit and Duck Mountain Provincial Park areas in the southeastern part of the province near the Manitoba-Saskatchewan border (Figure 11).

In 2003, Saskatchewan Parks and Special Places Branch contracted BioForest Technologies Inc., to provide FTC management services in the core area of Good Spirit Provincial Park. A 215 ha area in the core of the Good Spirit provincial park was selected for treatment on the strength of egg mass survey data collected in the fall 2002. On May 13 2003, a single application of Foray 48B (*Bacillus thuringiensis* var. *kurstaki*) provided by Valent BioSciences Corp. was sprayed at a rate of 20BIU/1.6L/ha. Results showed that although mean egg mass density per branch was similar in both treatment and control blocks, average defoliation was as low as 22% in treatment blocks as compared to 76% in the control blocks (Figure 12). Subsequent defoliation forecast surveys (egg mass surveys) in the core area of the park (Table 3) and adjacent (untreated) areas, revealed a variable forecast for the park and surrounding areas for 2004. Defoliation predictions for 2004 range from moderate to moderate-severe.

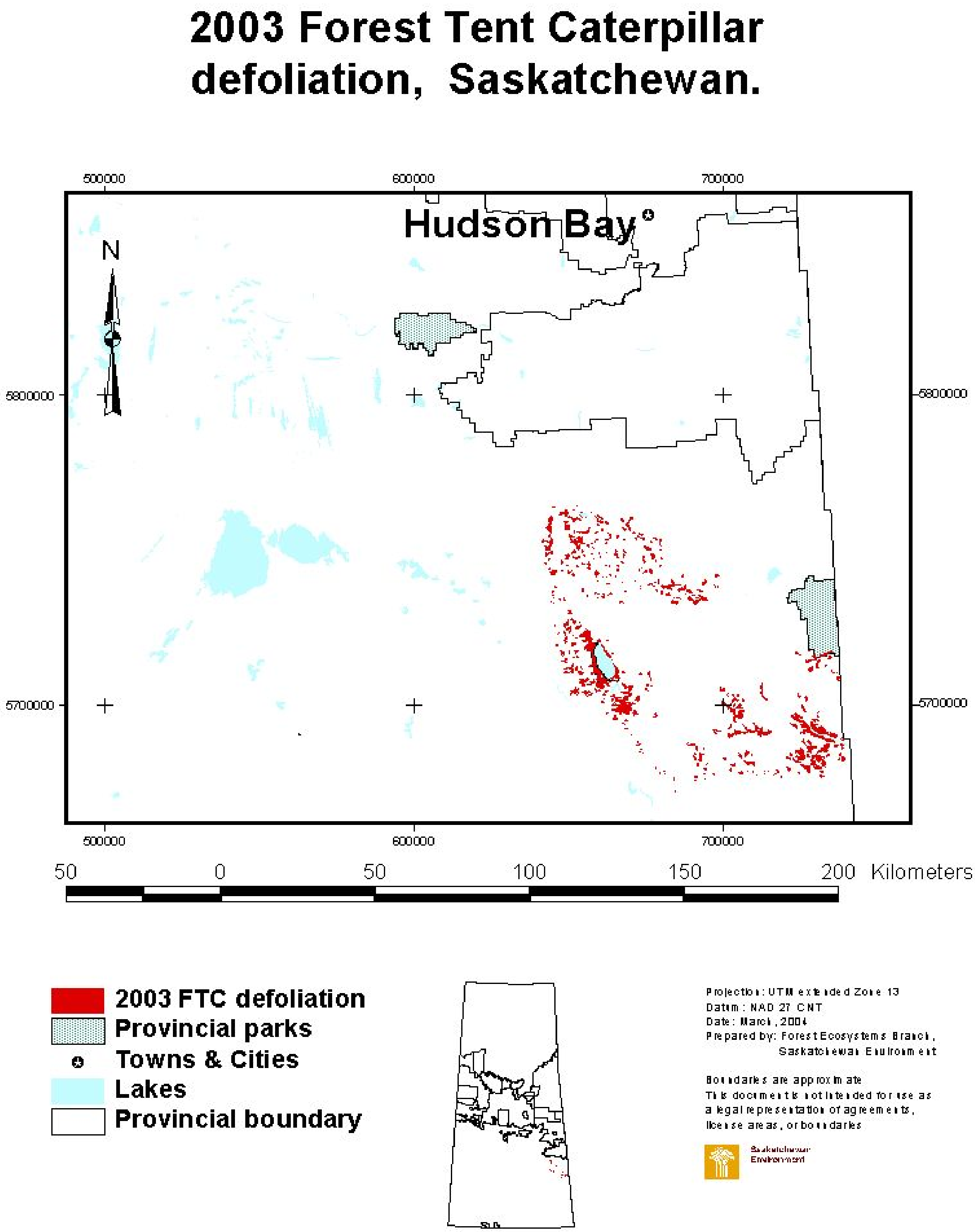


Figure 11. Area of forest tent caterpillar defoliation in Saskatchewan 2003.

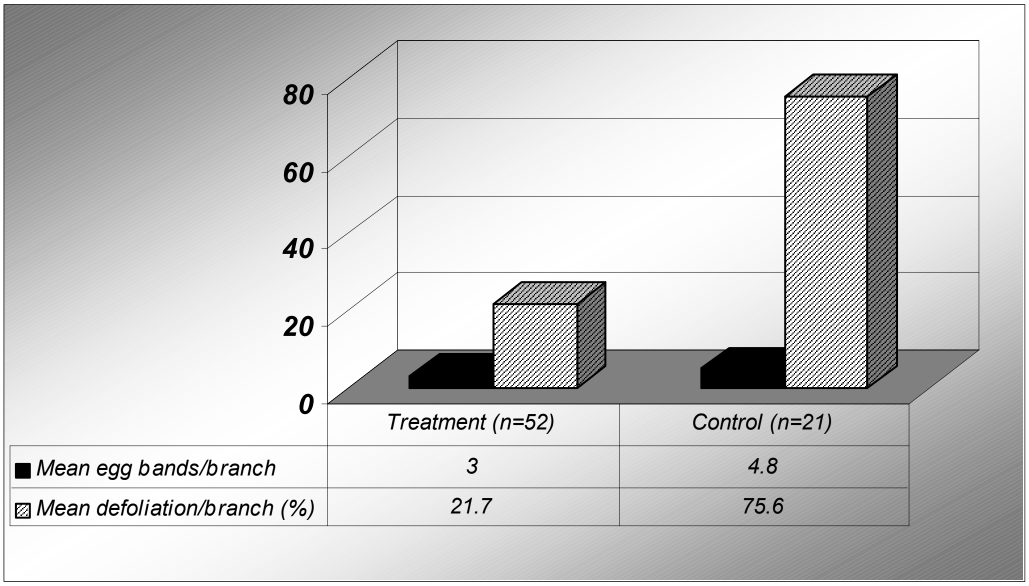


Figure 12. Comparison of egg mass densities and percent defoliation by Forest Tent Caterpillar in blocks treated with Foray 48B and unsprayed controls in Good Spirit Provincial Park, Saskatchewan 2003.

2003 FTC Summary and Predictions for 2004

- In 2002, moderate to high populations of forest tent caterpillar caused moderate to severe defoliation in Aspen stands in and around Good Spirit Provincial Park. In mid-may 2003, a 215 ha area of the core area in Good spirit Provincial Park was treated with a single application of the biological insecticide Foray 48B *Bacillus thuringiensis* var. *kurstaki* (*Btk*) at a rate of 20BIU/1.0L/ha. Mean % defoliation in Control blocks (75.6%) was significantly higher than in Treatment (21.7%) $P<0.001$.

- In the fall, BioForest Technologies Inc. conducted a FTC defoliation forecast survey of the core area at Good Spirit Provincial Park. The survey revealed egg mass densities which would result in moderate to severe defoliation for 2004.

- Based on the high likelihood of immigration of female moths from adjacent areas into the treated blocks and outbreak histories in other jurisdictions, there is a high probability that the Good Spirit Provincial Park will experience at least one more year if moderate to severe defoliation before natural control factors reduce FTC populations in the area.

Table 3. 2003 FTC defoliation forecast survey – Good Spirit Provincial Park based on egg band surveys conducted by BioForest Technologies Inc., in fall 2002.

Location	Tree Species	Total Trees Sampled	Total Egg Bands Per Location	2004 Defoliation[2.] Forecast	2004 Corrected Defoliation Forecast*
Maintenance Area	tA[1.]	8	41	Severe	Severe
Boy Scout Camp	tA	4	19	Severe	Severe
Overflow Campground	tA	9	31	Severe	Severe
Road to Fish Cleaning Shelter	tA	10	20	Moderate to Severe	Moderate
Donald Gunn Subdivision South	tA	10	31	Moderate to Severe	Moderate to Severe
Balsam Campground	tA	10	9	Light to Moderate	Light to Moderate
Aspen Campground	tA	10	7	Light	Light
Donald Gunn Subdivision North	tA	4	0	Light	Light
Park Gatehouse	tA	10	20	Moderate to Severe	Moderate

1. tA Trembling Aspen *(Populus tremuloides)*

2. Light: No trees showing complete defoliation. Feeding damage nil or confined to top of aspen crowns; little or no feeding on other tree or brush species.

Moderate: Occasional aspen completely stripped, most aspens with tops thin; little feeding on underbrush.

Severe: Aspen trees completely stripped, and conspicuous feeding damage to other species including underbrush.

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 (Figure 13). 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).

Figure 13. Witches brooms caused by Lodgepole pine dwarf mistletoe *Arceuthobium americanum*

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 14). 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.

It is anticipated that by the end of 2004, provincial standards and guidelines will have been completed and public information workshops offered to government and industry to address DMT management.

The eastern spruce mistletoe *Arceuthobium pusillum* is a pest in black spruce *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.

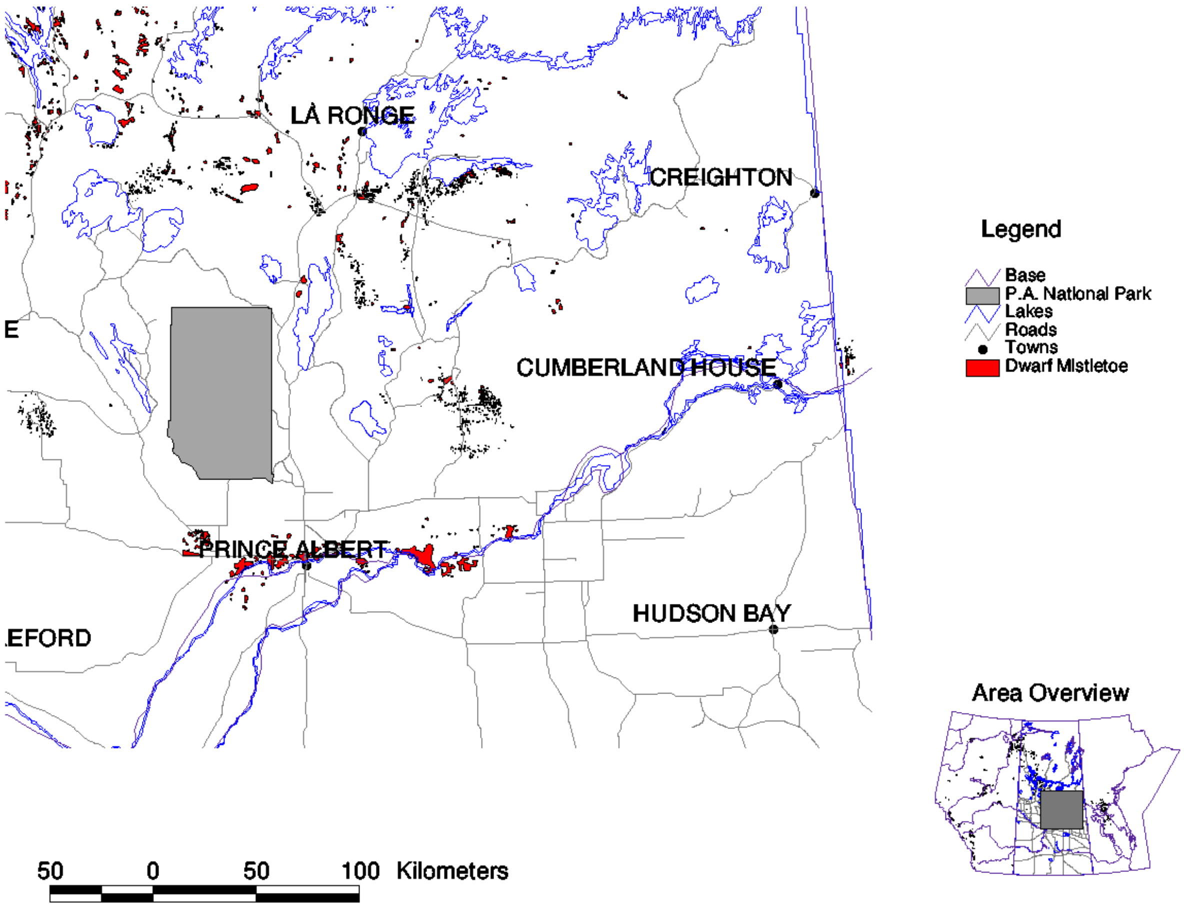


Figure 14. Distribution of severe mistletoe infestations in jack pine stands in Central Saskatchewan (Lat 53° - 56° N and Long 102° -108° W). Brandt *et al.* 1998.

Dutch Elm Disease Management

Dutch elm disease (*Ophiostoma novo-ulmi* Brasier) (DED) was first confirmed in Regina, Saskatchewan in 1981. The infection was removed and the disease was not detected again until 1990. 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 15). Some communities and areas in the active DED zone include: Sherwood Forest, Tisdale, Moosomin, Estevan, Carnduff, Lumsden, Round lake, Crooked Lake and Buffalo Pound Provincial Park area. DED was confirmed in the communities of Kamsack and Fort Qu'Appelle for the first time in 2000 and in six new communities in 2001. In 2002 no new communities were confirmed with DED (McIntosh *et al*. 2002). In 2003, DED was confirmed in two new communities: Melville and Caronport.

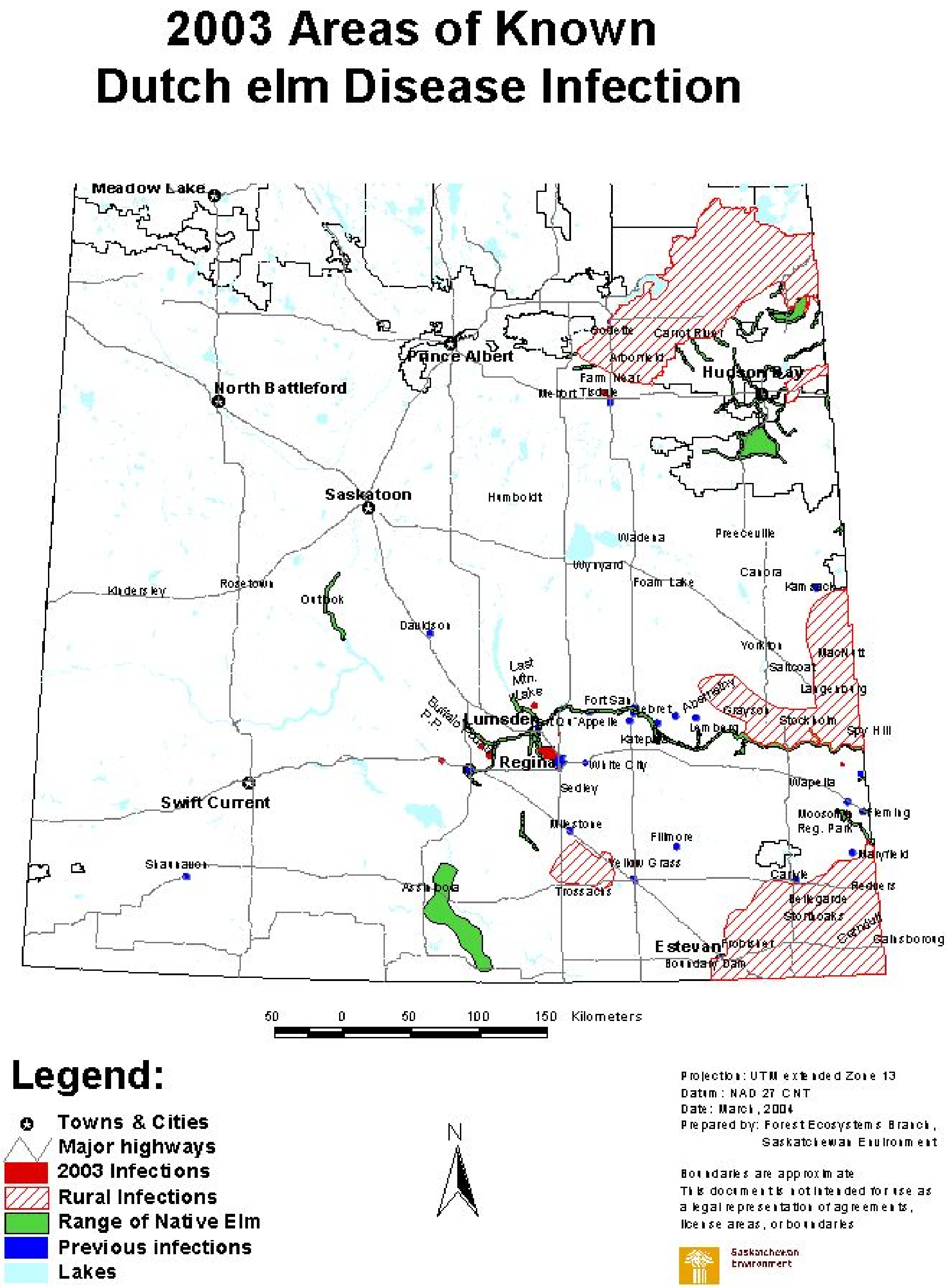


Figure 15. Extent of the spread of Dutch elm disease in Saskatchewan by 2003.

DED Management Program

The Forest Ecosystems Branch (FEB) of Saskatchewan Environment (SE) administers DED management. Saskatchewan Agriculture, Food & Rural Revitalization (SAFRR) and the Saskatchewan Dutch Elm Disease Association (SDEDA) work together with SE to manage of DED. Since 2000, DED surveillance has been contracted to BioForest Tech. Inc.

The major components of the provincial DED management program include:

- **Legislation** - In 2003, DED Regulations are in the final stages. This is the final step in the process of transferring administrative authority and enforcement from the *Pest Control Act* to the *Forest Resources Management Act (2000)*;
- **Public awareness and education -** television and newspaper advertisements, public service announcements, DED Hotline 1 (800) SASKELM; communications campaign SDEDA, SE, & SOS ELMS. The wording on the roadside signs has been revised and now reads: "Do not store or Transport Elm wood". Additional advertising was conducted on busses in the cities of Regina and Moose Jaw and billboard advertising was used throughout the province;
- **Cost-share communities -** Program costs shared between 35 communities and SE (e.g. elm inventory, staff training, pruning, elm disposal, basal spraying, regeneration). To qualify, communities must have 400+ native Elm trees and 800 + residents;
- **Surveillance -** BioForest Technologies Inc. conduct 2 surveys (typically late June/ 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 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 SAFRR Crop Protection Laboratory;
- **Pruning -** Conducted annually prior to and following the annual ban which runs from April 13-July 31;
- **Buffers -** Currently buffer zones at a 2 km radius are established around the communities of Estevan and Fort Qu`Appelle. In 2003, SE in conjunction with the City of Regina continued Regina Buffer expansion to include a 15km radius around the city. The buffer around the city of Moose Jaw extends 10-12 km toward Buffalo Pound Provincial Park. Tisdale buffer, set up at a 5 km radius around the community, was initiated in 2002 and surveyed in 2003 (See Table 4);
- **Elm tree sanitation -** Removal of diseased and hazard elms in communities and buffer zones by SE under contract.
- **Beetle trapping -** Traps are used to monitor elm bark beetle populations in communities. In 2003, no Multilure™ baited traps were put out;
- **Basal trunk treatment -** Applications of Dursban to reduce elm bark beetle populations conducted on a two-year cycle.
- **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. Currently, this program is under review and in all likelihood will be discontinued.

- **Research -** M.Sc. research continues at Simon Fraser University, to elucidate the chemical ecology of the native elm bark beetle. Advances in our knowledge of chemical ecology of this beetle will enhance monitoring and trapping programs. This project is supported by SE, SDEDA, PheroTech Inc. and an NSERC Industrial Postgraduate Scholarship

Table 4. Total number of diseased and hazard elm trees removed from Saskatchewan municipalities and buffer areas, 2002-2003.

	NO. OF ELMS REMOVED	
LOCATION	**2002**	**2003**
MUNICIPALITIES		† removed from Condie buffer
(DED; HAZARD)	(110*; 340†)	(63** ; 350†)
* Includes Lumsden 68 trees	110	63
** Includes Lumsden 34 trees		
BUFFERS		† includes Condie buffer removals
Regina	561†	517†*
Estevan	114	112
Fort Qu'Appelle	34	20
MooseJaw	-	2
Tisdale	-	
BUFFER TOTALS	**709**	**652†**
TOTAL	**819**	**715**

† Includes trees removed from the Condie Nature Reserve buffer around Regina

2003 Program Summary

- In 2003, funding levels remained at $500,000
- DED soon to be enforced under *The Forest Resources Management Act (2000); Dutch Elm Disease* Regulations should be complete by Summer 2004;
- DED Hotline received over 518 calls – the majority between July 10 and August 10;
- Over 390 samples were submitted to the Crop Protection Lab for confirmation. This was an increase over 2002 possibly due to drought conditions;
- Trees in two new communities (Melville and Caronport) confirmed DED positive in 2003;
- Infected communities in 2001 (Weyburn, Carlyle and White City) remained DED free in 2002 & 2003;
- Moose Jaw and Moosomin were DED-free in 2002 but infections were found again in these communities in 2003;
- Numbers of infected trees removed in municipalities and in some of the buffers declines (Table 4);

- In 2003 buffer expansion around the Cities of Regina and Moose Jaw continued. In total approximately 350 elms were removed from the Condie Nature reserve near Regina;
- DED still continues to spread along river valleys (west of Buffalo Pound Provincial Park near Moose Jaw and on the east and west sides of Last Mountain Lake);
- Number of DED positive trees in the City of Regina significantly lower – in 2002~ 14 infected trees were removed; in 2003~1 infected tree removed;
- Dutch elm disease still continues to spread throughout the natural range of *U. americana* in the Rendek forest and along the little Red Deer River in the Boreal Lowland EcoRegion; and
- City of Saskatoon remains DED-free.

Abiotic/Drought.

Repeated years of drought have had a major impact in the province: not just in agriculture, but also in the forests; in particular the island and fringe forests located in the Boreal Transition EcoRegion of the Boreal Plain Ecozone. In 2002 2,916 ha of jack pine *Pinus banksiana* plantations were killed by drought (McIntosh *et al*. 2002). In 2003, aerial surveys revealed 173,371 ha of decline in the hardwood forests in SK. (Figure 16). Many of these areas were located in and around Meadow Lake in the Boreal Transition and Mid boreal upland Ecozones in the West Boreal EcoRegion.

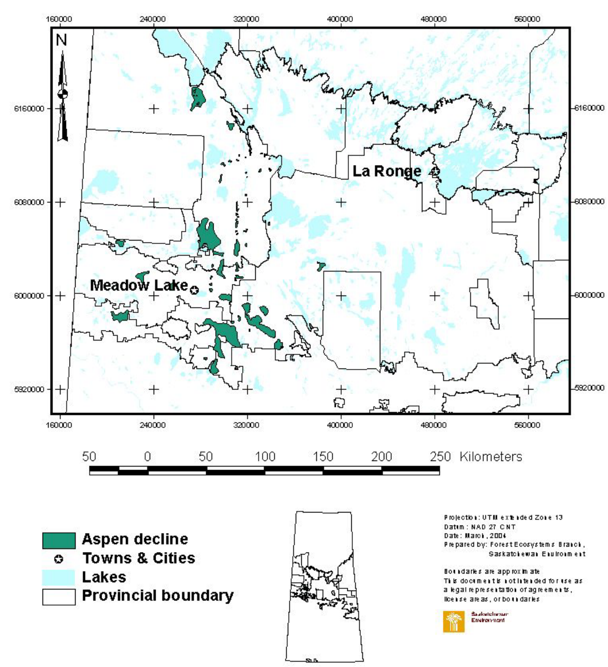


Figure 16. Geographic area affected by "abiotic" stressors, as detected in aerial surveys 2003. Stressors include: late season frost, crown thinning and dieback, and effects of drought

Larch Bark Beetle - *Dendroctonus simplex* Hopkins

Mortality associated with increased levels of Larch bark beetle *Dendroctonus simplex* (Figure 17) (LBB) activity were first detected in 2002. In 2003, aerial surveys revealed that a total of 2,733 ha of larch *Larix laricina* (Du Roi) K. Koch have suffered mortality (Figure 18). Currently, Larch is not considered a commercial species, however, there are initiatives to explore value-added opportunities and alternative forest products in Saskatchewan.

Figure 17. Larch Bark beetle *Dendroctonus simplex* damage

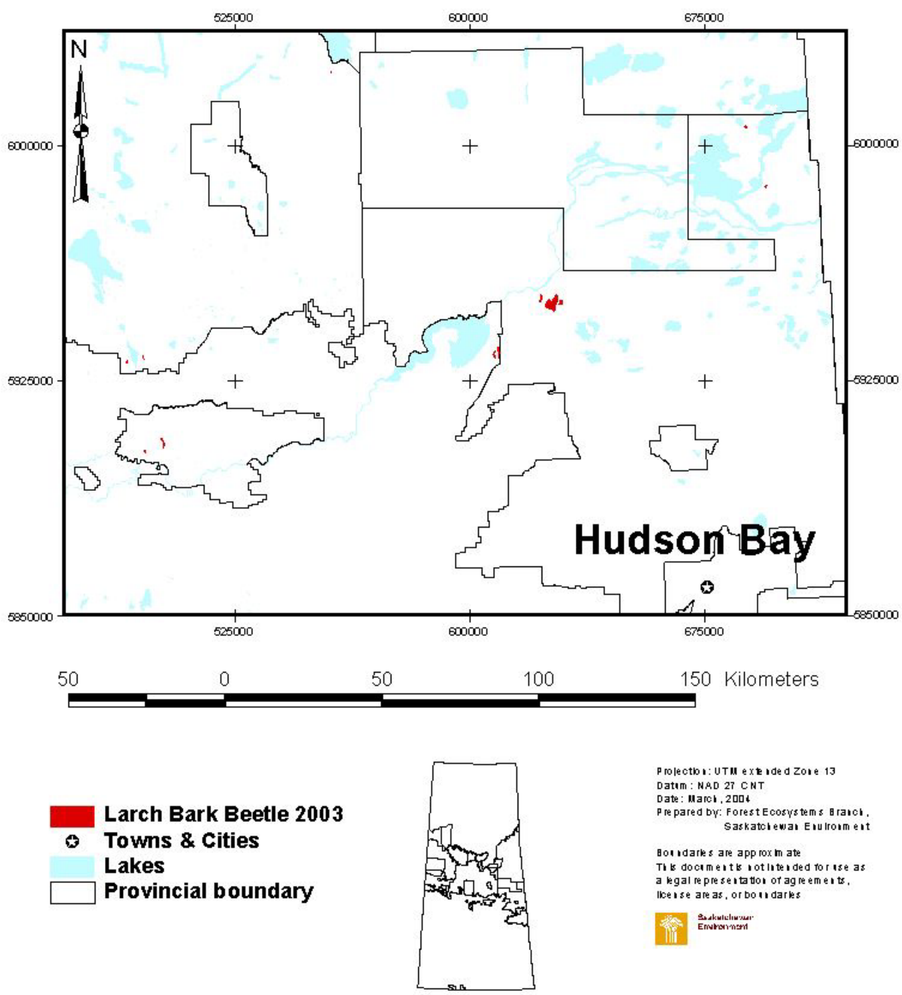


Figure 18. Geographic areas where stands of Larch mortality attributed to *D. simplex* were detected in 2003 aerial surveys.

Exotic Pests and Pests not Native to The Boreal Forest

Mountain Pine Beetle - *Dendroctonus ponderosae* Hopkins

The mountain pine beetle *Dendroctonus ponderosae* (MPB) (Figure 19) historically has been of considerable concern in the old Lodgepole pine *Pinus contorta* Dougl. 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.

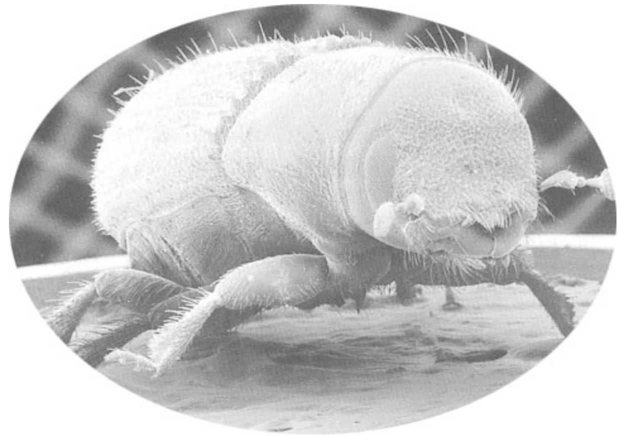


Figure 19. Mountain pine beetle *Dendroctonus ponderosae*. (Photo Canadian Forestry Service)

MPB associated pine mortality declined following tree and stand-level population management and continued silvicultural treatment in the most susceptible stands. By 1986, populations had dropped to endemic levels (Brandt and Amirault 1994).

Monitoring susceptible forest cover – Cypress Hills
Currently SE's Parks and Special Places Branch conduct aerial fire surveys during which observations are made to monitor incipient populations. Any suspect red trees are ground-probed to determine MPB status. In 2003, pheromone baited Lindgren multiple funnel traps (Lindgren 1986) were deployed in the Centre and East Block areas as an early detection system. Ground surveys continue to monitor trees around traps for evidence of MPB. All insects collected in traps are sent in to the Provincial Forest Insect and Disease specialist for identification. As of the time of preparation of this report, three (3) mountain pine beetles have been found in the traps.

SE Parks are engaged in an integrated land use management plan, which includes silvicultural re-structuring of the most susceptible stands and increased monitoring. In 2003, forest health surveys continued. These surveys are used to aid decision-making in the overall land use plan as well as serving as an early detection system for MPB in the core area and allow for timely intervention.

Mountain pine beetle: a threat to the Boreal forest?
Alberta Sustainable Resource Development initiated a restriction in the movement of logs, un-manufactured timber and forest products with bark attached originating from outside Alberta. Imports from BC, SK and Western United States between June 1 and September 30 are prohibited.

The Threat to Saskatchewan

Since MPB is not a restricted pest, the Canadian Food Inspection Agency (CFIA) has no mandate to regulate MPB 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.

A significant risk to Saskatchewan forest ecosystems exists. It has been demonstrated that MPB is very capable of completing its life cycle in jack pine (Safranyik & Linton 1982; Cerezke 1995) and there is reasonable expectation that MPB might survive and pre-adapt in jack pine in parts of the southern Boreal forest. There is building evidence that the MPB range is gradually shifting Northwards and eastward and in elevation (Jessie Logan, USDA; Allan Carroll, CFS) as regulation by extreme climate becomes less of a limiting factor in MPB overwintering survival.

Saskatchewan Strategy & Response

The following two main strategies continue to remain the major response to this threat:

1) **Communications**.
   - Prevention through increased education/information of risks. Information release can be found on the Saskatchewan Environment media release website http://www.se.gov.sk.ca/media/Saskatchewan%20Environmentnewsline/Pine_Beetle.htm.
   - Workshops and information sessions have been conducted to educate the Provinces Conservation and Transportation officers in the identification of non-native insect pests, pest risk assessment and review of enforcement options available under the *The Forest Resources Management Act (2000).*

2) **Regulatory control**.
   - 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. **The SE moratorium on the import transport and storage of pine forest products with bark attached remains in place.** Documents showing the legislative authority can be seen on the Saskatchewan Environment Forest Health website: http://www.se.gov.sk.ca/forests/directives_alerts.htm
   - Further initiatives include "designation" of the Mountain pine beetle as a *"pest"* and set up a quarantine area in the Southwestern part of the province to define *"any lands"* under *The Forest Resources Management Act (2000)*. The purpose of this action is to enable localized utilization while restricting movement of Lodgepole pine harvested as part of the restructuring efforts in the Cypress Hills Inter-provincial park. This will increase environmental protection and enforcement capabilities by restricting movement to the mill located in the southwestern part of the province. Movement outside the designated lands and into the rest of the province will be restricted.

European Gypsy Moth – *Lymantria dispar* (L.)

The gypsy moth *Lymantria dispar* (Figure 20) is one of the most significant hardwood defoliators in North America. Canadian Food Inspection Agency (CFIA) coordinates monitoring programs.

Each year, CFIA set out pheromone-baited moth traps for detection purposes. In 2003, CFIA, in collaboration with CFS and SE[11], deployed a total of 285 Pherocon Delta IIID traps. Two suspect moths, trapped in Regina and Meadow Lake, are still to be confirmed at the time of this report.

Figure 20. Gypsy Moth egg mass

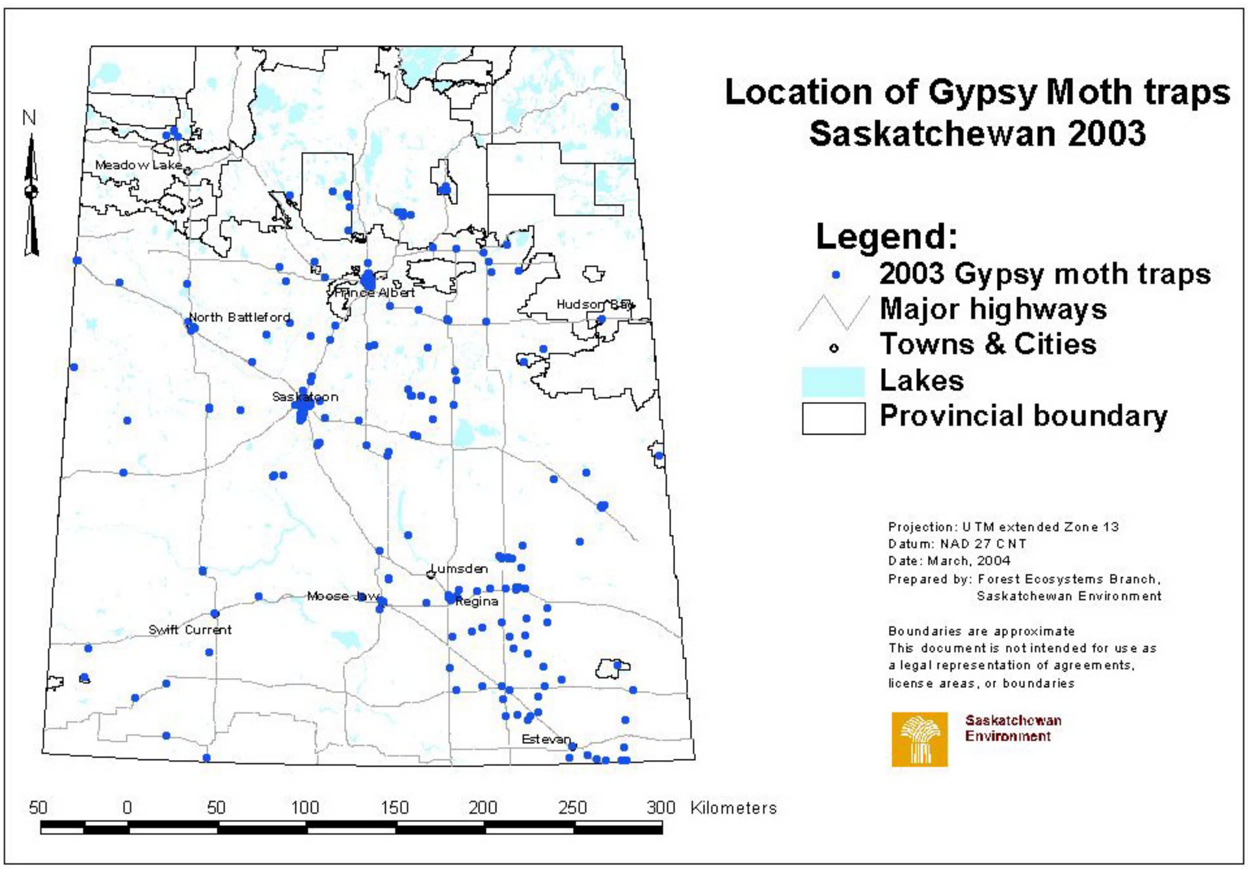


Figure 21. CFIA Gypsy moth trap locations (n=285) in Saskatchewan in 2003.

[11] . Contributions by: **City of Regina:** Taz Stuart; **Parks Canada**: Jeff Weir; **Saskatchewan Environment**: James Daigneault, Alex Dunlop, Glen Honig, Kelvin Kelly, Donna Lundquist, Gary Neil, Bruce Mclarty, Terry Minter, Robert Moore, Shane Vermette; **Saskatchewan Forest Centre:** Joanne Kowalski

Disposal/Sanitation

Proper disposal, as recommended by CFIA included chipping for mulch and composting or burning in municipal tree disposal programs. Media releases resulted in interviews with media across the province. The message continued to be one of awareness and proper disposal of Christmas trees in proper municipal disposal programs.

Goals for future development of pest management in Saskatchewan.

In Saskatchewan the major forest pest problems are being addressed, however, there are others of concern. The last jack pine budworm *Choristoneura pinus pinus* outbreak occurred more than 15 years ago, and the threat of a new outbreak is ongoing. Saskatchewan Environment is currently supporting research and development, which aims to develop semiochemical-based detection systems which can be used to detect building populations and thus provide an early warning system. The Spruce weevil *Pissodes strobi* is present in many plantations and the eastern larch beetle *Dendroctonus simplex* is killing mature larch trees near Candle Lake Provincial Park and in the Nisbet Island forest, Torch river, and Cumberland House areas. Reports of damage by the Yellow headed spruce sawfly *Pikonema alaskensis* continued to increase in 2003. Mountain pine beetle *Dendroctonus ponderosae* and stem rots (predominantly *Fomitopsis pinicola* and *Phellinus pini*) continue to cause significant damage in overmature Lodgepole pine stands in the Cypress Hills Inter-provincial Park. In addition, the pine engraver *Ips pini* and wood boring beetles such as Sawyer beetles *Monochamus* spp. and Ambrosia beetles *Trypodendron* spp. are causing damage and degrade to cut logs in storage and processing areas.

Future initiatives might include:

1. Further develop a provincial Forest Insect and Disease strategy document.
2. Continue to support initiatives to aid in the research and development of new survey techniques and technologies to ensure forest management activities are science-based.
    a. Further enhance our knowledge of spruce budworm epidemiology, impacts and the interaction between spruce budworm and fire.
    b. Further develop the spruce budworm impact plot network to enhance existing database with information of fuel loading and other factors contributing to mortality.
3. Improved general education in forest entomology and pathology.
4. Continue to work with other jurisdictions to develop systems for esponding to introductions of non-native species that might threaten Provincial forest ecosystems and economies.

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Forest Pest Management in Manitoba in 2003

Lutte contre les organismes forestiers nuisibles au Manitoba en 2003

Présented by:
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Abstract

In 2003, approximately 125,000 ha were infested by spruce budworm in Manitoba. The biosynthetic insecticide, Mimic® 240 LV (tebufenozide) was aerially applied to 17,475 ha in the Northwest Region. Within treatment blocks, the mean population reduction was 93% in the Saskatchewan River spray blocks and 90% in the Highrock spray blocks. However, good foliage protection was not achieved due to the small number of vegetative shoots relative to the number of spruce budworm larvae. Egg Mass surveys predict defoliation to be severe in 2004 in the Spruce Woods Provincial Forest and in the Northwest Region. Dutch elm disease (DED) extends throughout the entire natural range of the American elm in Manitoba. DED management is carried out, by Manitoba Conservation, within 38 communities and a buffer zone area surrounding the city of Winnipeg. Communities participate in the program on a cost-sharing basis with the Province. Winnipeg has its own Dutch elm disease management program with the help of an annual grant from the Province. DED removal crews in Manitoba removed 15,953 elm trees between April 1, 2002 and March 31, 2003. Of this total, Provincial crews removed 9,206 elm trees.

City of Winnipeg crews removed 6,005 elm trees, and City of Brandon removed 382 trees. Provincial DED survey crews marked 12,885 trees for removal in 2003 and City of Winnipeg survey crews marked 3,674 elms for removal. Populations of jack pine budworm continue to be endemic throughout Manitoba's jack pine forests. Adult male moth captures from pheromone traps decreased slightly, following an increase for four consecutive years. The only area of the Province that experienced severe forest tent caterpillar defoliation was in the Western Region in the south portion of Duck Mountain Provincial Forest, Assessippi Provincial Park and in the Roblin, Rossburn and Grandview areas. Severe root disease was identified on upland black spruce sites during pre-harvest surveys in the Porcupine Provincial Forest. A cut and leave harvest system was planned in the area. Ground surveys were carried out to determine the extent of the root disease, the current volume loss, to project future losses and to focus harvest activity in the most severely infested areas. Armillaria root rot was found to be the main pathogen in the infested areas. The infestation was 22% of the entire operating area. The volume loss due to root disease was 8%. A 15-year projection estimated the infested area would increase to 58% of the total area and the volume loss would increase to 25%. The cut and leave plan was abandoned and the harvest was completed within two years in order to prevent the projected large volume loss.

A number of site preparation treatments were employed to remove stumps and major roots in order to reduce the amount of fungal inoculum left on site to infect the renewed forest. Following planting in 2003, assessment plots were setup to determine if the stump and root removal reduces root disease in the regenerated forest. The intensive ground survey method used to map the root disease was costly and time consuming. In 2003, an aerial survey, using a helicopter, was done to map root disease. A video camcorder (vertical view) combined with the Red Hen Video Mapping System was used to record openings in the forest canopy. The aerial method is not as effective as the ground survey in detecting root disease centres that have not yet formed well-defined openings in the forest canopy.

Résumé

En 2003, quelque 125 000 ha ont été infesté par la tordeuse des bourgeons de l'épinette au Manitoba. Des applications aériennes de l'insecticide biosynthétique Mimic® 240 LV (tébufénozide) ont été effectuées sur 17 475 ha dans la région du nord-ouest. Les populations de la tordeuse ont été réduites en moyenne de 93 % dans les blocs traités près de la rivière Saskatchewan et de 90 % dans ceux de Highrock. Toutefois, le feuillage n'a pas été bien protégé à cause du faible nombre de pousses végétatives par rapport au nombre de larves de la tordeuse. D'après les relevés des masses d'œufs, la défoliation devrait être sévère en 2004 dans la forêt provinciale Spruce Woods et la région du nord-ouest.

La maladie hollandaise de l'orme sévit sur toute l'aire naturelle de l'orme d'Amérique au Manitoba. Conservation Manitoba applique des mesures de lutte contre la maladie dans 38 collectivités et dans une zone tampon autour de Winnipeg. Les collectivités participent au programme en partageant les frais avec la province. Winnipeg a son propre programme de lutte contre cette maladie, qui est mis en œuvre avec un appui financier annuel de la province. Au total, 15 953 ormes malades ont été abattus entre le 1er avril 2002 et le 31 mars 2003. Les équipes de la province en ont abattus 9 206; celles de Winnipeg, 6 005, tandis que la ville de Brandon en a fait enlever 382. Le personnel de la province a aussi marqué 12 885 arbres devant être éliminés en 2003, et le personnel de la municipalité de Winnipeg en a marqués 3 674. Les populations de la tordeuse du pin gris se maintiennent à des niveaux endémiques dans les forêts de pin gris partout dans la province. Après quatre années consécutives d'augmentation, les captures de mâles adultes dans les pièges à phéromone ont légèrement diminué. La livrée des forêts a causé une forte défoliation seulement dans la région de l'ouest, plus précisément dans la partie sud de la forêt provinciale du Mont-Duck, dans le parc provincial Assessippi et dans les régions de Roblin, de Rossburn et de Grandview.

Lors d'inspections prérécolte, une grave maladie des racines a été décelée dans des peuplements d'épinette noire de hautes terres dans la forêt provinciale Porcupine. Une récolte en damier était planifiée dans la région. Des inspections sur le terrain ont été réalisées afin de déterminer l’ampleur de la maladie, le volume déjà perdu et les pertes futures probables et de concentrer l’effort de récolte sur les zones les plus fortement affectées. Le champignon du pourridié-agaric est le principal pathogène trouvé dans les zones touchées. L’infection sévissait sur 22 % du territoire

d'exploitation. La perte en volume causée par la maladie des racines a été estimée à 8 %. Il a également été estimé que, dans 15 ans, 58 % du territoire serait touché et que la perte en volume atteindrait 25 %. Le plan de coupe en damier a été abandonné, et la récolte a été menée à terme en deux ans afin d'éviter les importantes pertes de volume prévues. Un certain nombre de traitements de préparation du terrain ont été appliqués afin d'éliminer les souches et les grosses racines et ainsi de réduire l'inoculum résiduel pouvant infecter la forêt régénérée. Après la plantation en 2003, des placettes d'évaluation ont été établies afin de déterminer si l'enlèvement des souches et des racines réduisait l'incidence de l'infection dans la forêt régénérée. La méthode des relevés intensifs sur le terrain employée pour la cartographie de la maladie ayant coûté cher en temps et en argent, il a été décidé d'effectuer un relevé aérien, par hélicoptère, en 2003. Un caméscope vidéo (vue verticale) combiné au système de surimpression vidéo Red Hen a été utilisé pour consigner l'emplacement des trouées dans le couvert forestier. La méthode aérienne s'est toutefois révélée moins efficace que la méthode au sol pour la détection des foyers d'infection des racines n'ayant pas encore créé d'ouvertures bien définies dans le couvert.

Spruce Budworm

In 2003 the spruce budworm, *Choristoneura fumiferana,* infestation continued in Manitoba. Moderate to severe defoliation occurred in the Northwest Region, Northeast Region, Lake Winnipeg East area and in Spruce Woods Provincial Park and Forest in southwestern Manitoba. The infestation in the Northeast Region is a new outbreak this year. In 2003 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 131,135 ha. The area of infestation was 14,005 ha in Spruce Woods Provincial Forest and Park, 10,650 ha in the Lake Winnipeg East area, 100,830 ha in the Northwest Region and 5,650 ha in the Northeast Region.

Based on the 2002 aerial defoliation survey and defoliation predictions derived from the 2002 egg mass surveys, an operational budworm suppression program was implemented in 2003 within the Tolko Industries Inc. Forest Management License (FML) in the Northwest Region.

The biosynthetic insecticide, Mimic® 240 LV (tebufenozide) was aerially applied to 17,475 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 three Air Tractor AT 502B fixed-wing aircraft each equipped with eight AU 5000 Micronair rotary atomizer nozzles. The insecticide applications were carried out from June 2 to 8.

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 2003 spray project was successful. Within treatment blocks, the mean population reduction was 93% in the Saskatchewan River spray blocks and 90% in the Highrock spray blocks (Table 1). However, good foliage protection was not achieved due to the small number of vegetative shoots relative to the number of spruce budworm larvae. In 2003 both white and black spruce produced very heavy male cone crops combined with a reduction in vegetative shoot production. Once larvae finished feeding on pollen, they moved to the current shoots and often destroyed them before they elongated. Consequently, 2003 bud production was greatly reduced and foliage protection in the spray blocks was poor.

Table 1: Spruce Budworm (Northwest Region) - Percent reduction in larval numbers

Spray Block[a]	Area Treated	Pre Spray Larvae[b]	Post Spray Larvae/Pupae[b]	Larval Mortality
Saskatchewan River Forest Section	12,612 ha	28	2	93%
Saskatchewan River Untreated Controls	N/A	22	5	77%
Highrock Forest Section	4,863 ha	31	3	90%
Highrock Forest Section Untreated Controls	N/A	23	7	66%

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

[b.] Number of budworm per 45-cm branch

A survey was conducted in the spray and untreated control blocks, during the month of August, to assess this year's defoliation (Table 2) and to predict 2004 defoliation. Severe defoliation is predicted in the Highrock Forest Section and moderate defoliation is predicted for the Saskatchewan River Forest Section (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) - 2003 defoliation and 2004 predictions

Spray Blocks[a]	2003 Defoliation	2003 Egg Masses per 10 m^2	2004 Defoliation Prediction
Saskatchewan River Forest Section	82%	141	Moderate
Saskatchewan River Untreated Controls	93%	162	Moderate
Highrock Forest Section	63%	213	Severe
Highrock Forest Section Untreated Controls	73%	352	Severe

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

In Spruce Woods Provincial Forest spray blocks treated in 2002 were assessed in 2003 to monitor the rebounding of budworm populations. Defoliation in the 2002 sprayed blocks (Table 3) was significantly less in 2003 than in the untreated control blocks, which experienced severe defoliation. The 2002 treatment was effective in providing two years of foliage protection. However, 2003 egg mass densities indicate severe defoliation will occur in both the sprayed and untreated controls in 2004

Table 3: Spruce Budworm (Spruce Woods) - 2003 defoliation predictions

Treatment	2003 Defoliation	2003 Egg Masses per 10 m^2	2004 Defoliation Prediction
Mimic, 70 gram a.i./ha	46%	986	Severe
Untreated Controls	77%	1,457	Severe

In addition to the spray and untreated control blocks, egg mass surveys were carried out in the Lake Winnipeg East area (Whiteshell Provincial Park, Tembec Forest Resource Group FML and Nopiming Provincial Park) and Spruce Woods Provincial Park in southwestern Manitoba. Predictions for 2004 indicate a general increase in the infestation in the Lake Winnipeg East area. Severe defoliation is predicted in the Spruce Woods Provincial Park. Light defoliation is predicted in the Northeast Region. Severe defoliation is predicted in Northwest Region (Table 4).

Table 4: Defoliation and Predictions outside the Spray Project Area

Area	Location	2003 Defoliation	Egg Mass per10 m^2	2004 Defoliation Prediction
Southwest	Spruce Woods Park	77%	1,457	Severe
L. Winnipeg E.	Tembec FML, Wpg. R.	21%	38	Light
L. Winnipeg E.	Tembec FML, Black R.	79%	121	Moderate
L. Winnipeg E.	Tembec FML, Manigotagan	35%	60	Moderate
L. Winnipeg E.	Nopiming Park, Bird L.	43%	8	Light
L. Winnipeg E.	Whiteshell, Dorothy L.	76%	60	Moderate
L. Winnipeg E.	Whiteshell, Falcon L.	3%	3	Light
Northwest	Sask. R. Forest Section	90%	234	Severe
Northwest	Highrock Forest Section	73%	329	Severe
Northeast	Nelson R. Forest Section	49%	3	Light

Spruce budworm pheromone traps were placed at 25 locations in the Lake Winnipeg East area and at eight locations in the Northwest Region. Three Multi-Pher® insect traps containing spruce budworm pheromone (PVC lure containing 0.3% by weight of a 95:5 blend of (E)- and (Z)-11-tetradecenal) were placed 40 m apart at each plot location in either a straight or triangular configuration. Overall, moth captures increased by 38% in the Lake Winnipeg East area and by 29% in the Northwest Region (Table 7).

Table 7: Spruce Budworm Pheromone Trapping

Location	2002 Moth Capture/Trap	2003 Moth Capture/Trap	Percent Change
Northwest Region	1,322	1,709	+29%
Lake Winnipeg East	480	660	+38%

Dutch Elm Disease

The annual Manitoba Conservation Dutch elm disease (DED) surveillance program operated for approximately four months during the summer of 2003. This program covers 38 communities and a buffer zone area surrounding the city of Winnipeg. Winnipeg itself is not included as it operates its own Dutch elm disease management program with the help of an annual grant from the Province. Communities participate in the program on the basis of cost sharing. Usually, the Province is responsible for the survey and removal of diseased and hazardous elm trees, i.e. decadent to the point that they are capable of supporting elm bark beetle breeding activity. The communities take care of control measures such as basal spraying with insecticide, pruning, and tree replacement.

Regular spraying of the basal part of elm stems with a pesticide, chlorpyrifos (Dursban), solution is a crucial strategy for controlling the native elm bark beetle (*Hylurgopinus rufipes*), the major vector of the disease and responsible for the majority of new infections. Restrictions imposed in 2001 on the use of this insecticide are cause for concern as Chlorpyrifos is the only pesticide currently available for this basal treatment. Initiatives are currently under way to develop a search and test program for implementing alternative means for controlling overwintering native elm bark beetles. This will ensure that this important control strategy remains available for managing Dutch elm disease.

Dutch elm disease now extends throughout the entire natural range of the American elm in Manitoba; spreading across southern and central regions of the province from the Manitoba-Ontario border into Saskatchewan and northward to the Saskatchewan River. River areas continue to have high levels of DED, especially along the Red and Assiniboine. The Boyne River near Carman and the Souris River in southwestern Manitoba remain extensively infected. In the western and northwestern portions of the province the Swan, Red Deer, Carrot and Saskatchewan Rivers plus numerous smaller rivers are also heavily infested.

In Manitoba, DED removal crews removed a total of 15,693 elm trees between April 1, 2002 and March 31, 2003. Provincial staff removed 9,306 elm trees, 5,019 from the Winnipeg buffer zone and the remainder from the cost sharing communities. In addition, City of Winnipeg staff removed 6,005 elm trees, and the City of Brandon removed 382 trees.

The major vector of Dutch elm disease in Manitoba is the native elm bark beetle. The more aggressive smaller European elm bark beetle (*Scolytus multistriatus*) has been found in small numbers in the City of Winnipeg, since 1975. In its biannual survey, the City of Winnipeg found three smaller European elm bark beetles in 1999 and two beetles in 1995 for a total of five. None have been captured since 1999. Manitoba Conservation's pheromone trap locations were established across southern Manitoba in 1982 to monitor S. Multistriatus. Two specimens were captured in rural Manitoba in 1989 and four in 2003.

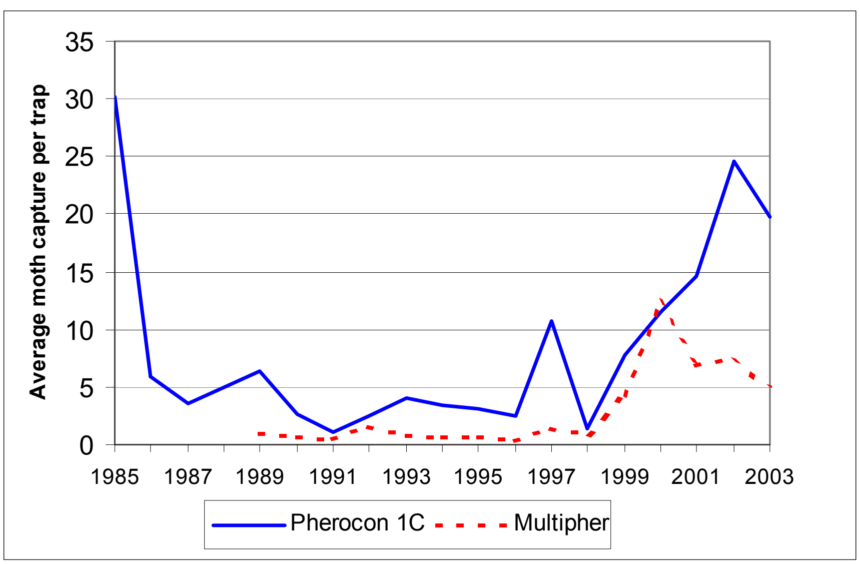
Jack Pine Budworm

Defoliation by jack pine budworm, *Choristoneura pinus*, in Manitoba, continues to be negligible but moth captures have increased in the last few years 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 microgram concentration of pheromone lure.

In 2003, the number of male moth captures in both trap types decreased slightly throughout the province (Figure 1). Moth numbers dropped at half of the collection sites and numbers rose in four of the locations with an overall provincial average of 20 moths per trap. This is a slight decrease from last year. Shilo and Reed Lake had the highest and lowest capture rate at 65 and 3 moths per trap, respectively.

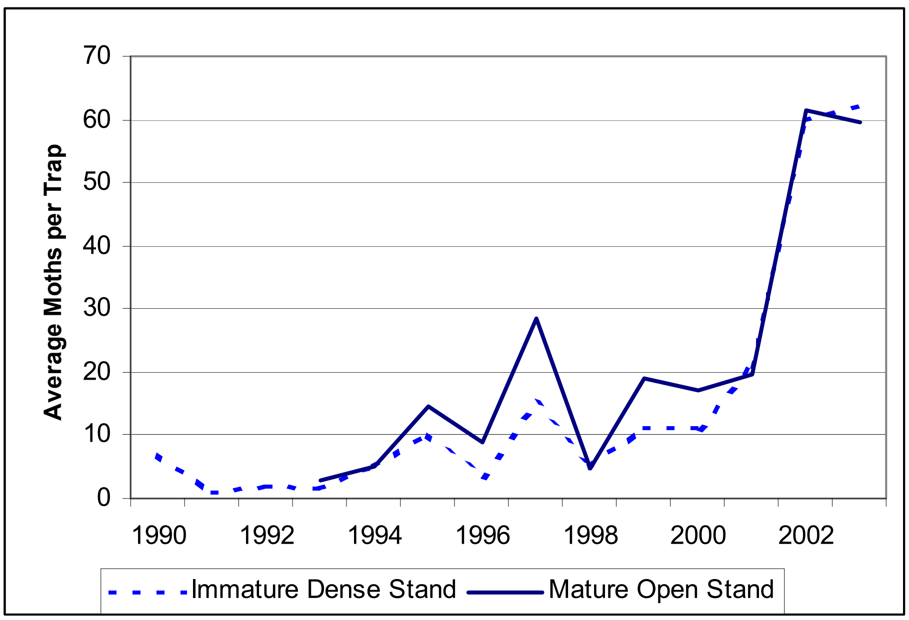
Figure 1: Annual average male jack pine budworm moth capture in two trap types for the 12 provincial locations.



Branch assessment for shoot defoliation and egg masses were completed. Light defoliation was recorded on sampled branches from several sites otherwise little to no defoliation was observed at all 12 locations. Four egg masses were found in 2003, two in Sandilands Provincial Forest and one in two northern Manitoba locations. Pollen cone bud levels for 2004 are predicted to be 43% on the branch tips.

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 2). Until 2001, moth captures in the mature open stands were slightly higher than the immature dense stands. After that, moth captures were almost equal as the population increased. There has been little difference in pollen cone bud levels between the young/dense and mature/open jack pine stands.

Figure 2: Annual average male jack pine budworm moth capture in two stand types in the Sandilands Provincial Forest.



Pest Impact Plot Survey

From 1986 to 1988, the Silviculture Section of the Manitoba Forestry Branch placed Regeneration Performance Assessment (RPA) plots in recently established plantations of the four major tree species. Plots are maintained by species and differentiated by stock type and site preparation method. In 1990, the Forest Health and Ecology section began a survey regime in the Silvicultural RPA plots to periodically assess the seedlings for pest damage and occurrence and relate this incidence to tree growth and vigour. The seedlings are assessed every three years until approximately age 15.

In 2003, the fifth and final pest assessment was conducted in the 1988 Silvicultural RPA plots. These were 4 plantations or 48 plots that included two tree species: white spruce and jack pine. Data entry and analysis is ongoing. Light levels of terminal weevils and related damage were recorded in pine and some tree mortality and damage from competition was noted in both pine and spruce sites.

Forest Tent Caterpillar

The only area of the Province that experienced severe defoliation was in the Western Region in the south portion of Duck Mountain Provincial Forest, Assessippi Provincial Park and in the Roblin, Rossburn and Grandview areas. A fall egg band survey was carried out to predict forest tent caterpillar defoliation for 2004. Nil to light defoliation is expected throughout Manitoba.

Dwarf Mistletoe

Dwarf mistletoe sanitation treatments in young jack pine (approximately 25 years old at the time of treatment) were assessed for effectiveness over a 23-year period (1982 to 2003). The treatments included thinning, pruning and combined thinning and pruning. Thinning alone was the only treatment that has resulted in the dwarf mistletoe severity level remaining below the untreated control plots. In both the pruning and the pruning plus thinning treatments, the treatment initially reduced dwarf mistletoe severity, but it has recovered over the assessment period to a level similar to that of the untreated control plots. As well tree mortality in the pruned plots is similar to that of the untreated controls. Only in the thinned plots has tree mortality remained well below that in the control plots.

Root Disease

Severe root disease was identified on upland black spruce sites during pre-harvest surveys and an aerial reconnaissance flight in the Schade Lake operating area of Porcupine Provincial Forest. A cut and leave harvest system was planned for this area.

An intensive root disease ground survey was carried out in the autumn of 2001. The objective of the survey was to determine the current extent of the root disease, the current volume loss, and to project losses over the next several years. The information was used to minimize volume loss by focusing harvest activity in the most severely infested areas.

GPS technology was employed to carry out the root disease survey. Root disease centers (>10 metres in diameter) were mapped by collecting UTM coordinates along parallel lines spaced 75 meters apart. Root disease centres encountered along the transect lines were assumed to extend half the distance to the adjacent survey line. These polygons were used to calculate the infested area.

Once root disease centres were mapped, an inventory cruise followed placing 22 prism plots within disease centres and 16 prism plots in uninfested portions of the survey area. This data was used to calculate volume loss due to root disease.

Projections for root disease spread and mortality were done over a fifteen-year period, using a spread rate of two-metres/year and mortality rate of 3.5%/year, derived from studies done by Whitney and Dumas. Infection centres were not expanded into lowland black spruce sites or other habitats unsuitable to root disease.

Root disease was found to be extensive throughout the surveyed area, being especially prevalent on upland sites where black spruce was the dominant species. The upland black spruce (average age of 88 years) was cutting class 4 (mature class, rotation 80 ± 10 years). Root disease centres were almost non-existent on lowland black spruce sites.

Armillaria root rot was found to be the main pathogen in the infested areas. White pocket stem rot, brown cubical butt rot, tomentosus root and butt rot and yellow stringy butt rot were also common within the root disease centres. These decay organisms caused tree breakage on lateral roots or the main stem.

The area infested was 171 ha (22%) over the entire survey area. The volume loss was 17,551 m^3, which is 8% of the potential volume (volume in the absence of root disease), which was 213,833 m^3. The 15-year projection estimated the infested area would more than double its size to 447 ha (58% of the total area) and the volume loss would increase to 53,422 m^3 or 25% of the potential volume of the surveyed area.

The cut and leave harvest system planned for the second cut of the operating area to be in 10 to 15 years. By that time, the volume loss would have been substantial. Therefore, the cut and leave plan was abandoned and the harvest was completed within a two-year period in order to prevent the large volume loss, which was eminent.

Armillaria root disease often becomes a long-term chronic disease of the site causing losses for many generations. A number of site preparation treatments were employed to remove stumps and major roots in order to reduce the amount of fungal inoculum left on site to infect the renewed forest. Following planting in 2003, assessment plots were setup in five different site prep treatments: hydraulic hoe, ripper plow and ripper tooth as stump removal methods and bracke and barrel & chain as standard non-stump removal methods. Sampling consisted of six 20 x 20 meter plots situated randomly in each treatment, three within an infection centre and three in an uninfected area. The hydraulic hoe site was less than 2 hectares in size and had only four plots situated within it. Re-measurement and assessments will be conducted one, three, five, seven and ten years after plot establishment.

The intensive ground survey method used to map the root disease centres at Schade Lake was costly and time consuming. Therefore, in 2003 an aerial survey, using a helicopter, was done to map root disease in the Rice Creek operating area in Porcupine 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. Ground checks indicated that the method was accurate in locating root disease centres. However, the aerial method is not as effective as the ground survey in detecting root disease centres without well-defined openings in the forest canopy.

Bronze Leaf Disease of Poplar

In September 2002, extensive browning was observed throughout the crowns of tower poplar in farm shelterbelts and golf course fairways in the Carman area. This condition occurred again in 2003 and has been identified as bronze leaf disease of poplar caused by *Apioplagiostoma populi*. This disease has been reported on aspen in the Lake States area since 1973. It is considered to be potentially a destructive disorder of poplar, as branch death and eventually tree mortality may occur. Tree mortality due to this disease was observed in 2003.

SESSION II -

IN PUBLIC VIEW - ECOSYSTEM MANAGEMENT AND PUBLIC AWARENESS IN NATIONAL PARKS

Chair: Ariane Plourde
Natural Resources Canada

SÉANCE II -

SUR LA SCÈNE PUBLIQUE - LA GESTION DES ÉCOSYSTÈMES ET LA SENSIBILISATION DU PUBLIC DANS LES PARCS NATIONAUX

Présidente : Ariane Plourde
Ressources naturelles Canada

SESSION II - SÉANCE II

Ecosystem-based Mountain Pine Beetle Management in Canada's Mountain National Parks

Lutte contre le dendroctone du pin ponderosa à l'échelle de l'écosystème dans les parcs nationaux canadiens des Rocheuses : Dendroctones, loups, wapitis, trembles, incendies et participation du public

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Abstract

Parks Canada (PC) lands occupy a strategic position along the continental divide area of the Central Rocky Mountains with respect to limiting the eastward spread of mountain pine beetle (MPB), *Dendroctonus ponderosae*. The handful of low elevation mountain passes combined with the inherent cold climate restricts the number of MPB-susceptible areas to low elevation valleys. Management actions focus primarily on Jasper and Banff National Parks where actual and forecast MPB spread rates, and downwind forest susceptibility, suggests the highest risk of MPB outbreak. PC is committed to maintaining and restoring ecological integrity using ecosystem-based, publicly vetted management actions. Recognizing that historic fire suppression has increased forest susceptibility to MPB, a strategy to limit MPB in Banff National Park was recently approved under the Canadian Environmental Assessment Act. The strategy commits PC to: 1) accelerate prescribed burning in beetle-susceptible forests, 2) a limited program of logging infected trees, 3) an emphasis on key research, and, 4) comprehensive public communications. It also commits PC to annual public and scientific vetting of its MPB management program in an adaptive management process. Alberta departments of Sustainable Resource Development (SRD) and Community Development work cooperatively with Parks Canada by evaluating the use of prescribed fire on their lands to reduce forest insect susceptibility and to enhance grizzly bear and elk habitat. SRD will also evaluate the need to modify predator management in some areas to maintain wolf populations. This broad view of socio-economic and ecological links among humans, wolves, elk, MPB and forest diversity have resulted in a promising approach to regional forest health, wildlife, habitat, and MPB management.

Results of Banff National Park's adaptive approach to MPB management, indicate encouraging success in the deployment of an innovative combination of: 1) accelerated prescribed burning program to remove large stands of mature lodgepole pine that are becoming increasingly susceptible to mountain pine beetle attack as well as to kill beetle-attacked trees outright; 2) single-tree treatment of attacked trees including fall and burn, and fall and peel, to reduce the potential for MPB dispersion and slow the rate of spread in critical areas; 3) forest thinning to provide support-guards for prescribed fires and townsite fire protection, as well as to render MPB habitats less suitable; 4) intensive MPB pheromone baiting to limit the dispersion of

MPB to known areas, and to increase green-attacked tree search and removal efficiency in subsequent seasons; and, 5) an accompanying applied research and monitoring program to maximize scientific learning, monitor indicators of success, and provide a scientific basis for adjusting the MPB program to achieve goals.

Résumé

Les terres de Parcs Canada (PC) situées le long des monts centraux des Rocheuses qui divisent le continent occupent une position stratégique pour la limitation de la propagation vers l'est du dendroctone du pin ponderosa (DPP), *Dendroctonus ponderosae*. Quelques cols montagneux de basse altitude, combinés au climat froid inhérent, limitent aux basses vallées les secteurs vulnérables au DPP. D'après les vitesses actuelles et prévues de propagation et la vulnérabilité de la forêt, le risque d'infestation est le plus élevé dans les parcs nationaux de Jasper et Banff, et les mesures de lutte contre cet insecte y sont concentrées. PC s'est engagé à maintenir et à restaurer l'intégrité écologique en appliquant des mesures publiquement scrutées, tenant compte de l'écosystème, pour la protection de la forêt. Dans le parc national Banff, une stratégie de lutte contre le DPP, qui reconnaît que les mesures passées de lutte contre le feu avaient rendu la forêt plus vulnérable au DPP, a récemment été adoptée conformément à la *Loi canadienne sur l'évaluation environnementale*. Suivant cette stratégie, PC doit : (1) accélérer le brûlage dirigé dans les forêts vulnérables au dendroctone; (2) exécuter un programme limité de récolte des arbres atteints; (3) mettre l'accent sur des recherches pertinentes importantes; (4) informer pleinement le public. Il doit également soumettre son programme de lutte contre le DPP à un examen public et scientifique annuel dans un processus de gestion adaptative. Les ministères du Développement durable des ressources et du Développement communautaire de l'Alberta collaborent avec Parcs Canada en évaluant sur leurs terres l'emploi du brûlage dirigé pour réduire la vulnérabilité aux insectes forestiers et améliorer les habitats du grizzli et du wapiti. Le premier évaluera également la nécessité de modifier la gestion des prédateurs dans certains secteurs pour maintenir des populations de loup. Cette large vision des liens socio-économiques et écologiques entre humains, loups, wapitis, DPP et diversité forestière a résulté en une approche prometteuse pour gérer à la fois la santé de la forêt, la faune, les habitats et le DPP à l'échelle régionale.

Les résultats de l'approche adaptative appliquée au parc national Banff témoignent du succès encourageant de l'application d'une combinaison novatrice de mesures : (1) programme accéléré de brûlages dirigés pour éliminer de gros peuplements de pins tordus mûrs, de plus en plus vulnérables face au dendroctone, ainsi que pour détruire rapidement les arbres attaqués; (2) traitement d'arbres isolés attaqués, entre autres, en les abattant puis brûlant ou écorçant afin de réduire la dispersion du DPP et de ralentir la propagation dans des secteurs critiques; (3) éclaircie forestière pour créer des zones d'isolement (d'appui) pour les brûlages dirigés et la protection de la ville contre le feu, ainsi que rendre les habitats moins propices au DPP; (4) piégeage intensif du DPP à la phéromone pour limiter sa dispersion dans les zones connues et accroître l'efficacité de la recherche et de l'élimination, les saisons suivantes, des arbres verts attaqués; (5) programme connexe de recherche et de

surveillance afin de maximiser les connaissances scientifiques, de mesurer des indicateurs de succès et d'établir une base scientifique pour ajuster le programme de lutte contre le DPP de manière à assurer l'atteinte des objectifs.

Outline

- Background
- MPB Management Strategy
- Fairholme Prescribed Burn
- MPB Control Program
- MPB Related Research

Banff National Park is located 128km from Calgary Alberta. It was established in 1885 and covers approximately 6641 square kilometers. Since 1880, the area burned within the park has been steadily decreasing. The area burned each year decreased from approximately 75000 acres, to just a few thousand acres 100 years later. Historically, the primary ignition source in Banff was burning by First Nations people for clearing wildlife habitat and travel access. This contrasts with other areas in the Rocky Mountains where lightning is the primary ignition source. Figure 1 shows that Banff exists in a lightning 'shadow' where few fires are caused by lightning strikes.

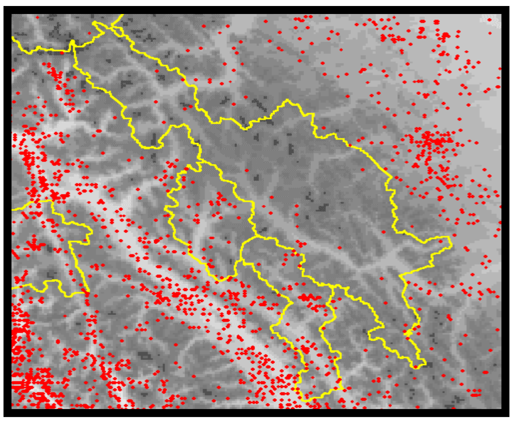


Figure 1. Lightning Fires 1961-1994

Following the inception of the Warden Service and the increase in fire prevention and suppression, the occurrence of fire on the landscape in Banff was greatly reduced, resulting in a dense forest of mostly over mature pine. The distribution of trees less than 80 years old has decreased dramatically in the past 50 years during the fire suppression era. During the late seventies and early eighties, Park managers realized the importance of keeping fire on the landscape and began it's prescribed burn program with its first prescribed burn in 1981. Prescribed burning served as a tool to decrease the build up of fuel in the dense, mature pine forests. Prescribed burns also helped to achieve other ecological objectives. For example, burned areas with large quantities of palatable plants provide favourable habitat for wildlife such as grizzly bears and ungulates. Park research showed that regenerating plants were subject to heavy herbivore grazing following fire. Analyses of grizzly bear telemetry data (Figure 2) also found that bears spent most of their time in forests that had been subject to relatively recent fire rather than in forests that had not seen fire for long periods of time. Fire also has a positive effect on vascular plant species, with biodiversity and biomass of plants increasing following fire.

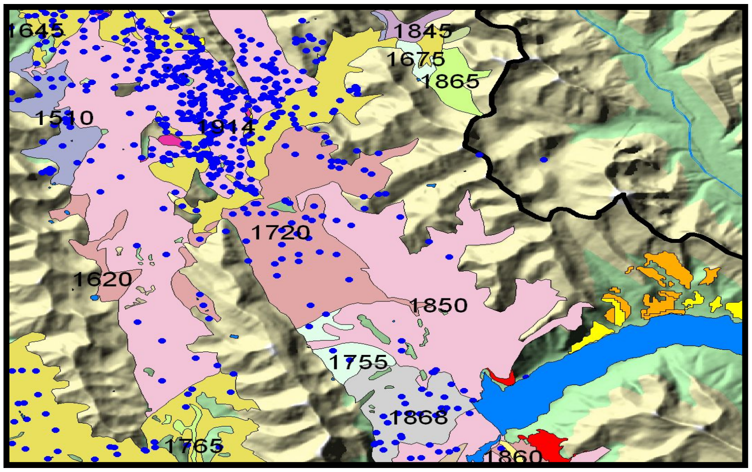


Figure 2. Stand origins and grizzly bear telemetry

However, the lack of fire on the landscape caused not only an increase in fuel and reduction in the amount of suitable wildlife habitat, but also the potential for favourable conditions for insects and disease. In particular, conditions were set for an increase in mountain pine beetle populations in Banff. A number of conditions led to an increase in the mountain pine beetle population starting in 1997. In addition to over 80 years of fire suppression, successive winters of mild temperatures, a large MPB population in an adjacent, upwind area (current BC outbreak) and an expansive area of susceptible forest resulted in a significant increase in the MPB population. In 1997, a handful of MPB attacked trees were found in Banff. Since then there has been a steady increase in attacked trees, with a peak in 2002 when over 2500 trees were found.

In response to the increase in the MPB population, and the increased risk of an outbreak onto adjacent lands, Banff park managers put together the Regional Forest Management Strategy (RFMS). This document takes into consideration the mandate of Parks Canada to maintain naturally occurring processes, such as fire and insects but actively manage them when there is potential for serious adverse effects on neighbouring lands (Parks Canada Policy 3.2.4). The RFMS states that Banff National Park will use prescribed fire to reduce the susceptibility of forest stands to MPB. It also details two separate management zones. One in which active management such as sanitation cutting and hand falling operations will be utilized in conjunction with prescribed fire, and another zone in which no sanitation cutting or hand falling operations will be conducted. In addition to tree removal and prescribed burning, the strategy outlines a schedule for annual green attack surveys and public review of environmental assessments.

One important area in Banff National Park is the Fairholme Bench located just east of the Banff Townsite. The Fairholme Bench consists of the largest area of montane habitat in Banff. This ecotype is particularly important to wildlife such as grizzly bears and elk. Due to the expansion of the MPB into this area, and its importance to the park ecosystem, fire managers planned and implemented the Fairholme Prescribed Burn in the spring of 2003. One of the first and most important issues that park managers were faced with was the public's perception of the fire. Banff National Park employed a team of communications specialists and media personnel to convey the park's messages to the public. It was important to communicate the justification for the burn and how fire management teams would deal with issues important to the public such as public safety, facility protection and smoke dispersal. Numerous newspaper and television stories, leaflets distributed through postal mail, websites, public forums and mobile information centres helped to educate the public on the details of the prescribed burn operations.

Burning commenced in the spring of 2003 and was largely successful in accomplishing many of the ecological objectives outlined in the burn plan. First, the threat of catastrophic wildfire to adjacent communities was reduced by a large fuel break constructed adjacent to the municipality of Harvie Heights. The Carrot Creek fuel break saw stand densities greatly reduced to prevent the spread of a wildfire into the small community. Secondly, the removal of over 5500 hectares of mature pine forests represents a significant decrease in the susceptibility of forest stands to mountain pine beetles. A number of different fuel manipulation treatments also ensured that old growth Douglas fir trees were protected. Prior to ignition, a thorough survey of the Fairholme area determined the distribution of all old growth Douglas fir trees. Prescribed burn experts and researchers used hand raking, low intensity aerial ignition and hand lighting to protect these ancient trees. In years to come, park researchers will determine the degree to which the fire was successful at stimulating the reproduction of aspen and poplar, and increasing biodiversity.

In addition to using prescribed burning to reduce the susceptibility of forest stands to MPB, Banff also uses direct control methods to slow the spread of MPB into adjacent lands. Park Wardens in the Fire and Vegetation Management Section erect pheromone baits in areas prone to MPB to concentrate populations in areas that can then be hand cut and burned or mechanically logged. Figure 3 shows the distribution of MPB colonized trees in the lower Bow Valley and east of the Town of Banff in 2002 and 2003. In 2003, approximately 524 pheromone baits were erected. However, due to the success of the prescribed burn in removing habitat, the MPB control work conducted last year, and increased overwinter mortality, the number of green attacked MPB trees detected in 2003 is approximately one-third of the total from 2002. The rate of population expansion in 2003 was down to 1.2 fold compared to highs of 7 fold expansions a few years ago.

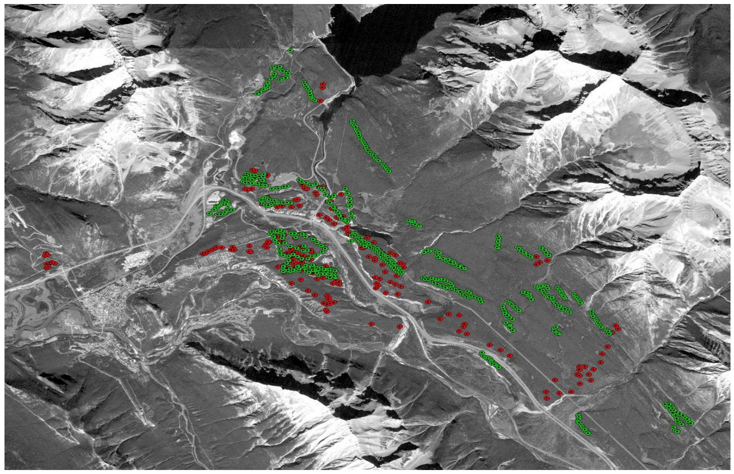


Figure 3. Green attack trees in 2002 (in red) and 2003 (in green).

Currently the MPB broods are developing well with mostly 3rd instar larvae with pupae in some areas. During this control season, we approximate that 1175 trees are colonized in the management zone, with 450 to be hand felled and 500 to be cut mechanically. Sanitation cutting will be followed by pheromone baiting next summer (2004). Park managers will also be continuing fireguard construction to prepare for future prescribed burns that will continue to decrease stand susceptibility.

All the control work and prescribed fire planning could not have been completed without the collaboration of all of Parks Canada's stakeholders. To organize the stakeholders, several approaches were taken. The Strategic Direction Council (SDC) involves Parks Canada, the Canadian Forest Service, Alberta Sustainable Resource Management and Alberta Community Development. The SDC recognizes that collaboration is necessary for the management of forests to protect the economic value of provincial forests and to achieve ecological integrity objectives in national and provincial parks. Its goal is to use aggressive short term approaches to controlling MPB in high risk areas in conjunction with long term strategies to increase biodiversity. The SDC also works with industry, interest groups and local communities to take into account different interests. In addition to the large-scale scope of the SDC, Banff National Park is involved with the Bow Valley MPB Control Team. This regional working group consists of Banff National Park, Alberta Sustainable Resource Development, Alberta Community Development, the Town of Canmore, the Municipal District of Bighorn, industry partners (Burnco Mining, Stone Creek Properties, Three Sisters Mountain Village), and non-profit organizations such as the Biosphere Institute. Together with this agencies, joint control and communications plans are put together and information is exchanged. In 2004, Parks Canada proposes to continue to work with stakeholders, monitor MPB populations, actively manage MPB populations along the east boundary, coordinate fire guard development and develop communications programs, and undertake research in support of an integrated approach.

Several research projects have been initiated with help from the MPB initiative from the Canadian Forest Service in an attempt to better understand the effects of prescribed burning and mountain pine beetle on the forest. Under the direction of Dr. Mary Reid from the University of Calgary, several projects examining the life history and colonization behaviour of MPB are being conducted in Banff. Graduate students will be looking at the dispersal of MPB through burned areas, colonization success in burned trees, and pioneer behaviour in MPB populations. Another project that is closely linked with MPB management and prescribed fire is the use of remote sensing to determine burn severity in prescribed burns. This method developed in the United States by the U.S. Geological Survey uses Landsat satellite imagery to determine the differences between pre- and post-burn vegetation. Banff National Park is pairing this remote sensing technique with field measurements to see whether this method can be made standard practice across ecotypes and among all National Parks. In conclusion, Parks Canada has used innovative methods to attempt to slow the spread of MPB into adjacent lands. Collaboration between neighbouring agencies, communication and discussion with nearby communities and the public has facilitated the implementation of Mountain Pine Beetle management efforts and the prescribed burn program in Banff National Park.

SESSION III -
CROSS-COUNTRY CHECK-UP
ONTARIO & QUEBEC

SÉANCE III -
BILAN NATIONAL -
L'ONTARIO ET LE QUÉBEC

Ontario

Ontario

Presented by :
Anthony Hopkin, Canadian Forest Service, Great Lakes Forestry Centre

STATUS OF IMPORTANT FOREST PESTS IN ONTARIO IN 2003

OVERVIEW

In 2003, the Canadian Forest Service and Ontario Ministry of Natural Resources deployed a team of 12 Forest Health Technicians throughout Ontario. The season's activities included a cooperative study of the aspen decline/mortality problem in northeastern Ontario. Based on aerial surveys, it is clear that aspen decline/mortality increased in 2003 to over 500 000 ha. The area defoliated by spruce budworm (*Choristoneura fumiferana* Clem.), increased to 230 000 ha, whereas the area defoliated by gypsy moth (*Lymantria dispar* [L.]) and forest tent caterpillar (*Malacosoma disstria* Hbn.) declined to 59 000 ha and 4 500 000 ha respectively. Large aspen tortrix (*Choristoneura conflictana* [Wlk.]) defoliated a total of 5 179 ha in 2002 and Bruce spanworm (*Operophtera bruceata* [Hulst]) defoliation, which was mapped around Lake of the Woods in 2002, was not evident in 2003.

Continued emphasis was placed on introduced pests in 2003. Both the emerald ash borer, *Agrilus planipennis*, which occurred across Essex County in Southwestern Ontario, and the Asian Longhorned beetle, *Anoplophora glabripennis,* which was discovered in the cities of Toronto and Vaughan were major concerns in Ontario this year. Both insects are native to temperate forests in Asia and were introduced into Ontario within the last 4-6 years.

FOREST INSECTS

Spruce Budworm, *Choristoneura fumiferana* Clem.

The area of moderate-to-severe current defoliation caused by spruce budworm totalled 229 726 ha in 2003, an increase of 98 603 ha from 2002 (Table 1). Increases were noted in all three OMNR regions but were particularly significant in northeastern Ontario in the North Bay District. All of the decreases in area of defoliation occurred in northeastern Ontario in the North Bay District. There was a slight increase in the Sudbury District. Infestations also occurred in the Bancroft, Pembroke and Kemptville districts.

Table 1: Gross area of moderate-to-severe defoliation caused by the spruce budworm in Ontario, 2000 - 2003.

Region	Area (ha)			
District	2000	2001	2002	2003
Northwest				
Kenora	0	0	0	1 188
	0	0	0	1 188
Northeast				
North Bay	87 646	127 788	88 607	158 305
Sault Ste. Marie	130	0	0	0
Sudbury	16 242	32 298	32 734	41 071
	104 018	160 086	121 341	199 376
South Central				
Bancroft	0	0	439	3 805
Kemptville	129	1431	2 435	2 117
Pembroke	10 933	8 305	6 908	22 818
Peterborough	0	0	0	422
	11 062	9 736	9 782	29 162
TOTAL	115 080	169 822	131 123	229 726

Gypsy Moth, *Lymantria dispar* (L.)

Gypsy moth infestations decreased considerably in 2003 to a total area of 59 413 ha of moderate-to-severe defoliation mapped this year, compared to 153 674 ha mapped in 2002 (Table 2). Much of the defoliation, 25 732 ha, occurred in or near Parry Sound. Virus and fungal diseases, including *Entomophaga maimaiga*, were generally prevalent in larval populations this year.

Table 2: Gross area of moderate-to-severe defoliation caused by the gypsy moth in Ontario, 2000 - 2003.

Region	Area (ha)			
District	2000	2001	2002	2003
Northeast				
North Bay	217	183	0	0
Sault Ste.	0	0	0	130
Sudbury	0	6 391	136 878	979
	217	6 574	136 878	1 109
South Central				
Aylmer	891	5	0	0
Bancroft	0	238	799	5216
Guelph	17 606	0	0	0
Kemptville	0	0	364	938
Midhurst	0	0	3 539	11 728
Parry Sound	0	0	7 666	25 732
Pembroke	18	528	2 098	0
Peterborough	0	0	2 330	14 690
	18 515	771	16 796	58 304
TOTAL	18 732	7 345	153 674	59 413

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The total area of forest tent caterpillar defoliation in the province continued to decline in 2003 to a total area of 4 490 000 ha, compared to 8 245 964 ha in 2002 (Table 3). Large decreases occurred in every district except Nipigon, where there was a significant increase in damage for the second consecutive year. As in 2002, the largest decrease occurred in the Northwest Region where 2 757 629 ha of moderate-to-severe defoliation was mapped, compared with 5 821 878 ha in 2002.

Table 3: Gross area of moderate-to-severe defoliation caused by the forest tent caterpillar in Ontario, 2000 - 2003.

Region	Area (ha)			
District	2000	2001	2002	2003
Northwest				
Dryden	1 655 278	2 053 529	1 389 513	0
Fort Frances	1 832 570	2 351 938	643 256	6 345
Kenora	1 222 642	1 657 053	2 685	0
Nipigon	717	10 755	363 406	857 302
Red Lake	530 163	1 940 113	0	0
Sioux Lookout	421 986	1 166 290	530 450	0
Thunder Bay	307 422	1 307 598	2 892 569	1 893982
	5 970 778	10 487 276	5 821 879	2 757 629
Northeast				
Chapleau	1 139	880	614	0
Cochrane	131 732	47 447	10 017	0
Hearst	274 687	240 926	175 126	141 690
Kirkland Lake	501 414	1 130 928	894 615	418 379
North Bay	19 675	320 146	300 769	318 330
Sault Ste. Marie	283	10 038	11 869	26 549
Sudbury	27 131	368 560	809 822	608 301
Timmins	246 921	357 951	168 376	155 477
	1 202 982	2 476 876	2 371 208	1 668 726
Southcentral				
Bancroft	0	22 421	0	0
Midhurst	5 823	54 785	2 356	2 798
Parry Sound	30 849	235 672	50 522	60 889
Peterborough	0	2 985	0	0
	36 672	315 836	52 878	63 687
TOTAL	7 210 432	13 279 988	8 245 965	4 490 042

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

The Pine False Webworm defoliated a total of 820 ha in 2003, compared with 2 140 ha of moderate-to-severe defoliation in 2002 (Figure 1). The heaviest damage was again situated in Grey County in the west part of Midhurst District. Here there were some 65 locations of damage scattered through a general agricultural/reforested area from Chatsworth south to Dornoch and Markdale. The most damage occurred on eastern white pine and to a lesser degree on other pines. This differs somewhat from the past couple of years when Scots pine in the area was also heavily damaged. Because of this difference the total area of damage is reduced from that of 2002. Trees of all age and size classes were affected.

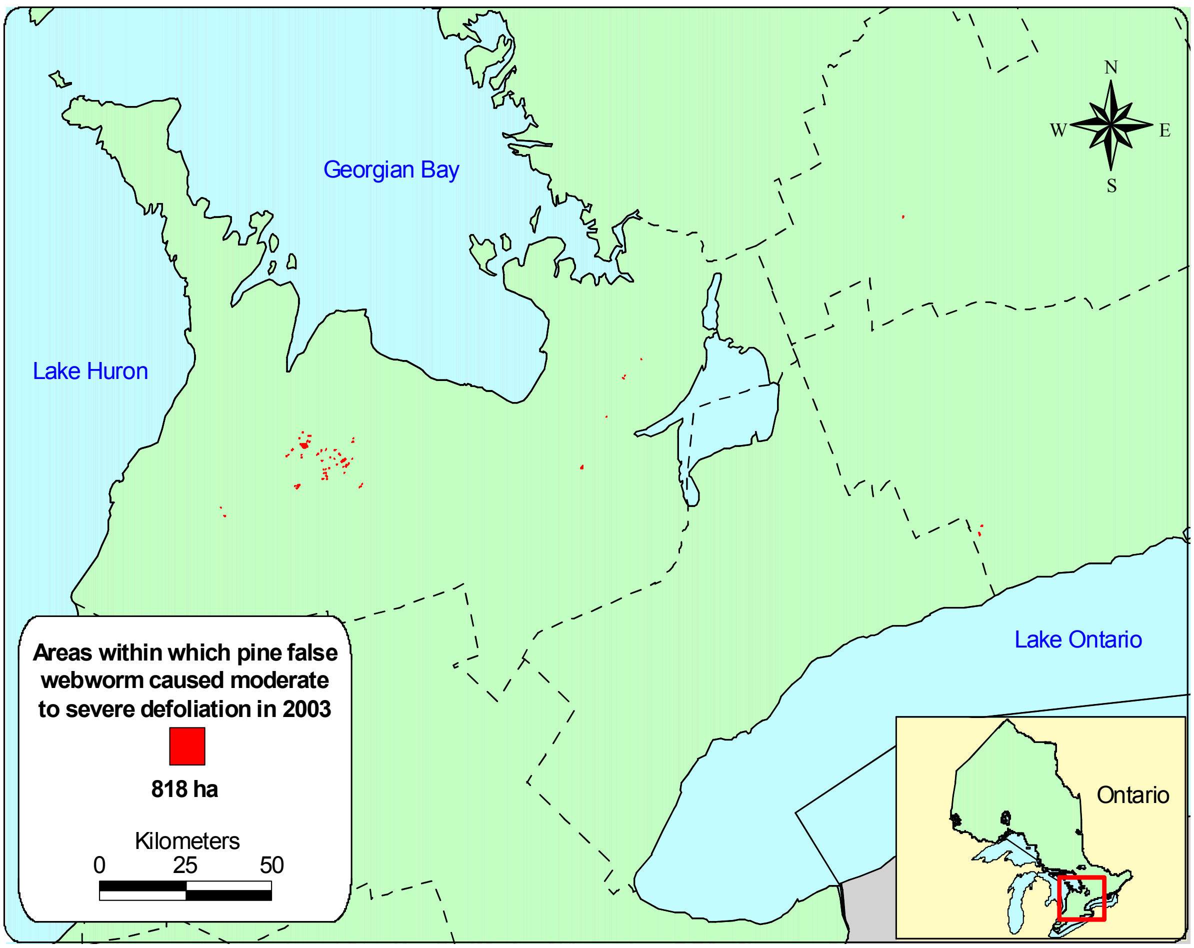


Image 1. Areas of Pine False Webworm defoliation in Ontario in 2003.

OTHER DEFOLIATING INSECTS

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

In 2003 a total of 8 542 ha of defoliation caused by the hemlock looper was recorded in northeastern Ontario in the Sudbury District. Some of the areas heavily damaged in Sudbury and Parry Sound districts in 2002 had varying levels of tree mortality this year. A total of 1 771 ha of nemlock looper-caused mortality was mapped in the Sudbury District, and 384 defoliated ha were detected at the southwest end of Parry Island in the Parry Sound District; no current defoliation was recorded in the Parry Sound District in 2003.

Bruce Spanworm, *Operophtera bruceata* (Hulst)

Moderate-to-severe defoliation was recorded over an area of 17 774 ha of aspen in northwestern Ontario (Figure 2). In 2002 Bruce spanworm defoliated a total of 264 687 ha primarily north and east of Lake of the Woods in northwestern Ontario.

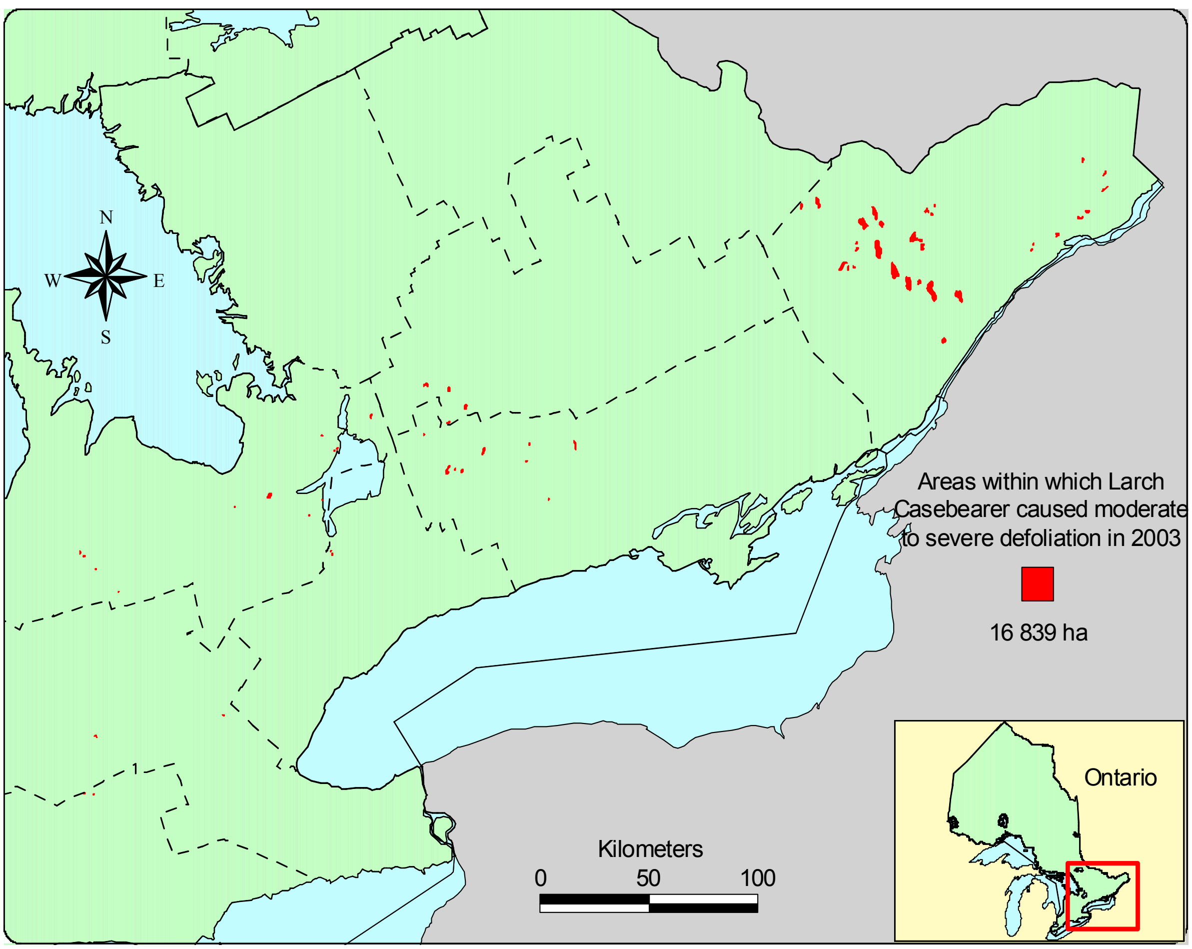


Image 3. Areas of Larch Casebearer defoliation in Ontario in 2003.

Larch Casebearer, *Coleophora laricella* (Hbn.)

In 2003 the larch casebearer defoliated 16 800 ha, primarily in eastern Ontario, but also at isolated locations across southern Ontario (Figure 3). This was an increase in defoliation compared to 2002, when 3 700 ha were defoliated across a similar area.

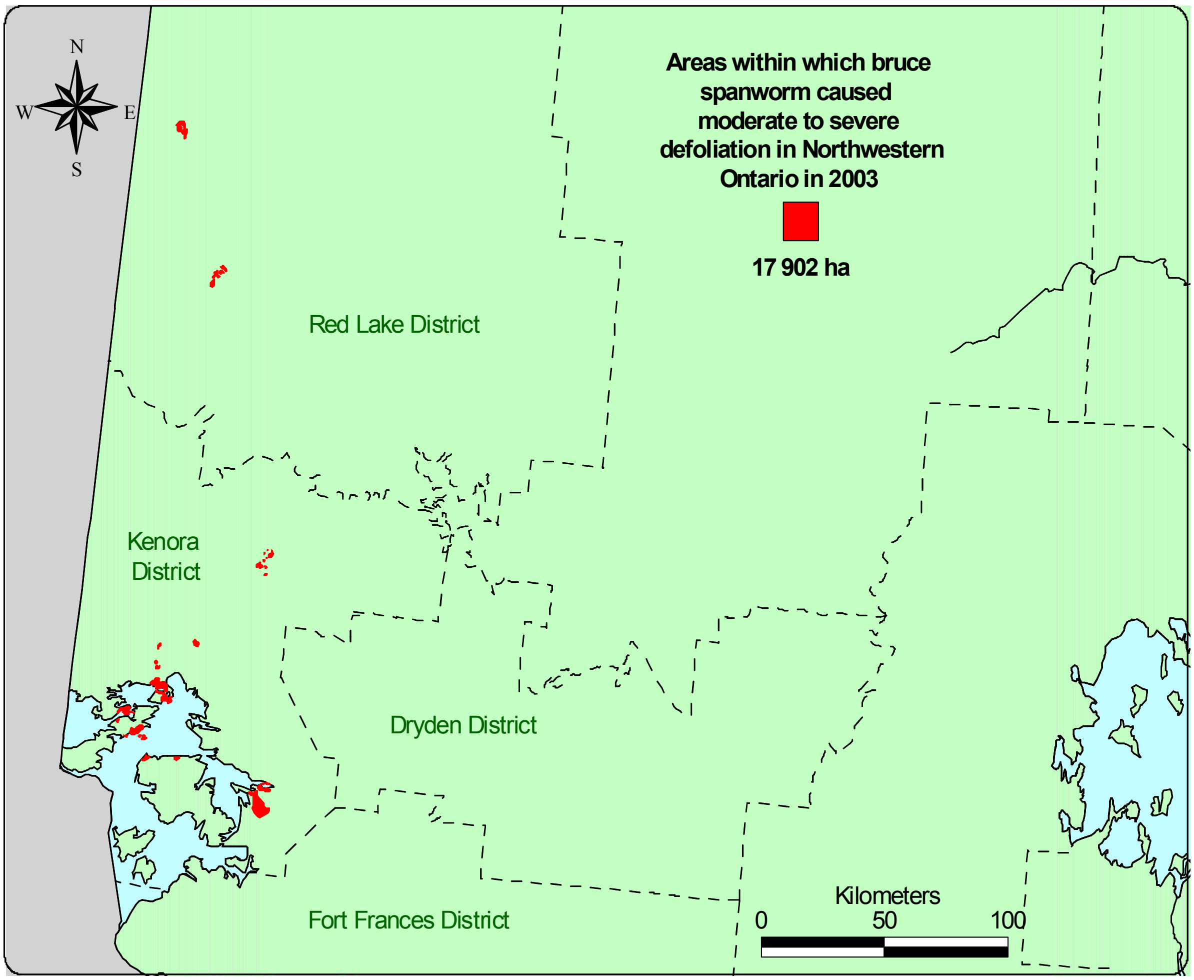


Image 2 Areas of Bruce Spanworm defoliation in Ontario in 2003.

Beetle Activity (*Agrilus sp*)

About 900 ha of balsam poplar mortality was evident in 2003 throughout an area west of Thunder Bay. Stands examined had high levels of an *Agrilus* species (buprestidae) wood borer activity causing the trees to be girdled. A total of 28 pockets in O'Connor, Oliver, Paipoonge and Neebing townships were mapped but mortality probably exists to a lower degree in other stands in the area. Ground checks of numerous stands indicate that most balsam poplar are dead or dying. Balsam poplar is the major species in the stands and in some cases comprises as much as 75%. Trembling aspen trees, the other main tree species in these stands, are living. This area has experienced drought years, forest tent caterpillar defoliation, and a severe winter in 2002-2003 when the area received very little snow with very cold temperatures. Stands examined had buprestid wood borer activity causing the trees to be girdled. The typical D-shaped exit holes were observed on most dead trees. Larvae have been collected from the trees but not yet identified. Adults were collected but may not be associated with the damage.

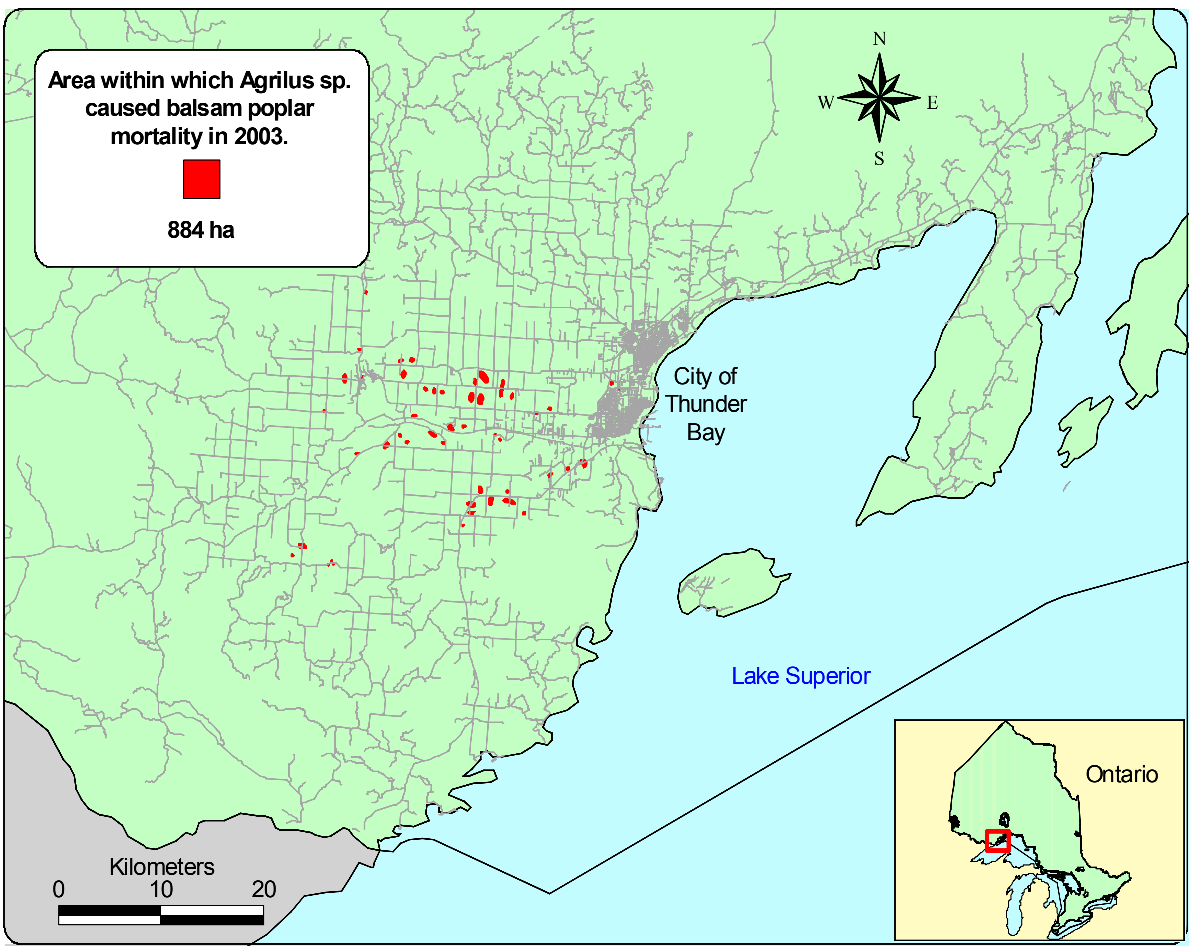


Image 4. Areas of *Agrilus sp.* damage in Thunder Bay District in 2003.

Hickory Bark Beetle, *Scolytus quadrispinosus* Say

The hickory bark beetle is one of most serious insect pest of hickories. Since 2001, hickory bark beetle has been infesting stands and woodlots in Aylmer district and has since spread into Guelph district. Aerial mapping in 2003 of the hickory bark beetle-infested woodlots disclosed most of the hickory mortality in East and West Williams townships, Middlesex County, Aylmer District and one stand in Stephen Township, and two stands in Usborne Township, Huron County, Guelph District (Figure 5).

Outbreaks of this insect occur, as with other bark beetles, following periods of drought. Adults feed for a short period at the base of leaf petioles and at twig junctions of the host, before flying to the trunks and branches to bore into the bark and construct egg laying galleries, where the most serious damage occurs when populations are high.

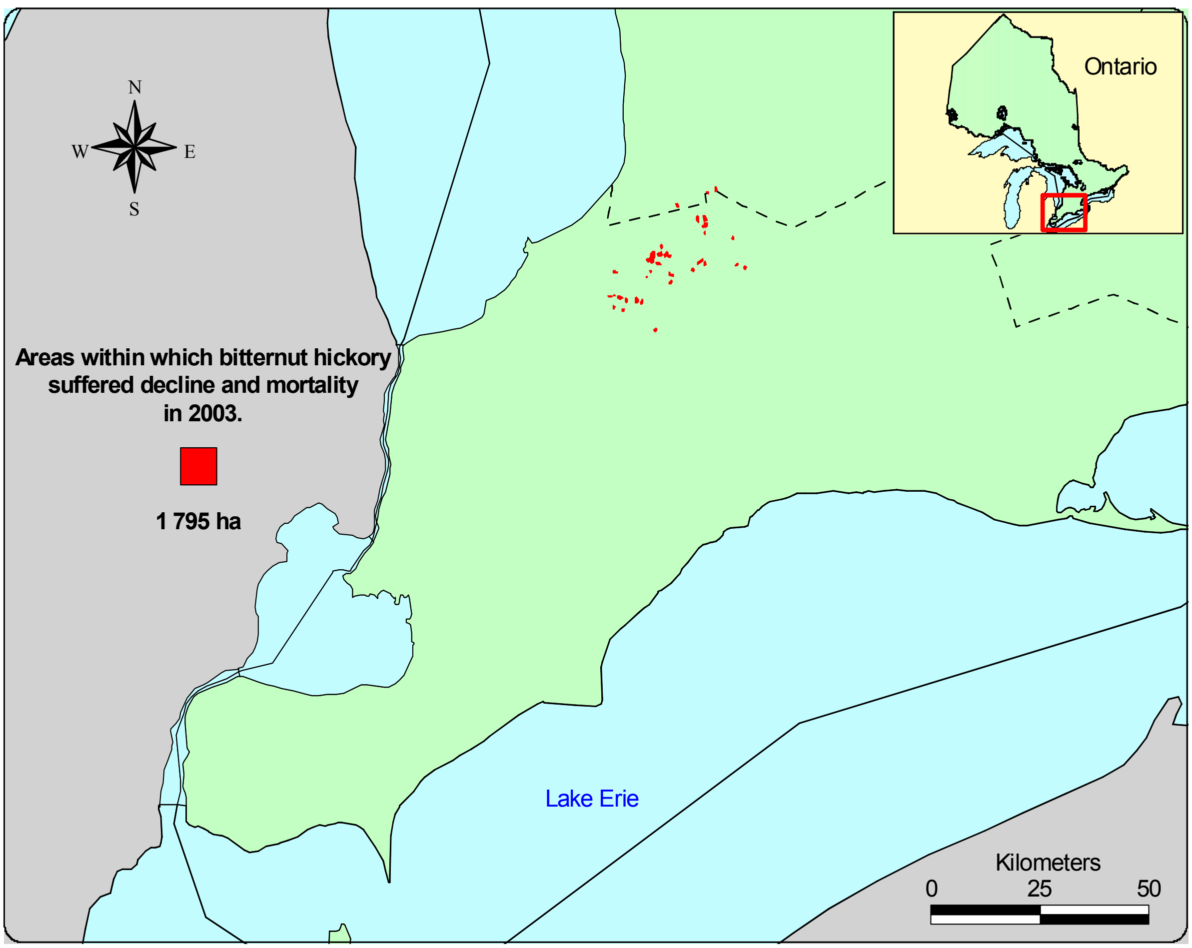


Image 5. Areas of hickory bark beetle damage in Ontario in 2003.

ABIOTIC

Aspen Decline/Mortality

In 2000, 174 898 ha of aspen decline/mortality was aerially mapped, primarily in the northeast Region of Ontario (Figure 6). In 2001, the area of decline/mortality increased to 319 462 ha; in 2002, the area mapped increased further by 123 072 ha for a total of 442 324 ha (Table 4, Figure 7). Preliminary tree mortality data indicates that about 70% of the aspen are dead compared to an average mortality of 54% for last year. In 2003, an additional 62 700 ha of mortality and decline was mapped, for a total area of 505 022 ha.

Repeated defoliation by the forest tent caterpillar (*Malacosoma disstria* Hbn.) occurred from 1995 to 1999. The second area of damaged aspen stands is located west of Hearst along the Highway 631 corridor. Whole-tree mortality and declining crowns are visibly scattered through the stands although the decline is not as severe as in the Smooth Rock Falls area. Typical boreal mixed-wood forests are also found here growing amongst the Arnott Moraines, which are glacio-fluvial tills characterized by well drained soils.

Image 6. Aerial view of aspen mortality in Northeastern Ontario.

Table 4: Gross area of aspen decline/mortality in 2000 - 2003.

Region	Area (ha)			
District	2000	2001	2002	2003
Northwest				
Nipigon	832	217	880	880
	832	217	880	880
Northeast				
Chapleau	0	0	43	7 069
Cochrane	87 619	128 572	183 929	217 330
Hearst	83 612	177 234	236 688	246 872
Kirkland Lake	0	2 692	5 313 938	7 599
Timmins	2 835	10 395	14 315	23 674
Wawa	0	359	1 156	1 598
	174 066	319 252	441 444	504 142
TOTAL	174 898	319 462	442 324	505 022

Other insects including the aspen two-leaf tier, *Enargia decolor* (Wlk.) and the aspen leafroller, *Pseudexentera oregonana* (Walsingham), have caused multiple years of defoliation from 1989-1994. Drought damage and potential freeze-thaw events are also believed to be involved.

INVASIVE FOREST PESTS

Emerald Ash Borer, *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae)

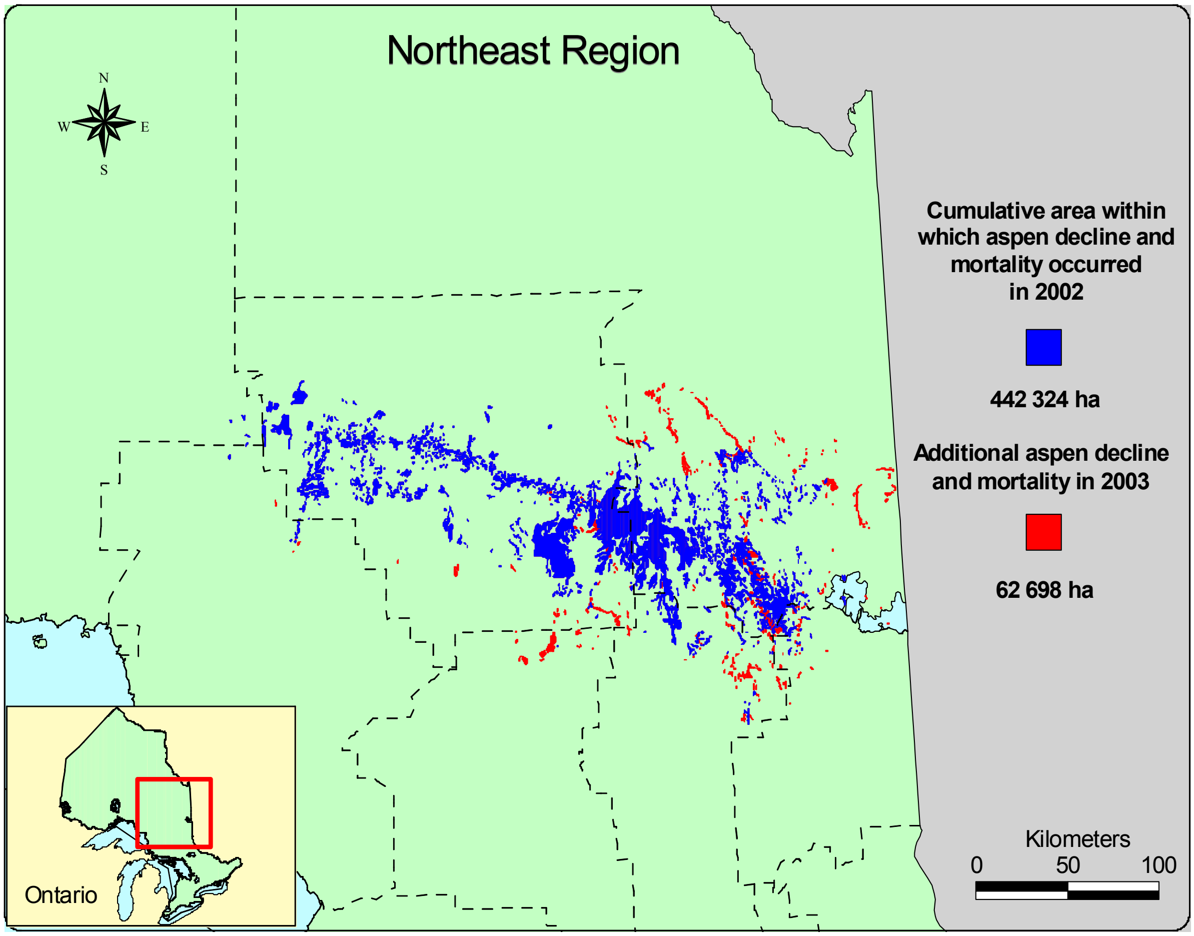


Image 7. Areas of aspen mortality/decline in Ontario in 2003.

The emerald ash borer, EAB, was first detected in North America in the spring of 2002, in southeastern Michigan, near Detroit. Based upon evidence collected from dead green ash trees (*Fraxinus pennsylvannica* var. *subintegerrima* [Vahl] Fern), it was concluded that it had been present in Michigan for at least five years. This insect is native to Asia, and was likely transported to North America in solid wood packing material, or in logs that are used to stabilize cargo within containers during shipping.

In July 2002 infested ash trees were detected within the city limits of Windsor, in southwestern Ontario by a team of forest health technicians from the Canadian Forest Service and the Ontario Ministry of Natural Resources. Subsequent surveys by the Canadian Food Inspection Agency (CFIA) have shown that the beetle has spread through much of Essex County and into the adjoining Chatham-Kent (Figure 8).

In Ontario, the emerald ash borer attacks stressed and healthy, urban and forest trees of all sizes. Other biotic and abiotic factors have been affecting the health of ash trees in Ontario for the past several years. Some of these other factors can result in symptoms that are very similar to those displayed by trees that are infested with the EAB, making it critical to properly identify which factor is actually affecting a particular tree.

The EAB was previously unknown in North America and little was known of the beetle in its native range. Because of this, the CFIA requested the assistance of the CFS in conducting a research program to study:

- The development of early detection methods for trees infested with EAB.

- Trapping methods for the detection of adult insects. As part of any control program development of effective traps to locate the insects before they infest new trees is critical. Woodborers such as EAB are usually attracted to trees by odours or colour. Work is underway to test the effectiveness of different traps.

- The effectiveness and movement of tree-injected insecticides to control EAB. A study has been initiated to evaluate imidacloprid, a synthetic chemical, as a systemic insecticide to kill EAB larvae feeding under the bark. There is no single answer to the control of EAB. Current techniques to control the spread of EAB rely on tree removal and destruction of the infested wood. While this will likely remain the most effective approach, methods are urgently needed so that we can avoid complete elimination and destruction of valuable trees from streets or parks.

- The biology and seasonal development of the insect to determine emergence patterns, adult longevity, possible natural enemies. Conduct an examination of site and tree factors affecting susceptibility and vulnerability to damage by EAB, and determine what species of ash and other hardwoods EAB can attack.

- The dispersal distance for EAB in a single season and to determine the conditions that influence it to take flight. One of the key questions is, how far can this beetle fly? The beetle was not believed to be a strong flier in its native habitat. However, work conducted by the CFS has shown that the beetle can fly up to 5 km per day, which has greatly influenced the size of the firebreak needed to contain the insect. Based on these and other findings, the CFIA is attempting to contain the beetle through the creation of a 10 km wide firebreak between Lake St Clair and Lake Erie (see Figure 8) within which all ash trees will be removed. In addition, a 10 km area of suppression (from which all infested trees will be removed), will be established west of the no ash zones.

- The development of early detection methods for trees infested with EAB. Presently EAB is detected only when the tree shows evidence of insect galleries, or beetles have emerged, creating their classic D-shaped holes. EAB can also attack the top of the tree, making exit holes impossible to observe. To detect new infestations and to prevent the further spread of the insect, identification of early symptoms is needed.

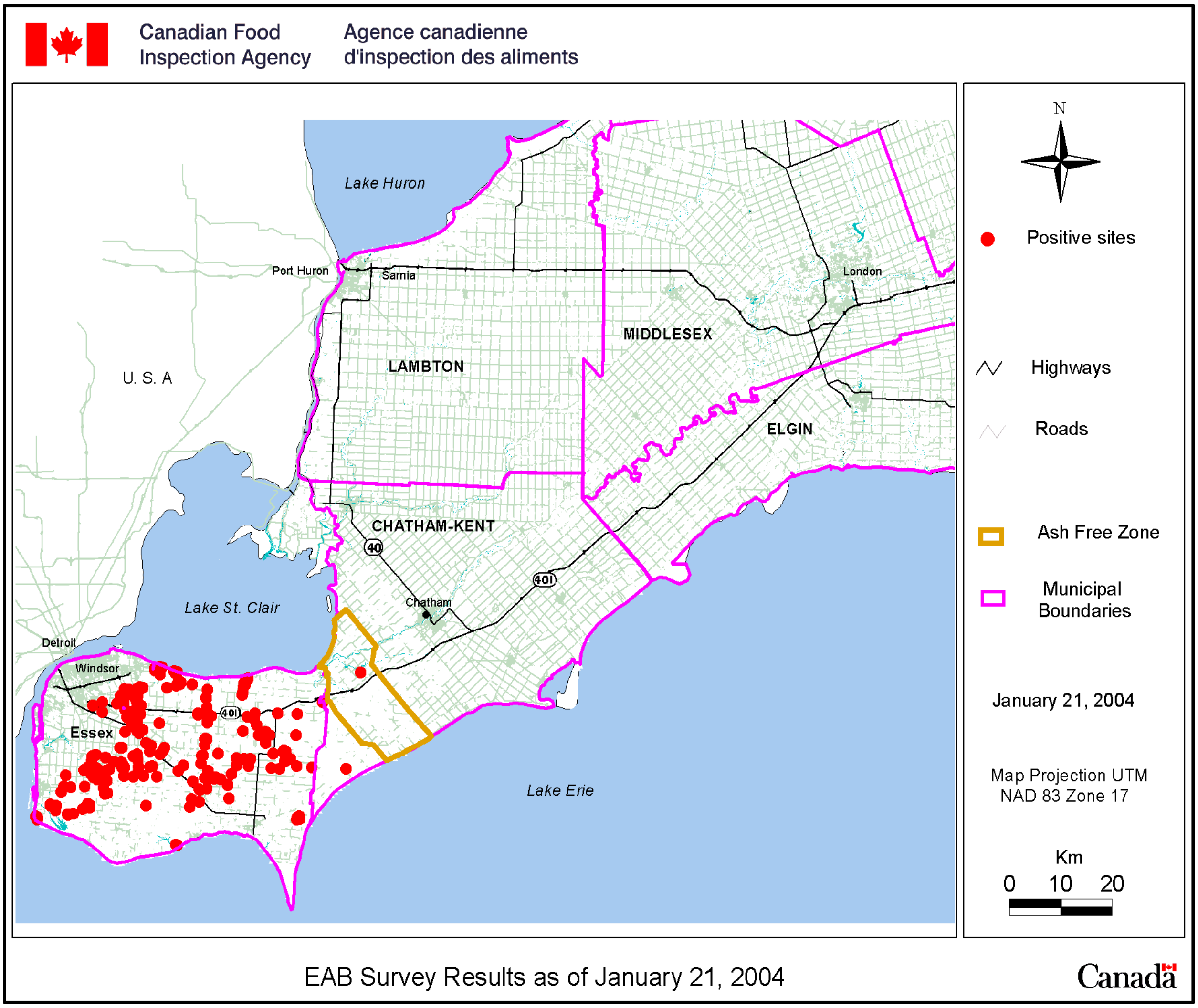
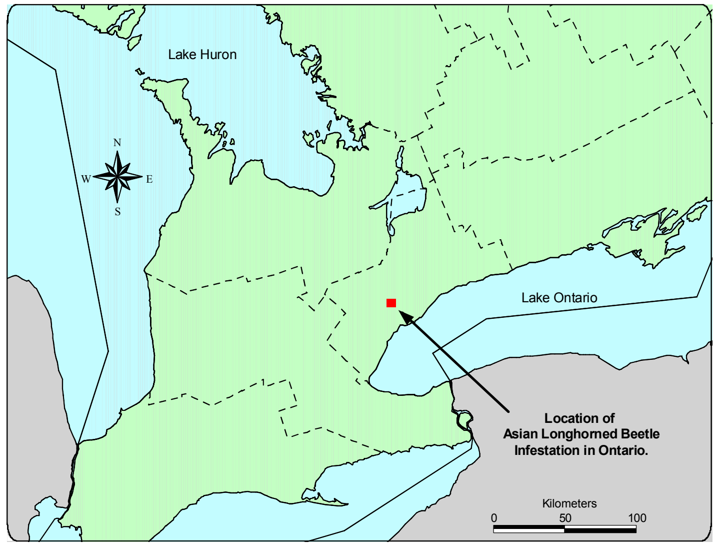


Image 8. Results of CFIA survey for emerald ash borer in Ontario.

Asian Longhorned Beetle, *Anoplophora glabripennis*

The Asian longhorn beetle (ALHB) was discovered in the Toronto/Vaughan area in September, 2003 (Figure 9) . This insect was first discovered in the mid 1990s in Chicago and New York and subsequently in New Jersey. In Canada the CFIA had intercepted the beetle at various locations in Ontario but this was the first record of an established population in Canada. Numerous infested trees have been located in industrial, residential and park areas by the CFIA in North Toronto and the adjacent community of Vaughan. Like the EAB, Asian Longhorned beetle is an exotic insect pest from Asia that likely arrived in wood packing material in the industrialized area in which it was found.

The ALHB attacks many hardwood species in Canada, but prefers maple, elm, birch and sycamore. While some pest management alternatives are being experimentally tested, tree removal is still the only viable control method. A number of other science based issues such as clarification of susceptible tree species in the Toronto area, and rate of insect spread and population growth are still unclear.



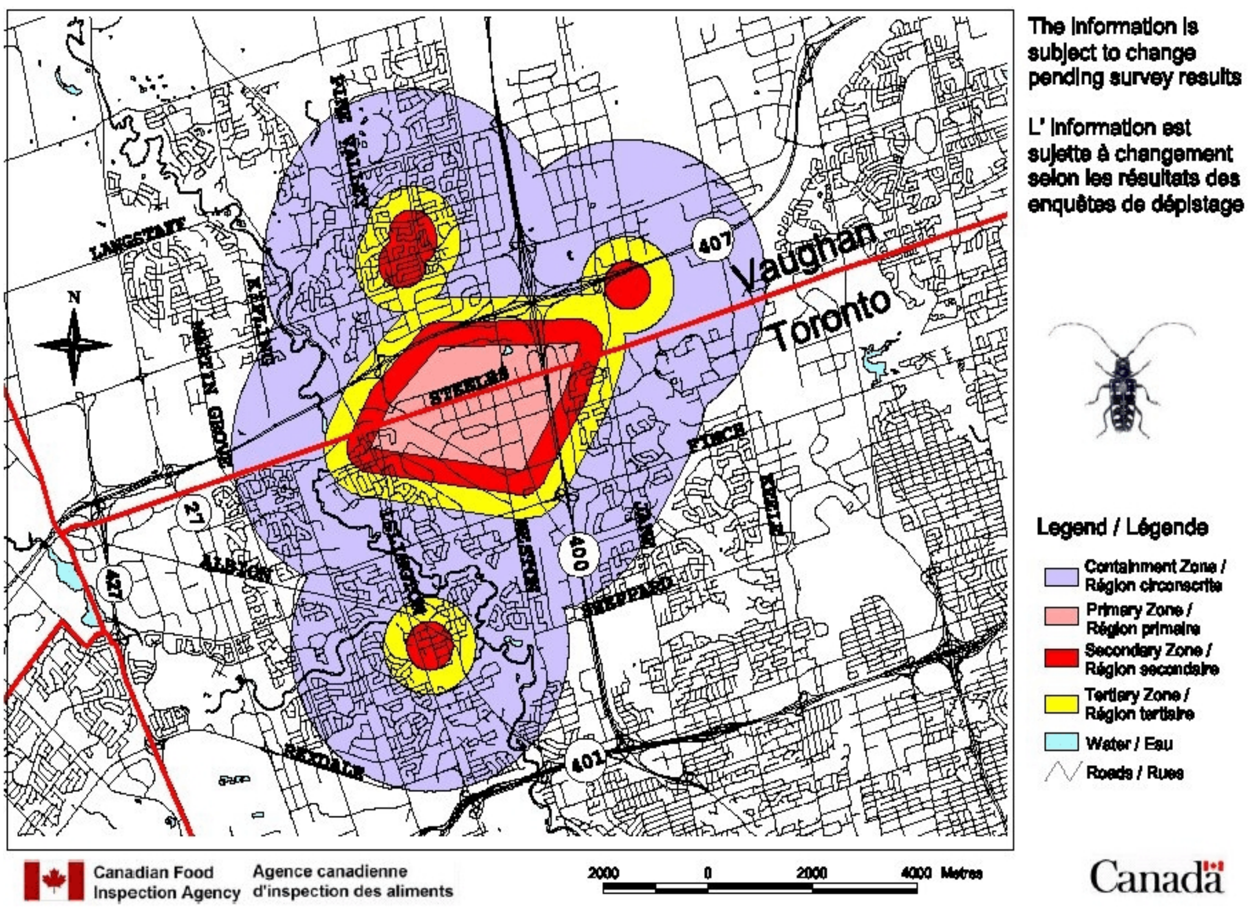


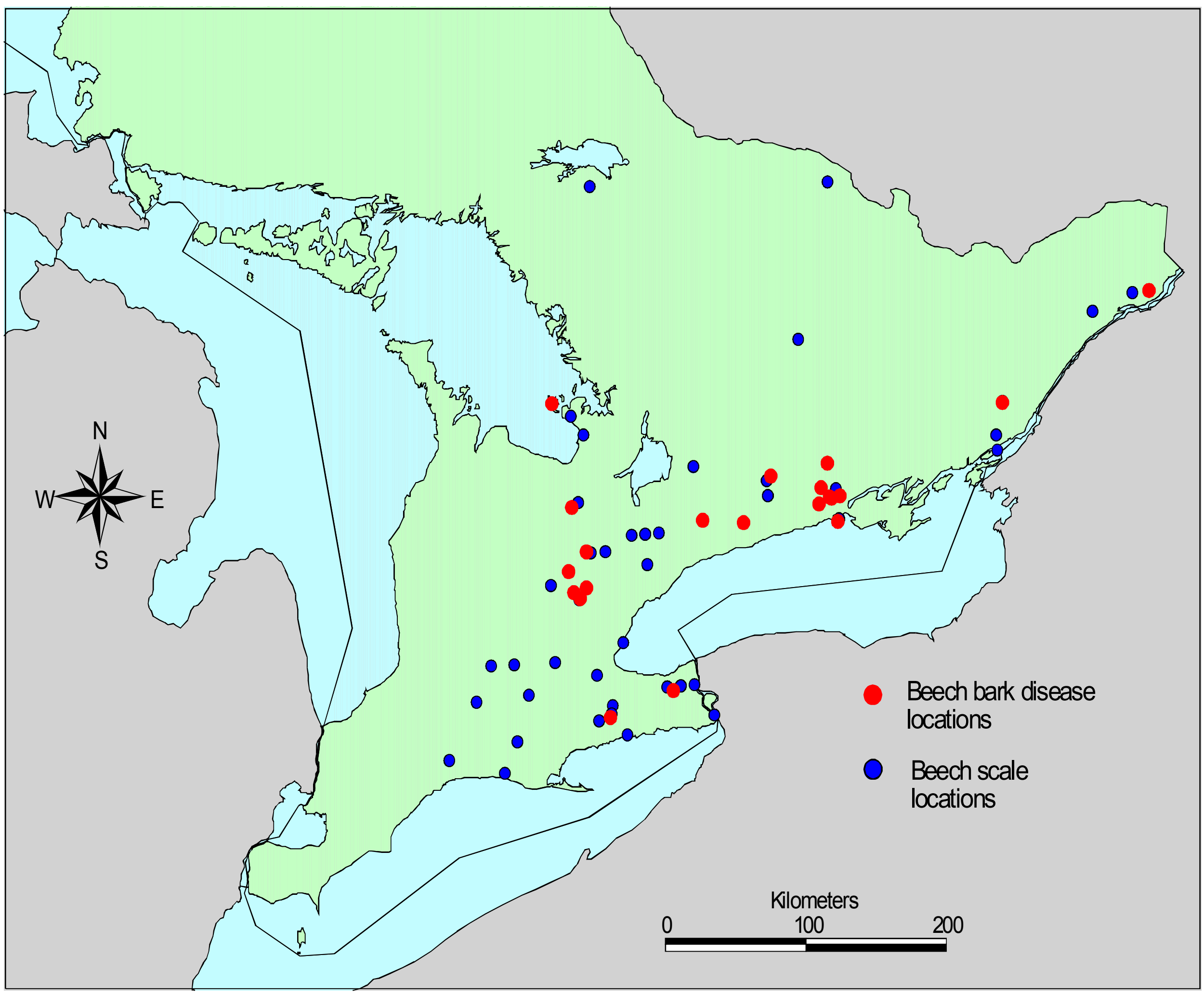
Image 9. Areas of Toronto and Vaughan infested by the Asian Longhorned Beetle in 2003.

Beech Bark Disease (*Nectria coccinea* var. *faginata*)

Since the late 1960s, surveys have detected heavy infestations of beech scale *(Cryptococcus fagisuga* Lind.) in numerous woodlots in southern Ontario; the insect is now known to be distributed across southern Ontario. Although confirmed samples of beech bark disease from Ontario have not been previously reported, it has been suggested that the disease has been present in Ontario for some 10 years (D. Houston pers comm.). In 1999, ten positive locations with the disease were identified and confirmed in southern Ontario. The first location was in the southern portion of Murray Township in Hastings County, northwest of the city of Trenton (Figure 10).

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.

For further information contact:



Quebec

Québec

Presented by:
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ABSTRACT

Eastern spruce budworm and hemlock looper remained the two predominant pests of conifers in 2003. In deciduous forests, the forest tent caterpillar was the main entomological problem. Finally, the pine shoot beetle remained a concern in plantations.

RÉSUMÉ

La tordeuse des bourgeons de l'épinette et l'arpenteuse de la pruche sont demeurées encore cette année les principaux ravageurs des résineux. Dans les forêts de feuillus, la livrée des forêts a posé le problème entomologique le plus important. Enfin, le grand hylésine des pins est demeuré une préoccupation importante dans les plantations.

TORDEUSE DES BOURGEONS DE L'ÉPINETTE

Choristoneura fumiferana (Clem.)

Les dégâts causés par la tordeuse des bourgeons de l'épinette couvrent de petites zones à l'échelle provinciale. Ils sont demeurés localisés dans les mêmes secteurs que les années précédentes (Carte 1). Aucune progression majeure n'a été observée. Les dommages ont connu une régression en Outaouais, une progression au Saguenay–Lac-Saint-Jean et sont restés comparables à ceux des années antérieures dans les autres régions du Québec. Les superficies affectées sont passées de 4 822 hectares à 2 658 hectares (Tableau 1), soit une baisse de 45 % par rapport à 2002. Ce changement est en partie attribuable à la diminution de l'intensité du relevé ainsi qu'à l'utilisation d'une nouvelle méthodologie de relevé aérien des dommages permettant de mieux circonscrire les superficies affectées.

En Outaouais, des défoliations ont été rapportées principalement le long de la rivière Gatineau ainsi que sur l'île du Grand Calumet. Les aires infestées sont toutefois moindres que l'année dernière. D'autre part, des relevés terrestres ont permis de détecter plusieurs îlots de défoliation qui n'ont pu être détectés par voie aérienne. La superficie totale infestée est ainsi légèrement supérieure à celle qui a été rapportée. Les infestations qui persistent dans les régions de l'Estrie et du Centre-du-Québec sont locales. En Mauricie, la situation est stable et les dégâts demeurent localisés dans les mêmes secteurs que l'année dernière. Au Saguenay–Lac-Saint-Jean, on constate une augmentation des superficies affectées et une aggravation des dégâts. Aucune défoliation n'a été signalée dans les autres régions du Québec.

Carte 1. Régions affectées par la tordeuse des bourgeons de l'épinette en 2003

Tableau 1. Superficies (ha) affectées par la tordeuse des bourgeons de l'épinette au Québec en 2003

Régions administratives	Niveaux de défoliation			Total
	Léger	Modéré	Sévère	
Saguenay–Lac-Saint-Jean	168 (186)[1]	414 (209)	692 (129)	1 274 (524)
Centre-du-Québec	0 (0)	0 (83)	20 (0)	20 (83)
Mauricie	0 (88)	0 (82)	356 (628)	356 (798)
Estrie	0 (0)	0 (0)	6 (18)	6 (18)
Laurentides	0 (0)	11 (0)	0 (0)	11 (0)
Outaouais	212 (1 404)	448 (707)	314 (1 288)	974 (3 399)
Total	**380** (1 678)	**873** (1 081)	**1 388** (2 063)	**2 641** (4 822)

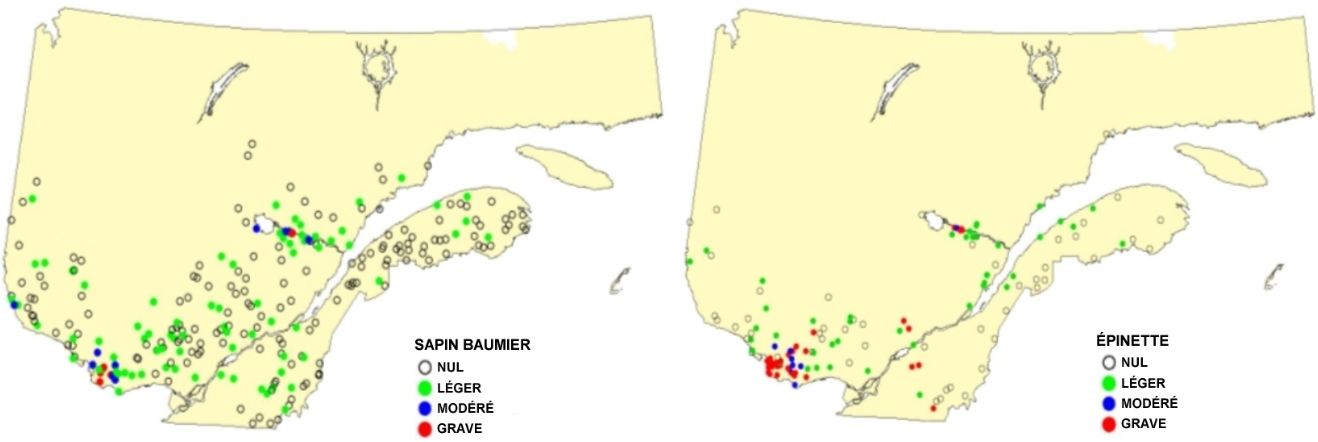
( )[1] = Superficies affectées en 2002

PRÉVISIONS POUR 2004

L'inventaire des larves en hibernation (L2) a encore été réalisé en 2003 à l'échelle de la province afin de suivre l'évolution, à court terme, des populations de tordeuses. Les inventaires réalisés par la Société de protection des forêts contre les insectes et les maladies (SOPFIM) nous ont permis d'évaluer les populations de L2 dans 71 sites additionnels localisés dans les régions de l'Outaouais et de la Mauricie. Au total, 467 sites ont été échantillonnés.

Les résultats sur le sapin baumier et l'épinette blanche montrent que l'épidémie ne connaîtra pas d'expansion majeure en 2004 (Carte 2). Celle-ci demeurera généralement confinée dans les mêmes secteurs que ceux des années antérieures. Une hausse marquée des populations a toutefois été observée en Outaouais, alors que quelques nouveaux foyers de défoliation devraient apparaître, notamment dans les régions des Laurentides et du Saguenay–Lac-Saint-Jean.

Carte 2. Niveaux de populations de tordeuses des bourgeons de l'épinette prévus en 2004.



Dans la région de l'Outaouais, on appréhende encore des défoliations graves dans la zone comprise entre Maniwaki, Fort-Coulonge et Buckingham. Dans les régions du Centre-du-Québec, de l'Estrie et de la Mauricie, les mêmes foyers seront encore gravement infestés l'an prochain. Au Saguenay–Lac-Saint-Jean, les dégâts demeureront localisés bien que quelques foyers de défoliations apparaîtront en périphérie de la zone infestée, en 2003, le long de la rivière Saguenay. Dans les autres régions du Québec, les populations de tordeuses restent faibles.

ARPENTEUSE DE LA PRUCHE

Lambdina fiscellaria fiscellaria (Guen.)

L'épidémie d'arpenteuses de la pruche, qui s'est amorcée en 1998 dans la Moyenne et la Basse-Côte-Nord, a atteint son apogée en 2000. Cette infestation, qui ne s'était maintenue que dans un secteur localisé à l'est de la rivière Saint-Augustin l'année dernière, n'a pas fait l'objet d'un suivi en 2003. Compte tenu du nombre d'années consécutives d'infestation dans ce territoire, on présume que l'épidémie y a poursuivi sa régression cette année. Comme il était prévu, les petits foyers d'infestation rapportés en 2002 le long du fleuve Saint-Laurent n'ont pas connu d'expansion importante en 2003 (Carte 3). Seules quelques variations locales ont été observées lors de l'inventaire aérien des dommages. Les foyers couvrent une superficie de 111 hectares, comparativement à 79 hectares en 2002 (Tableau 2).

Carte 3. Défoliations causées par l'arpenteuse de la pruche en 2003

Tableau 2. Superficies (ha) affectées par l'arpenteuse de la pruche au Québec, en 2003

Régions administratives	Niveaux de défoliation			Total
	Léger	Modéré	Sévère	
Bas-Saint-Laurent	0 (0)[1]	0 (3)	93 (61)	93 (64)
Chaudière-Appalaches	0 (0)	0 (0)	0 (15)	0 (15)
Côte-Nord	- (1288)	- (8955)	- (35 200)	- (45 443)
Gaspésie– Îles-de-la-Madeleine	0 (0)	4 (0)	14 (0)	18 (0)
Total	0 (1 288)	4 (8 958)	107 (35 276)	111[2] (45 522)

( )[1] : Superficies affectées en 2002
[2] : N'incluant pas la défoliation sur la Côte-Nord

PRÉVISIONS POUR 2004
À l'automne 2003, le relevé des œufs d'arpenteuse de la pruche a été effectué par le MRNFP dans 81 sites de l'est de la province. Les résultats indiquent que les populations d'arpenteuses se maintiendront à un niveau endémique en 2004. Des niveaux élevés de population ont toutefois encore été détectés dans quelques endroits rapportés le long du fleuve Saint-Laurent. Bien que certains foyers n'ont pas été inventoriés en raison de difficultés d'accès, on appréhende que les infestations s'y poursuivront l'an prochain. Dans la Haute et la Moyenne-Côte-Nord, les populations se maintiendront à un niveau très faible, à l'exception d'un site localisé sur l'Île d'Anticosti où des défoliations pourraient être apparentes en 2004.

TORDEUSE DU PIN GRIS
Choristoneura pinus pinus Free.

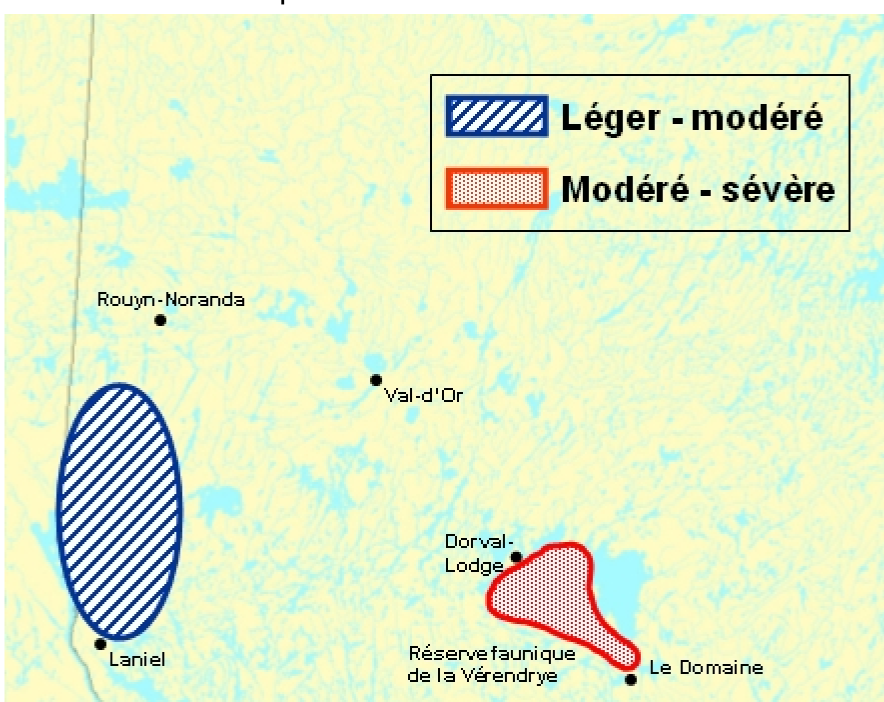
Les populations de cet insecte sont demeurées à l'état endémique en 2003.

LIVRÉE DES FORÊTS
Malacosoma disstria Hbn.

L'épidémie de livrées des forêts, qui sévit dans l'ouest de la province depuis 1999, a poursuivi sa régression en 2003 comme prévu. À son apogée, en 2001, l'insecte avait affecté les peupliers et les bouleaux sur une superficie de quelque 1 250 000 hectares. Les dégâts qu'il a causés en 2003 n'ont pas été circonscrits par voie aérienne. Les observations terrestres ont toutefois permis de constater que les défoliations ont été moins intenses et moins étendues que l'année dernière (Carte 4). En Abitibi-Témiscamingue, des foyers de défoliation ont encore été rapportés. On a également relevé des dommages dans la réserve faunique La Vérendrye jusqu'à la limite sud de l'Abitibi-Témiscamingue ainsi qu'au sud du lac Roland en Outaouais. Dans les autres régions du Québec, aucune défoliation n'a été remarquée.

Carte 4. Zones touchées par la livrée des forêts au Québec en 2003

Carte 5. Défoliations causées par la livrée des forêts en 2003



PRÉVISIONS POUR 2004
L'inventaire des œufs n'a pas été réalisé en 2003. Cependant, plusieurs indices portent à croire que le déclin de l'épidémie se poursuivra dans l'ouest de la province en 2004, dont l'augmentation des populations d'un parasite de la livrée, la mouche sarcophage, *Sarcophaga aldrichi* Park., ainsi que la présence d'un virus rapportée sur des larves âgées.

SPONGIEUSE
Lymantria dispar (L.)

Quelques petits foyers d'infestation sont toujours présents dans les régions du sud du Québec, soit en Montérégie, Chaudière-Appalaches, Outaouais et Mauricie. Les dégâts sont très légers dans la plupart des cas.

TORDEUSE DU TREMBLE
Choristoneura conflictana (Wlk.)

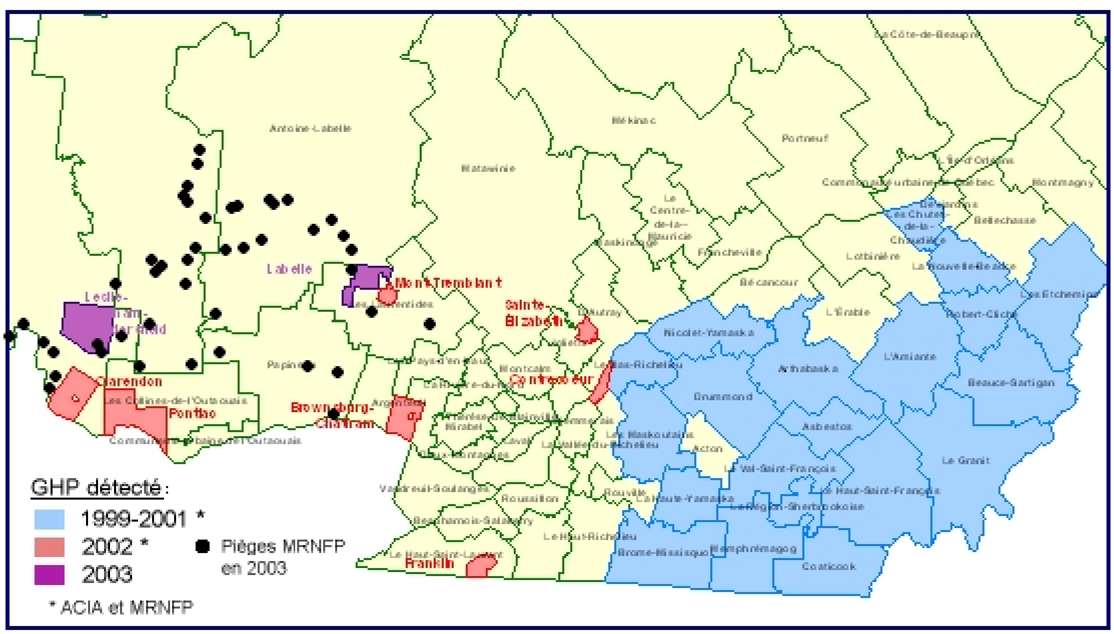
En 2003, la tordeuse du tremble a causé de légères défoliations en Outaouais et dans les Laurentides. Une recrudescence des populations a été relevée en quelques endroits au Saguenay–Lac-Saint-Jean sur des superficies très restreintes.

GRAND HYLÉSINE DES PINS
Tomicus piniperda (L.)

Depuis 1999, la DCF menait en collaboration avec l'Agence canadienne d'inspection des aliments (ACIA), une opération de piégeage dans toute la partie sud du Québec afin de délimiter l'aire de distribution du grand hylésine des pins *Tomicus piniperda* (L.). En 2003, la DCF a poursuivi seule un programme restreint de piégeage dans six municipalités régionales de comté (MRC) de l'ouest du Québec. Une cinquantaine de pièges de type Lindgren ont été installés dans des plantations de pins sylvestres et de pins rouges situées le long des principales routes de transport de bois. Le réseau de piège a permis de découvrir la présence de l'insecte dans deux nouveaux sites. Ces municipalités sont cependant localisées dans deux MRC où la présence de l'insecte a déjà été rapportée. En 2003, l'insecte était donc présent dans 88 municipalités réparties dans 26 MRC.

Carte 6. Zone de distribution du grand hylésine des pins au Québec en 2003

Carte 7. Localités où le grand hylésine des pins a été retrouvé de 1999 à 2003



DÉGÂTS CLIMATIQUES

Au printemps 2003, deux phénomènes, la dessiccation hivernale et la gelure hivernale, ont été rapportés à plusieurs occasions dans presque toutes les régions de la province, sauf sur la Côte-Nord et dans l'Estrie. Dans les deux cas, la vie des arbres n'est pas menacée bien que les dégâts aient été assez spectaculaires.

SESSION IV - GLOBALIZATION AND FOREST PESTS

SÉANCE IV - LA MONDIALISATION ET LES RAVAGEURS FORESTIERS

SESSION IV - SÉANCE IV

Molecular diagnosis of the causal agent of sudden oak death

Diagnostic moléculaire de l'agent causal de l'encre des chênes rouges

Presented by:
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Abstract

In June 2003, *Phytophthora ramorum,* the organism responsible for Sudden oak death, was found in Canada, British Columbia for the first time. This pathogen causes severe damage on oak trees in California and Oregon. The list of hosts is extensive and now reaches above 50. Molecular diagnosis is an important tool to prevent spread of this pathogen and enforce its eradication in B.C. Most assays currently in use do not reliably distinguish between *P. ramorum* and *P. lateralis,* two genetically close species. We developed specific primers combined with Taqman and Molecular beacon probes specific to *P. ramorum*, to detect by fluorescence this pathogen in a real-time PCR assay. The internal transcribed spacer (ITS), elicitin and beta-tubulin genes were sequenced and compared among *Phytophthoras*. The assays developed were specific to *P. ramorum* and allow differential diagnostic of *P. ramorum* and *P. lateralis*. They were also used with DNA extracted from plants inoculated and infected with *P. ramorum*. All inoculated samples were positive with both genes using three types of DNA detection assays. In our sequences, we uncovered some single nucleotide polymorphisms (SNP) in two genes (Beta-Tubuline and CBEL «Cellulose Binding Elicitor Lectin ») that distinguish the European and the North American *P. ramorum*. Surprisingly, the B.C. and Oregon isolates possess the European DNA profile. This finding is extremely important for two reasons: 1-the pathogen present in California apparently has not yet migrated to Canada, and 2-information on the biology, epidemiology, etiology and host range of *P. ramorum* is currently based on the California biotype and may differ from the European type.

Résumé

En juin 2003, *Phytophthora ramorum,* l'organisme responsable de la maladie de l'encre des chênes rouge (Mort subite du chêne) fût découvert au Canada, en Colombie Britannique pour la première fois. La liste des hôtes ne cessent d'augmenter et en est maintenant à une cinquantaine. Le diagnostic moléculaire est un outil important pour prévenir la propagation de ce pathogène et renforcir son éradication en Colombie-Britannique. Plusieurs tests présentement utilisés ne

permettent pas efficacement de distinguer entre *P. ramorum* et *P. lateralis,* deux espèces génétiquement proche. Nous avons développé des amorces spécifiques combinées à des Taqmans et des « molecular beacons » spécifiques à *P. ramorum* afin de le détecter par fluorescence en PCR en temps réel. L'espace interne transcrite (ITS), le gène de l'élicitine et le gène de la beta-tubuline ont été séquencés et comparés pour plusieurs *Phytophthoras*. Les tests développés sont spécifiques à *P. ramorum* et permettent un diagnostic différentiel de *P. ramorum* et *P. lateralis*. Les tests utilisent aussi de l'ADN extraite de plantes inoculées et infectées par *P. ramorum*. Tous les échantillons inoculés étaient positifs pour tous les gènes utilisant les trois méthodes de détection d'ADN. Dans les séquences, nous avons découvert certains polymorphismes de simple nucléotide (SNP) dans deux gènes (Beta-Tubuline et CBEL «Cellulose Binding Elicitor Lectin ») qui permettent de différencier entre la souche européenne et la souche nord-américaine. Curieusement, les isolats retrouvés dernièrement en Colombie Britannique et en Oregon possèdent un profil d'ADN de type européen. Cette découverte est extrêmement importante pour deux raisons : 1-le pathogène présent en Californie n'a pas migré au Canada, et 2- les information sur la biologie, épidémiologie, étiologie et les différents hôtes de *P. ramorum* sont apparemment basées sur le biotype californien et pourrait différer du type européen.

* * * * * * *

Sudden oak death, caused by *Phytophthora ramorum*, is a severe disease of several trees and shrubs. This pathogen is spreading rapidly and a quarantine is currently in effect to prevent spread. Molecular diagnosis is an important tool for rapid detection and to reduce the spread of this pathogen. New molecular assays are being developed to detect and identify *P. ramorum* reliably in order to implement this quarantine. However most assays cannot distinguish between *P. ramorum* and *P. lateralis*. In order to overcome this cross reaction, Beta-tubulin and elicitin regions were sequenced and used to find polymorphisms between *P. ramorum* and other *Phytophthora* spp.. New assays were designed using existing internal transcribed spacer (ITS) sequences. Specific primers for the Polymerase Chain Reaction used with molecular beacons, Taqman probes and SybrGreen were developed to detect this pathogen. The real-time assays and primers differentiated *P. ramorum* from the 67 species of *Phytophthora* tested, including *P. lateralis*. The assays developed were also used with DNA extracted from plants inoculated with *P. ramorum*. Overall, Taqman assays with ITS or elicitin were found to have the best combination of sensitivity and specificity.

KEYWORD: Sudden Oak Death, Real-Time PCR, *Phytophthora ramorum*, Beta-tubulin, elicitin, Taqman, Molecular beacons, SybrGreen, Diagnosis

Introduction

Massive oak mortality has been reported since 1995 in California. In 2001, a new pathogen called *Phytophthora ramorum* Werres, de Cock & Man in't Veld has been described [Werres *et al*., 2001] and identified as the causal agent of SOD [Garbelotto *et al.,* 2001; Davidson *et al.*, 2002a; Maloney et al, 2002; Rizzo et al, 2002; Murphy & Rizzo, 2003]. This pathogen has since spread to several counties in California and was discovered [Goheen *et al*., 2002] and then eradicated in Oregon in 2001 [Kanaskie *et al*., 2002]. However, it was found again in 2003 in nurseries from Oregon, Washington, and British Columbia [CFIA, 2003; ODA, 2003]. *Phytophthora ramorum* is also present in Europe where it has been reported in 11 countries, mostly in nurseries, but also in the public green, where it causes leaf blight and shoot dieback mainly in *Rhododendron* and *Viburnum* [Moralejo & Werres, 2002; Lane *et al*., 2003; De Merlier *et al.*, 2003; Jullien & Casset, 2003; Werres, 2002]. Recently, it was found on red oaks in England where symptoms typical of sudden oak death were observed [DEFRA, 2003].

One of the challenges for plant pathologists is that *P. ramorum* infects a broad range of hosts and causes different symptoms, including cankers, leaf spots, blights and diebacks [CFIA. 2003; Garbelotto *et al*., 2003a]. Inspection and proper identification of nursery material can be problematic, in particular for hosts for which the etiology has not been described, or on asymptomatic host material. Experience in Europe and, recently, North America indicates that *Pr* spreads readily on infected nursery material. The pathogen is also potentially spread via chlamydospores in soil debris and rain splash [Davidson *et al.,* 2002b], adding another level of difficulty in detection.

State and federal quarantines have been put into place in the U.S.A. and in Canada to prevent the movement of material from infected areas to disease-free regions. In spite of these quarantine measures, the disease has spread to new locations along the Pacific west coast in 2003. Intensive surveys are being conducted in several countries where this pathogen could represent a risk including Canada to determine whether the pathogen is present and to assess its distribution. Such surveys generally rely on isolation of the pathogen by plating, followed by identification based on morphological characteristics and usually by molecular identification. But one of the difficulties encountered with the identification based on morphology is that it cannot always allow the distinction of closely related species and it cannot distinguish variants such as races or varieties within species. This is important in the case of P. ramorum since close relatives of *P. ramorum*, exist in North America and variants within P. ramorum are known in North America and Europe. Molecular diagnostic tools can allow to detect rapidly and sensitively the pathogen and provide an increased confidence level in the identification. Molecular assays have the advantage that they can be used on any type of material, from pure or mixed cultures of the pathogen, to symptomatic or asymptomatic host tissue.

The internal transcribed spacer (ITS) of the rRNA cistron was used to differentiate between *Phytophthora* species by PCR [Cooke *et al.* 2000]. A recent phylogeny study that included *P. ramorum* revealed a close relationship between *P. ramorum* and *P. lateralis* and the presence of only 12 polymorphisms between these species [Garbelotto *et al.,* 2002; Rizzo *et al*., 2002]. The PCR assay developed from this gene cannot reliably discriminate between these two species due to the presence of only a point mutation at the priming sites. This is important since *P. lateralis* is commonly found on the west coast of North America and is the causal agent of Port Orford cedar root rot [Garbelotto *et al.,* 2002; Garbelotto, 2003b].

Although rDNA has been widely used as the gene region for molecular diagnostic and phylogeny, other gene regions are emerging as advantageous for phylogeny and diagnostic. Since different rates of polymorphism can be observed in various genes, in cases where closely related species or taxa are targeted for diagnosis, genes can be selected according to their level of DNA polymorphism. Moreover, relying on multiple genes for diagnostic could increase reliability. In some cases, phylogenies generated with several single copy nuclear genes showed better resolution than with rDNA [O'Donnell *et al.,* 1998a, O'Donnell. *et al.,* 1998b O; Skovgarrd *et al.,* 2001; Taylor *et al.,* 2000]. Increasingly, molecular phylogenies are relying on multiple genes. This can be especially relevant when recombination or hybridization are suspected [O'Donnell *et al.,* 2000]. Diagnostic based on a single gene could not detect such recombination or hybridization events. Reliance on several genes for diagnostic could alleviate this problem.

PCR diagnostic has been adopted as a method of choice in molecular diagnostic. PCR reactions can use primers specific to target or be followed by restriction enzyme digestions. Alternatively, Real-time polymerase chain reaction (RT-PCR) is a fast and reliable method for molecular diagnostic that can provide accurate quantification of DNA in environmental samples [Shaad *et al*., 2002]. It can be used in conjunction with a fluorescent dye such as SYBR-Green, or with internal reporter probes labelled with fluorescent dyes. This allows the reaction to be monitored in real time and the quantification of the PCR products in the exponential phase of the reaction. In addition, the use of a metric based on a threshold is amenable to automation and high-throughput sample processing. Real-time PCR has been used in plant pathology for DNA quantification and diagnosis of several plant pathogens [Shaad & Frederick, 2002; López *et al*., 2003]. A SYBR-Green assay was used to quantify fungal DNA from soil using real-time PCR [Filion et al, 2003]. A Taqman assay was used to detect *Ralstonia solanacearum* [Weller *et al*., 2000]. Other studies were conducted using dual-labeled probes on *P. infestans* and *P. citricola* in their respective host plants [Böhm *et al*., 1999]. A molecular beacon assay was used in a study on population dynamics of *Pythium aphanidermatum* in cucumber [Postma *et al*., 2001].

The objectives and approach of this investigation were the following. (1) to sequence two nuclear genes (beta-tubulin and elicitin "ramorumin") and the ribosomal ITS regions of a wide range of *Phytophthora* species to identify polymorphisms specific for *P. ramorum*, to be used for the development of specific primers and probes. (2) to design real-time PCR assays to specifically detect *P. ramorum*, based on the polymorphisms identified and using three reporter technologies: SybrGreen, Taqman® probes and Molecular beacons targeting three gene regions. (3) To validate the real-time PCR assays using DNA from pure cultures and infected plant samples.

MATERIALS AND METHODS

Isolates

Isolates used in this study comprise 30 isolates of *Phytophthora ramorum* from both European and North American origin and different hosts (Table 1) and 65 isolates, representing most of the recognized *Phytophthora* species available in pure culture (Table 2)

Sequencing

Mycelium was cultivated and DNA was extracted following the procedure described in De Cock *et al.,(*1992) or Möller *et al.,* (1992). Primers for the Beta-tubulin and the elicitin genes were designed for this study. The PCR products were purified, quantified and sequenced using the same primers as PCR. Sequencing reactions were performed using a Big Dye Terminator Sequencing kit on an ABI 310 automated sequencer (PE Applied Biosystems, Foster City, CA). Sequences were aligned using Sequencher (Gene Codes Corporation, Ann Arbor, Michigan) and Megalign (DNASTAR, Inc. Madison, WI) using Clustal W.

Selection of primers and probes

The software Primer Premier 5.00 (Premier Biosoft International, Palo Alto, CA) was used to design PCR primers. The selection criteria were the following: Tm (melting temperature) 55-65C, primer length 18-22 pb. Specific primers were designed so that the unique nucleotides were at the 3' end position of the primer if possible. The primer pairs were designed such that PCR products were shorter than 200 bp. In cases were only single nucleotide differences were present and regular primers did not allow specific amplifications, primers were synthesized with a Lock Nucleic Acid (LNA) [Orum *et al.*, 1999; Braasch & Corey., 2000], (Proligo LLC, Boulder, CO) to increase specificity.

Molecular Beacon, Taqman and SybrGreen design

Molecular beacons were designed using Mfold (DNA mfold server: 1996-2003, Michael Zuker, Rensselaer Polytechnic Institute) and Beacon designer software (Premier Biosoft International, Palo Alto, CA) to calculate the Tm and the structure of the molecule. The Tm of the molecular beacon should be 7-10°C higher than annealing temperature [Tyagi *et al.*, 2002]. The selecting criteria were set so that the stem was 5-7 bases of length and the loop 15-30 nucleotides. The probes were labelled with fluorescein at the 5'end and with the quencher Dabcyl at the 3'-end [Tyagi & Kamer, 1996; Tyagi *et al.*, 2002; Bonnet *et al.*, 1999]. Taqman probes [Heid *et al.*, 1996] were designed with Primer Premier 5.00. We used the following parameters for the design: Tm 10°C higher than the primers, 15-30 pb in length and the total number of G's or C's in the last five nucleotides at the 3' end of the primer not exceeding two. The mismatching nucleotide was set whenever possible in the middle of the probe rather than at the ends [Dorak, 2003].

PCR Amplification

PCR was performed with an MJ-Research Opticon2 DNA Engine (MJ Research, Inc. Waltham, MA) in real-time PCR. Fluorescent molecules (SybrGreen, dual-labeled probe (Taqman®), or Molecular beacons) were included in the PCR master mix (QuantiTect^{TM}; QIAGEN). All reactions were performed in 25 µl volumes. Negative controls consisted of reactions with all reagents minus the template DNA.

<u>SybrGreen</u>

The PCR reaction contained 0.3 µM of each LNA primer or regular primer, 1X of QuantiTect^{TM} Sybr® Green PCR Kit (QIAGEN), and template DNA. PCR cycling conditions were set at 95°C for 15 min, 38 cycles at 94°C for 15 s, 60°C for 30 s, and 72°C for 30 s. The fluorescence reading time was during the extension at 72°C.

<u>Taqman® probe</u>

The PCR reaction contained 0.2 µM of each LNA primer or regular primer depending of the region used, 0.2 µM of Taqman® (dual-labeled probe) probe, 1X of QuantiTect^{TM} Probe PCR Master Mix (QIAGEN), and template DNA. PCR cycling conditions were set at 95°C for 15 min, 36 cycles at 94°C for 15 s, and 65°C for 60 s (68°C for 60 s for elicitin). The fluorescence reading time was during the extension at 65-68°C.

<u>Molecular beacons</u>

The PCR reaction contained 0.4 µM of each LNA primer for Beta-tubulin, 0.2 µM of Molecular beacon probe, 1X of QuantiTect^{TM} Probe PCR Master Mix, and template DNA. PCR cycling conditions were set at 95°C for 15 min, 36 cycles at 94°C for 15 s, 65°C for 30 s, and 72°C for 30 s. The fluorescence reading time was during the annealing at 65°C. This allows the Molecular beacon to open and anneal with the target sequence. The analysis software Opticon Monitor version 2.01.10 (MJ Research inc., Waltham, MA) was used to analysed the data.

DNA extraction of inoculated samples

Plant tissue samples (Table 3) were extracted using the Spin Protocol of the Fast DNA kit (Q-biogene Inc. p.n.6540-400 Carlsbad, CA) or the USDA protocol.

Results:

Species specificity of probes

Specific PCR primers to *P. ramorum* were designed for the three gene regions to amplify products varying in length from 133 to 171 bp. Most primers contained more than a single nucleotide polymorphism (SNP) when compared to the subset of *Phytophthora* species used in this study (Table 2). However, because of the low divergence between *P. ramorum* and *P. lateralis*, some primers (ITS and Beta-tubulin) contained only one SNP and were modified with LNA to increase specificity. Specificity of the probes was compared for the three types of PCR assays initially on *P. ramorum*, *P. lateralis*, *P. cactorum, P. cinnamomi*, *P. citricola*, *P. infestans* (Figure 1), which represent the most closely related species and as well as some more divergent ones. With the beta tubulin gene, the Taqman assay yielded a slightly lower CT value (21.2) for the *P. ramorum* samples than the SYBR-Green (Ct=21.8) whereas the Molecular Beacon was the highest (Ct=23.7). With pure cultures, the beta-tubulin assays with molecular beacons, Taqman, and SYBR-Green assay gave no positive results with other *Phytophthora* species. Therefore, for Beta-tubulin and the set of species tested here, there were no false positives.

To determine whether or not false negatives could be expected with the *P. ramorum* assay, we tested 32 *P. ramorum* isolates from the CBS collection (Table 1) with a single *P. lateralis* using Taqman probes for the three different gene regions. All *P. ramorum* isolates yielded positive results (CT<28). By contrast, the *P. lateralis* isolate and the negative control did not raise above the detection threshold. CT values for *P. ramorum* were variable and ranged between 16-28 (Table 1).

Detection of inoculated and environmental samples

To determine the efficacy of the assays to reliably amplify *P. ramorum* DNA from infected plant samples (Table 3), DNA was obtained from naturally- infected plants and from inoculated plants. All samples inoculated with *P. ramorum*, or from which *P. ramorum* had been isolated yielded PCR reactions that raised above the detection threshold. However, CT values were variable and depended upon the assay used. CT values ranged from 26 to 32 for ITS using the Taqman probe, but varied between 28 and 34 for β-tubulin and between 26 and 31 for elicitin. All plant samples that had been inoculated or from which the pathogen had been isolated yielded Ct values of less than 35 in the assays with Taqman and the three genes tested (Table 4). There was a 100% concordance between the assays on the three genes tested. There were no false positives or false negatives using the Taqman and molecular beacon assays that targeted β-tubulin, elicitin or ITS.
The sensitivity of the Taqman assay was higher when used with the ITS probe by 3 cycles when compared to β-tubulin with the same sample (Table 4). This would make the Taqman-ITS assay one order of magnitude more sensitive than the ß-tubulin assay.

Discussion

The real time PCR assays described in this paper gave specific and sensitive detection of *P. ramorum* from cultures and environmental samples. Tests with pure cultures of thirty two *P. ramorum* and 67 other *Phytophthora* species demonstrated the specificity of the ITS, Beta-tubulin and elicitin TaqMan assays. No false positive and false negative results were observed with any of the assays consisting of dual probes and specific PCR primers. More importantly, there was a 100 % concordance between the isolation of the pathogen by culturing methods or the inoculation assays and all real-time PCR assays developed here.

Molecular beacons and Taqman probes have built-in redundancy and give two potential levels of specificity in their design: the PCR primers and the internal dual-labelled probe. In the assays we developed this provided several cumulated SNPs between the target *P. ramorum* and related taxa. Even for the closely related *P. lateralis*, which has only 1.7% divergence with *P. ramorum*, it was possible to design a Taqman assay with one SNP per PCR primer, and an additional 3 SNP's within the Taqman probe.

The extra specificity given by the internal probes could be significant in particular to eliminate the possibility of false positives. The SYBR-Green-ITS assay generated some false positives. As SYBR-Green intercalates non-specifically into all double-stranded DNA molecules in the reaction the assay must rely entirely on the PCR primers for specificity [Giglio et al, 2003]. The ITS assay we developed here using *P. ramorum*-specific primers with SybrGreen as a fluorescent dye was not as specific as the assays with internal probes, as some *P. lateralis* gave positive results with the *P. ramorum* specific assay. A possible additional explanation for this lower specificity in our assay is the inhibition of the TAQ DNA polymerase by SYBR-Green. The annealing temperature had to be lowered in the reactions using SybrGreen to counter this inhibition. Since the same primers were used in the SYBR-Green and the Taqman and Molecular beacons assays, a lower specificity could have resulted.

Nevertheless, design of the assay is simpler for SYBR-green than for dual-labelled probes. Designing primers is essentially the same as for a regular PCR reaction. By contrast, dual-labelled probes require extra considerations, in particular molecular beacons for which the stem-loop Tm has to be balanced with the target Tm.

The TaqMan assays yielded the highest fluorescence intensity, and fluorescence continued to increase even after 40 cycles suggesting that none of the reaction components had yet become limiting. One possible explanation for this is that unquenched fluorophore molecules accumulate in the reaction as the cycles progress. By contrast, the SybrGreen and molecular beacon fluorescence reached a plateau probably because fluorescence is generated "de novo" at every cycle by the intercalation of the SyberGreen dye in the double stranded DNA during extension or the hybridization of the molecular beacon at annealing. Alternatively it is possible that the dye used for the Taqman was more fluorescent than the others. However, the CTs and the overall intensity of fluorescence followed the same trends among the three types of DNA detection assays.

DNA extracts from 67 of the 70 known *Phytophthora* species were tested in our study with the ITS, beta-tubulin and elicitin TaqMan assays. These *P. ramorum*-specific assays did not cross react with the other *Phytophthora* species tested here, including the closely related *P. lateralis*. These three TaqMan assays also correctly identified *P. ramorum* in the 20 plant tissue extracts tested. In the future it would be useful to test a variety of *Pr* host species including more samples infected with non-target species as only non-target infected samples tested in this study were those infected with *Phytophthora nemorosa* (Hensen).

The combination of ITS with SybrGreen and Taqman yielded a more sensitive assay than those targeting β-tubulin. When Ct values were compared between the Taqman ITS and β-tubulin assays , the former was 4-5 CT lower than the latter. This is somewhat expected since the rDNA consists of a tandemly repeated gene cluster and therefore a single cell contains several copies of the gene [White et al, 1990]. By contrast, β-tubulin is usually found in one or two copies [Ayliffe et al, 2001; Weerakoon et al, 1998]. The consistent results between the two technologies would suggest that there may be approximately 16-32 (2^n; n= number of cycles) more copies of ITS than ß-tubulin. This could be important for operational purposes since it means that the ITS assay would allow detection of smaller amount of inoculum than assays based on lower copy genes.

The real-time PCR assays developed here can be a useful tool to detect *Phytophthora ramorum* rapidly, sensitively and quantitatively in environmental samples. Our approach allows for redundancy both in the gene regions targeted by designing assays that take advantage of SNP's at priming sites as well as at internal sites for probes. This should greatly increase the confidence level of these assays and result in less false positives.

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Table 1 ***Phytophthora ramorum*** **isolates tested and number of cycles before fluorescence is detected (Ct) using three different gene regions (ITS, β-tubulin and elicitin) with Taqman.**

CBS number	Origin	Isolate number	Ct			
			Beta-tubulin	ITS	elicitin	Average CT of probes
101553	Germany	BBA 9/95 Type	24.0	19.3	21.2	21,5
109278	Germany	BBA 16/99	24.6	210	21.2	22,3
101331	Netherlands	PD 98/8/2627	26.4	20.4	22.7	23,2
101329	Netherlands	PD 98/8/6285	24.3	19.3	21.1	21,6
101332	Netherlands	PD 94/844	24.3	20.9	20.6	21,9
101330	Netherlands	PD 98/8/5233	24.5	20.8	20.3	21,9
101328	Netherlands	PD 98/8/6743	28. 8	23.3	24.9	24,1
101548	Germany	BBA 69082	24.4	20.6	21.2	22,1
101549	Germany	BBA 104/5	24.9	23.1	21.1	23
101551	Germany	BBA 12/98	23.3	21.2	20.9	21,8
101552	Germany	BBA 9/3	24.5	21.1	21.8	22,5
109279	Germany	BBA 13/99-1	22.0	18.4	20.5	20,3
101550	Germany	BBA 14/98-a	24.3	21.3	20.9	22,2
101326	Netherlands	PD 98/8/6933	20.8	16.1	18.4	18,4
101554	Germany	BBA 2/4	22.7	18.3	20.5	20,5
101327	Netherlands	PD 93/56	19.4	16.0	17.1	17,5
110548	France	adc 02.09	23.4	20.1	20.8	21,4
110534	California	Pr01	30.3	24.6	26.5	27,1
110535	California	Pr03	25.4	21.8	22.8	23,3
110537	California	Pr52	21.9	17.9	19.4	19,7
110538	California	Pr65	20.0	17.3	18.2	18,5
110539	California	Pr70	22.1	18.4	19.7	20,1
110541	California	Pr86	21.1	18.6	19.4	19,7
110542	California	Pr110	27.6	24.1	24.7	25,5
110543	Oregon	Pr159	20.7	16.8	19.8	19,1
110544	California	PrPRJL3.5.3	24.7	19.9	21.9	22,2
110545	Poland	Rh/2/00	23.0	19.5	21.1	21,2
110546	Poland	Rh/6/00	24.0	20.0	21. 6	22
110547	Poland	Rh/122/98	26.0	21.7	23.0	23,6
110601	California	Pr84-sz	18.4	17.7	19.7	18,6
Average CT by Taqman			23.8	19.9	21.1	20,5
Standard deviation			2.6	2.2	1.9	2,1

a Ct Number of cycles before fluorescence threshold is reached. The threshold was never reached for *P. lateralis*.

b The ANOVA with two-factors without replication are significant with a p-value of 7E-23 df (29)on for samples and 9.2E-26 df (2) for genes.

Table 2 Phytophthora species DNA used

Species	CBS number
gonapoyides	554.67
cryptogea	113.19
cambivora	248.60
iranica	374.72
mirabilis	678.85
primulae	275.74
megasperma v. megasperma	402.72
syringae	132.23
humicola	200.81
cryptogea f. sp. begoniae	468.81
fragariae v. fragariae	209.46
infestans	366.51
vignae	241.73
richardiae	240.30
citrophthora	950.87
pseudotsugae	444.84
capsici	128.23
clandestina	347.86
botryosa	581.69
meadii	219.88
katsurae	587.85
megakarya	238.83
operculata	241.83
citricola	221.88
syringae	367.79
palmivora	236.30
spec. Marine	215.85
heveae	296.29
erythroseptica	129.23
cactorum	108.09
sinensis	557.88
phaseoli	556.88
ilicis	255.93
mexicana	554.88
drechsleri	291.35
arecae	305.62
hibernalis	522.77
idaei	971.95
kandelii	111.91
citricola (type of P. pini)	181.25
brassicae	178.87
quercina	784.95
tartarea	208.95
tentaculata	552.96
sp. (' aquatica')	363.79
cinnamomi v. parvispora	413.96
colocasiae	955.87
erythroseptica (type of P.himalayensis)	357.59
insolita	691.79
sojae	418.91
sojae	382.61
melonis	582.69
nicotianae	305.29
nicotianae(type of terrestris)	109.17
tropicalis	434.91
brassicae	686.95
cinnamomi var parvispora	411.96
multivesiculata	545.96
fragariae var rubi	967.95
boehmeriae	291.29
lateralis	ATCC201856
erythroseptica var pisi	adc 99.69
europea	109049
psychrophila	803.95
uliginosa	109054

Table 3: Plant species inoculated with *P. ramorum* or *P. ilicis*-like (*P. nemorosa*)

Name	Content	number	Source
02-PDD-233-1♣	*Umbellularia californica* + *P. ramorum*	157581	CFIA†
02-PDD-233-2♣	*Umbellularia californica* + *P. ramorum*	85464	CFIA
02-PDD-233-3♣	*Umbellularia californica* + *P. ramorum*	157584	CFIA
02-PDD-233-4♣	*Umbellularia californica* + *P. ramorum*	157589	CFIA
02-PDD-233-5♣	*Umbellularia californica* + *P. ilicis-like*	70833	CFIA
02-PDD-233-6♣	*Umbellularia californica* + *P. ilicis-like*	141177	CFIA
02-PDD-233-7	*Rhododendron sp.*	92688	CFIA
02-PDD-233-8♣	*Rhododendron* sp. + *P. ramorum*	66556	CFIA
S118	Negative control of extraction		CFIA
02-PDD-231-1♣	*Umbellularia californica* + *P. ramorum* (BBA9/95))		CFIA
02-PDD-231-2♣	*Umbellularia californica* + *P. ramorum* (BBA9/95))		CFIA
02-PDD-231-3♣	Uninfected *Umbellularia californica*		CFIA
02-PDD-231-4♣	*Kalmia latifolia* var « Madeline » + *P. ramorum* 0-217		CFIA
02-PDD-231-5♣	*Kalmia latifolia* var « Madeline » + *P. ramorum* 0-16		CFIA
02-PDD-231-6♣	*Kalmia latifolia* var « Madeline » + *P. ramorum*		CFIA
02-PDD-231-7	Uninfected *Kalmia latifolia* var « Madeline »		CFIA
S117	Negative control of extraction		CFIA
USDA-1	*Umbellularia californica* (healthy)		USDA‡
USDA-2♣	*Umbellularia californica* + *P .ramorum* (artificially)		USDA‡
USDA-3	*Rhododendron* (healthy)		USDA‡
USDA-4	*Rhododendron* infected from WA state nursery (Environmental sample)		USDA‡
USDA-5	DNA of *P.ramorum* isolate 0-16		USDA‡

† CFIA: Canadian Food Inspection Agency, Centre for Plant Quarantine Pest, Ottawa, Canada

‡ Laurene Levy: USDA, APHIS' PPQ-NPGBL, Beltsville, MD, USA

♣ Inoculated samples

Table 4 Detection of *P. ramorum* in inoculated plant material in real-time PCR using three gene regions and Taqman probes.

Samples	Ct		
	Beta-tubulin	**ITS**	**elicitin**
02-PDD-231-1	30,5	28,1	27,2
02-PDD-231-2	31,7	26,4	26,3
02-PDD-231-4	31,0	30,0	28,7
02-PDD-231-5	31,4	30,0	28,4
02-PDD-231-6	33,1	31,9	30,1
02-PDD-233-1	33,9	31,3	31,2
02-PDD-233-2	34,0	30,0	30,1
02-PDD-233-3	34,3	31,0	29,9
02-PDD-233-4	33,1	30,4	30,3
02-PDD-233-8	28,3	26,3	26,9
02-PDD-231-3	None	None	None
02-PDD-231-7	None	None	None
02-PDD-233-5	None	None	None
02-PDD-233-6	None	None	None
02-PDD-233-7	None	None	None
S117	None	None	None
S118	None	None	None
Negative Control	None	None	None

a The ANOVA with two-factors without replication are significant with a P-value of 1.2E-06 df (9)for samples and a P-value of 5.7E-08 df (2) for genes.

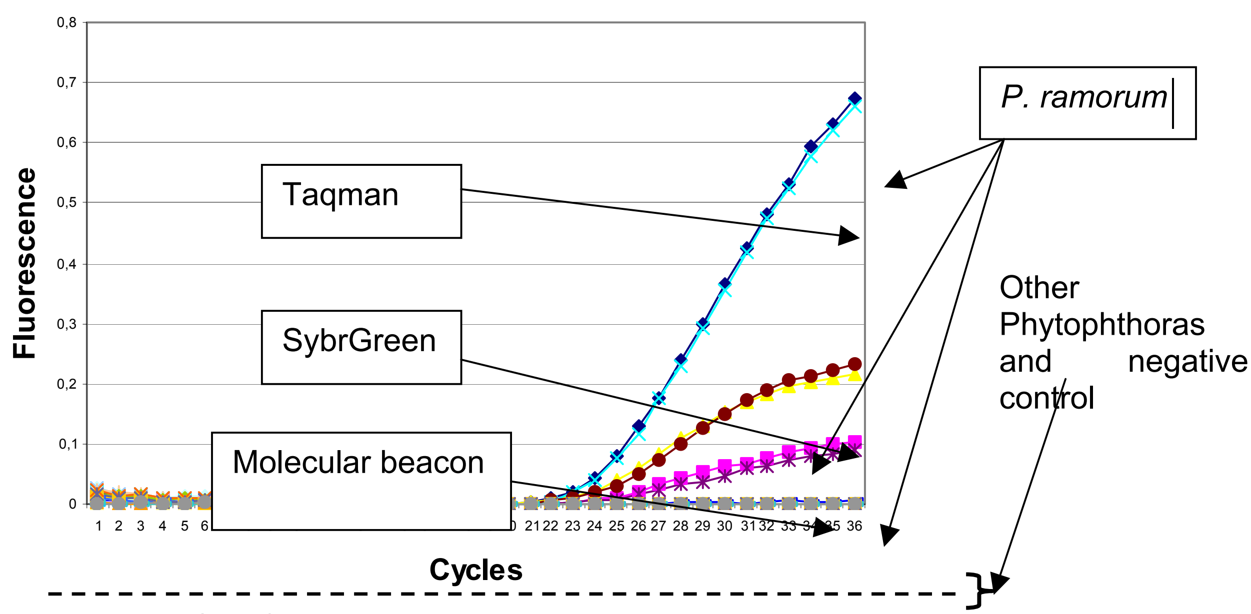

Figure 1: Real-time PCR of *Phytophthora* samples with Taqman, Molecular beacons and SybrGreen (β-tubulin gene). The *Phytophthora* species used were: *P. ramorum* 230928, *P. ramorum* 230991, *P. lateralis* ATCC 201856, *P. cactorum* BR675, *P. cinnamomi* BR680, *P. citricola* BR681, *P. infestans* M0014 and a negative control (water).

Invasive Species in the United States 2003

Les espèces envahissantes aux Etats-Unis en 2003

Presented by:
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Abstract

America's forests cover 747 million acres, of which 20 percent are on National Forest System lands; non-industrial landowners, 8 percent by States, 13 percent by other Federal agencies, and 10 percent by industrial landowners owns 49 percent. This forest land is an invaluable asset to the American people, providing water, recreation, wildlife habitat, and future timber. Maintaining the health and sustainability of natural resources is a national security issue and the United States Department of Agriculture (USDA) Forest Service remains committed to the protection of these resources. America's forests continue to face many catastrophic risks, including fires, invasive species, and fragmentation.

Forest Service definition of a healthy, sustainable forest—A condition wherein a forest has the capacity across the landscape for renewal, for recovery from a wide range of disturbances, and for retention of its ecological resiliency while meeting current and future needs of people for desired levels of values, uses, products, and services.

The USDA Forest Service works collaboratively with State foresters, State departments of agriculture, and other USDA agencies, including Animal and Plant Health Inspection Service (APHIS) to protect America's forests from native and introduced insects, pathogens, and invasive plants. The FHP program provides services to Federal, State, tribal, and private managers of forest lands. Services include technical information and assistance in management and control of forest insects, diseases, and invasive plants; forest health monitoring; technology development; and pesticide use.

This report provides a summary of current forest ecosystem health issues in America's forests. There are three general areas of concern:

- Nonnative invasive insects and pathogens
- Invasive plants
- Native invasive insects and pathogens

Nationally, invasive species cost Americans over $137 billion each year, with a large portion of the impacts affecting public lands and agriculture. As the largest land managing agency within the Department of Agriculture, the Forest Service has a significant role in battling these insidious invaders and has stepped forward to work collaboratively at the local, State and National levels. The economic threats from invasive species to Forest Service timber and other production operations are significant and cannot be marginalized, and the linkage between the spread of invasive species and increased wildfire frequency and intensity has been well documented. It has been estimated that invasive plants occupy nearly 133 million acres of National Forests and rangelands, other Federal ownerships, State, Tribal and private lands, and are spreading at a rate of nearly 1.7 million acres per year. It is estimated that invasive plants cause an estimated $13 billion annually. Insect and disease problems continue to increase and plague millions of acres of private, State, and National forests in nearly every region of the nation.

Résumé

Aux États-Unis, les forêts couvrent 747 millions d'acres, dont 20 % font partie du domaine forestier national. Du reste de cette superficie, 49 % appartiennent à des propriétaires non industriels, 8 % aux États, 13 % à d'autres organismes fédéraux et 10 % à des propriétaires industriels. Ce patrimoine forestier a une valeur inestimable pour le peuple américain, car il recèle des ressources en eau, des possibilités récréatives, des habitats fauniques et l'approvisionnement en bois de demain. Le maintien de la santé et de la durabilité des ressources naturelles est une question de sécurité nationale, et le Service des forêts du département américain de l'Agriculture (USDA) demeure résolu à protéger ces ressources. Les forêts des États-Unis continuent de faire face à nombre de risques catastrophiques, y compris le feu, les espèces envahissantes et le morcellement des forêts.

Le Service des forêts définit ainsi une forêt durable en santé : une forêt qui, à l'échelle du paysage, a la capacité de se renouveler, de se rétablir à la suite d'une vaste gamme de perturbations et de conserver sa résilience, tout en satisfaisant les besoins de la génération actuelle et des générations futures en matière de valeurs, d'utilisations, de produits et de services.

Le Service des forêts de l'USDA collabore avec les départements de l'Agriculture et les forestiers des États ainsi qu'avec d'autres organismes de l'USDA, y compris l'Animal and Plant Health Inspection Service (APHIS), afin de protéger les forêts américaines contre les insectes, les pathogènes et les espèces végétales envahissantes exotiques et indigènes. Le programme FHP fournit des services aux aménagistes des forêts fédérales, des États, tribales et privées. Il offre notamment des services d'information et d'aide techniques en matière de lutte contre les insectes et les maladies des arbres et les espèces végétales envahissantes ainsi que des services de surveillance de la santé des forêts, de développement technologique et d'application de pesticides.

Le présent rapport fournit un résumé des problèmes phytosanitaires actuels dans les forêts des États-Unis. Trois grands sujets sont préoccupants :

- les insectes et les pathogènes envahissants exotiques
- les espèces végétales envahissantes
- les insectes et les pathogènes envahissants indigènes

À l'échelle du pays, les espèces envahissantes coûtent aux Américains plus de 137 milliards de dollars chaque année, les incidences de ces indésirables frappant en grande partie les terres publiques et agricoles. À titre de plus important organisme de gestion des terres du département de l'Agriculture, le Service des forêts a un rôle important à jouer dans la lutte contre ces envahisseurs sournois et a entrepris de collaborer avec les intervenants locaux, nationaux et des États. Les menaces d'ordre économique que font planer les espèces envahissantes sur les activités d'exploitation et autres opérations du Service des forêts sont de taille et ne peuvent être ignorées, et le lien entre la propagation des espèces envahissantes et la fréquence accrue des feux

de forêt a été bien documenté. Selon les estimations, les espèces végétales envahissantes occupent près de 133 millions d'acres dans les forêts et les parcours naturels nationaux, sur d'autres terres fédérales ainsi que sur les terrains privés, tribaux et d'État. Elles se propagent à un rythme de près de 1,7 millions d'acres par année et, selon les estimations, elles causent des pertes annuelles d'environ 13 milliards de dollars. Les problèmes dus aux insectes et aux maladies continuent de s'aggraver et d'affliger des millions d'acres de forêt privée, nationale et d'État dans pratiquement toutes les régions du pays.

Scope of Problem

The threat of aquatic and terrestrial invasive species is one of the greatest natural resources concerns in the United States. Their prevention and control is operationally critical to meeting the stewardship mission of the USDA Forest Service. Thousands of species of invasive plants, invertebrates, fishes, diseases, birds, and mammals threaten ecosystem function, economic stability, and human health. Second only to direct habitat destruction, invasive species are the greatest threat to native biodiversity and alter native communities, nutrient cycling, hydrology, and natural fire regimes. Direct and indirect impacts of invasive species have contributed to the decline of approximately 46% of all listed threatened and endangered species. Public recreational opportunities and experiences have been severely degraded by rapid infestations of invasive species, in many cases hampering access, reducing recreational quality and enjoyment, and decreasing the aesthetic values of public use areas.

Nationally, invasive species cost Americans over $137 billion each year, with a large portion of the impacts affecting public lands and agriculture. As the largest land managing agency within the Department of Agriculture, the Forest Service has a significant role in battling these insidious invaders and has stepped forward to work collaboratively at the local, State and National levels. The economic threats from invasive species to Forest Service timber and other production operations are significant and cannot be marginalized, and the linkage between the spread of invasive species and increased wildfire frequency and intensity has been well documented. It has been estimated that invasive plants occupy nearly 133 million acres of National Forests and rangelands, other Federal ownerships, State, Tribal and private lands, and are spreading at a rate of nearly 1.7 million acres per year. It is estimated that invasive plants cause an estimated $13 billion annually. Insect and disease problems continue to increase and plague millions of acres of private, State, and National forests in nearly every region of the nation.

Due to the broad range of pathways for invasive species to enter and become established within our nations forests and rangelands, the rate of new infestations is growing exponentially. Also, due to overstocking of many forested areas, the threat of infestations of insects, pathogens and invasive plants is greatly enhanced. It is estimated that 70 million acres of the nations forests are at threat of infestations of insects and disease mortality, including 21 million acres by western bark beetles. Compliance with the requirement of the National Environmental Policy Act governing agency actions, and subsequent appeals and litigation has slowed the USDA Forest Service efforts in completing many projects designed to improve forest health.

Definition of Invasives Species: An invasive species is defined as a species that is 1) non-native to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).

Introduction

America's forests cover 747 million acres, of which 20 percent are on National Forest System lands, 49 percent are owned by non-industrial landowners, 8 percent by States, 13 percent by other Federal agencies, and 10 percent by industrial landowners. See Figure 1 Forest Cover Types in the United States. This forest land is an invaluable asset to the American people, providing water, recreation, wildlife habitat, and future timber. Maintaining the health and sustainability of natural resources is a national security issue and the United States Department of Agriculture (USDA) Forest Service remains committed to the protection of these resources. America's forests continue to face many catastrophic risks, including fires, invasive species, and fragmentation.

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This report provides a summary of current forest ecosystem health issues in America's forests. There are three general areas of concern:

- Nonnative invasive insects and pathogens
- Invasive plants
- Outbreaks of native insects

Nonnative Invasive Insects and Pathogens

Global trade and travel are causing an unprecedented movement of animals, plants, and microorganisms across continents and oceans. All too often, these nonnative species are invasive and can cause impacts that are extremely costly to both the U.S. economy and environment. When brought into new ecosystems, nonnative invasive species have no natural enemies and can cause extensive damage. Nearly 50 percent of the plants and animals on the Federal endangered species list have been negatively impacted by nonnative invasive plants, animals, insects, and microbes. These species threaten biodiversity and have caused catastrophic damage to agriculture, forest products, recreation, and natural resources across North America. Examples include yellow star thistle, leafy spurge, Gypsy moth, American chestnut blight, and white pine blister rust.

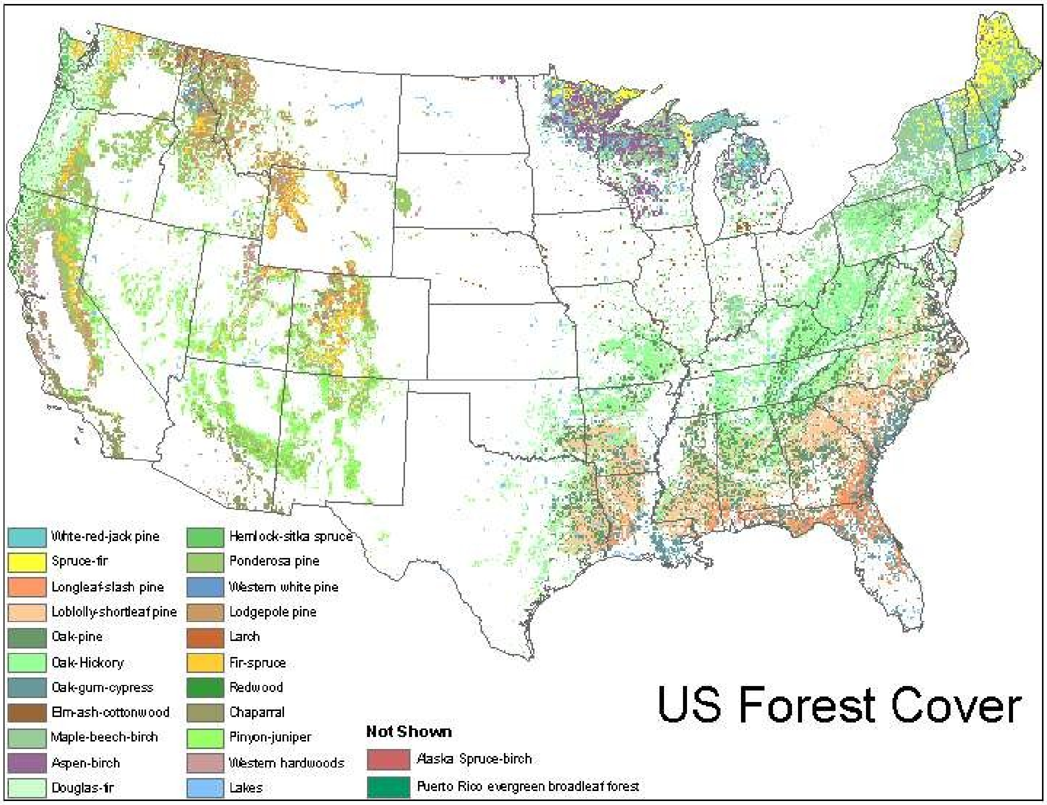

Figure 1 United States Forest Cover Types

In February 1999, the President issued Executive Order 13112 on Invasive Species, establishing the National Invasive Species Council. The council provides, for the first time, a coordinated effort of 10-member Departments. In October 2001, the council completed a management plan, Meeting the Invasive Species Challenge, to address the Executive order. The plan is designed to raise public awareness and control the introduction and spread of nonnative invasive pests. According to the plan, the economic cost of invasive species is estimated at $137 billion every year.

The USDA Forest Service alone spends more than $40 million to control the introduction and spread of nonnative species and approximately $40 for native species. The control efforts include refining, developing, and deploying a broad array of technologies to minimize the impacts of invasive species. Technology includes remote sensing, computer modeling, mechanical treatments, biopesticides, biological controls, and conventional pesticides. The USDA Forest Service and APHIS have started an early detection and rapid response program to detect and promptly eradicate any new invasive species. Invasive pests are dealt with as aggressively as possible, within budget constraints, before they become well established.

Selected Examples of Major Invasive Insects Affecting U.S. Forests

Emerald Ash Borer

The invasive emerald ash borer, a recently introduced pest, is threatening ash in North American forests, urban plantings, and shelterbelts. Critical, time sensitive research is needed on the borer's basic biology, ecology and management. At the present time, information is insufficient to support ongoing detection efforts and to develop effective strategies for containing the infestation, reducing beetle density or eradicating this pest.

Background:

In 2002, the emerald ash borer, *Agrilus planipennis*, was discovered in dead and dying ash in a 5-county region around Detroit, Michigan and in neighboring Windsor, Ontario, Canada. Just last week FS Researchg confirmed its presence in Toledo, Ohio. The borer, which was introduced into Michigan about five years ago, is native to China, Korea, Japan and other Asian countries.

A recent federal and state survey of ash in southwest Michigan determined that the outbreak covers over 2000 square miles. In Southwest Michigan, 49.1 percent of the trees surveyed and an estimated 5.2 million ash trees are dead or declining. The State of Michigan has quarantined movement of ash trees and ash wood products from the five counties around Detroit to reduce the chances of transporting emerald ash borer outside of the currently infested area.

In Michigan, only ash has been attacked; in Asia elm, walnut and chestnut may be attacked. The borer may have a major impact on forests across the US. Ash is a major component of natural and urban forests in the east and central United States and urban areas in the west. The potential value loss in nine major urban centers is estimated at $20-60 billion for 30-60 million ash trees. Losing urban ash is also critical because ash has been the primary replacement tree for American elm.

Information on biology, detection and control of emerald ash borer is limited to under a paragraph in the Chinese literature. Currently, infestations are detected by visually examining each tree for exit holes left by emerging adults. "Control" is limited to removal and destruction of infested trees, although preliminary tests conducted this year indicate that tree injections or avid may work.

Needs:

Research to obtain information on the basic biology and ecology of emerald ash borer and tools for assessing ecosystem risk, detection and control that managers must have to formulate effective management strategies.

The Undersecretary of Natural Resources and Environment at USDA and Chief of the Forest Service are aware of the urgency of the problem and the need for emergency research funds to obtain vital information. APHIS and FS are planning to submit a request to the Secretary for authority to use Commodity Credit Corporation (CCC) emergency funds.

Scolytus schevyrewi – A Bark Beetle New to the United States

Scolytus schevyrewi is native to eastern Russia, China, and Korea. The beetle was first collected in the rapid detection bark beetle pheromone traps set in Aurora, CO (a suburb of Denver) and Ogden, UT, starting in late April 2003 and is considered very invasive. Dr. James LeBonte, Oregon Department of Agriculture, first identified the beetle as new to the United States. At this time there is no common name for this beetle and it is currently not known how damaging this insect can potentially be.

APHIS has increased their detection effort for this bark beetle in Colorado, Utah, and several adjacent states. The Forest Health Protection (FHP) rapid detection group along with staff of other FHP offices in the West and the Colorado State Forest Service are assisting APHIS.

In Colorado, *S. schevyrewi* has been collected all along the Front Range from Pueblo to Fort Collins and has been found in Durango in the southwest and in Lamar, a town in southeastern Colorado. In Utah, the bark beetle has been found in Ogden, Salt Lake City, and in eastern Utah. The beetle was found from samples from fresh wood of American, rock, and Siberian elms.

The biology of *S. schevyrewi* is similar to that of *S. multistriatus*. The beetle completes a generation in about two months (fresh attacks in late April and early May in the Denver area and brood emergence by early July). We expect that *S. schevyrewi* will complete 2 – 3 generations per year in the Denver area. The literature suggests that the beetle has a feeding period on branch junctions like that of *S. multistriatus*. The egg galleries are very similar between these two bark beetle species.

Sudden Oak Death

Sudden Oak Death (SOD)—a disease caused by *Phytophthora ramorum,* a newly discovered pathogen of uncertain origin—has killed thousands of trees in coastal, mixed evergreen forests and urban-wildland interfaces in California and southern Oregon. It kills coast live oak, California black oak, shreve oak, tan oak trees, and madrone and infects several other plant species, including rhododendron, manzanita, California bay laurel and buckeye, evergreen huckleberry, and big leaf maple. The disease degrades ecological processes and watershed functions and lowers forest productivity. It reduces aesthetic, recreational, and economic values and leaves forests susceptible to invasive plant infestations. Dead trees add fuel to an already high fire risk.

We don't know enough about how the disease spreads and its biology. We know it is spreading rapidly and has been found in nursery stock (particularly rhododendron) in a few ornamental nurseries, raising concerns that it could be transported to and infect the extensive, susceptible oak forests of the Eastern United States. The oak-hardwood forest is the largest forest type in the United States.

In response to the current outbreak:

- The USDA Forest Service has spent over $5 million to research, monitor, manage, and educate the public about SOD. The USDA Forest Service is also working closely with APHIS to assist in implementing a quarantine and to regulate the transportation of wood, bark, and nursery stock that might harbor the SOD pathogen.
- California and Oregon implemented State regulations, prior to the release of the Federal regulations, to prevent the spread of this disease. The States are coordinating their respective regulations with APHIS.

Through the California Oak Mortality Task Force, a public-private coalition, the USDA Forest Service lead Federal, State, and local partners in implementing effective SOD research, monitoring, management, and education programs to protect the Nation’s oak forests.

In 2000, USDA Forest Service provided funds to help investigate the cause of this disease. Investigations led to the discovery that the primary cause of SOD is a previously undescribed species of *Phytophthora*. In 2001, the USDA Forest Service provided additional funds to determine the extent and severity of SOD in oaks and other native plants in California and Oregon. The funds were also used to develop diagnostic and survey methodologies for the SOD pathogen, evaluate fungicide treatments and other management strategies, and assess the fire risk and other ecosystem effects of accelerated oak mortality. The USDA Forest Service continues to support cooperative efforts in 2002 to monitor the disease development and spread. Forest health monitoring surveys detected the pathogen in southwestern Oregon. In the fall of 2001, the Oregon Department of Forestry attempted to eradicate the pathogen. Monitoring efforts to determine the effectiveness of the eradication treatment are underway.

White Pine Blister Rust: Pathways to Restoration

White pine blister rust (WPBR), an introduced fungus from Asia, has decimated several species of native white pines across the American West and Canada. Native white pines are an integral part of the natural biodiversity of western forests. The ecological and economic impacts have been most acute on the two large commercial species—western white pine and sugar pine. WPBR entered North America through the east and west coasts on European nursery stock around 1910. In the West, it quickly spread from Vancouver, British Colombia, Canada, south through the Cascades and Sierra Nevada, and east into the Rocky Mountain States of Idaho, Montana, Colorado, Wyoming, and New Mexico. The pest has also inflicted severe ecological damage in high-altitude whitebark and limber pine forests. In susceptible stands, WPBR can kill over 95 percent of mature trees, effectively altering a forest ecosystem forever.

Strategies for control include:

- Restoration of white pine forests through development and planting of white pines, which are genetically resistant to WPBR. More than 8 thousand acres of forest lands have been planted with resistant seed from seed orchards and proven resistant seed trees.
- Restoration of white pines through deployment of silviculturally integrated practices, such as pruning the infected plantation trees and planting in low hazard areas.

The USDA Forest Service has extensive on-going resistance-breeding programs that began in the 1950s. These breeding programs continue to discover and develop WPBR-resistant varieties of white pines. These programs saved the western white and sugar pine from extinction. In California, a total of 1,329 proven resistant seed trees have been identified, and two seed orchards are established. In the Pacific Northwest, the resistance-breeding program supports 40 seed orchards. The Rocky Mountain Region has identified more than 3,100 trees and planted 96,255 acres with WPBR-resistant white pine seedlings.

Gypsy Moth: Slowing The Spread

Since 1930, gypsy moth has defoliated more than 80 million acres of forests in the Eastern United States, with most of that damage occurring during the past 20 years. A hardwood defoliator native to Europe and Asia, gypsy moth arrived in the United States in the 1800s, established itself in the oak forests of southern New England, and then spread south and west across 19 States. Occasionally, it appears in western forests but has been successfully eradicated each time. Unfortunately, gypsy moth is now a permanent resident of eastern forests.

During outbreaks, moth populations often outpace the few natural enemies, parasites, predators, and pathogens that attack them. The gypsy moth feed on the delicate first flush of leaves in the spring. It prefers oaks, but it will feed on 500 species of woody plants. The attacked trees become highly susceptible to secondary attacks from other insects and pathogens. Often, the trees die. The deaths alter the forest ecosystem dramatically; usually dead oaks are replaced not with more oaks, but with other species that do not produce as much mast for wildlife.

In response to this pest, the USDA Forest Service adopted the following strategies:

- Implementing programs and providing technical and financial assistance to States and other Federal agencies to suppress and slow the spread of gypsy moth in the East.
- Detecting and eradicating—along with APHIS, State governments, and other Federal agencies—localized introductions of gypsy moth in the West.

A gypsy moth virus and aerial treatments with biological and chemical insecticides conducted over 460,000 acres in 2001 have effectively suppressed or slowed the spread of gypsy moth in nine Northeastern States. The USDA Forest Service's Gypsy Moth-Slow-the Spread program slows the south-westerly spread of the insect by 60 percent through concentrated monitoring and by using environmentally benign mating disruption techniques. After discovering adult gypsy moths in pheromone traps in seven Western States in 2000, steps were taken that eradicated the pest from these States. The USDA Forest Service and many other cooperators continue to develop new controls and delivery methods to use against this pest.

Eastern Hemlock Forests Are Dying: Hemlock Woolly Adelgid

The hemlock woolly adelgid (HWA) is one of the most serious forest pests threatening eastern forests. The insect defoliates eastern hemlock; trees can die within 4 years of infestation. Native to China and Japan and introduced to the American Northwest in the 1920s, it has spread quickly across the Northern United States. Fortunately, the western hemlock proved resistant to HWA. Unfortunately, the eastern hemlock is highly susceptible to HWA. Beginning in the 1950s, the pest began a destructive march north and south through eastern forests. Today, it infests nearly half of the hemlock forests across 11 States from Massachusetts to South Carolina and as far west as the southwest tip of West Virginia.

Eastern hemlock is a pivotal player in eastern forest ecosystems. It is especially important along streams and creeks where its shade helps control water temperatures, thereby helping to sustain aquatic ecosystems. Eastern hemlocks span the Eastern United States from Maine west to northern Wisconsin and south along the Appalachians to north Georgia. The span also includes small pockets in Indiana and Mississippi. To arrest the pest's advance, the USDA Forest Service has:

- Implemented spray programs on individual trees wherever practical and environmentally safe, such as in nonriparian settings.
- Identified, developed, and released HWA-specific biological control agents.
- Developed an integrated plan to address the problem as funding permits.

The USDA Forest Service identified a number of pathogens and predators native to the United States that would attack HWA. The most effective to date is the Japanese ladybird beetle. This predator attacks only HWA, will feed on all stages (egg to adult) of HWA, and, in sufficient numbers, will consume up to 97 percent of a HWA population. Since 1999, the USDA Forest Service has raised and released over half-a-million beetles in nine States. Additional research, development, and subsequent management actions are expected to reduce the impacts of this destructive pest.

Invasive Plants

Thousands of invasive plant species have been introduced in the United States. About 1,400 are recognized as pests that pose significant threats to the biodiversity of forest and grassland ecosystems. Federal natural resource agencies list 94 species of exotic plants as noxious weeds, and many more appear on States' lists. Experts estimate that well over 100-million acres are infested with invasive plants, and that between 8- and 20-million more acres are being added every year. An estimated 3.6 million acres on National Forest System lands are infested.

Many of the invasive plants are not native to the United States. Therefore, they have no natural enemies to limit their reproduction and spread. Although rangelands are the primary targets of many invasive plants, they are showing up everywhere—in forests, parks, preserves, wilderness areas, wildlife refuges, croplands, and urban spaces. Invasive plants threaten two-thirds of the habitat of all threatened and endangered species.

Two federally coordinated efforts are:

- The Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW)—comprised of 17 Federal agencies with a common goal to develop biologically sound techniques to manage invasive plants on all lands.
- The National Fire Plan—focused on rehabilitating and restoring forests and rangelands, specifically reducing the spread of noxious weeds.

In 2001, the USDA Forest Service spent over $27 million implementing provisions of the National Fire Plan to prevent and control the spread of noxious weeds on more than 145,000 acres of National Forest System lands. Part of these funds, $3.5 million, was allocated to Idaho and Montana to protect approximately 93,000 acres of State and private lands from invasive weeds.

The USDA Forest Service and its cooperators are conducting extensive research and development that is needed on biological control agents for use against many invasive plants, such as mile-a-minute weed, a major problem in five Northeastern States. Biological control agents are showing some success in slowing the spread of invasive plants, such as leafy spurge in the West.

Selected Examples of Invasive Plants Affecting U.S. Forests

Leafy Spurge

Leafy spurge is the classic nonnative, invasive plant. Arriving on North America from Eurasia in the 1890s, it now infests over 2.5-million acres of rangeland in Southern Canada and the Northern United States. At maturity, it can reach heights of 7 feet. Leafy spurge can kill cattle and horses, and its sap can cause irritation to the eyes, mouths, and digestive systems of all domestic and wild grazing animals, except goats and sheep. The sap can also cause blistering, severe dermatitis, and permanent blindness among humans. Seedpods explode when touched, scattering seeds up to 15 feet. It has a nutrient-storing taproot system that can reach soil depths of 20 feet. Pulling the plant actually encourages it to spread.

Although conventional herbicides are effective against leafy spurge, they have a limited use. Due to this limited use, the USDA Agricultural Research Service, in cooperation with APHIS, developed and evaluated integrated approaches to managing leafy spurge. Now a cooperator, the USDA Forest Service is researching and applying several biological control agents to suppress the pest's spread, including:

- Grazing goats and sheep.
- Fungal controls that kill the plant by causing root rot.
- Flea beetles that feed specifically on leafy spurge.

Of these three, the flea beetles appear to be most effective against this pest, especially when used as an integral part of a pest management approach that includes grazing by sheep and goats and use of conventional herbicides whenever possible. Imported from Asia, beetle populations have been established in Montana, the Dakotas, and Wyoming. Adult insects weaken the plants by attacking leaves and stems, and the larvae feed upon the roots. The USDA Forest Service and other cooperators are refining laboratory techniques so that the beetles can be mass produced.

Mile-a-Minute Weed

Mile-a-minute weed is a prickly, annual vine that, true to its name, grows very rapidly and overpowers virtually all vegetation in its path. Originally from Asia, it first appeared on the west coast in the 1890s. In 1946, it was found in nurseries in Pennsylvania. It has spread to New York, Ohio, Maryland, New Jersey, Virginia, West Virginia, Delaware, and the District of Columbia. Seeds are spread by birds and rodents and are carried in rivers and streams. The plant is an excellent climber and easily overpowers, engulfs, and displaces much of the native flora in its path. It invades nurseries, forest openings, railroads, utility rights-of-way, roadsides, and riverbanks. It also threatens forest regeneration and recreational activities. In short, mile-a-minute weed is degrading plant diversity in North America.

Controlling the spread of mile-a-minute weed presents a tremendous challenge to forest and rangeland managers. The USDA Forest Service and its cooperators are working diligently to identify and apply effective biological controls to use against this nonnative pest, including:

- Identifying over 20 varieties of fungi that attack and/or kill the weed. Additional tests on the fungi are planned.
- Evaluating three insects from China known to attack the weed. One of the insects in particular, a weevil shows promise for future release.

Outbreaks of Native Insects
Al though native insects don't fall into the EO's definition of invasives species, they are an important damaging agent in the United State. Examples include Southern Pine Beetle and Western Bark Beetles are causing significant mortality.

Native insects such as bark beetles in the West and southern pine beetle in the South act as "agents of change" in conifer forests. At the endemic level, they play a critical role in the development, aging, and rebirth of entire forests. At the landscape level, insect-caused mortality contributes to the structural and mosaic diversity within ecosystems. Insects can also cause major disturbances within U.S. forests. For example, tree mortality due to bark beetle outbreaks can be extensive, affecting thousands of acres.

Certain circumstances can exert uncommon stress on forests and predispose them to extraordinary insect outbreaks and damage. These circumstances include drought, overstocking, and large areas of aging forest. During the last decade, several of these circumstances have arisen simultaneously, causing extensive tree mortality. In turn, that mortality has threatened wildlife, endangered and threatened species habitat, and degraded recreational quality. The increased mortality has contributed to considerable fuel accumulation, which in turn increases the risk of catastrophic fires.

In 2001, the USDA Forest Service spent about $10 million to suppress and prevent bark beetle outbreaks. Because more work is needed, the USDA Forest Service has developed management plans to address the problem in an integrated manner and will implement these long-term plans as funding permits.

Southern Pine Beetle: Laying Waste to Southern Forests

Southern pine beetle (SPB) is the most destructive forest pest in the South. Over 90 million acres of southern forests are at a moderate to high risk of SPB infestation. In 2001, due to a combination of a mild winter and a prolonged drought, the South experienced its most severe and prolonged SPB outbreak in history. SPB infested tens of thousands of acres and caused over $200 million in damages. A single SPB “spot” (outbreak) can spread very quickly and cover up to 1,000 acres in one season. The situation was especially dire in Alabama, where more than 25,000 SPB spots have been detected. In the Southern Appalachian Mountains, SPB has killed thousands of acres of pines. It has killed more than 70 percent of the pine forest habitat of the red cockaded woodpecker, a federally listed endangered species, on the Daniel Boone National Forest in southern Kentucky.

In response, the USDA Forest Service has:

- Stepped up its funding of programs to detect, suppress, and prevent SPB infestation and restore southern pine forests.
- Modernized and improved computer modeling and tracking technology—including the Southern Pine Beetle Information System (SPBIS), which enables national forest field staffs to quickly log information about SPB spots and schedule, execute, and monitor treatments on those spots.

In 2001, the USDA Forest Service doubled its financial commitment from the previous year and provided over $13 million to fund SPB suppression projects on Federal, State, and private lands across the South. A comprehensive plan focusing on prevention and restoration has been developed and will be implemented as funding permits.

Mountain Pine Beetle in Colorado: Cooperative Management

The native mountain pine beetle (MPB) kills more pines in the American West than any other bark beetle. A regional assessment conducted by USDA Forest Servicer staff of the forests in Vail’s wildland-urban interface found that almost all of the 34,000 acres of lodgepole pine in the area were at moderate to high risk of MPB infestation because of tree age, density, and drought.

Vail, CO, the site of the 1999 World Alpine Ski Championships, is a world-class recreation setting. Vail also has some of the most valuable real estate in the United States. Among Vail’s natural treasures is the nearby White River National Forest, a large, and mostly wild, expanse of forest land. Increases in MPB infestations among Vail’s lodgepole pine forests started in 1996. Increases in the MPB infestation were also detected in the forest around the Steamboat Springs area. The management of these outbreaks highlighted the importance of early communication and better understanding of science-based management methods to implement suppression and restoration practices within the wildland-urban interface.

Sensitive to community concerns, while recognizing the urgent need to address the growing MPB problem, the USDA Forest Service:

- Initiated a cooperative effort to address landowner and public concerns with the Colorado State Forest Service; the Town of Vail; and the ski area management company, Vail Associates.
- Devised and implemented a comprehensive plan to address the MPB problem.

Since 1997, the USDA Forest Service has provided technical assistance through the Colorado State Forest Service. This assistance has helped implement prevention and suppression programs on private property, within the White River National Forest, and on property owned by the Town of Vail. The USDA Forest Service has also conducted programs to peel and remove bark from beetle-infested trees in isolated locations, conducted field trials to identify and deploy pheromones effective against MPB, and applied insecticides to select individual trees. In April 2002, the USDA Forest Service published *Western Bark Beetle Report: A Plan to Protect and Restore Western Forests*, which addresses the prevention, suppression, and restoration needs related to bark beetle outbreaks.

The USDA Forest Service is an active member of the Bark Beetle Information Task Force that helps residents of Routt County and surrounding areas understand the potential effects of bark beetles on national forests and State and private lands. The task force was formed in 1999 to provide the public with information about bark beetles and potential tree mortality so that they could make informed decisions about protecting their private property and provide meaningful input on proposed actions on public lands.

Risk Map

Figure 2 is the risk map for insect and disease potential within the United States. It depicts where USDA Forest Service scientists predict mortality will occur over the next 15 years. Areas in red will experience at least 25 percent mortality over and above normal levels (under 1 percent per year) due to the actions of insects and pathogens. The map is not site-specific. It is a coarse-filtered map and, with other data, is used to plan where treatments will take place. Based upon our definition of risk, it depicts about 70 million acres at risk out of a total of 749 million acres of forest land in the United States. Four pests are responsible for 66 percent of the risk acres: gypsy moth in the East, southern pine beetle in the South, root disease in the Interior West, and bark beetles in the West.

Forest Service Budget for 2004

FY 2004 Budget in Dollars in Thousands and includes both native and non-native invasive species

Forest Service Programs	2001 Actual	2002 Current Estimate	FY2003 President's Budget	FY 2004 President's Budget
Forest and Rangeland Research	13,183	10,034	7,940	14,540
International Programs	575	575	575	575
National Forest System	8,000	10,400	16,200	18,300
State & Private Forestry				
S&PF: Forest Health	20,600	40,121	45,000	59,152[12]
S&PF: Pest Mgmt. Emergency	12,472	0	0	0
S&PF::Emerging Pest and Pathogens Fund	0	0	11,968	0[1]
Total Forest Service	**54,830**	**61,130**	**81,683**	**92,535**

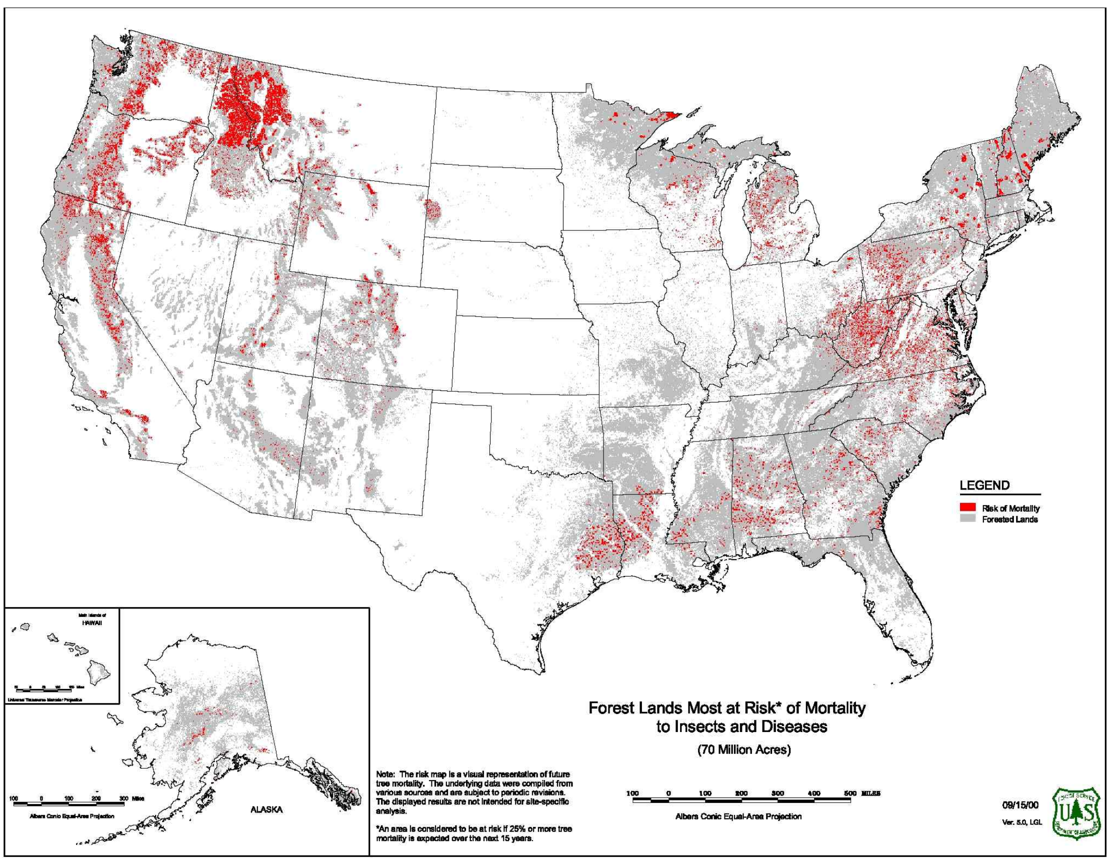

Figure 2 Risk Map

[12] The Emerging Pest and Pathogens Fund was eliminated and added to S&PF Forest Health in 2004

International Forestry Quarantine Research Group: coordinating research through International Union of Forest Research Organizations and Food and Agriculture Organization

Groupe international de recherche sur les forêts et la mise en quarantaine : coordonner la recherche par l'entremise de l'Union internationale des instituts de recherches forestières et de l'Organisation des Nations Unies pour l'alimentation et l'agriculture

Presented by:
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Abstract

Phytosanitary regulations are required to be based on scientific principles under the WTO - SPS agreement. There is a clear need, therefore, for scientists to work closely with regulatory officials to provide up-to-date, sound scientific data to support the development of phytosanitary measures.

In 2000, the North American Forestry Commission, Insect and Disease Study Group formed a committee to identify critical research needs in support of North American Plant Protection Organization (NAPPO) regulations, specifically the solid wood packaging standard. The efforts of this group turned to analyses of the science supporting the development of a global wood packaging standard, ISPM #15. Through this process, the value of an international science/regulatory advisory group became evident. In 2003, the International Forestry Quarantine Research Group (IFQRG) was formed drawing participants from around the world in both the science and plant health communities in order to provide a mechanism where critical forestry quarantine issues can be addressed through discussion, analysis and collaborative research.

Résumé

Les règlements phytosanitaires doivent reposer sur des principes scientifiques, comme le veut l'Accord de l'OMC sur les mesures sanitaires et phytosanitaires. Il importe donc que les scientifiques aient des contacts étroits avec les agents de réglementation pour leur communiquer l'information scientifique valide et à jour dont ils ont besoin aux fins de l'élaboration des mesures phytosanitaires. En 2000, le Groupe d'étude sur les insectes et les maladies des forêts de la Commission des forêts pour l'Amérique du Nord a établi un comité chargé de définir les besoins critiques en matière de recherche pour appuyer les règlements de l'Organisation nord-américaine pour la protection des plantes (NAPPO), en particulier la norme relative aux matériaux d'emballage en bois. Les efforts de ce comité ont porté sur des analyses de l'information scientifique d'intérêt pour l'élaboration d'une norme mondiale sur les matériaux d'emballage en bois (NIMP 15). Ils ont fait ressortir l'utilité d'un groupe consultatif international sur la science et la réglementation.

En 2003, un groupe de recherche a été formé afin d'offrir un mécanisme pour aborder de diverses façons (discussions, analyses et recherches concertées) des questions critiques touchant les mesures de quarantaine pour protéger les forêts. Ce groupe réunit des spécialistes de la science et de la santé des plantes de diverses parties du monde.

CFIA Forestry Report

Le rapport 03 de l'ACIA, Foresterie

Presented by:
Jean-Guy Champagne, Canadian Food Inspection Agency
http://www.inspection.gc.ca/english/plaveg/for/fore.shtml

Abstract

Asian Longhorned Beetle:
This insect was introduced to the Toronto region in early September 2003. Following this discovery, the CFIA and its partners immediately set up a delimitation survey and a program to eradicate the insect. A vast awareness and communication program was also initiated.

Sudden Oak Death:
In June 2003, the CFIA confirmed the presence of this disease in a British Columbia nursery. To allow Canadian importers access to non-infested plant materials, the CFIA has been working closely with the U.S. Department of Agriculture and Plant Protection officials in Europe to develop certification strategies that would permit the movement of host species to Canada following a rigorous verification that the material is produced in a pest-free production site.

Emerald Ash Borer:
In July 2002, the emerald ash borer was discovered in Ontario. The CFIA and stakeholder groups are developing potential regulatory options for eradicating the insect from Canada.

Canadian Heat Treated Wood Products Certification Program **(CHTWPCP)** for export. This program is to permit certification of wood for export. This wood must have been dried at a temperature of 56 degrees C /30 minutes. The program is to come into effect in January 2004.

Canadian Wood Packaging Certification Program (CWPCP) for export:
The purpose of the directive (D-01-05) is to meet the phytosanitary measures stated in the Guidelines for Regulating Wood Packaging in International Trade, ISPM #15, published in March 2002 in connection with the International Plant Protection Convention.

Other matters of interest:
Pine shoot beetle, brown longhorned beetle, woolly aphid, firewood etc.

Résumé

Longicorne asiatique :
L'insecte a été introduit dans la région de Toronto au début septembre 2003. Suite à cette découverte l'ACIA en collaboration avec ses partenaires a immédiatement mis en place une enquête de délimitation ainsi qu'un programme d'éradication de l'insecte. Un vaste programme de sensibilisation et de communication a également été initié.

La mort subite du chêne :
En juin 2003, l'ACIA a confirmé le présence de la maladie dans un pépinière de Colombie- Britanique. En vue d'assurer aux importateurs canadiens un accès au matériel végétal non infesté, l'ACIA collabore étroitement avec le département de l'Agriculture des États-Unis et avec les autorités européennes responsables de la protection des végétaux à la mise au point de stratégies de certification qui permettraient l'entrée de matériel hôte au Canada à la suite d'une vérification rigoureuse garantissant que le lieu de production est exempt du pathogène.

L'Agrile du frêne :
En juillet 2002, l'agrile du frêne a été découvert en Ontario. L'ACIA et d'autres organismes concernés sont en train d'élaborer diverses options réglementaires visant l'éradication de l'insecte au Canada.

Programme canadien de certification des produits de bois traités à la chaleur (PCCPBTC) pour exportation. Ce programme doit permettre la certification du bois destiné à l'exportation. Ce bois doit avoir été séché à une température de 56 degrés C /30 minutes. Le programme doit entrer en vigueur en janvier 2004.

Le Programme canadien de certification des matériaux d'emballage en bois pour l'exportation (PCCMEB)
La directive (D-01-05) vise à satisfaire aux mesures phytosanitaires énoncées dans les Directives pour la réglementation de matériaux d'emballage à base de bois dans le commerce international, NIMP no 15, publiée en mars 2002 dans le cadre de Convention internationale pour la protection des végétaux.

Autres dossiers d'intérêts :
Le grands hylésine des pins, le longicorne brun, le puceron lanigère, le bois de chauffage, etc.

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The Eastern Ontario Model Forest: Forests for Seven Generations

Forêt modèle de l'Est de l'Ontario : Sept générations de forêts

Presented by:
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Abstract

The Eastern Ontario Model Forest (EOMF) is a group of people working together to sustain and ensure the health of the forests of eastern Ontario and beyond.

The EOMF promotes sustainable forest practices and principles through education, demonstration, facilitation of cooperative programs, addressing science and information gaps, reporting on the state of the forest to communities in eastern Ontario, and by sharing knowledge and information beyond our boundaries.

Through a variety of partnership activities, the EOMF is connecting forests and people. Examples include:

Landowner Workshops – creating and delivering an ever-expanding series of workshops on forest topics ranging from invasive species to chain saw use and safety.

Bog-to-Bog Landscape Demonstration – working with landowners to connect isolated forest islands and to protect biodiversity of wetlands and wildlife values.

Sustainable Forest Certification – working with landowners to expand Forest Stewardship Council (FSC) forest certification.

Black Ash Regeneration & Preservation – working with the Mohawk Community of Akwesasne to preserve and regenerate black ash trees used for traditional basket making.

Eastern Ontario Urban Forest Network – working with local communities to ensure the health of trees and forests in urban landscapes.

Forest Events in the Community – working with partners to organize a suite of seasonal events including the Forest Fair of Eastern Ontario, the Kemptville Winter Woodlot Conference, an Annual Christmas Forest Seminar and National Forest Week in the National Capital Region.

Résumé

La Forêt modèle de l’Est de l’Ontario (FMEO) représente un groupe de gens qui unissent leurs efforts en vue de maintenir et d’assurer la santé des forêts dans l’Est ontarien et au-delà.

Elle met en valeur les pratiques et les principes d’aménagement durable des forêts en sensibilisant la population, en faisant des démonstrations, en gérant les programmes de coopération, en comblant les lacunes sur le plan de la science et de l’information, en présentant aux collectivités de l’Est ontarien des rapports sur l’état de la forêt ainsi qu’en échangeant des connaissances et de l’information avec des intervenants de l’extérieur de la région.

Grâce à diverses activités entreprises dans le cadre de partenariats, la FMEO met en contact les forêts et les gens. Citons, entre autres, les activités suivantes :

Les ateliers à l’intention des propriétaires fonciers – conception et organisation d’une série d’ateliers qui prend de plus en plus d’ampleur et qui porte sur des sujets liés aux forêts, allant des espèces invasives à la l’utilisation de la scie à chaîne et aux mesures de sécurité connexes.

Les sites de démonstration sur les tourbières (D’une tourbière à l’autre) – collaboration avec les propriétaires fonciers visant à relier les îles forestières isolées et à protéger la biodiversité des terres humides et les valeurs fauniques.

La certification en aménagement durable des forêts – collaboration avec les propriétaires fonciers en vue d’élargir le programme de certification du Forest Stewardship Council (FSC).

Régénération et protection du frêne noir – collaboration avec les Mohawks d’Akwesasne visant la protection et la régénération du frêne noir servant à la vannerie traditionnelle.

Le réseau des forêts urbaines de l’Est de l’Ontario – collaboration avec les localités de la région dans le but d’assurer la santé des arbres et des forêts en milieu urbain.

La tenue d’événements forestiers dans la collectivité – organisation, en collaboration avec des partenaires, d’une série d’événements saisonniers, y compris la foire forestière de l’Est de l’Ontario, la conférence d’hiver de Kemptville sur les terrains boisés, un séminaire annuel sur les forêts tenu à Noël et la Semaine nationale des forêts dans la Région de la capitale nationale.

Leafmining sawflies of Canada and Alaska

Les petites mineuses au Canada et en Alaska

Presented by:
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Abstract

A number of exotic heterarthrine sawflies are reported from Canada, most feed on birch (*Betula* sp.). These species are believed to have been introduced from Europe from the late 19th century to the mid 20th century. The distribution and abundance of these species is not well known in Canada, except where populations cause significant economic or aesthetic damage to host trees. A number of these species are believed to be controlled by natural enemies, notably Ichneumonid parasitoids of the genus *Lathrolestes*. Recently one of these sawfly species, amber marked birch leafminer *Profenusa thomsoni* (Konow), has become a significant pest of urban birch trees in Anchorage, AK and surrounding communities and near Eielson Air Force Base, and is the focus of a current biological control program.

Résumé

Un certain nombre de petites mineuses exotiques ont été signalées au Canada, dont la plupart se nourrissent de bouleau (*Betula* spp.). On croit que ces espèces ont été apportées d'Europe entre la fin du 19^{e} siècle et la moitié du 20^{e} siècle. La répartition et l'abondance de leurs populations ne sont pas bien connues au Canada, sauf là où celles-ci ont causé aux arbres hôtes d'importants dommages d'ordre économique ou esthétique. Il semble que plusieurs de ces espèces ont des ennemis naturels, qui servent d'agents de lutte, notamment des parasitoïdes de la famille des *Ichneumonidae* du genre *Lathrolestes*. Dernièrement, une de ces espèces de mineuses, soit *Profenusa thomsoni* (Konow), est devenue un ravageur important des bouleaux urbains à Anchorage, en Alaska, dans les collectivités environnantes et près de la Eielson Air Force Base. Elle fait actuellement l'objet d'un programme de lutte biologique.

Dow AgroSciences Canada Inc.

Dow AgroSciences Canada Inc.

Presented by:
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Abstract

Dow AgroSciences Canada Inc. is a research based, agricultural sciences company with diverse product portfolio including weed, insect and disease management for agricultural/horticultural crops and products for forestry and industrial vegetation management. The company has also made significant investments in developing a plant genetics and biotechnology platform in canola and corn. This investment is focused on a range of research for the development of input production traits and value-added quality traits. Dow AgroSciences has established field research capabilities across western and eastern Canada including a plant breeding and cell biology group based in Saskatoon, Saskatchewan.

Our forestry products include, Mimic® 240 LV insecticide, Release® herbicide, and Vantage® Forestry herbicide.

Résumé

Dow AgroSciences Canada Inc. est une compagnie spécialisée en sciences agricoles qui est fondée sur la recherche. Elle occupe un porte-feuille diversifié qui inclut la gestion des mauvaises herbes, des insectes et des maladies au niveau des cultures agricoles/horticoles et des produits pour la gestion de la végétation dans les milieux forestiers et industriels. De plus, la compagnie a fait des investissements significatifs dans le développement d'une plate-forme pour la génétique et la biotechnologie des plantes dont le colza et le maïs. Cet investissement vise un éventail d'études pour le développement de traits de production d'intrants et de traits de qualités à valeur ajoutée. Dow AgroSciences a établi des capacités d'études sur le terrain à travers l'ouest et l'est canadien, dont un groupe spécialisé dans l'amélioration des plantes et la biologie cellulaire à Saskatoon, en Saskatchewan.

Nos produits forestiers incluent, l'insecticide Mimic® 240 LV, l'herbicide Release® et l'herbicide Vantage® Forestry.

Molecular markers for the detection and monitoring of Brown Spruce Longhorn Beetle, *Tetropium fuscum* (Fabr.)

Des marqueurs moléculaires permettant de détecter et de surveiller le longicorne brun de l'épinette, (Tetropium fuscum) *(Fabr.)*

Presented by:
N. Lecours[1], G. Smith[2], M.-J. Coté[3], K. Nystrom[4], R.C. Hamelin[1]
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Abstract

In the spring of 2000, *Tetropium fuscum* (Fabr.), the brown spruce longhorn beetle (BSLB), was determined to be responsible for the spruce mortality, predominantly *Picea rubens* (red spruce), in Point Pleasant Park, Halifax, Nova Scotia. This is the first established population of this Eurasian longhorned beetle (Cerambycidae) in North America and is a quarantine species. Larvae and other immature stages of Eurasian *Tetropium* cannot be distinguished and diagnostic keys for North American species are incomplete. The suspect immature specimens are intercepted in wood dunnage at ports of entry. Species identification currently depends on several months of rearing the insects to adults. The objective of this study is to develop species-specific DNA markers for the rapid detection, differential diagnosis and monitoring of BSLB and other *Tetropium* species from samples of immature and adult specimens procured worldwide. Various protocols for extracting genomic DNA from minute amounts of tissue from *Tetropium* specimens were assessed. A new technique, whole genome amplification, was tested to overcome problems in maintaining the quality and quantity of the original template DNA. Universal DNA primers were used to amplify and sequence several nuclear and mitochondrial genes. Two mitochondrial (COI, cyt b) and one nuclear gene (ITS2) showed the proper inter-specific variability required for the design of specific probes or the use of restriction enzymes for DNA restriction profiles. These were sequenced for the entire collection. Restriction profiles for these three genes allow a high confidence level in the identification of *T. fuscum* and its allies. PCR primers that differentially amplify closely related species of *Tetropium* were developed, synthesized and are being used in real-time PCR.

Résumé

Au printemps 2000, on a déterminé que *Tetropium fuscum* (Fabr.), soit le longicorne brun de l'épinette, était responsable de la mortalité de l'épinette, surtout de *Picea rubens* (épinette route), dans le parc Point Pleasant, à Halifax, en Nouvelle-Écosse. Il s'agit de la première population de ce longicorne eurasien (Cerambycidae) à s'être établie en Amérique du Nord et il s'agit d'une espèce justiciable de quarantaine. On ne peut pas distinguer les larves ni les autres stades immatures de ce longicorne eurasien de ceux des espèces d'Amérique du Nord et les clés de diagnostic ne sont pas complètes. Les spécimens immatures douteux sont interceptés dans le matériel d'arrimage en bois dans les ports d'entrée. Actuellement, l'identification des espèces nécessite plusieurs mois d'élevage d'insectes jusqu'à maturité. La présente étude vise à mettre au point, à partir de spécimens immatures et adultes provenant de partout dans le monde, des marqueurs génétiques spécifiques permettant la détection rapide, le diagnostic différentiel et la surveillance du longicorne brun de l'épinette et d'autres espèces de *Tetropium.* Nous avons évalué divers protocoles de prélèvement d'ADN génomique de quantités infimes de tissu de spécimens de *Tetropium.* De plus, nous avons fait l'essai d'une nouvelle technique, soit l'amplification du génome entier, dans le but d'éliminer les difficultés que pose le maintien de la qualité et de la quantité de la matrice originale d'ADN. Des amorces d'ADN universelles ont été utilisées pour amplifier plusieurs gènes nucléaires et mitochondriens ainsi qu'en établir la séquence. Ainsi, deux gènes mitochondriens (COI, cyt b) et un gène nucléaire (ITS2) affichaient la variabilité interspécifique nécessaire pour permettre la conception de sondes spécifiques ou l'utilisation d'enzymes de restriction à l'égard de profils de restriction génétique. Nous avons déterminé la séquence d'ADN pour toute la collection. Les profils de restriction de ces trois gènes assurent un degré de confiance élevé relativement à l'identification de *T. fuscum* et de ses alliées. Des amorces PCR qui permettent l'amplification différentielle d'espèces étroitement liées à *Tetropium* ont été mises au point et synthétisées et elles sont utilisées dans le cadre de PCR en temps réel.

Remote Sensing Tools for Monitoring and Assessment

Outils de télédétection pour la surveillance et l'évaluation

Presented by:
Carol Hopkins, Image Analyst, Dendron Resource Surveys Inc

Abstract

Carol will provide a brief overview of a couple of Dendron efforts relevant to Integrated Pest Management:

- hyperspectral imagery to:
- assess the physiological condition of jack pine,
- identify individual tree species,

both collaborative Research & Development efforts with the Ontario Forest Research Institute and the Earth Observation Laboratory at York University, with the support of these groups as well as the Canadian Space Agency and the Canada Centre for Remote Sensing, semi-automated approaches for forest stand and individual tree classification.

CFS-Atlantic Exotic Bark Beetle and Associated Fungi Project

Le projet du SCF – Atlantique sur les scolytes exotiques et les champignons connexes

Presented by:
J.E. Hurley, G.E. Smith, K.J. Harrison, A.W. MacKay, A.S. Doane, D. O'Brien, and T. Walsh

Abstract

The arrival of "biological pollution" in the form of invasive insects like the brown spruce longhorn beetle in Halifax, Asian longhorned beetle in Toronto, and emerald ash borer in Windsor, Ontario are the most recent well-publicized examples of threats to the forested ecosystems of Canada. On a continental basis, the rate of introductions has risen dramatically over the past several years coincident with an increase in the volume of trade from a growing number of trading partners.

With 500 years of European settlement, history Atlantic Canadian forest ecosystems have experienced many damaging introductions, e.g. Dutch elm disease, European spruce sawfly, white pine blister rust and beech bark disease, among several others of lesser economic impact. CFS-Atlantic is sensitive to the current high-risk environment for yet undetected new introductions.

This poster outlines our project objectives and goals for research related to the surveillance of non-native bark beetles (Scolytidae) and longhorned beetles (Cerambycidae) and their fungal associates.

Résumé

L'arrivée du longicorne brun de l'épinette à Halifax, celle du longicorne d'Asie, à Toronto, et celle de l'agrile du frêne à Windsor, en Ontario, sont les exemples médiatisés les plus récents de la « pollution biologique » qui menace les écosystèmes forestiers du Canada. À l'échelle du continent, le taux d'introduction d'espèces exotiques a grimpé en flèche au cours des quelques dernières années. Cette hausse coïncide avec une augmentation du volume d'échanges commerciaux avec un nombre grandissant de partenaires commerciaux.

Au cours de 500 ans d'histoire marqués par l'établissement d'Européens, les écosystèmes forestiers du Canada atlantique ont connu l'introduction de bon nombre d'espèces exotiques qui leur ont causé des dommages considérables, notamment la maladie hollandaise de l'orme, le diprion européen de l'épinette, la rouille vésiculeuse du pin blanc et la maladie corticale du hêtre ainsi que d'autres ravageurs de conséquences moindres sur le plan économique. Le SCF-Atlantique est conscient du risque élevé que pose l'introduction encore non détectée de nouvelles espèces exotiques dans le milieu actuel.

L'affiche décrit les objectifs et les buts de notre projet de recherche, lequel est axé sur la surveillance des scolytes (Scolytidae) et des cérambycidés (Cerambycidae) non indigènes ainsi que des champignons qui leur sont associés.

New research group: ECOBIOM (2 posters)

Nouveau groupe de recherche : ECOBIOM (2 affiches)

Presented by:
Jean A. Bérubé, G. Laflamme and R. Lavallée

Abstract

Extended collaboration on biological control of forest Insects or pathogenic microorganisms

Résumé

Effort concerté de lutte biologique contre les insectes ou les microorganismes pathogènes des forêts

Presented by:
Jean A. Bérubé, E. Allen, J.G. Champagne and B. Callan

Abstract

Exotic fungal pests isolated from foreign wood dunnage and wood packaging.

Résumé

Ravageurs fongiques exotiques isolés de bois de fardage et d'emballage étrangers.

SESSION V -
- CROSS-COUNTRY CHECK-UP -
ATLANTIC CANADA

SÉANCE V -
BILAN NATIONAL -
LE CANADA ATLANTIQUE

SESSION V - SÉANCE V

Status of Forest Pests in New Brunswick in 2003

État des organismes forestiers nuisibles au Nouveau-Brunswick en 2003

Presented by:
N. Carter, L. Hartling and D. Lavigne, NB Natural Resources, Forest Pest Management Section, 1350 Regent St., Fredericton, NB E3C 2G6

Abstract

Defoliation by **Spruce Budworm** has not been reported since 1995, the last year that controls were applied. Pheromone trap catches were lowest in 1997; and since 1995, few over wintering larvae (L2) have been detected. Populations are well below thresholds of impending defoliation, but small and constant annual increases in catches suggest they may be rising. Overall, the data suggest 1997 might be the nadir of the budworm population cycle in NB, though that remains to be seen in future years.

In 2003, defoliation by **Gypsy moth** was detected in south-central NB for the third consecutive year (1290 ha; *c.f.* 2061 ha in 2002; 1164 ha in 2001). An egg mass survey in 2002 had found significant increases in egg mass densities in these areas. New and old egg masses were also found for the first time in Miramichi City in northeastern NB and Upper Northampton in west-central NB. More defoliation and expanding populations were forecasted barring a collapse due to major over winter egg mortality, or build-up of natural controls over the summer. Government chose not to conduct a spray program in 2003, though collaborative research was initiated with the Canadian Forest Service and University of NB. As in 2002, some private landowners contracted to spray some of their land (~155 ha), as did J.D. Irving, Limited (~905 ha). All areas were treated with *B.t.* at 2x50 BIU/ha (applications made by Forest Protection Limited). Fortuitously, there was significant over winter mortality of eggs and buildup of disease in the summer. Together this reduced the potential intensity and area of defoliation in 2003. Compared to the previous two summers defoliation was mostly trace to moderate, rather than predominantly severe. The forecast for 2004 is not yet available.

In 2003, populations of Jack Pine Budworm, Hemlock Looper, Whitemarked Tussock Moth, Rusty Tussock Moth, Yellowheaded Spruce Sawfly, Balsam Fir Sawfly, Forest Tent Caterpillar, and Satin Moth remained at or below detectable low levels. Symptoms of attack by Balsam Woolly Adelgid were prevalent throughout southern NB. Defoliation by Greenstriped Mapleworm was less than the 63 ha mapped in 2002. In 2002 and 2003, Beech Bark Disease was reported in association with beech mortality in northwestern NB.

There have been no confirmed changes for other foreign pests including: Brown Spruce Longhorn Beetle (absent), Pine Shoot Beetle (absent), European Larch Canker (present throughout southern half of NB), European Race of Scleroderris Canker of Pines (currently only confirmed at 3 locations in northwestern NB), and Butternut Canker (first confirmed present in NB in 1997 and presently only known at 5 sites near Woodstock).

Résumé

Depuis 1995, aucune défoliation par la **tordeuse des bourgeons de l'épinette** n'a été signalée, et aucune mesure de lutte contre cet insecte n'a été appliquée. Les plus faibles captures de l'insecte dans les pièges à phéromone ont été faites en 1997. Depuis 1995, peu de larves hivernantes (L2) ont été décelées. Les populations sont bien inférieures aux seuils laissant présager une défoliation imminente, mais elles pourraient être en hausse, vu les augmentations annuelles faibles et constantes des captures. Dans l'ensemble, les données indiquent que le point le plus bas du cycle de la population de la tordeuse au N.-B. pourrait avoir été atteint en 1997; il faudra attendre quelques années pour l'affirmer de façon définitive.

En 2003, des foyers de défoliation par la **spongieuse** ont été décelés dans le centre-sud de la province pour la troisième année consécutive (1 290 ha en 2003; 2 061 ha en 2002; 1 164 ha en 2001). En 2002, un relevé avait indiqué des hausses importantes de la densité des masses d'œufs à ces endroits. De nouvelles et de vieilles masses d'œufs ont également été trouvées pour la première fois dans la ville de Miramichi, dans le nord-est de la province, ainsi qu'à Upper Northampton, dans le centre-ouest. Une défoliation accrue et l'expansion des populations étaient prévues, à moins d'une mortalité élevée des œufs au cours de l'hiver ou d'un développement important des agents de régulation naturels au cours de l'été. En 2003, le gouvernement a décidé de ne pas effectuer d'arrosages, mais a entrepris des recherches en collaboration avec le Service canadien des forêts et l'université du N.-B. Tout comme en 2002, certains propriétaires privés (~155 ha), ainsi que J.D. Irving Limited (~905 ha), ont fait faire des arrosages sur leurs terres. Dans tous les cas, l'insecticide utilisé a été *B.t.*, à raison de 2 x 50 BIU/ha (applications effectuées par Forest Protection Limited). Heureusement, la mortalité hivernale des oeufs et les maladies au cours de l'été ont fortement réduit les populations de la spongieuse et, par conséquent, l'intensité et l'étendue potentielles de la défoliation en 2003. Alors que les deux étés précédents la défoliation avait surtout été sévère, l'intensité de la défoliation a plutôt varié de trace à modérée. Les prévisions pour 2004 ne sont pas encore disponibles.

En 2003, les populations de la tordeuse du pin gris, de l'arpenteuse de la pruche, de la chenille à houppes blanches, de la chenille à houppes rousses, de la tenthrède à tête jaune de l'épinette, du diprion du sapin, de la livrée des forêts et du papillon satiné sont demeurées très faibles, à peine décelables tout au plus. Des signes d'attaques par le puceron lanigère du sapin ont été observés dans tout le sud de la province. La défoliation par l'anisote de l'érable, qui couvrait 63 ha en 2002, a diminué. Comme en 2002, la maladie corticale du hêtre ainsi que des hêtres morts ont été signalés dans le nord-ouest.

Il n'y a eu aucun changement confirmé des conditions relatives aux autres organismes nuisibles étrangers, y compris le longicorne brun de l'épinette (absent), le grand hylésine des pins (absent), le chancre du mélèze d'Europe (présent dans toute la partie sud de la province), la version européenne du chancre scléroderrien des pins (présence confirmée actuellement à trois endroits seulement dans le nord-ouest) et le chancre du noyer cendré (première confirmation dans la province en 1997 et seulement cinq foyers connus actuellement près de Woodstock).

SUMMARY

From 1998 to 2001, there were four consecutive years of increases in the proportion of **Spruce Budworm** pheromone traps that caught male moths, with corresponding slight increases in mean number of moths/trap. This trend did not continue in 2002. No defoliation has been reported since 1995, the last year that controls were applied.

Populations of **Hemlock Looper** had increased in 2000 (hinting an impending outbreak), but decreased in 2001. Populations were slightly lower again in 2002 as revealed by lower catches of moths in the pheromone trap monitoring survey. No defoliation was recorded in 2002.

There were significant changes with **Gypsy Moth** in 2002. Some private landowners in the Grand Lake and Washademoak Lake areas opted to have aerial spraying with *B.t.* done (~ 30 ha). Defoliation was mapped over 2061 ha, 77% more than last year. This greatly increased the likelihood of further expansion and spread into new areas. In fact, new and old egg masses were found for the first time in Miramichi City in northeastern NB and at Upper Northampton near Woodstock in the west-central region. Fall egg-mass surveys revealed population increases in general areas around Grand Lake, Washademoak Lake, and Lower Gagetown. Barring a collapse (e.g. major over winter egg mass mortality, or large build-up of natural bio-controls), the majority of the survey evidence indicates that more defoliation will occur in 2003 and populations could expand, including increased risk of movement to new areas by man. There has been heightened public awareness about various implications including possible control actions.

A **Balsam Woolly Adelgid** (BWA) survey was conducted in southern New Brunswick at 260 locations, of which 85 (32.7%) were positive. In 75% of the positive stands, < 10% of the trees sampled had any evidence of BWA damage, and damage was predominantly light (only 13% of the positive stands had trees with moderate damage).
Pheromone trap results for **Jack Pine Budworm, Whitemarked Tussock Moth**, and **Rusty Tussock Moth** show that populations remain very low. In anticipation of a future outbreak of **Forest Tent Caterpillar**, pheromone traps were set out at 130 locations around the Province to establish baseline data for comparison in following years. The maximum trap catch was 51 moths, which is not perceived to indicate any impending defoliation in 2003. No significant defoliation was detected.
Greenstriped Mapleworm caused defoliation to 63 ha (defoliation was last reported in 1997). No significant defoliation by **Satin Moth** was detected. Beech mortality occurred in northwestern New Brunswick and **Beech Bark Disease** was confirmed to be present.
Observations indicate that populations of **Balsam Twig Aphid** declined slightly, but are still at high levels. Populations of **Balsam Gall Midge** also declined, suggesting a hiatus if the past trend continues.
At present, there have been no confirmed changes for foreign pests including: **Brown Spruce Longhorn Beetle** (absent), **Pine Shoot Beetle** (absent), **European Larch Canker**, **European Race of Scleroderris Canker of Pines**, or **Butternut Canker**.
Pest management support was provided to DNR's tree Nursery at Kingsclear, and monitoring was done in DNR's 1 st and 2 nd generation Seed Orchards. One of the 2 nd generation jack pine Seed Orchards had high populations of a sawfly resulting in ground treatment with permethrin (Ambush) to prevent defoliation. In various other orchards, low numbers of spruce budworm, spruce cone maggot, spruce seedmoth, yellowheaded spruce sawfly, and jack pine budworm were detected, but did not require treatment. One gypsy moth larva (suspected blow in from nearby known positive site) was found on a jack pine at Wheeler Cove seed orchard.

The PDF version 0f 2003 aerial overview survey report for New Brunswick has been posted on the web at: http://www.gnb.ca/0078/fpm/status.asp

SOMMAIRE

Entre 1998 et 2001, le nombre de pièges à phéromone de **la tordeuse des bourgeons de l'épinette** qui renfermaient des papillons mâles a augmenté pendant ces quatre années consécutives, et l'on a observé une faible augmentation correspondante dans le nombre moyen de papillons par piège. Cette tendance ne s'est pas maintenue en 2002. Aucune défoliation n'a été signalée depuis 1995, dernière année de l'application de mesures de lutte.
Les populations **d'arpenteuses de la pruche** ont augmenté en 2000 (laissant prévoir une flambée imminente), mais elles ont diminué en 2001. Les populations étaient encore un peu plus réduites en 2002, comme on a pu le constater dans le relevé de pièges à phéromone. Aucune défoliation n'a été enregistrée en 2002.

Pour **la spongieuse**, des changements considérables ont eu lieu en 2002. Quelques propriétaires privés des régions du Grand Lac et du lac Washademoak ont recouru à la pulvérisation aérienne de *B.t.* (~ 30 ha). La défoliation a été cartographiée sur plus de 2 061 hectares, 77 % de plus que l'an dernier. Cette situation augmente beaucoup la probabilité d'une plus grande propagation de spongieuses dans de nouvelles régions. En fait, des masses d'œufs anciennes et nouvelles ont été découvertes pour la première fois dans la ville de Miramichi, dans le nord-est du Nouveau-Brunswick, et à Upper Northampton près de Woodstock, dans le centre ouest. Le relevé des masses d'œufs en l'automne a révélé que la population de spongieuses a augmenté dans les secteurs généraux entourant le Grand lac et le lac Washademoak et à Lower Gagetown. En l'absence d'une grande baisse de population (p. ex. à la suite d'une grande mortalité des masses d'œufs durant l'hiver ou d'une accumulation considérable d'ennemis biologiques naturels l'été prochain), la plupart des relevés indiquent qu'une plus grande défoliation se produira en 2003 et que les populations pourraient augmenter, sans oublier les risques accrus de propagation de spongieuses dans de nouvelles régions par les activités humaines. Le public est sensibilisé davantage aux diverses implications, notamment pour les mesures de lutte éventuelles.

Un dépistage du **puceron lanigère du sapin** a été réalisé à 260 endroits au sud du Nouveau-Brunswick, et des résultats positifs ont été enregistrés à 85 endroits (32,7 %). Dans 75 % des peuplements infestés, moins de 10 % des arbres échantillonnés présentaient des signes de dommage causé par le puceron, et il s'agissait principalement de faibles dégâts (seulement 13 % des peuplements infestés renfermaient des arbres ayant subi un dommage moyen).

Les résultats des relevés de pièges à phéromone pour **la tordeuse du pin gris, la chenille à houppes blanches, et la chenille à houppes rousses** indiquent que les populations sont encore très réduites. En prévision d'une prochaine flambée de **la livrée des forêts**, des pièges à phéromone ont été installés à 130 endroits dans la province pour recueillir des données de base aux fins de comparaison durant les prochaines années. Le plus grand nombre de prises dans les pièges étaient de 51 papillons, ce qui n'indique pas de défoliation imminente en 2003. Aucune défoliation importante n'a été observée.

L'anisote de l'érable a causé une défoliation sur 63 hectares (une défoliation avait été signalée pour la dernière fois en 1997). On n'a pas observé de défoliation importante causée par **le papillon satiné**. Des hêtres sont morts dans le nord-ouest du Nouveau-Brunswick, et la présence de **la maladie de l'écorce du hêtre** a été confirmée.

Les observations indiquent que les populations de **puceron des pousses du sapin** ont diminué un peu, mais qu'elles sont encore nombreuses. Les populations de **cécidomyie du sapin** ont aussi diminué, ce qui laisse présager une interruption si la tendance antérieure se maintient.

Aucun changement n'a encore été confirmé en ce qui concerne les ravageurs étrangers, notamment : **le longicorne brun de l'épinette** (absent); **le grand hylésine des pins** (absent); **le chancre du mélèze d'Europe**; **la race européenne du chancre scléroderrien des pins**; ou **le chancre du noyer cendré**.
Une aide a été fournie à la pépinière du MRN à Kingsclear pour lutter contre les ravageurs, et un dépistage a eu lieu dans les vergers à graines de première et deuxième génération. Un des vergers à graines de pin gris de deuxième génération renfermait de grandes populations de tenthrèdes, et il y a fallu appliquer un traitement au permethrin (Ambush) pour prévenir la défoliation. Dans d'autres vergers, on a détecté la présence de faibles quantités de **la tordeuse des bourgeons de l' épinette** , **la mouche granivore de l'épinette, la tordeuse de graines de l'épinette**, **la tenthrède à tête jaune de l'épinette**, et **la tordeuse du pin gris**, mais le traitement n'a pas été nécessaire. Dans le verger à graines de Wheeler Cove, une larve de **la spongieuse** a été découverte sur un pin gris (on soupçonne qu'elle a été transportée par le vent en provenance d'un lieu avoisinant que l'on savait infesté).

La version PDF du rapport du Nouveau-Brunswick 2003 est disponible à l'adresse suivante : http://www.gnb.ca/0078/Fpmf/status-f.asp

Newfoundland and Labrador: Status of Forest Insect Activity in 2003 and Preliminary Outlook for 2004

Terre-Neuve et Labrador : Bilan des ravageurs forestiers en 2003 et prévisions préliminaires pour 2004

Presented by:
Hubert Crummy, Newfoundland Department of Forest Resources & Agrifoods, Corner Brook, NF

Abstract

On-going infestations of two forest insect pests (hemlock looper and balsam fir sawfly) continued in 2003 in various locations in insular Newfoundland. The moderate and severe defoliation forecast for 2003 was 223,000 hectares (ha) for hemlock looper and 59,000 ha for balsam fir sawfly. During pre-spray reconnaissance of proposed treatment areas, it became obvious that hemlock looper larval population levels were not materializing to the extent predicted. The Department (DFRA), in partnership with Abitibi-Consolidated and Corner Brook Pulp & Paper, carried out a reduced operational control program (approx. 61,600 ha) against the hemlock looper in western and central NF with Foray 76B (B.t.k.) on 37,658 ha and Mimic (tebufenozide) on 23,977 ha. DFRA did not carry out an operational control program against the balsam fir sawfly. The Canadian Forest Service - Atlantic did conduct an experimental/research trial on the sawfly. Results of the 2003 program will be discussed along with outlooks for both insects for 2004.

Résumé

Des infestations de deux ravageurs forestiers, soit l'arpenteuse de la pruche et le diprion du sapin, ont continué de sévir en 2003 dans divers endroits de l'île de Terre-Neuve. En 2003, on prévoyait que l'arpenteuse de la pruche causerait une défoliation modérée et grave sur 223 000 hectares (ha) et le diprion du sapin, sur 59 000 ha. Lors des relevés de reconnaissance dans les secteurs où des pulvérisations étaient projetées, il est devenu évident que les populations larvaires de l'arpenteuse de la pruche n'avaient pas atteint les niveaux prévus. Le ministère des Richesses forestières et de l'Agroalimentaire (MRFA), en partenariat avec l'Abitibi-Consolidated et la Corner Brook Pulp and Paper, a mené des opérations restreintes (environ. 61 600 ha) de lutte contre l'arpenteuse de la pruche dans l'ouest et le centre de Terre-Neuve et a traité 37 658 ha à l'aide de Foray 76B (*B.t.k.*) et 23 977 ha, à l'aide de Mimic (tébufénozide). Le MRFA n'a pas mené d'opérations de lutte contre le diprion du sapin. Le Centre de foresterie de l'Atlantique du Service canadien des forêts a effectué un essai/expérience avec le diprion du sapin. On traitera des résultats du programme de 2003 ainsi que de la situation de ces deux ravageurs à prévoir en 2004

HEMLOCK LOOPER

Forecast 2003:

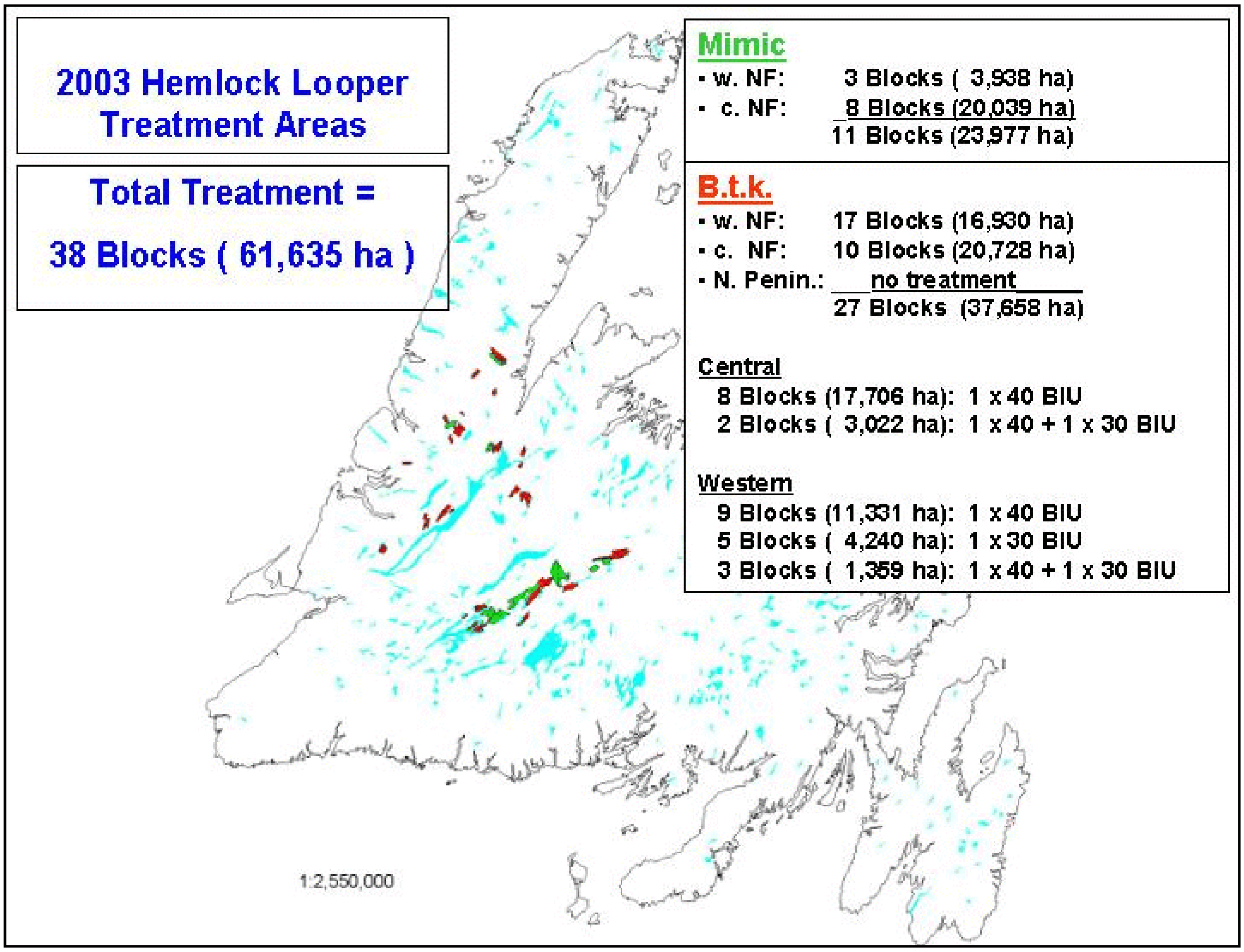
The moderate and severe defoliation forecast for 2003 was for some 223,000 ha to be affected in northern, western and central areas but with scattered pockets elsewhere on the Island. Of note is that there was overlap of the looper and the balsam fir sawfly forecasts in parts of western NF.

Control 2003:

Based on this forecast, DFRA proposed to carry out a hemlock looper control program on approximately 100,000 ha in western, central and northern NF. In fact, because of a reduction in population levels, the net control program consisted of thirty-eight (38) blocks totaling 61,635 hectares (ha) located in western and central NF.

Spray aircraft consisted of twelve (12) Dromader M18s from Supermarine in Ontario. Bases of operation were: Stephenville Airport for calibration, Deer Lake airport for western NF areas and Buchans airstrip for central NF areas. Initially, Main Brook airstrip (Northern Peninsula – east side) was setup for the Northern Peninsula treatments, however because of the reduced population levels, no operations were conducted from this base. Three (3) helicopters were used for supervision and support. Operations were carried out from June 23rd to July 31st. The season was approximately “normal” in terms of tree and insect development.

On a tragic note, there was a spray aircraft crash early in the program in central NF in which the pilot was killed.



Two products were used for hemlock looper control: an earlier application of Mimic (tebufenozide) and Foray 76B (B.t.k.) as the major treatment. The breakdown in terms of product, rate, number of applications and locations are as indicated in the illustration above.

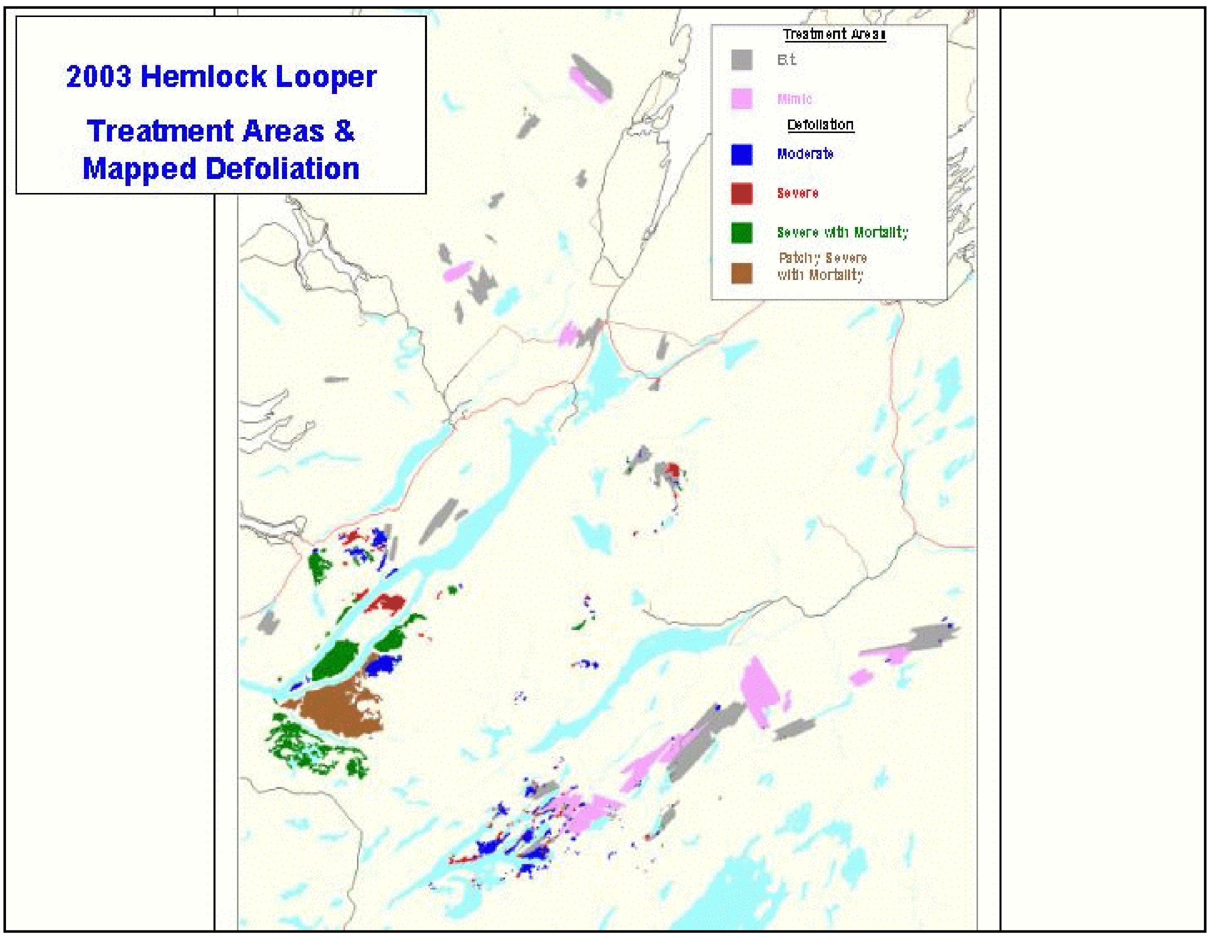
In terms of the Mimic application, there was no delay in application of treatment compared with 2002 when there was asynchrony between larval emergence and the flaring of fir shoots (i.e. a suitable target for droplet deposit).

For the B.t.k. treatment, areas received combinations of one (1) or two (2) applications of B.t.k. and at different rates (either 30 BIUs and / or 40 BIUs) depending upon stand priority, looper population levels and treatment timing.

Results:

Overall, both the Mimic and the B.t.k. treatments worked well, and reduced population levels and prevented additional significant defoliation. In some western areas, as noted the past two years, a complicating factor in the control program was the presence of other defoliators in treatment areas. Combinations of these insects are causing concern for tree viability and have influenced observed results where both occurred. The control products used for hemlock looper control do not affect the sawfly.

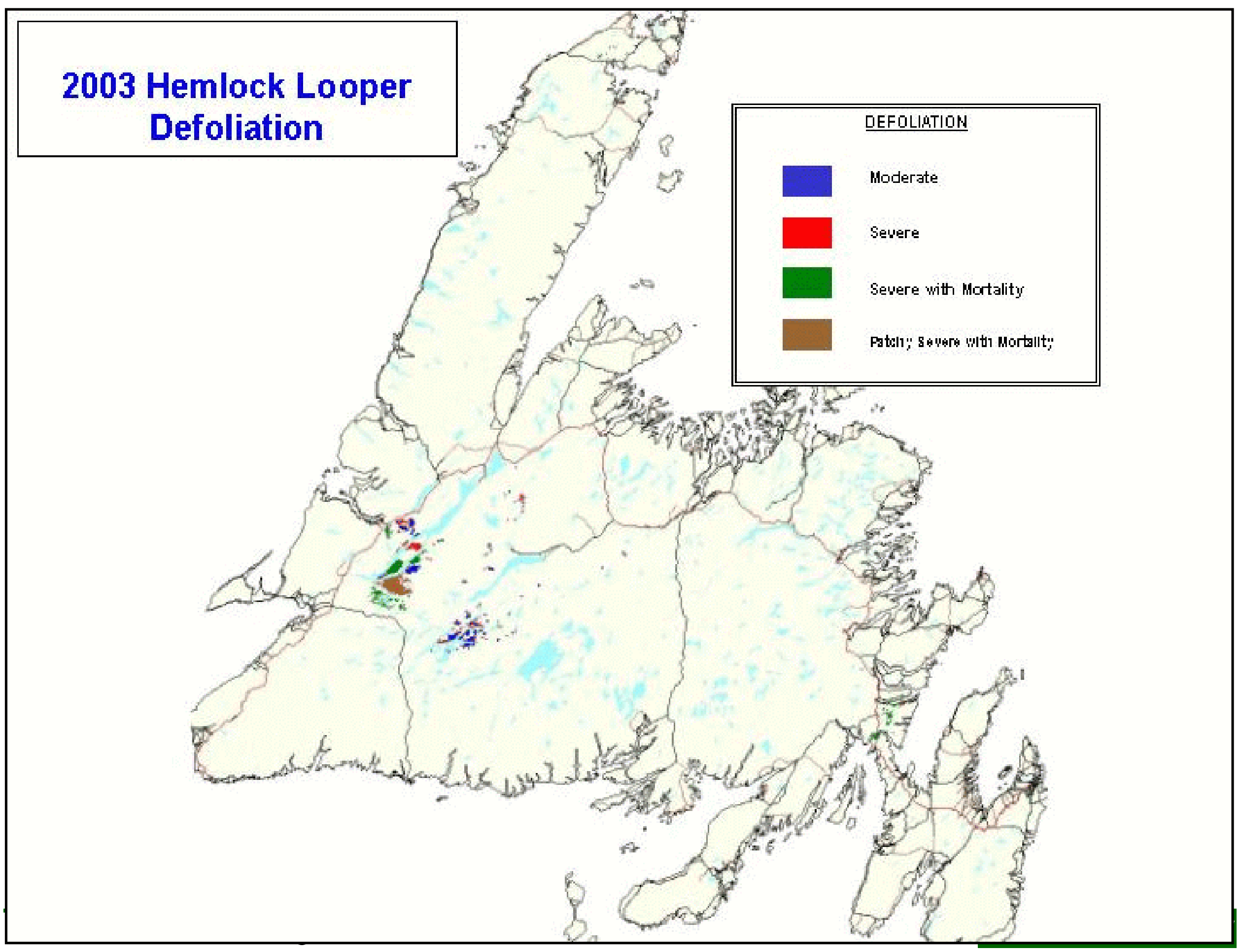
Overall, general observations during the treatment program and later during the defoliation survey indicated that treated areas had much less defoliation and even where there was defoliation, it was less intense compared with untreated areas.



In terms of the population reduction, it was noted that expected larval population levels, based on fall egg counts, did not materialize in northern NF and in some areas of western NF. Larval population levels in central NF were consistent with the prediction. The cause of the reduction is unknown. There did not appear to be any significant weather events, e.g. a frost at larval hatch, which might account for the reduction. When larvae were not emerging as expected, branch samples were collected from the northern NF areas and processed to determine if larval hatch had not occurred or there was some other reason for the delay. Results provided little to explain the phenomena other than there were fewer eggs extracted compared with samples taken at the same plot locations in the fall. Further work is planned for 2004 to see if spring egg parasitism is prevalent and could account for the 2003 observations.

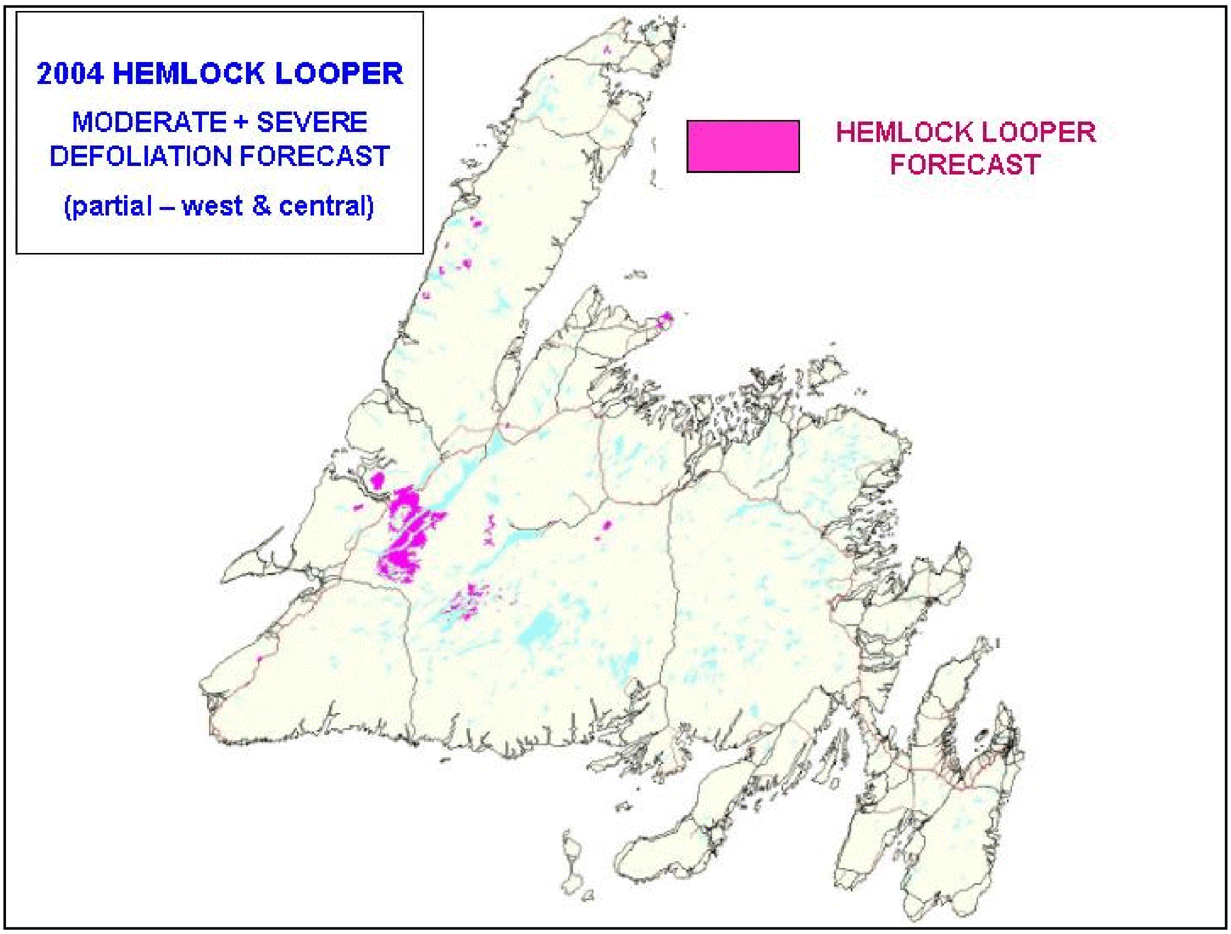
Defoliation 2003:

The hemlock looper caused moderate and severe defoliation basically within the forecast boundaries, except as noted for the areas affected by the reduction in population levels at hatch and where treatment occurred. Most of the observed defoliation occurred outside of treatment areas as illustrated. Approximately 30,000 ha received moderate and severe defoliation. In some western areas, defoliation was the result of feeding by both the hemlock looper and the balsam fir sawfly.



Outlook for 2004:

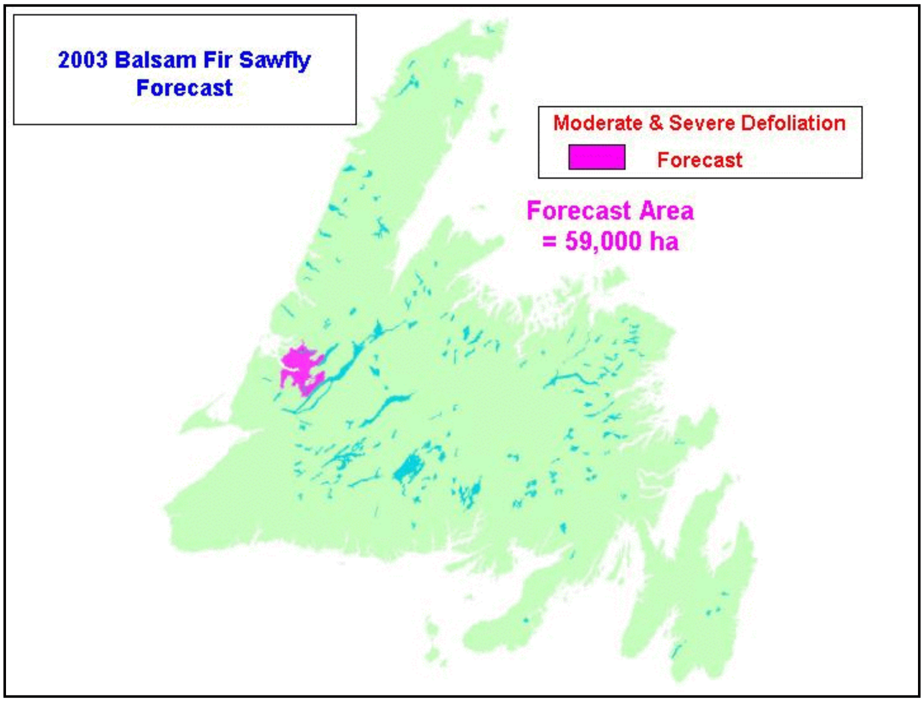
The fall forecast survey was conducted, based on locations of infestation during the summer of 2003 and observed moth activity. The number of sample points similar to 2002, but there were adjustments in number of plots to reflect either a decrease / or an increase in population levels. The preliminary outlook is that the infestation will continue in western and central NF, although at a lower level reflecting the unexpected population reduction and as a result of the treatment program. Levels in eastern NF will likely continue similar to 2003. The preliminary forecast is illustrated in the following graphic. It should be noted that the eastern NF portion of the forecast has not been finalized and as such is incomplete in terms of locations and final areas figures. To date over 75,000 ha of moderate and severe defoliation have been forecast.



BALSAM FIR SAWFLY

Forecast 2003:

Moderate and severe defoliation was forecast to occur on approximately 59,000 ha in western NF in the general vicinity of Corner Brook and extending southward, northward and eastward.



Control 2003:

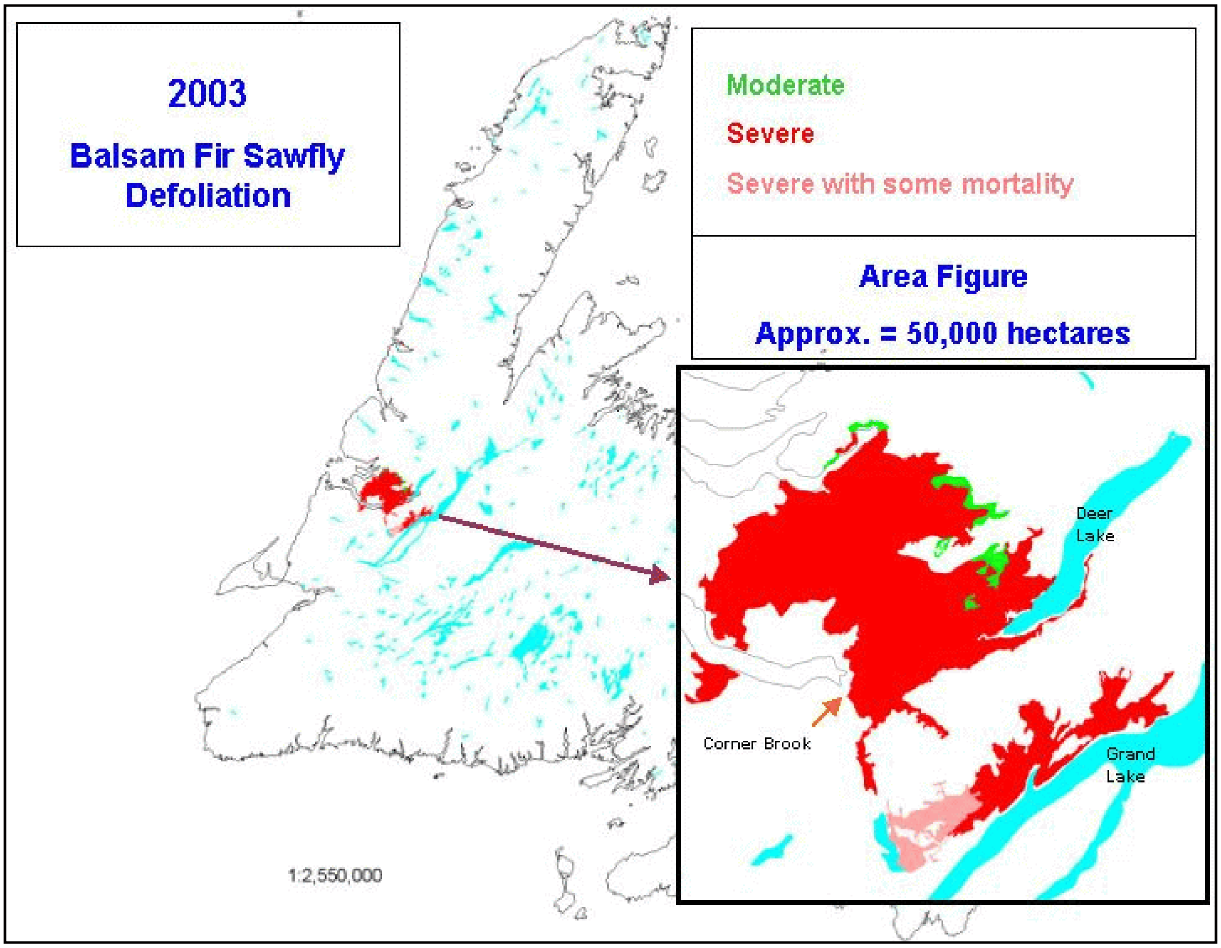
The DFRA did not carry any operational control program in 2003.

Experimental Trial:

The Canadian Forest Service, with cooperation from the DFRA, carried out an experimental trial in western NF on approximately 5,000 ha using the naturally occurring balsam fir sawfly virus (NeabNPV).

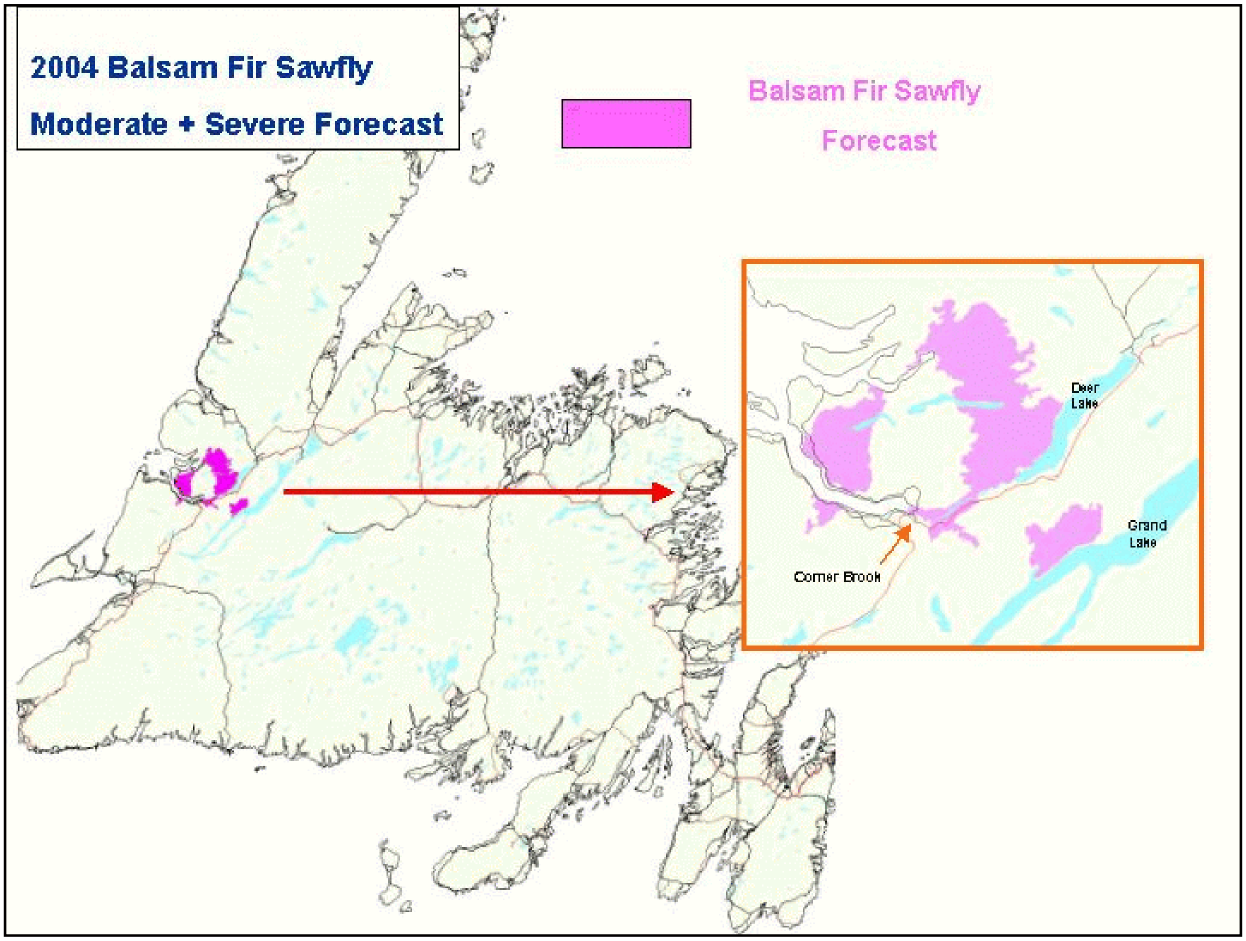
Defoliation 2003:

In 2003, the balsam fir sawfly caused moderate and severe defoliation in western NF in areas forecast. Preliminary area figures indicate that in 2003, approximately 50,000 ha were affected. Of note is that there has been some mortality associated with this insect, although the major impact is growth loss and weakened tree condition.



Outlook for 2004

The infestation in western NF is expected to continue with predicted moderate and severe defoliation on the leading northern and eastern edge of the 2003 infestation. Some 34,000 ha of moderate and severe defoliation are forecast to be affected. These are mainly second growth balsam fir stands, much of which has been thinned at considerable expense. Some of these stand have been or are being affected by the hemlock looper as well, which further increases the concern.



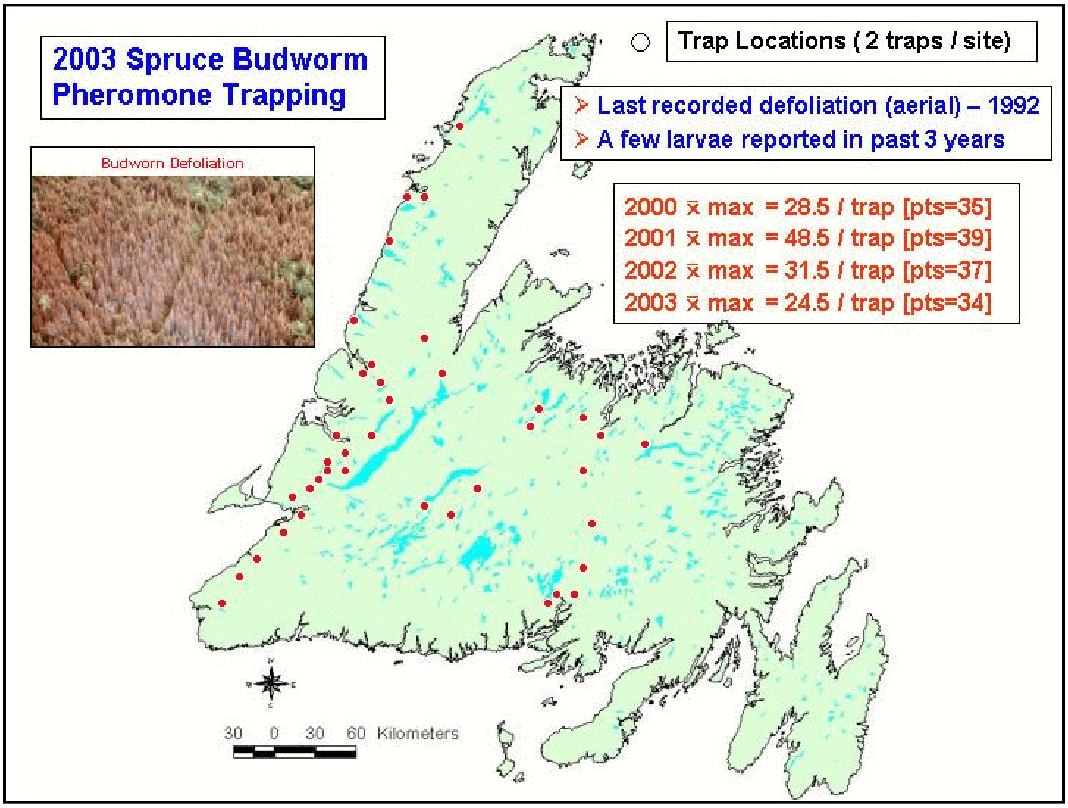
YELLOWHEADED SPRUCE SAWFLY

No control activity was carried out against this insect in 2003. A few pockets of infestation were reported in 2002 with localized damage to natural and planted young Black Spruce stands in central NF. However, as predicted, this insect did not cause any significant damage in 2003.

OTHER INSECTS

The blackheaded budworm is still affecting some stands of spruce trees, particularly in eastern NF. In addition the larch beetle and the spruce beetle (on mature white spruce) are still being detected, especially in eastern NF.

In 2003, as in 2000, 2001 and 2002, pheromone traps were put out to monitor male moth activity of the spruce budworm. Thirty-four (34) locations were monitored, two (2) traps per location. Although at low levels, male moths were captured at 20 of these sites. The maximum average number of moths recorded per trap was 24.5. This was a at a par to the number of positive traps recorded in 2002 but the average number per trap was lower than levels recorded in 2002. These levels are not of biological concern at this point in time. Monitoring will continue.



Volume Optimization and Forest Health Management in Canada: are we losing too much volume to be competitive?

L'optimisation du volume et la gestion de la santé des forêts au Canada : Perdons-nous trop de volume pour être concurrentiels?

Presented by:
Joe Meating Director Forest Health Management, BioForest Technologies Inc., 105 Bruce Street, Sault Ste. Marie, ON P6A 2X6

Abstract

With over 230 million hectares of productive forest, Canada is the largest forest product exporter. However, for many years Canada has faced a variety of social, environmental and economic pressures to achieve sustainability through conservation and ecosystem management. The Canadian Council of Forest Ministers has proposed a Canada-wide approach, Forest 2020, to increase conservation and ensure continued growth in the forest industry. The CCFM has proposed to make better use of fast growing, high-yield plantations and intensive silviculture, along with existing forest management practices.

We are proposing another option, Volume Optimization. Future improvements in silvicultural systems, harvest methods and processing technologies will not likely result in significant increases in stand productivity or wood utilization. The most significant opportunity to enhance forest productivity is to reduce losses caused by insects and disease on what is growing in our forests now. Complete integration of pest management into forest management planning coupled with intensive management of productive sites has the potential to significantly increase stand productivity and forest conservation.

Résumé

Avec plus de 230 millions d'hectares de forêts productives, le Canada est le plus important exportateur de produits forestiers au monde. Cependant, diverses pressions sociales, environnementales et économiques sont exercées sur le Canada depuis de nombreuses années pour qu'il utilise la conservation et la gestion écosystémique pour parvenir à la durabilité. Le Conseil canadien des ministres des forêts (CCMF) a proposé une approche pancanadienne appelée Forêt 2020, destinée à accroître la conservation et à garantir une croissance continue de l'industrie forestière. Le CCMF a proposé de mieux utiliser les plantations à croissance rapide et à rendement élevé et la sylviculture intensive, de concert avec les pratiques existantes d'aménagement forestier.

Nous proposons une autre option, l'optimisation du volume. Il est peu probable que les améliorations futures apportées aux régimes sylvicoles, aux méthodes d'exploitation et aux techniques de transformation procureront des gains importants de productivité des peuplements ou d'utilisation du bois. Le meilleur moyen que nous ayons d'accroître la productivité de nos forêts est de réduire les pertes causées par les insectes et les maladies des arbres qui y poussent. L'intégration complète de la lutte antiparasitaire à la planification de l'aménagement forestier, conjuguée à un aménagement intensif des stations productives, peut permettre d'accroître considérablement la productivité des peuplements et la conservation des forêts.

* * * * * * *

Volume Optimization and Forest Health Management in Canada

Some Statistics

- Canada = 997 million ha gross area
- Forested area – 418 million ha
- Productive forest = 227 milion ha
- Wood production forest = 120 milion ha
- Mean volume = 131 m^3/ha
- Productivity to maturity = 1.76 m^3/yr
    - 197 million m^3/yr

(State of Canada's Forests 2002-2003)

- 2.8 million ha bumed in 2002
- 1.03 million ha harvested in 2000
- 18.6 million ha affected by insect defoliation in 2001

Why worry ?

- Competition
    - Brazil, Chile, New Zealand: fast growing plantations
- Social and environmental concerns with current forestry practices;
- Shrinking land base for commercial use;
- Local and regional wood supply concerns.

CCFM Proposal: Forests 2020

- Internsive management
- High yield plantations (Poplar, spruce, willow larch)
- 20 m^3/yr
- Harvest in 20 years
- Three management zones
    - Parks & conservation
    - Integrated use
    - Intensive commercial use
- 2 milion ha = 23 million ha fiber production

Another Option: volume optimization – more from less

- Future improvements in silvicultural systems, harvest methods and processing technology are likely to be small;
- The most significant opportunity to achieve increased volumes is to reduce losses to insects and diseases on what's out there now.

Spruce Budworm in Ontario
(Gross et al. 1992)

- **1982-87 Losses**
  - 52,4 million m^3
  - ~ 600,000 ha equivalent
  - $ 2,1 - $ 10,8 bilion loss
- Harvest (bF Sp)
  - 53,6 million m^3

- **1967-87 Losses**
  - 126,5 million m^3
  - ~ 1,4 million ha equivalent
  - 14 years harvest
  - $ 5,1 – $ 25 billion loss

Protection intensity in Ontario and New Brunswick: 1985 – 1997

- New Brunswick
  - Infested = 3,9 million ha
  - Sprayed = 4,2 milion ha

- Ontario
  - Infested = 82,6 million ha
  - Sprayed = 0,4 milion ha

Aspen is not a weed anymore! Forest Tent Caterpillar

- Outbreaks occur abour every 10 years
- Last 6 years (3-9)
- At stand level L-S defoliation 4-5 years
  - Yr 1 Light
  - Yr 2 Severe
  - Yr 3 Severe
  - Yr 4 Light – moderate
  - Yr 5 Collapse

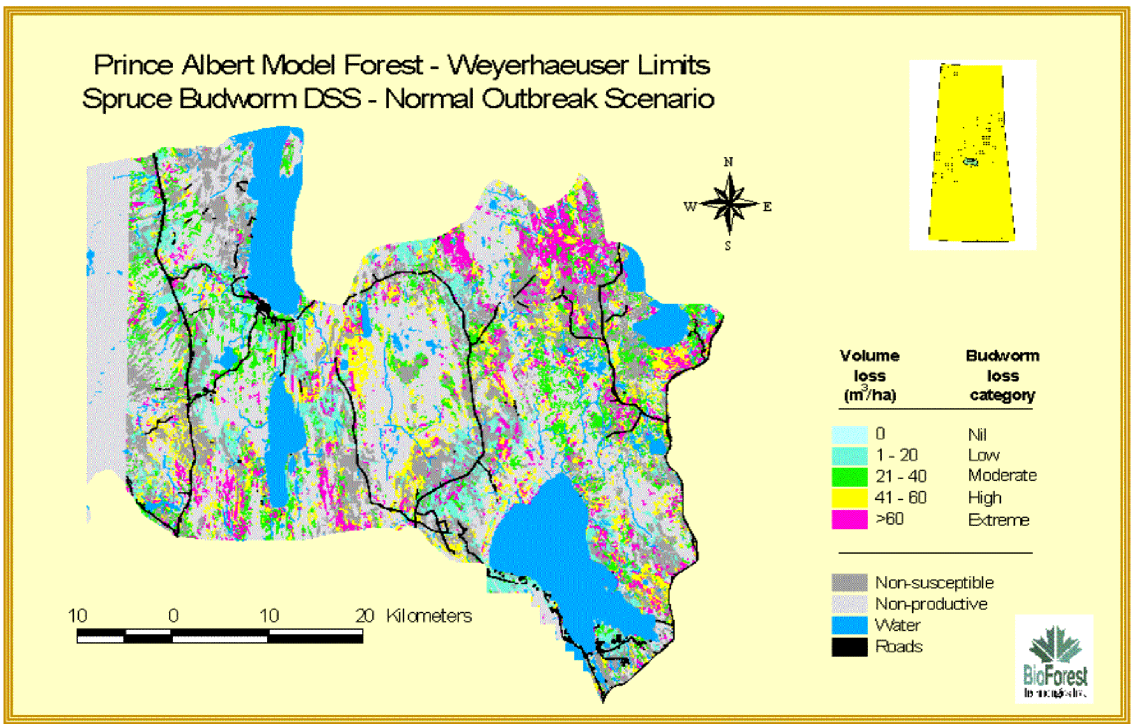
JPBW in NE Ontario 1982-86
(Gross & Meating 1994)

- Growth loss = 2.1 million m^3
- Mortality = 5.1 million m^3
- Total loss = 7.2 million m^3
- Estimated 1986 value = $ 1.13 bilion (JW)
- JP harvested in **all** Ont. 82-86 = 25.9 million m^3
- Losses – 28 % of total volume harvested
- Or ~ 80.000 ha

So what can we do about it?
Volume Optimization Strategy: More from less

Signigicant advancements in pest management

- Decision Support Systems
- BioSIM
- Spray Advisor
- Spray optimization
- GPS navigation
- Flow control
- Auto booms
- Delivery systems
- Formulations
- **Greater program efficacy and consistency!**



Decision Support Systems
Prince Albert Model Forest Simulation:
PAMF Protection Scenario

- 103,000 productive forest
- 64,765 ha susceptible forest
- Assume
  - 40 % protected = 25,900 ha
  - 40 % defoliation target met
  - Sprayed 5 years during outbreak
- Spray costs ~ $ 6,5 million
- Volume saved (DSS) = 439,405 m^3 (17m^3/ha)
- ~ 3500 ha harvested to compensate
- Value = $ 18 - $ 87 million

FTC Control: Saskatchewan 2003

- Foray 48B
- 1 application
- 20 BIU / 1,6L / ha
- Defoliation:
  - Spray block = 22 %
  - Controls = 76 %
- I wish all bugs were this easy !

One man's opinion: Personal general generalizations

- We still don't honestly integrate pest depletions into forest management planning;
- Foresters are not educated in pest management;
- In most undergrad forestry programs insect and disease course are almost off the radar;
  - 2 of 82 courses at UNB
  - 1.5 of 46 courses at Lakehead
  - 2 at UBC
  - Not compulsory
  - Not integrated into forest management program

- The government / Industry dance or who's on first, no what's on first…
  - Wood supply?
  - If I do protect, where do I send the bill?
    - Forestry Futures Trust model
- Avoidance behaviour: if I close my eyes long enough, surely the problem will go away of I'll be retired and it will be someone else's problem.

Conclusion

- Protect more of what we have now
  - More from less
- Proactive
- Educate: public, industry, governments & politicians

IPM Options – Are we ready or is it a case of 'Old Mother Hubbard'?

Les possibilités en matière de lutte intégrée – Sommes-nous prêts ou s'agit-il d'une « autre histoire de grand-mère… »?

Presented by:
Christopher Lucarotti, Canadian Forest Service, Atlantic Forestry Centre, PO Box 4000, Fredericton, NB E3B 5P7

Abstract

According to the "Compendium of Canadian Forestry Statistics" compiled by the Council of Canadian Forestry Ministers, forestry accounts for only 2% of all pesticides used in Canada. The Compendium also shows that, between 1995 and 2001, Bacillus thuringiensis was the main product used to control forest pest Lepidoptera at the operational level. Tebufenozide was also used operationally but many of the other products used were applied under research permits issued by the Pest Management Regulatory Agency. Considering the taxonomic diversity of forest pest insects (both indigenous and introduced) and the scale and scope (both potential and realized) of infestations, the available arsenal of pest control products, as shown in the Compendium, is not reassuring. Additionally, the US Environmental Protection Agency and the Pest Management Regulatory Agency are currently reviewing all pesticide registrations. By the time these reviews are complete, there will be fewer products available for use. It should also be remembered that a registered pesticide must meet a certain level of "acceptable practice". If it fails provincial environmental assessment, community acceptance or if the conditions for its use are so restrictive as to make it ineffective it cannot and will not be used. As an example, Dylox (Trichlorfon) can be used against sawfly pests but its use against balsam fir sawfly did not meet community acceptance in western Newfoundland and spray exclusion zones to water were such that Dylox could not be applied productively.

Biological control agents are often suggested as alternatives to broad-spectrum pesticides. Biological control agents have narrow host spectra and, in the classical sense, can continue to suppress the pest over the long term. The very characteristics that make biological control agents a blessing environmentally inhibit their development commercially because the costs of development and registration are difficult to recover. This is especially true in forestry, which accounts for only a small portion of total pesticide use. It may be possible, however, to develop biological control agents for use in forestry by taking a team approach involving partnerships between the Canadian Forest Service, universities, the forest industry and provincial land management departments. This approach would utilize expertise in a number of disciplines, (e.g. ecology, genetics, pesticide application) simultaneously to solve a specific pest problem. Basic and applied research would come together to provide the necessary data for product registration and, as the end-user, forest industry would, in part, serve the role of industrial or commercial partner. The development of a nucleopolyhedrovirus as a control agent of the balsam fir sawfly may be a case in point where this type of partnership approach has worked to deliver a product for a specific use in forestry.

Résumé

Selon l'Abrégé de statistiques forestières canadiennes compilé par le Conseil canadien des ministres des forêts, l'aménagement forestier ne contribue qu'à 2% 100 de l'utilisation de tous les pesticides au Canada. L'Abrégé montre aussi que, entre 1995 et 2001, Bacillus thuringiensis a été le principal produit utilisé pour lutter contre le ravageur Lepidoptera sur le terrain. L'insecticide tébufénozide a également servi de façon opérationnelle, mais bon nombre d'autres produits ont été appliqués en vertu de permis de recherche délivrés par l'Agence de réglementation de la lutte antiparasitaire. Compte tenu de la diversité taxinomique des insectes nuisibles (tant indigènes qu'exotiques) ainsi que de l'envergure et de la portée (tant potentielles que réelles) des infestations, l'arsenal disponible de produits antiparasitaires, tel que le montre l'Abrégé, n'est pas très rassurant. En outre, la US Environmental Protection Agency et l'Agence de réglementation de la lutte antiparasitaire sont en train de passer en revue l'homologation de tous les pesticides. D'ici la fin de cet exercice, il y aura moins de produits sur le marché. Il faut aussi se rappeler qu'un pesticide homologué doit respecter un certain niveau de « pratique acceptable ». Si un produit échoue l'évaluation environnementale provinciale, s'il n'est pas accepté par la collectivité ou si les conditions nécessaires à son usage sont tellement restrictives qu'elles le rendent inefficace, il ne peut pas et ne sera pas utilisé. Par exemple, le pesticide Dylox (Trichlorfon) peut être utilisé pour lutter contre la tenthrède. Toutefois, son utilisation contre le diprion du sapin n'a pas été acceptée par la collectivité dans l'ouest de Terre-Neuve et les zones d'exclusion d'épandage près de l'eau étaient tellement importantes que ce pesticide ne pouvait pas être appliqué de façon productive.

On propose souvent le recours aux agents de lutte biologique comme solutions de rechange aux pesticides à large spectre. En effet, la gamme d'hôtes des agents biologiques est limitée et, dans le sens classique, ceux-ci peuvent continuer à éliminer les ravageurs visés pendant longtemps. Cependant, les caractéristiques mêmes qui font des agents de lutte biologique un bienfait écologique en empêchent la production commerciale du fait qu'il est très difficile de récupérer les coûts liés à la mise au point du produit et à son homologation. Cela est particulièrement vrai pour la foresterie, qui ne représente qu'une infime portion de l'utilisation totale de pesticides. Il pourrait être possible, toutefois, de mettre au point des agents de lutte biologique aux fins d'usage en foresterie grâce à une approche collective fondée sur des partenariats regroupant le Service canadien des forêts, les universités, le secteur des forêts et les ministères provinciaux responsables de l'aménagement des terres. Cette approche permettrait de tirer parti du savoir-faire de spécialistes dans bon nombre de disciplines (p. ex. écologie, génétique et application de pesticides) simultanément afin de trouver une solution à un problème lié à un ravageur particulier. On pourrait combiner la recherche fondamentale et la recherche appliquée pour fournir les données nécessaires à l'homologation d'un produit et, en tant qu'utilisateur final, le secteur forestier jouerait, dans une certaine mesure, le rôle de partenaire industriel ou commercial. La mise au point du virus de la polyédrose nucléaire comme agent de lutte contre le diprion du sapin pourrait être un exemple de situation où ce genre de partenariat permet de mettre en marché un produit destiné expressément à l'usage en foresterie.

Ideas Exchange

Échange d'idées

Presented by:
Guy Smith, facilitator, Canadian Forest Service, Great Lakes Forestry Centre

Abstract

The purpose of the Ideas Exchange was to generate ideas and discussion about the future of integrated pest management in Canada and to identify possible roles for the public and private sectors. The session involved small group discussion on topics chosen by participants. The choice of topics is itself an indication of where some of the main issues lie, in the view of the approximately 60 participants. The following summary is grouped by topic and includes point form responses to the main questions posed to each group: what will the big needs be in the next three-to-five years, and what should be done now to prepare for the future? Some groups addressed a third question, what should the public and private sectors do?

Résumé

Le but des Échanges d'idées était de susciter des réflexions et discussions sur l'avenir de la lutte intégrée contre les ravageurs au Canada et d'identifier les rôles possibles des secteurs public et privé. Cette session a pris la forme de discussions en petits groupes sur des sujets choisis par les participants. Le choix des sujets est en lui-même une indication des principaux enjeux selon l'opinion de la soixantaine de participants. Le résumé qui suit est présenté par sujet et inclut des réponses en style télégraphique aux principales questions posées à chaque groupe : Quels seront les principaux besoins au cours des trois à cinq prochaines années et que devrions-nous faire maintenant pour nous y préparer? Quelques groupes ont aussi répondu à une troisième question : quel devrait être le rôle des secteurs public et privé

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Effective use of silviculture to maintain forest health

<u>Big Needs</u>:

Awareness of silvicultural options; future outcomes using integrated pest management (IPM) and maintaining growth and yeild studies

Guidelines that indicate and awareness of practices that mitigate or exacerbate pest problems

Maintain training associated with silvicultural surveys – forester technical training

What should be done:

Education for IPM and intensive forest management (IFM) – continuing education (esp. pathology and entomology)
Training pathologists and entomologists across Canada
Increased emphasis on tech. Transfer and extension to end users

1. New products for very small areas of use

Big Needs:

Iron out differences in registration requirements between US EPA and PMRA, e.g. requirement for efficacy data; requirements for pheromone traps for control requiring a PCP No.

We need replacements for organophosphates for urban pest management

We need to change registration processes to be more 'friendly' to companies to introduce new products.

What should be done:

Do a benefit/risk analysis for loss of these products
Get an industry association to lobby for these products

Make the regulatory process more clear, streamlined, and favourable to encourage companies to pursue registration

2. Managing pests by managing forests for the long-term

Big Needs:

Need a long-term vision (over-mature forests in west leading to pest outbreaks; young forests in east leading to supply shortages)

Climate change is causing variations in ranges of pests (including range expansion of some species)

Need to incorporate age/species mosaic into operational landscape planning (i.e. emulating natural disturbance)

Need an emergency fund for a defined protocol to deal with exotic detections

What should be done:

Risk assessment
Commitment from land manager to protect resources we have now
Better incentives for industry-based long-term research

What should various players do:

Federal Government: research
Provincial Government: linkages with industry; coordinate protection with harvest schedules; look at tenure reform; educate industry
Forest industry: mandate professional foresters associations to mandate minimum level of forest health training
Pest management industry: facilitate technology transfer of innovations into operational programs.

3. Increasing sector and forest industry participation

Big needs:

Accept broader definition for sector (e.g. include municipal parks, private land, NGOs)

Mechanism for effective response by entire sector is missing (regular or rapid response)

Lack of focus on management needs

Cost-effective treatments and operations

Vision and perspective on the needs for investment
Preparation and risk management for climate change.

What should be done:

Engage broader sector in discussions, risk assessments, planning, and implementation. Develop a clear statement on roles and focus (e.g. regulatory-science-operations). Make use of industry and other sector capacity

Look at fire control as a model for pooling knowledge and resources and coordinating deployment with a national perspective (also links to USA). We have procedures and protocols that seem to be in place that work; adopt and improve upon these.

Build resilient, responsive institutions to absorb shocks and emergencies

Take climate change into account in visioning

Build insect and disease management into certification requirements

What should various players do:

Federal: draw together CFIA/CFS/PMRA; facilitate this process; create working groups
Provincial: links to forest management plans; provincial mandates on pests; emergency planning.
FPAC/CFIC: Research, S&T, pest operations

4. More open-minded regulatory process (open to innovation)

Big needs:

Simplified, rapid research permit process for reduced-risk pesticides

Increased rate of registration of reduced risk pesticides such as viruses, fungi, and semiochemicals

An open, cooperative consultative process between researchers and registrants and the PMRA. E.g. faster turnaround time on pre-registration consultation.

(note: Wayne Gratton, PMRA was part of this group)

What should be done:

Minor use registration process should be modified to enhance registration of new products for forestry use.

Ensure harmonization with U.S. EPA e.g. exemption for pheromone control products used in traps identical indexing system.

Develop an alternative to the current minor use registration (which is for products registered in USA or OECD country) to embrace new, reduced-risk "minor use" agents, most of which are natural products (or identical agents that are synthesized or cultured) already present, and often ubiquitous, in natural environments.
Entire registration process should be faster for reduced-risk pesticides.

What should various players do:

Federal (PMRA): Need to realize that the alternative pesticide industry relies on a large number of small-revenue, species-specific products, while the conventional pesticide industry markets a small number of high-revenue products. The former has little money, few people, and scarce resources. It cannot afford the time and expense for registration that the large conventional companies can.

Forest industry: could be much more proactive, but this may be a tenure issue. Note that Provincial Governments are an 'industry' re. forestry

Pest Management industry: Need to forget the past and pursue what we know is the right thing to do, and that includes submitting applications for registration, and working to streamline the process.

5. Pay more attention to pathology

Big Needs

What are the pathogens, and where are they? (inventory)

Education – root rots; exotics; etc.

Show the impact of losses – make the case

What should be done

Pre-harvest surveys

Why are we not acting on pathogens?

Postscript – a perspective on forest productivity

There are three ways of increasing the productivity of our forests:

1. enhance growth and quality of timber
2. increase efficiency, and
3. cut our losses

The third is where forest health comes in. However, industry, which stands to benefit most from forest pest management, is a tenant on much of our forest land, and without a long-term secure tenure is reluctant to invest in forest health. Meanwhile, government invests in education, highways and human health. The problem that we all face, is how do we break this impasse.

Conservationists constitute a strong, vocal lobby against harvesting of much of our forest land. However, in the face of change, particularly in climate, much of the forest they seek to preserve is subject to extreme pest depredation, and may cease to exist in its present form. How do we get them to realize that forest pest management, and even harvesting, may be in their best long-term interest?

Is there a way to strengthen certification requirements (IS0, FSC etc.) to demand truly effective forest health practices in the manner advocated by Joe Meating?

SESSION VI -
URBAN /
MUNICIPAL PERSPECTIVE

SÉANCE VI -
PERSPECTIVE URBAINE
ET MUNICIPALE

SESSION VI - SÉANCE VI

Urban Forests: Canada's 9th Forest Region

Les forêts urbaines : la 9e région forestière au Canada

Presented by:
Michael R. Rosen, R.P.F., Vice-President, Tree Canada Foundation

Abstract

As we enter the 21st Century, forestry in Canada demonstrates a level of diversity unparalleled in the rest of the world. From grizzly bears to prickly pear cactus, Canada has to live up to its reputation as a "Forest Nation" while being one of the most urbanized countries on earth. While being at the same time guardian of 10% of the earth's forest and the world's leading exporter of forest products, almost 80% of Canadians make their homes in urban areas. This disconnect has been difficult for those in forestry to deal with. How can an essentially urban population relate to an essentially rural resource?

One way is by meeting Canadians half way, in the urban forest – the forest that they intimately know and treasure. The recognition of the urban forest is ever slowly, increasing. From the definition of the term in Canada in the 1960's to the establishment of professional and technical forestry positions in municipalities to the inclusion of urban forests as an objective in the National Forest Strategy 2003-2008, the urban forest has been brought into increasing recognition by Canadians.

The implications for forest pest management are challenging and enormous. Urban forests are quite frequently points of entry for exotic insects and disease that have little or no natural controls. The pressures that urban forests face (pollution, underground utilities, compaction etc.) are made that much more serious by the pests that flourish all too easily in our urban centres. Whether we like it or not, Canadians, their governments at all levels and private industry will be forced to find the resources to increasingly recognize, regenerate and maintain our 9th Forest Region.

Résumé

Au moment où nous entrons dans le 21e siècle, la foresterie au Canada affiche un niveau de diversité sans parallèle dans le reste du monde, intégrant une large gamme d'organismes depuis les grizzlis jusqu'aux cactus. Le Canada doit être à la hauteur de sa réputation de « nation forestière » en dépit du fait qu'il est l'un des pays les plus urbanisés de la planète. Il est gardien de 10 % des forêts de la Terre et le plus gros exportateur de produits forestiers; par ailleurs, sa population est concentrée à près de 80 % dans les zones urbaines. Cette déconnexion s'est révélée un problème pour les forestiers. Comment une population essentiellement urbaine peut-elle comprendre une ressource essentiellement rurale?

Introduction

Tree Canada Foundation

The Tree Canada Foundation was founded in 1992 as a not-for-profit, charitable organization to, "... provide leadership and promote public awareness, education and community action for the planting and caring of trees across the country…" It has a volunteer board, 13 Community Advisers, three permanent staff and many local and national partners/volunteers. The Foundation has planted 75 million trees (many caliper sized), greened 300 schoolyards, and served 250 communities. The Canadian Forest Service provides funding for the Foundation for both core and specific programs, including *Green Streets Canada* – the only municipal urban forestry program in Canada. Other revenue comes from the corporate sector, mainly retail and petroleum sector companies using tree planting in their marketing and/or to meet various ISO or Voluntary Challenge Registry criteria.

The Foundation's key programs are:
Green Streets Canada (municipal program)
Greening Canada's Schoolgrounds
Corporate Sponsorship (60+ companies, retail sector)
Climate Change (carbon neutral conferences etc.)
Special Programs - Ice Storm, B.C. Fire ReLeaf, Maritime Hurricane ReLeaf
Canadian Urban Forest Conference (Kelowna, 2004)
Urban Forestry (first time in National Forest Strategy)
Awards (Afforestation Award, Tree Canada Cup, John Fisher etc.)

Urban Forests Are Important

Over 80% of Canadians live in urban areas where their natural experiences frequently originate from their own neighbourhoods. In an Environics poll, 84% of Ontario urbanites felt trees and woodlands were "extremely important" to them. Since the 1960's there has been great growth in the arboricultural industry, tree committees, urban foresters, tree bylaws, single tree inventory systems and agencies.

Urban forests are being increasingly seen as a human health issue, an economic generator and something which contributes to our psychological well being. The urban forest permeates Canada's eight "other" Forest Regions.
Benefits of Urban Forests
The benefits of urban forests are for the most part the same as forests everywhere except that their impact can be more evident because of their proximity to people. These benefits include:
Sequestering of gaseous air pollutants and particulates
Energy conservation through cooling, shade and wind reduction
stormwater attenuation
noise buffering
wildlife habitat
increased property values
improved aesthetics
psychological well-being

Economic Value Enormous

The economic value of these forests cannot be overstated. In a recent study, Toronto's forest cover was found to be about one tree/person. Based on the average appraised value of $700/tree there would be a replacement value of over $2 billion for Toronto alone (without computing the environmental benefits). *City green*, an American model which computes the economic value of the environmental services offered by trees and greenspace, estimates in Washington, D.C. that trees provide US$4.9 billion in stormwater retention services and US$49 million in air pollution abatement alone.

More Urban Forests = Better Communities

The relationship between improved communities and more tree cover has been well documented. Real estate & property values are increased with tree cover. More property value usually translates into more municipal tax which usually translates into more services. More trees means greater public cost reduction including increased safety, better health and less need for social services. Corporations are very mobile in their location – well-treed communities attract business and retain employees. In large cities and small towns, tourism and ecotourism are burgeoning trends which depend on trees. Retail redevelopment (creating a consumer-friendly downtown environment) depends largely on tree cover – studies have shown greater consumer confidence in shopping areas with high forest cover.

Threats to Canada's Urban Forests

Foresters, technicians and arborists are all in agreement with regards to the threats to Canada's 9th Forest Region. They include:

The urbanization of natural wooded areas
The loss of topsoil/nutrients in new developments
Introduction of exotic pest, disease and plant species
Maintenance of urban infrastructure
The use of trees of landscape stock of unknown seed source and provenance
Climate change, greater salt usage and elevated air pollution
Lack of financial support for municipal tree programs at the provincial, federal and academic levels
Costs of tree planting and maintenance on municipalities
The lack of available planting space in new subdivision designs, and
The lack of soil moisture due to stormwater conveyance and the homeowner preference to live without above surface rooftop drainage.

Urban Forests and Pest Management

Urban forests are in many ways at the front line, the point of embarkation for a huge variety of invasive alien insects, diseases and plants. Amongst insects, the obvious ones which have received a foothold in Canada from cities includes: brown spruce longhorn beetle (Halifax); emerald ash borer (Windsor) and Asian long-horned beetle (Toronto and Vaughan). As far as tree diseases go, the number of imported diseases through cities is long and troubling. It includes: Dutch elm disease, butternut canker, European larch canker and chestnut blight. In the plant kingdom, a number of plants have been introduced in urban areas, only to make their way into rural areas to interfere with natural regeneration. They include: glossy buckthorn, garlic mustard and swallowort. The danger is that these problems easily migrate from the urban forest to the periurban forest to the rural forest in a short period of time.

Some Milestones in Canadian Urban Forestry

Canada has been at the cutting edge of urban forestry even though our programs remain underfunded and confined to the municipal level of government. Erik Jorgensen first coined the term “urban forestry” in 1960’s. The 1970’s saw a great expansion in the concept of greenbelt areas, naturalization and the first large-scale Dutch elm disease control programs. The 1980’s saw a large increase in the hiring of foresters, technicians and arborists by municipalities with a much greater role for the International Society of Arboriculture in Canada. With the creation of the Tree Canada Foundation in 1992, the first Canadian Urban Forest Conference was held in Winnipeg in 1993. The Urban Forests Centre of U of T opened in 1994. Finally, the first definition of “urban forest” in legislation took place under the Professional Foresters Act, Ontario in 2000. A major initiative to recognize urban forests nationally resulted in the inclusion of Urban Forests as part of the National Forest Strategy, 2003-2008. Finally, as a result of a key meeting in Winnipeg in 2004, the Canadian Urban Forest Network was created to “ … to increase awareness of the urgent issues facing Canada's urban forests and to stimulate action to address those issues”.

National Forest Strategy 2003-2008 - Seven Action Items

The Strategy includes amongst Strategic Theme the following action items related to urban forestry:

To develop a national urban forestry strategy
To develop guidelines and support tools to help municipalities
To develop guidelines and support tools to protect the surrounding forest
Establish research priorities for urban forestry in Canada
Develop and implement a communications strategy on how the forest contributes to their quality of life
Develop educational initiatives
Identify unique and threatened habitats in and near municipalities with conservation strategies

Results of 5th Canadian Urban Forest Conference – Markham, ON, 2002
The Markham conference featured a workshop that saw the following recommendations proposed buy the top urban forestry experts in the country:

Promote cost/benefit analyses of urban forests in Canada
Re-examine taxation and incentive programs to promote gufp
Fully fund a national body as a catalyst
Raise awareness of urban forest issues
Have good science to support decision making
Articulate a consistent vision, with goals and monitoring of process
Actively plan for sustainable urban forests
Achieve parity with other infrastructure (roads, lights, etc.)
Provide leadership for community action
Optimize tree selection for urban and peri-urban areas
Develop linkages between urban forestry groups

The Challenges for the 9th Forest Region

The challenges for urban forestry are complex and include:

To achieve greater recognition from the traditional Canadian forestry community
To have the federal and provincial governments participate more in research and operational programs
To encourage greater support for urban forest programs from the private sector
To enhance the efforts to conserve and expand urban forest cover through legislation, practices and dialogue
To build on the Action Items as defined in the National Forest Strategy
To work with those within municipalities to see urban forests as truly “green infrastructure”

Une solution consiste à faire la moitié du chemin et à rencontrer les Canadiens dans la forêt urbaine – celle qu’ils connaissent et chérissent. Lentement, de plus en plus, les Canadiens valorisent cette forêt. Le terme a été défini au Canada dans les années 1960; ensuite, les municipalités ont commencé à embaucher des ingénieurs et des techniciens forestiers; maintenant, la forêt urbaine figure dans les objectifs de la Stratégie nationale sur les forêts 2003-2008.

La forêt urbaine crée des défis énormes en matière de lutte phytosanitaire. Elle est souvent un point d’entrée pour les insectes et les pathogènes exotiques qui n’y trouvent pas d’ennemis naturels ou très peu. Les stress qu’elle subit (pollution, équipements souterrains de service public, compaction, etc.) sont beaucoup aggravés par les organismes nuisibles qui se développent tous trop facilement dans nos centres urbains. Que cela nous plaise ou non, les Canadiens, leurs gouvernements à tous les niveaux et l’industrie devront trouver de plus en plus de ressources pour la reconnaissance, la régénération et l’entretien de notre neuvième région forestière.

SESSION VIII - REGULATORY AFFAIRS UPDATE

SÉANCE VIII - MISE À JOUR SUR LES AFFAIRES RÉGLEMENTAIRES

PMRA Update

Mise à jour de l'ARLA

Presented by:
Brian Belliveau[1] and Terry Caunter[2]
Health Evaluation Division[1] and Re-evaluation Management Division[2]
Pest Management Regulatory Agency, Health Canada

Introduction

Over the past several years the Pest Management Regulatory Agency (PMRA) has adopted a number of policies aimed at increasing access to biopesticides in the Canadian marketplace. The purpose of this presentation, however, is not to review well known policies and programs such as the registration and research permit guidelines for microbials and pheromones, the minor use program or the North American Free Trade Agreement (NAFTA) Joint Review process, but instead focus on more recent policy and procedural changes that have been implemented, and provide a progress report on harmonization activities at the international level, specifically at the Organisation for Economic Co-operation and Development (OECD).

Biopesticides in Canada

To better understand some of the recent changes in the regulation of biopesticides in Canada, it is important to first define the term "biopesticide". Prior to 2002, the PMRA limited its definition of biopesticides to only microbial and semiochemical (namely pheromone) pesticides. A third group, the invertebrate biological control agents (IBCAs) or "macroorganisms", included larger organisms such as nematodes and beneficial insects (predators and parasites), but PMRA has chosen not to regulate these products to date. The Canadian Food Inspection Agency continues to have responsibility for controlling the import and release of invertebrate biological control agents into Canada. In 2002, the PMRA implemented a reduced-risk initiative and the biopesticide class was expanded to include substances that the U.S. EPA classifies as "biochemical pesticides" (see below for details).

The number of biopesticides in the Canadian marketplace remains small compared to the United States (U.S.), although the PMRA has made many changes to the registration process in an attempt to generate greater interest in manufacturers to seek registration of biopesticides in Canada. For example, the PMRA waives all registration fees (except a $262.00 label review fee), there are reduced review timelines for minor use and NAFTA joint reviews (i.e., reduced from 18 to 12 months), and data requirements are essentially harmonized in North America. To date, there are 14 active microbial ingredients in approximately 52 end-use products in Canada, compared to 59 actives and about 220 products in the U.S. The track record for pheromones is comparatively poor, with 10 active ingredients in 26 registered products in Canada compared to 36 actives and approximately 219 products in the U.S. Although the PMRA currently has about 50 microbial and pheromone submissions, most involve label amendments or expanded uses for existing registered actives. In 2002, the PMRA registered a bioherbicide containing the fungus *Chondrostereum purpureum* to control hardwoods in rights-of-way and forced plantations. Another fungus, *Ophiostoma piliferum*, is pending registration for use in controlling sapstain fungi on freshly felled softwood trees. For forest insect control products, there haven't been any new microbial or pheromone active ingredients registered in more than a year.

The PMRA has initiated new approaches to encourage more biopesticide submissions, especially for products registered in the U.S. In 2002, PMRA introduced a new initiative for reduced-risk pesticides that essentially extended the NAFTA Joint Review Program from Reduced-Risk Pesticides to include submissions made to the PMRA only. The PMRA reduced-risk policy, announced in Regulatory Directive DIR2002-02, is modelled on the U.S. EPA Pesticide Registration (PR) Notice 97-3 guidelines on reduced risk pesticides, and is designed to encourage manufacturers to apply for Canadian registration of reduced-risk pesticides that are currently registered in the U.S. The PMRA will adopt the same criteria to determine eligibility of chemicals for reduced-risk classification and recognize the U.S. EPA's biopesticide designation, thereby further harmonizing the regulatory approaches between Canada and the U.S. The PMRA has also committed to shorter review timelines for reduced-risk chemicals and biopesticides. The reduced-risk or biopesticide designation under this new initiative does not mean "reduced" from normal data requirements or no data requirements.

With PMRA's adoption of the U.S. EPA biopesticide designation comes a newly expanded class of products. In the U.S., biopesticides include two main categories: (1) microbials and (2) biochemicals. The biochemicals include pheromones and other semiochemicals already recognized by PMRA as biopesticides, but also includes many more substances such as naturally-occurring chemicals, proteins, plant-derived oils, plant growth hormones, organic acids, etc., that control pests by non-toxic mechanisms of action. These products are all perceived by the U.S. EPA to represent a low (i.e., reduced) risk to human health and the environment.

Progress at the OECD

At the OECD level, Canada (PMRA) is the chair of the Biopesticides Steering Group and has taken a lead role in furthering harmonization of microbial, semiochemical and invertebrate biocontrol pesticides internationally. The greatest advancements so far have been made with pheromones and other semiochemicals, where data requirements for registration are 90% harmonized and dossier (applicant submission) and monograph (regulatory review) guidance documents have been published and adopted by member countries. The microbials are not far behind, with greater than 80% of data requirements for registration now harmonized and dossier and monograph guidance documents drafted and ready for implementation in 2004.

Next Steps

The PMRA's efforts on biopesticides are now focussed mainly at the OECD level, with an aim to increase interest in reduced-risk products beyond the scope of NAFTA. Over the next couple of years, much effort will be spent on developing harmonized guidelines (methods) for toxicity and pathogenicity/infectivity testing of microorganisms, as well as on manufacturing methods and efficacy testing. Candidate submissions continue to be sought for OECD Joint Reviews and for other forms of worksharing, aimed at reducing the barriers of registration and at facilitating harmonization of review procedures among OECD member countries (especially between Canada-U.S. and the European Union).

Minor Uses

Utilisations mineures

Presented by:
Michael Irvine, Ontario Ministry of Natural Resources

Introduction

A minor use pesticide is one for which the projected sales of the pest control product are so low that registrants cannot justify the costs to support registration. There are two programs that lead to minor use registrations. The URMULE (User Requested Minor Use Label Expansion) program extends the label of currently registered products, while the URMUR (User Requested Minor Use Registration) program is a route for the registration in Canada of products not currently registered here.

URMULE proposals should fill an identified need from a user or commodity group. The applicant (sponsor) should supply the label text if the proposed use is substantially different from currently registered uses. The registrant's regulatory affairs department must provide a letter of support, and a provincial minor use coordinator must sign off on the proposed URMULE.

The requirements for URMUR are much more stringent. The active ingredient of the proposed product must be registered in another OECD country, but not in Canada. The data package that supported that registration must also be less than five years old. For URMURs, the registrant must be willing to support, make the submission, and act as liaison between sponsor/user group and PMRA. This requires a high level of commitment for a registration that the registrant is, by definition, not going to make any money on.

Efficacy data required is required for registration in Canada, and is usually required to support minor use proposals. Sometimes, especially if the use pattern is substantially different from currently labeled uses, other studies such as worker exposure, environmental effects, etc. may be required. Residue data is not required for non-food uses. Data does not have to be from Canada to support a Canadian registration, but it must be of an acceptable standard; data from other countries may support the proposed use.

The Pest Management Regulatory Agency (PMRA) of Health Canada administers the registration process and makes regulatory decisions. PMRA acts on data, and works on defined timelines. They make regulatory decisions in consideration of the Canadian context; simply because a product is registered in the U.S. is not sufficient reason for them to register a product. The people at PMRA are the experts in pesticide regulation, but they may seek input of outside experts in pest management issues.

Agriculture and Agri-food Canada (AAFC) has created the new minor use centre, hosts the minor use priority setting meeting, and provides liaison with IR-4, the U.S. minor use agency. As about 99% of minor use requests come from agriculture, they tend to dominate the system.

Natural Resources Canada (NRCan) has scientists and facilities that are capable of doing the work to support minor use registrations. Shiyou Li, a NRCan scientist, is Forestry Minor Use Products Coordinator at the AAFC minor use centre. As a study director, he will facilitate the compilation and generation of data to support minor uses. Through the Enhanced Forest Protection program, NRCan has supported some forestry minor use projects.

The registrants are the companies such as Dow, Dupont or Monsanto that own the pesticide products, and who must approve any new uses added to their label, or if their products are to be imported into Canada. Because many of these companies are worldwide, they have access to data and resources from other markets. They are usually helpful, but the proposed minor use must fit with their business and product strategies. The regulatory affairs department of the registrant must approve a minor use in writing before PMRA will consider it.

There are 11 provincial minor use coordinators; ten are for agriculture, I am the one for forestry. We have a lot of experience with the registration process; contact us early. We must review and sign the minor use application before it is submitted.

As an example of a current URMULE project, Arsenal (imazapyr) is a soil active herbicide that shows promise for weed and brush control around pine and spruce seedlings. Work is now being conducted in three provinces (AB, NB, ON) to support an URMULE application.

Goal (oxyfluorfen) has been registered for many crops in the U.S. since the late 70's. It has been available for onions in Canada for 17 years, but no new minor uses were being granted because this was a temporary registration. Dow has recently improved the product (Goal 2XL) and provided new supporting data. An URMULE has been submitted for conifer nurseries. Unfortunately oxyfluorfen is now under re-evaluation with PMRA and no new minor uses will be granted until this re-evaluation is complete.

Bayleton (triadimefon) has been proven efficacious for white pine blister rust. Since this product has been withdrawn from Canadian market, there is now a screening study being undertaken for other fungicides with known activity against rusts.

Remember the following when considering applying for a minor use registration:

- It is much easier to extend the labels of currently registered products. Seek URMULEs, not URMURs.
- Keeping rates, application methods and use-pattern the same as currently registered will simplify the process.
- Involve you PMUC (FMUC?).
- Be nice to the registrant! They can be very helpful, and must approve any minor uses.
- Work with new compounds.
- Joint registrations with the US might give you access to resources of IR-4 in generating data.

SPECIAL FEATURE

SÉANCE SPÉCIALE

SPECIAL FEATURE - SÉANCE SPÉCIALE

Invasive Species - the Threats and the Response. A special information session for landowners and municipal representatives

Les espèces envahissantes – Les menaces et l'intervention.
Séance spéciale à l'intention des propriétaires fonciers et des représentants municipaux

Summary prepared by:
Ben Moody, Natural Resources Canada, Canadian Forest Service, Ottawa

Brian Emmett, Assistant Deputy Minister, Canadian Forest Service, Natural Resources Canada (CFS-NRCan), welcomed the group and spoke on the high profile that invasive alien species was receiving by governments and the general public.

The session addressed case studies of the most recent invasive species affecting Canada's urban forest and potential impacts on the forest at large. Presentations were made by the Canadian Food Inspection Agency, Canadian Forest Service, Environment Canada, City of Ottawa forester, City of Toronto, Maple Leaf Producers, and other forest health specialists.

Case studies included the following: the Emerald Ash Borer which is killing ash trees in the Windsor area, the Asian Long-horned Beetle which is killing maples and other hardwoods in Toronto. The question was raised as to what measures were being applied to stop invasive pests. The response was that the main measures were prevention including tightening of regulations, increased surveillance, control/emergency response, etc.

The second part of the session included presentations on Emergency Response, the Proposed National Strategic Plan, and the Plant & Plant Pest Action Plan. The discussion centred on ongoing emergencies toward a coordinated response capability for the management of invasive species.

The tourism industry has been affected even more from IAS, e.g., the effects of West Nile Virus, animal diseases and the potential impact of invasives on "fall colours"of trees and the national symbol (maple). Resources are very limited, the City of Toronto and other municipalities are under-resourced, urban forest funding has been cut, and capacity is very limited. The CFIA is currently dealing with two exotic beetles at the same time, and is stretched well beyond their limits.

In summary, managing exotics are very much a team effort. A national federal policy and action plans on invasive alien species are very important. The Species at Risk Act (SARA) took nine years to get legislation through. We cannot wait that long, we have to put invasives on the fast track. It was suggested that to make a case for resources, we need to engage a modeller, to demonstrate that to do nothing will have great economic and environmental impact on our natural resources and trade.

Emerald Ash Borer and Asian Longhorn Beetle

L'argile du frêne et le longicorne asiatique

Presented by:
Kenneth R. Marchant, Forestry Specialist, Canadian Food Inspection Agency, 174 Stone Rd. West, Guelph, ON Canada N1G 3G6

Abstract

The Emerald Ash Borer (EAB) was confirmed to be present in Canada in August of 2002. During 2002 and 2003, the Canadian Food Inspection Agency (CFIA) conducted extensive delimitation and detection surveys throughout southwest Ontario. At present, it is believed that EAB has infested between 100,000 to 200,000 ash trees in Essex County with an estimated 1,000,000 trees in that county at risk of imminent infestation. In all, in excess of a billion ash trees in Ontario are believed threatened by EAB with countless more in the remainder of Canada and the eastern US at risk.

In September of 2002, the CFIA issue a Ministerial Order placing the western portion of Essex county under quarantine with restrictions on the movement of ash trees and parts thereof and firewood of all species. Based on 2003 survey data, it has now been necessary to amend the MO to include all of Essex county in the area regulated for EAB.

The CFIA is currently deciding on whether to proceed with the cutting of a no-ash zone on the eastern edge of the known infestation as was recommended by the EAB Science and Risk Mitigation Committee established to advise the agency. This concept is still the strategy of choice, and perhaps the only valid option now to slow the spread of EAB to the more heavily forested areas of Ontario east of Essex county. A decision is pending.

Résumé

La présence de l'agrile du frêne au Canada a été confirmée en août 2002. Au cours de 2002 et de 2003, l'Agence canadienne d'inspection des aliments (ACIA) a mené à bien, dans tout le sud-ouest de l'Ontario, de vastes relevés visant à détecter et à délimiter cette présence. Aujourd'hui, on croit que l'agrile du frêne a infesté entre 100 000 et 200 000 frênes dans le comté d'Essex et on estime que 1 000 000 d'arbres sont à risque d'une infestation imminente dans ce comté. En tout, plus d'un milliard de frênes, en Ontario, pourraient être menacés par l'agrile et d'innombrables autres arbres de cette essence sont aussi à risque dans le reste du Canada et l'est des États-Unis.

En septembre 2002, l'ACIA a émis un arrêté ministériel ordonnant la mise en quarantaine de la partie ouest du comté d'Essex et imposant des restrictions relativement au déplacement de frênes et de portions de ces arbres ainsi que de celui de bois chauffage de toutes sortes. Selon les données découlant d'un relevé effectué en 2003, il est maintenant nécessaire de modifier cet arrêté et d'inclure tout le comté d'Essex dans la région visée.

L'ACIA est en train de décider s'il faudrait procéder à une coupe en vue de créer une zone sans frêne à l'extrémité est de la région infestée comme l'a recommandé le comité sur la science de l'agrile du frêne et l'atténuation des risques qui a été mis sur pied pour conseiller l'ACIA. Ce concept s'avère une stratégie de choix et peut-être la seule solution possible à l'heure actuelle pour ralentir la propagation de l'agrile vers les régions plus densément boisées de l'Ontario à l'est du comté d'Essex. La décision est en suspens.

National Plan on Invasive Alien Species

Plan national sur les espèces exotiques envahissantes

Presented by:
Mark Hovorka, Environment Canada

Visit our Web site at: http://www.bco.ec.gc.ca/en/default.cfm

Abstract

Canada is developing a national plan to address the threat of invasive alien species that responds to increasing concerns regarding the risks of invasive alien species to the environment, economy, and society. This paper provides context and summarizes progress-to-date on the development of a coordinated and integrated plan for Canada. It outlines the key elements of the emerging draft national plan, focusing on leadership and coordination issues and actions proposed for the strategic goals of prevention, early detection, rapid response, and management (eradication, containment, and control). The paper also highlights early priorities that have been identified as components of an action plan to address invasive plants and invasive alien species that threaten plants.

Definitions

Under Canada's emerging draft national plan to address the threat of invasive alien species, *alien species* are defined as species of plants, animals, and micro-organisms introduced by human action outside their natural past or present distribution. *Invasive alien species* are those harmful alien species whose introduction or spread threatens the environment, the economy, or society, including human health. These working definitions are intended to be overarching and inclusive of concepts such as plant quarantine pests as defined by the International Plant Protection Convention, foreign animal diseases, aquatic invasive species, and other terms and synonyms.

Context

Canada's response to invasive alien species is based on the Convention on Biological Diversity (1992) and Article 8(h), which commits signatories to "...prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitat or species". Canada ratified the Convention on Biological Diversity in 1992, and institutionalized its commitment to implement the Convention in the Canadian Biodiversity Strategy (1995). The Canadian Biodiversity Strategy is a national commitment that was endorsed by 17 federal government departments and agencies and the provinces and territories. The Canadian Biodiversity Strategy adopts a collaborative, inter-jurisdictional approach to biodiversity conservation, and provides strategic directions for addressing invasive alien species:

[1.81] Take all necessary steps to prevent the introduction of harmful alien organisms and eliminate or reduce their adverse effects to acceptable levels by:

a) developing and implementing effective means to identify and monitor alien organisms;
b) determining priorities for allocating resources for the control of harmful alien organisms based on their impact on native biodiversity and economic resources, and implementing effective control or, where possible, eradication measures;
c) identifying and eliminating common sources of unintentional introductions;
d) developing national and international databases that support the identification and anticipation of the introduction of potentially harmful alien organisms in order to develop control and prevention measures;
e) ensuring that there is adequate legislation and enforcement to control introductions or escapes of harmful alien organisms, and improving preventative mechanisms such as screening standards and risk assessment procedures; and
f) enhancing public education and awareness of the impacts of harmful alien organisms and the steps that can be taken to prevent their introduction.

[1.82] Promote research into methods and approaches that improve our ability to assess whether or not alien organisms will have an adverse impact on biodiversity.

The Invasive Species Audit Chapter of the 2002 Report to Parliament of the Office of the Auditor General/Commissioner on Environment and Sustainable Development reviewed the federal government's progress in coordinating the implementation of a coherent and comprehensive national program to protect Canada's ecosystems, habitats and species from existing and potential invaders. The Audit focused on the government's progress in implementing the strategic directions set out in Canada's

Biodiversity Strategy (1995). The Audit concluded that while the federal government has legislation and programs to protect agriculture crops, forests, and human health from specific alien pests, no comparable effort has been made to protect ecosystems, habitats and species from other invaders. The Audit observed that invasive alien species that threaten Canada's ecosystems or their pathways have not been identified; human and financial resources are spread across multiple departments and agencies and are not co-ordinated; there is no agreement on priorities or understanding of who will do what to respond; and there is no capability to assess progress.

Three Audit recommendations were directed toward Environment Canada, recommending that the department coordinate the development of a national invasive species action plan, secure the commitment of all relevant departments and agencies to implement the plan, and put in place a monitoring and reporting system to track the effectiveness of measures taken. Environment Canada accepted the audit recommendations on behalf of the Government of Canada.

Process & Progress

In their review of progress on the implementation of Canada's Biodiversity Strategy in 2001, federal, provincial, and territorial Ministers for wildlife, forests, and fisheries and aquaculture identified invasive alien species as one of four priorities for enhanced federal-provincial-territorial collaboration. More specifically, this joint meeting of federal, provincial, and territorial Ministers responsible for fisheries and aquaculture, forests, and wildlife (Canadian Council of Fisheries and Aquaculture Ministers, Canadian Council of Forest Ministers, and the Wildlife Ministers Council of Canada) requested the development of a draft plan by September 2002.

Environment Canada is coordinating the development of the draft national plan in cooperation with federal departments and agencies and the provinces and territories. While some departments and agencies are not represented at the Ministerial level in the joint meeting of resource Ministers' councils, sectors such as agriculture, parks, transportation, national defense, human health, and others have actively contributed to the development of the national plan from the inception of the process. Ministerial representatives from the agriculture sector have also participated in recent Ministerial meetings.

As a first step in the development of the plan, a multi-stakeholder national workshop was held in November 2001. The workshop recommendations were summarized in a 'blueprint' that outlined 14 elements for a national plan: leadership and coordination; legislation, policies and programs; prevention; risk analysis; early detection and rapid response; eradication, containment and control; restoration; taxonomy and diagnostics; research; surveillance; data and information management; education and outreach; stewardship; and international cooperation.

Ministers approved the blueprint at their meeting in September 2002, and further requested the establishment of four thematic working groups to advance the blueprint: aquatic invasives, terrestrial animals, terrestrial plants, and leadership and coordination. Each thematic working group is tasked with identifying and assessing priority policy issues, invasive alien species and pathways of invasion, and developing recommendations to address them. The working groups were established between December 2002 and April 2003 and have begun to assess priorities and develop action plans for their respective thematic areas.

Ministers met again in September 2003, providing approval-in-principle for a discussion document (Toward a National Plan: A Discussion Document) that will be the foundation of the national plan. Ministers requested that a final national plan be presented for their consideration and approval at their meeting in September 2004.

Strategic Challenges

There are four strategic challenges that must be addressed to develop an effective national plan for invasive alien species.

First, environmental considerations should be fully integrated with economic and social factors into decision-making on the use of alien species. Environmental risk assessment is only a minor component in the process of authorizing intentional introductions, and regulatory tools for biodiversity protection have not been fully developed or implemented. Environmental and economic factors are not brought together in a coordinated process, and decisions are still largely made sectorally.

Second, coordination and cooperation should be enhanced to respond more rapidly to new invasions and pathways of invasion. New activities and pathways that do not fall neatly under existing sectors can simply fall through the gaps, such as the pet and aquarium and water garden trades. Other pathways such as internet mail-order are so complex that they require coordinated responses from multiple sectors.

Third, there is a need to strengthen programs to protect natural resources and resource-based industries that are under growing pressure from increased global trade and travel. While this initiative is being led under the biodiversity banner, it will integrate environmental and economic interests. It recognizes the contributions of existing plant and animal health programs to biodiversity conservation, as well as the fact that they are also dealing with a greater number of invaders and pathways as trade expands.

Fourth, collaboration between ad hoc and regional/issue-specific efforts should be maximized to ensure limited resources are used on the highest priority issues.

Toward a National Plan: A Discussion Document

The draft policy and management framework illustrated below (Figure 1) presents the emerging Canadian response to the threat of invasive alien species. The scope of the national plan is broad, and includes the protection of aquatic and terrestrial ecosystems, and the native biodiversity and domestic animals and plants of those systems. It focuses on leadership and coordination, on the need to get the national and federal 'houses in order', to clarify roles, responsibilities, and accountabilities.

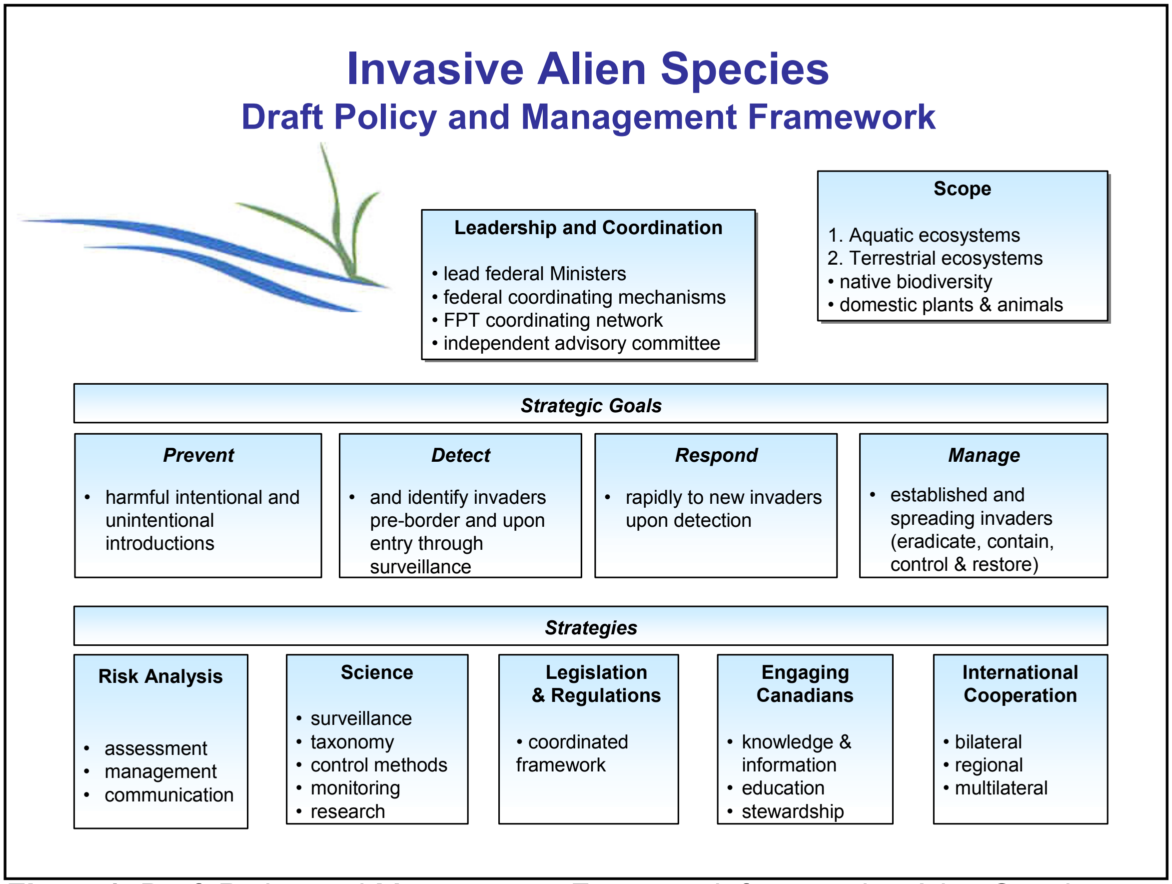

Figure1. Draft Policy and Management Framework for Invasive Alien Species.

Four strategic goals are identified to identify the measures that are essential for effective action on invasives: prevent, detect, respond, and manage. Each of these four goals is dependent on key implementation strategies: risk analysis (including risk assessment, risk management, and risk communication), science (including surveillance, research, and taxonomy), legislation and regulations, education and outreach, and international cooperation. While this framework is still being refined, it is broadly consistent with national and international commitments and agreements across a wide range of sectors, including the management of invasive alien forest pests.

The main elements of the discussion document “Toward a National Plan” (hereafter referred to as the draft national plan) are outlined below in Table 1. The draft national plan provides working definitions of alien species and invasive alien species, as well as working definitions of risk, risk analysis, and associated terms and concepts. The proposed scope of the draft national plan includes: intentional (authorized and unauthorized/illegal) and unintentional (accidental) introductions; species that are alien to Canada, as well as those that are native to Canada but alien to particular ecosystems; the protection of terrestrial and aquatic ecosystems and their native and domestic (agriculture crops and forestry) biodiversity; and all relevant sectors that are impacted by - or pathways of - invasive alien species, including agriculture, wildlife, forests, fisheries, and transportation. The draft national plan highlights the need for linkages with human health issues such as zoonotic diseases, particularly where pathways have multiple economic, biodiversity, and human health impacts. The draft national plan also recognizes the role of governments as regulators of intentional and unintentional introductions, and as the proponents of some intentional introductions.

Table 1. Toward a National Plan: A Discussion Document - Table of Contents

• Executive Summary • Definitions • Scope • Rationale for Action ▪ The invasive alien species problem ▪ Environmental threats ▪ Economic threats ▪ Social and human health threats ▪ International trade dimension ▪ Pathways of invasion ▪ What is working well ▪ Inadequacy of current invasive alien species measures ▪ International progress and lessons learned	• Policy and Management Framework ▪ Purpose ▪ Vision ▪ Principles & practices ▪ Roles & responsibilities ▪ Strategic goals – Prevention – Early detection – Rapid response – Eradication, containment & control ▪ Implementation strategies – Risk analysis – Science – Legislation and regulations – Education and outreach – International cooperation ▪ Priority-setting criteria • Action plans ▪ Aquatics ▪ Animals ▪ Plants

The draft national plan articulates a clear "Rationale for Action" within the Canadian context that outlines the nature of the invasive alien species problem, highlights significant environmental threats, economic threats, and social and human health threats, as well as important pathways of invasion. In addressing what is working well, the draft national plan recognizes the contribution of existing plant and animal health programs to the protection of agriculture crops (including livestock) and forestry, as well as the incidental benefits of those programs to the protection of native plant and animal biodiversity.

The draft national plan identifies four strategic challenges for its implementation (see preceeding section on "Strategic Challenges"), and notes that the need to respond to these challenges is confirmed by international progress and lessons learned. Like Canada, countries including Australia, New Zealand, South Africa, and the United States are responding to invasive alien species through the development of national strategies and action plans (either overarching or sectoral) that are comprehensive, integrated, and coordinated.

The purpose of the draft national plan is to establish a coordinated national policy and management framework that minimizes the risk of invasive alien species to the environment, economy, and society. The purpose statement is supported by a vision, as well as key principles and practices, including a commitment to not knowingly introduce high risk invasive alien species, and to prioritize prevention but simultaneously invest in the management of well-established invaders.

Governments and stakeholders alike have highlighted the need to clarify roles and responsibilities, both within and across jurisdictions, and a process is now underway to develop an accountability framework for who-does-what across a range of sectors. Overarching policy commitments and action items are identified under each of the four strategic goals of prevention, early detection, rapid response, and management (eradication, containment, control, and recovery). In addition, preliminary priority-setting criteria are proposed to facilitate a more strategic approach that identifies priorities within and across sectors. This broad policy and management framework will be complemented by action plans on aquatic invasives, terrestrial animals, and terrestrial plants that identify priority invasive species and pathways/vectors for their respective thematic areas.

Proposed Actions

The following paragraphs outline some key elements of the discussion document endorsed by Ministers in September 2003. It should be noted the components of Canada's final plan may have variations in scope from what is outlined below.

Four priority areas have been proposed for enhanced leadership and coordination, and options will be developed to address each of them over the coming year:

- recognizing a lead Minister or group of Ministers as an overall lead on invasive alien species within the Government of Canada;
- establishing federal coordinating and decision-making mechanisms at appropriate levels, from technical experts to Ministers; and
- establishing national coordination mechanisms, including evaluating the need for regular federal-provincial-territorial meetings of Ministers responsible for invasive alien species.

Enhancing prevention will focus on expanding the scope and application of risk analysis and risk assessment through:

- development of an integrated approach to risk assessment that is consistent nationally and internationally across sectors;
- mandatory risk assessment of all proposed intentional introductions;
- enhanced coordination of risk management and decision making across departments and agencies;
- enhanced risk assessment of commodities, pathways, and vectors; and
- enhanced risk assessment capacity.

Early detection initiatives will include:

- increasing capacity and emphasis on pre-border detection, through inspection at the source and international cooperation;
- enhanced import inspection and border surveillance; and
- establishing a core capacity of diagnostics and taxonomic expertise, and international cooperation to develop networks of expertise in key areas.

Proposed measures to enhance the effectiveness and efficiency of rapid responses to incursions of invasive alien species include:

- establishment of broader government networks to coordinate rapid response;
- development of species-specific and response plans;
- mechanisms to ensure access to funding for rapid response activities; and
- development of communication initiatives to secure public support where necessary actions may be controversial.

While it is clear that some of these proposed action scan be undertaken with minimal investment, others will require the enhancement of capacity in critical areas, including risk assessment, surveillance, and taxonomy and diagnostics.

Focus on Plants

Under the draft national plan, the Canadian Food Inspection Agency is leading efforts to develop an action plan for terrestrial plants. A Terrestrial Plants Working Group on Invasive Species has been established, co-chaired by the Agency and the province of Ontario. The terms of reference of the Working Group are inclusive, and it is mandated to address invasive plants and invasive alien species that impact plants. Invasive alien species that are themselves plants - weeds or pest plants - are an emerging priority, with significant and long-standing weed problems across Canada impacting agriculture, forests, and biodiversity. Policy issues identified by the Working Group as early priorities include: clarifying roles and responsibilities across governments; broadening the scope and application of risk analysis; and developing a coordinated surveillance network.

The working group has identified key pathways and vectors for the introduction of invasives relevant to plants (see table below). The pathways are both intentional (authorized and unauthorized/illegal) and unintentional (accidental) in nature, with many involving the movement of species within Canada and internationally. Preliminary assessments of these pathways will begin shortly to identify priorities, initiatives that may already be underway, and develop an action plan to address those pathways and vectors.

Table 2. Preliminary list of pathways and vectors of invasion

• agricultural crops • nursery stock • restoration/remediation • ornamentals/seedlings • packing materials • commodities: seed, forage, food produce, grains/birdseed, wood products	• spread/movement (e.g. wind, water, wildlife, livestock – including transboundary movement) • hitchhikers on transport • aquarium trade • soil/sod/gravel • escapes from research, botanical gardens, etc. • travel & tourism (including baggage) • Internet & mail order

Next Steps

In terms of the path forward toward a final national plan, consultations to validate the proposed policy and management framework of the draft national plan will continue throughout fall 2003 with federal, provincial, and territorial governments. The four thematic working groups are expected to develop draft action plans in their respective areas by spring 2004, following which public consultations will be initiated. A final national plan will be presented to Ministers for their consideration and approval at their meeting in September, 2004. Following Ministerial approval, implementation of the national plan to address the threat of invasive alien species would begin immediately.

Panel Presentations

Présentations par un groupe d'experts

Presented by:
Craig Huff, Forester, City of Ottawa

CITY OF OTTAWA - ENVIRONMENTAL POLICIES

The City of Ottawa's Official Plan sets a goal of 30% forest cover for its urban and rural areas. By setting this goal it affirms City Council's commitment to an overall increase in the urban and rural forest cover. The existing tree cover in the City varies from 43% in the southwest (Rideau Ward) to less than 7% in downtown Ottawa with an overall forest cover of 27%.

This goal is then implemented through such mechanisms as the Environmental Strategy that requires the City to protect Urban Natural Features such as sensitive wetlands and significant urban woodlands and to adopt a Design with Nature philosophy when evaluating new sub-division applications.

In addition to the environmental policies the City also has a Forest Strategy that includes the development of a Good Forestry Practices By-law that will protect trees outside the urban area and a requirement for all plans of subdivision to provide Tree Preservation and Protection Plans that maximize the retention of existing trees wherever possible.

CITY OF OTTAWA TREE INVENTORY

The City's Forestry Services is responsible for the life cycle management of over 250,000 street, park and roadway trees. Of some concern from an exotic insect perspective, is the presence of some monocultures, primarily green ash, in several areas of the city.

In addition to this inventory the city is also required to maintain 220 linear km of roadside bush, numerous urban woodlots and ravines and over 10,000 ha. of community forest land.

HISTORICAL SIGNIFICANCE

Trees played a major role in the original settlement of the Ottawa area. Loggers arrived in the early 1800s in pursuit of white pine and the Ottawa River was a major transportation corridor to move the timber to the east coast.

THE URBAN FOREST

However beautification as Canada's capital has also been on-going for over a century. With the creation of the Ottawa Improvement Commission in 1899 Prime Minister Wilfred Laurier laid the groundwork for the present day National Capital Commission. This organization, in concert with the City, attempts to raise the importance of trees in the urban landscape throughout Canada's capital through their arboriculture and horticultural programs.

As our city's increase in size there is greater focus on the importance of urban trees and on the pressures on them such as conflicting land uses and competition for available growing space. Of equal importance is a growing concern on a municipality's ability to adequately maintain urban trees as forestry programs compete with other city programs for declining financial resources.
To meet these pressures municipalities and professionals from across Canada are joining forces to apply pressure on the federal government to create a National Forest Strategy with an urban forestry component. In addition, Professional Foresters and arborists across Canada are networking like never before and all practitioners are encouraged to lobby for financial support and outside assistance in advancing urban forestry initiatives and priorities.

EXOTIC INSECT ACTION PLAN

At the City of Ottawa Forestry Services staff have developed an action plan to address the exotic insect issue.

Forestry Services primary role will be to act as the City's Technical Specialist and the City Forester will be to main point of contact with City Emergency Services personnel in the event that an exotic insect pest is found to be in the Ottawa area.

Forestry staff are required to monitor the insects whereabouts throughout the province and will also be responsible for liaising with other government agencies at the local, provincial and federal levels.

A local Coordinating Committee has been formed that includes representation from both the public and private sector and an information campaign is being developed that will educate the public at the local level on exotic insect issues.

The Coordinating Committee will also assist by obtaining and distributing educational material, preparing a training program for local forest and arboriculture practitioners and it will also provide local coordination in the event of an outbreak.
The main initiatives in 2004 will be focusing on monitoring target areas such as trees in industrial and manufacturing areas, in parks and ravines and inspecting nursery stock upon arrival from out-of-town sources.

Presented by:
Hanna Fraser, Ontario Ministry of Agriculture and Food

The Ontario Ministry of Agriculture and Food (OMAF) is the lead provincial agency for technology transfer in the nursery, maple syrup, tree fruit & nut, and Christmas trees production industries, and shares a lead role with the Ontario Ministry of Natural Resources in farm woodlot management. In terms of invasive pests, OMAF has been involved with the Canadian Food Inspection Agency (CFIA) at all three lines of defense: prevention, eradication and management. OMAF Crop Technology staff provide technical information to CFIA task forces, contribute to pest risk assessments (PRA), liase between industry and regulators, determine financial impacts & trade barriers, review eradication protocols, identify research personnel, facilitate minor use registrations and develop management strategies to limit economic loss, where eradication fails. The arrival of invasive woodboring pests including the Asian long-horned beetle and the emerald ash borer poses significant risk to several agricultural industries in Ontario; OMAF staff are positioned to work with CFIA, Canadian Forest Service, other provincial ministries, and industry to address these threats.