November 13-15 novembre 2002

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

NOT FOR PUBLICATION

NE PAS DIFFUSER

Natural Resources Canada | Ressources naturelles Canada

Canada

2002 Forest Pest Management Forum Proceedings

Ottawa Congress Centre
Ottawa, ON
November 13 – 15, 2002

The Forest Pest Management Forum is annually sponsored by Natural Resources Canada, Canadian Forest Service, to provide a platform for representatives of various provincial and Federal governments 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 canadiens des forêts, Ressources Naturelles Canada. Il permet à des représentants de divers gouvernements provinciaux et du gouvernement federal de présenter et d'examiner la situation des principaux ravageurs forestiers au Canada et aux États-Unis.

Pauline Sikorski
Natural Resources Canada/ Ressources naturelles Canada
Canadian Forest Service / Service canadien des forêts
Sault Ste. Marie, Ontario / Sault Ste. Marie (Ontario)
March 2003 / mars 2003

PROCEEDINGS

TABLE OF CONTENTS / TABLE DES MATIÈRES

FORUM 2002 CORPORATE SPONSORS

The Forest Pest Management Forum Committee wish to acknowledge and thank our Corporate Sponsors for their continuing support of this prestigious, annual, international pest Forum 2002.

COMMANDITAIRES DU FORUM 2002

Le comité du forum sur la répression des ravageurs forestiers désire reconnaitre et remercier les commanditaires pour leur appui continuel de ce forum annuel, prestigieux et international sur les ravageur forestiers.

BioForest Technologies Inc.
Canadian Institute of Forestry
Canadian Food Inspection Agency
Certis
Dow AgroSciences
Forest Protection Limited
Natural Resources Canada
Dendron Resource Surveys Inc.
Phero Tech Inc.
SOPFIM
Tembec
Valent BioSciences Canada Ltd

Greg Adams
Silviculture Manager
J.D. Irving Ltd
181 Aiton Road
Sussex East, NB
E4G 2V5 Canada

Paul Addison
Director General
CFS
506 W. Burnside Road
Victoria, BC
V8Z 1M5, Canada
250-363-0608
250-363-6088
paddison@pfc.forestry.ca

Ingrid Aguayo
University of Toronto
33 Willcocks St
Toronto, ON
M5S 3B3, Canada

Eric Allen
Research Scientist
CFS
506 W. Burnside Road
Victoria, BC
V8Z 1M5, Canada
250-363-0674
250-363-0775
eallan@pfc.forestry.ca

Peter Amirault
Operations manager
Forest Protection Ltd
2502 Route 102 Hwy
Lincoln, NB
E3B 7E6, Canada
506-446-6930
506-446-6934
pamirault@forestprotectionltd.com

Joseph Anawati
Science marketing officer
NRCan CFS
580 Booth St 7th Fl
Ottawa, ON
K1A 0E4, Canada
613-947-8996
613-947-9090
janawati@NRCan.gc.ca

T.M.(Mike) Apsey
Chair
National Forest Strategy
Coalition
4070 Hi-Mount Drive
Victoria, BC
V9C 3X9, Canada
250-595-4776
250-595-4176
ska@islandnet.com

Christian G. Archambault
Vice-President executif
Warnex Inc
3885 boul. Industriel
Laval, QC
H7L 4S3, Canada
450-663-6729
450-669-2784
carchambault@warnex.ca

Brian Barkley
General Manager
EOMF
PO Bag 2111
Kemptville, ON
K0G 1J0, Canada
613-258-8424
bbarkley@eomf.on.ca

Wendy Beilhartz
A/Director, Integrated Res.
Management
NRCan CFS GLFC
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5560
wbeilhar@NRCan.gc.ca

Alain Belanger
Supervisor
SOPFIM
1780 Semple
Quebec, QC
G1N 4B8, Canada
418-681-3381x262
418-681-3401
a.belanger@sopfim.qc.ca

Jean Berube
Researcher
RNCAN, SCF, CFS
1055 rue du P.E.P.S. C.P. 3800
Ste-Foy, QC
G1V 4C7, Canada

Guillaume Bilodeau
RNCAN, SCF, CFS
1055, Rue du P.E.P.S. C.P. 3800
Ste-Foy, QC
G1V 4C7, Canada
418-648-5824
418-648-5848
gbilodeau@CFL.forestry.ca

Paul Bolan
Operations Manager-Sask
Bioforest Technologies Inc
105 Bruce Street
Sault Ste Marie, ON
P6A 2X6, Canada
705-942-5824
705-942-8829
pbolan@soonet.ca

Clement Bordeleau
Chef de la division des releves et des diagnostics
MRN du Quebec
2700, rue Einstein local D.2.370a
Ste-Foy, QC
G1P 3W8, Canada
418-643-0381
clement.bordeleau@mrn.gouv.qc.ca

Guy Brassard
Science Advisor
NRCan CFS
580 Booth St 12th Fl
Ottawa, ON
K1A 0E4, Canada
613-943-5258
613-947-9035

Keith W. Brown
Marketing and Technology Transfer Officer
CFS GLFC
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5596
kbrown@NRCan.gc.ca

Robin Brown
Senior Forestry Associate
ITRES Research Ltd
4808 Tennyson Place
Victoria, BC
V8Z 6S8, Canada
250-888-3538
250-382-5855
rbrown@ITRES.com

Stephen Burke
General Manager
PHEROTECH INC
7572 Progress Way
Delta, BC
V4G 1E9, Canada
604-940-9944
604-940-9433

Errol Caldwell
Director IPM
Great Lakes Forestry Centre, CFS, NRCan
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5558
705-541-5704
ecaldwell@nrcan.gc.ca

Dr. Allan Carroll
Research Scientist
NRCan CFS
506 W. Burnside Road
Victoria, BC
V8Z 1M5, Canada
250-363-0639
250-363-0775

Nelson Carter
Manager, FPM
NB DNR & E
1350 Regent Street
Fredericton, NB
E3C 2G6, Canada
506-453-2516
506-453-6689

Lesley Cree
Plant Pathologist
PHRA Unit CFIA
3851 Fallowfield Rd
Nepean, ON
K2H 8P9, Canada
613-228-6698
613-228-6100
creel@inspection.gc.ca

Hubert Crummey
Supervisor, Forest Insect and Disease Control
Dept. Forest Resources and Agrifoods
PO Box 2006 Fortis Tower
Corner Brook, NFL
A2H 6J8, Canada
709-637-2424
709-637-2403
hcrummey@mail.gov.nf.ca

Martin Damus
Biotechnology
NRCan CFS
580 Booth St., 12th Fl
Ottawa, ON
K1A 0E4, Canada
613-947-8999
mdamus@nrcan.gc.ca

Dave Davies
General Manager
Forest Protection Ltd
2502 Route 102 Hwy
Lincoln, NB
E3B 7E6, Canada
506-446-6930
506-446-6937

Chuck Davis
Fungal Taxonomy &Biology
Technologist
NRCan
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5637
705-541-5700

Pierre Desrochers
Chef du projet, Sante des
Forets
SCF-CFL
1055 du P.E.P.S.
Ste-Foy, QC
G1V 4C7, Canada
418-648-3922
418-648-5849
pidesroe@NRCan.gc.ca

Mary Ellen Dix
Entomologist
USDA Forest Service
1601 N Kent St RPC 7th
Fl(FHP)
Arlington, VA
22209, USA
703-605-5336
703-605-5353
mdix@fs.fed.us

Erhard Dobesberger
Program Entomologist
PHRA Unit CFIA
3851 Fallowfield Rd
Nepean, ON
K2H 8P9, Canada
613-228-6698
613-228-6662
dobesbergere@inspection.gc.ca

Louise Dumouchel
Entomologiste
PHRA Unit CFIA
3851 Fallowfield Rd
Nepean, ON
K2H 8P9, Canada
613-228-6698
613-228-6100
ldumouchel@inspection.gc.ca

Alain Dupont
Coord Program planning and
evaluation
SOPFIM
1780 Semple
Quebec, QC
G1N 4B8, Canada
418-681-3381 x261
418-681-3401
a.dupont@sopfim.qc.ca

Dr. Hugh Evans
Forest Research
Alic Holt Lodge, Wreeclesham
Farnham, Surrey
GU10 4LH, UK
44142053631
44142023653
hugh.evans@forestry.gsi.gov.uk

Robert Favrin
Survey coordinator
PHRA Unit CFIA
3851 Fallowfield Rd
Nepean, ON
K2H 8P9, Canada
613-228-6698
613-228-6662
favrinr@inspection.gc.ca

Richard Fleming
NRCan CFS GLFC
1219 Queen Street East
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5608
705-5410-5700
rfleming@nrcan.gc.ca

Brian Fox
Forest Health & Silv. Specialist
OMNR
PO Bag 3020
South Porcupine, ON
P0N 1H0, Canada
705-235-1186
705-235-1246
brian.fox@mnr.gov.on.ca

Robert Fusco
Valent BioSciences
C/o 2704 Orser Road
Elginburg, ON
K0H 1M0, Canada

Eric Georgeson
Provincial Entomologist
NSDNR
PO Box 130
Shubencacadie, NS
B0N 2H0, Canada
902-758-7238
902-758-3210

Bruce Gill
Entomologist
CFIA
4125-960 Carling Ave
Ottawa, ON
K1A 0C6, Canada
613-759-1842
613-759-6938

Andre Gravel
Premier vice-president
CFIA
59 Promenade Camelot
Nepean, ON
K1A 0Y9, Canada
613-225-2342x4191
613-228-6608
agravel@em.agr.ca

Richard Hamelin
Chercheur Scientifique
RNCAN, SCF, CFS
1055, Rue du P.E.P.S. C.P.
Ste-Foy, QC
G1V 4C7, Canada
418-648-5849
hamelin@CFL.forestry.ca

Dr.Yvan Hardy
Assistant Deputy Minister
NRCan CFS 580 Booth St
580 Booth St
Ottawa, ON
K1A 0Z4, Canada
613-847-7400
613-947-7395
yhardy@nrcan.gc.ca

Ken J. Harrison
Disease Identification Officer
NRCan CFS
Atlantic PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-452-3513
506-452-3525
kharriso@nrcan.gc.ca

Dr. Gary R. Hogan
Director Forest Biology
Program
NRCan CFS
506 W. Burnside Road
Victoria, BC
V8Z 1M5, Canada
250-363-0705
250-363-6004
ghogan@pfc.forestry.ca

E.H. Ted Hogg
Research Scientist
CFS
5320-122 Street
Edmonton, AB
T6H 3S5, Canada
780-435-7225
780-435-7359
thogg@nrcan.gc.ca

Anthony Hopkin
Research Scientist
NRCan CFS
1219 Queen St E
Sault Ste Marie, ON
P6A 5E2, Canada
705-541-5612
705-541-5700

Carol Hopkins
Image Analyst
Dendron Resource Surveys Inc
205-880 Lady Ellen Place
Ottawa, ON
K1Z 5L9, Canada
613-725-2971
613-725-1716

Gordon Howse
Leader FH Monitoring
CFS GLFC
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
ghowse@nrcan.gc.ca

Martin Hubbes
Prof. Emeritus
University of Toronto
33 Willcocks St
Toronto, ON
M5S 3B3, Canada
416-978 3834
martin.hubbes@utoronto.ca

Leland M Humble
Research Entomologist
NRCan CFS
506 West Burnside Road
Victoria, BC
V8Z 1M5, Canada
250-363-0644
250-363-0775
lhumble@pfc.forestry.ca

J. Edward Hurley
NRCan CFS
Atlantic PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-452-3515
506-452-3078
ehurley@nrcan.gc.ca

Michael Irvine
Prov. Veg. Mngmt. Specialist
OMNR
70 Foster Drive Suite 400
Sault Ste Marie, ON
P6A 6V5, Canada
705-945-5724
705-945-6667
michael.irvine@mnr.gov.on.ca

Andy Kenney
Assistant Professor
University of Toronto
33 Willcocks St
Toronto, ON
M5S 3B3, Canada
416-978-0474
416-978-3834
a.kenney@utoronto.ca

Ed Kettela
Research Program Manager
CFS AFC
PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-457-3214

Albert D King
Manager
OMNR
Suite 400, 70 Foster Drive
Sault Ste Marie, ON
P6A 6V5, Canada
705-945-6718
705-945-6667

Keith Knowles
Forest Health Biologist
Manitoba Conservation
200 Saulteaux Crescent
Winnipeg, MB
R3J 3W3, Canada
204-945-7868
204-948-2671

Gaston Laflamme
Chercheur Scientifique
SCF-CFL
1055 du P.E.P.S.
Ste-Foy, QC
G1V 4C7, Canada
418-648-4149
glaflamme@CFL.forestry.ca

Dr. Christopher Lucarotti
Research Scientist
CFS
PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-452-3538
506-452-3525
clucarot@nrcan.gc.ca

Derek MacFarlane
Director, Forest Production & Protection
NRCan CFS ATL
PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-452-3680
506-452-3140

Wayne Mackay
Forest Health Monitoring Supervisor
NRCan CFS
150 Regent Street South
Fredericton, NB
E3B 5P7, Canada
506-452-3078
wmackay@nrcan.gc.ca

Dr. Ken Mallett
Director Forest Biology
NRCan CFS
Northern Forestry Centre
5320 - 122 Street
Edmonton, AB
T6H 3S5, Canada
780-435-7201
780-435-7396

Larry Matwee
Dow AgroSciences
101 River Drive
Selkirk, MB
R1A 3Z5, Canada
204-489-2513

John McFarlane
Toxicology Technician
NRCan CFS GLFC
1219 Queen Street East
Sault Ste Marie, ON
P6A 4S3, Canada
705-541-5521
705-541-5700

Rory McIntosh
Insect and Disease Specialist
Sask. Env
Box 3003 McIntosh Mall
Prince Albert, SK
S6V 6G1, Canada

Dave McManama
Certis USA
1703 Delaney Drive
Indianapolis, IN
46217, USA
317-587-5797
317-859-6200
dmcmanama@certisusa.com

Kim McNeilly
Biologist
NRCan CFS GLFC
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5636
705-541-5700
kmcneilly@nrcan.gc.ca

Bill Meades
Director, Forest Ecology
GLFC
1219 Queen Street East
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5562
705-541-5704
bmeades@nrcan.gc.ca

Joe Meating
Director Surveys
Bioforest Technologies Inc
105 Bruce Street
Sault Ste Marie, ON
P6A 2X6, Canada
705-942-5824
705-942-8829
jmeating@soonet.ca

Jessie A. Micales
Supervisory Plant Pathologist
USDA Forest Service For. Prod Lab
One Gifford Pinchot Drive
Madison, WI
53726, USA
608-231-9215
608-231-9529
jmicales@fs.fed.us

Gordon Miller
Director General, Science Branch
NRCan CFS
580 Booth St
Ottawa, ON
K1A 0E4, Canada
613-947-8984
613-947-8984
gmiller@nrcan.gc.ca

Francois Miville-Deschenes
Senior Communications Advisor
NRCan CFS
580 Booth St, 8-D3
Ottawa, ON
K1A 0E4, Canada
613-947-7350
613-947-7397
fmiville@nrcan.gc.ca

Dr. Benjamin H. Moody
Science Advisor
NRCan CFS
580 Booth St., 12th Fl
Ottawa, ON
K1A 0E4, Canada
613-947-9016
bmoody@nrcan.gc.ca

Denise Moranville
Director of Forestry
SOPFIM
1780 Semple
Quebec, QC
G1N 4B8, Canada
418-681-3381 ex 255
d.moranville@sopfim.qc.ca

Geoff Munro
Director General
NRCan CFS GLFC
1219 Queen Street East
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5703

Mark Newcombe
Market Access Analyst
NRCan CFS
580 Booth St
Ottawa, ON
K1A 0E4, Canada
613-943-5231
613-947-7399

Stephen Nicholson
Valent BioSciences
C/o 2704 Orser Road
Elginburg, ON
K0H 1M0, Canada
613-376-1070
Stephen.Nicholson@valent.com

Vidar Nordin
Editor in Chief
CIF The Forestry Chronicle
Ottawa, ON
K1P 5H3, Canada
613-234-7478
vidar.nordin@sympatico.ca

Kathryn Nystrom
Biologist
NRCan CFS GLFC
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5763
705-541-5400
knystrom@NRCan.gc.ca

Hideji Ono
Manager
Alberta Sus. Res. Dev.
L&F Div 9th Fl, 9920 - 108 St
Edmonton, AB
T5K 2M4, Canada
780-422-8802
780-427-0085
hideji.Ono@gov.ab.ca

Bruce Pendrel
Director, Forest Health & Biodiversity
NRCan CFS AT
PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-452-3505
506-452-3140

Ariane Plourde
Directrice de recherche
Biol. For. RNC, SCF
1055 rue du P.E.P.S. C.P. 3800
Ste-Foy, QC
G1V 4C7, Canada
418-648-7616
418-649-6956

Bill Roesel
City Forester
City of windsor
2450 McDougall Street
Windsor, ON
N8X 3N6, Canada
519-969-8335
broesel@city.windsor.on.ca

Bill Rose
Forest Health & Silv. Specialist
OMNR
300 Water St 4th Fl S. Tower
Peterborough, ON
K9J 8M5, Canada
705-755-3202
705-755-3292

Robert Sajan
Forest Health Research Officer
NRCan CFS
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5700
bsajan@nrcan.gc.ca

Paul Schorn
Marketing Manager
Dow Agrosciences Canada Inc
201, 1144-29 Avenue N.E.
Calgary, AB
T2E 7P1, Canada
403-725-8834
403-735-8819
pschorn@dow.com

Charlotte Sharkey
Science & TT Intern
NRCan CFS GLFC
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5757
csharkey@NRCan.gc.ca

Li Shiyou
Research Scientist, CFS
PO Box 960 University Drive
Corner Brook, NFL
A2H 6J3, Canada
709-637-4907
709-637-4910
sli@nrcan.gc.ca

Pauline Sikorski
Marketing & Publication Assistant
NRCan CFS GLFC
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5664
705-541-5701
psikorsk@nrcan.gc.ca

Ralph Simpson
NRCan CFS
PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-452-2446
506-452-3525
rsimpson@nrcan.gc.ca

Guy K.M. Smith
Chief, M&TT Section
NRCan CFS GLFC
1219 Queen St E
Sault Ste Marie, ON
P6A 2E5, Canada
705-541-5595
gusmith@nrcan.gc.ca

Megan Smith
S&TT Intern
Tembec
PO Box 430 Hwy 17 W
Mattawa, ON
P0H 1V0, Canada
705-744-1715x545
705-744-1716
megan@canadianecology.ca

Greg Stubbings
National Manager
CFIA
59 Camelot Drive
Nepean, ON
K1A 0Y9, Canada
613-225-2342
613-228-6626
gstubbings@inspection.gc.ca

Jon Sweeney
NRCan CFS
PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-452-3499
506-452-3525
jsweeney@nrcan.gc.ca

Dr. Graham Thurston
NRCan CFS
PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-452-3026
506-452-3828
gthursto@nrcan.gc.ca

Rodney(Rod) Turnquist
Insect Ecology Technician
NRCan CFS
Pac. For Centre
506 West Burnside Road
Victoria, BC
V8Z 1M5, Canada
250-363-0754
250-363-0775
rturnquist@pfc.forestry.ca

Cees van Oosten
Silviconsult Woody Crops Tech Inc
2356 York Cres
Nanaimo, BC
V9T 4N3, Canada
250-758-8230
250-758-8251
silviconsult@telus.net

Gerrit van Raalte
Director General
Atlantic Forestry Centre NRC
PO Box 4000
Fredericton, NB
E3B 5P7, Canada
506-452-3508
506-452-3140
gvanraal@nrcan.gc.ca

George VanDusen
Forest Management
Superintendent
Corner Brook Pulp and Paper
Ltd
PO Box 2001
Corner Brook, NFL
A2H 6J4, Canada
709-637-3322
709-637-3467
gvandusen@CB.KRUGER.Com

Helen Vlasblom
Private Consultant
2090 Beach Road RR #2
Oxford Mills, ON
K0G 1S0, Canada
613-258-4313
vlasblom@istar.ca

Gary R. Warren
Forest Pathologist/Hycologist
NRCan CFS Atl.
Cornerbook Div
PO Box 960
Corner Brook, NL
A2H 6J3, Canada
708-637-4912
709-637-4910
gwarren@nrcan.gc.ca

Doreen Watler
National Manager
PHRA Unit CFIA
3851 Fallowfield Rd
Nepean, ON
K2H 8P9, Canada
613-228-6698
613-228-6100
watlerd@inspection.gc.ca

Andy Welch
Marketing Manager
Dendron Resource Surveys Inc
206-880 Lady Ellen Place
Ottawa, ON
K1Z 5L9, Canada
613-725-2971
613-725-1716

Roger Whitehead
NRCan CFS
506 West Burnside Road
Victoria, BC
V8Z 1M5, Canada
250-363-0765
rwhitehead@pfc.forestry.ca

Dr. Richard Wilson
Ontario Prov. Forest
Pathologist, OMNR
70 Foster Drive Suite 400
Sault Ste Marie, ON
P6A 6V5, Canada
705-541-5106
705-945-6667
Richard.Wilson@mnr.gov.on.ca

John P Wilson
Forester, OMNR
PO Bag 2002 Concession Rd
Kemptville, ON
K0G 1J0, Canada
613-258-8382
613-258-3920
john.p.wilson@mnr.gov.on.ca

Jim Wood
Director Forest Resources
Program
NRCan CFS
506 W. Burnside Road
Victoria, BC
V8Z 1M5, Canada
250-363-6008
250-363-6004
jwood@pfc.forestry.ca

Yang Zhongqi
Chinese Academy of Forestry
Beijing,
100091, PRC
86106288 4972
yangzq@mail.forestry.ac.cn

08:00 **Registration/Continental breakfast** **Capital Hall Rooms 1B – 2B**

Welcoming Remarks

08:30 *Yvan Hardy, Assistant Deputy Minister, Canadian Forest Service*

SESSION I - WESTERN CANADA ROUND-UP

Chair: *Cees van Oosten, SilviConsult Woody Crops Tech Inc.*

09:00 B.C. Report
Tim Ebata, British Columbia, Ministry of Forests

09:20 Alberta Report
Hideji Ono, Alberta Environment, Land and Forest Service

09:40 Saskatchewan Report
Rory McIntosh, Saskatchewan Environment and Resource Management

10:00 **Break** **Capital Hall Rooms 1B – 2B**

10:30 Manitoba Report
Keith Knowles, Conservation Manitoba

Pests of Aspen – an Update

10:50 Update on aspen health in western Canada from the CIPHA study (Climate Change Impacts on Productivity and Health of Aspen)
Ted Hogg, Natural Resources Canada, Canadian Forest Service

11:10 Aspen Decline/Mortality in Northeastern Ontario – 2002 An Update
Gordon Howse, Natural Resources Canada, Canadian Forest Service

SESSION II - DOMESTIC MOVEMENT OF NATIVE AND EXOTIC PESTS
ARE WE PREPARED? HOW DO WE MANAGE IT?

Chair: *Gerrit Van Raalte, Natural Resources Canada, Canadian Forest Service*

11:30 Framing the problem: differences in insect diversity between eastern and western North America, and movement across the continent
Leland Humble, Natural Resources Canada, Canadian Forest Service

11:45 Range expansion by mountain pine beetle under climate change
Allan Carroll, Natural Resources Canada, Canadian Forest Service

12:00 **Lunch** **Capital Hall Rooms 1B – 2B**

13:00 Pest Risk Assessment

Greg Stubbings, Canadian Food Inspection Agency

13:20 Provincial Perspectives – West and East
Hideji Ono, Alberta Environment, Land and Forest Service

13:40 Discussion

SESSION III - CROSS-COUNTRY CHECK-UP – ONTARIO AND QUEBEC
Chair: Craig Huff, Forester, Transportation, Utilities, and Public Works, City of Ottawa

14:00 Status of Important Forest Pests in Ontario - 2002
Gordon Howse, Natural Resources Canada, Canadian Forest Service
Taylor Scarr, Ontario Ministry of Natural Resources

14:20 Quebec Report
Clement Bordeleau, Ministère des ressources naturelles du Québec

Student Research Presentation
14:40 Factors affecting oviposition site selection on three different hosts of *Monochamus s. scutellatus* (Say) (Coleoptera: Cerambycidae)
Ingrid Aguayo, PhD student, Faculty of Forestry, University of Toronto

15:00 **Break** **Capital Hall Rooms 1B – 2B**

SESSION IV - URBAN / MUNICIPAL PERSPECTIVE

15:30 Urban Forests: A critical perspective on connecting communities and trees
Andy Kenney, Faculty of Forestry, University of Toronto

15:50 Emerald Ash Borer found in Windsor:
Exotic Pests and the Urban Forest a Municipal Perspective
Bill Roesel, City Forester, Windsor

16:10 Slowing the Spread of the Emerald Ash Borer in Canada
Greg Stubbings, Canadian Food Inspection Agency

17:00 **FORUM MARKETPLACE**
The place for networking and information exchange
Light food and refreshments served – Corporate displays, sponsors, research

17:30 Pest Forum Steering Committee - members only **Capital Hall Room 5B**

08:00 **Continental breakfast** **Capital Hall Rooms 1B – 2B**

08:30 SESSION V – CROSS-COUNTRY CHECK-UP – ATLANTIC CANADA
Chair: Mike Apsey, Executive Director, FORCAST

08:40 New Brunswick Report
Nelson Carter, New Brunswick Department of Natural Resources and Energy

09:00 Nova Scotia Report
Eric Georgeson, Nova Scotia Department of Natural Resources

09:20 Newfoundland Report
Hubert Crummey, Newfoundland Dept. of Natural Resources and Agri-Foods

Operational Perspective – Applying the Tools, Technologies, and Strategies of IPM

09:40 Management Strategies for the Future
Joe Meating, BioForest Inc

10:00 **Break** **Capital Hall Rooms 1B – 2B**

10:30 Prescriptions for Integrated Pest Management Solutions
Dave McManama, Certis USA
10:40 Monitoring Insect Populations using Semiochemicals
Steve Burke, Pherotech
10:50 Integrated Applied Technologies for Optimized Deposition
Peter Amirault, Forest Protection Limited
11:00 Remote Sensing Tools for Monitoring and Assessment
Carol Hopkins, Dendron Resource Surveys Inc.

Research Presentation
11:20 Patterns of defoliation by western black headed budworm, *Acleris gloverana*, in juvenile western hemlock, Haida Gwaii (Queen Charlotte Islands), British Columbia
Rod Turnquist, Natural Resources Canada, Canadian Forest Service

12:00 **Lunch** **Capital Hall Rooms 1B – 2B**

SESSION VI - GLOBALIZATION AND FOREST PESTS

13:00 Chair and Introduction:
Dr. André Gravel, Vice-President, Canadian Food Inspection Agency

13:15 United States - *Mary Ellen Dix, Entomologist and Forest Health Specialist, Forest Health Protection, USDA Forest Service, Arlington VA*
13:55 Europe - *Hugh Evans, Head of Entomology Research, Forest Research, Alice Holt Lodge, Surrey UK*

14:35 China - *Dr. Yang Zhongqi, Chinese Academy of Forestry, Beijing, China*

15:15 **Break** **Capital Hall Rooms 1B – 2B**

Regulatory Affairs Update

15:45 Pest Management Regulatory Agency, *Lars Juergensen, PMRA*

16:15 Canadian Food Inspection Agency, *Greg Stubbings, CFIA*

BANQUET AND SPEAKER

Hosted by*: Canadian Institute of Forestry and Forest Pest Management Forum*

17:00 Cocktails

18:00 Dinner

19:00 Introductory Remarks

FRIDAY NOVEMBER 15, 2002

Ottawa Congress Centre
Capital Hall Rooms 3B – 4B

SPECIAL FEATURE

INTENSIVE FORESTRY – MANAGING FIBRE MEANS MANAGING PESTS

Canada's globally competitive forest industry is increasing efforts to apply intensive forest management (IFM). Experience suggests that in some areas, intensive treatments can open stands to increased risk of pest damage and associated volume and quality losses.

This special feature will examine the case for tightly linking pest management with IFM planning. Public and private policy drivers – including the National Forest Strategy, Criteria and Indicators, Forests 2020, and Sustainable Forest Management Certification – underscore the importance of pest management considerations in IFM. The use of pesticides is both important to protecting intensively managed stands and controversial in the public arena and in the eyes of some certification standards.

This session will include a one-hour breakout period to identify priority issues for future national-level discussions on intensive forest management.

PROGRAM

Chair: *Paul Addison, Director General, Canadian Forest Service, Pacific Forestry Centre*

08:30 Context/Introduction
Paul Addison, Director General, Canadian Forest Service, Pacific Forestry Centre

08:45 Western Canada Case Study: Silvicultural treatments to avoid Mountain Pine Beetle losses in southern BC
Roger Whitehead, Canadian Forest Service, Pacific Forestry Centre

09:05 Eastern Canada Case Study: Experiences with insects in intensively managed stands
George VanDusen, Corner Brook Pulp and Paper Ltd.

09:25 International Case Study: Lessons from China – the world's biggest plantation
Dr. Yang Zhongqi, Chinese Academy of Forestry, Beijing, China

09:45 **Break** **Capital Hall Rooms 1B – 2B**

10:15 How certification relates to intensive forest management and pest management.
Paul Wooding, Canfor

11:15 Short rotation intensive culture- operational management of hybrid poplar
Cees van Oosten, SilviConsult Woody Crops Tech Inc.

11:45 Discussion

12:00 **Buffet Luncheon** **Capital Hall Rooms 1B – 2B**

13:00 **Discussion groups:**
Identify main issues and make recommendations for future national IFM discussions

14:00 Wrap up

PROGRAMME

8 h **Inscription et petit déjeuner continental** **Salles de la capitale 1B – 2B**

Mot de bienvenue

8 h 30 *Yvan Hardy, sous-ministre adjoint, Ressources Naturelles Canada, Service canadien des forêts*

SÉANCE I - LE POINT SUR L'OUEST CANADIEN
Président : *Cees van Oosten, SilviConsult Woody Crops Tech Inc.*

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

9 h 20 Rapport de l'Alberta
Hideji Ono, Alberta Environment, Land and Forest Service

9 h 40 Rapport de la Saskatchewan
Rory McIntosh, Saskatchewan Environment and Resource Management

10 h **Pause** **Salles de la capitale 1B – 2B**

10 h 30 Rapport du Manitoba
Keith Knowles, Conservation Manitoba

Les parasites du peuplier faux-tremble – Mise à jour

10 h 50 Mise à jour sur l'état de santé du peuplier faux-tremble dans l'Ouest canadien selon l'étude sur l'impact du changement climatique sur la productivité et la santé du peuplier faux-tremble
Ted Hogg, Ressources Naturelles Canada, Service canadien des forêts

11 h 10 Déclin et mortalité des peupliers faux-trembles dans le nord-est de l'Ontario en 2002
Gordon Howse, Ressources Naturelles Canada, Service canadien des forêts

SÉANCE II - LE DÉPLACEMENT AU CANADA DES RAVAGEURS INDIGÈNES ET EXOTIQUES SOMMES-NOUS PRÊTS? COMMENT TRAITONS-NOUS CE PROBLÈME?
Président : *Gerrit Van Raalte, Ressources Naturelles Canada, Service canadien des forêts*

11 h 30 La définition du problème: Les différences en matière de diversité des insectes entre l'est et l'ouest de l'Amérique du Nord et les déplacements d'un bout à l'autre du continent
Leland Humble, Ressources Naturelles Canada, Service canadien des forêts

11 h 45 Expansion de l'aire de répartition du dendroctone du pin argenté dans un contexte de changement climatique
Allan Carroll, Ressources Naturelles Canada, Service canadien des forêts

12 h **Déjeuner** **Salles de la capitale 1B – 2B**

13 h Évaluation du risque que posent les ravageurs
Greg Stubbings, Gestionnaire national, ACIA

13 h 20 Perpectives provinciales – L'Ouest et l'Est
Hideji Ono, Alberta Environment, Land and Forest Service

13 h 40 Discussions

SÉANCE III - BILAN NATIONAL – ONTARIO ET QUÉBEC
Président : Craig Huff, forestier, Transports, Services publics et Travaux publics, Ville d'Ottawa

14 h Rapport d'Ontario
Gordon Howse, Ressources Naturelles Canada, Service canadien des forêts
Taylor Scarr, Ministère des ressources naturelles de l'Ontario

14 h 20 Rapport du Québec
Clément Bordeleau, ministère des Ressources naturelles du Québec

Présentation d'une recherche réalisée par une étudiante
14 h 40 Les facteurs influant le choix d'un site d'oviposition sur trois hôtes de *Monochamus. s. scutellatus* (Say) (*Coleoptera : Cerambycidae*)
Ingrid Aguayo, étudiante de doctorat à la Faculty of Forestry de l'Université de Toronto

15 h **Pause** **Salles de la capitale 1B – 2B**

SÉANCE IV - PERSPECTIVE URBAINE ET MUNICIPALE

15 h 30 Forêts urbaines : Une perspective critique sur l'établissement d'un lien entre les communautés et les arbres, *Andy Kenney, Faculty of Forestry, Université de Toronto*

15 h 50 Présence de la sésie du frêne découverte à Windsor : Espèces nuisibles exotiques et espace boisés en milieu urbain dans une perspective municipale
Bill Roesel, City Forester, Windsor

16 h 10 Freiner la propagation de l'agrile du frêne au Canada
Greg Stubbings, Agence canadienne d'inspection des aliments

17 h **MARCHÉ DU FORUM 2002**
L'endroit pour réseauter et échanger de l'information
Goûter et rafraîchissements – Stands d'entreprises, commanditaires et présentations par affiches

17 h 30 Réunion du Comité directeur du Forum-réservée aux membres **Salle de la capitale 5B**

8 h **Petit déjeuner continental** **Salles de la capitale 1B – 2B**

8 h 30 **SÉANCE V – BILAN NATIONAL – CANADA ATLANTIQUE**
Président : Mike Apsey, Directeur général, FORCAST

8 h 40 Rapport du Nouveau-Brunswick
Nelson Carter, ministère des Ressources naturelles et de l'Énergie du Nouveau-Brunswick

9 h Rapport de la Nouvelle-Écosse
Eric Georgeson, ministère des Ressources naturelles de la Nouvelle-Écosse

9 h 20 Rapport de Terre Neuve
Hubert Crummey, Newfoundland Department of Natural Resources and Agri-Foods

Perspective opérationnelle – Application des outils, des techniques et des stratégies de lutte intégrée contre les ravageurs

9 h 40 Stratégies d'aménagement pour l'avenir
Joe Meating, BioForest Inc

10 **Pause** **Salles de la capitale 1B – 2B**

10 h 30 Solutions de lutte intégrée contre les espèces nuisibles
Dave McManama, Certis USA
10 h 40 La surveillance des populations d'insectes à l'aide d'écomones
Steve Burke, Pherotech
10 h 50 Optimisation du dépôt de pesticide sur les organismes ciblés
Peter Amirault, Forest Protection Limited
11 h 00 Développement d'applications forestières utilisant des données hyperspectrales
Carol Hopkins, Dendron Resource Surveys Inc.

Présentation de recherche
11 h 20 Tendances de défoliation par la tordeuse à tête noire de l'ouest, *Acleris gloverana*, chez les jeunes pruches occidentales à Haida Gwaii (îles de la Reine-Charlotte), en Colombie-Britannique,
Rod Turnquist, Ressources Naturelles Canada, Service canadien des forêts

12 h **Déjeuner** **Salles de la capitale 1B – 2B**

SÉANCE VI – LA MONDIALISATION ET LES RAVAGEURS FORESTIERS

13 h Président et introduction : *André Gravel, vice-président, Agence canadienne d'inspection des aliments*

13 h 15 États-Unis - *Mary Ellen Dix, entomologiste et spécialiste de la santé des forêts, Forest Health Protection, USDA Forest Service, à Arlington, en Virginie*

13 h 55 Europe - *Hugh Evans, chef de la recherche en entomologie, Forest Research, au Alice Holt Lodge, à Surrey, au Royaume-Uni*

14 h 35 Chine – *Yang Zhongqi, Ph. D., Académie de foresterie de la Chine, à Beijing, en Chine*

15 h 15 **Pause** **Salles de la capitale 1B – 2B**

Mise à jour sur les affaires réglementaires

15 h 45 Agence de réglementation de la lutte antiparasitaire , *Lars Juergensen, ARLA*

16:h 15 Agence canadienne d'inspection des aliments, *Greg Stubbings, Gestionnaire national, ACIA*

BANQUET & EXPOSÉ

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

17 h Cocktails

18 h Dîner

19 h Mot d'ouverture

VENDREDI 15 NOVEMBRE 2002

Centre des congrès d'Ottawa
Salles de la capitale 3B – 4B

SÉANCE SPÉCIALE

AMÉNAGEMENT INTENSIF DES FORÊTS–GESTION DES FIBRES SIGNIFIE LUTTE CONTRE LES RAVAGEURS

L'industrie forestière du Canada, qui s'est taillé une place concurrentielle sur la scène mondiale, s'emploie de plus en plus à appliquer les principes de l'aménagement intensif des forêts. Or, l'expérience montre que dans certaines régions, les traitements intensifs peuvent rendre les peuplements vulnérables aux attaques des ravageurs, ce qui entraîne une perte de volume et une baisse de la qualité.

Dans le cadre de cette séance spéciale, les participants examineront les arguments en faveur du lien étroit qu'il faut faire entre la lutte contre les ravageurs et la planification de l'aménagement intensif des forêts. Les principaux impératifs stratégiques, dont la Stratégie nationale sur les forêts, les Critères et indicateurs, Forêts 2020 et la certification de l'aménagement forestier durable, mettent en évidence l'importance de tenir compte de la lutte contre les ravageurs en matière d'aménagement intensif des forêts. Par exemple, l'utilisation de pesticides est essentielle à la protection des peuplements faisant l'objet d'un aménagement intensif. Toutefois, elle est controversée sur la scène publique et selon certaines normes de certification.

Cette séance comprendra une heure de travail en groupes afin de cerner les enjeux prioritaires qui seront abordés dans le cadre de discussions nationales sur l'aménagement intensif des forêts.

PROGRAMME

Président : *Paul Addison, Ressources Naturelles Canada, Service canadien des forêts*

8 h 30 Contexte et introduction
Paul Addison, Ressources Naturelles Canada, Service canadien des forêts

8 h 45 Étude de cas portant sur l'Ouest canadien : Les traitements sylvicoles visant à éviter les pertes attribuables au dendroctone du pin argenté dans le sud de la Colombie-Britannique
Roger Whitehead, Ressources Naturelles Canada, Service canadien des forêts

9 h 5 Étude de cas portant sur l'Est du Canada : Expériences réalisées avec des insectes dans des peuplements faisant l'objet d'un aménagement intensif
George VanDusen, Corner Brook Pulp and Paper Ltd.

9 h 25 Étude de cas internationale : Leçons à apprendre de la Chine, la plus grande plantation au monde
Yang Zhongqi, Ph. D., Académie de foresterie de la Chine, à Beijing, en Chine

9 h 45 **Pause** **Salles de la capitale 1B – 2B**

10 h 15 Le rapport entre la certification et l'aménagement intensif des forêts
Paul Wooding, Canfor

11 h 15 Culture intensive en rotation courte – L'aménagement opérationnel du peuplier hybride
Cees van Oosten, SilviConsult Woody Crops Tech Inc.

11 h 45 Discussion

12 h **Buffet** **Salles de la capitale 1B – 2B**

13 h Groupes de discussion
Cerner les principaux enjeux et formuler des recommandations en vue de discussions futures sur l'aménagement intensif des forêts à l'échelle nationale.

14 h Conclusion

SESSION I –
WESTERN CANADA ROUND-UP

Chair: Cees van Oosten
SilviConsult Woody Crops Tech. Inc.

SESSION I - SÉANCE I

SÉANCE I –
LE POINT SUR L'OUEST CANADIEN

Président: Cees van Oosten
SilviConsult Woody Crops Tech. Inc.

BC Report

Tim Ebata, Forest Health Project Specialist, Forest Practices Branch, BCMOF
(250) 387-8739 fax: (250) 387-1467

Visit our web site at: http://www.for.gov.bc.ca/hfp/hfp.htm

This presentation is not available.

The pdf version of 2002 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

Important Forest Pest Conditions in 2002 and Predictions for 2003 in Alberta

Presented by:
H. Ono, Land and Forest Division, Alberta Sustainable Resource Development

Compiled By:
S. Ranasinghe

Contributors:
C. Crocker, T. Hutchison, C. Kominek, D. Lux, M. Maximchuk and E. Mueller (Alberta Sustainable Resource Development), J. Feddes-Calpas (Alberta Agriculture, Food and Rural Development) and C. Saunders (The City of Edmonton)

ABSTRACT

Spruce budworm (*Choristoneura fumiferana* (Clemens) defoliated area in northern Alberta increased by about 39% in 2002, compared to the area defoliated in 2001. As well, several new spruce budworm outbreaks were detected in 2002, including a new infestation extending into Wood Buffalo National Park. As much as 40% tree mortality was observed in some severely budworm-infested stands. Two-year cycle budworm (*C. biennis* Free.) activity increased in southwestern Alberta. Pheromone-baited traps were deployed province-wide to monitor budworm moth populations. The analysis of the trap catches showed that the risk of new spruce budworm occurring in 2003 has somewhat decreased northwestern Alberta; this risk remains high in northeastern Alberta. Yellowheaded spruce sawfly (*Pikonema alaskensis* (Rohwer) outbreaks killed trees in young white spruce plantations in northeastern Alberta and in Cypress Hills Provincial Park in southeastern Alberta.

Large aspen tortrix (*C. conflictana* (Walker) defoliated aspen stands over an estimated 4.2 million hectares scattered throughout the province. Forest tent caterpillar (*Malacosoma disstria* Hübner) defoliated aspen scattered over an estimated 70 000 hectares. The satin moth (*Leucoma salicis* (L.) infestation around Edmonton declined further in 2002. The cottony psyllid (*Psyllopsis discrepans* (Flor.) attacked ash trees in Edmonton area. The gray willow leaf beetle (*Tricholochmaea decora* (Say) was among the other noteworthy defoliator pests observed in 2002. Gypsy moths were not detected in the pheromone-baited traps set up in 2002 by the Department of Sustainable Resource Development.

The mountain pine beetle (*Dendroctonus ponderosae* Hopkins) attacked an estimated 9000 trees in Banff National Park in 2002, despite removal of 800 beetle-attacked trees in 2001/02 winter. For the first time during the current outbreak, beetle-infested trees were detected in Canmore, a community located just outside the eastern boundary of Banff National Park. Aerial overview surveys, ground surveys, and pheromone-baited trees were used to monitor mountain pine beetle activity along the eastern slopes in Alberta.

Alberta remains free of Dutch elm disease; however, 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 declined in 2002, compared to 2001.

This year, we initiated field trials to study the impact of wood borer damage on fire-killed timber and to evaluate the use of Verbenone to protect mature lodgepole pine from mountain pine beetle attack.

Principaux ravageurs forestiers en Alberta : Le point pour 2002 et les prévisions pour 2003

RÉSUMÉ

En 2002, la superficie défoliée par la tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana* (Clemens) dans le nord de l'Alberta a augmenté d'environ 39 % par rapport à l'année précédente.) De plus, plusieurs nouveaux foyers d'infestation de la tordeuse des bourgeons de l'épinette ont été repérés dans le parc national Wood Buffalo. Une mortalité allant jusqu'à 40 % a été observée dans certains des peuplements les plus lourdement infestés par ce ravageur. L'activité de la tordeuse bisannuelle de l'épinette (*C. biennis* Free.) a augmenté dans le sud-ouest de l'Alberta. Des pièges à phéromone ont été déployés dans toute la province afin de surveiller les populations des papillons de tordeuse. D'après le nombre de prises, le risque de nouvelles infestations en 2003 s'est atténué pour le nord-ouest de l'Alberta, mais demeure élevée pour le nord-est de la province. Des infestations de la tenthrède à tête jaune de l'épinette (*Pikonema alaskensis* (Rohwer)) ont entraîné la mort de jeunes épinettes blanches dans des plantations établies dans le nord-est de l'Alberta et dans le parc provincial Cypress Hills dans le sud-est de la province.

La tordeuse du tremble (*C. conflictana* (Walker) a défolié quelque 4,2 millions d'hectares de tremblaies répartis dans l'ensemble de la province. La livrée des forêts (*Malacosoma disstria* Hübner) a défolié des peupliers faux-trembles dispersés sur environ 70 000 hectares. Dans la région d'Edmonton, le papillon satiné (*Leucoma salicis* (L.)) a continué de régresser, et le *Psyllopsis discrepans* (Flor.) a attaqué des frênes. La galéruque grise du saule (*Tricholochmaea decora* (Say) figurait parmi les autres défoliateurs dignes de mention qui ont été observés en 2002. Aucun spécimen de spongieuse n'a été trouvé dans les pièges à phéromone déployés en 2002 par le ministère du Développement durable des ressources de l'Alberta.

En 2002, le dendroctone du pin ponderosa (*Dendroctonus ponderosae* Hopkins) a attaqué quelque 9 000 arbres dans le parc national Banff, malgré l'abattage en 2001 de 800 arbres atteints par ce ravageur. C'est la première fois depuis le début de cette infestation que des arbres infestés par ce coléoptère sont repérés près de Canmore, une collectivité située à l'est du parc national. Des relevés aériens à grande échelle, des relevés au sol et des arbres appâtés à l'aide de phéromones ont servi à surveiller l'activité de ce ravageur le long des versants est de l'Alberta.

L'Alberta est toujours épargnée par la maladie hollandaise de l'orme, mais un vecteur de l'agent pathogène, le scolyte européen de l'orme (*Scolytus multistriatus* (Marsham)), a de nouveau été capturé dans les pièges à phéromone. Le nombre de spécimens capturés de ce scolyte a toutefois diminué de 2001 à 2002.

Cette année, nous avons entrepris des essais sur le terrain afin d'étudier l'impact des dégâts causés par des scolytes aux arbres tués par le feu et d'évaluer l'emploi du verbénone pour protéger les pins tordus mûrs contre les attaques du dendroctone du pin ponderosa.

1.0 INTRODUCTION

This is a summary report on noteworthy forest insect and disease pest conditions found in Alberta in 2002. The details of provincial forest pest conditions (including details about invasive exotic plants) will be published in the "2002 Annual Report: Forest Health in Alberta."

The Department of Sustainable Resource Development (SRD) deals with forest health concerns in the "Green Area" (managed forested area) in Alberta. Other agencies handle forest pest concerns found within the "White Area" (settled area) and in provincial or national parks within the province. In 2002, the Green Area comprised of 10 *Corporate Areas* organized into three *Corporate Regions* (Figure 1). Before 2002 there were 17 *Forest Areas* organized into four *Forest Regions*.

The Forest Health Officers (FHO) — Tom Hutchison, Northeast Corporate Region (NE), Daniel Lux and Erica Mueller, Southwest Corporate Region (SW) and Mike Maximchuk, Northwest Corporate Region (NW) — collected the "Green Area" forest pest information presented in this report. Janet Feddes-Calpas (Alberta Agriculture, Food and Rural Development) and Christopher Saunders (The City of Edmonton) provided the "White Area" urban forest pest information reported here. Leo Unger (Canadian Forest Service, Pacific Forestry Centre) and Ian Pengelley (Banff National Park) provided information on the forest pests in Banff and Jasper national parks. Les Weekes provided information on the forest health conditions in Cypress Hills Provincial Park.

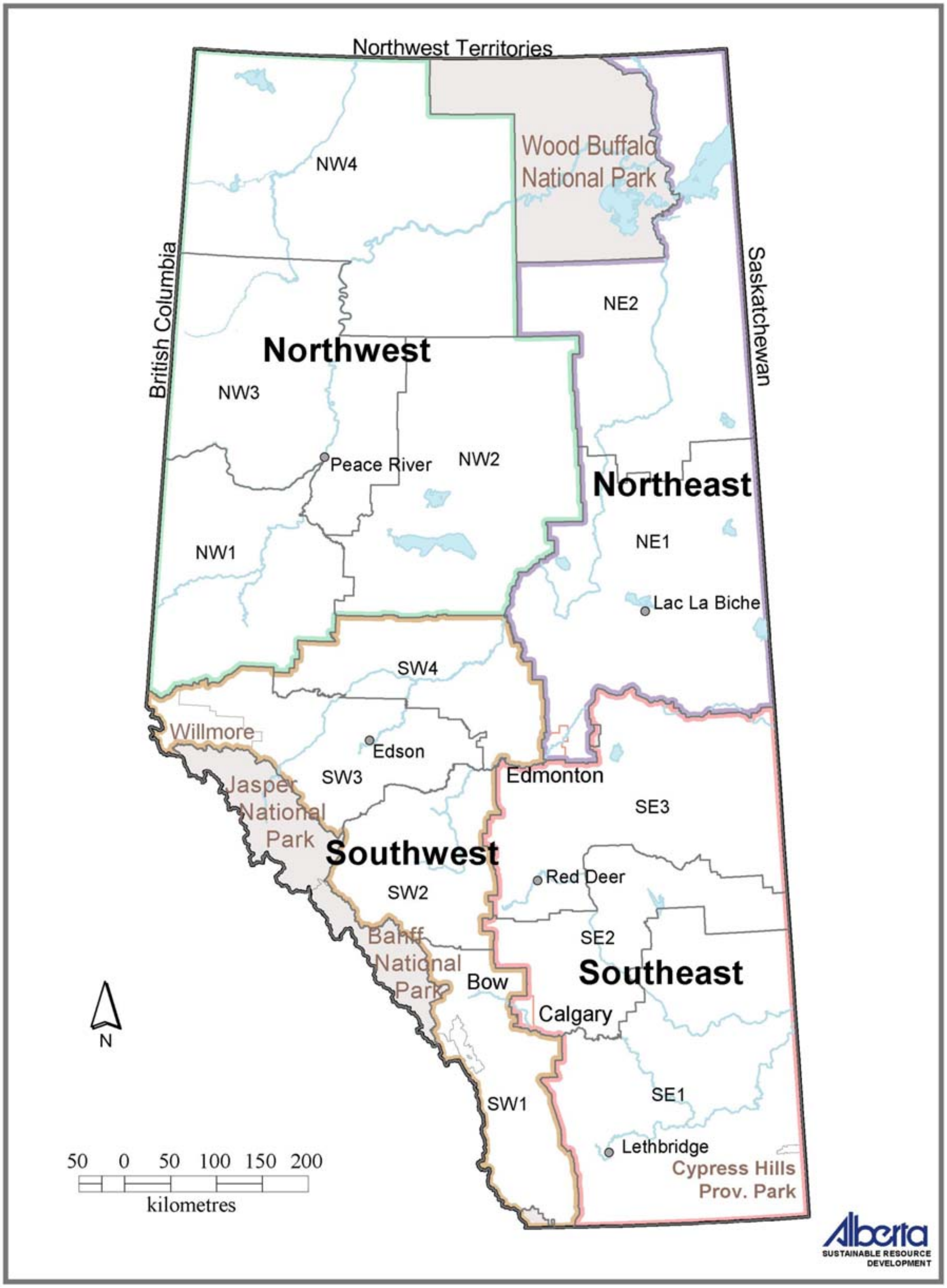


Figure 1. Corporate regions and areas applicable to forestry in Alberta, 2002.

2.0 FOREST PEST CONDITIONS IN 2002 AND FORECASTS FOR 2003

A. Defoliators

2.1 Conifer Defoliators: Spruce Budworm, *Choristoneura fumiferana* (Clemens)

2.1.1 Spruce Budworm Defoliation in 2002

The extent and severity of spruce budworm defoliation were estimated during aerial overview surveys carried out in the summer. The results of these aerial surveys are summarized in Table 1. 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 procedures used for these surveys are described in the "Forest Health Aerial Survey Manual" (Ranasinghe and Kominek, 1999).

Silk strands on a spruce budworm-infested tree

Table 1. Results of the spruce budworm defoliation aerial overview surveys in 2002, Alberta

Corporate Region	Defoliated Area (ha)		Total (ha)
	Moderate	Severe	
Northwest	**14 324**	**97 107**	**111 431[a]**
Northeast			
South of lat. 58º N	**35 108**	**12 917**	**48 025[a]**
	6500	**------**	**6500[b]**
North of lat. 58ºN	**2438**	**14 720**	**17 158[b]**
Total	49 432[a]	110 024[a]	159 456[a]
	8938[b]	14 720[b]	23 658[b]

[a] net area of spruce budworm defoliation
[b] gross area of spruce budworm defoliation

In 2002, visible spruce budworm defoliation in the province was confined to the Northwest and Northeast corporate regions in Alberta. The net area of spruce budworm defoliation in the province in 2002 was estimated at 159 456 ha (Table 1).

In the Northwest Region, the net area defoliated by the spruce budworm increased by 41.7% in 2002 compared to the net area defoliated in 2001 (Figures 2 and 3). This increase was due to new spruce budworm infestations as well as expansion of the previous infestations. Most (87%) of the infested area was severely defoliated. The new infestations included a relatively large infestation along the western boundary of Wood Buffalo National Park, which extended into the park (Figure 2). Up to 40%, tree mortality was recorded in the semi-permanent sampling plots established in the unsprayed in this region. Out of all the blocks sprayed to control the spruce budworm in 1999 in this region, all except one block sprayed with Mimic® had visible defoliation in 2002.

In the Northeast Region, spruce inventory data to calculate the net defoliated area are not available for the areas north of latitude 58º N and a few areas south of latitude 58º N. Thus, only gross figures are available for the area defoliated north of latitude 58º N and for a few areas defoliated south of latitude 58º N (Table 1). In this region, the net area defoliated by the spruce budworm in 2002 was about 219% higher than in 2001 (Figures 2 and 3). The net area severely defoliated by the spruce budworm in 2002 is a 13-fold increase of the net area severely defoliated in 2001. In the area north of latitude 58º N, the gross area defoliated by the spruce budworm decreased by about 22% compared to the area defoliated in 2001. The spruce budworm infestation along the eastern boundary of Wood Buffalo National Park appeared to have spread well into the park. This observation, together with the infestation reported along the western boundary, indicates a major spruce budworm outbreak in this national park.

There was no spruce budworm defoliation in 2002 in the Southwest Region.

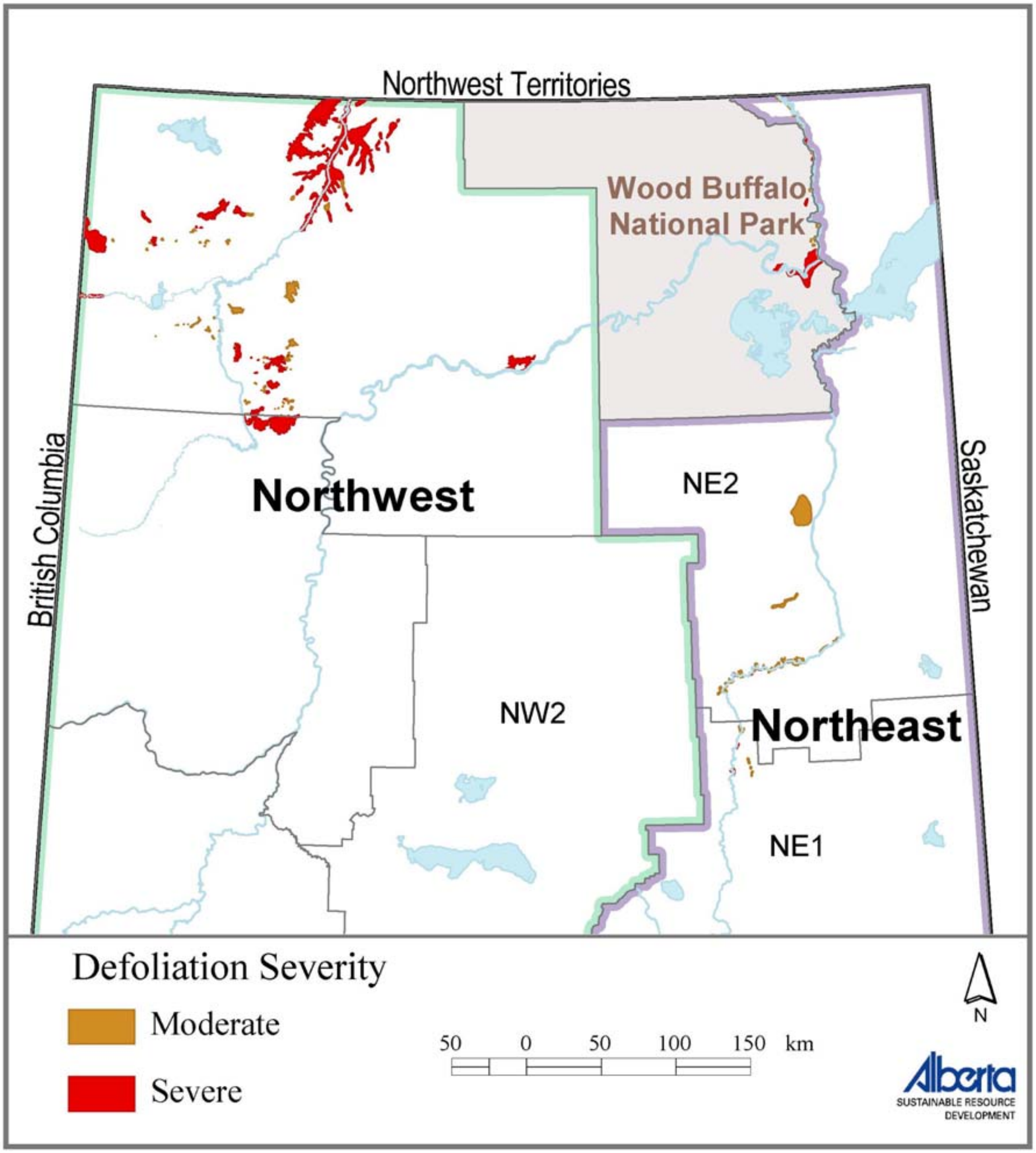


Figure 2. Spruce budworm-defoliated areas in Alberta in 2001.

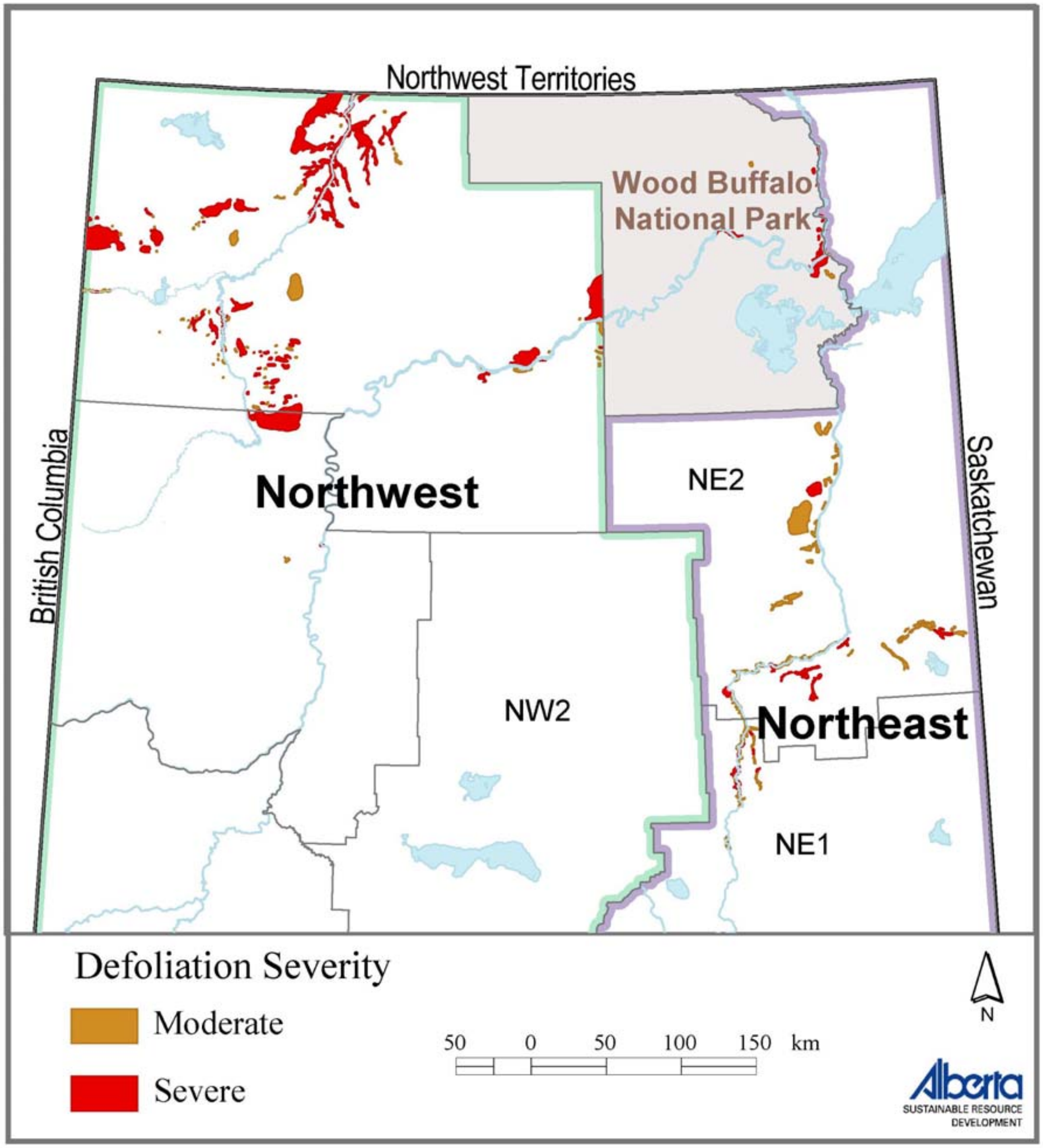


Figure 3. Spruce budworm-defoliated areas in Alberta in 2002.

<u>2.1.2 Forecast for 2003 Based on Pheromone Trap Catches in 2002</u>

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 (Biolure®, Consep Membranes Inc., USA). 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 4.

In the Northeast Region, 49 trap sites were established. In general, the trap catches in 2002 were higher than in 2001. Overall, the moth catches predicted that the probability of new spruce budworm outbreaks occurring was high at 12 (24%) of the 49 trap sites and moderate at 26 (53%) of the trap sites; traps were lost at two sites and the probability of outbreaks occurring was nil to low at the other nine sites. In this region, the probability of outbreaks occurring in 2003 is higher compared to that in 2002. In the Northwest Region, traps were set up at 70 sites in 2002; both traps at one of the sites were lost. The moth catches indicated a low risk of spruce budworm outbreaks occurring in 2003 at 47 (67%) of the trap sites, a moderate risk of outbreaks occurring at 17 (24%) of the trap sites and a high risk of outbreaks occurring at the remaining 6 (9%) of the trap sites. This is a 14% drop in the number of sites with high risk of outbreaks occurring compared to the corresponding figures in 2001. In the Southwest Region, 31 trap sites were established. Trap counts with high risk of outbreaks occurring were found at two (6%) sites in southern Alberta. Risk of outbreaks was moderate at seven (23%) sites and low at 22 (71%) of the sites. Preliminary observations suggest that the moth catches in pheromone-baited traps in southern Alberta may contain a mixture of budworm species.

2.1.3 Forecast for Spruce Budworm Defoliation Severity in 2003 Based on Second-Instar Survey Results in 2002

Second-instar (L_2) surveys are carried out in forest stands that have been defoliated by the budworm during the current outbreak and their vicinities or in some plots with high pheromone trap catches. The survey procedures are described in the "Spruce Budworm Management Guide" (Ranasinghe and Kominek, 1998).

In 2002, L_2 surveys were carried out in the NW Region only. All 15 L_2 plots were located in unsprayed stands because in 2002 there was no spray operation to control the spruce budworm in Alberta. These plots had average counts varying from 116.98 to 3302.57 budworms per 10 m^2. Twelve L_2 plots had counts predicting severe defoliation in 2003; two plots had counts predicting moderate defoliation and the other plot had counts predicting light defoliation in 2003 (Figure 5).

<u>2.2 Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Rohwer)</u>

Young white spruce stands severely defoliated by the yellowheaded spruce sawfly in Alberta.

Yellowheaded spruce sawfly (YHSS) severely defoliated some young white spruce plantations in the Northeast Region. Open grown white spruce at oil and gas reclamation sites was particularly vulnerable to this attack. Some plantations suffered up to 40% of tree kill. This insect has been damaging young white spruce in Cypress Hills Provincial Park during the past few years and the infestations continued there in 2002. However, the YHSS damage in this park was less in 2002 compared to 2001.

2.3 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). Table 2 and Figure 4 show the results of these surveys.

Table 2. Results of aspen pest defoliation surveys in Alberta, 2001 vs. 2002

	Gross area of defoliation (ha)[a]					
Region	2001			2002		
	Light	Moderate	Severe	Light	Moderate	Severe
Northeast	0	0	0	1489	109 691	15 733
Northwest	141 994	3 044 776	5742	74 165	2 612 780	908 006
Southwest	7207	175 163	142 425	141 324	252 594	83 827
Total	3 517 307			4 199 609		

[a] Gross area of defoliation, i.e., total area covered by the polygons with defoliation

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

Aspen severely damaged by the large aspen tortrix in Alberta.

Overall, the area of aspen defoliated by insects increased in 2002. The large aspen tortrix (LAT) continued to be the predominant aspen defoliator in the province in 2002. In the NE Region, LAT defoliated gross area was nearly 127 000 ha; in comparison, there was no aspen defoliation in this region in 2001. Most of this defoliation was of moderate severity. Area defoliated by LAT in the NW Region in 2002 increased marginally (13%) compared to the area defoliated in 2001; however, the severely LAT-defoliated area in this region increased dramatically (157-fold). The eastward movement of LAT infestation in this region continued in 2002. In the SW Region, LAT as well as the forest tent caterpillar (FTC) defoliated aspen stands in 2002. The area defoliated in 2002 increased by 47% compared to 2001. Most of this defoliation was moderate (Table 2 and Figure 4).

2.3.2 Forest Tent Caterpillar, *Malacosoma disstria* Hűbner

In 2002, the forest tent caterpillar (FTC) defoliated nearly 70 000 ha in the SW Region in southern Alberta. Although some forest tent caterpillar defoliation and larvae were observed during the ground surveys in the NW Region, the damage caused by the FTC and LAT was indistinguishable and was ascribed to the predominant defoliator, the large aspen tortrix.

2.3.3 Gypsy Moth, *Lymantria dispar* (L.)

The Land and Forest Division of Sustainable Resource Development set up 75 traps as a part of the annual gypsy moth survey conducted by the Canadian Food Inspection Agency (CFIA). No gypsy moths were caught in the traps that were deployed throughout the Green Area of the province. However, in 2002 one gypsy moth was trapped in Alberta by another agency working under the CFIA program.

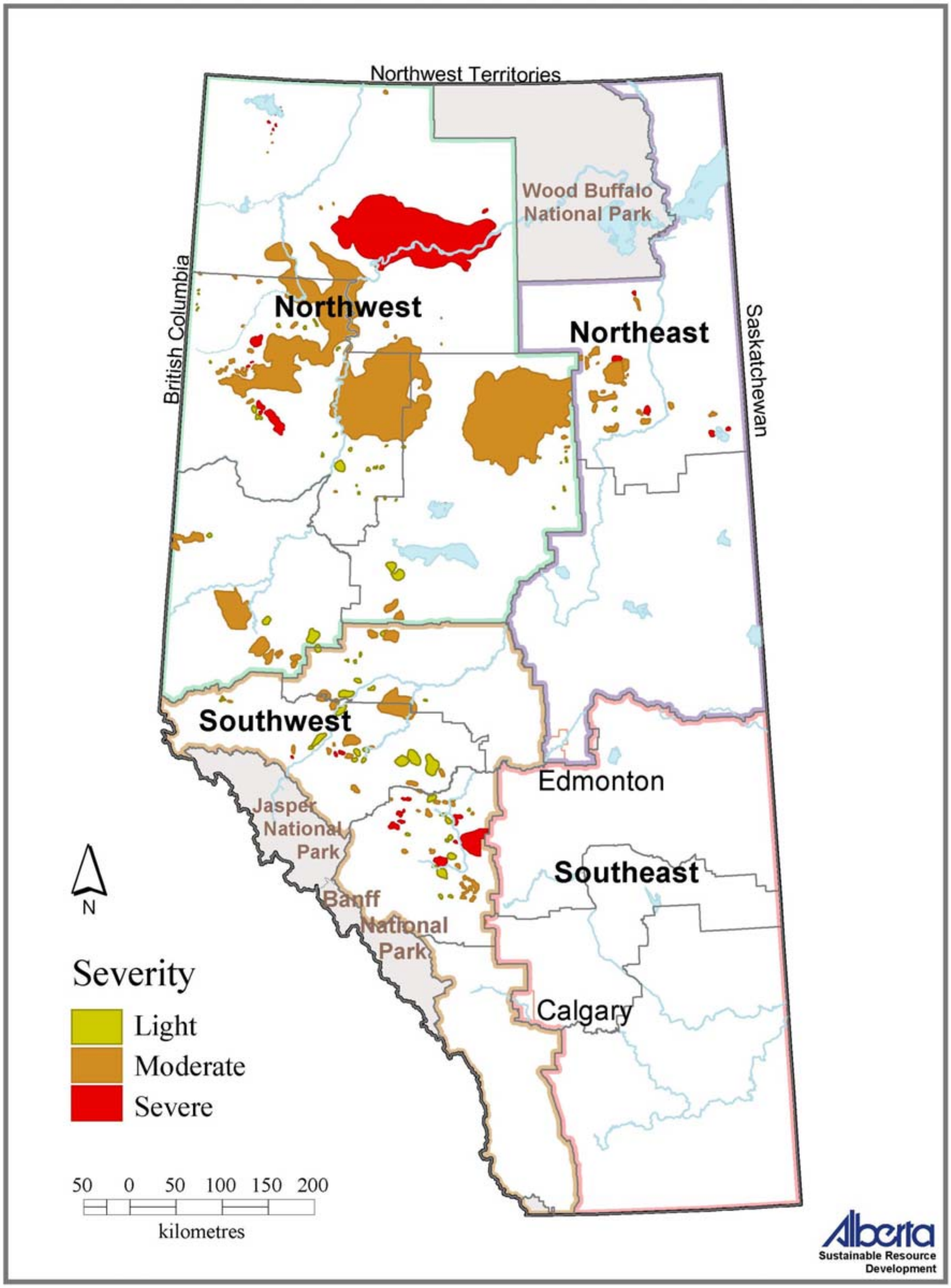


Figure 4. Gross area of insect pest-defoliated aspen in Alberta, 2002.

B. Bark Beetles

2.4 Mountain Pine Beetle, *Dendroctonus ponderosae* Hopkins

Mountain pine beetle-killed trees in Banff National Park in Alberta, 2002

2.4.1 Aerial Overview Surveys

In the fall, the Green Area and some parks in southwestern Alberta were surveyed to detect mountain pine beetle (MPB) infestations. The Regional Forest Health Officers in the Southwest 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. Leo Unger (Pacific Forestry Centre, Canadian Forest Service) carried out an aerial survey over Banff, and Jasper national parks.

Banff National Park

In 2002, the MPB populations continued to increase four to five folds at the currently infested sites in Banff National Park. Approximately 1900 new faders, i.e., lodgepole pines MPB-killed in 2001 and turning red colour in 2002, were mapped during an aerial overview survey of Banff National Park. An estimated 7000 – 11 000 green attack trees, i.e., current year attack, occurred east of Banff in this national park. Nearly 800 green attack trees were removed in 2001/02 winter from Banff National Park as a part of MPB management program. Another 200 ha with lodgepole pine were clear-cut from this park in the course of setting up fire-guards to prepare for the prescribed burn scheduled for 2003.

Prescribed burn scheduled for 2003 and sanitation harvesting are expected to reduce the number of green attack trees to about 1200 prior to beetle flight in 2003. However, if the current trend continues unabated, 5000 to 10 000 mature lodgepole pines are expected to be killed by the mountain pine beetle in Banff National Park in 2003 (Pengelly, Ian and Unger, Leo - pers.

communication). Thus, the mountain pine beetle populations in Banff National Park are increasing exponentially and appear to be entering the epidemic phase (Figures 5 and 6).

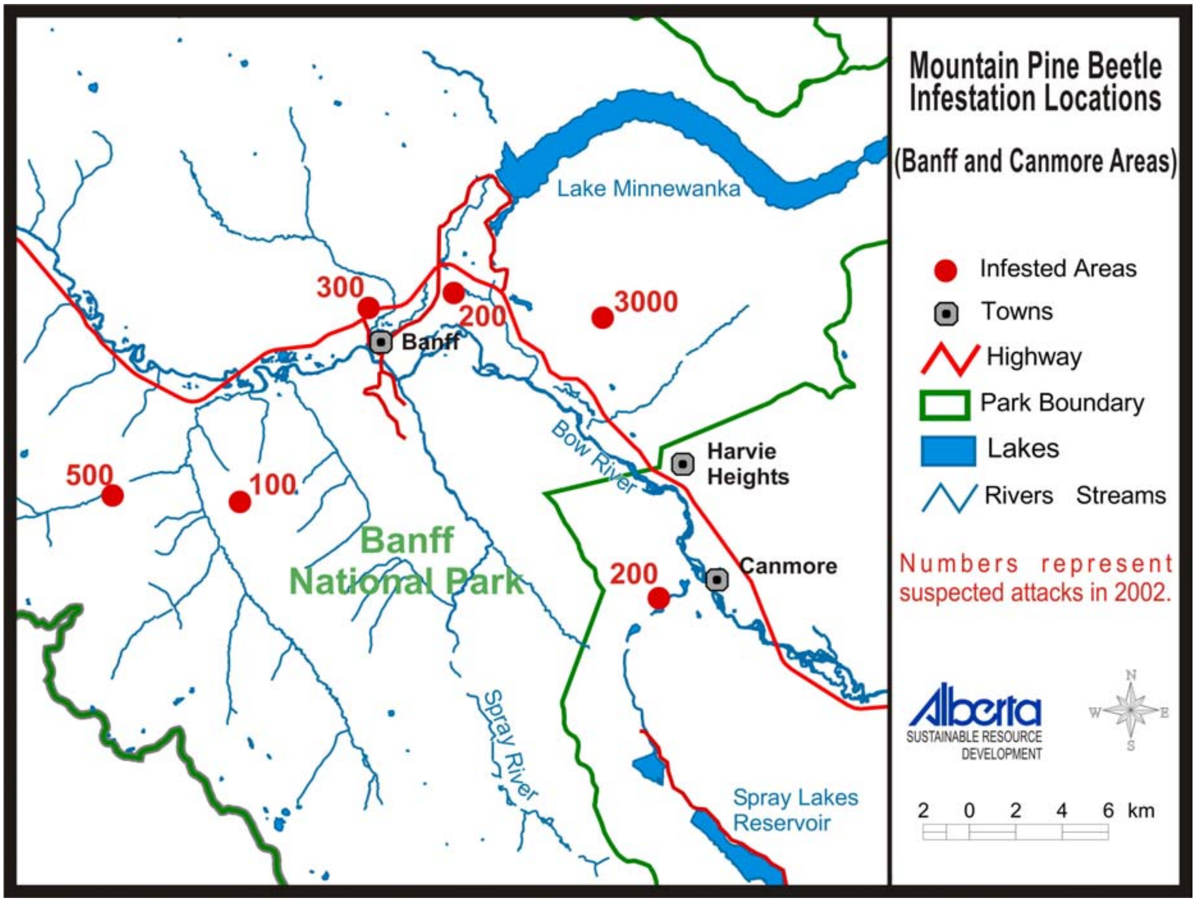


Figure 5. Mountain pine beetle infestations in Banff National Park and the vicinity in Alberta, 2002.

Jasper National Park

Mountain pine beetle is still present in the Smoky River area but suffered high over-wintering mortality. Two MPB-killed trees and a few faders were observed within this park However, many beetle-killed trees were observed during aerial surveys between the western boundary of this park and Mount Robson Park in B.C. (Unger, pers. communication). These may trigger new beetle infestations on mature lodgepole pines in the south-facing slopes of Jasper National Park.

Provincial Parks

A substantial number of lodgepole pines with red crowns that are symptomatic of mountain pine beetle attacks were observed during the aerial surveys of Willmore Wilderness Park. During a follow-up ground survey, about 200 red-attacked trees and 113 green-attack trees were detected in this park. All the red-attacked trees were cut and the green-attack trees were cut and burned.

No MPB-killed trees were observed in 2002 either in Waterton National Park or in Cypress Hills Provincial Park.

<u>2.4.2 Ground Surveys</u>

A ground survey was conducted in and around the town of Canmore following reports of lodgepole pines with red crowns observed by a Conservation Officer. The affected trees were confirmed to have mountain pine beetle attacks. This is the first confirmed report of mountain pine beetle attacks in an area adjoining Banff National Park during the current outbreak. The ground survey comprised of walkthroughs (recces) to identify the pockets of attack and probes to mark the trees with mountain pine beetle attacks. Nearly 800 mountain pine beetle-attacked trees were detected in this area during the beetle probes. A ground survey in Willmore Wilderness Park helped to locate 200 red-attacked trees (see above under 2.4.1).

<u>2.4.2 Survey with Pheromones</u>

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. These baits were not deployed in stands near the currently infested areas in Banff National Park. The procedure for deploying these pheromone baits is described in “Mountain Pine Beetle Management Guide 1999” (Kominek, 1999).

Forty-seven plots with pheromone-baited trees were established to monitor mountain pine beetle activity in southern Alberta. In the Southern Rockies Area (SW1), 79% of the 19 plots had beetle attacks on baited-trees. The number of attacks per tree ranged from 1 to 131. None of the non-baited trees in the vicinity was attacked. In the Clearwater Area (SW2) only one out of six plots (17%) had a tree with beetle attack; baited-trees in the other plots were not attacked. In the Foothills Area (SW3), 45% of the 22 plots had baited-trees with beetle hits varying from 1 to 84 per tree. In addition, beetles attacked 13 non-baited trees near four of the plots.

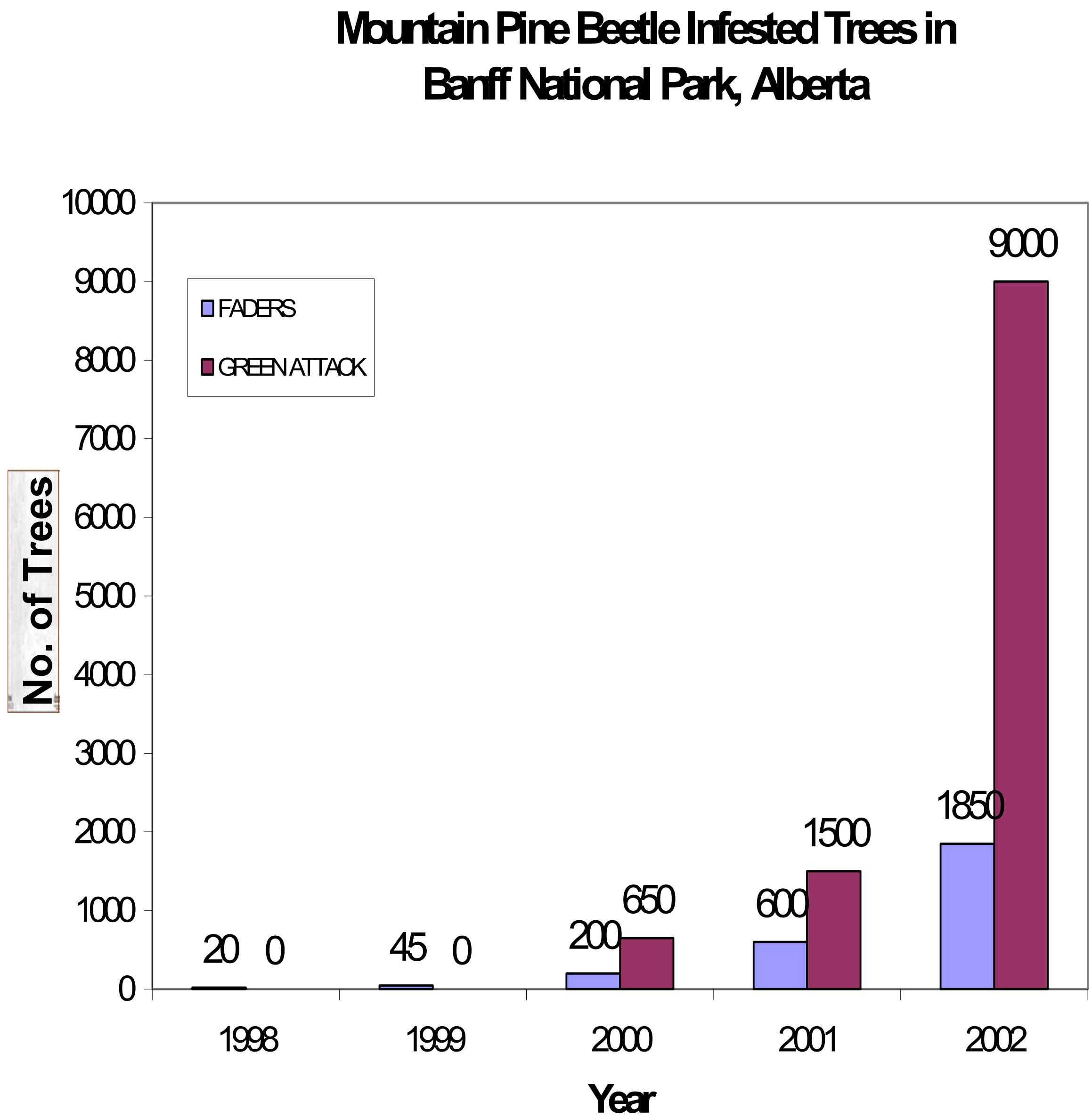


Figure 6. Number of mountain pine beetle-killed trees in Banff National Park, 1998 – 2002.

In Cypress Hills Provincial Park, mountain pine beetles attacks on pheromone-baited trees were lighter than in 2001.

C. Diseases

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

No new cases of DED were reported in 2002 in Alberta although many cases of a similar vascular wilt disease caused by *Dothiorella ulmi* have been confirmed from samples gathered in Edmonton.

The smaller European elm bark beetle (SEEBB), *Scolytus multistriatus* (Marsham) – one of the vector species of DED – has been found in Alberta on a recurring basis. These beetles have been trapped every year from 1994 to 2002 in Calgary and from 1995 to 2002 in Edmonton. In 2002, trap sites were established at 209 locations throughout the province. One SEEBB was trapped in Edmonton; one was trapped in Lloydminster and eight were trapped in Calgary in 2002.

The other vector of DED, the native elm bark beetle, *Hylurgopinus rufipes* Eichh. has not been trapped to date in Alberta.

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

2.9 Other Noteworthy Pests

Douglas fir beetle, *D. pseudotsugae* Hopkins, attacked trees around Jasper Townsite in Jasper National Park (Unger, Leo - pers. communication). Spruce beetle infestations were reported from Cypress Hills Provincial Park. These infestations are expected to rise with the spring storms that either blew down or sheared tops of many spruce trees in the park. The cottony psyllid, *Psylopis discrepans* (Flor.) attacked many black ash trees in Edmonton area. *Caloptillia flexinella*, a leafroller, damaged ash trees in Edmonton. Satin moth, *Leucoma salicis* (L.), populations declined in Edmonton and in surrounding areas. The gray willow leaf beetle, *Tricholochmaea decora* (Say) was abundant in the NE Region. The aspen leafroller, *Pseudexentera oregonana* (Walsingham) was found intermixed with large aspen tortrix in the NE Region. Red elm weevil *Magdalis armicollis* (Say) continued to damage elm trees in Lethbridge area. The white pine terminal weevil, *Pissodes strobi* (Peck), continues to be a problem in open-grown young forest stands in many areas in Alberta.

Dothiorella wilt caused by *Dothiorella ulmi* was confirmed on another 23 elms in Edmonton bringing the toll to-date to over 200 trees. Decay organisms caused heart rot, butt rot and root rot in overmature conifers in Cypress Hills Provincial Park. Hypoxylon canker caused by *Hypoxylon mammatum* (Wahl.) J.H. Miller was common in this park and in the parkland area. The lodgepole pine dwarf mistletoe, *Arceuthobium americanum* Nutt. is widespread in the jack pine and lodgepole pine stands of the province. Armillaria root disease, *Armillaria* spp., is also of common occurrence.

Drought conditions experienced in the spring stressed out many trees in Alberta. Both the urban areas and forested areas had trees with dieback and dicoloured foliage due to drought.

3.0 RESEARCH AND DEVELOPMENT

3.1 Field Trial on the Use of Verbenone to Protect Lodgepole Pine from the Pine Beetle

An anti-aggregation pheromone, Verbenone (Phero Tech Inc., BC), was used on a trial basis to protect the mature lodgepole pine from the mountain pine beetle attack. This pheromone was placed at the rate of 100 pouches per hectare in three one-hectare blocks close to an existing mountain pine beetle infestation in Banff National Park. The beetles did not attack any trees in the treated blocks but did attack ten trees in the untreated check blocks. This trial will be repeated in 2003.

Woodborer vs. Checking Damage in Fire-Killed Timber

Woodborers, particularly the white-spotted sawyer beetle (*Monochamus scutellatus* (Say), commonly attack fire-killed timber in Alberta. Following the large-scale 2002 spring fires in the province, a field trial was initiated in fire-killed white spruce stands to compare the impact of woodborer damage vs. damage due to checking. Three one-hectare blocks were chosen to represent areas with light, moderate and severe burn, respectively. Four plots were demarcated in each trial block. Half of the trees in each plot will be harvested this fall and the other half in the fall of 2003. Woodborer damage and checking damage will be assessed by sampling the trees and following up with the manifestation of this damage with the grading of lumber at the mill level.

4.0 REFERENCES

Kominek, C. 1999. Mountain pine beetle management guide. Alberta Environmental Protection, Forest Health Branch.

Ranasinghe, S.; Kominek, C. 1998. Spruce budworm management guide. Alberta Environmental Protection, Forest Health Branch.

Ranasinghe, S.; Kominek, C. 1999. Forest health aerial survey manual. Alberta Environment, Forest Health Branch.

Unger, Leo. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, 506 West Burnside Road, Victoria, B.C.

Pengelly, Ian, Parks Canada, Banff National Park, Banff, Alberta

Status of Forest Insect and Disease Conditions In Saskatchewan - 2002

Rory McIntosh, Robert Moore, John Thompson, Saskatchewan Environment, Prince Albert, Saskatchewan
Joe Meating, Paul Bolan and Mike Francis, BioForest Technologies Inc., Sault Ste. Marie, Ontario

ABSTRACT

The eastern spruce budworm *Choristoneura fumiferana* [Clemens] is the most significant insect pest in Saskatchewan's Boreal Forest. Since 1981, 3 million ha have been severely defoliated. In 2002, 40, 074 ha of severely defoliated forest was treated with *Bacillus thuringiensis* var. *kurstaki* (Foray 76B). Spray deposit using ADAM kits at all application rates was extremely high. On average, the 40% defoliation target was achieved in 2002. Research trials to test application rates of *Btk*. were conducted in 2002. In addition, an intensive study to determine the potential impact of *Btk*. on non-target songbirds was incorporated into the operational program. Forest tent caterpillar *Malacosoma disstria* (Hübner) populations were low and no areas of severe defoliation were detected in the aerial surveys over the provincial forest. Dutch elm disease (DED) *Ophiostoma novo-ulmi* Brasier continued to spread in the province, however, there were fewer trees removed and no infections were confirmed in new communities. In 2002, 819 infected elm trees were removed: 110 from communities and 709 from buffer zones.

Currently the legal authority for DED management is enforced under *The Pest Control Act.* In 2002, amendments were made to transfer the authority to *The Forest Resources Management Act.* The DED *Regulations* are currently being drafted. 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 were prepared and should be complete by 2003. In 2002, drought caused significant mortality in 2,916 ha of Jackpine plantations in the Nisbet forest in the Aspen Parkland EcoRegion. The 2002 aerial surveys detected 1,878 ha of Larch mortality attributed to increased infestations of the Larch bark beetle *Dendroctonus simplex.* Concerns around the potential spread of the Mountain pine beetle *Dendroctonus ponderosae* Hopkins, led to the province drafting a restriction order under the authority of *The Forest Resources Management Act* banning the import, transport or storage of any pine forest products with bark attached originating in British Columbia, Alberta, or the United States. Although one interception was made in Alberta, no restricted material was intercepted in Saskatchewan in 2002. In December, routine CFIA inspections revealed 9 Gypsy moth *Lymantria dispar* egg masses on a shipment of Christmas trees from Ontario. About 75% of the trees had been further distributed to communities in Saskatchewan and Alberta. Proper post-season disposal of Christmas trees was recommended. Yellowheaded spruce sawfly *Pikonema alaskensis*, activity appears to be increasing in young white spruce stands in provincial forests. Other forest insects of interest in the province include the spruce weevil *Pissodes strobi* and Jack pine budworm *Choristoneura pinus pinus* that are considered significant forest insect pests.

Le point sur les ravageurs et les maladies des arbres forestiers en Saskatchewan - 2002

Rory McIntosh, Robert Moore, John Thompson, Ministère de l'Environnement de la Saskatchewan, Prince Albert (Saskatchewan)
Joe Meating, Paul Bolan et Mike Francis, BioForest Technologies Inc. , Sault Ste. Marie (Ontario)

RÉSUMÉ

La tordeuse des bourgeons de l'épinette, *Choristoneura fumiferana* [Clemens], est le plus important insecte ravageur dans la forêt boréale de la Saskatchewan. Depuis 1981, 3,1 millions d'hectares ont été gravement défoliés. En 2002, 40 074 hectares de forêt gravement défoliée ont été traités avec le *Bacillus thuringiensis* var. *kurstaki* (Foray 76B). On a obtenu avec les trousses ADAM utilisées un dépôt de pulvérisation extrêmement élevé à tous les taux d'application. L'objectif de limiter la défoliation à 40 % a en moyenne été atteint en 2002. Des travaux de recherche visant à évaluer divers taux d'application du *B.t.k* ont été effectués en 2002. De plus, une vaste étude visant à déterminer l'impact potentiel du *B.t.k.* sur les oiseaux chanteurs a été menée dans le cadre du programme opérationnel. Les populations de livrée des forêts, *Malacosoma disstria* (Hübner), ont été faibles et on n'a détecté aucune zone gravement défoliée lors des relevés aériens du domaine forestier de la province. La maladie hollandaise de l'orme, causée par *Ophiostoma novo-ulmi* Brasier, a continué de se propager dans la province.

Cependant, aucun nouveau foyer d'infestation n'a été signalé en 2002, et le nombre d'arbres qui ont dû être abattus a diminué. En tout, 819 ormes infectés ont été abattus, soit 110 dans les collectivités et 709 dans les zones tampons. Auparavant, la gestion de la maladie hollandaise de l'orme relevait de la *Pest Control Act*, mais en 2002, la législation a été modifiée de sorte que la gestion de cette maladie relève désormais de la *Forest Resources Management Act*. Le règlement concernant la gestion de la maladie hollandaise de l'orme est en préparation. Le faux-gui du pin, causé par *Arceuthobium americanum*, se montre encore le plus important ennemi du pin gris. On procède à cet égard à une gestion fondée sur des mesures sylvicoles sanitaires. Des ébauches de normes et de recommandations provinciales ont été rédigées et devraient être finalisées d'ici 2003. En 2002, la sécheresse a entraîné une mortalité importante dans les plantations de pin gris de la forêt Nisbet, dans l'Écorégion de la tremblaie-parc. D'après les relevés aériens de 2002, la propagation du dendroctone du mélèze (*Dendroctonus simplex*) aurait causé la mort de l'espèce sur une superficie de 1 878 ha. Vu le risque de propagation du dendroctone du pin ponderosa, *Dendroctonus ponderosae* Hopkins, le gouvernement provincial a émis, en vertu de *The Forest Resources Management Act*, un arrêté interdisant l'importation, le transport et l'entreposage de tout produit de pinède avec écorce provenant de la Colombie-Britannique, de l'Alberta et des États-Unis. Une interception a été effectuée en Alberta, mais aucun produit visé par l'arrêté n'a été intercepté en Saskatchewan en 2002. En décembre, les inspecteurs de l'ACIA ont découvert, lors d'un contrôle régulier, 9 masses d'œufs de la spongieuse (*Lymantria dispar*) dans un chargement d'arbres de Noël en provenance d'Ontario. Environ 75 % du chargement avait été distribué dans plusieurs localités de Saskatchewan et d'Alberta. Des recommandations ont été émises quant aux précautions à prendre pour l'élimination de ces arbres après les Fêtes. Les ravages causés par la tenthrède à tête jaune de l'épinette (*Pikonema alaskensis*) semblent avoir augmenté dans les jeunes peuplements d'épinette blanche de la province. Deux autres insectes sont considérés comme d'importants ravageurs dans les forêts de la province; ce sont le charançon du pin blanc (*Pissodes strobi*) et la tordeuse du pin gris (*Choristoneura pinus pinus)*.

INTRODUCTION

The eastern spruce budworm *Choristoneura fumiferana* (Clemens) is the most significant pest of Saskatchewan's Boreal Forest. The outbreak began in the early 1980's and has been increasing since then. By the 2002 spray season, 3,020,962 ha of spruce and fir forests had sustained moderate or severe defoliation. In 2002, aerial surveys showed that moderate to severe defoliation increased significantly affecting some 669,591 ha of forest in the Prince Albert National Park area, north central and northeastern Saskatchewan (Figure 1). This was an increase of 230,708 ha above defoliation levels in 2001.

Aerial defoliation surveys in late summer and subsequent overwintering larval surveys conducted in the fall of 2001 indicate that spruce budworm (SBW) populations would likely remain high throughout most of the infested area and that host trees such as white spruce (*Picea glauca* (Moench) Voss.), upland black spruce (*Picea mariana* (Mill.) B.S.P.*)* and balsam fir (*Abies balsamea* (L.) Mill*.)* would continue to suffer moderate to severe levels of defoliation in 2002 (Figure 2).

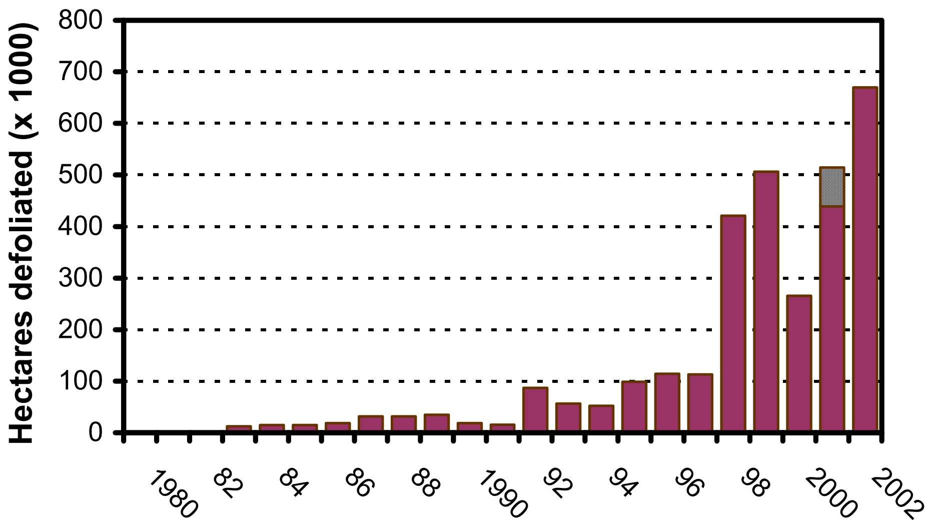


Figure 1. Area of moderate to severe defoliation caused by the spruce budworm *Choristoneura fumiferana* 1980-2002**.**

Saskatchewan Environment (SE) has conducted a successful foliage protection program against the SBW over the past six years. Forest stands within areas treated in previously years were generally in good overall condition compared to stands that had not received protection. Experimental spray areas were selected in the Creighton area to conduct an ecological study to determine the impact of the spray program on non-target songbirds, and areas around Big River were selected to test the efficacy of several new *Btk*. formulations.

Using historical SBW defoliation records, 2001 L2 forecasts, and forest management plans, SE developed an aerial spraying program to spray 40,074 hectares in 2002. 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%.

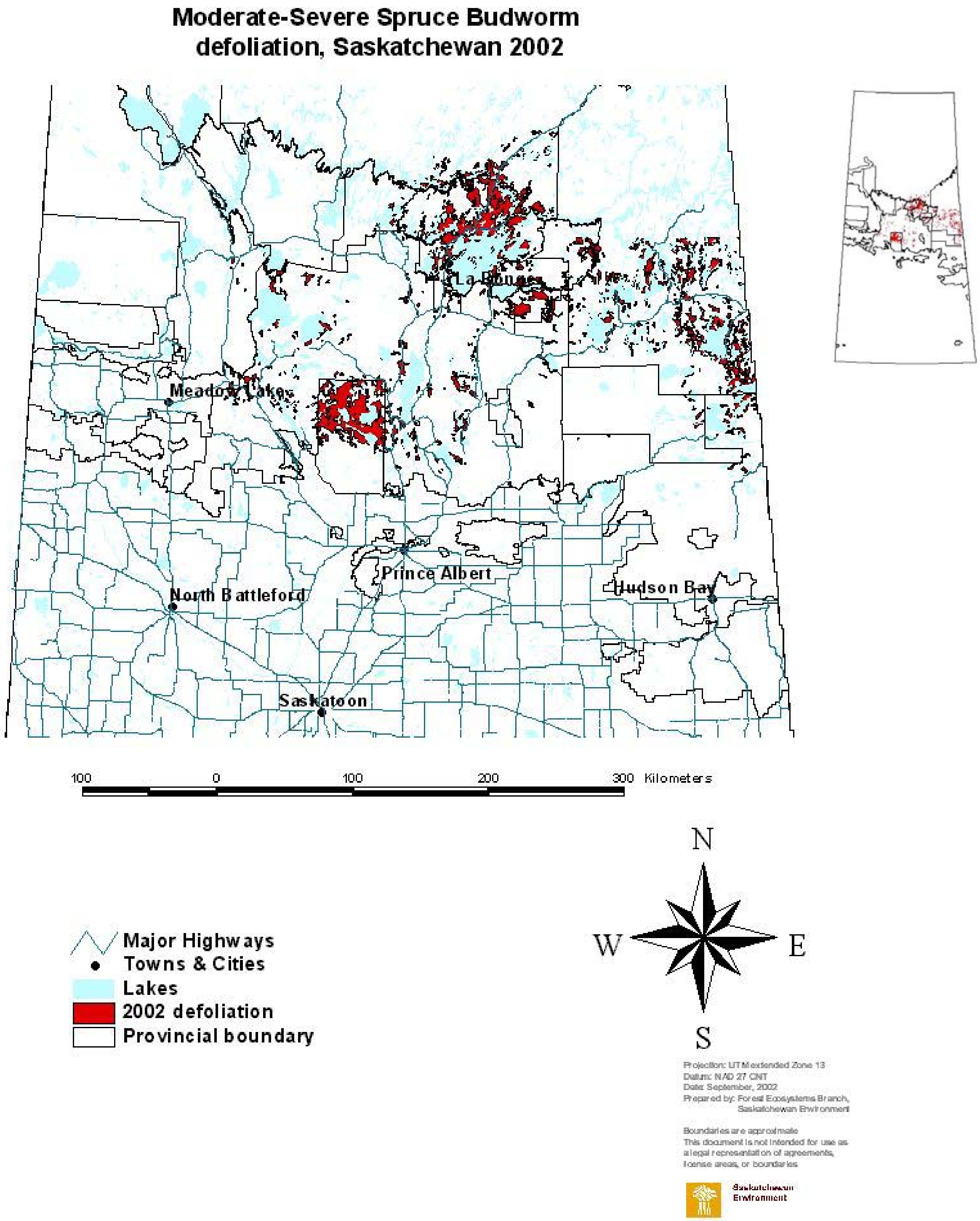


Figure 2. Geographic extent of moderate to severe spruce budworm *Choristoneura fumiferana* defoliation as determined through systematic aerial surveys conducted in Saskatchewan in 2002.

Methods

In 2002, SE conducted operational spraying over 40,074 hectares of moderate to severely defoliated white spruce and mixed-wood forest (Table 1). All operational spray blocks were treated with two or three applications of Foray 76B (Valent BioSciences) *Bacillus thuringiensis* var. *kurstaki* (*Btk*) with three to five days separating applications. The 2002 program comprised 3 components:
Standard operational blocks using 2 applications of Foray 76B @ 30BIU/1.5L/ha
Aggressive strategy using increasing dosages of Foray 76B
3 applications of 30BIU/1.5L/ha
2 applications of 50 BIU/2.5L/ha
Songbird research study blocks treated with 3 applications of Foray 76B @ 30BIU/1.5L/ha

The 2002 spray blocks were located in two main geographic areas: Amisk lake (operational blocks), while research blocks were located in the Big River area to the west of the Prince Albert National Park. The songbird research study was conducted in 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, 2002.

	Big River/Research blocks	**Amisk**
Airbase	Big River	Creighton/Bakers Narrows
Start date	June 14	June 15
Termination date	June 19	June 27
Area sprayed (ha)		
2 x 30 BIU		37,442
3 x 30 BIU		
Operational blocks		869
Bird blocks		484
2 x 50 BIU		1,279
Research Blocks	609	
Total Area sprayed (ha)	609	40,074

Aircraft

In total, 5 spray aircraft provided by Battlefords Airspray and Wetaskiwin Aerial Applicators Ltd. were used in the 2002 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 and Creighton airstrips. Because ground thaw created unsafe airstrip conditions at Creighton, the operational spray program was moved and operations run out of Bakers Narrows, Manitoba. One observer aircraft was used to monitor the operational treatments and one observer aircraft was used to monitor the research treatments.

Weather

From March 1, 2002, climate information was obtained from Atmospheric Environment Services, Environment Canada stations in Prince Albert, and Flin Flon Manitoba. Daily maximum and minimum temperatures were used to calculate degree-day estimates and monitor heat sum accumulation above 2.8°C. Accumulated heat sum was used to monitor conditions in the spray areas and aid timing and operational decisions. During the operational spray program, local weather data (temperature, relative humidity, wind speed and wind direction) was obtained from Saskatchewan Environments' Fire Management and Forest Protection Branch (FMFP) network of remote automated weather stations within or near treatment blocks.

Spray Timing

The 2002 SBW aerial spraying program was timed using indices of host and larval development. The Host Development Index (HDI) and Larval Development Index (LDI) were determined from samples collected regularly at 7 locations distributed throughout the spray area. On each sample date, SBW larvae (n=50) were collected from host white spruce to determine the LDI using the procedure described by Dorais and Kettela (1982). Binocular microscopes were used to measure head capsule width of all sample larvae to determine instar. The HDI was calculated from new shoot samples (n=120) collected from the mid-crown of six host trees. Spray operations were targeted to begin once LDI = 3.5 to 4.5 and HDI = 4.0 or higher.

Spray Deposit Monitoring

Spray deposit was assessed 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 59 white spruce trees. A total of 72 plots were assessed in the bird study blocks: 87 white spruce and 32 black spruce were sampled. All foliage samples were collected within 48 hours of application. All samples were stored at 4ºC until they could be processed in Prince Albert. Results were coded and a Deposit Index (DI), ranging from 1 (Nil) to 4 (high), was calculated for each sample. Mean Deposit index per block was used to rate and compare spray deposit within and between blocks. The following ADAM kit deposit categories were used:

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, 26 spray assessment plots (six white spruce per plot) were established in treatment blocks and another 24 plots in unsprayed control stands to assess the efficacy of the 2001 aerial spray program. In the bird blocks, 24 plots were established in unsprayed control areas. 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 June 15 to June 19 from each assessment block. Post-spray samples were collected between July 14 and July 18, on termination of spruce budworm feeding activity. All samples were stored at 4ºC until processed at the foliage mill in Prince Albert. To ensure quality assurance, (> 95%), 25% of the pre-spray branch samples were examined twice by different personnel. A correction factor was calculated and applied to the remaining branches.

Defoliation Assessment

Pre- and post-spray defoliation was assessed in all plots during the pre-spray (June 15-19,) and post-spray (July 14-18) collection periods. Defoliation was quantified on all sample trees in each sample plot using the detailed Fettes method (Fettes 1950).

RESEARCH

Bird Study

Each of the six treatment blocks was treated with three 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 AirTractor 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 5 days following each of the three subsequent spray treatments. Pre-spray recordings were completed June 12 and 13. All post-spray recordings were completed July 8, 2002. Bird calls were recorded digitally and stored to CD-ROM for later review by an experienced ornithologist.

Data Analysis:

Measures of species richness and diversity will be determined using the Simpson's diversity and the Shannon-Wiener Indices. Mean numbers of species and individuals calling pre- and post-spray in each of the two study areas will be compared. Differences between means will be analyzed using analysis of variance (ANOVA). Should there be no statistical difference between sites, all treatments will be pooled to increase the power of the test. In all cases $\alpha = 0.05$.

Pesticide Development ~ *Bacillus thuringiensis* var. *kurstaki* (*Btk*)

As part of an ongoing process, SE encourages and supports continued innovative Research and Development initiatives to further improve efficacy of pest management tools. In 2002, Valent BioSciences conducted research in the Big River area to test variable formulations of *Btk* in addition to testing different application methods, rates, and delivery strategies. Results of these trials are proprietary and will not be reported here.

RESULTS – OPERATIONAL SPRAY PROGRAM

Spray Timing

The cooler than normal temperatures experienced in Saskatchewan in 2002 delayed spruce budworm larval emergence and white spruce budbreak and shoot development. In 2001, the aerial spraying program in northeastern Saskatchewan was completed on June 10, four days earlier than the start of the 2002 program. In 2001, the HDI on white spruce in the Deschambault Lake area was around 4.0 on June 1. While in 2002, the HDI in the same general area did not reach 4.0 until around June 16.

This late start created some difficulties in timing the 2002 program. With the forecast of warmer temperatures in the latter part June, there was concern that budworm larval development would significantly outpace shoot development and result in heavy damage of relatively small-undeveloped shoots. Therefore, the decision was made to begin spraying on June 14 in the most advanced areas to reduce this risk. Most budworm larvae were in the 4^{th} and 5^{th} instar. Host development in the south end of Deschambault Lake was very close to optimum on June 14 and by the time the more northerly blocks in the program were treated with the first application, the HDI's exceeded 4.0. The LDI's ranged from 3.5 to 4.5. Black spruce development was approximately ten days behind white spruce development in the Meridian Creek plots (Figure 3).

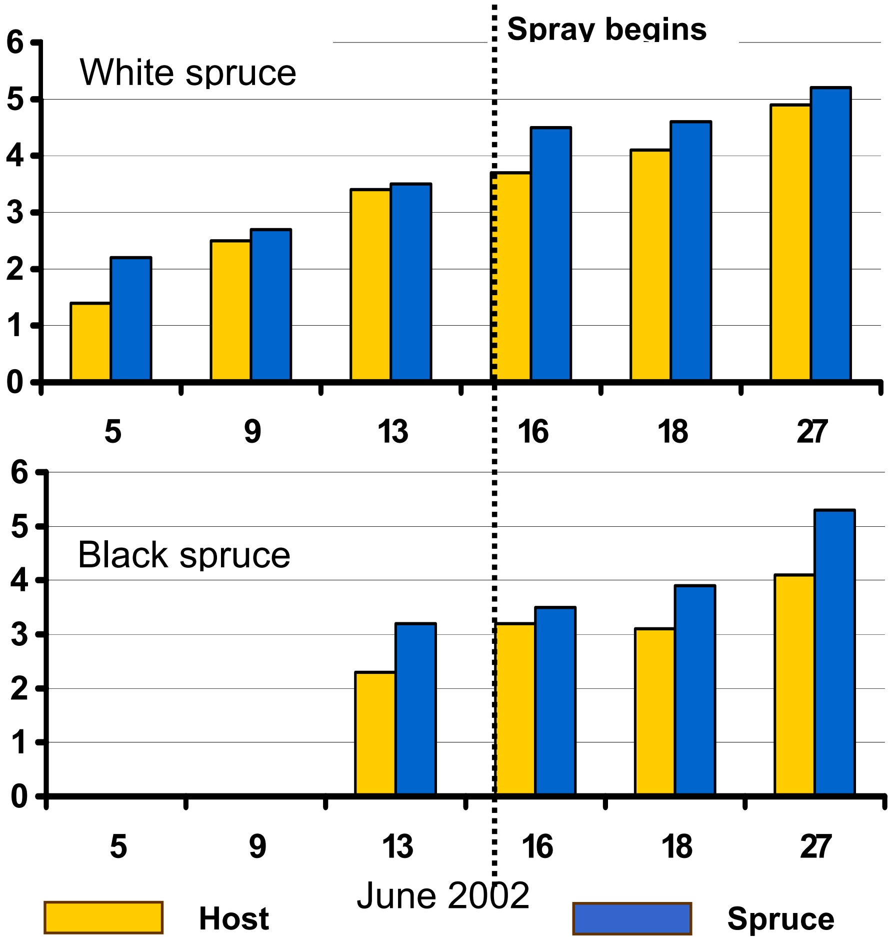


Figure 3. Spruce budworm (SDI) and host development indices (HDI) in black and white spruce in Amisk South area at Meridian Creek treated with Foray 76B in June 2002.

Spray Deposit

ADAM Kit results showed *Btk.* concentrations on the white spruce foliage was extremely high indicating excellent deposit at all application rates in all operational blocks (Figure 4). In the 2 x 30 BIU blocks deposit index averaged 3.5; in the triple application (3 x 30 BIU) and the 2 x 50 BIU blocks the deposit index averaged 3.7. In 2001, deposit indices were quite variable, ranging from 1.5 (moderate–low) to 3.3 (high), and averaging 2.2 (moderate). In contrast, in the 2002 operational program showed deposit indices ranging from 3.1-3.9 and averaged 3.7 out of a possible index of 4.0.

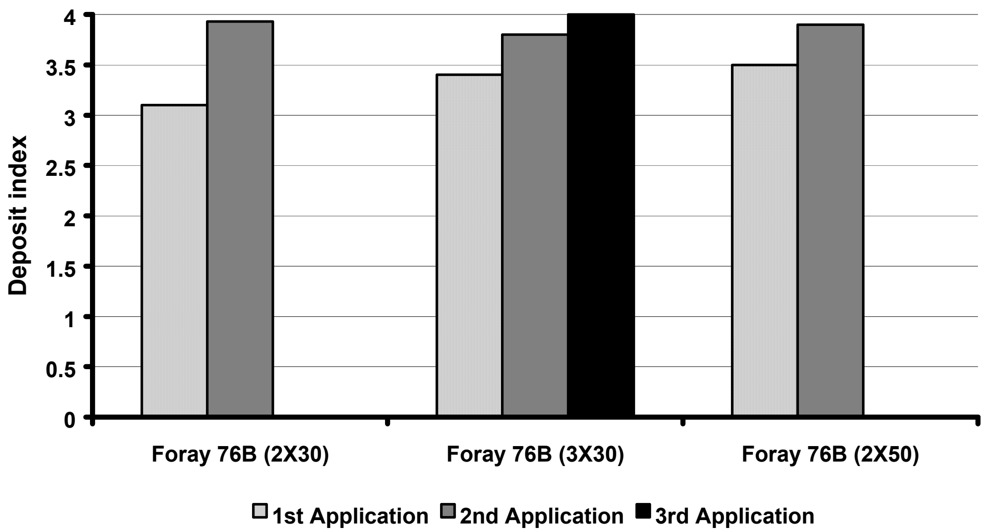


Figure 4. Deposit indices for Foray 76B, sprayed at three different rates, on white spruce foliage collected 1 to 4 days following treatment in Saskatchewan, 2001.

Spray Assessment

Spruce Budworm Populations

Pre-spray populations were highly variable within and between blocks. Population densities ranged from 6 to 167 larvae per branch. Overall, mean (±SD) pre-spray SBW population densities in the treated blocks were 37.9 (±22.6) larvae per branch. Pre-spray populations in the untreated controls were somewhat higher averaging 53.3 (±30.6). Pre-spray and post-spray population densities and white spruce defoliation rates are summarized in Table 2.

Almost 70% of trees sampled in the spray blocks had pre-spray population densities in the 1-20 and 21-40 density classes. The majority (47%) of samples were in the 21 to 40 larvae per branch class (Figure 5). Estimates of population reduction have4 been shown to be unreliable due to the high degree of intrinsic variation in larval populations, initial fitness and movement of late instar larvae. Thus, no attempt has been made to compare pre- and post-treatment populations

Table 2. Comparison of mean pre- and post-spray spruce budworm populations on white spruce in stands sprayed with Foray 76B at three different application rates as compared to controls in Saskatchewan, 2002 (SD = Standard deviation).

	Mean # spruce budworm per branch				
Treatment	n	Pre-spray	±SD	Post-spray	±SD
2 x 30BIU/1.5L/ha					
Block 204		43.5	22.6	12.1	8.5
Block 206		28.2	12.6	5.7	6.2
Block 207		34.4	18.4	2.3	2.3
Overall		35.5	19.3	7.7	7.7
3 x 30BIU/1.5L/ha					
Norton 2		49.3	35.6	7.5	6.1
Block 204		38.4	25.7	10.1	12.8
Block 206		31.8	20.3	4.5	4.5
Overall[1]		40.0	28.6	7.4	8.8
3 x 30BIU/1.5L/ha					
Norton 2		29.8	17.7	7.3	4.8
Block 204		45.2	22.2	11.5	7.7
Block 206		41.8	28.4	3.4	3.9
Overall[1]		38.8	23.7	6.5	6.5
Controls					
		53.3	30.6	2.6	2.8

1. Assessment plots for experimental spray projects included in this total.

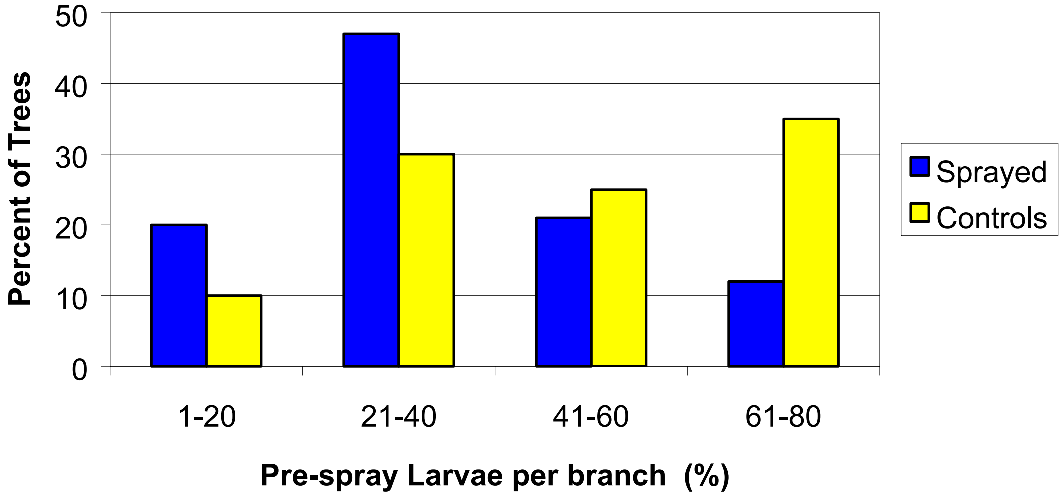


Figure 5. Frequency distribution of pre-spray spruce budworm larval populations, by density class, on white spruce in treatment and control plots in Saskatchewan 2002.

Foliage Protection

Defoliation rates in the spray blocks were significantly lower than in the unsprayed controls (*ANOVA*, $P = 0.05$) (Figure 6). White spruce defoliation averaged 34% in the 2 x 30BIU blocks, 52% in the 3 x 30BIU blocks, and 37% in the 2 x 50BIU blocks (Table 2; Figure 6). White spruce defoliation in the unsprayed controls averaged 96%.

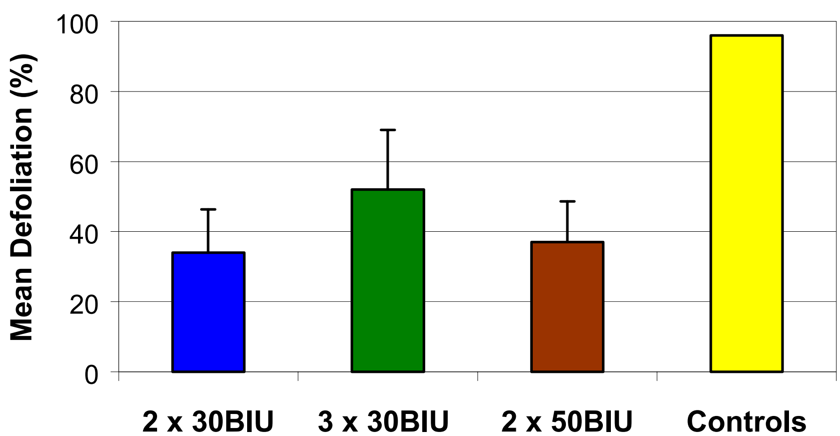


Figure 6. Average white spruce defoliation rates in blocks treated with Foray 76B (2 x 30BIU/1.5L/ha) in Saskatchewan, 2000 (all blocks and treatments).

Results – 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 good coverage in the spray blocks and high levels of deposit on the foliage. Of the 118 branch samples collected and processed, only two (1.7%) showed no *Btk* deposit. The DI's were consistently near 3.0 or greater on the white spruce samples (Blocks 1, 2, 3, 4, and 6) and were consistently near 3.0 on the black spruce foliage in Block 5 (Figure 7).

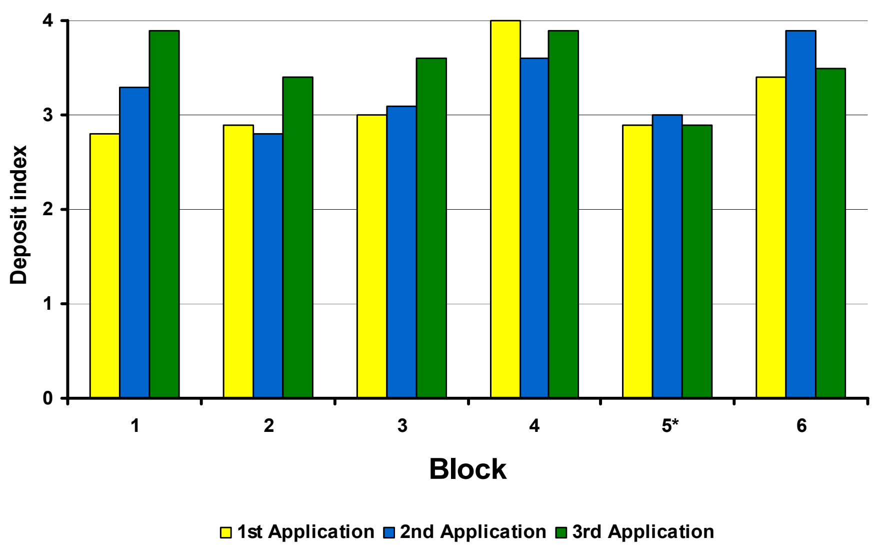


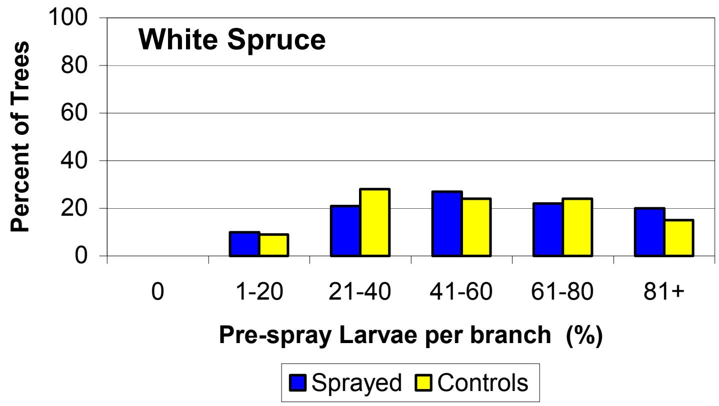
Figure 7. Bird Study: Average spray deposit indices for aerial applications of Foray 76B (3 x 30BIU/1.5L/ha) on white spruce (Blocks 1, 2, 3, 4 and 6) and on black spruce (Block 5) in Saskatchewan, 2002.

Spruce Budworm Populations: Bird Study Blocks

Overall, pre-spray spruce budworm populations on white spruce and black spruce averaged 58.5 (±33.9) and 17.5 (±15.2) larvae per branch respectively in the spray blocks. Pre-spray budworm populations in the control plots averaged 59.0 (±40.1) on white spruce and 21.3 (±12.4) on black spruce (Table 3). Frequency distributions of pre-spray budworm populations are presented on both white and black spruce in Figure 8. As in the other operational spray blocks, there was no apparent population reduction attributable to the treatments in the Bird Study blocks.

Table 3. Spruce budworm populations and host defoliation rates in the Bird Study blocks treated with three applications of Foray 76B (30BIU/1.5L/ha), 2002.

	Pre-spray budworm per branch	**SD**	**Post-spray budworm per branch**	**SD**	**Defoliation (%)**
White Spruce					
Block 1	57.6	23.5	3.6	2.9	75
Block 2	59.2	46.1	4.5	4.2	65
Block 3	59.7	35.2	3.5	3.0	78
Block 4	55.8	27.5	3.7	2.9	75
Block 6	61.4	36.7	2.9	3.6	72
Overall	58.5	33.9	3.7	3.3	73
wS Controls	59.0	40.1	4.2	4.2	93
Black Spruce					
Block 5	14.4	12.1	2.3	2.7	35
Block 6	25.7	19.9	1.6	1.8	29
Overall	17.5	15.2			33
bS Controls	21.3	12.4	7.1	3.2	69



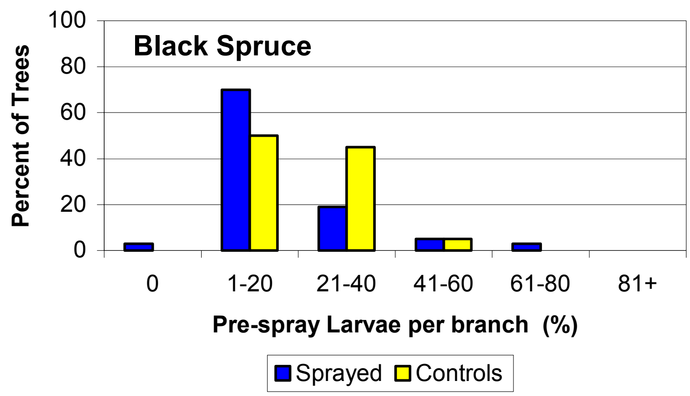


Figure 8. Frequency distribution of pre-spray spruce budworm population densities on white spruce and black spruce in blocks treated with three applications of Foray 76B (30BIU/1.5L/ha) in Saskatchewan, 2002.

Foliage Protection – Bird study blocks

White spruce 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.

SUMMARY OF SPRUCE BUDWORM OPERATIONAL SPRAY PROGRAM 2002

- Aerial surveys and overwintering L2 surveys conducted in 2001 showed increasing spruce budworm populations and defoliation in the northeastern portion of the province. Populations in the central part of the province had declined somewhat in portions of the commercial forest that had been treated in previous aerial spraying programs, but remained high in Prince Albert National Park. SE used the results of the aerial defoliation survey, overwintering population data, stand condition data and harvest schedules to block out some 40,074 hectares for inclusion in the spruce budworm protection program in 2002. This was the smallest operational program conducted in Saskatchewan in recent years.

- The 2002 aerial spraying program against the budworm included an environmental impact study to assess the impacts of *Btk* applications and subsequent budworm population reductions on songbirds that commonly feed on budworm. There was also an attempt to improve foliage protection by increasing the number of applications or dosage rates on several blocks. Results of the more aggressive applications using triple application of 30 BIU/1.5L/ha and double application of 50BIU/1.5L/ha did not reduce defoliation significantly over the double application of 30 BIU/1.5L/ha treatments. Defoliation in all treatment blocks was reduced significantly over controls.

- In 2002, spring temperatures were unusually cool in much of Canada. Degree-day accumulations in Saskatchewan were approximately 10 days behind the 30-year normal for the Prince Albert and Creighton areas and approximately 20 days behind development rates recorded in 2001. The cooler temperatures delayed spruce budworm emergence from the overwintering stage and delayed budbreak and shoot development on the white spruce host. Consequently, the 2002 aerial spraying program did not begin until June 14, several days later than the completion date of the 2001 program.

- Spray deposit for all applications appeared to be exceptionally good in 2002. Deposit indices averaged 3.1 and 3.9 for the first and second applications respectively in the operational blocks. Comments from crews monitoring on site weather conditions, airstrip staff and pilots indicated that weather conditions were optimum for spraying on most days.

- Overall, pre-spray budworm larval populations in Saskatchewan were similar to previous years, averaging 37.9 larvae per branch in the operational blocks (avg. = 38.4 in 2001). The highest count recorded in 2002 was 147 larvae per branch compared to 247 in 2001, but only about 12 percent of the samples had densities greater than 60 larvae per branch (>20 percent in 2001). Pre-spray budworm populations were considerably higher in the Bird Study blocks averaging 58.5 larvae per branch on white spruce. This may help explain the relatively poor levels of foliage protection observed in these blocks (avg. defoliation = 73%) compared to the operational spray blocks (avg. defoliation = 34%). As expected, budworm populations on black spruce in the Bird Study blocks were substantially lower than on white spruce, averaging 17.5 larvae per branch. Black spruce defoliation averaged 33 percent in the spray blocks and 69 percent in the controls. In all cases, defoliation rates in spray blocks were significantly lower than in the unsprayed control plots.

- On average, defoliation in the operational blocks was kept below the program target (40%) in 2002. Despite excellent levels of spray deposit, however, foliage protection was poor in the Bird Study blocks. This might be attributed to the fact that these blocks had not been sprayed before.

SPRUCE BUDWORM FORECAST FOR 2003

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 2002 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. In 2003, the operational spray program will likely be focused in the Big River and Creighton areas.

FOREST TENT CATERPILLAR *Malacosoma disstria* Hübner

INTRODUCTION


Photograph: R. McIntosh, SE

Outbreaks of the forest tent caterpillar *Malacosoma disstria* (FTC) occur about every ten years within the range of the preferred hosts (poplar, white birch, hard maple and species of oak). Trees are generally not killed during FTC outbreaks but volume losses can be significant. In Saskatchewan, there is a renewed interest in aspen as a commercially important species in the forest. Forest companies in some regions now implement active management of the aspen resource to fuel new Oriented Strand board (OSB mills). FTC is also a significant nuisance especially in provincial parks, campgrounds, and municipalities. Future economic initiatives, and the need to address safety and nuisance issues in the parks, will most likely result in increased interest in protection programs to minimize losses to pests such as the FTC in the future.

The 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 east along the Saskatchewan-Manitoba border. In 2000-2001, increased nuisance, reduced visitor days and concerns for public health and safety as a result of FTC associated mortality after severe repeated defoliation led to a decision to manage populations in the core areas in some of the provincial Parks. In 2001, BioForest Technologies Inc. was contracted by Saskatchewan Parks and Special Places Branch, to provide FTC management services in the core areas of Greenwater Lake and Duck Mountain Provincial Parks. BioForest provided timing and assessment services and coordinated a spray of 890 ha in these parks (McIntosh *et al.* 2001).

In 2002, FTC activity Duck Mountain Provincial Park was low and no further treatment was warranted. However, approximately 200 ha in the Greenwater Lake Provincial Park (Golf course and parts of the core area) were sprayed using *Btk*., (single application of Foray 76B at 30BIU/1.5L/ha, under a supplemental minor-use label). Populations continue to increase in the Good Spirit Provincial Park, which is located to the northwest of Yorkton in the southeastern part of the province near the Manitoba-Saskatchewan border. Egg mass surveys conducted by BioForest Technologies Inc., in the core area of the park led to the prediction that there would be significant FTC populations in 2003 (Table 4). BioForest Technologies recommended treating the core area with Foray 48B in 2003.

Table 4. 2003 FTC Defoliation Forecast Survey – Good Spirit Provincial Park based on Egg band surveys conducted by BioForest Technologies in fall 2002.

Location	Tree Species	Total Trees Sampled	Cumulative Egg Bands Per Location	2003 Defoliation[2.] Forecast	2003 Corrected Defoliation Forecast*
Park Gate House	tA[1.]	4	18	Severe	Severe
Park Maintenance Compound	tA	7	26	Severe	Severe
Boy Scout Camp	tA	4	25	Severe	Severe
Over Flow Campground Area 2	tA	10	15	Moderate	Moderate
Fish Cleaning Shelter	tA	10	22	Moderate to Severe	Moderate
Sandy Ridge Campground - Site 148	tA	6	31	Severe	Severe
Donald Gunn Subdivision End of Dogwood Drive	tA	4	17	Severe	Severe
Balsam Campground Site 121	tA	4	20	Severe	Severe
Gitko Lake Store	tA	6	23	Severe	Severe

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.

2002 SUMMARY AND PREDICTIONS FOR 2003

- Due to moderate to high populations of forest tent caterpillar in the Golf course and core area of the Greenwater Lake Park, an area of 200 ha was treated with Foray 76B (under a minor-use label). Population densities in Duck Mountain Provincial Park were low and did not warrant treatment.

- In the fall, SE Parks and Special Places Branch contracted BioForest Technologies Inc.; to conduct a FTC defoliation forecast survey of the core area at Good Spirit Provincial Park. The survey revealed egg mass densities which would result in severe defoliation for 2003

- In 2003, no further action is planned for Duck Mountain or Greenwater Provincial Parks; however, continued aggressive FTC management is anticipated in the core area of the Good Spirit Provincial Park.

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


Photograph: R. McIntosh, SE.

The Lodgepole pine Dwarf Mistletoe *Arceuthobium americanum* (DMT) is the most significant pest in Jack pine *Pinus banksiana* Lamb. forests in Saskatchewan. DMT is distributed throughout the boreal plains ecoregion. There are also extensive areas of severely infested Jack pine to the southeast of Lake Athabasca; however, this area is not within the operational forest land-base. Forest management practices, such as fire-suppression and selective logging have created conditions that expedite the spread of this parasitic plant. The most recent surveys were those conducted by the Forest Insect and Disease Survey (FIDS). As a result of these surveys, it was estimated that between 1984 and 1996 205,000 ha of Jack pine forest are severely infested resulting in an estimated 369,000 m3 lost to mortality (Brandt *et al* 1998).

The most significantly impacted areas are those found in the forest management zone in the Boreal Transition Ecoregion – in particular in the Canwood, Fort a la Corne and Nisbet Island forests (Figure 9). On June 28 2002, two lightning strikes started the Crutwell forest fire. This fire burned an area of approximately 9,000 ha, sanitizing a significant portion of the most severely infested Jack pine stands in the northern part of the Nisbet forest.

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

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

It is anticipated that by April 2003, 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 *Picea mariana* (Mill) B.S.P. and white spruce *P. glauca* and is found predominantly in the east-Boreal region in the Hudson Bay area. This species is considered, at the moment, to be of lesser economic significance.

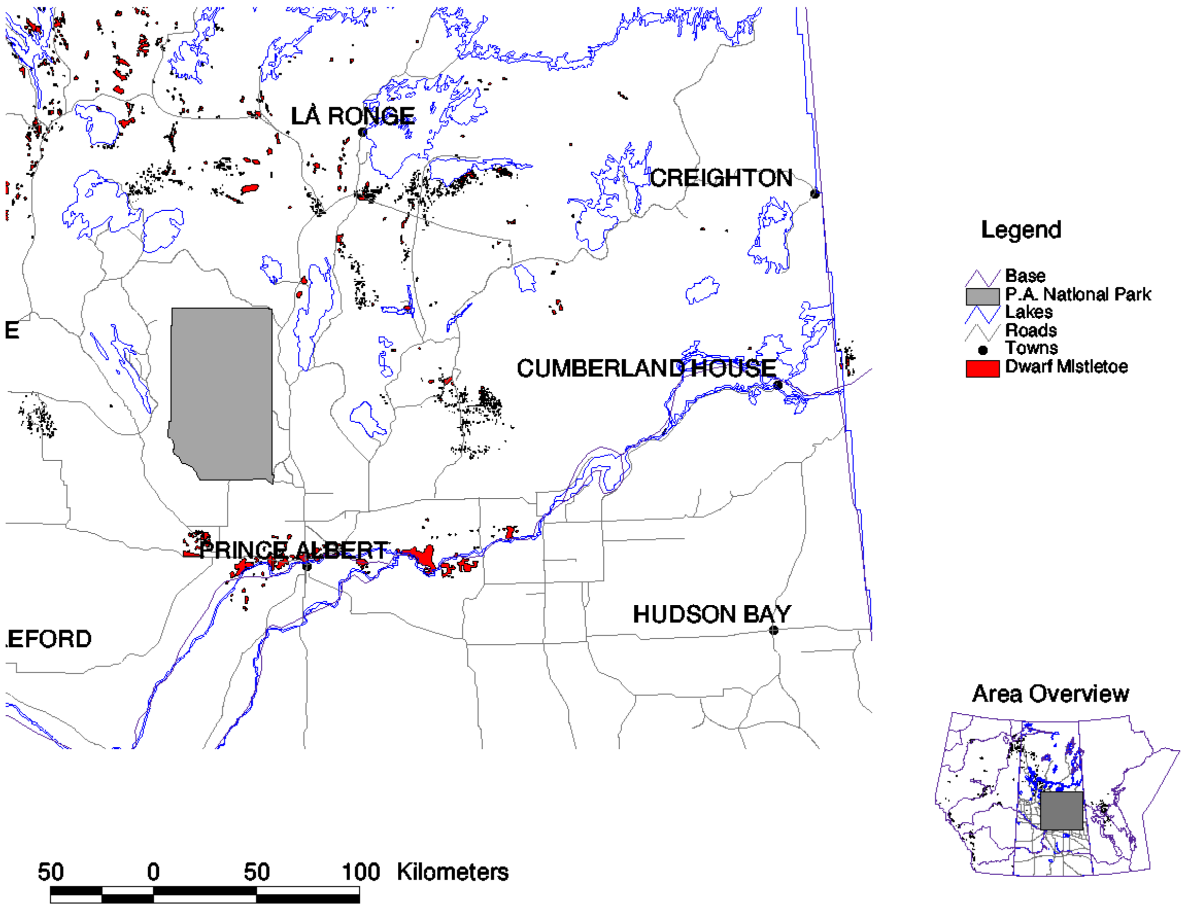


Figure 9. Distribution of severe mistletoe infestations in Jack Pine stands in Central Saskatchewan (Lat 53° - 56° N and Long 102° -108° W). Brandt *et al.* 1998.

DUTCH ELM DISEASE MANAGEMENT

Dutch elm disease (*Ophiostoma novo-ulmi* Brasier) (DED) was first confirmed in Regina, Saskatchewan in 1981. Since then, the disease has spread westward along the Red Deer and Carrot river valleys in the northeast and along the Qu'Appelle valley in the east and the Souris river in the southeastern corner of the province and now extends approximately 450 km westward throughout the southeastern portion of the province (Figure 10). Some communities and areas in the active DED zone include: Sherwood Forest, Tisdale, Moosomin, Estevan, Carnduff, Carlyle and Buffalo Pound Provincial Park. 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 (McIntosh *et al*. 2001). In 2002, no new communities were confirmed with DED.

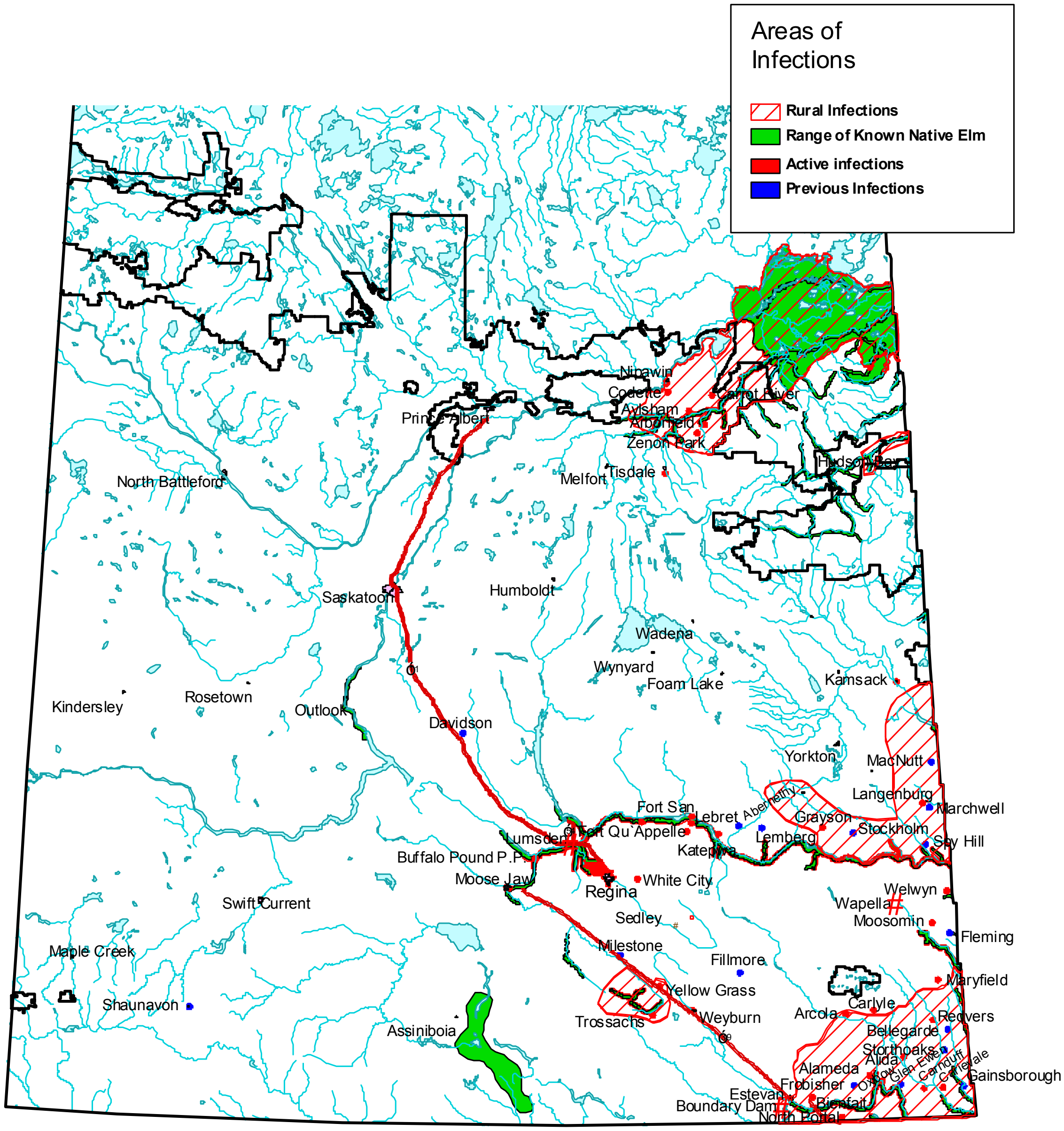


Figure 10. Extent of the spread of Dutch elm disease in Saskatchewan by 2002.

DED Management Program

In Saskatchewan, the Forest Ecosystems Branch (FEB) of Saskatchewan Environment (SE) administers DED management. Saskatchewan Agriculture, Food & Rural Revitalization (SAFRR), and the Saskatchewan Dutch Elm Dutch Elm Disease Association (SDEDA) work cooperatively with SE to facilitate the management of DED. In previous years, SE conducted all the DED surveillance, however, since 2000, DED surveillance has been contracted out to BioForest Technologies Inc.

The major components of the provincial DED management program include:

- **Legislation**- In 2002, DED Regulations are in the process of being transferred from the *Pest Control Act* to enable enforcement powers and administrative authority under the *Forest Resources Management Act*.
- **Public awareness and education -** Roadside signs; information leaflets; 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.
- **Cost-share communities -** program costs shared between 33 communities and SE (e.g. elm inventory, staff training, pruning, elm disposal site maintenance regeneration.). To qualify for the cost-share program, communities must have 400+ native Elm trees and 800 + residents.
- **Surveillance -** BioForest Technologies Inc. conduct 2 surveys (typically late June/ 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 have been established around large urban elm populations such as Regina, Estevan and Fort Qu`Appelle. In 2002, SE expanded the Regina Buffer in the Northwest to 15 km, expansion in the Northeast to continue in 2003. The buffer around the city of Moose Jaw extends 10-12 km toward Buffalo Pound Provincial Park.
- **Elm tree sanitation -** Removal of diseased and hazard elms in communities and buffer zones by SERM under contract.
- **Beetle trapping –** Traps were set out to monitor elm bark beetle populations in communities. In 2002, no Multilure™ baited traps were put out along the Saskatchewan/Alberta border to monitor for the smaller European bark beetle.
- **Basal trunk treatment –** Applications of Dursban to reduce elm bark beetle populations.
- **Reforestation** - Improve species diversity and age class distribution in the urban forest. An urban diversification program through Tree Canada Foundation was launched on May 12, 2000. Part of this initiative was the introduction of 1,000 Discovery Elm *Ulmus davidiana* var. *japonica* c.v Discovery elm, along with 25 other non-host species, for distribution among about

35 communities in Saskatchewan. Currently, this program is under review and in all likelihood will be discontinued.

- **Research -** A collaborative research initiative to elucidate the chemical ecology of the native elm bark beetle is in the preliminary phase of development. It is hoped that attractant and repellent formulations might be identified and developed to enhance monitoring and trapping programs. This research is ongoing as an M.Sc. project at Simon Fraser University and is supported by SE, SDEDA, PheroTech Inc. and an NSERC Industrial Postgraduate Scholarship

2002 Program Summary

In 2002, funding levels remained at $500,000. Although DED continues to spread through the province, no new communities were reported to be DED infected in 2002. Eradication efforts can be confirmed in 3 of the 6 communities (City of Moose Jaw, White city and Weyburn) where DED was reported for the first time in 2001. These communities were confirmed DED free in 2002. However, Grayson, Welwyn and Sedley cannot be confirmed DED free at this time because follow-up surveys were not conducted in these locations in 2002. The city of Saskatoon remains DED-free, however, in the City of Regina the number of DED positive trees almost doubled from 8 in 2001 to 14 in 2002. The number of trees removed in the Estevan and Regina Buffers increased in 2002. In total, 819 trees were removed. Of these, 110 trees were removed from municipalities and a further 709 were removed from buffers set up around Regina, Estevan, and Fort Qu'Appelle (Table 5). It should be noted that the removals from municipalities includes 67 trees that were removed from the town of Lumsden alone. Similarly, the increased number of removals in 2002 in the Regina buffer reflects the removal of 221 hazard trees in the Condie Reserve, which has now been incorporated in to the Regina Buffer expansion.

Dutch elm disease still continues to spread through the natural range of *U. americana* in the Rendek forest and along the little Red Deer River in the Boreal Lowland ecoregion.

Table 5. Total number of elm trees removed from Saskatchewan municipalities and buffer areas, 2001-2002.

	NO. OF ELMS REMOVED	
LOCATION	**2001**	**2002**
MUNICIPALITIES (DED; HAZARD) * Includes Lumsden 68 trees ** Includes Lumsden 67 trees	(115*; 5) 120	(110**) 110
BUFFERS		† Includes 221 removed from extended buffer
Regina	157	561†
Estevan	202	114
Fort Qu'Appelle	26	34
• **BUFFER TOTALS** In 2003, no further action is planned for Duck Mountain or Greenwater Provincial Parks; however, continued aggressive FTC management is anticipated in the core area of the Good Spirit Provincial Park.	**385**	**709**
TOTAL	**505**	**819**

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 Jackpine *Pinus banksiana* plantations were killed by drought (Figure 11). Many of these plantations were established in the two “island” forests: the Nisbet forest to the south west of Prince Albert and in the Fort a La Corne to the east of Prince Albert. The specific cause of the mortality is still under review. Mortality might be attributed to establishing tree cover on Chernozemic (prairie grassland) soil type which was characteristic to many of the affected areas; or differences in site preparation techniques; or a combination of the two.

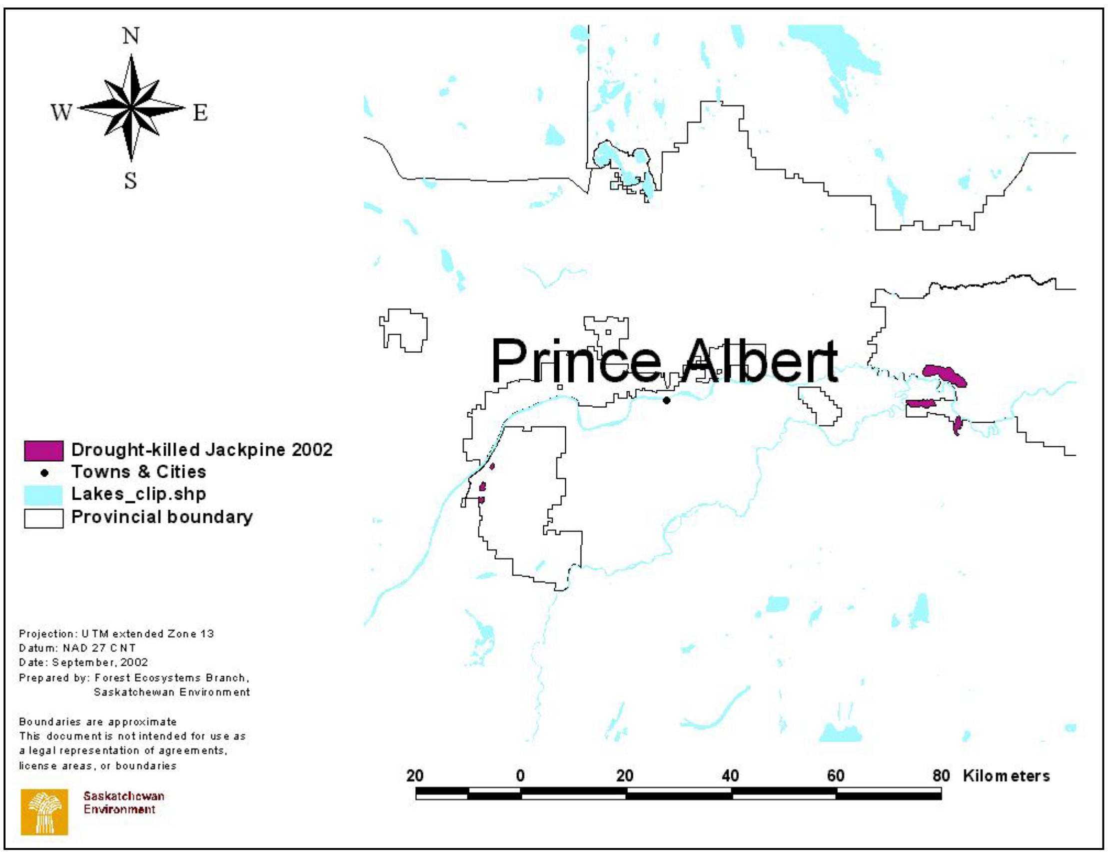


Figure 11. Geographic area affected by drought as detected in aerial surveys 2002. Areas most significantly affected are found in the Nisbet and Fort a la Corne Island forests.

LARCH BARK BEETLE - *Dendroctonus simplex* Hopkins

Mortality associated with increased levels of Larch bark beetle *Dendroctonus simplex* (LBB) activity were detected in the 2002 aerial surveys. In total 1,878 hectares of larch, *Larix laricina* (Du Roi) K. Koch have suffered mortality.

Currently, Larch is not considered a commercial species, however, there are initiatives to explore value-added opportunities and alternative forest products in Saskatchewan.

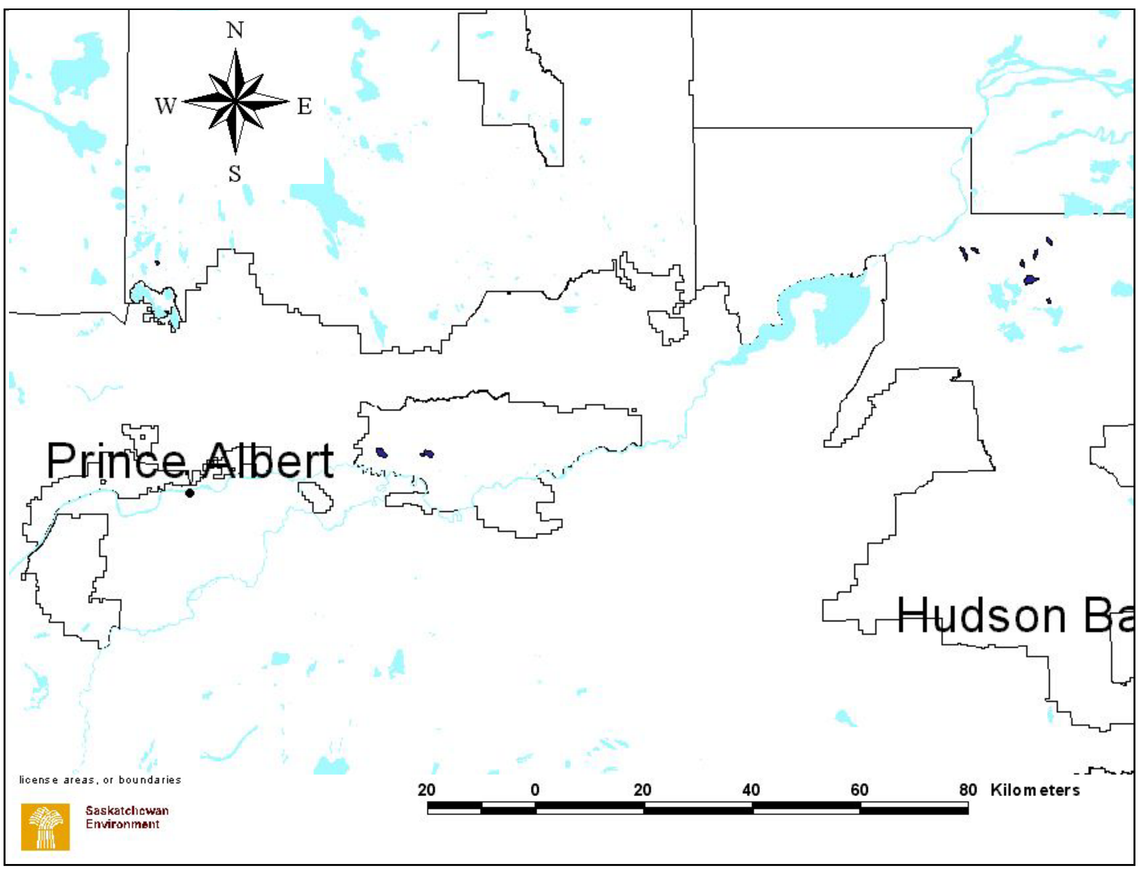
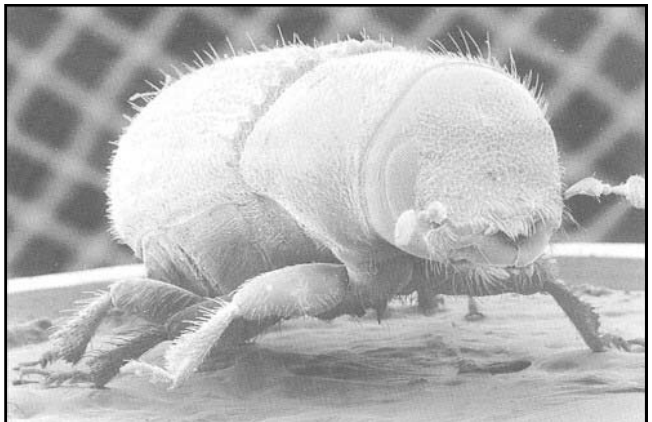


Figure 12. Geographic areas where stands of Larch mortality attributed to *D. simplex* were detected in 2002 aerial, and follow-up ground surveys.

EXOTICS PESTS AND PESTS NOT NATIVE TO BOREAL FOREST

MOUNTAIN PINE BEETLE - *Dendroctonus ponderosae* Hopkins


Photograph: Canadian Forestry Service

The mountain pine beetle *Dendroctonus ponderosae* (MPB) 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. 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).

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 2002, Pheromone baited Lindgren multiple funnel traps (Lindgren 1983) were deployed in the East Block area as an early detection system. Wet collection cups were used in 2002. Ground surveys are conducted to monitor trees around traps for evidence of MPB. All insects collected in traps are sent in to the Provincial Forest Insect and Disease specialist for identification. As of the time of preparation of this report, no mountain pine beetles have been found in the traps.

Currently, management includes silvicultural re-structuring of the most susceptible stands and increased monitoring. In 2002, forest health surveys have been developed to monitor the health of trees in the core area. These surveys will help in the early detection of MPB activity in the core area and allow for timely intervention.

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.

In response to the massive Mountain pine beetle (MPB) epidemic in BC, Larry Pedersen (BC. Chief Forester) increased the allowable cut in many regions (PG Region and Lakes) to reduce spread of the beetle and salvage MPB-killed trees. Salvage priority is aimed at freshly killed Lodgepole pine logs. As a result, a large supply of freshly-killed pine is flooding the market place. In addition, there is an emerging niche market opportunity for "Denim" (blue stained preferred) logs for specialty use such as log home construction. At this time, BC has no export permit/restriction system to control domestic movement of wood. Once timber is at log yard, the buyer is free to sell to any market.

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 truckloads transporting can't 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 and Linton 1982) and there is reasonable expectation that MPB might survive and pre-adapt in Jack pine in parts of the southern Boreal forest. The MPB range is gradually shifting Northwards (Jessie Logan, USDA; Allan Carrol, CFS) as regulation by extreme climate becomes less of a limiting factor in MPB survival.

The two main strategies are summarized in Table 6:

1) **Communications**. Prevention through increased education/information of risks and develop "market demand" for de-barked wood. If processors demand de-barked logs, the merchants will be forced to supply that demand.

2) **Regulatory**. 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.

Table 6. Summary of Saskatchewan's response to MPB threat.

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

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

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

In November 2002, Gypsy moth egg masses were discovered by CFIA inspectors on a shipment of approximately 4,400 Christmas trees imported from Ontario. In total, nine (9) egg masses were found in a subsample of 900 trees. The majority of the trees had been further distributed to destinations in Saskatchewan and Alberta. In Saskatchewan, the major centres included: Prince Albert, Saskatoon; and Swift Current along with smaller shipments to Humboldt and Tisdale.

Since further distribution and sale of trees had occurred, a communications strategy was initiated to inform the public. Key points included:

- Low threat of establishment in prairies
- CFIA regularly inspect Christmas trees
- Number of trees found was small
- No threat to human health and pets
- Proper tree disposal can eliminate the risk

Communications

Representatives from all affected municipalities together with SE and CFIA officials were included in the response team. The multi-jurisdictional team collaborated on all aspects of the response including communications and disposal strategies. Communications included media (TV and print) coverage and posting of information on the Saskatchewan Environment website. An article was published on December 18, 2002 in the Provincial Environmental Newsline[1] series for distribution to the local print media. In addition, CFIA published a seasonal fact sheet promoting participation in municipal tree disposal programs.

As a result of this incident, collaborating agencies were able to test Standard Operating Procedures (SOP's) for reporting and responding to non-native introduction of Insect pests. The protocols were developed as part of the Saskatchewan Environment's commitment to implement Environmental Management System and become certified ISO 14001 compliant.

Disposal/Sanitation

Proper disposal, as recommended by CFIA included chipping for mulch and composting or burning in municipal tree disposal programs. All affected municipalities used one or the other disposal method.

Moth Trapping

Each year CFIA set out pheromone-baited moth traps for detection purposes (Figure 13). In 2001, 151 traps were set up across the province. Only 3 adult moths were trapped in three of these traps. In 2002, with the assistance of CFS, 202 traps were set up in high-risk areas (i.e. campgrounds; transportation terminals and storage areas). In addition, grid trapping was set up within the ½ mile radius of positive trap catches from 2001. In total three insects were caught – 2 of those in a new area near Saskatoon and the third in the area east of Regina within the 2001 positive area.

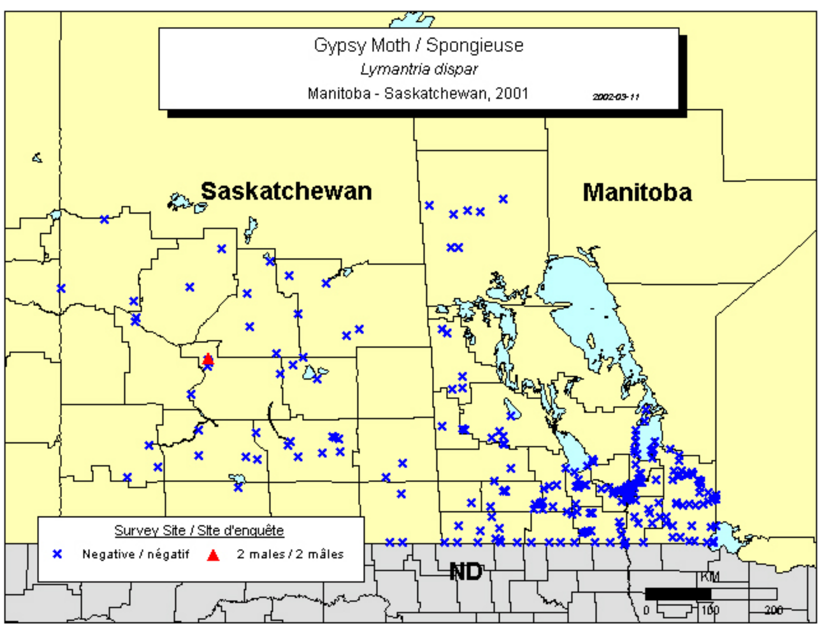


Figure 13. CFIA Gypsy moth trap locations (n=151) in Saskatchewan and Manitoba in 2001. Note, the third moth was trapped at a campground east of Regina (* on map)

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

*

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 and Torch river areas. Reports of damage by the Yellow headed spruce sawfly *Pikonema alaskensis* are on the increase in 2002. 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 woodboring 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 enhance the Forest Insect and Disease policies included in the existing Provincial Fire and Forest Insect and Disease Policy document. It is necessary to further develop and clearly define protocols to be followed when addressing all forest pest management issues and actions in Saskatchewan.
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 responding to introductions of non-native species, which might threaten Provincial forest ecosystems and economies. As part of the Environmental Monitoring System (ISO 14001), standard operating procedures have already been developed for reporting and verifying non-native species. This SOP has now been tested. In addition, a draft emergency preparedness plan has been developed to integrate multi-jurisdictional activities roles and responsibilities in the event of introductions of non-native speciesThere is a need to further review regulatory capacities to restrict the movement of pest species at regional, national, and international levels.

REFERENCES

Brandt, J.P., Amirault, P. 1994. Forest Insect and Disease-Caused Depletions to forests of West-Central Canada: 1982-87. Natural Resources Canada, Canadian Forest Service, Edmonton, Alberta. Information Report NOR-X-333. 28 pp.

Brandt, J.P., Brett, R.D., Knowles, K.R., Sproule, A. 1998. Distribution of severe dwarf mistletoe damage in west-central Canada. Natural Resources Canada, Canadian Forest Service, Edmonton, Alberta. Special Report. 27 pp.

Dorais, L. Kettela, E. 1982. A review of entomological survey and assessment techniques used in regional spruce budworm *Choristoneura fumiferana* (Clem.) surveys and in the assessment of operational spray programs. Report to the committee for the standardization of survey and assessment techniques to the eastern spruce budworm council. Quebec, PQ: Quebec Department of Energy and Resources; 1982. 43 pp.

Fettes, J.H. 1950. Investigations of sampling techniques for population studies of the spruce budworm on Balsam fir in Ontario. Annual Technical Report No. 14. Sault Ste. Marie, Ontario: Forest Insect Laboratory; 1950.

Hobson, K.A., Rempel, R. S., Greenwood, H., Turnbull, B. Van Wilgenburg, S.L. 2002. Acoustic surveys of birds using electronic recordings: new potential from an omnidirectional mocrophone system. *Wildlife Society Bulletin*, **30:**709-720.

Lindgren, B.S. (1983) A multiple funnel trap for scolytid beetles (Coleoptera). *The Canadian Entomologist,* **115:**299-302.

McIntosh, R., Thompson, J., Moore, R., Campbell, M., Meating, J., Bolan, P., Francis, M. 2001. *Status of Forest Insect and Disease conditions in Saskatchewan, 2000.* Internal Report. Forest Ecosystems Branch, Saskatchewan Environment and Resource Management, McIntosh Mall. 800 Central Avenue, Prince Albert, Saskatchewan. 18 pp.

Safranyik, L. and Linton, D. 1982. Survival and Development of Mountain Pine Beetle Broods in Jack pine bolts from Ontario. *Canadian Forest Service Research Notes,* **3(2):** 17-18.

Forest Pests in Manitoba – 2002

K. Knowles, Forest Health and Renewal, Forestry Branch, Manitoba Conservation, 200 Saulteaux Crescent, Winnipeg, Manitoba R3J 3W3

Contributors:
L. Christianson, R. Eagle, K. Knowles, J. Leferink, J. Ninkovic, I. Pines, J. Skuba

ABSTRACT

In 2002, 111,480 ha were infested by spruce budworm in Manitoba. The biosynthetic insecticide, Mimic® 240 LV (tebufenozide) was aerially applied to 17,538 ha in the Northwest Region and to 300 ha in Spruce Woods Provincial Forest. Within treatment areas, the population reduction ranged from 92% to 95% in the Northwest Region and from 73% to 82% in Spruce Woods. The insecticide application also provided good foliage protection. Defoliation reduction ranged from 52% to 69% in the spray blocks. 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 runs its own Dutch elm disease management program with the help of an annual grant from the Province. Manitoba Conservation DED removal crews removed 21,122 elm trees between April 1, 2001 and March 31, 2002. In addition, City of Winnipeg crews removed 6,454 elm trees, and the City of Brandon removed 355 trees. Provincial DED survey crews marked 13,703 trees for removal in 2002 and City of Winnipeg survey crews marked 6,005 elms for removal. Populations of jack pine budworm continue to be endemic throughout Manitoba's jack pine forests. However, adult male moth captures from pheromone traps continued to increase for the fourth consecutive year, suggesting populations may be on the rise.

Despite predictions for severe forest tent caterpillar defoliation, in southeastern Manitoba in 2002, defoliation was generally light. Cold wet weather, which occurred for a number of days during the larval hatching period, is believed to have caused widespread larval mortality. Severe defoliation occurred in some areas of western Manitoba. Damage from white pine weevil decreased for a second year in a white spruce family test plantation in western Manitoba. Collection of general forest health data during the Regeneration, Free to Grow and Pre-harvest surveys continued in 2002. Dwarf mistletoe has tended to be the major problem detected in Regeneration surveys, while root disease and mistletoe have been detected most frequently in Free to Grow surveys. Stem canker, root disease, spruce budworm and mistletoe were the major health concerns in the Pre-harvest Survey. Dwarf mistletoe was mapped over an area of 3,000 ha using a helicopter.

Three methods were employed to map the mistletoe: traditional sketch mapping, GeoExplorer 3 GPS unit, and a video camcorder (oblique view) combined with the Red Hen Video Mapping System. Both the GeoExplorer 3 and the video camcorder were able to capture significantly more of the mistletoe infestation than the traditional sketch mapping method. A multi-year study determined that pine stem canker mortality centres frequently occurred on old beach ridges

where there are alternating bands of course and finer materials, resulting from sorting by wave action. The mortality centres tended to follow the bands of course material deposits, where the moisture deficit was greater during extended droughts, enabling the causal fungus to cause cankers and tree mortality. Bronze leaf disease of poplar was suspected to be the cause of extensive browning throughout the crowns of tower poplar trees in late summer.

RÉSUMÉ

En 2002, 111 480 ha de forêt au Manitoba étaient infestés par la tordeuse des bourgeons de l'épinette. Des épandages aériens de l'insecticide biosynthétique Mimic® 240 LV (tébufénozide) ont été effectués contre ce ravageur sur 17 538 ha dans le nord-ouest de la province et sur 300 ha dans la forêt provinciale Spruce Woods. Comme suite à ce traitement, les effectifs du ravageur ont chuté de 92 % à 95 % dans le nord-ouest de la province et de 73 % à 82 % dans la forêt Spruce Woods. L'application de l'insecticide a également protégé le feuillage contre le ravageur. La défoliation a diminué de 52 % à 69 % dans les parcelles traitées. La maladie hollandaise de l'orme est répandue dans toute l'aire naturelle de l'orme d'Amérique au Manitoba. Le ministère de la Conservation du Manitoba a instauré un programme de lutte contre la maladie hollandaise de l'orme dans 38 collectivités, associées au programme par des ententes de partage des coûts, ainsi que dans une zone tampon autour de la ville de Winnipeg. La municipalité de Winnipeg gère son propre programme de lutte contre la maladie hollandaise de l'orme avec l'appui de subventions annuelles du gouvernement provincial. Le ministère de la Conservation du Manitoba a fait abattre 21 122 ormes entre le 1er avril 2001 et le 31 mars 2002, la municipalité de Winnipeg en a fait abattre 6 454 et la municipalité de Brandon, 355.

De plus, le personnel du Ministère a marqué 13 703 ormes atteints par la maladie et devant être abattus en 2002, et le personnel de la municipalité de Winnipeg en a marqué 6 005. La tordeuse du pin gris demeure endémique à la grandeur du Manitoba. Le nombre de mâles adultes pris dans les pièges à phéromones a augmenté pour la quatrième année consécutive, signe probable que l'effectif est en croissance. Contrairement aux prévisions, la défoliation par la livrée des forêts dans le sud-est de la province a été plutôt légère en 2002. On pense que les conditions météorologiques froides et pluvieuses qui ont marqué durant plusieurs jours la période d'éclosion des larves ont peut-être entraîné une forte mortalité larvaire. Certains secteurs de l'ouest du Manitoba ont par contre été gravement défolié. Les dégâts causés par le charançon du pin blanc ont diminué pour la deuxième année consécutive dans une plantation expérimentale d'épinettes blanches dans l'ouest du Manitoba. La collecte de données sur l'état général de santé des forêts s'est poursuivie en 2002. La principale menace pour la santé des peuplements en régénération est le faux-gui; pour les peuplements en pleine croissance, ce sont le pourridié des racines et le faux-gui; pour les peuplements mûrs, ce sont les chancres sur la tige, le pourridié des racines, la tordeuse des bourgeons de l'épinette et le faux-gui. La cartographie aérienne du faux-gui a été établie pour une superficie de 3 000 ha. Trois méthodes ont été employées : le croquis cartographique classique, un appareil GPS GeoExplorer 3 et un caméscope (vue oblique) associé à un appareil vidéo de présentation cartographique Red Hen. Les deux dernières méthodes se sont avérées plus efficaces que la méthode classique. Une étude pluriannuelle a permis d'observer que la mortalité due au chancre du pin est plus fréquente sur les crêtes de plages où les matériaux, triés par l'action des vagues, se sont déposés en bandes alternes d'éléments fins et d'éléments grossiers.

Les foyers de mortalité apparaissent surtout dans les bandes de matériaux grossiers, où le déficit hydrique est plus important en période de sécheresse prolongée, ce qui crée des conditions propices au développement du pathogène qui cause la maladie. On pense que la « maladie de la feuille bronzée » du peuplier serait à l'origine du brunissement d'une grande partie des cîmes de peupliers à la fin de l'été.

Spruce Budworm

In 2002 the spruce budworm, *Choristoneura fumiferana,* infestation continued in Manitoba. Moderate to severe defoliation occurred in the Northwest Region, Lake Winnipeg East area and in Spruce Woods Provincial Park and Forest in southwestern Manitoba. The total area of infestation in 2002 was 111,480 ha.

Based on the 2001 aerial defoliation survey and defoliation predictions derived from the 2001 egg mass surveys, an operational budworm suppression program was implemented in 2002 within the Tolko Industries Inc. Forest Management License Area (FMLA) in the Northwest Region. An experimental trial, which will monitor the rebounding of budworm populations in the treatment blocks, was conducted in the Spruce Woods Provincial Forest.

The biosynthetic insecticide, Mimic® 240 LV (tebufenozide) was aerially applied to 17,538 ha in the Northwest Region and to 300 ha in Spruce Woods Provincial Forest. In the Northwest Region, the spray program was carried out in the Bakers Narrows area (8,448 ha), File River/Sherridon area (7,845 ha), and Goose Lake area (1,245 ha). 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 4000 Micronair rotary atomizer nozzles. The insecticide applications were carried out on June 14 in Spruce Woods and from June 20 to June 24, 2002 in the Northwest Region.

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. When sampling, each plot consisted of five dominant or co-dominant white spruce or balsam fir trees. Sampling consisted of the removal of two 45-cm branch tips at mid-crown per tree to assess larval mortality.

The 2002 spray project was successful. Within treatment blocks the population reduction ranged from 92% to 95% in the Northwest Region (Table 1) and from 73% to 82% in Spruce Woods (Table 2). The insecticide application also provided good foliage protection. Defoliation reduction (expected defoliation - observed defoliation / expected defoliation x 100%) ranged from 52% to 69% in the spray blocks (Table 3).

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**
Bakers Narrows	8,448 ha	39	3	92%
File River/Sherridon	7,845 ha	17	1	94%
Goose lake	1,245 ha	70	3	95%
Untreated Control	N/A	35	8	77%

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

Table 2: Spruce Budworm (Spruce Woods) - Percent reduction in larval numbers

Spray Block[a]	**Area Treated**	**Pre Spray Larvae[b]**	**Post Spray Larvae/Pupae[b]**	**Larval Mortality**
Block 1	100 ha	55	15	73%
Block 2	100 ha	45	10	78%
Block 3	100 ha	43	8	82%
Untreated Control	N/A	63	25	59%

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

Table 3: Spruce Budworm (Northwest Region) - Defoliation Reduction

Spray Block	Pre Spray Larvae[a]	Expected Defoliation[b]	Observed Defoliation	Defoliation Reduction[c]
Bakers Narrows	39	73%	35%	52%
File River/Sherridon	17	38%	16%	58%
Goose lake	70	87%	27%	69%
Untreated Control	35	69%	60%	13%

a. Treatment: Mimic, 70 gram a.i./ha
b. Expected defoliation based on regression analysis of peak 3rd/4th larval densities and resulting defoliation from untreated sample plots (data from 1990 to 1998)
c. Defoliation Reduction = $\frac{\text{Expected - Observed}}{\text{Expected}} \times 100\%$

A survey was done during the month of August to assess this year's defoliation (Table 3) and to predict 2003 defoliation. Next year's predicted defoliation ranges from light to severe in the Northwest treatment blocks. Severe defoliation is predicted in the Northwest untreated control blocks (Table 4). There was a substantial decrease in egg mass densities between 2001 and 2002 in the File River/Sherridon spray block in the Northwest Region. Light defoliation is predicted for this block in 2003 (Table 4).

Table 4: Spruce Budworm (Northwest Region) - Net change in egg mass densities (2001 to 2002) and 2003 predictions

Spray Blocks[a]	2001 Egg Masses per 10 m^2	2002 Egg Masses per 10 m^2	Percent Change	2003 Defoliation Prediction[b]
Bakers Narrows	253	189	-25%	Severe
File River/Sherridon	111	33	-70%	Light
Goose Lake	N/A	59	N/A	Moderate
Untreated Control	340	234	-31%	Severe

a. Treatment: Mimic, 70 gram a.i./ha
b. Defoliation classes: 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

In Spruce Woods, despite the relatively high pre spray larval numbers, the defoliation for 2003 is predicted to be light in two spray blocks, suggesting significant population reduction had been achieved. Moderate defoliation is predicted for 2003 in one spray block and in the control block (Table 5).

Table 5: Spruce Budworm (Spruce Woods) - 2003 defoliation predictions

Spray Block[a]	Pre Spray Larvae	2002 Egg Masses per 10 m^2	2003 Defoliation Prediction[b]
Block 1	55	27	Light
Block 2	45	27	Light
Block 3	43	56	Moderate
Untreated Control	63	116	Moderate

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

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 FMLA and Nopiming Provincial Park) and Spruce Woods Provincial Park in southwestern Manitoba. Predictions for 2003 indicate a general decrease in the infestation in the Lake Winnipeg East area. Within this area, defoliation is expected to range from light at Falcon Lake to moderate at Dorothy Lake. Moderate defoliation is predicted in the Spruce Woods Provincial Park (Table 6).

Table 6: Defoliation and Predictions outside the Spray Project Area

Region	Location	2002 Defoliation[a]	Egg Masses per 10 m^2	2003 Defoliation Prediction[a]
Southwest	Spruce Woods Park	Severe	87	Moderate
Lake Winnipeg E.	Winnipeg River	Light	3	Light
Lake Winnipeg E.	Black River	Moderate	44	Moderate
Lake Winnipeg E.	Manigotagan	Moderate	38	Light
Nopiming Park	Bird Lake	Light	42	Moderate
Whiteshell Park	Dorothy Lake	Moderate	87	Moderate
Whiteshell Park	Falcon Lake	Light	2	Light

[a.] Defoliation classes: 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.

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 decreased by 18% in the Lake Winnipeg East area and increased by 21% in the Northwest Region (Table 7).

Table 7: Spruce Budworm Pheromone Trapping

Location	2001 Moth Capture/Trap	2002 Moth Capture/Trap	Percent Change
Northwest Region	1,094	1,322	+21%
Lake Winnipeg East	583	480	-18%

Dutch Elm Disease

The annual Manitoba Conservation Dutch elm disease (DED) surveillance program ran for approximately four months during the summer of 2002. This program covers 38 communities and the buffer zone area surrounding the city of Winnipeg. Winnipeg itself is not included as it runs its own Dutch elm disease management program with the help of an annual grant from the Province. Communities participate in the program based on 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, and 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, our only 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.

DED removal crews in Manitoba removed 21,122 elm trees between April 1, 2001 and March 31, 2002. Of this total, Provincial crews removed 14,313 elm trees; 6,050 of which came out of the Winnipeg buffer zone and the remainder from the cost sharing communities. In addition, City of Winnipeg crews removed 6,454 elm trees, and the City of Brandon removed 355 trees.

DED survey crews marked 13,703 trees for removal in the province in 2002. Of this total, 4,956 elms were marked by provincial DED surveyors within the Winnipeg buffer zone area and 3,628 in cost-sharing communities. In addition, the provincial crews identified 223 elm firewood piles. Winnipeg survey crews marked within the city 6,005 elms, of which 5,498 were diagnosed as having DED and the remainder (507) classified as hazards. They also issued a total of 84 firewood notices. Other major urban centres with DED include Brandon, Morden, Neepawa, Portage la Prairie, Selkirk, Steinbach and Winkler.

The major vector of Dutch elm disease in Manitoba is the native elm bark beetle (*Hylurgopinus rufipes*). The more aggressive smaller European elm bark beetle (*Scolytus multistriatus*) has been found in small numbers in the City of Winnipeg, since 1975. 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 the population and distribution of *S. multistriatus.* Two specimens were captured in rural Manitoba in 1989. None have been captured since then.

During the 2002 DED survey season, some trees that displayed symptoms of elm yellows disease, general yellowing throughout the entire crown with some dieback, were marked for removal in Brandon and Boissevain. These trees did not have the typical flagging symptoms of DED and yielded a negative result when cultured for DED. A fibrous root sample was collected from one of these trees in Brandon and sent for testing to Agdia Incorporated in Elkhart, Indiana. The sample tested negative for the presence of the elm yellows phytoplasma, using the Phytoplasma PCR Test.

Jack Pine Budworm

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

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

In 2002, the number of male moth captures, in Pherocon 1C traps, increased significantly throughout the province (Figure 1). Moth numbers rose in all twelve locations with a provincial average of 24 moths per trap. This is the fourth consecutive year where an increase in moth captures has occurred. Shilo and Wabowden again had the highest and lowest capture rate at 73 and 2 moths per trap, respectively. The Multipher traps captured the same number of moths as last year.

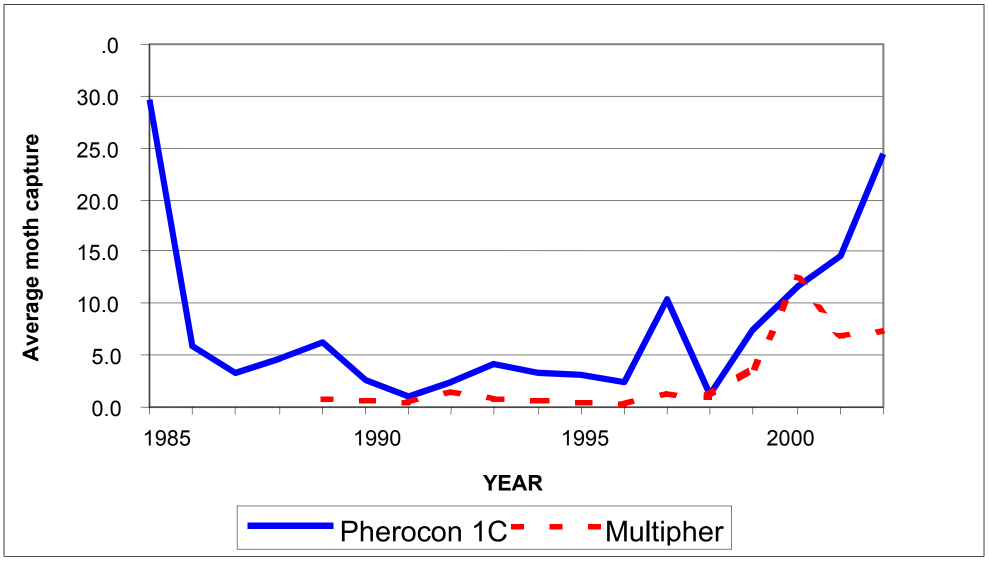


Figure 1: Annual average male jack pine budworm moth capture in two trap types for the 12 provincial locations**.**

Branch assessment for shoot defoliation and egg masses have been completed. Light defoliation was recorded on some of the sampled branches but no egg masses were found. The mean level of pollen cone buds for the province in 2002 was estimated at 23%. Since 1989, the annual average pollen cone level for all provincial sample plots has fluctuated between 23% to 86% 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 young, 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. To date, there has been little difference in moth captures or pollen cone bud levels between the young/dense and mature/open jack pine stands. In 2002, the male moth captures increased significantly for the 24 Sandilands plots averaging 60 moths per trap up from 20 moths per trap in 2001.

Severe defoliation was predicted for much of southeastern Manitoba in 2002. However, defoliation was generally light with only localized patches of severe defoliation occurring. The cold wet weather, which occurred for a number of days during the larval hatching period, is believed to have caused widespread larval mortality.

The only area of the Province that experienced widespread 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 in 2003. Light defoliation is predicted in southeastern Manitoba, Lake Winnipeg East, and the Interlake area. Moderate or severe defoliation is only predicted in the Rossburn, Roblin, and Assessippi Park areas of western Manitoba.

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 21.

In 2002, the fifth pest assessment was conducted in the 1987 Silvicultural RPA plots. These were in 27 plantations or 249 plots that included three tree species: white spruce, black spruce and red pine. Data entry and analysis is ongoing. Light levels of white pine weevil, eastern pine shoot borer, terminal weevil and spruce bud midge damage were recorded in the spruce plantations as well as some tree mortality from competition and beaver flooding.

Damage from white pine weevil decreased for a second year in a white spruce family test plantation in western Manitoba. One spring application of methoxychlor was conducted as well as pruning of infested terminals in mid-summer. A late spring and cold temperatures prevented a second pesticide application from being performed. Growth loss in terminals infested by white pine weevil was calculated. The average loss was approximately two years of growth or 60 cm. The current level of white pine weevil damage is 2% in the Tree Improvement site.

Integrated Forest Renewal Program - Pest Survey

a) Regeneration and Free To Grow Surveys

Collection of general forest health data on both softwoods and hardwoods during the Regeneration (Regen) and Free To Grow (FTG) Surveys continued. Problems causing tree mortality were the focus of the assessment and each pest was rated according to level of occurrence, from low to severe. Tree vigour, browse damage, and diseases were recorded in the Regen Survey while tree vigour; browse damage, insects, and diseases were recorded in the FTG Survey. As more than one pest problem could occur per plantation, a stand hazard rating was incorporated identifying the primary pest problem on site. Follow-up checks were conducted in plantations with serious problems to verify the pest and, if warranted, recommend a site prescription to manage the problem.

In 2002, four blocks were submitted with forest health concerns in the Regen Survey. One block had dwarf mistletoe as the primary pest problem and two had moderate browse damage on aspen. A follow-up survey was conducted on the fourth block but no mistletoe was found. Only one FTG stand was submitted in 2002 with a light level of dwarf mistletoe. The dwarf mistletoe volume loss model was conducted on several Regen blocks and the data will be processed this winter to determine whether sanitation and clean up of the diseased trees is warranted. Removal of dwarf mistletoe at an early age will reduce tree mortality and volume loss on site.

The last five years of data for the Regen and FTG blocks submitted with forest health concerns were compiled and graphed. Figures 2 and 3 illustrate the summarized results for these two surveys, respectively.

Figure 2: Major forest health concerns in Regen Survey Blocks from 1997 – 2001. (based on 3,700 ha from 99 blocks)

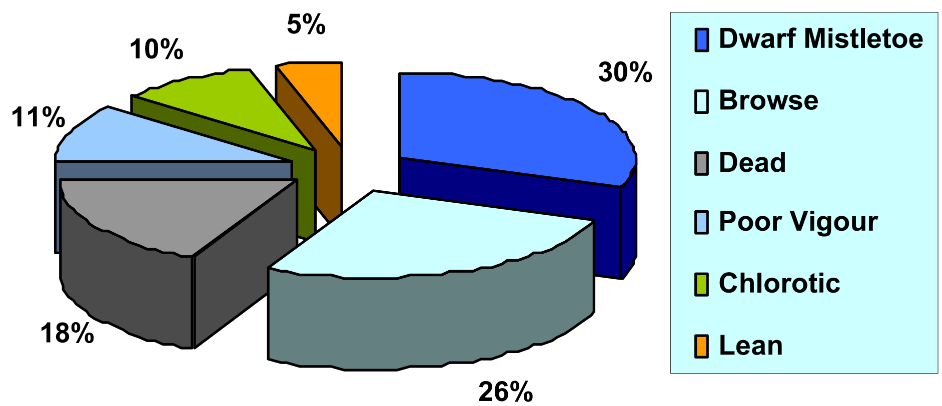
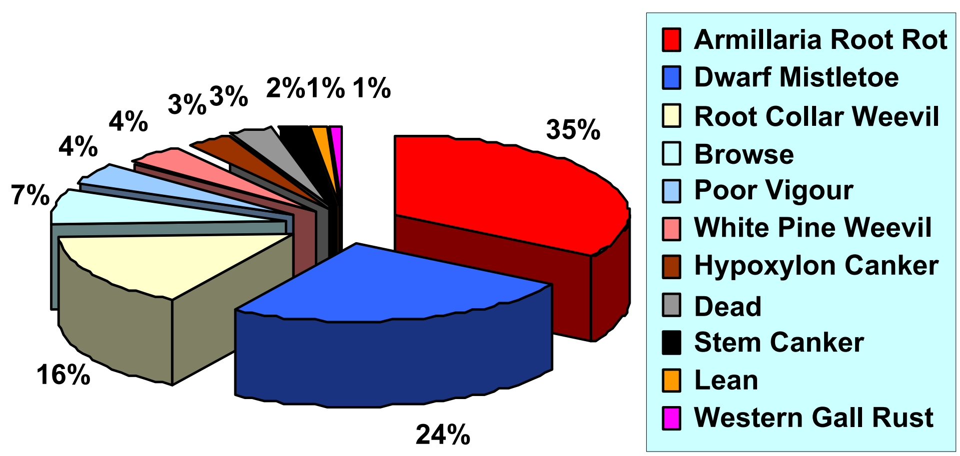


Figure 3: Major forest health concerns in FTG Survey Blocks from 1997 – 2001. (Based on 4,700 ha from 137 blocks)

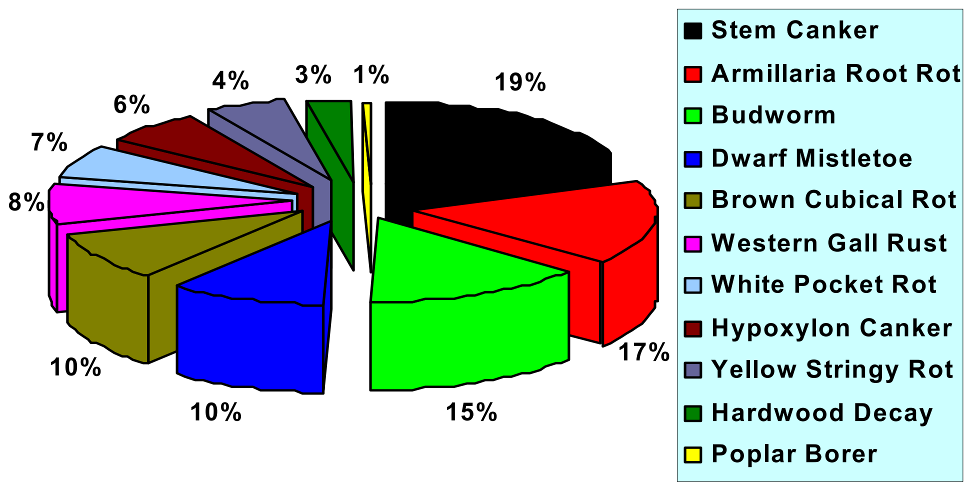


b) Pre-Harvest Survey

In the Pre-Harvest Surveys (PHS), forest health data was collected for a specific list of tree diseases plus damaging insects according to level of occurrence. Depending on the type and severity of pest, follow-up checks were conducted to verify and determine the inheritability of the pest on site. Again, as more than one pest problem could occur per stand, a stand hazard rating was utilized identifying the primary pest problem affecting the site. This year a large number of the PHS blocks submitted were inaccessible for a follow-up survey and only 11 blocks were checked.

A review of forest health concerns identified in the Pre-Harvest survey from 1998 to 2002 were compiled and graphed. Figure 4 illustrates the summarized results.

Figure 4: Major forest health concerns in PHS Blocks from 1998 - 2002.
(Based on 49,176 ha from 474 blocks)



As many of these insects and diseases can remain on site and affect the renewed plantation, specific site prescriptions and recommendations are suggested to modify harvesting plans and minimize pest impact. Additional long-term goals include linking the pest problems with certain geographic locations, site type and forestry practice.

Dwarf Mistletoe

Observation Point, on the east shore of Lake Winnipeg, is an area of approximately 3,000 ha that has significant dwarf mistletoe infestation in its black spruce forests. In order to determine the appropriate management approach, the impact of the mistletoe was to be assessed using the volume loss simulator model. The model, using the mistletoe distribution data, simulates the enlargement of disease infection centres as the forest ages. At ten-year intervals, the model provides outputs of the stand volume; volume lost to mistletoe at that point, the area requiring treatment to eliminate mistletoe from the stand and the stand volume at rotation age with and without treatment. The model provides the information necessary to make management decisions regarding timing and necessity of control measures and/or to harvest prematurely, when annual losses due to mistletoe exceed the annual increment. In order to obtain the mistletoe distribution data, the area had to be surveyed. Due to the size of the area, the survey was done from the air using a helicopter. Three methods were employed to map the mistletoe: traditional sketch mapping, GeoExplorer 3 GPS unit and a video camcorder (oblique view) combined with the Red

Hen Video Mapping System. Both the GeoExplorer 3 and the video camcorder were able to capture significantly more of the mistletoe infestation than the traditional sketch mapping method.

Pine Stem Canker

In the late 1980's, following a number of successive hot dry summers; severe stem cankering was detected in red and jack pine plantations in Sandilands Provincial Forest in southeastern Manitoba. The cankers caused girdling leading to top kill and tree mortality. In some areas large mortality centres developed. Three species of fungi, *Sphaeropsis sapine*a, *Aureobasidium pullulans* and *Ceratocystis minor*, were isolated from the cankers. Pine seedlings were inoculated with the three fungal cultures. The majority of seedlings inoculated with *S. sapinea* and *C. minor* were killed, suggesting either of these species, or both, could be causal agents of the stem cankers. Field inoculations were carried in May of 1991. Host tree reaction to the inoculations was only slight resinosis. The inoculated trees were monitored over a number of years. No canker development has occurred at the inoculation site. Throughout this period, there was little stress on tree growth, as precipitation had been above normal. It appeared that the causal fungus was opportunistic in nature, only capable of inducing severe stem cankers during periods of stress such as drought.

It was determined from air photos and subsequent field checks that the stem canker mortality centres frequently occurred on old beach ridges. On these ridges, there are alternating bands of course and finer materials, resulting from sorting by wave action. The mortality centres tended to follow the bands of course material deposits. On these very well drained sites, the moisture deficit, and therefore stress, was greater during the extended drought period, enabling the causal fungus to cause cankers and tree mortality.

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 was suspected to be 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.

Update on aspen health in western Canada
From the CIPHA study
(Climate Change Impacts on Productivity and Health of Aspen)

E.H. (Ted) Hogg and James P. Brandt, Canadian Forest Service, Natural Resources Canada, Northern Forestry Centre, 5320 - 122 St., Edmonton, Alberta, T6H 3S5 thogg@nrcan.gc.ca, jbrandt@nrcan.gc.ca

Bob Kochtubajda, Meteorological Service of Canada, Prairie and Northern Region, Environment Canada, 200 4999 - 98 Ave., Edmonton, Alberta, T6B 2X3, Bob.Kochtubajda@ec.gc.ca

ABSTRACT

Trembling aspen (*Populus tremuloides* Michx.) is the most important deciduous tree species in the Canadian boreal forest. In the early 1990s, dieback and reduced growth of aspen was noted in some areas of Saskatchewan and Alberta. Early studies suggested that drought, in combination with insect defoliation and fungal pathogens, played a major role. This led to concerns about the status of aspen health, including the question of how aspen may be responding to climatic warming that is already evident in western Canada. To address these concerns, we established a regional study (CIPHA) that includes annual forest health monitoring of 72 aspen stands in climatically sensitive areas across western Canada. Tree-ring analysis was conducted on 432 trees at these sites, and showed that regional aspen growth from 1950 to 2000 has undergone several periods of reduced growth and recovery, associated mainly with drought and outbreaks of forest tent caterpillar (*Malacosoma disstria* Hbn.). During 2001-2002, the region was affected by one of the most severe droughts on record. The 2002 forest health assessments show that the drought has not yet caused widespread aspen dieback within these stands. However, a preliminary analysis indicates an increase in the incidence of poplar borers in some parts of the drought-affected region. Continued monitoring will provide an early indication of any long-term impacts of this drought on the health of the aspen forests in this region.

Le point sur la santé des peupliers faux-trembles dans l'ouest du Canada – étude CIPHA (Impacts des changements climatiques sur la productivité et la santé des peupliers faux-trembles)

E.H. (Ted) Hogg et James P. Brandt, Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie du Nord, 5320 - 122 St., Edmonton (Alberta) T6H 3S5, thogg@nrcan.gc.ca jbrandt@nrcan.gc.ca

Bob Kochtubajda, Service météorologique du Canada, Région des Prairies et du Nord, Environnement Canada, 200 4999 - 98 Ave., Edmonton (Alberta) T6B 2X3, Bob.Kochtubajda@ec.gc.ca

RÉSUMÉ

Le peuplier faux-tremble (Populus tremuloides Michx.) est le feuillu le plus important dans la forêt boréale canadienne. Au début des années 1990, on avait signalé un dépérissement et une réduction de la croissance des peupliers faux-trembles dans certaines régions de la Saskatchewan et de l'Alberta. Les premières études à ce sujet laissaient penser que la sécheresse, associée à la défoliation par des insectes et à des maladies fongiques, avait joué un rôle important. Il en est découlé qu'on se pose aujourd'hui des questions quant à l'état de santé actuelle des peuplements de peupliers faux-trembles, concernant notamment la réaction de cette essence aux changements climatiques déjà sensibles dans l'ouest du Canada. Pour répondre à ces questions, nous avons lancé une étude régionale (CIPHA) qui comprend la surveillance annuelle de la santé des forêts touchant 72 peuplements de peupliers répartis dans diverses zones de l'ouest du Canada susceptibles d'être affectés par les changements climatiques. Les analyses des cernes de croissance effectuées sur 432 arbres de ces zones ont révélé l'existence de plusieurs périodes de croissance réduite et de rétablissement entre 1950 et 2000, associées principalement à des sécheresses et des infestations de livrée des forêts (Malacosoma disstria Hbn.). En 2001-2002, cette région du Canada a connu l'une des sécheresses les plus graves jamais enregistrées. Selon les évaluations de la santé des forêts réalisées en 2002, cette sécheresse n'a pas encore entraîné un dépérissement étendu des peupliers dans ces peuplements. Cependant, une analyse préliminaire indique un accroissement des populations d'insectes perceurs du bois dans certaines zones de la région touchée par la sécheresse. La surveillance continue pourra nous fournir une indication précoce de tout impact à long terme de cette sécheresse sur la santé des forêts de peupliers dans la région.

SESSION II –
DOMESTIC MOVEMENT OF NATIVE AND EXOTIC PESTS
Are we prepared?
How do we manage it?

Chair: Gerrit Van Raalte
Natural Resources Canada, Canadian Forest Service

SESSION II - SÉANCE II

SÉANCE II –
LE DÉPLACEMENT AU CANADA DES RAVAGEURS INDIGÈNES ET EXOTIQUES
Sommes-nous prêts?
Comment traitons-nous ce problème?

Président: Gerrit Van Raalte
Ressources Naturelles Canada, Service canadien des forêst

Regional Diversity Revisited: the Domestic Movement of Native and Exotic Pests

Leland M. Humble, Natural Resources Canada, Canadian Forest Service, Forest Health and Biodiversity Network, 506 West Burnside Road, Victoria, British Columbia, V8Z 1M5
Phone: 250-363-0644 Fax: 250-363-6005 or 363-0775 lhumble@pfc.forestry.ca

ABSTRACT

The introduction of non-indigenous species into forest ecosystems is an ongoing consequence of national and international trade. In the past decade, ten species of non-indigenous of bark and wood-boring beetles have been found in Canadian forests. Seven of the species were recorded for the first time in Canada and three species previously known to be occur in eastern North America were discovered for the first time in western Canada. Significantly, one of the latter three taxa is not exotic to Canada, but rather is native to eastern North America and is now firmly established in western Canada and the United States. Recent introductions, examples of significant regional diversity and pathways for domestic movement are briefly reviewed.

Nouveau point de vue sur la diversité régionale : le déplacement des espèces nuisibles indigènes et exotiques à l'échelle nationale

RÉSUMÉ

L'introduction d'espèces exotiques dans les écosystèmes forestiers est le résultat du commerce national et international, et le problème se perpétue encore aujourd'hui. Au cours de la dernière décennie, on a relevé la présence, dans les forêts du Canada, de dix espèces non indigènes de coléoptères creusant des galeries dans le bois ou l'écorce. Sept d'entre elles étaient signalées pour la première fois au Canada, et la présence des trois autres était déjà attestée dans l'est de l'Amérique du Nord, mais leur existence était constatée pour la première fois dans l'Ouest canadien. Le fait que l'une de ces trois dernières soit une espèce indigène de l'est de l'Amérique du Nord, et qu'elle se trouve maintenant solidement implantée dans l'Ouest canadien, est digne de mention. Les questions suivantes seront aussi brièvement abordées : espèces apparues récemment au Canada, exemples de diversité régionale notable et voies de déplacement à l'échelle nationale.
.

INTRODUCTION

The current outbreak of mountain pine beetle, *Dendroctonus ponderosae* LeConte has created large volumes of standing dead lodgepole pine across 1.5 million ha of central British Columbia. Recently, concerns have been raised regarding the risks posed by the transport of harvested mountain pine beetle (MPB) infested timber to jurisdictions outside of British Columbia and regulations have been developed to ensure that shipments of logs entering Alberta and Saskatchewan are free of MPB (ASRD Ministerial Order 2002a,b; Saskatchewan 1996). These concerns highlight the potential for the movement of exotic and/or native pest species with the transport of roundwood. As an introduction to potential pest problems associated with the long-distance transport of raw logs, differences in the regional diversity of the beetle fauna associated with wood and wood products are reviewed.

Regional differences in the distribution of bark- and wood-boring beetles

Canada has a large and diverse insect fauna. Danks (1979a) has estimated the total insect fauna to contain in excess of 54,000 species, of which about 30,000 species have been described. About 17% of this fauna (>6,700 described species and about 2,400 undescribed species) are beetles (Coleoptera). Regional diversity data for the beetle fauna associated with wood and wood products, the bark and ambrosia beetles (Scolytidae), flat-headed wood-boring beetles (Buprestidae) and longhorn wood-boring beetles (Cerambycidae) are reviewed to provide insights into the differences in their fauna across Canada.

The geographic ranges of the species included in these three phytophagous families in part parallel the distribution of their host plants in Canada. Danks (1979a) notes that species of several genera of Scolytidae feeding on the western conifers *Juniperus scopulorum, Chamaecyparis nootkatensis, Pinus contorta* and *Thuja plicata* are limited to the far western ranges of their host plants. Other species are restricted to the diverse deciduous flora of the Carolinian forests of eastern Canada. Atkinson et al. (1990) have suggested that climatic factors associated with natural dispersal barriers such as the deserts in the west of the continent have limited post glacial dispersal of xyleborine ambrosia beetles (Scolytidae) in North America. They hypothesize that the higher relative humidities coupled with the continuity of forests has favoured the dispersal of xyleborine ambrosia beetles into eastern North America, leading to a greater diversity of native species as well as a more diverse introduced fauna. The treeless central plains of the continent are also a significant natural barrier to the dispersal of many bark- and wood-boring species in North America. Absence of suitable host genera and species has precluded the natural dispersal of many native species across the continent. In Canada, transcontinental bark and wood-boring species tend to be associated with tree species of the boreal forest. For the purposes of this discussion, the distribution of the Canadian genera and species of the bark and wood-boring families will be classified into three somewhat artificial categories: 1. Transcontinental taxa; 2. taxa with a restricted cordilleran distribution (species occurring west of the Rocky Mountains); and taxa restricted to east of the Rocky Mountains (see Figure 1).

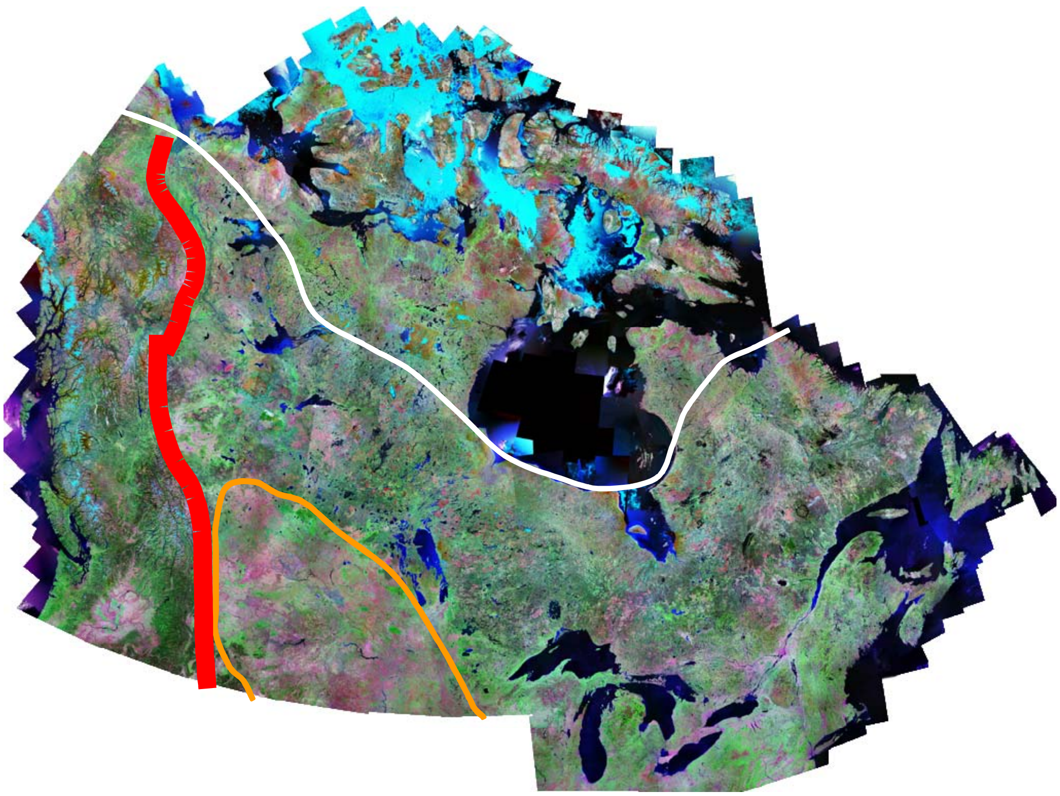


Figure 1. Geographic barriers to dispersal and the northern limit of trees in Canada. The cordilleran region is defined as the area west of the Rocky Mountains and their northern extension (denoted in red). The northern extent of the treeless great plains is denoted in brown and the northern limit of trees is denoted in white.

Table 1. The number of genera and species of wood-boring beetles known from Canada.

FAMILY	Canadian Taxa	
	General	Species
Scolytidae	45	204
Cerambycidae	141	302
Buprestidae	21	151

Table 2. The regional distribution of number of genera and species of bark- and wood-boring beetles recorded from Canada. For genera, both the total number of genera recorded and the number of genera (in brackets) restricted to a region are provided.

SCOLYTIDAE	Cordilleran Taxa		Transcontinental Taxa		Eastern Taxa	
	Genera[1]	Species	Genera[1]	Species	Genera[1]	Species
All hosts	27 (5)	78	29	69	25 (6)	57
Coniferous hosts[2]	17 (2)	51	19	41	13	17
Deciduous hosts	9 (3)	10	11	15	13 (6)	28
CERAMBYCIDAE						
All hosts	56 (23)	82	37	56	96 (66)	182
BUPRESTIDAE						
All hosts[3]	16 (5)	31	15	40	19 (2)	80
Coniferous hosts	7 (3)	18	5	13	4	19
Deciduous hosts	4	6	7	25	12 (6)	45

1 – as species restricted to a region or host group may be included in genera occurring in other regions or on other host types values in the "genera" column cannot be summed.
2 – numbers given exclude species of the genus *Pityophthorus* (the twig beetles) that normally would not be transported in wood or wood products
3 – numbers on coniferous hosts and deciduous hosts do not sum to equal the total on all hosts as some species feed on both coniferous and deciduous trees and others feed on neither.

There are 207 genera and 657 species of bark- and wood-boring beetles in the families Scolytidae, Buprestidae, and Cerambycidae known to occur in Canada (Table 1.) (Bright 1976; 1987; Bright and Skidmore 1997; Davies 1991; McNamara 1991a,b; Wood 1982, Wood and Bright 1992). The regional distribution for each family as well as that of the coniferous and deciduous feeding species of Scolytidae and Buprestidae are summarized in Table 2.

The proportion of the transcontinental or regionally restricted genera and species varies by family of wood-boring beetles and host type. In the Scolytidae, slightly more than one third of the species and 64% of the genera are transcontinental in Canada. Thirty-eight percent of the species of Scolytidae are restricted to the cordilleran and 30% are restricted to east of the Rocky Mountains. Coniferous feeding taxa dominate the species and genera of Scolytidae restricted to the cordilleran region, while deciduous feeding species predominate in the eastern taxa. Indeed, six of the deciduous feeding genera of Scolytidae present in Canada are found only in the Carolinian forests, while three deciduous-feeding and two coniferous-feeding genera are unique to the cordilleran region.

In the Cerambycidae, slightly more than 18% of the Canadian fauna have transcontinental ranges, 60% of the species are found only east of the Rocky Mountains, and 27% are restricted to the cordilleran region. Almost half of the genera (47%) of Cerambycidae occur only in eastern Canada, while only 16% of the Canadian genera are restricted to the cordilleran region. Again, the diversity of genera and species of Cerambycidae in eastern Canada appears to be associated with the diversity of deciduous species in the Carolinian forests although complete data on the host ranges of the Cerambycidae has not been compiled.

More than half (53%) of all species of Buprestidae occurring in Canada are found east of the Rocky Mountains, 26% are transcontinental in distribution and only 21% are restricted to the western cordilleran region. All six of the genera and 56% of the species unique to the east utilize deciduous hosts while the three genera and 58% of the species restricted to the cordilleran region are associated with coniferous hosts

This cursory analysis documents the significant differences in regional diversity of species in the major beetle families developing under bark or within wood of deciduous and coniferous trees. These regional differences result in part from differences in the regional flora as well as from post-glacial evolution of the beetle fauna. While ecological factors such as climatic requirements contributing to the faunal differences are ignored in this overview, one can infer that there is a potential for redistribution of regionally unique species of bark and wood-boring beetles with the movement of untreated wood and wood products.

Re-distribution of native bark- and wood-boring beetles

Recent research has documented the re-distribution of some species of Scolytidae to areas beyond their natural ranges in North America. Mudge et al. (2001) have documented the occurrence in Oregon of the eastern ambrosia beetle, *Gnathotrichus materiarius* (Fitch), a species that ranges as far west as Great Slave Lake in the boreal forest of Canada (Bright 1976). A second eastern North American ambrosia beetle, *Xyloterinus politus* (Say), whose natural range lies east of Manitoba (Bright 1976), has established in coastal British Columbia (Humble 2001) as well as the adjacent United States (Mudge et al. 2001). Transfer of native species has also been documented from west to east. Seybold (pers. comm.) has documented the occurrence of Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopkins, a species that does not naturally occur east of the Rocky Mountains (Bright 1976, Wood 1982), in Minnesota where it has established on larch.

Re-distribution of non-indigenous bark- and wood-boring beetles

Over the past decade, an ever-increasing number of non-indigenous bark- and wood-boring beetles have been discovered to establish in Canada and the adjacent regions of the United States (Table 3). While the majority of the established species have been Scolytidae, species of both the Cerambycidae and Buprestidae have also been discovered. Included in these introductions are damaging forest pests such as: the pine shoot beetle, *Tomicus piniperda* (Linnaeus); the brown spruce longhorn beetle, *Tetropium fuscum* (Fabricius); and the emerald ash borer, *Agrilus planipennis* Fairmaire. At least five of the species noted in Table 3 are present in both eastern and western North America. Two of the species recently discovered in British Columbia, *Xylosandrus germanus* (Blandford) and *Phymatodes testaceus* (Linnaeus) have been present for many decades in eastern North America (Hoffman 1941; Linsley 1964). The remaining western species have all been discovered in the past decade, as have those same species, which also occur in eastern North America. It is unclear whether the populations of non-indigenous species present in both eastern and western North America (e.g. *Xyleborinus alni* (Niisima), *Xyleborus pfeili* (Ratzeburg), *X. germanus*, *P. testaceus* and *Trypodendron domesticum* (Linnaeus.)) have resulted from multiple introductions from offshore to the different regions of the continent or whether their occurrence in some regions may result from the redistribution of naturalized populations from other parts of the continent through the movement of untreated wood and wood products.

Table 3. Examples of recently discovered non-indigenous Scolytidae, Cerambycidae and Buprestidae in Canada and adjacent regions of the United States. The single letters in brackets after species names denote family assignments: B – Buprestidae; C – Cerambycidae; and S – Scolytidae.

Western North America		Eastern North America	
Trypodendron domesticum (S)	BC	*Agrilus planipennis* (B)	ON
Xyleborinus alni (S)	BC, OR	*Hylurgops palliatus* (S)	ne US
Xyleborus pfeili (S)	BC, OR	*Hylurgus ligniperda* (S)	ne US
Xylosandrus germanus (S)	BC	*Trypodendron domesticum* (S)	PE
Xyloterinus politus (S)	BC, OR	*Tetropium fuscum* (C)	NS
Phymatodes testaceus (C)	BC	*Tomicus piniperda* (S)	ON, PQ
Buprestis haemorrhoidalis (B)	BC	*Hylastes opacus* (S)	ON, PQ
		Xyleborinus alni (S)	ON
		Xyleborus pfeili (S)	ne US
		Xylosandrus germanus (S)	ON
		Xyloterinus politus (S)	**native**
		Phymatodes testaceus (C)	ON, PQ

Pathways for domestic movement of bark and wood-boring beetles

The primary pathway of current concern relating to mountain pine beetle is the inter-provincial movement of raw saw logs for the lumber sector. Raw logs with bark on provide opportunities for the domestic movement of species that feed primarily on phloem tissues (e.g. bark beetles and many metallic wood-boring species) as well as those species which develop or overwinter within the wood (ambrosia beetles, metallic wood-boring beetles, long-horned wood-boring beetles and woodwasps (Hymenoptera: Siricidae). Inter-provincial movements of raw logs for the manufacture of log homes or specialty products such as utility poles are also potential pathways. In addition, one cannot ignore inter-provincial trade in firewood as well as cut or potted Christmas trees or live trees as potential pathways for the redistribution of exotic or native species. The inadvertent movement of species to new areas in live ornamental plants has also been documented (e.g. transport of *Callidiellum rufipenne* (Motschulsky) in cedar hedging). Finally, the use of untreated wood in the packaging or pallets used to ship commodities provides another pathway for the movement of native and exotic bark and wood-boring species (Allen and Humble 2002).

Conclusion

There are marked regional differences in the composition of both the native and non-indigenous bark- and wood-boring beetle fauna associated with both deciduous and coniferous trees across Canada. While science-based risk assessment methodology is used to quantify the risk posed by non-native species and regulatory procedures are developed to prevent the accidental transport of those non-indigenous species deemed to be of quarantine concern (e.g. *Tomicus piniperda, Tetropium fuscum*) across international borders, and to some extent within the boundaries of Canada, no such procedures are used to identify and regulate the movement of either other naturalized non-indigenous species or native pest species with the domestic movement of wood and wood products. Recent examples of the inadvertent movement of native species from west to east or vice versa demonstrate that such re-distributions can occur. The concerns raised by the potential for re-distribution of mountain pine beetle, *D. ponderosae*, with logs exported from areas of British Columbia heavily impacted by the current outbreak emphasize the need for an objective evaluation of the risks posed by the redistribution of native bark- and wood-boring species to areas outside of their native ranges and an evaluation of the potential pathways.

References

Alberta Sustainable Resource Development. 2002a. Forests Act Ministerial Order 25/2002 Prohibition of transportation within Alberta of certain forest products. **http://www3.gov.ab.ca/srd/forests/health/pdf/ministerialorder25.pdf** viewed 10 March 2003.

Alberta Sustainable Resource Development. 2002a. Forests Act Ministerial Order 40/2002 July 12 Amendment. Prohibition of transportation within Alberta of certain forest products. **http://www3.gov.ab.ca/srd/forests/health/pdf/ministerialorder25.pdf** viewed 10 March 2003.

Allen, E.A. and L.M. Humble. 2002. Non-indigenous species introductions: a threat to Canada's forests and forest economy. Canadian Journal Plant Pathology 24: 103-110.

Atkinson, T.H., Rabaglia, R.J. and Bright, D.E., 1990. Newly detected exotic species of *Xyleborus* (Coleoptera: Scolytidae) with a revised key to species in eastern North America. Canadian Entomologist, vol. 122, pp. 93-104.

Bright, D.E 1976. The insects and arachnids of Canada Part 2 the bark beetles of Canada and Alaska Coleoptera: Scolytidae. Research Branch Agriculture Canada Publication No. 1576. Ottawa. 241 pp.

Bright, D.E 1987. The insects and arachnids of Canada Part 15 the metallic wood-boring beetles of Canada and Alaska Coleoptera: Buprestidae. Research Branch Agriculture Canada Publication No. 1810. Ottawa. 335 pp.

Bright, D.E. and Skidmore, R.E., 1997. A Catalog of Scolytidae and Platypodidae (Coleoptera), Supplement 1 (1990-1994). NRC Research Press, Ottawa, ON, Canada, p. 368

Danks, H.V. 1979a. Summary of the diversity of Canadian terrestrial arthropods. pp. 240-244 in H.V. Danks, ed. Canada and its insect fauna. Memoirs of the Entomological Society of Canada, 108:1-573.

Danks, H.V. 1979b. Terrestrial habitats and distributions of Canadian insects. pp. 195-210 in H.V. Danks, ed. Canada and its insect fauna. Memoirs of the Entomological Society of Canada, 108:1-573.

Davies, A. 1991. Family Buprestidae metallic wood-boring beetles. pp. 160-170 *in* Y. Bousquet, ed. Checklist of the beetles of Canada and Alaska. Research Branch, Agriculture Canada, Ottawa ON, Publication 1861/E. 430 p.

Hoffmann, CH. 1941. Biological observations on *Xylosandrus germanus* (Bldfd.). J. Econ. Ent. 34:38-42.

Humble, L.M. 2001. Invasive bark and wood-boring beetles in British Columbia, Canada. Pages 69-77 in R.I. Alfaro, K.R. Day, S.M. Salom, K.S.S Nair, H. Evans, A.M. Liebhold, F. Lieutier, M. Wagner, K. Futai, and K. Suzuki, editors. Protection of World Forests: Advances in Research, Proceedings: XXI IUFRO World Congress. August 7-12, 2000, Kuala Lumpur, Malaysia. IUFRO Secretariat, Vienna, IUFRO World Series Vol. 11. 253 p.

Linsley, E.G. 1964. The Cerambycidae of North America Part v. Taxonomy and classification of the subfamily Cerambycinae, tribes Callichromini through Ancylocerini. University of California Publications in Entomology 22:1-197.

McNamara, J., 1991a. Family Cerambycidae, *in* Y. Bousquet, ed. Checklist of the beetles of Canada and Alaska. Research Branch, Agriculture Canada, Ottawa ON, Publication 1861/E. 430 p.

McNamara, J., 1991b. Family Scolytidae, *in* Y. Bousquet, ed. Checklist of the beetles of Canada and Alaska. Research Branch, Agriculture Canada, Ottawa ON, Publication 1861/E. 430 p.

Mudge, A.D., J.R. LaBonte, K.J.R. Johnson and E.H. LaGasa. 2001. Exotic woodboring Coleoptera (Micromalthidae, Scolytidae) and Hymenoptera (Xiphydriidae) new to Oregon and Washington. Proc.Entomological Society-of-Washington: 103 (4): 1011-1019.

Saskatchewan. 1996. Forest Resources Management Act. 62 pp.

Wood, S.L. 1982. The bark and ambrosia beetles of North and Central America (Coleoptera: Scolytidae), a taxonomic monograph. Great Basin Naturalist Memoir 6, 1359 pp.

Wood, S.L. and Bright, D.E. 1992. A catalog of Scolytidae and Platypodidae (Coleoptera), Part 2: Taxonomic Index Vol. A & B. Great Basin Naturalist Memoir 13, 1553 pp.

Range expansion by mountain pine beetle under climate change

Allan L. Carroll, Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre
506 West Burnside Rd., Victoria, BC
Jacques Régnière, Natural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre
1055 du P.E.P.S., Sainte-Foy, Quebec
Stephen P. Taylor, Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre
506 West Burnside Rd., Victoria, BC

ABSTRACT

The mountain pine beetle (MBP) is the most serious pest of mature pine forests in western North America. It is responsible for the mortality of approximately 135 million m^3 of timber (≈367 million trees) during the last 20 years in British Columbia alone. Most western pines are attacked by MPB, but lodgepole pine is its primary host throughout most of its range. Although it is widespread - occurring from northern Mexico, through 12 states and 3 provinces - outbreaks of MPB in Canada are mainly restricted to the southern half of BC and the extreme south-western portion of Alberta. Available hosts do not limit the current latitudinal and elevational range of MPB. In fact, lodgepole pine extends north into the Yukon and Northwest Territories, and east across much of Alberta. Instead, the potential for MPB to expand north and east is currently limited by climatic conditions unfavorable for brood development. It is anticipated that under climate change, former thermally hostile environments will become thermally benign allowing MPB to significantly expand its range. Indeed, observations suggest that recent infestations may be occurring in areas further north than any recorded previously. This study was initiated to determine (i) if there has been an increase in the range of thermally benign habitats since 1970, and if so, have MPB populations expanded into these new areas, and (ii) given climate change, what will be the distribution of thermally benign habitats in the future? The results of these analyses will be discussed.

Expansion de l’aire de répartition du dendroctone du pin ponderosa en rapport avec les changements climatiques

Allan L. Carroll, Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie du Pacifique, 506 West Burnside Rd. , Victoria (Colombie-Britannique)
Jacques Régnière, Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie des Laurentides, 1055, rue du P.E.P.S., Sainte-Foy (Québec)
Stephen P. Taylor, Ressources naturelles Canada, Service canadien des forêts, Centre de foresterie du Pacifique, 506 West Burnside Rd. , Victoria (Colombie-Britannique)

RÉSUMÉ

Le dendroctone du pin ponderosa (DPP) est le plus important ravageur des forêts de pins mûrs dans l’ouest de l’Amérique du Nord. En Colombie-Britannique seulement, il a détruit environ 135 millions de m^3 de bois (367 millions d’arbres) au cours des 20 dernières années. La plupart des pins de l’ouest sont attaqués par le DPP, mais le pin tordu latifolié est son hôte principal dans la plus grande partie de son aire de répartition. Bien que cet insecte occupe un vaste territoire (nord du Mexique, treize États des États-Unis et trois provinces canadiennes), ses infestations au Canada sont principalement limitées à la moitié sud de la Colombie-Britannique et à l’extrême sud-ouest de l’Alberta. La répartition latitudinale et latitudinale actuelle du DPP n’est pas limitée par la disponibilité de ses hôtes. Sa capacité de se propager vers le nord et l’est a plutôt été limitée par des conditions climatiques défavorables au développement des larves. En utilisant conjointement un modèle de l’impact des conditions climatiques sur l’établissement et la persistance des populations de DPP et un outil de simulation à références spatiales fondé sur le climat, nous avons obtenu des cartes indiquant les zones de l’Ouest canadien dont le climat antérieur était propice au DPP. En superposant à ces cartes la répartition annuelle du DPP, on peut déterminer si cet insecte a connu en Colombie-Britannique, au cours des dernières années, un accroissement d’aire imputable aux changements climatiques. L’examen de la répartition des zones à climat propice par intervalles de 10 ans, à partir des normales climatiques (1921-1950 à 1971-2000), montre clairement que ces zones se sont étendues. De plus, l’augmentation accélérée du nombre des infestations survenues depuis 1970, dans des zones à climat auparavant peu propice, montre que les populations de DPP ont connu une expansion vers ces nouvelles zones.

SESSION III –
CROSS-COUNTRY CHECK-UP –
ONTARIO AND QUEBEC

Chair: Craig Huff, Forester
Transportation, Utilities, and Public Works, City of Ottawa

SÉANCE III –
BILAN NATIONAL -
ONTARIO ET QUÉBEC

Président : Craig Huff, forestier
Transports, Services publics et Travaux publics, Ville d'Ottawa

Status of Important Forest Pests in Ontario in 2002

G.M. Howse[1] and T. Scarr[2]
[1]Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, Ontario
[2]Ontario Ministry of Natural Resources, Forest Management Branch, Sault Ste. Marie, Ontario

ABSTRACT

For the fifth consecutive year, (1998-2002) the Canadian Forest Service and Ontario Ministry of Natural Resources have deployed a team of Forest Health Technicians throughout Ontario. The team totaled 12 members this season instead of last year's 11. The personnel were the same as two years ago. The six OMNR staff is based in Thunder Bay, Nipigon, Hearst, Chapleau, Kemptville, and Belleville; the six CFS staff is based in Fort Frances, Sioux Lookout, Sault Ste. Marie, Sudbury/Temagami, Angus, and St. Williams.

This season's activities included a cooperative study with the global change gradient project, a study concerned with ice storm impact and recovery, monitoring boreal forest health plots and hardwood forest health plots including maple and oak, a cooperative study of the aspen decline/mortality problem in northeastern Ontario, continued emphasis on introduced pests that included detection of the emerald ash borer, *Agrilus planipennis,* an exotic insect native to China, Korea and Japan killing ash trees in the Windsor area and major forest disturbances.

Based on weather records from the Sault Ste. Marie airport, April was cooler than normal and precipitation nearly normal, May was cooler and wetter than normal, June was warmer than normal and precipitation was normal and in July temperatures were warmer than normal and rainfall was normal. Based on aerial surveys, gypsy moth (*Lymantria dispar* [L.]) and aspen decline/mortality increased in 2002 whereas spruce budworm (*Choristoneura fumiferana* Clem.), forest tent caterpillar, (*Malacosoma disstria* Hbn.) and large aspen tortrix (*Choristoneura conflictana* [Wlk.]) declined. A large new infestation of Bruce spanworm *(Operophtera bruceata [Hulst])* was mapped around Lake of the Woods in the Kenora and Fort Frances districts.

Le point sur les principaux ravageurs forestiers en Ontario en 2002

RÉSUMÉ

Pour la cinquième année consécutive (1998-2002), le Service canadien des forêts (SCF) et le ministère des Richesses naturelles de l'Ontario (MRNO) ont déployé des techniciens forestiers à travers la province pour surveiller l'état de santé des forêts. L'équipe de cette année comptait un membre de plus que celle de l'an passé, soit les mêmes 12 techniciens qu'il y a deux ans. Les six membres du MRNO étaient postés à Thunder Bay, Nipigon, Hearst, Chapleau, Kemptville et Belleville, et leurs collègues du SCF, à Fort Frances, Sioux Lookout, Sault Ste. Marie, Sudbury/Temagami, Angus et St. Williams.

Parmi les activités menées en 2002 : une étude conjointe réalisée dans le cadre du projet d'étude du gradient du changement climatique planétaire, une étude sur l'impact de la tempête de verglas de 1998 et le rétablissement de la forêt à la suite de cette catastrophe, des contrôles de l'état de santé de parcelles de surveillance dans la forêt boréale et la forêt de feuillus, notamment de l'érable et du chêne, une étude conjointe sur le déclin du peuplier faux-tremble dans le nord-est de la province, des relevés de détection de ravageurs forestiers exotiques, notamment de l'agrile du frêne (*Agrilus planipennis*), espèce indigène de Chine, de Corée et du Japon qui sévit dans la région de Windsor et, enfin, une étude des principales perturbations survenues dans le domaine forestier.

D'après les températures et les précipitations enregistrées à l'aéroport de Sault Ste. Marie, on a connu en avril des températures inférieures à la normale et des précipitations proches de la normale, en mai, des températures inférieures à la normale et des précipitations plus abondantes, en juin, des températures plus élevées que la normale et des précipitations normales et, en juillet, des températures plus élevées que la normale et des précipitations normales. D'après les relevés aériens, les dégâts causés par la spongieuse (*Lymantria dispar* [L.]) et le déclin du peuplier faux-tremble se sont accentués en 2002, tandis que les infestations par la tordeuse des bourgeons de l'épinette (*Choristoneura fumiferana* Clem.), la livrée des forêts (*Malacosoma disstria* Hbn.) et la tordeuse du tremble (*Choristoneura conflictana* [Wlk.]) ont diminué. Une nouvelle infestation, importante, par l'arpenteuse de Bruce *(Operophtera bruceata [Hulst])* a été signalée près du lac des Bois, dans les districts de Kenora et de Fort Frances

FOREST INSECTS

Spruce Budworm, *Choristoneura fumiferana* Clem.

The area of moderate-to-severe current defoliation caused by spruce budworm totaled 131 123 ha in 2002, a decrease of 38,699 ha compared to the 169 822 ha defoliated in 2001 (Table 1, Fig. 1). All of the decrease 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.

The southern boundary of the infestation in Sudbury/North Bay districts, which totaled 121 341 ha in 2002 continues to be more or less HW 17 from east of the village of Markstay in the west to Verner in the east. The main body of infestation extends to the north and northeast to Red Cedar Lake. In southeastern Ontario, infestations reoccurred in the eastern part of the Pembroke District (6 908 ha) and in the Almonte and LaRose Forest areas of the Kemptville District (2 435 ha). A new infestation (439 ha) was detected in Petroglyphs Provincial Park. The total area of defoliation, 9 762 ha, in southeastern Ontario in 2002 was a slight increase over the 9 736 ha mapped in 2001.

Table 1: Gross area of moderate-to-severe defoliation caused by the spruce budworm in Ontario, 1999 - 2002.

Region	Area (ha)			
District	1999	2000	2001	2002
Northwest				
Kenora	513	0	0	0
	513	0	0	0
Northeast				
North Bay	44 345	87 646	127 788	88 607
Sault Ste. Marie	10	130	0	0
Sudbury	27 522	16 242	32 298	32 734
	71 877	104 018	160 086	121 341
South Central				
Bancroft	0	0	0	439
Kemptville	4 524	129	1431	2 435
Pembroke	4 290	10 933	8 305	6 908
	8 814	11 062	9 736	9 782
TOTAL	81 204	115 080	169 822	131 123

Gypsy Moth, *Lymantria dispar* (L.)

Gypsy moth infestations increased considerably in 2002 to a total area of 153 674 ha of moderate-to-severe defoliation mapped this year compared to 7 345 ha in 2000 (Table 2, Fig. 2).

Much of the defoliation, 136 878 ha, occurred in or near the city of Sudbury, Sudbury District, where the insect was feeding on scrub white birch and oak growing on rocky hilltops. Infestations occurred from Wanapitei Lake, through the city of Sudbury to Round Lake. Another pocket of defoliation was mapped in the Espanola area. Some 11 205 ha of defoliation was mapped in the southern part of Parry Sound District and the adjoining part of northern Midhurst District. Another 799 ha of defoliation was mapped in the south central part of Bancroft District, 2098 ha in the southeastern part of Pembroke district, 2 330 ha in the northeastern part of Peterborough District and 364 ha of defoliation in the western part of Kemptville district. 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, 1999 - 2002.

Region	Area (ha)			
District	1999	2000	2001	2002
Northeast				
North Bay	290	217	183	0
Sudbury	0	0	6 391	136 878
	290	217	6 574	136 878
South Central				
Aylmer	2 933	891	5	0
Bancroft	0	0	238	799
Guelph	10 150	17 606	0	0
Midhurst	0	0	0	3 539
Kemptville	1 660	0	0	364
Parry Sound	0	0	0	7 666
Pembroke	0	18	528	2 098
Peterborough	366	0	0	2 330
	15 109	18 515	771	16 796
TOTAL	15 399	18 732	7 345	153 674

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

Infestations of pine false webworm totaling 2 140 ha of moderate-to-severe defoliation of pine plantations occurred in Midhurst District in 2002 compared to 1 832 ha of defoliation mapped in 2001 (Fig. 4). The heaviest damage occurred in Grey County within a triangular area between the communities of Chatsworth, Markdale and Chesley. White and Scots pine were most seriously defoliated. In Bruce County, four small areas of defoliation of white pine occurred 5-8 km southeast of the village of Paisley along the Saugeen River. In Simcoe County, defoliation was mapped in Tecumseth, Adjala, Oro, and Vespra townships. No defoliation was mapped in the Ganaraska County Forest, Peterborough District where infestations persisted for a number of years (571 ha in 2001). Heavy infestations occurred in a jack pine orchard located at the Northwest Region Natural Resource Center, Thunder Bay District that was eventually sprayed with malathion. An infestation was noted in Merrit Township, Sudbury District and along Highway 17 on the Garden River Indian Reserve, Sault Ste. Marie District.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The total area of forest tent caterpillar defoliation in the province declined by more than 5 million ha in 2002 totaling 8 245 964 ha compared to 13 279 988 ha in 2001 (Table 3, Fig. 3). The largest decrease occurred in the Northwest Region where 5 821 878 ha of defoliation was mapped in 2002 compared to 10 487 276 ha in 2001. Large decreases occurred in every district except Thunder Bay and Nipigon. In the Northeast Region, there were decreases in the two northern districts, Cochrane and Hearst, as well as Chapleau, Kirkland Lake, North Bay, and Timmins districts. Increases occurred in Sudbury and Sault Ste. Marie districts. The net effect was an overall decrease in the region in the area of defoliation in 2002 to 2 371 208 ha compared to 2 476 876 ha in 2001. In the South central Region, 52 878 ha were mapped in 2002 compared to 315 836 ha in 2001. Declines occurred in the four districts infested in 2001, namely Bancroft, Midhurst, Parry Sound and Peterborough.

Table 3: Gross area of moderate-to-severe defoliation caused by the forest tent caterpillar in Ontario, 1999 - 2002.

Region / District	Area (ha) 1999	2000	2001	2002
Northwest				
Dryden	661 302	1 655 278	2 053 529	1 389 513
Fort Frances	93 339	1 832 570	2 351 938	643 256
Kenora	189 795	1 222 642	1 657 053	2 685
Nipigon	0	717	10 755	363 406
Red Lake	171 569	530 163	1 940 113	0
Sioux Lookout	122 727	421 986	1 166 290	530 450
Thunder Bay	242 392	307 422	1 307 598	2 892 569
	1 481 124	5 970 778	10 487 276	5 821 879
Northeast				
Chapleau	0	1 139	880	614
Cochrane	1 218 759	131 732	47 447	10 017
Hearst	451 163	274 687	240 926	175 126
Kirkland Lake	224 997	501 414	1 130 928	894 615
North Bay	0	19 675	320 146	300 769
Sault Ste. Marie	0	283	10 038	11 869
Sudbury	0	27 131	368 560	809 822
Timmins	277 540	246 921	357 951	168 376
	2 172 459	1 202 982	2 476 876	2 371 208
South central				
Bancroft	0	0	22 421	0
Midhurst	0	5 823	54 785	2 356
Parry Sound	0	30 849	235 672	50 522
Peterborough	0	0	2 985	0
	0	36 672	315 836	52 878
TOTAL	3 653 583	7 210 432	13 279 988	8 245 965

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

This exotic beetle, native to Southeast Asia, was found in Windsor in early July by CFS/OMNR Forest Health staff. Now, the distribution of this insect is believed to be confined to six counties in southeastern Michigan and the Windsor area. Apparently, healthy ash trees are being attacked and killed. This includes both street trees and ash trees growing in naturally forested areas. The insect is believed to have been in Michigan for at least five years but only two or three years in Ontario. The Canadian Food Inspection Agency (CFIA) has issued a Ministerial Order "declaring certain places to be infested with the EAB and prohibiting or restricting the movement of the pest and nursery stock, trees, logs, lumber and wood with bark attached, wood chips or bark chips from trees in the genus *Fraxinus* (commonly known as ash) and firewood of all species that has not been treated in a manner to eliminate the pest. " CFIA in cooperation with OMNR, CFS and Ontario Ministry of Agriculture and Food (OMAF) will be developing a plan this fall to deal with this pest presumably in coordination with the U.S.

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

In 2002, moderate to severe defoliation by this insect totaling 5 179 ha (Fig. 5) was mapped in Sault Ste. Marie (2 930 ha), Bancroft (2 112 ha) and Pembroke districts (137 ha) compared to a total area of 9 317 ha in 2001. In the Sault Ste. Marie district, defoliation was mapped in Laughren, Morningstar, Yaremko, Vance, Tweedle, and Landreault townships. In Bancroft District, defoliation was mapped in Monteagle, Carlow, Mayo, and the former Denbigh townships. In Pembroke District, three pockets of defoliation were mapped along Highway 41 north of Denbigh and near the village of Khartum.

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

Hemlock looper caused some 4 453 ha of defoliation in 2002 (Fig. 6) compared to 553 ha in 2001. Most of the defoliation (3 832 ha) occurred in the Sudbury District to mature and over mature hemlock and some scattered larch in the Panache Lake area east of the town of Espanola and Bell and Johnie lake area located at the eastern foothills of the LaCloche Mountain range. Defoliation was mapped in McKennon, Mongowin, Truman, Goschen, Carlyle, Sale and Humboldt townships. The remaining defoliation (621 ha) was mapped in the Parry Sound District in and around the town of Parry Sound and on numerous islands along the Georgian Bay coastline, Parry Sound (body of water), islands on Lake Joseph and Healey Lake. The main host was hemlock but cedar and balsam fir were also defoliated.

Bruce Spanworm, *Operophtera bruceata (Hulst)*

Bruce spanworm, feeding on trembling aspen, defoliated a total of 264 687 ha in Kenora (260 613 ha) and Fort Frances (4 074 ha) districts (Fig. 7) primarily north and east of Lake of the Woods in northwestern Ontario in 2002. Some 390 ha of defoliation were mapped in 2001 in

Parry Sound and Bancroft districts. This new infestation of spanworm in northwestern Ontario occurred in an area that had been completely defoliated by forest tent caterpillar in 2001.

Larch Casebearer, *Coleophora laricella* (Hbn.)

In 2002, larch casebearer defoliated larch trees in the districts of Kemptville (3 207 ha), Peterborough (116 ha), Aurora (174 ha) and Midhurst (174 ha). Defoliation was also noted in Guelph, Sault Ste. Marie, and Chapleau districts.

Hickory Bark Beetle, *Scolytus quadrispinosus* Say

This bark beetle was first reported in 2001 causing damage to bitternut hickory in 10 woodlots in Middlesex County, Aylmer District. More than 70% tree mortality was recorded last year. In 2002, 48 more woodlots were noted to be infested (Fig. 8). In many cases, the woodlots had high percentages of hickory and virtually all hickory was dead. The 48 woodlots are in 11 townships in 3 counties; Middlesex and Lambton counties in Aylmer District and Huron County in Guelph District.

TREE DISEASES

Dutch elm disease, *Ophiostoma ulmi* (Buisman) Nahnf

This disease continues to "devastate" the remaining elm trees in southern Ontario. One Forest Health technician observed that DED remains at epidemic levels throughout his work area: "There are numerous areas of dead and dying elm that is reminiscent of the first wave of the disease that swept through the same area some thirty years ago. Trees appear to be decimated in a single season. The whole tree is affected in one year as the entire crown displays symptoms of current infection. Forty three percent of living host were affected at one location. Such levels of damage are not uncommon." Another Forest Health technician reported "diseased trees that show flagging are completely brown and dead in a three to four week period. The apparent new, more aggressive strain of the disease is very efficient and leaves few trees in its path."

ABIOTIC

Aspen Decline/Mortality

In 2000, 174 898 ha of aspen decline/mortality was aerially mapped, primarily in the Northeast Region. In 2001, the area of decline/mortality increased to 319 462 ha. In 2002 the area mapped increased further by 123 072 ha for 442 324 ha (Table 4, Fig.9). Preliminary tree mortality data indicates that about 70% of the aspen are dead compared to an average mortality of 54% for last year. Forest tent caterpillar defoliation, drought, a thaw-freeze event in late February-early March 2000, and soil type are believed to be responsible.

Table 4. Gross area of aspen decline/mortality in 2000 - 2002.

Region	Area (ha)		
District	2000	2001	2002
Northwest			
Nipigon	832	217	880
	832	217	880
Northeast			
Chapleau	0	0	43
Cochrane	87 619	128 572	183 929
Hearst	83 612	177 234	236 688
Kirkland Lake	0	2 692	5 313
Timmins	2 835	10 395	14 315
Wawa	0	359	1 156
	174 066	319 252	441 444
TOTAL	174 898	319 462	442 324

Blowdown

In early July 2002, tornados or severe thunderstorms caused blow down in northwestern Ontario (Fig. 10). There was 7 137 ha of blowdown in Kenora District and 325 in Dryden District. Blowdown was mapped around Umfreville Lake, north of Separation Lake with smaller pockets south and a separate pocket further east crossed over Highway 105 south of Cedar Lake. Most of the area had only scattered trees down but a few areas were totally flattened.

Another weather event, termed an "microburst", occurred 2 August 2002 in the Cartier area of Sudbury District. A microburst is a downward rush of air or a severe downdraft with winds reaching up to 200 km/hr. This microburst touched down in the north end of Halfway Lake Provincial Park and blew down trees in the campground and surrounding forest. Some 724 ha were affected.

Another microburst referred to as straight-line winds from downbursts or "derecho" occurred on 2 August 2002 in Bancroft District northeast of the city of Peterborough. The storm path crossed Highway 62 south of Gilmour, Tudor and Cashel townships heading in an easterly direction ending just east of Cloyne, Barrie Township. It is estimated that about 1000 ha of forest were affected but this damage area has not been digitized yet.

Drought Damage

In 2001, some 5 142 534 ha of drought damage was mapped in northeastern and southern Ontario. Further consequences of last year's drought resulted in the aerial mapping of 71 620 ha of dead or dying trees in 2002 in the Northeast Region and southern Ontario (Table 5, Fig. 11). The most severely affected tree species in northeastern Ontario were jack pine, white spruce and balsam fir. In some locations such as Chapleau District, black spruce was also affected while red pine was also affected in North Bay District. Hardwood species, particularly white birch, were also affected in some locations but generally not as severe as the coniferous species. Drought killed jack pine and balsam fir was noted near Fallingsnow Lake, Thunder Bay District.

In southern Ontario, tree mortality was mapped in Parry Sound, Midhurst, Bancroft, and Peterborough districts. Jack and white pine along Highway 69 south of the Magnetawan River were affected. In the southern part of the district and an adjoining area in Midhurst District, red oak was the main species affected. In Bancroft and Peterborough districts, about 15 pockets of dead and dying red pine were aerially mapped. In addition, balsam fir trees died singly or in small clumps, too numerous to record. In Kemptville and Pembroke districts, some 20 pockets of red pine plantation mortality were recorded. Many conifers and some hardwoods died when hot, dry weather occurred in July. The drought mortality was considered too general and widespread to aerially map in these two districts.

Hardwood Decline

A condition, called hardwood decline, that affected trembling aspen was mapped in the northeast part of Wawa District in 2001. The area of decline totaled 5429 ha; 5166 ha in Wawa District and 263 ha in Hearst District. This condition is not the same as the aspen decline/ mortality in Hearst and Cochrane districts initially reported in 2000. There have not been any recent (i.e. within the last five years) occurrences of insect defoliation or drought in this area. Symptoms observed include dwarf foliage, general reduction in tree vigour and crown dieback ranging from 30-50%. Normal appearing foliage was produced in this decline area in 2002 and it is now thought that drought in 2001 may have been the primary cause.

Table 5. Gross area of drought damage in 2002.

Region / District	Area (ha) 2002
Northeast	
Chapleau	10 073
North Bay	2 400
Sault Ste. Marie	22 277
Sudbury	8 059
Timmins	22 092
	64 901
South central	
Bancroft	272
Midhurst	791
Parry Sound	5 646
Peterborough	10
	6 719
TOTAL	71 620

Snow Damage

A severe storm involving high winds and wet snow occurred during late October 2001 in the eastern part of the Northwest Region, north, and northeast of Lake Nipigon. Approximately 3.15 million ha of forest in three districts (Thunder Bay, Nipigon and Sioux Lookout) were damaged (Table 6, Fig.12). The main tree species affected were black spruce and jack pine although all species were affected to some extent. Damage consisted of whole stands being flattened, many trees in stands were bent to the ground, or stems were broken by the accumulated weight of freezing rain and wet snow.

In the Aylmer District, trees on some 176 551 ha were damaged when heavy wet snow accumulated on trees in mid February through an area from Port Dover to Port Stanley on Lake Erie reaching north to the towns of Simcoe, Delhi, Tillsonburg and Aylmer. Damage consisted of tops and branches being broken down or off. The main conifers affected were Scots pine, western red cedar, and white pine. Hardwood species affected included trembling aspen and other poplars birch species, locust, willow, and elm.

Table 6. Gross area of snow damage in 2002.

Region / District	2002 Area (ha) Light	Severe
Northwest		
Nipigon	1 465 450	776 866
Sioux Lookout	68 340	0
Thunder Bay	422 660	413 666
	1 956 450	1 190 532
South central		
Aylmer	0	176 551
	0	176 551
TOTAL	1 956 450	1 367 083

OTHER FOREST PESTS

In 2001, hemlock borer, *Melanophila fulvoguttatta* (Harris), was found killing mature hemlock trees on the shores of Catchacoma and Mississauga lakes, Peterborough District and Cache Lake, Algonquin Park.

High populations of cedar leafminers, *Argyresthia thuiella* and *canadensis*, and defoliation occurred throughout Kemptville, Pembroke, Peterborough, Bancroft, Aurora, and the southern half of Midhurst districts.

Defoliation of roadside white and black spruce by yellowheaded spruce sawfly, *Pikonema alaskensis*, was prominent in Red Lake, Sioux Lookout, Dryden and Thunder Bay districts in 2002.

For further information contact:

G.M. Howse, Leader, Forest Health Monitoring
Great Lakes Forestry Centre, Canadian Forest Service, Natural Resources Canada
1219 Queen St. East, Sault Ste. Marie, Ontario, P6A 5M7
Telephone: (705) 541-5542 Fax: (705) 541-5700 E-mail: ghowse@nrcan.gc.ca

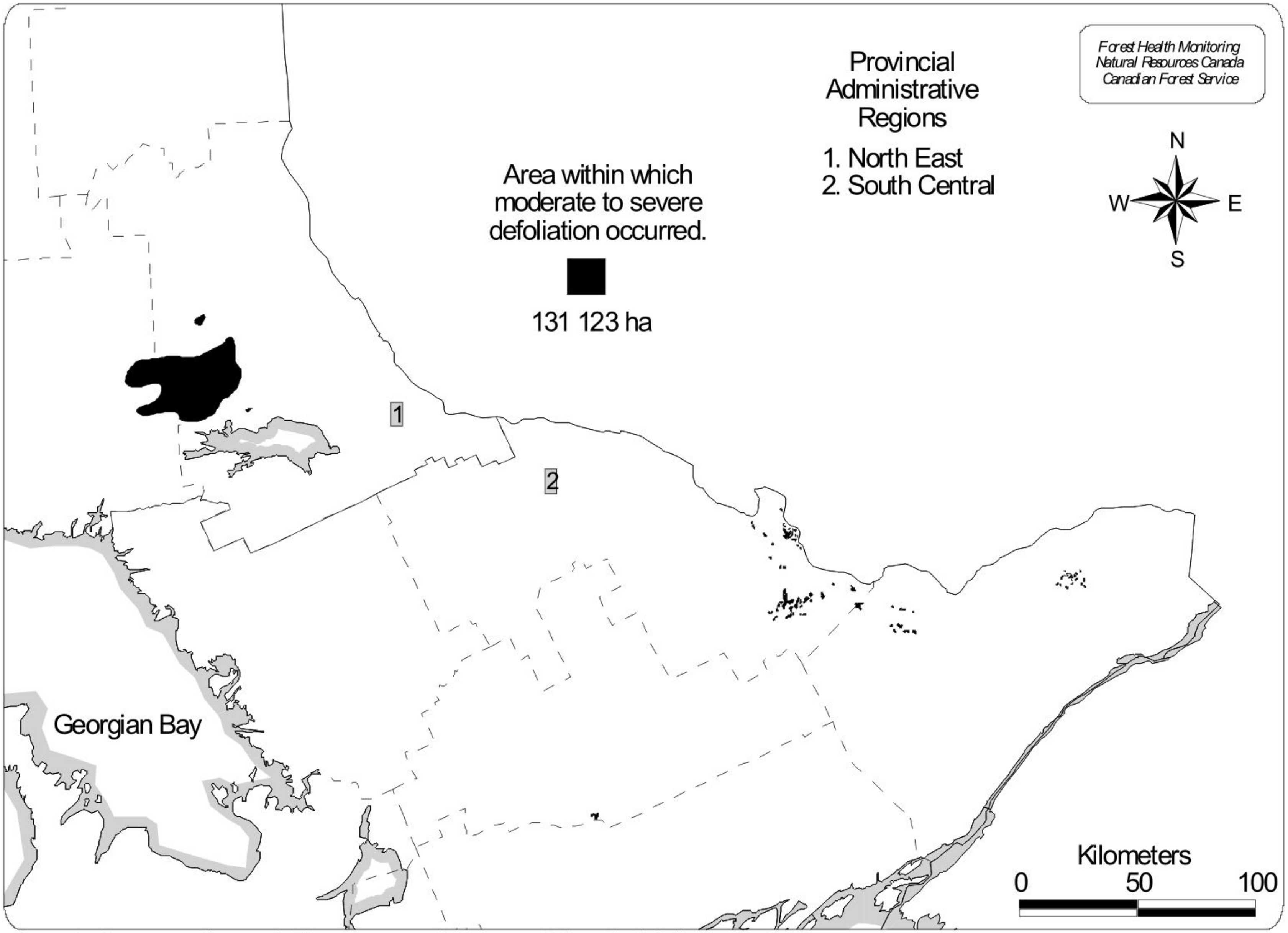


Figure 1. Spruce Budworm (*Choristoneura fumiferana* [Clem.]) defoliation in 2002.

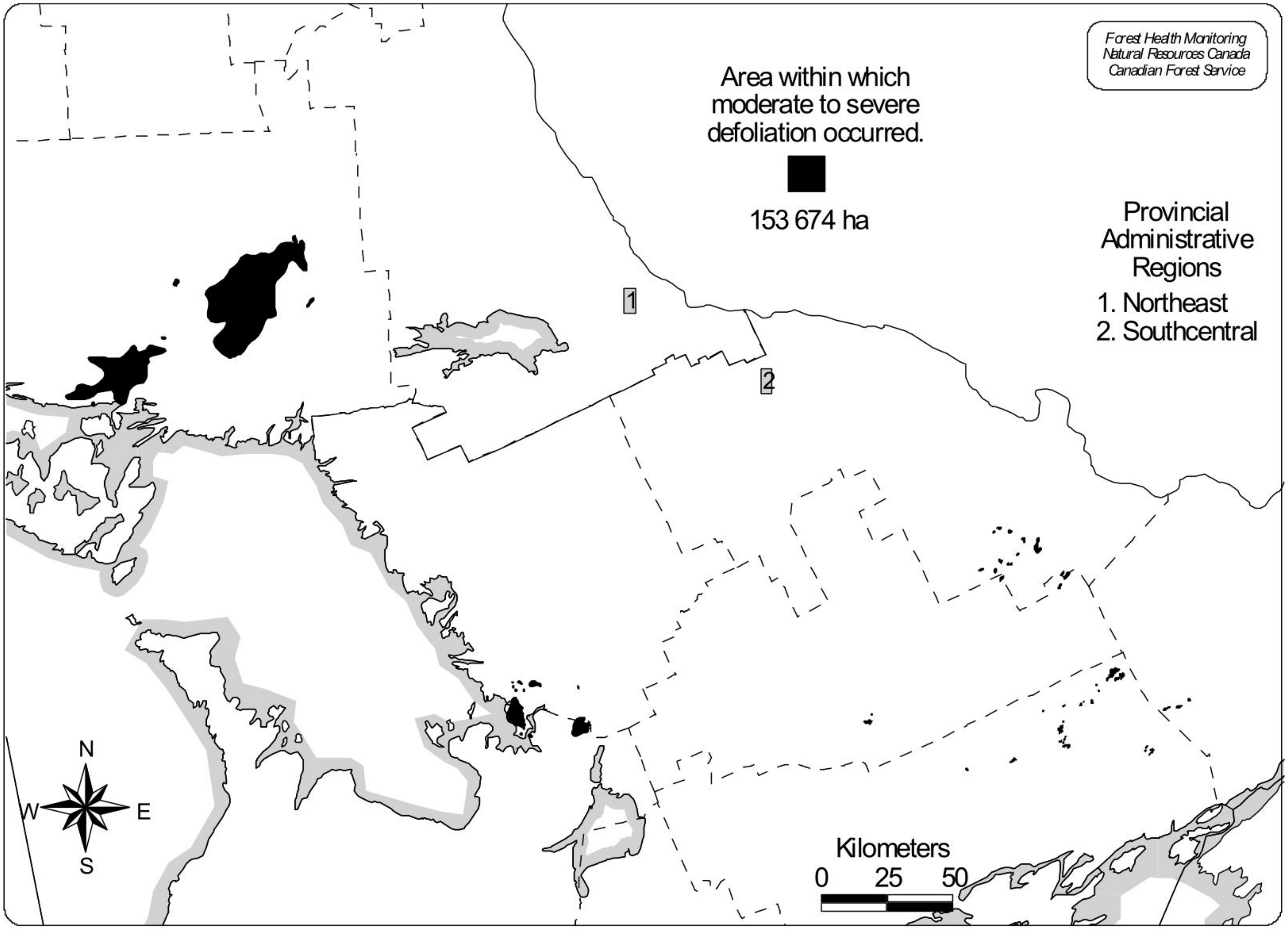


Figure 2. Gypsy Moth (*Lymantria dispar* L.) defoliation in 2002.

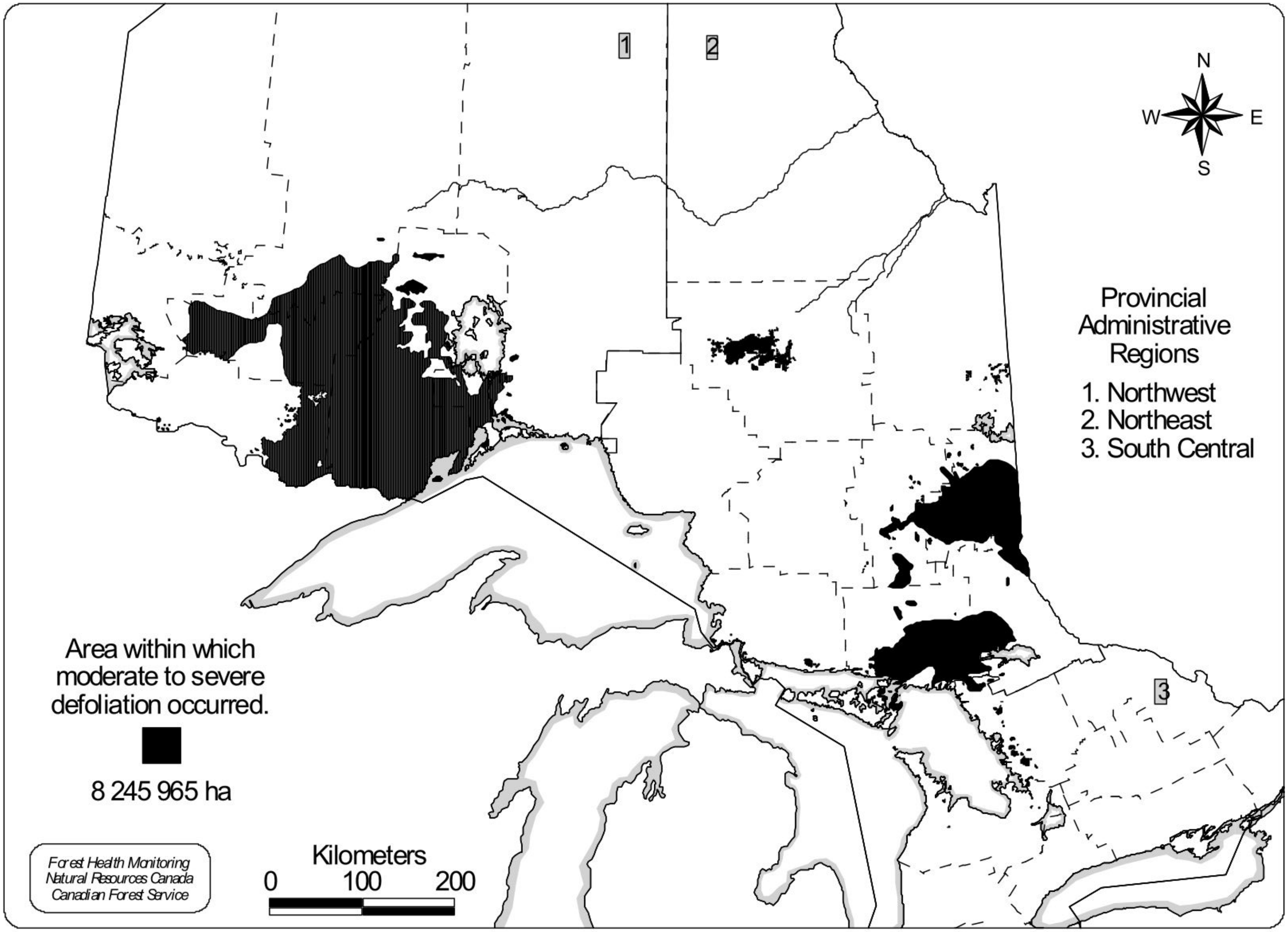


Figure 3. Forest Tent Caterpillar (*Malacosoma disstria* Hbn.) defoliation in 2002.

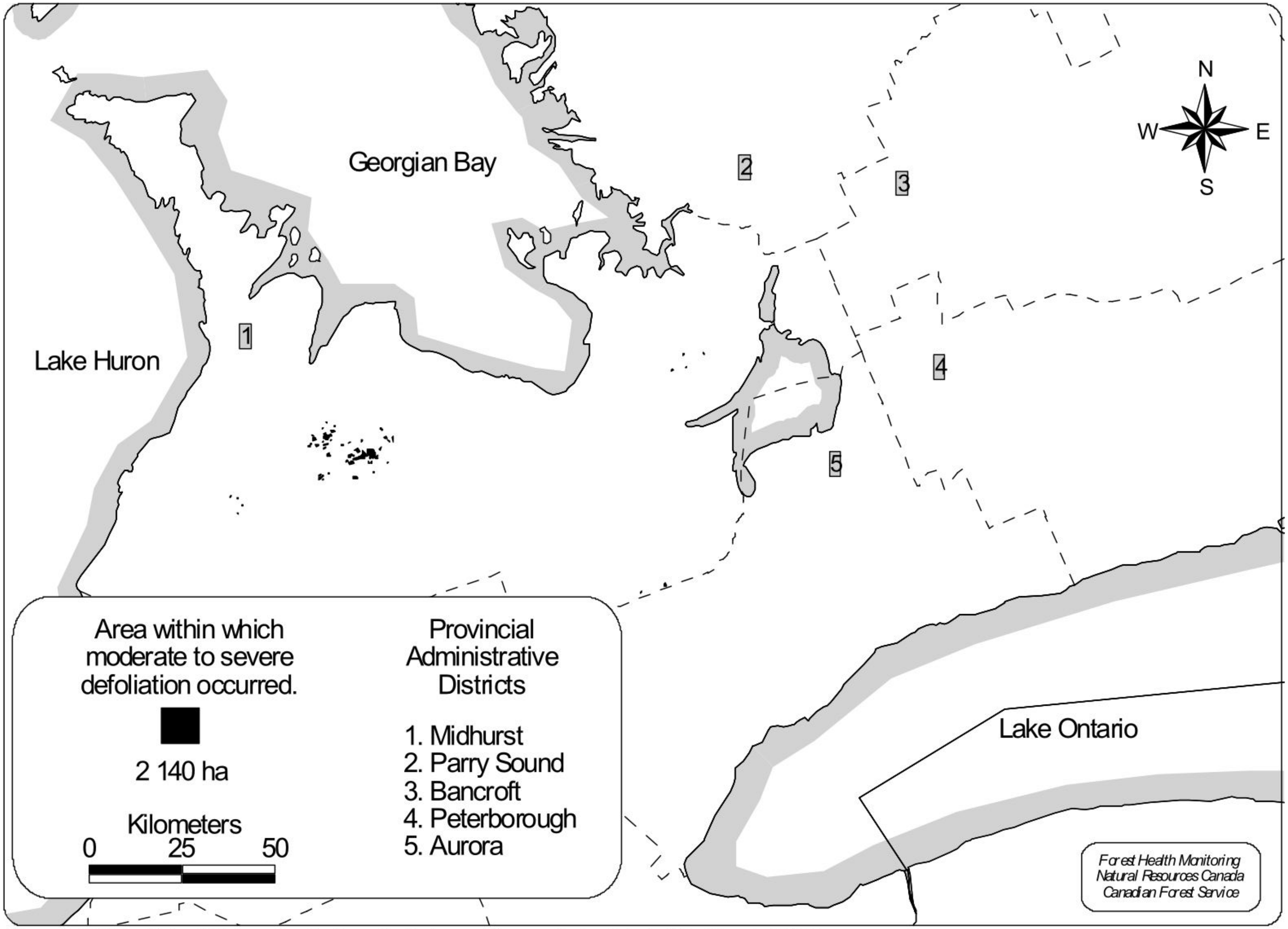


Figure 4. Pine False Webworm (*Acantholyda erythrocephala* L.) defoliation in 2002.

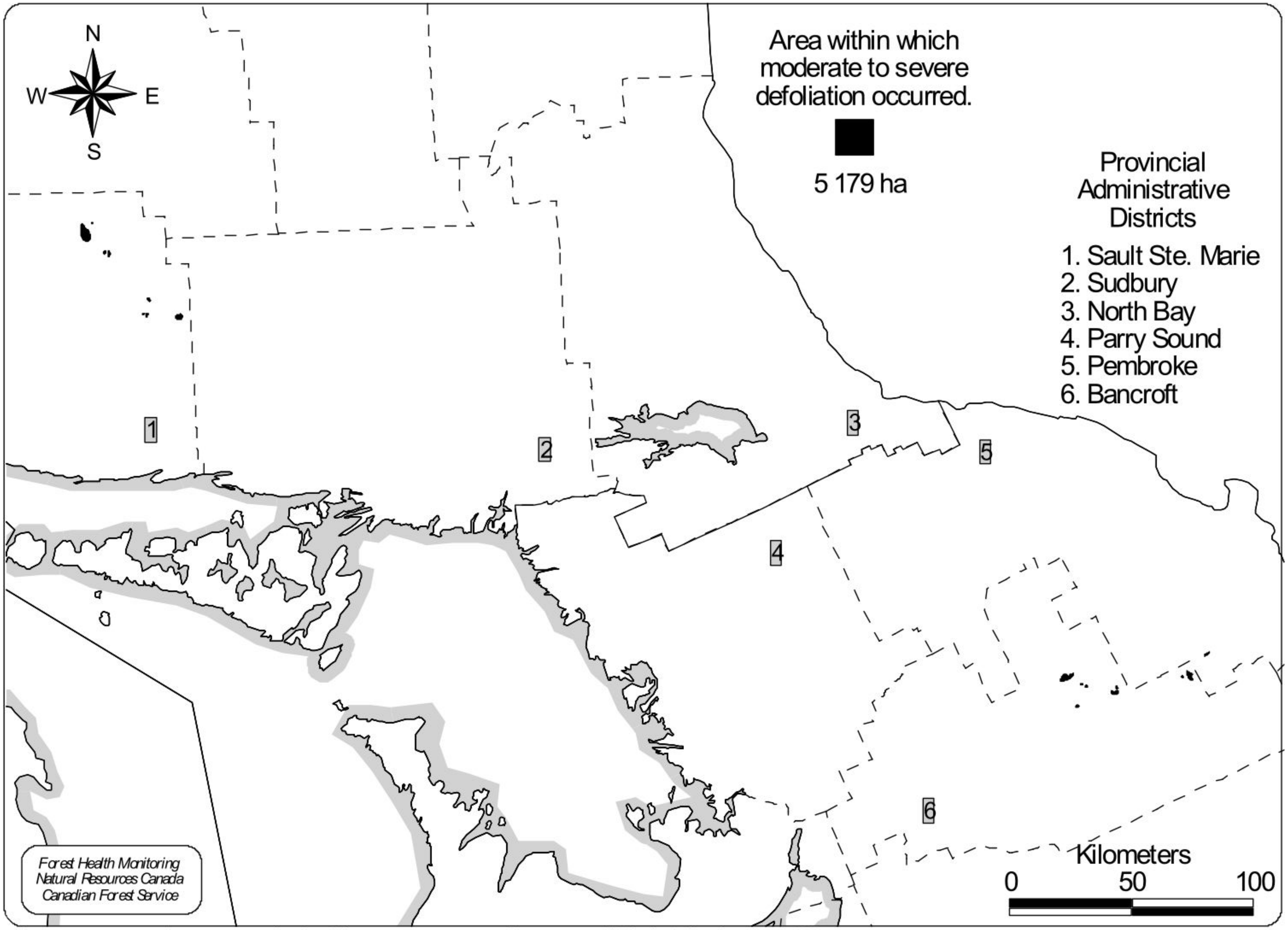


Figure 5. Large Aspen Tortrix (*Choristoneura conflictana* Wlk.) defoliation in 2002.

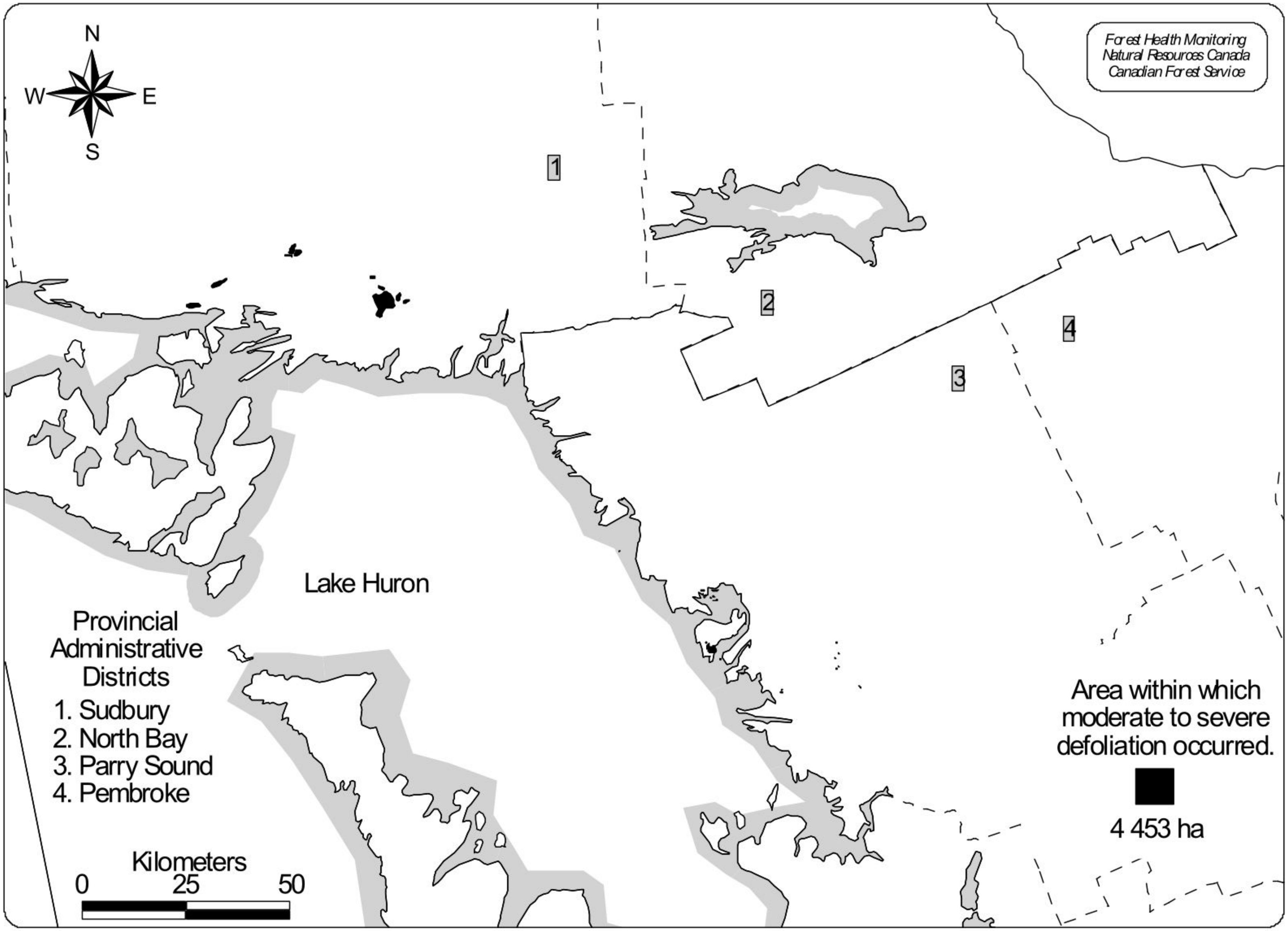


Figure 6. Hemlock Looper (*Lambdina fiscellaria fiscellaria* (Gn.)) defoliation in 2002.

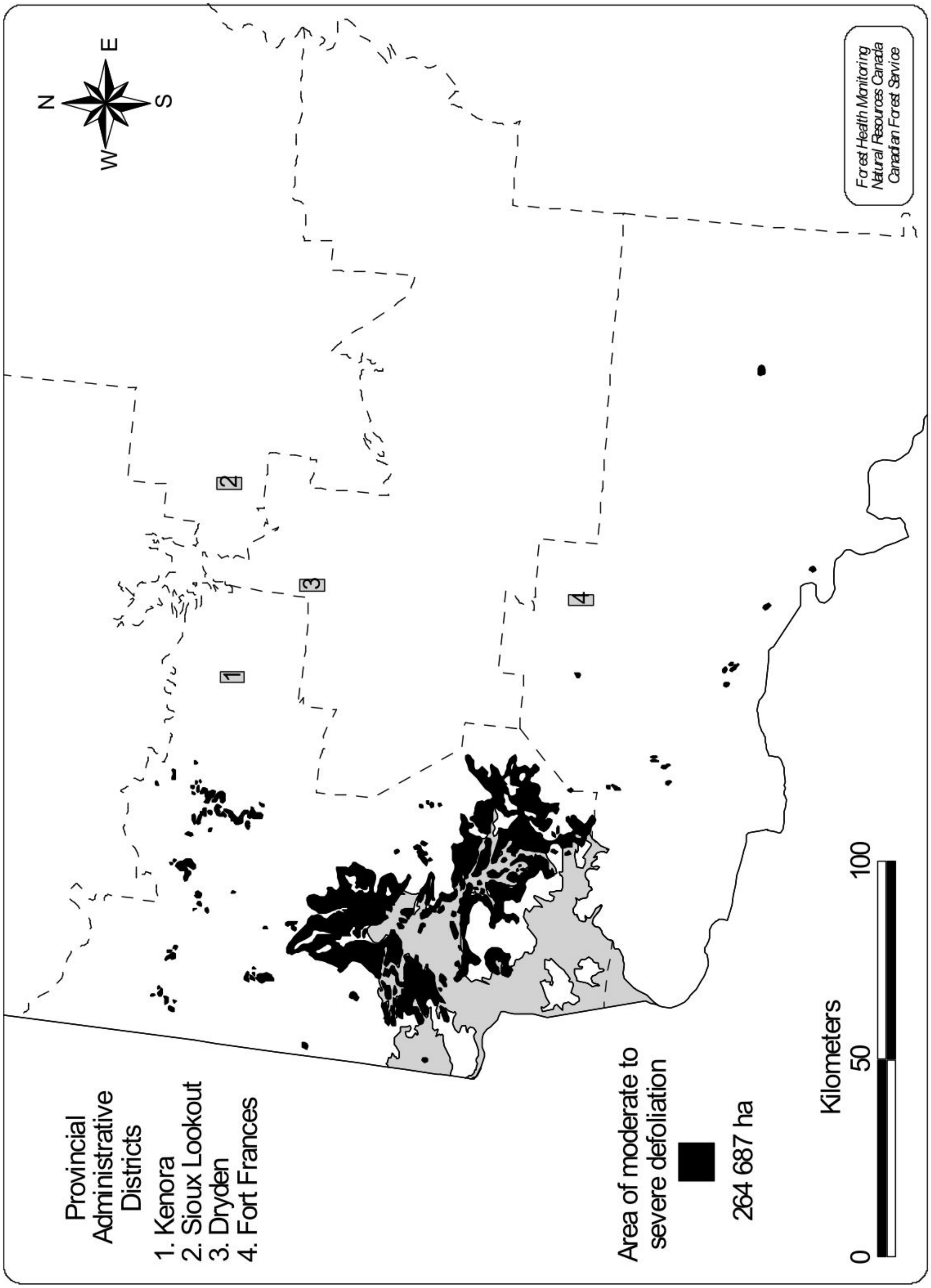


Figure 7. Bruce Spanworm (*Operophtera bruceata* Hlst.) defoliation in 2002.

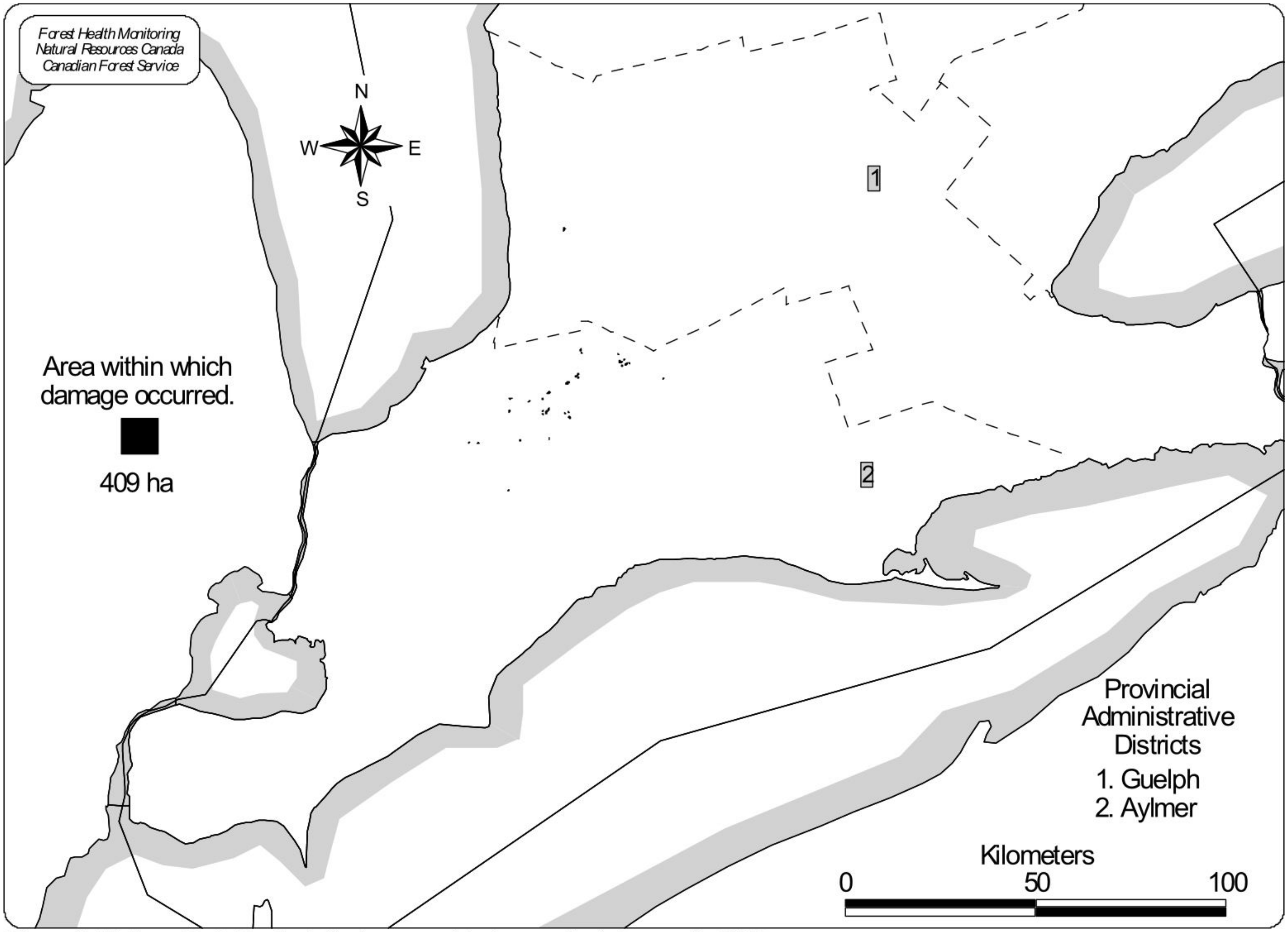


Figure 8. Hickory Bark Beetle (*Scolytus quadrispinosus* Say) damage in 2002.

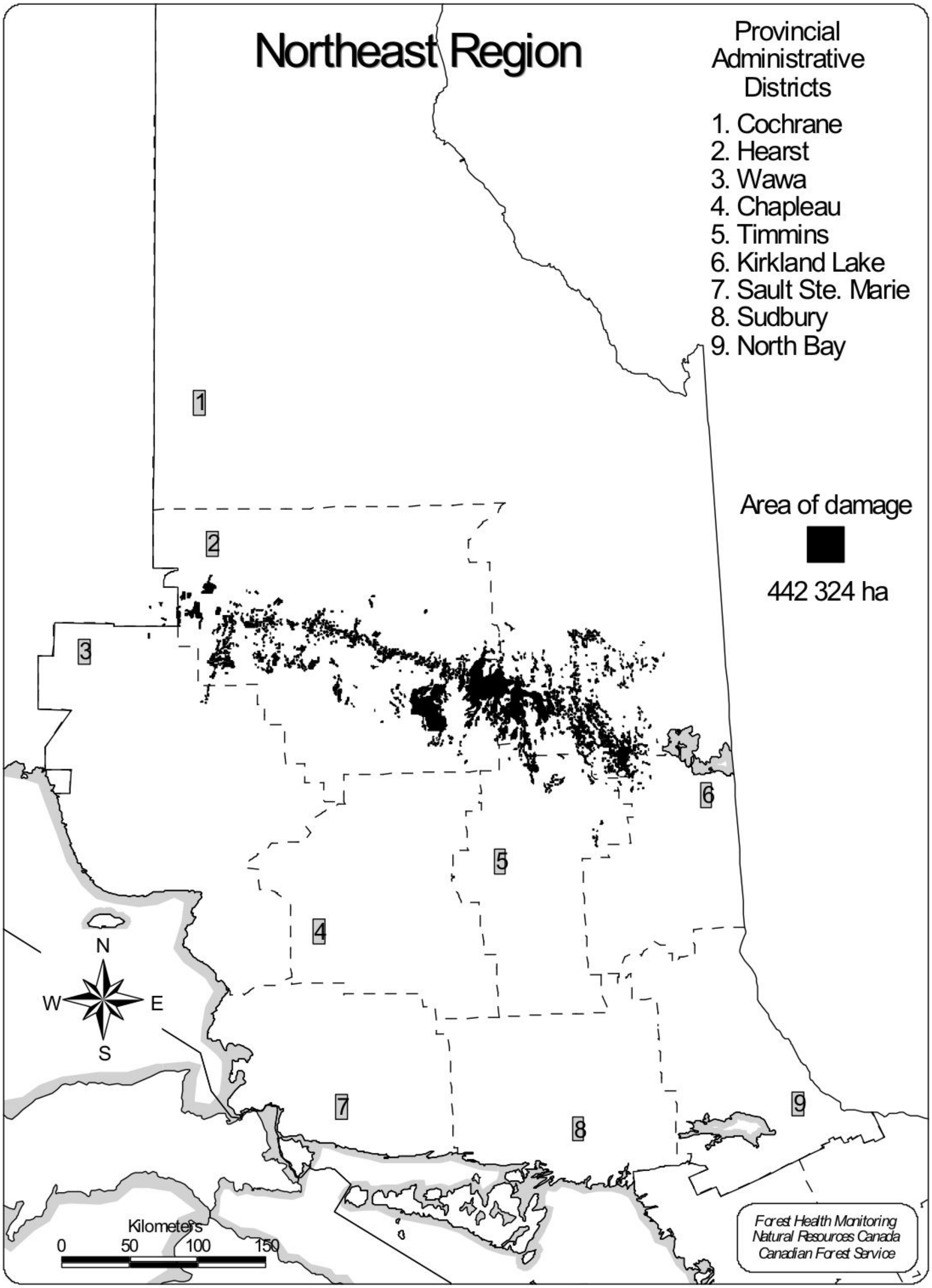


Figure 9. Aspen decline/mortality in 2002.

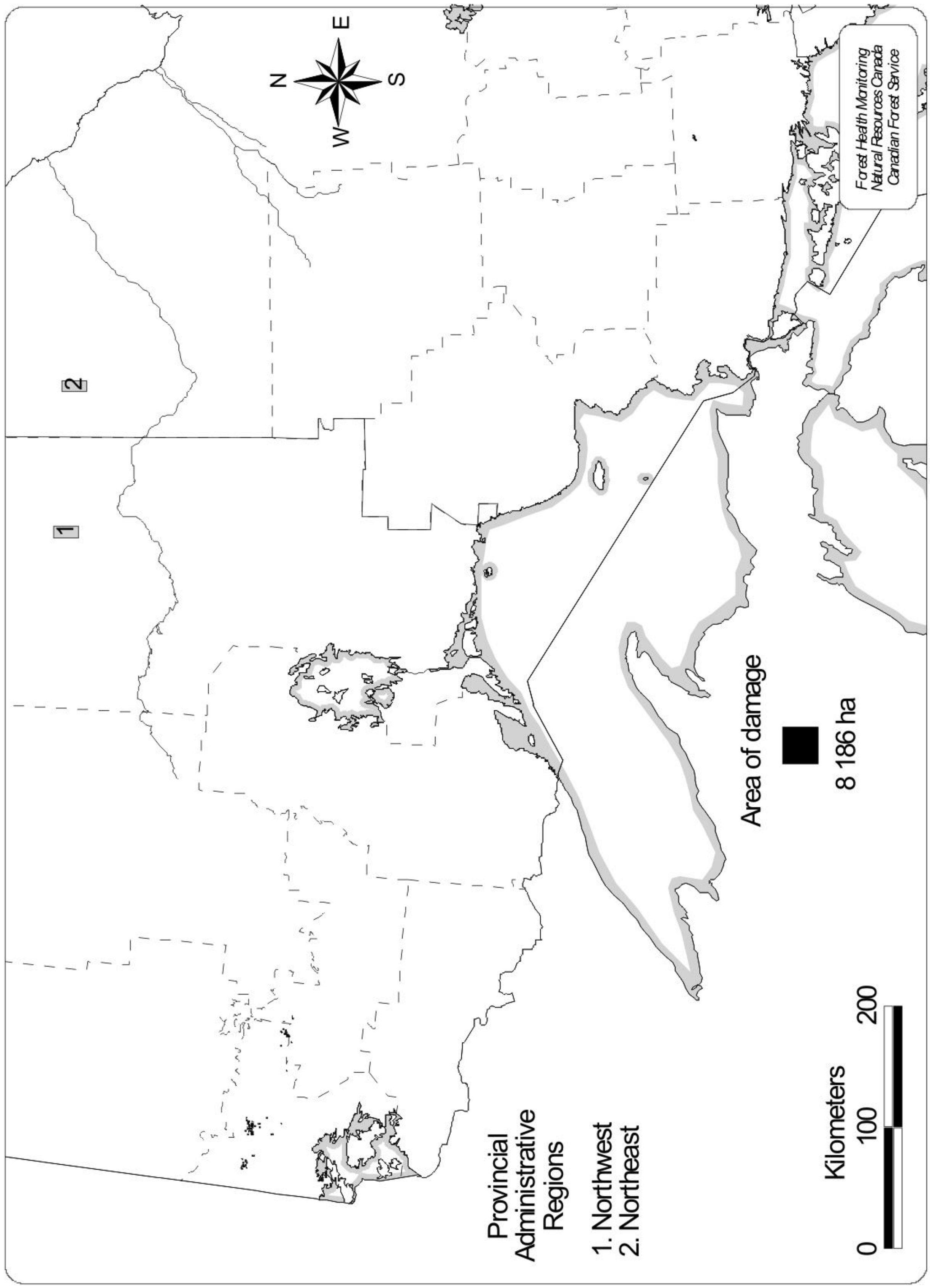


Figure 10. Blowdown damage in 2002.

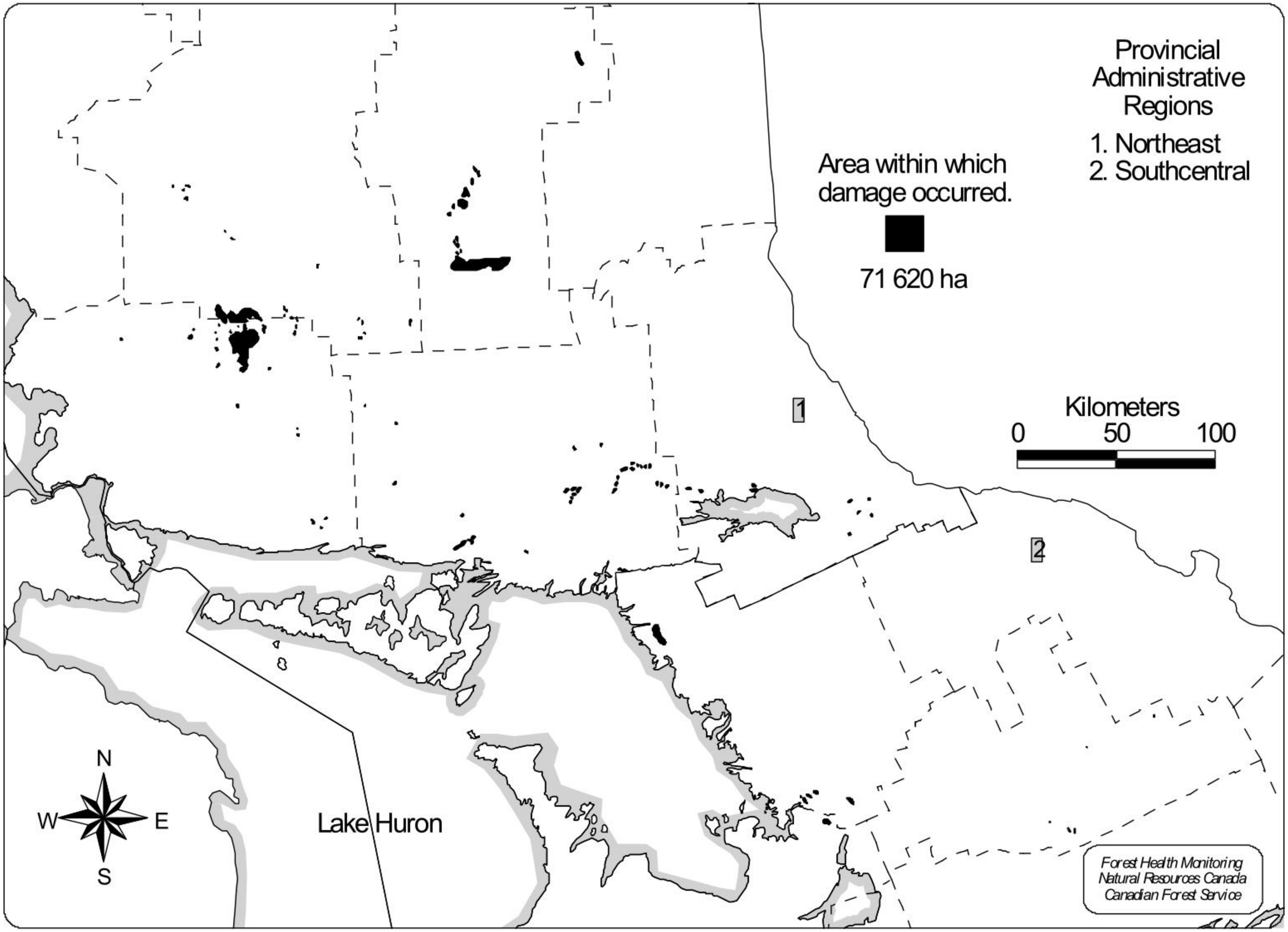


Figure 11. Drought Damage in 2002.

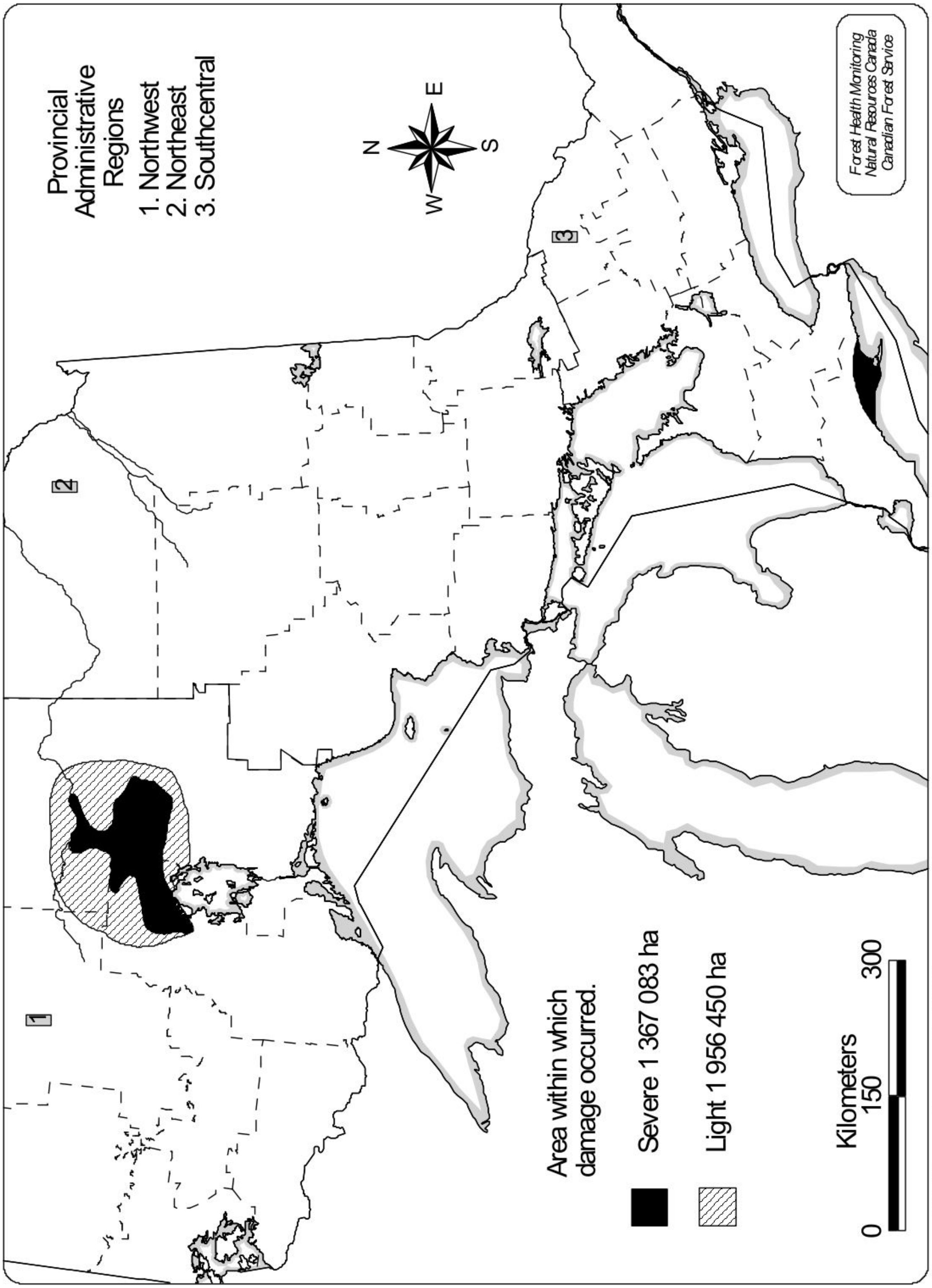


Figure 12. Snow damage in 2002.

Sommaire du relevé
Des insectes et des maladies des arbres au Québec en 2002

Clement Bordeleau, Direction de la conservation des forêts, Ministère des ressources naturelles du Québec

RÉSUMÉ

Les conditions climatiques froides et pluvieuses qui ont prévalu d'avril à la mi-juin 2002 ont favorisé le développement d'une panoplie de maladies des feuilles et ont contribué à atténuer les dégâts causés par les insectes défoliateurs printaniers. La tordeuse des bourgeons de l'épinette et l'arpenteuse de la pruche sont demeurées les principaux ravageurs des résineux. Par rapport à 2001, les défoliations qu'elles ont causées ont toutefois connu une baisse importante. Dans les forêts de feuillues, la livrée des forêts a posé le problème entomologique le plus important, alors que dans les plantations, le grand hylésine des pins est demeuré une préoccupation importante.

ABSTRACT

The cold and rainy conditions that prevailed from April to mid-June 2002 favoured the development of a variety of leaf diseases and served to mitigate the damage caused by defoliator insects in the spring. The spruce budworm and the hemlock looper were once again the species primarily responsible for softwood tree damage. However, the defoliation that they caused was substantially less than in 2001. The forest tent caterpillar caused the greatest entomological problem in hardwood forests, while the pine shoot beetle remained a major concern in plantations.

Les principaux faits marquants de la saison ont été :

. la diminution importante des superficies défoliées par la tordeuse des bourgeons de l'épinette comparativement à l'année dernière ;
. la poursuite de la régression de l'épidémie d'arpenteuses de la pruche dans la région de la Côte-Nord et la détection d'infestations locales dans les régions du Bas-Saint-Laurent et de la Chaudière-Appalaches ;
. le déclin de l'épidémie de livrées des forêts dans plusieurs territories de l'Abitibi-Témiscamingue:
. la détection du grand hylésine des pins dans six nouvelles municipalités régionales de comté (MRC) ;
. la régression des populations de tordeuses du tremble dans les régions des Laurentides et de l'Outaouais ;
. la dessiccation entraînée par la sécheresse chez plusieurs feuillus.

Les unités territoriales retenues pour situer les phénomènes sont les régions administratives du Québec ainsi que les unités de gestion du ministère des Ressources naturelles (MRN). Les limites de ces entités administratives sont indiquées sur la carte 1. Les noms des localités citées dans le rapport sont conformes au *Répertoire toponymique du Québec* (1987). On peut obtenir des informations complémentaires et des précisions quant aux endroits où l'on a détecté des ravageurs en consultant le site Internet, Feux, insectes et maladies des arbres au Québec (FIMAQ), www.mrn.gouv.qc.ca/fimaq/ ou en s'adressant à la Direction de la conservation des forêts.

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

Les dégâts attribuables à la tordeuse des bourgeons de l'épinette ont connu une forte régression en 2002. Les superficies affectées sont en effet passées de 18 900 ha en 2001 à quelque 4 800 ha cette année (tableau 1, carte 2). La baisse des défoliations a été considérable principalement dans la région de l'Outaouais. L'inventaire des larves en hibernation (L2) effectué à l'automne 2001 nous avait permis de prévoir ce recul de l'infestation dans maints secteurs des unités de gestion de la Coulonge et de la Basse-Lièvre. La réduction des aires défoliées est cependant aussi attribuable aux températures fraîches et pluvieuses du printemps 2002, qui ont contribué à atténuer les dégâts en désynchronisant le développement de l'insecte et celui des pousses. Les superficies infestées par la tordeuse ont par contre légèrement augmenté dans les régions de la Mauricie et du Saguenay–Lac-Saint-Jean.

Tableau 1 - Superficies (ha) affectées par la tordeuse des bourgeons de l'épinette au Québec en 2002

Régions administratives	Unités de gestion	*Niveaux de défoliation*			*Total*
		Léger	*Modéré*	*Grave*	
Saguenay–Lac-Saint-Jean	21	136 (59)[1]	200 (26)	129 (228)	465 (313)
	23	50 (0)	9 (0)	0 (0)	59 (0)
	Total	186 (59)	209 (26)	129 (228)	524 (313)
Centre-du-Québec	41	0 (32)	83 (67)	0 (7)	83 (106)
Mauricie	41	88 (0)	82 (31)	628 (497)	798 (528)
Estrie	51	0 (0)	0 (0)	18 (19)	18 (19)
Laurentides	64	0 (0)	0 (8)	0 (45)	0 (53)
Outaouais	71	322 (160)	202 (1 071)	1 247 (3 845)	1 771 (5 076)
	72	553 (295)	117 (1 073)	0 (8 694)	670 (10 062)
	73	529 (131)	388 (215)	41 (2 399)	958 (2 745)
	Total	1 404 (586)	707 (2 359)	1 288 (14 938)	3 399 (17 883)
Total général		**1 678** (677)	**1 081** (2 491)	**2 063** (15 734)	**4 822** (18 902)

( )[1] = Superficies affectées en 2001

Les défoliations relevées dans l'Outaouais ne couvrent que 3 400 ha cette année. L'épidémie a connu une forte baisse dans la majorité des secteurs qui sont affectés depuis plusieurs années, soit ceux inclus dans le périmètre délimité par les municipalités de Fort-Coulonge, Maniwaki et Buckingham. Les dégâts les plus importants (de modérés à graves) ont été observés à l'Île-du-Grand-Calumet et le long de la rivière Gatineau, entre Low et Maniwaki, alors que des foyers de moindre intensité ont été repérés en périphérie de Portland-Ouest, au sud-est de Val-des-Monts et au nord de Bristol-Ridge.

Les infestations rapportées dans les autres régions du Québec sont demeurées locales. Aucun dégât n'a été rapporté cette année dans les Laurentides, alors qu'en Estrie et dans le Centre-du-Québec, l'épidémie est demeurée circonscrite aux plantations d'épinettes blanches de Compton et du Sanctuaire de Drummondville. Les superficies défoliées ont continué à s'accroître en Mauricie. Les dégâts demeurent toutefois confinés au secteur du lac Bouchard (parc national de la Mauricie), en bordure de la route 155 (au sud de Saint-Roch-de-Mékinac) ainsi que dans une plantation d'épinettes blanches à Saint-Georges. Les superficies défoliées se sont également accrues au Saguenay–Lac-Saint-Jean. L'intensité des dégâts y a généralement été moindre que l'année dernière, mais quelques nouveaux foyers sont apparus au nord de la rivière Saguenay ainsi que dans l'arrondissement de Chicoutimi.

PRÉVISIONS POUR 2003

L'inventaire des larves en hibernation (L2) a été réalisé dans quelque 400 sites répartis dans la province. Plusieurs données ne sont pas encore disponibles. Dans l'Outaouais, les résultats préliminaires indiquent que l'épidémie demeurera confinée majoritairement à l'intérieur du périmètre infesté depuis quelques années et qu'elle ne devrait pas progresser de façon notable à l'extérieur de cette zone (cartes 3 et 4). Les dégâts devraient y être cependant plus graves et plus étendus qu'en 2002. Les foyers localisés en Estrie, en Mauricie, dans le Centre-du-Québec et dans le Saguenay–Lac-Saint-Jean seront encore infestés gravement l'an prochain. Aucune expansion majeure de ces infestations locales n'est toutefois prévue pour 2003. Dans toutes les autres régions du Québec, les populations de tordeuses resteront à l'état endémique.

ARPENTEUSE DE LA PRUCHE *Lambdina fiscellaria fiscellaria (Guen)*

En 2002, l'épidémie d'arpenteuses de la pruche a poursuivi sa régression dans la Moyenne et la Basse-Côte-Nord, alors que de nouvelles infestations locales ont été détectées dans les régions du Bas-Saint-Laurent et de la Chaudière-Appalaches. Les superficies défoliées couvrent un peu plus de 45 500 ha, comparativement à 63 529 ha l'année dernière (tableau 2, carte 5).

Tableau 2 - Superficies (ha) affectées par l'arpenteuse de la pruche au Québec, en 2002

Région administrative	Unités de gestion	Niveaux de défoliation			Total
		Léger	Modéré	Grave	
Bas-Saint-Laurent	11	0 (0)[1]	3 (0)	61 (0)	64 (0)
Chaudière-Appalaches	35	0 (0)	0 (0)	15 (0)	15 (0)
Côte-Nord	95	1 288 (0)	8 955 (866)	35 200 (62 663)	45 443 (63 529)
Total		**1 288** (0)	**8 958** (866)	**35 276** (62 663)	**45 522** (63 529)

( )[1] = Superficies affectées en 2001

L'épidémie, qui s'est amorcée en 1998 dans la région de la Côte-Nord, a atteint son apogée en l'an 2000, pour ensuite connaître une régression considérable en 2001. Comme cela avait été prévu, cette régression s'est poursuivie en 2002. Tous les foyers qui avaient persisté l'année dernière entre la municipalité de Rivière-Saint-Jean et la rivière Saint-Augustin ont chuté cette année. L'infestation ne s'est maintenue que dans un secteur à l'est de la rivière Saint-Augustin, et de nouveaux territoires avoisinant l'aire infestée en 2001 ont été affectés.

Enfin, des infestations locales de faible étendue ont été détectées le long du fleuve Saint-Laurent, entre Cap-Saint-Ignace et l'Isle-Verte. Neuf foyers ont été repérés dans le Bas-Saint-Laurent, soit à Rivière-Ouelle, Pointe-aux-Orignaux, Rivière-du-Loup, Cacouna et l'Isle-Verte, et un autre à l'Île-aux-Oies, dans la région de la Chaudière-Appalaches. Ils couvrent une superficie totale de 79 ha.

PRÉVISIONS POUR 2003

Les résultats de l'inventaire des œufs effectué dans l'est du Québec ne sont pas encore disponibles. Les captures de papillons dans les stations du réseau de pièges à phéromone indiquent cependant que les populations d'arpenteuses demeureront généralement endémiques dans la province. Aucune expansion importante des infestations locales détectées en 2002 dans la région du Bas-Saint-Laurent n'est prévue pour 2003. On présume également que l'épidémie poursuivra sa régression dans la région de la Côte-Nord.

TORDEUSE DU PIN GRIS *Choristoneura pinus pinus* Free.

Les populations de tordeuses du pin gris sont demeurées à l'état endémique en 2002.

LIVRÉE DES FORÊTS ***Malacosoma disstria*** **Hbn**

L'épidémie de livrées des forêts a connu une régression considérable en 2002. Les superficies affectées par l'insecte ont diminué de près de 75 % par rapport à l'année dernière, passant de quelque 1 250 000 ha en 2001 à 315 853 ha en 2002 (tableau 3, carte 6). La baisse des défoliations a été considérable dans toutes les unités de gestion de l'Abitibi-Témiscamingue, sauf dans celle de Témiscamingue. Les dégâts se sont par contre légèrement accrus dans la région de l'Outaouais, bien qu'ils soient demeurés confinés dans le même secteur que l'année dernière.

Tableau 3 – Superficies (ha) affectées par la livrée des forêts au Québec en 2002

Régions administratives	Unités de gestion	Niveaux de défoliation			Total
		Léger	Modéré	Grave	
Outaouais	73	40 (408)[1]	319 (29)	0 (0)	359 (437)
	74	809 (12 014)	9 269 (11 538)	20 382 (475)	30 460 (24 027)
	Total	849 (12 422)	9 588 (11 567)	20 382 (475)	30 819 (24 464)
Abitibi-Témiscamingue	81	8 244 (44 303)	8 552 (53 200)	89 042 (1 636)	105 838 (99 139)
	82	19 248 (89 862)	21 375 (183 394)	41 137 (12 648)	81 760 (285 904)
	83	14 669 (27 972)	20 231 (96 482)	208 (17 227)	35 108 (141 681)
	84	11 202 (5 447)	1 930 (57 027)	0 (12 803)	13 132 (75 277)
	85	733 (42 677)	561 (144 634)	92 (18 283)	1 386 (205 594)
	86	19 273 (16 651)	2 143 (153 003)	19 (148 251)	21 435 (317 905)
	87	7 961 (16 470)	11 382 (65 796)	6 963 (17 968)	26 306 (100 234)
	Total	81 330 (243 382)	66 174 (753 536)	137 461 (228 816)	284 965 (1 225 734)
Nord-du-Québec	26	69 (0)	0 (0)	0 (0)	69 (0)
Total général		**82 248** (255 804)	**75 762** (765 103)	**157 843** (229 291)	**315 853** (1 250 198)

( )[1] = Superficies affectées en 2001

En Abitibi-Témiscamingue, l'infestation a fortement chuté dans la zone qui était infestée depuis 1999, soit dans le territoire situé au nord de la route 117. L'épidémie a presque complètement disparu dans l'unité de gestion du Lac-Abitibi, alors que dans celles de Mégiscane, d'Harricana, de Val-d'Or et de Quévillon, on n'a relevé que des défoliations sporadiques dont l'intensité était généralement de niveau léger. Les dégâts modérés n'ont été observés que dans quelques foyers résiduels, principalement en périphérie de Val-d'Or, Malartic, Cadillac, Lac-Castagnier, Senneterre et Louvicourt. Dans les secteurs de Desmaraisville, à la limite nord-est des aires affectées par la livrée, l'infestation s'est par contre intensifiée et étendue légèrement par rapport à l'année dernière. Elle a atteint la limite sud-ouest de l'unité de gestion de Chibougamau, dans la région du Nord-du-Québec. Le déclin des populations de livrées s'est aussi produit dans l'unité de gestion de Rouyn-Noranda. Cependant, des dégâts modérés et graves ont encore été enregistrés dans le sud-ouest de cette unité, alors que dans celle de Témiscamingue, l'épidémie demeurait très intense. Les territoires inclus dans le quadrilatère délimité par Laniel, le lac Simard, Évain et la frontière de l'Ontario ont été fortement défoliés en 2002.

En Outaouais, l'infestation s'est maintenue dans la réserve de La Vérendrye, soit entre les réservoirs Dozois et Cabonga ainsi qu'au nord du lac Jean Péré (Le Domaine). Elle a pris de l'expansion dans le secteur du réservoir Dozois, alors que les foyers relevés l'année dernière entre le Barrage Barrière et le lac Camachigama ainsi qu'au réservoir Cabonga (limite est de l'infestation en 2001) se sont résorbés en 2002. Une nouvelle zone d'infestation couvrant plus de 200 ha a par contre été détectée, lors des évaluations terrestres, au sud-est de la limite de l'infestation de 2001. Ce secteur, situé au sud du lac Roland, a été gravement défolié cette année. Dans les autres régions du Québec, aucune défoliation n'a été rapportée.

TORDEUSE DU TREMBLE *Choristoneura conflictana* (Wlk.)

Ce défoliateur important sur le peuplier faux-tremble a connu une régression significative de ses populations dans tous les foyers actifs en 2001.

Aussi bien dans la région des Laurentides que dans celle de l'Outaouais, il ne reste que de petits foyers épars de défoliation. Des dégâts modérés ont été relevés au lac Leslie, à Mont-Saint-Michel et à Notre-Dame-de-Pontmain, alors que des défoliations légères ont été enregistrées dans quelques localités situées au sud de l'unité de gestion de la Haute-Gatineau et près de Sainte-Véronique. Il existe également plusieurs petits foyers à l'état de trace dans ces deux régions. Ailleurs, l'insecte n'a pas été détecté.

SPONGIEUSE ***Lymantria dispar* (L.)**

On constate une baisse des populations de cet insecte dans les foyers existants en 2001. On a détecté, par contre, un nouveau foyer dans la région de la Chaudière-Appalaches.

En Montérégie, le foyer de défoliation modérée relevé l'année dernière le long de l'autoroute 10 près de Chambly présente, en 2002, des dégâts très légers. Le chêne rouge est l'essence affectée. Dans la région de l'Outaouais, on n'a observé que des traces de l'insecte, notamment à Caldwell, Fitzroy, Rivière-Barry et Portage-du-Fort.

Dans la Capitale-Nationale, le foyer d'infestation relevé en 2001 est resté stable. On a encore relevé de très faibles dégâts (à l'état de trace) sur les chênes rouges à Sainte-Pétronille et à Saint-Laurent (île d'Orléans). Finalement, un foyer d'infestation est apparu en 2002 à Saint-Jean-Chrysostome, dans la région de la Chaudière-Appalaches. Des peupliers à grandes dents y ont été modérément défoliés.

MALADIES DES FEUILLES

Le printemps frais et humide de 2002 a entraîné le développement de plusieurs maladies des feuilles, dont l'anthracnose sur le hêtre et le chêne, *Discula umbrinella* (Berk. & Broome) Sutton, la brûlure des pousses du peuplier, *Pollacia radiosa* (Lib.) Baldacci & Cif., la tache septorienne sur l'érable à sucre par *Septoria* spp., la tache d'encre sur le peuplier, *Ciborinia whetzelii* (Seaver) Seaver, et la cloque des feuilles sur l'érable rouge, *Taphrina dearnessii* Jenkins. On a retrouvé, pour une seconde année consécutive, à Kazabazua, la rouille sur les feuilles de chêne rouge, *Cronartium quercuum* (Berk.) Miyabe ex Shirai.

DÉGÂTS CLIMATIQUES

Gelure printanière

La saison de croissance a débuté tard ce printemps, et les températures froides ont persisté jusqu'au mois de juin. Les essences qui débourrent en premier, comme le peuplier faux-tremble, ont subi des dommages reliés aux gels printaniers. Au nord du 49^{e} parallèle, dans les secteurs de Chapais, Chibougamau et de la Réserve faunique Ashuapmuchuan, des cimes entières ont gelé. Les arbres ont dû puiser dans leurs réserves pour refaire leur feuillage. Les peupliers faux-trembles, en Estrie et en Montérégie, ont subi les mêmes sévices. Le chêne rouge, dans la région de la Mauricie, a aussi été endommagé, parfois gravement. Les plantation d'épinettes, dans beaucoup de régions, ont subi des gelures aux nouvelles pousses, à diverses intensités.

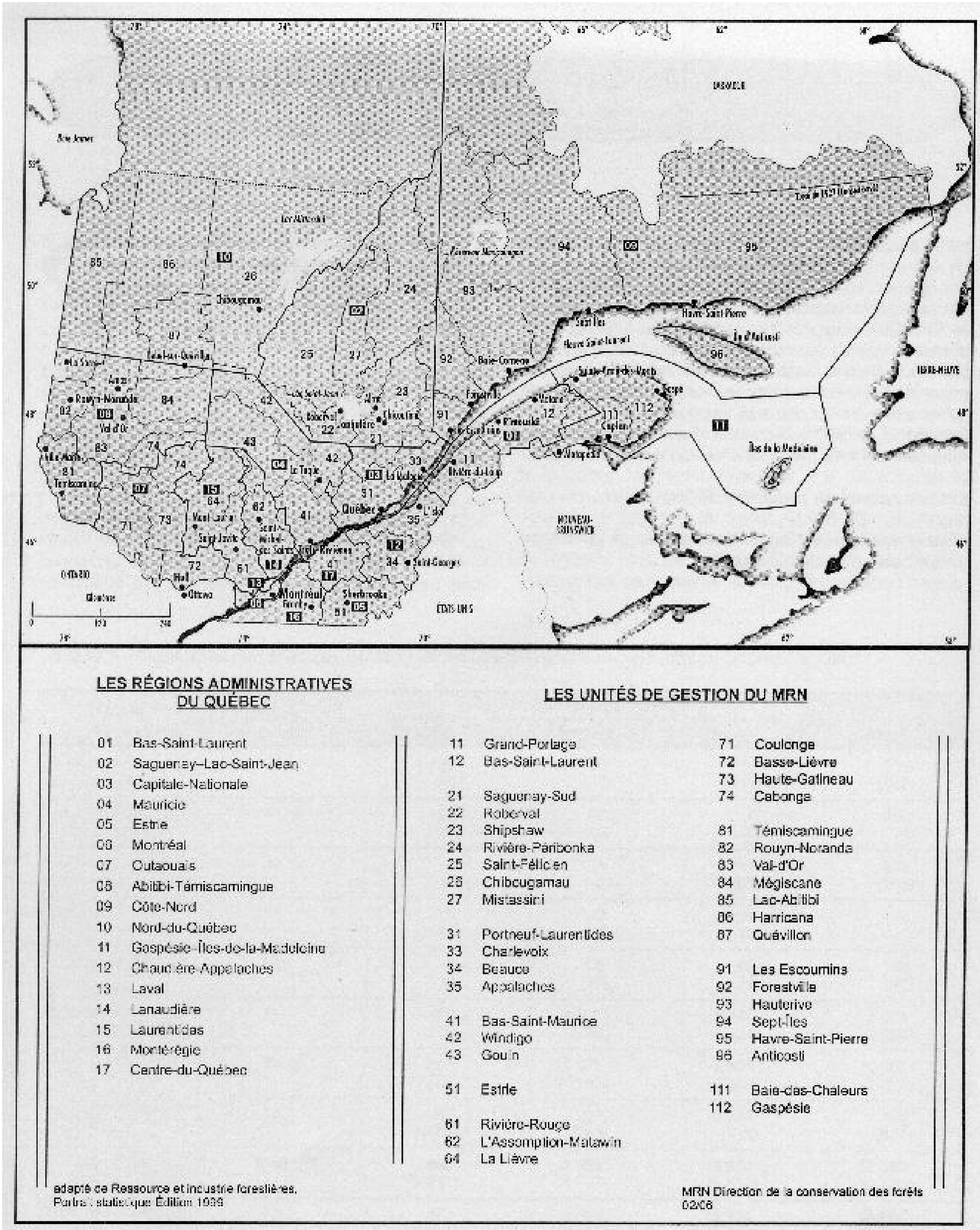
Sécheresse

Dans plusieurs régions de la province, les mois d'août et de septembre 2002 ont été caractérisés par des températures anormalement élevées et de faibles précipitations qui ont entraîné une dessiccation plus ou moins importante des végétaux. On a noté la roussissure et la décoloration hâtive des feuilles, la défeuillaison prématurée de certains feuillus, une réduction de la croissance ainsi qu'un dépérissement des rameaux et des branches des arbres. De plus, on a observé la mortalité de hêtres à grandes feuilles en Montérégie. Diverses essences ont été affectées, mais ce sont surtout le bouleau à papier, le bouleau jaune, l'érable rouge et le peuplier faux-tremble qui ont le plus souffert. Le thuya et un grand nombre de feuillus, dont le hêtre à grandes feuilles, l'érable à sucre, le frêne, le chêne rouge, l'ostryer de Virginie et le saule, ont également été affectés par la sécheresse. Des dommages sur d'importantes superficies ont été rapportés pour le bouleau, l'érable et le peuplier dans plusieurs régions, soit celles du Saguenay–Lac-Saint-Jean, de la Capitale-Nationale, de la Mauricie, de l'Estrie, de Montréal, de l'Outaouais et de l'Abitibi-Témiscamingue. Les arbres atteints croissaient généralement sur des sols minces de flancs de montagnes, de pentes abruptes et d'affleurements rocheux.

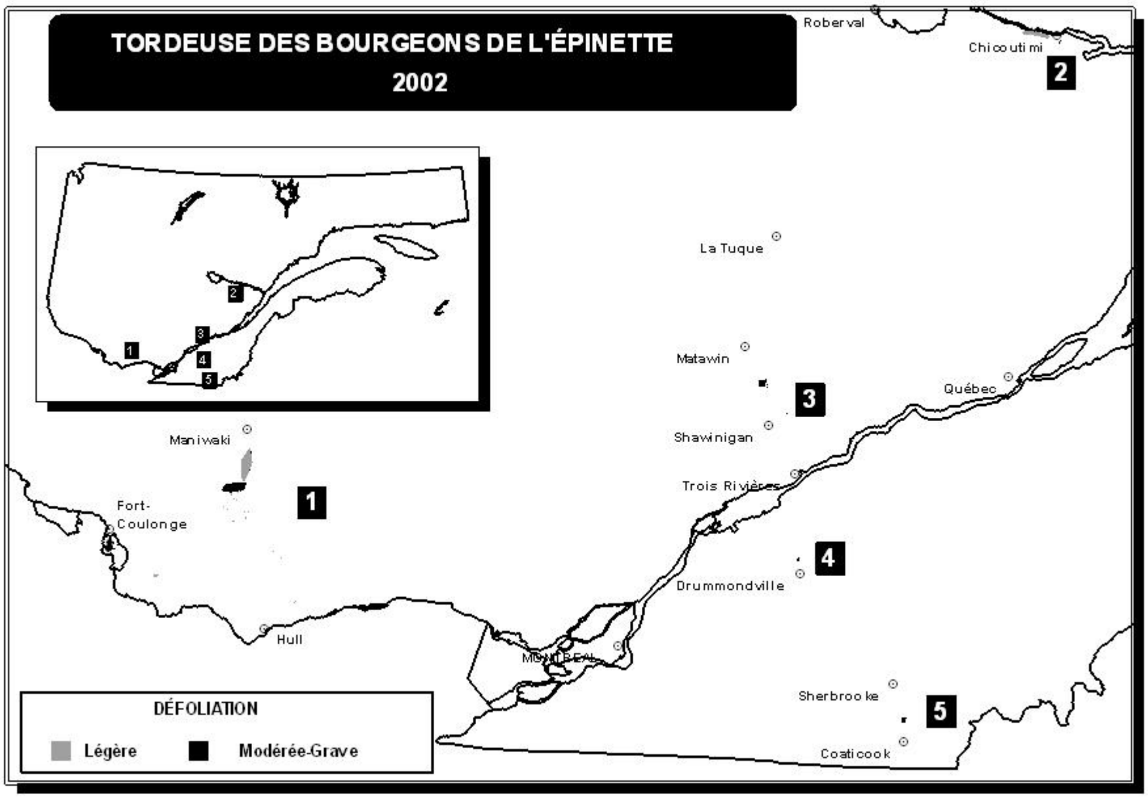
GRAND HYLÉSINE DES PINS *Tomicus piniperda* (L.)

Les relevés effectués par l'Agence canadienne d'inspection des aliments et la Direction de la conservation des forêts du ministère des Ressources naturelles du Québec ont permis de détecter la présence du grand hylésine des pins dans six nouvelles municipalités régionales de comté du Québec (MRC), dont quatre sont situées sur la rive nord du fleuve Saint-Laurent (carte 7). Ces résultats sont préliminaires car l'identification des spécimens capturés dans les pièges Lindgren n'est pas encore complétée.

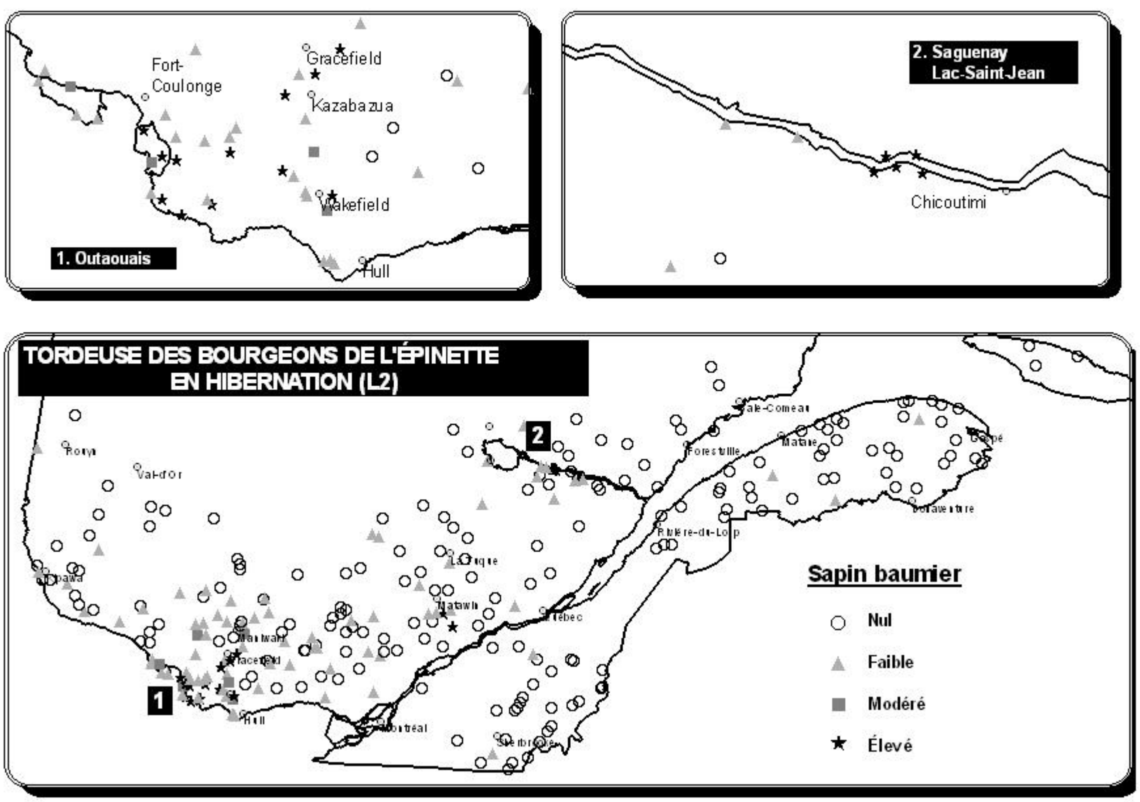
Les nouveaux sites ont été relevés près de Campbell's Bay (MRC de Pontiac), Mont-Tremblant (MRC des Laurentides), Brownsburg (MRC d'Argenteuil), Sainte-Élisabeth (MRC d'Autray), Franklin (MRC Le Haut-Saint-Laurent) et Contrecoeur (MRC de Lajemmerais).



Carte 1. Limites des régions administratives du Québec et des unités de gestion du ministère des Ressources naturelles

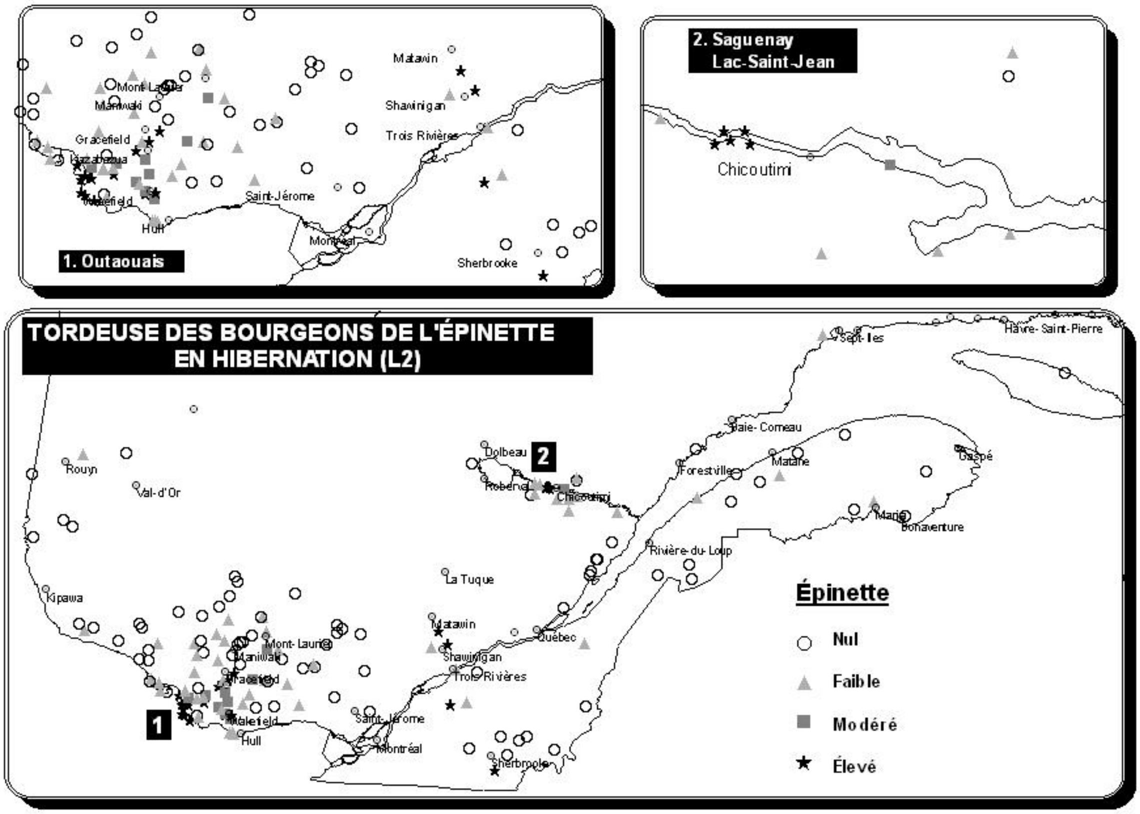


Carte 2. Territoires infestés par la tordeuse des bourgeons de l'épinette au Québec en 2002

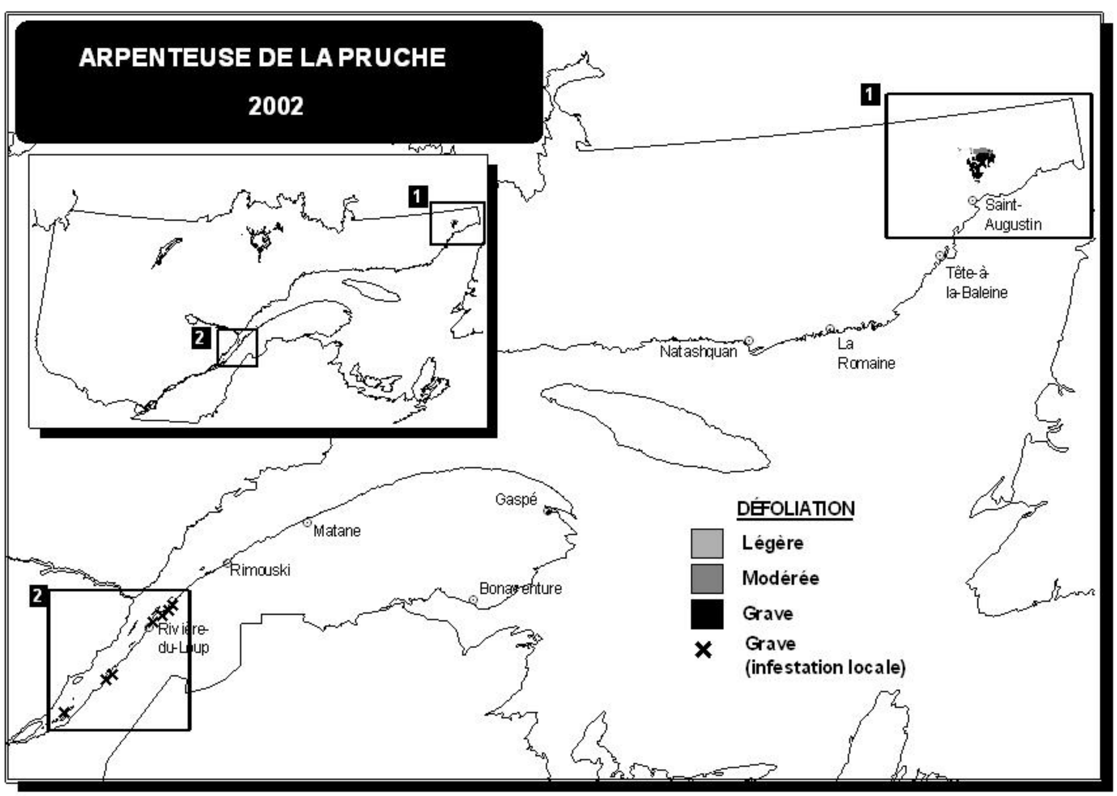


Carte 3. Niveaux de populations de tordeuses des bourgeons de l'épinette prévus sur le sapin baumier en 2003

SESSION/SÉANCE III

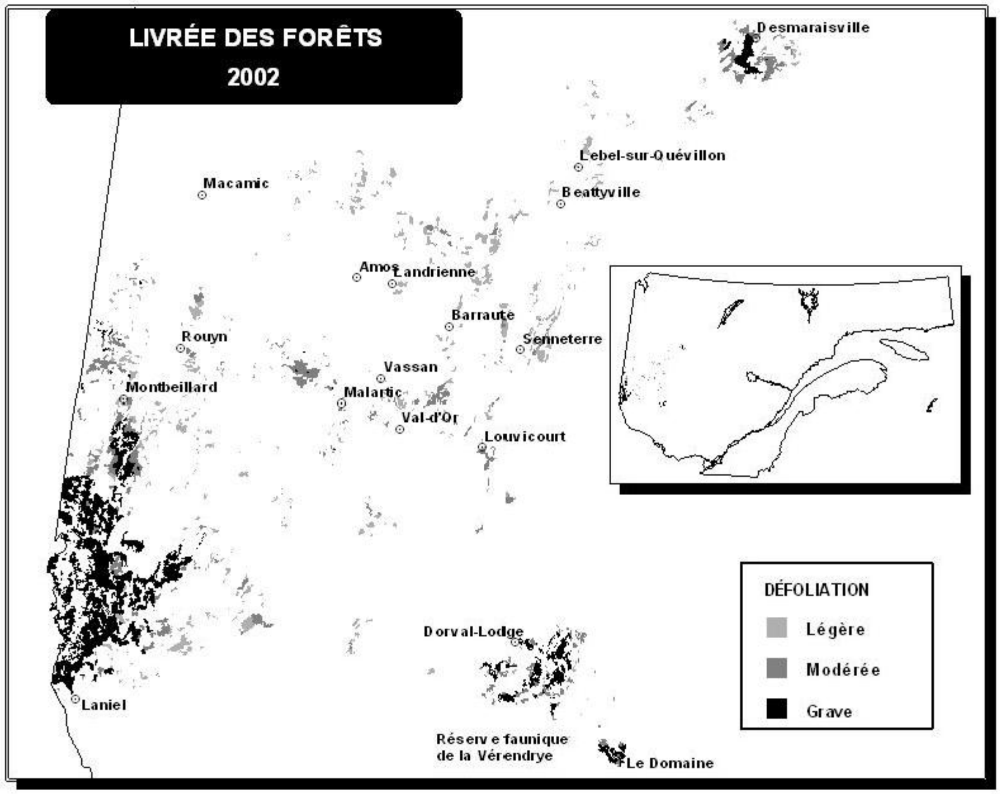


Carte 4. Niveaux de populations de tordeuses des bourgeons de l'épinette prévus sur l'épinette blanche en 2003

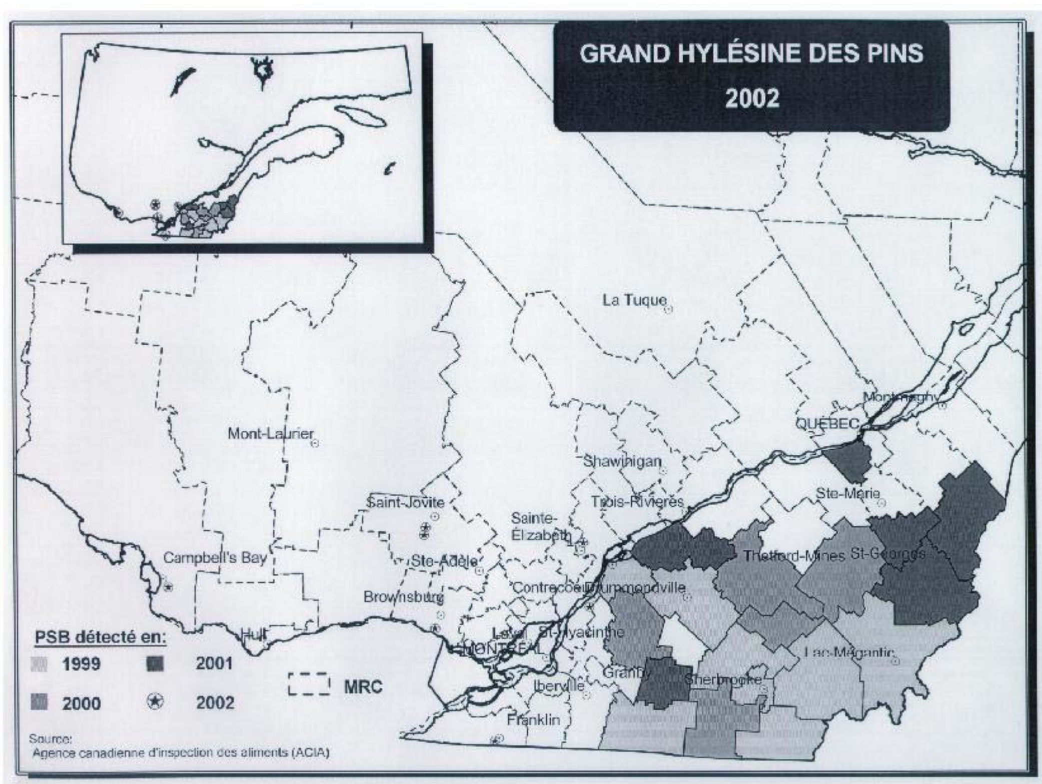


Carte 5. Territoires infestés par l'arpenteuse de la pruche au Québec en 2002

SESSION/SÉANCE III



Carte 6. Territoires infestés par la livrée des forêts au Québec en 2002



Carte 7. Distribution du grand hylésine des pins au Québec en 2002

Factors affecting oviposition site selection on three different hosts of *Monochamus s. scutellatus* (Say) (Coleoptera: Cerambycidae)

Ingrid Aguayo[1], Peter de Groot[2] and Sandy Smith[1]
[1] Faculty of Forestry, University of Toronto, Toronto, Ontario Ingrid.aguayofuentealba@utoronto.ca
[2] Great Lakes Forestry Centre, Canadian Forest Service, Sault Ste. Marie, Ontario

ABSTRACT

The whitespotted sawyer beetle, *Monochamus s. scutellatus* (Say) (Coleoptera: Cerambycidae) is a common, and widely distributed woodborer in North America, that feeds on weakened and recently felled conifers. Comprehending how woodborers locate and select host trees is critical to understanding which trees are at risk and why.

The host preference of *M. s. scutellatus* for different species of pine has not been determined, nor has linkage of preference and performance of larvae been investigated. Attributes crucial for both larval development and their influence upon oviposition site-selection for females will be investigated. Three host species are being studied*, Pinus strobus, P. banksiana, and P. resinosa,* conifers that are economically important in Canada. These species are notably different on their physical characteristics, and there is a lot of variability within species. Attributes under investigation include the physical and chemical characteristics at the microsite, such as phloem thickness, bark thickness, wood decomposition stage, and nutritional quality. In addition, the presence of conspecifics, specifically oviposition deterring compounds left by females will be analyzed. The work presented here has the following objectives: a) to determine the influence of bark and phloem thickness, and female weight on egg laying site selection, and b) to determine the influence of phloem thickness on larval characteristics.

Preliminary results do not show a marked difference in host acceptance for oviposition between the three species. Average slits made per day for jack pine, red pine and white pine were 4.91, 6.00 and 5.89 respectively. Jack and red pine were significantly different, while white pine with jack and red pine were not statistically different at α=0.05 level. In contrast, there is a difference in larval development between the three species. Average weight of larvae for jack, red, and white pine was 0.131, 0.242, and 0.127 g respectively. Differences were statistically significant for the three species at α=0.05 level. Female weight is positively correlated with the number of egg slits made per day; this tendency is manifested in the three species. Females make fewer slits in all three species as bark thickness increases. There is not a consistent relationship between phloem and egg slits made per day for the three species. This could be due to females not being directly in contact with the phloem, unable to assess phloem thickness, therefore not being able to discriminate between phloem thickness for the given range (1.81 to 3.94 mm). When looking at larval weight, the results show there are bigger larvae in thicker phloem; the relationships are statistically significant at α=0.05 for the three species. Despite these preliminary results, it is too early to make any definite conclusion; but they have arisen questions for future work. A greater understanding of the factors that are affecting oviposition site selection may lead to the development of effective management strategies.

Facteurs influant sur la sélection du site de ponte sur trois hôtes différents du longicorne noir (*Monochamus s. scutellatus* (Say) (Coléoptères : Cérambycidés)

Ingrid Aguayo[1], Peter de Groot[2] et Sandy Smith[1]
ingrid.aguayofuentealba@utoronto.ca
[1] Faculté de foresterie, Université de Toronto, Toronto (Ontario)
[2] Centre de foresterie des Grands Lacs, Service canadien des forêts, Sault Ste. Marie (Ontario)

RÉSUMÉ

Le longicorne noir (*Monochamus s. scutellatus* (Say)) (Coléoptères : Cérambycidés) est un perce-bois commun et très répandu en Amérique du Nord, qui ravage les conifères affaiblis ou récemment abattus. Il est capital de comprendre comment ces perce-bois repèrent et sélectionnent leurs arbres hôtes afin de connaître les essences menacées et les raisons pour lesquelles elles le sont.

Aucune étude n'a été publiée sur la préférence du *M. s. scutellatus* pour l'une ou l'autre des différentes espèces de pins, ni sur l'incidence du choix de l'arbre hôte sur le développement des larves. La présente étude a pour objet de déterminer les attributs de l'hôte qui sont essentiels au développement des larves et l'influence qu'ont ces attributs sur la sélection du site de ponte par les femelles. Trois conifères ayant une importance économique au Canada ont été choisis pour la comparaison, soit le pin blanc (*Pinus strobus*), le pin gris (*P. banksiana*) et le pin rouge (*P. resinosa*). Ces trois espèces présentent entre elles des caractères physiques très différents, de même qu'une variabilité considérable au sein de chaque espèce. Les attributs retenus pour l'étude sont les propriétés physiques et chimiques du microsite (notamment l'épaisseur du phloème et de l'écorce), l'état de décomposition du bois et sa valeur nutritive. De plus, nous analyserons la présence de substances conspécifiques, notamment de composés anti-oviposition laissés par les femelles. Les objectifs de l'étude sont les suivants : a) déterminer l'importance de l'épaisseur de l'écorce et du phloème de l'arbre hôte et du poids de la femelle sur la sélection du site de ponte; b) déterminer l'incidence de l'épaisseur du phloème sur les caractéristiques des larves.

Les résultats préliminaires ne révèlent aucune différence marquée au niveau de l'acceptation de l'une ou l'autre des trois espèces hôtes lors de la ponte. Le nombre moyen de trous de ponte forés par jour est de 4,91 pour le pin gris, de 6,00 pour le pin rouge et de 5,89 pour le pin blanc. La différence est significative (α=0.05) entre le pin gris et le pin rouge, mais non entre le pin blanc et le pin gris, ni entre le pin blanc et le pin rouge. On constate entre les trois espèces hôtes une différence significative (α=0,05) au niveau du développement des larves; le poids moyen des larves est de 0,131 g pour le pin gris, de 0,242 g pour le pin rouge et de 0,127 g pour le pin blanc. Pour les trois espèces, il y a une corrélation positive entre le poids des femelles et le nombre de trous de ponte par jour. Pour les trois espèces également, le nombre de trous de ponte diminue à mesure qu'augmente l'épaisseur de l'écorce. Par contre, il n'y a pas de corrélation entre le nombre de trous de ponte et l'épaisseur du phloème. L'explication se trouve peut-être dans le fait que la femelle, n'étant pas en contact direct avec le phloème, ne peut donc pas faire de distinction entre les différentes épaisseurs de phloème considérées (1,81 mm à 3,94 mm. Pour les

trois espèces, on constate une augmentation significative (α=0.05) du poids des larves avec l'augmentation de l'épaisseur du phloème. Ces résultats préliminaires ne permettent pas de se prononcer de façon sûre, mais ils soulèvent les questions qui orienteront la suite de nos recherches. Une meilleure compréhension des facteurs influant sur la sélection des sites de ponte pourrait conduire à l'élaboration de stratégies efficaces de lutte contre le ravageur.

SESSION IV–
URBAN / MUNICIPAL PERSPECTIVE

Chair: Craig Huff, Forester
Transportation, Utilities, and Public Works, City of Ottawa

SÉANCE IV –
PERSPECTIVE URBAINE ET MUNICIPALE

Président : Craig Huff, forestier
Transports, Services publics et Travaux publics, Ville d'Ottawa

Urban Forests: A Critical Perspective on Connecting Communities and Trees

Andy Kenney, Ph. D. R.P.F., Assistant Professor, Urban and Community Forestry, Faculty of Forestry, University of Toronto, Toronto, Ontario

ABSTRACT

Canada's urban forests are home to 80% of the population and provide a variety of environmental, economic, and social benefits. This includes: the sequestering of gaseous air pollutants and particulates; energy conservation through transpirational cooling, shade, and wind reduction; noise buffering; provision of wildlife habitat; increased property value; improved aesthetics; and psychological well being. Nationally, the resource has a conservatively estimated replacement value in the order of $20 billion.

A recent Environics poll asked Ontario urbanites if the presence of trees in their community was of importance to them. Eighty-four percent of respondents indicated that they were "very important" and an additional 14% indicated that they were "somewhat important". When asked if they were concerned about the condition of trees in their local community, one third of respondents said they were "very concerned" and an additional 36% indicated that they were "somewhat concerned".

The growing environment for most urban trees is less than optimal. Confined growing space, soil compaction, air and soil contamination, and physical damage predispose urban trees to secondary pest and disease problems. The narrow genetic base typical in our urban forests exacerbates this threat. For example, a recent study in Toronto estimated that the 72% of the trees in that urban forest (public and privately owned trees) are known hosts to the Asian Long-horned beetle, while 30% are susceptible to Gypsy moth. Approximately 10% of the overall tree population is susceptible to Emerald Ash Borer.

Cities tend to be the "port of entry" for many introduced pests. Historically these have included Dutch elm disease, Asian long horn beetle, Brown spruce long horn beetle, Emerald Ash Borer etc. Invasive plant species that threaten many forest ecosystems also find their way in through the more heavily populated parts of the country. Consequently, an effective program to monitor and control invasive pests in our urban forests will reduce their impact locally and will also help protect adjacent wildland forests. In many jurisdictions, this will greatly assist provincial and federal programs, often suffering from funding and staffing constraints.

In spite of their significance and the stresses they face, few Canadian urban forests have strong strategic plans in place to address these concerns in a proactive manner. In fact, most municipalities don't maintain inventories of their resource. In those cases where inventories or plans do exist, they only address that part of the forest under the jurisdiction of the municipality. As a result, any efforts to control pests and disease are rendered ineffective since 80 to 90 % of the forest is located on private land. Consider, for example, a municipality with a program to monitor and control DED in street and park trees while having no understanding of the status of

the majority of the urban forest on private property that forms the matrix in which the municipal forest is embedded.

Clearly, urban forest in Canada must move from a situation in which, at best, only 10 to 20% of the forest is managed. This will require a change in perspective at the municipal, provincial and national level. At the 5th Canadian Urban Forestry Conference held in Markham ON in October of 2002, participants took part in a series of "brain-storming" sessions to identify key issues and action items to move urban forestry forward. These issues and actions formed part of a submission to the National Forest Strategy Coalition in an effort to have urban forestry included in the next 5-year strategy for the country. The "rallying cry" for the strategy up-date has been "Canada has but one forest". This forest must include the urban forest; the forest where 80% of Canadians live work and play; a forest that provides many important ecological and socio-economic benefits to that population; a forest that is currently under-valued. Recognition of urban forestry in the Forest Strategy will not be enough. The actions outlined in the report will have to serve as the foundation for a National *Urban Forest* Strategy that will be consistent with the importance of the resource and will recognize the challenges that we face in its protection and enhancement.

(For more information, please contact-Pour plus d'information, prière de s'adresser à Andy Kenney at the Faculty of Forestry, University of Toronto (416) 978-0474 or a.kenney@utoronto.ca).

Espaces boisés en milieu urbain : Analyse critique sur les collectivités et leurs arbres

M. Andy Kenney, Ph. D., R.P.F., Professeur adjoint, Foresterie urbaine et communautaire,Faculté de foresterie, Université de Toronto

RÉSUMÉ

Au Canada, les espaces boisés en milieu urbain abritent 80 % de la population et sont à la source de bénéfices aux chapitres environnemental, économique et social : séquestration de polluants atmosphériques gazeux et particulaires, économie d'énergie grâce à l'évapotranspiration, à l'ombre et à la protection contre le vent, amortissement du bruit, gîte pour la faune, augmentation de la valeur des propriétés, qualité esthétique et bien-être. À l'échelle du pays, le coût de remplacement de cette ressource, selon des estimations modestes, serait de l'ordre des 20 milliards de dollars. Lors d'un sondage mené récemment par Environics auprès de citadins d'Ontario sur l'importance qu'ils attachent aux arbres dans leur collectivité, 84 % des personnes qui ont répondu au questionnaire ont déclaré qu'elles y attachent « une grande importance » et 14 %, « une certaine importance ». À la question demandant si elles étaient inquiètes quant à l'état des arbres dans leur collectivité, un tiers a déclaré être « très inquiet » et 36 %, avoir « une certaine inquiétude ».

En milieu urbain, les arbres ont dans la plupart des cas des conditions de croissance qui sont loin d'être optimales : espace réduit, sol compacté, pollution du sol et de l'air et sources diverses de

dommages physiques. Ces conditions les rendent sensibles aux maladies et aux ravageurs, d'autant plus que la diversité génétique au sein des populations urbaines est généralement faible. Selon une étude récente sur les espaces boisés de Toronto, environ 72 % des arbres (terrains publics et privés confondus) sont atteints par le longicorne asiatique, et 30 % sont menacés par la spongieuse. Environ 10 % sont menacés par l'agrile du frêne.

Les villes semblent avoir été les ports d'entrée d'un grand nombre d'organismes nuisibles, dont le vecteur de la maladie hollandaise de l'orme, le longicorne asiatique, le longicorne brun de l'épinette, l'agrile du frêne et bien d'autres. Les espèces végétales exotiques envahissantes qui menacent un grand nombre de nos écosystèmes forestiers ont aussi été introduites via les régions les plus densément peuplées. La mise en place de programmes efficaces de surveillance et de lutte contre les espèces nuisibles dans nos boisés urbains réduirait les dégâts causés localement et protégerait les forêts sauvages environnantes. Dans bien des cas, ces programmes constitueraient un appui non négligeable aux programmes provinciaux et fédéraux, qui souvent manquent de ressources humaines et financières.

En dépit de la grande valeur des arbres se trouvant sur leur territoire et des stress auxquels ceux-ci sont exposés, nombreuses sont les municipalités qui n'ont pas de plan stratégique pour la protection et l'enrichissement de leur forêt urbaine. En fait, la plupart des municipalités ne tiennent même pas d'inventaire de cette ressource. Dans les cas où un plan de gestion a été mis en place, celui-ci ne s'applique qu'aux arbres situés sur le territoire où s'exerce l'autorité de la municipalité. Toute mesure prise par celle-ci pour lutter contre les maladies et les ravageurs est donc vaine, puisque 80 % à 90 % des arbres sont situés sur des terrains privés et échappent à son autorité. Tel serait le cas, par exemple, d'une municipalité qui aurait adopté un programme de surveillance et de lutte contre la maladie hollandaise de l'orme chez les arbres situés en bordure des rues et dans les parcs, sans aucune connaissance de l'état des arbres situés sur les terrains privés, qui forment la matrice dans laquelle sont enchâssés les arbres dont la municipalité a la responsabilité.

Dans le meilleur des cas, seulement 10 à 20 % des arbres en milieu urbain bénéficient de mesures de gestion; il est donc impératif d'améliorer cette situation. Cela exigera de la part des autorités municipales, provinciales et fédérales une nouvelle approche en matière de planification et de gestion des espaces boisés en milieu urbain. À la 5e conférence canadienne sur les forêts urbaines tenue à Markham, en Ontario, en octobre 2002, plusieurs séances de remue-méninges ont été tenues pour dégager les principaux enjeux de la gestion des forêts urbaines et définir des actions concrètes pour faire progresser ce dossier. Les résultats ont été résumés dans le document présenté à la Coalition pour la stratégie nationale sur les forêts afin que la foresterie urbaine soit prise en compte dans la stratégie qui sera adoptée pour les cinq prochaines années. La mise à jour de la stratégie a été articulée autour du thème « Le Canada n'a qu'une seule forêt ». Cette grande forêt doit englober la forêt urbaine, où vivent, travaillent et se divertissent 80 % de la population canadienne et qui procure à cette même population une multitude de bénéfices écologiques et socio-économiques, sans être appréciée à sa juste valeur. Cependant, il ne suffira pas d'inscrire la foresterie urbaine au programme de la Stratégie nationale sur les forêts. Les mesures concrètes décrites dans le rapport devront servir de fondement à une *Stratégie nationale sur les forêts urbaines* qui soit à la mesure de la valeur de cette ressource et des défis que posent sa protection et son amélioration.

Exotic Pests and the Urban Forest A Municipal Perspective

Bill Roesel, R.P.F. City of Windsor, ON

ABSTRACT

Global trade has led to the introduction of exotic forest pests into Canada's Urban Forests. These pests can have a devastating effect on the urban forest, as many of Canada's older cities have a limited variety of mature trees in their core areas. Most residents take pride in the street trees and woodlots in their cities. The loss of urban trees is often felt on a more personal level as it often has a direct impact on city residents.

The City of Windsor is presently being invaded by the Emerald Ash Borer, which appears to have come over from the Detroit area. Although the infestation is in its early stages, it is already having a huge impact on the urban forest. We are receiving a number of calls from concerned citizens regarding this exotic invader. It is estimated that as much as 10 to 15 percent of the city's urban forest may be lost over the next few years. This loss of urban forest not only has a huge price tag attached to it, but it will have a negative impact on the city's residents.

Espèces nuisibles exotiques et espace boisés en milieu urbain dans une perspective municipale

Bill Roesel, ingénieur forestier, Ville de Windsor (Ontario)

RÉSUMÉ

Le commerce international est à l'origine de l'introduction de ravageurs forestiers exotiques dans les espaces boisés en milieu urbain du Canada. Ces espèces nuisibles peuvent s'avérer dévastatrices dans ce type d'environnement, puisque les arbres matures au cœur des villes les plus anciennes du pays appartiennent le plus souvent à peu près tous à la même espèce.

La plupart des résidants tirent fierté des arbres qui poussent dans les rues de la ville et dans les boisés qui la parsèment. La disparition d'arbres en milieu urbain est habituellement ressentie par tous, parce que presque tout le monde la constate.

La Ville de Windsor est actuellement aux prises avec une invasion d'agriles du frêne, qui semblent provenir de la région de Detroit. Bien que la propagation des insectes en soit pour l'instant aux premiers stades, elle a déjà causé des dommages substantiels aux espaces boisés en milieu urbain. La Ville reçoit un nombre croissant d'appels de citoyens préoccupés par la présence de cet envahisseur exotique. Selon les prévisions, 10 à 15 % de la population d'arbres pourrait être sacrifiés dans la ville au cours des années à venir. Non seulement cette perte sera très coûteuse financièrement, mais les résidants en seront également affectés.

Slowing the Spread of the Emerald Ash Borer in Canada

Greg Stubbings and Ken Marchant, Canadian Food Inspection Agency

ABSTRACT

The Emerald Ash Borer, (EAB), *Agrilus planipennis* Fairmaire, is an introduced flatheaded borer (family Buprestidae) responsible for the death of many of the ash trees (*Fraxinus* spp.) in the Detroit, Michigan and Windsor, Ontario areas this year. While there is evidence to suggest that the beetle, which is native to eastern Asia, has been present in the area for at least 5 years, EAB was only positively identified in the US in June of 2002, and on August 8, in Ontario.

The initial indications are that EAB is a primary killer of all species of ash with red and green ashes (*F. pennsylvanica)* being the hardest hit now. While little is know about the beetle in North America, EAB appears to be well adapted to our climate and host species here and has rapidly built up its population to epidemic levels since its original introduction, probably on wood packing materials or dunnage from eastern Asia. Preliminary surveys conducted by the United States Department of Agriculture (USDA) and the Canadian Food Inspection Agency (CFIA) during the summer suggest that EAB is confined to just the Windsor and Detroit areas now.

EAB is considered to be a pest of both economic and environmental significance to both Canada and the US and is likely to have a major impact on both urban and rural forests across North America. In Canada, the CFIA, under the authority of the Plant Protection Act and Regulations is the lead agency with respect to the eradication or preventing the spread of introduced pests such as EAB. Under a Ministerial Order signed in late September, the City of Windsor and its neighbouring municipalities are regulated with respect to the movement of potentially infested materials such as ash nursery stock debris, and forest products and firewood of all species from the infested area. The CFIA is actively working with affected parties in the area to ensure that these materials are not removed from the quarantine area without its permission. The CFIA is working closely with other federal and provincial government departments in Canada and the USDA to develop survey and control strategies for EAB and to coordinate research initiatives.

Freiner la propagation de l'agrile du frêne au Canada

RÉSUMÉ

L'agrile du frêne, *Agrilus planipennis* Fairmaire, est un buprestidé introduit qui a causé cette année la mort de nombre des frênes (*Fraxinus* spp.) des régions de Detroit (Michigan) et de Windsor (Ontario). Bien que certaines observations portent à croire que ce coléoptère, indigène de l'est de l'Asie, est présent dans la région depuis au moins 5 ans, il n'a été formellement identifié qu'en juin 2002 aux États-Unis et le 8 août en Ontario.

Selon les premières indications, l'agrile du frêne est un important ravageur de toutes les espèces de frêne, le frêne rouge et le frêne vert (*F. pennsylvanica)* étant les plus durement touchés à ce jour. On sait peu de choses sur la vie de cet insecte en Amérique du Nord, mais il semble bien adapté à notre climat et aux essences hôtes d'ici, sa population ayant atteint en peu de temps des proportions épidémiques depuis son introduction sur le continent, probablement dans des matériaux d'emballage en bois ou du bois de fardage provenant de l'est de l'Asie. Selon les études préliminaires effectuées durant l'été par le département de l'Agriculture des États-Unis (USDA) et l'Agence canadienne d'inspection des aliments (ACIA), l'agrile du frêne serait pour le moment confiné aux régions de Windsor et de Detroit.

L'agrile du frêne est considéré comme un ravageur qui peut avoir une incidence sur l'économie et l'environnement tant au Canada qu'aux États-Unis, et il pourrait avoir un impact important sur les boisés urbains et ruraux dans toute l'Amérique du Nord. Au Canada, l'ACIA, en vertu de la *Loi sur la protection des végétaux* et de ses règlements, est l'organisme responsable de la lutte contre les organismes nuisibles introduits, comme l'agrile du frêne. En vertu d'une ordonnance ministérielle signée à la fin de septembre, le déplacement des produits potentiellement infestés – matériel des pépinières de frêne, produits forestiers et bois de chauffage de toute espèce, etc. - hors de la zone déclarée infestée (ville de Windsor et municipalités voisines) est réglementé. L'ACIA collabore activement avec les parties concernées dans la région pour veiller à ce que ces produits ne sortent pas de la zone de quarantaine sans sa permission. L'ACIA collabore aussi étroitement avec d'autres ministères fédéraux et provinciaux du Canada et avec l'USDA pour élaborer des stratégies de détection et de lutte visant l'agrile du frêne et pour coordonner les initiatives de recherche.

WHAT IS THE CFIA?

CANADIAN FOOD INSPECTION AGENCY

- Created in April 1997, by Act of Parliament from parts of 4 Federal Government Departments:
  - Agriculture and Agri-Food Canada
  - Fisheries and Oceans Canada
  - Health Canada
  - Industry Canada
- CFIA delivers 14 inspection programs related to food, plants, and animals in 18 regions across Canada
- 3 main program areas:
  - Food Safety
  - Plant Protection
  - Animal Health

PLANT PROTECTION

The Plant Protection Program (Plant Health and Production Division/Programs Branch) is responsible for:

- The exclusion of plant pests (insects, diseases, weeds etc.) from Canada
- The certification of exports of agricultural and forestry products to meet the plant health import regulations of other counties
- The eradication or slowing the spread of endemic or introduced pests of quarantine significance to Canada or its trading partners

Agrilus planipennis Fairmaire (Coleoptera: Buprestidae),

NATIVE RANGE
Eastern Asia including:

- China
- Japan
- Korea
- Manchuria
- Mongolia
- Russia (far east)
- Taiwan

NORTH AMERICAN DISTRIBUTION
USA –as of November 2002
S/E Michigan: counties of:

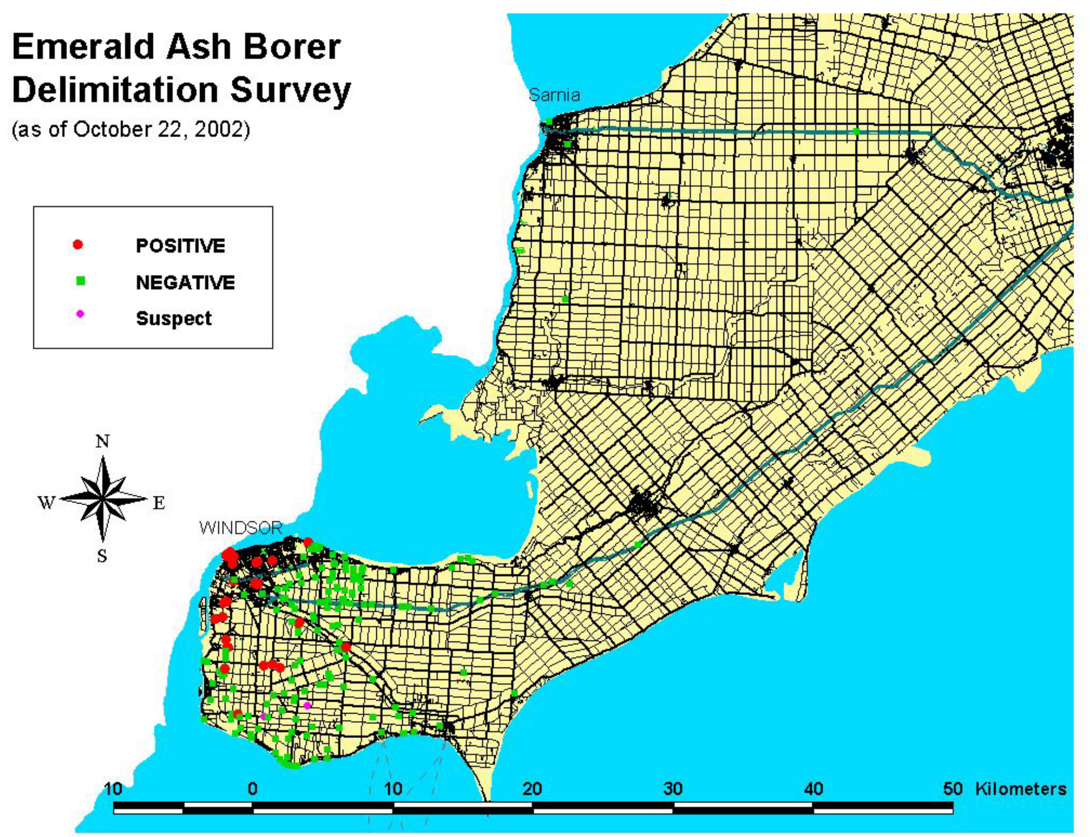
- Macomb
- Oakland
- Livingston
- Washtenaw
- Wayne {Includes City of Detroit}–Monroe (Sept. 2002)

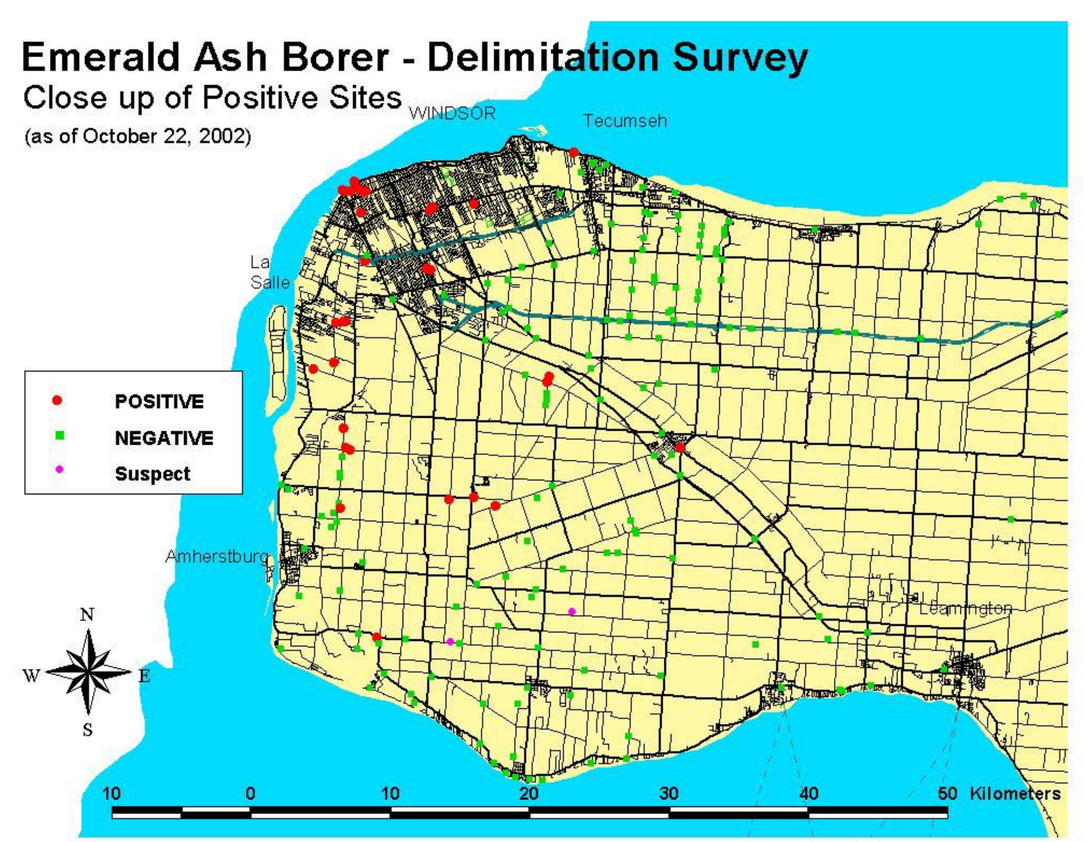
NORTH AMERICAN DISTRIBUTION
Canada –as of November 2002

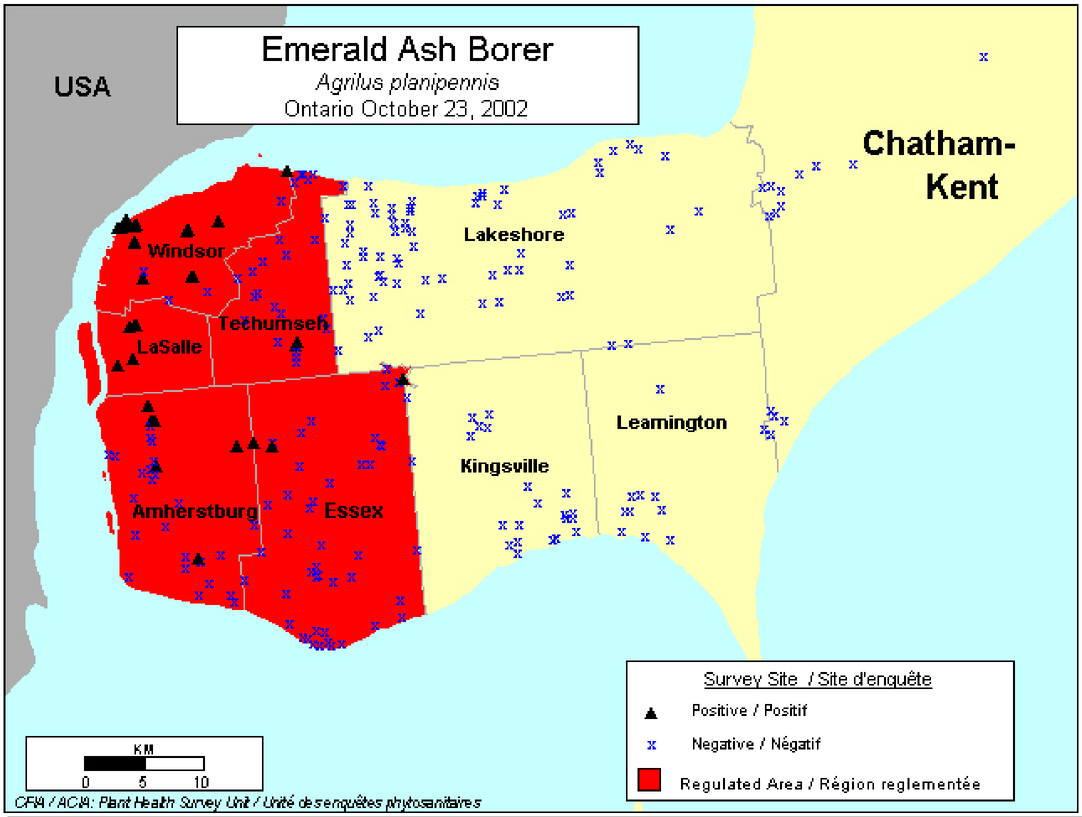
- City of Windsor
- Amherstburg
- LaSalle
- Tecumseh
- Essex

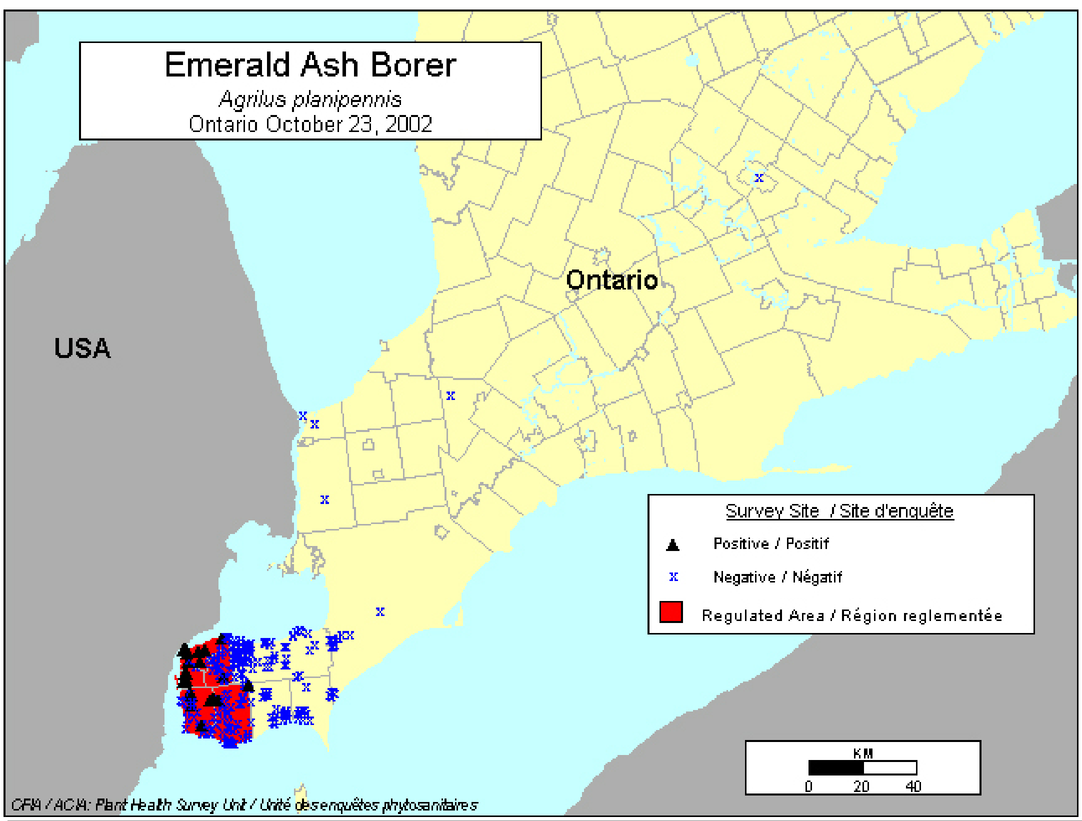
Survey -2002

- Delimitation Survey in Greater Windsor Area - Complete for 2002
- Ontario Municipalities requested to "Self Survey" no new infestations reported to this date
- 1 year life cycle (may be 2 in cold climates)
- Adults emerge from early May to late July
- Maturation feeding on leaves by adults
- Mating 7-10 days after emergence
- Egg laying (oviposition) 7-9 days after mating
- Up to 90 eggs laid in bark crevices
- Adults prefer sunny side of tree
- Eggs hatch in 7-9 days
- 1st instar bore through bark to feed on phloem
- Other instars feed on cambial layer and outer layer of sapwood
- 4 larval instars (stages)
- Characteristic "S" -shaped (or serpentine) tunnels
- Tunnels/galleries filled with brown frass
- Insect overwinters as 4th instar larva and may remain in this state for over a year
- Very resistant to extremes of temperature and desiccation


Emerald Ash Borer
Delimitation Survey
(as of October 22, 2002)
POSITIVE
NEGATIVE
Suspect
Sarnia
WINDSOR
N
W
E
S
10
0
10
20
30
40
50 Kilometers


Emerald Ash Borer - Delimitation Survey
Close up of Positive Sites
(as of October 22, 2002)
WINDSOR
Tecumseh
La Salle
POSITIVE
NEGATIVE
Suspect
Amherstburg
Leamington
N
W
E
S
10
0
10
20
30
40
50 Kilometers


Emerald Ash Borer
Agrilus planipennis
Ontario October 23, 2002
USA
Chatham-Kent
Windsor
Lakeshore
Tecumseh
LaSalle
Leamington
Kingsville
Amherstburg
Essex
Survey Site / Site d'enquête
Positive / Positif
Negative / Négatif
Regulated Area / Région reglementée
KM
0 5 10
CFIA / ACIA: Plant Health Survey Unit / Unité des enquêtes phytosanitaires


Emerald Ash Borer
Agrilus planipennis
Ontario October 23, 2002
USA
Ontario
Survey Site / Site d'enquête
Positive / Positif
Negative / Négatif
Regulated Area / Région reglementée
KM
0 20 40
CFIA / ACIA: Plant Health Survey Unit / Unité des enquêtes phytosanitaires

- An introduced Buprestid Beetle (flat headed borer) … closely related to bronze birch borer and two lined chestnut borer (but a more aggressive pest)
- Adults emerge from tree 8-15 days later
- Exit holes are distinctly “D” shaped or “half-mooned”
- Where populations are high inner bark (cambial) layer may be completely destroyed and bark is easy to remove
- Heavily infested trees may be killed 1-2 years after initial infestation
- Flight dispersal is local but may be up to several km
- Long distance dispersal through movement of infested materials e.g., firewood, nursery stock, dead or dying trees, lumber with bark and dunnage

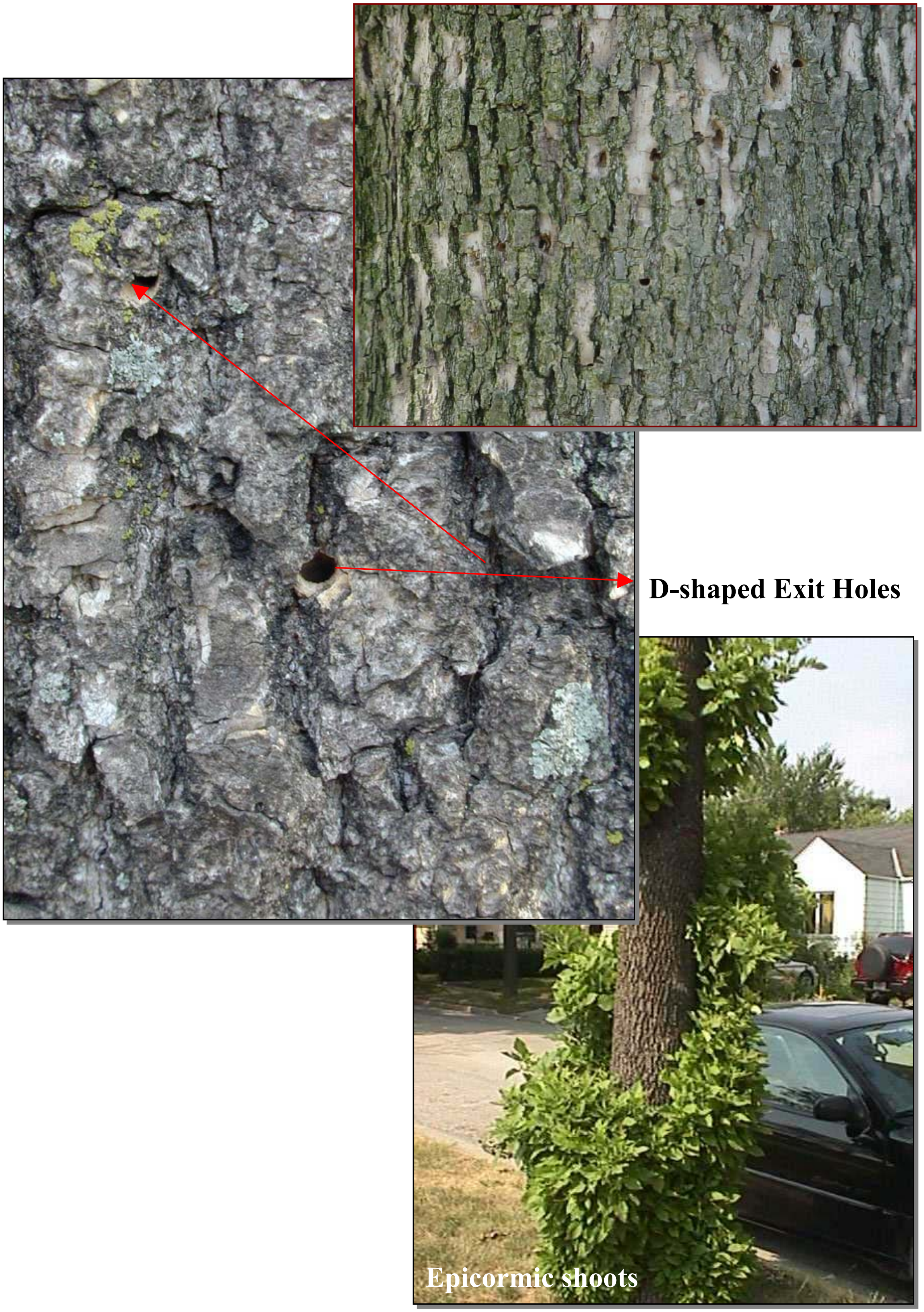
SIGNS/SYMPTOMS OF INFESTATION

- Thinning crown with or without dieback
- Presence of epicormic branches on trunk or base of tree (especially if these are dying)
- Cracks in bark
- Presence of “D” shaped emergence holes
- Serpentine galleries under bark
- Bark easily removed
- Presence of adult beetles (elusive)


MDA/CFIA


Thinning
Crown

CFIA


D-shaped Exit Holes
Epicormic shoots

CURRENT STATUS/CFIA POSITION

- EAB confirmed to be present in Canada - Aug. 2002
- Pest Risk Assessment (PRA) completed… EAB is a pest of economic and environmental significance to forested and urban areas of Canada and the US
- Primary killer of ashes and possibly other important forest and urban species (walnuts and elms?)
- Well suited to North American climate and host species - likely to spread
- Quarantine pest to Canada and the US
- Do nothing
- Eradicate?
- Slow/prevent further spread

CFIA Emergency Response Strategies

- Establish and enforce quarantine areas
- Public notification, education and consultation including media releases
- Secure cooperation from risk makers (stakeholders)
- Harmonize approach with US (Science and Management Panel Recommendations)
- Establish advisory and consultation committees
- Identify Research Priorities

Ministerial Order
Emerald Ash Borer Infested Places Order
September 17, 2002

The Minister of Agriculture and Agri-Food, pursuant to paragraphs 15(3)(a). (d) and (e) of the *Plant Protection Act**, hereby makes the annexed Order declaring certain places to be infested with the Emerald Ash Borer and prohibiting or restricting the movement of the pest and nursery stock, trees, logs, lumber and wood with bark attached, wood chips or bark chips from trees in the genus *Fraxinus* (commonly known as Ash) and firewood of all species that has not been treated in a manner to eliminate the pest, including conveyances Out of those infested places.

▲* S.C. 1990, c. 22

•ORDER DECLARING CERTAIN PLACES TO BE INFESTED WITH THE EMERALD ASH BORER AND

•PROHIBITING OR RESTRICTING THE MOVEMENT OF THE PEST AND

•NURSERY STOCK, TREES, LOGS, LUMBER AND WOOD WITH BARK ATTACHED, WOOD CHIPS OR BARK CHIPS FROM TREES IN THE GENUS *FRAXINUS* (COMMONLY KNOWN AS ASH) AND FIREWOOD OF ALL SPECIES THAT HAS NOT BEEN TREATED IN A MANNER TO ELIMINATE THE PEST, INCLUDING CONVEYANCES OUT OF THOSE INFESTED PLACES

•Short Title•

This Order may be cited as the Emerald Ash Borer Infested Places Order.

Emerald Ash Borer Infested Places Order

- Quarantine Area has been established for:
  - City of Windsor
  - Towns of: Amherstburg, Tecumseh, LaSalle, Essex

- Legal Authority
  - Plant protection act & regulations
- Movement Restrictions on:
  - Ash nursery stock
  - Ash trees and parts thereof (living or dead)
  - Firewood - all species

Consultation Strategies

- **Joint US/Canada Science Panel [SAP]**
- **Critical Pest Council [CFIA + OMNR + NRCan-CFS + OMAF] = shared resources? and harmonized approach to research, surveillance and control...**
- **Federal/Provincial EAB Advisory Committee**
- **Canadian Science & Risk Mitigation sub-committee**
- **Survey sub-committee**
- **Fed/Prov OPS core team**

Proposed EAB Management zones
As developed by US/Canada Science and Advisory Panel and Management Board

1. Core zone
2. Suppression
3. ‘Fire-break’ Zone
4. Detection Survey Zone
5. Targeted Survey Zone

1. Core zone
- Goal:
  - Allow EAB populations to exhaust food resource within a contained area
- Activities:
  - Systematic survey to monitor ash survival and condition and EAB population levels
  - Disposal of woody debris and enforcement of movement restrictions to reduce potential for spread
  - Research

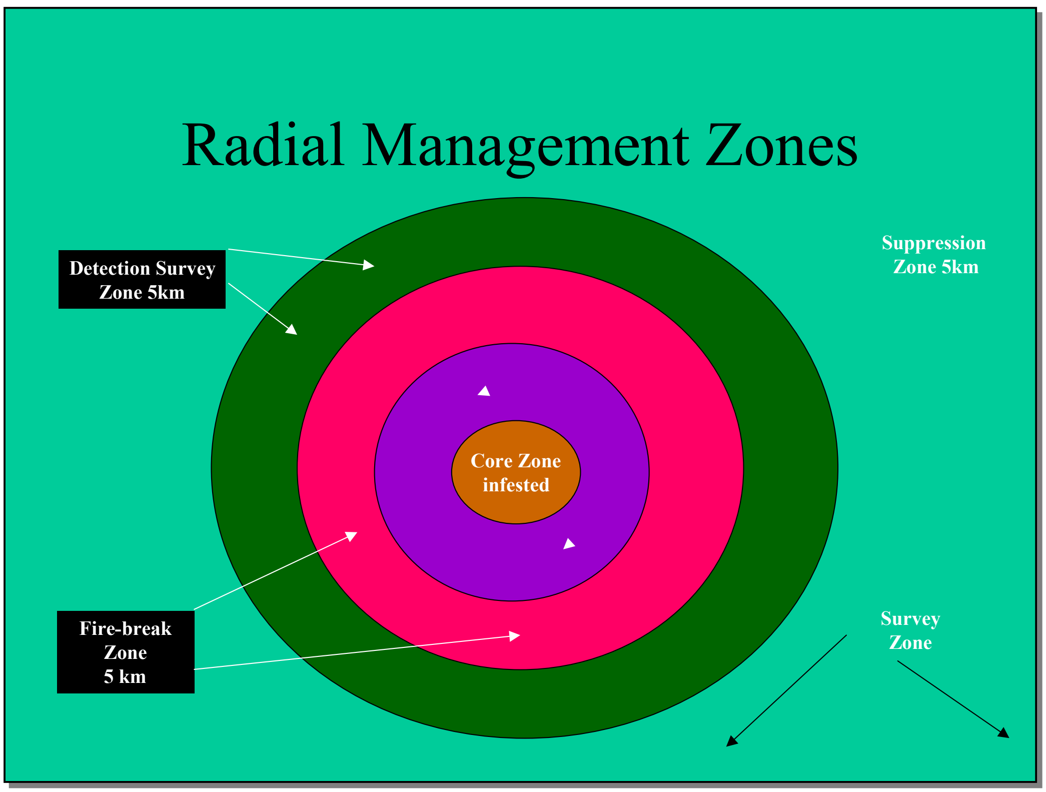
2. Suppression Zone
- Goal:
  - Reduce EAB population density
  - Minimum 5 km wide
  - Ensure integrity of “fire-break” zone
  - Population sink for core zone
- Activities:
  - Use of trap trees, systemic insecticides, adulticides and selective tree removal
  - Systematic survey to evaluate populations, treatments
  - Research

3. “Fire-break/no-host ” Zone
- Goal:
  - Establish and maintain a barrier… min 5 km wide
  - Block the spread from known infested area
- Activities:
  - Minimize availability of suitable hosts - make as unsuitable as possible
  - Use of physiographic features
  - Destruction of known populations in zone
  - Use of insecticides, repellants etc.
  - Systematic survey

4. Detection Survey Zone
- Goal:
  - Discover and eradicate all EAB infestations which have breached the fire-break zone
- Activities:
  - Systematic survey (95% accuracy) to detect infestations of 20 trees of more
  - Removal of all infested trees + hosts +250 m

- Visual inspection of all host trees
- Other as available (acoustic, trapping etc.)

5. Targeted Survey Zone
   - Goal:
     - Ensure that other large infestations do not exist within the region
   - Activities:
     - Inspect risk makers (recipients of possible infested materials such as sawmills, landscape sites, dumps, etc.)
     - Continuing agreement with Municipalities to self-survey



Public Notification & Education

- Work closely with affected municipalities
- Website = www.inspection.gc.ca
- Pest Fact Sheets (OMNR and CFIA)
- Local Media - *Media releases, extensive local coverage, official notices in newspapers etc.*
- 1-800 # = [519] 250-6546 or 1-800-442-2342
- Town hall meetings
- Mail outs

Next Steps

- Secure Funding… $s
- Secure support and commitment from cooperating agencies and affected municipalities
- Obtain secure disposal area - City of Windsor (*under negotiation)*
- Communication and Outreach
    - Public
    - Stakeholders/riskmakers (tree services, firewood vendors, public utilities, developers, nurseries etc.)
- Acceptance of zonal approach to containment and management as identified by EAB Science & Advisory Panel and EAB Management Board
- Identify research needs and priorities (Science &Risk Mitigation sub-committee)
- Design enhanced survey for 2003 (Survey subcommittee)

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

Chair: Mike Apsey
Chair National Forest Strategy
Coalition, Executive Director,
FORCAST

SESSION V - SÉANCE V

SÉANCE V –
BILAN NATIONAL –
CANADA ATLANTIQUE

Président: Mike Apsey
Président de la Coalition pour la
Stratégie nationale sur les forêt
Derecteur general, FORCAST

Forest Pest Conditions in New Brunswick in 2002

(Prepared for the Annual Forest Pest Management Forum held in Ottawa, Nov.13th – 15th, 2002)
[Updated Jan. 20, 2003]

N. Carter, L. Hartling and D. Lavigne, Department of Natural Resources and Energy, Forest Pest Management Section, P.O. Box 6000, Fredericton, N.B. E3B 5H1

ABSTRACT

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 opted to have aerial spraying with B.t. done (~ 30 ha). Defoliation was mapped over 2061 ha, up from 1164 ha last year. This has 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 were again found in the Woodstock area in the west-central region (last detected in 1995). The Canadian Food Inspection Agency had discussions with two forest Marketing Boards about federal regulations governing the movement of wood from designated infested parishes to non-infested areas. Fall egg-mass surveys revealed major population increases in the general Grand Lake – Washademoak Lake areas. Barring a catastrophic collapse (e.g. over winter mortality, or large build-up of natural bio-controls next summer), the majority of the survey evidence indicates that more defoliation will occur in 2003 and populations could expand if control measures are not initiated where threatening populations have been found. There has been heightened public awareness leading to questions about possible Government intervention.

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). Further data analysis is to be conducted.

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 ~ 40 ha (defoliation was last reported in 1997). No significant defoliation by Satin Moth was detected. Beech Bark Disease caused mortality of beech in hardwood stands in northwestern New Brunswick. Observations of Balsam Twig Aphid and Balsam Gall Midge on balsam fir branches checked for spruce budworm indicate that twig aphid populations declined slightly, but are still at high levels. Gall midge populations 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 DNRE's tree Nursery at Kingsclear, and monitoring was done in DNRE's 1st and 2nd generation Seed Orchards. One of the 2nd 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.

Le point sur les ravageurs forestiers au Nouveau-Brunswick en 2002

N. Carter, L. Hartling et D. Lavigne, Ministère des Ressources naturelles et de l'Énergie, Section de la lutte contre les ravageurs forestiers, c.p. 6000, Fredericton (N.-B.) E3B 5H1

RÉSUMÉ

De 1998 à 2001, la proportion de pièges à phéromones dans lesquels des papillons mâles de la tordeuse des bourgeons de l'épinette ont été capturés a augmenté chaque année, et le nombre moyen de papillons par piège a aussi connu une légère augmentation. Cette tendance ne s'est pas maintenue en 2002. Aucune défoliation par la tordeuse n'a été signalée depuis 1995, dernière année où des mesures de suppression ont été prises contre ce ravageur.

L'effectif de l'arpenteuse de la pruche avait augmenté en 2000 (ce qui faisait craindre une infestation), mais il a décliné en 2001. D'après le nombre de prises dans les pièges à phéromones, il a continué de décliner légèrement en 2002. Aucune défoliation par ce ravageur n'a été signalée en 2002.

La situation concernant la spongieuse a évolué considérablement en 2002. Certains propriétaires fonciers ont fait traiter leur propriété au B.t. (pulvérisations aériennes sur une superficie totale d'environ 30 ha. La défoliation atteint une superficie de plus de 2 061 ha, comparativement à 1 164 ha l'an passé, et le risque d'infestation de secteurs encore intouchés s'est considérablement accru. Pour la première fois, on a trouvé des masses d'œufs fraîches et anciennes à Miramichi, dans le nord-est de la province, et on en a trouvé de nouveau (pour la première fois depuis 1995)

dans la région de Woodstock, dans le centre-ouest. L'Agence canadienne d'inspection des aliments a eu des entretiens avec des représentants de deux offices de commercialisation des produits forestiers au sujet de la réglementation fédérale régissant le transport de bois depuis des zones infestées vers des zones non infestées. Les relevés de masses d'œufs effectués à l'automne révèlent une augmentation considérable de l'effectif dans la région des lacs Grand et Washademoak. À moins d'un déclin brutal de l'effectif (mortalité élevée durant l'hiver, forte augmentation des agents de lutte naturels l'été prochain), on peut s'attendre à une défoliation plus grave en 2003, et l'infestation risque de s'étendre si des mesures ne sont pas prises dans les régions où l'effectif atteint un seuil menaçant. Le public est sensibilisé aux dommages causés par la spongieuse, et la question se pose à savoir si une aide gouvernementale est prévue pour lutter contre ce ravageur

Un relevé du puceron lanigère du sapin a été effectué dans 260 localités du sud du Nouveau-Brunswick, et l'espèce a été repérée dans 85 (32,7 %) d'entre elles. Dans 75 % des localités où l'espèce était présente, moins de 10 % des arbres examinés étaient atteints par le ravageur, et les dommages étaient dans la plupart des cas légers (des arbres moyennement endommagés ont été observés dans seulement 13 % des peuplements où l'espèce a été repérée. Des analyses plus approfondies des données seront effectuées.

D'après les prises dans les pièges à phéromones, les effectifs de la tordeuse du pin gris, de la chenille à houppes blanches et de la chenille à houppes rousses demeurent faibles. En prévision d'infestations de la livrée des forêts, des pièges à phéromones ont été placés dans 130 stations à travers la province pour recueillir des données de référence pour fins de comparaison dans les années à venir. Le nombre maximum de prises était de 51 papillons, ce qui ne laisse pas présager d'infestion en 2003. Aucune défoliation significative par ce ravageur n'a été observée.

L'anisote de l'érable a défolié une superficie d'environ 40 ha (la dernière défoliation signalée remonte à 1997). Aucune défoliation significative par le papillon satiné n'a été observée. La maladie corticale du hêtre a causé de la mortalité chez cette essence dans les peuplements de feuillus du nord-ouest du Nouveau-Brunswick.

Le nombre de pucerons des pousses du sapin et de cécidomyies à galle du sapin comptés sur les branches de sapin examinées pour le relevé de la tordeuse des bourgeons de l'épinette montre que l'effectif du puceron a légèrement décliné mais demeure élevé. L'effectif de la cécidomyie a également décliné, et si la tendance se maintient, on assisterait à une stabilisation de la population.

Pour l'instant, on ne signale aucun changement dans la situation des ravageurs exotiques suivants : 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 et le chancre du noyer cendré.

Un soutien en matière de lutte antiparasitaire a été apporté à la pépinière forestière du MRNENB, à Kingsclear. Les vergers à graines de première et de deuxième générations du MRNENB ont fait l'objet d'une surveillance. L'effectif d'une tenthrède était élevé dans un des vergers à graines de pin gris de deuxième génération, et on a appliqué de la perméthrine (Ambush) au sol pour prévenir la défoliation. On a décelé la présence de la tordeuse des bourgeons de l'épinette, de la mouche granivore de l'épinette, de la tordeuse des graines de l'épinette, de la tenthrède à tête jaune de l'épinette et de la tordeuse du pin gris dans plusieurs autres vergers à graines, mais leur effectif n'était pas assez élevé pour nécessiter un traitement. On a trouvé une larve de spongieuse (probablement transportée depuis un peuplement voisin) sur un pin gris du verger à graines de Wheeler Cove.

PESTS OF SOFTWOODS

Spruce Budworm: There was no continuation of the prior 4-year trend of increased captures of male moths in pheromone traps distributed around the Province, and only 1 overwintering larva was found. Populations remain at endemic low levels.

The last area of defoliation (4000 ha) by spruce budworm in New Brunswick was detected in 1995. The last operational control programs were conducted in 1993 on Crown land, and in 1995 by J.D. Irving, Limited on their freehold lands. No defoliation was forecast for 2002 and none was reported.

Pheromone Survey: In 2002, FPMS distributed 202 Multipher pheromone traps around the Province (198 successfully retrieved). In the past four years there had been consecutive increases in the proportion of traps positive with consistent, though slight, increases in mean trap catch (Table 1). Nevertheless, the maximum trap catches were well below numbers expected to cause defoliation. This increasing trend did not continue in 2002, confirming our cautious interpretation of past results. Trap catches were similar to those of 1998 (Table 1).

J.D. Irving, Limited also placed out traps on their freehold limits, and interim results correspond very well with the FPMS survey data.

Table 1. Summary of spruce budworm male moths caught in the operational pheromone trap survey conducted by FPMS in New Brunswick from 1995 to 2002.

Year	Number of traps	Number of moths/trap			Maximum trap catch	Mean trap catch
		Nil	1-10	>10		
1995	296	42%	50%	8%	47	3.27
1996	99	53%	41%	6%	54	3.24
1997	148	73%	27%	0%	6	0.49
1998	148	67%	33%	0%	10	0.95
1999	155	59%	41%	<1%	12	1.05
2000	154	55%	42%	3%	25	1.67
2001	197	42%	50%	8%	32	2.90
2002	198	65%	33%	2%	12	1.02

L2 Survey: An overwintering L2 survey was also conducted by FPMS around the Province at 75 locations. At 50 plots, the usual method of sampling 3 trees/plot was maintained. At 25 other plots, 30 trees/plot were sampled to increase the chances of detecting rising populations earlier than might be detected in the regular survey and to analyze along with moth counts from pheromone traps. Only one larva was found on 900 branches.

Supplementary samples routinely collected by J.D. Irving, Limited from their freehold limits will be processed when they are received.

Table 2. Number of overwintering spruce budworm larvae detected in DNRE's operational L2 survey from 1996 to 2002.

	YEAR						
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Number of plot	503	317	75	75	75	78	75
Number of branches	1509	951	900	900	900	909	900
Number of L2	8	2	4	0	5*	1*	1

* Found on branches from a 30-tree plot – the same plot in 2000 and 2001.

Jack Pine Budworm: Pheromone traps captured low numbers of male moths indicating the continued presence of endemic low populations.

Defoliation by this insect has not been detected since 1983. Nonetheless, annual monitoring has been conducted because of the importance of jack pine, in natural stands and plantations, to the Provincial wood supply. No defoliation was expected in 2002, and none was detected.

Pheromone Survey: Since 1997, FPMS has placed out Delta traps at selected areas representing plantations and natural stands. Over the years, small numbers of moths continue to be caught thus indicating that populations remain at endemic low levels (Table 3).

Table 3. Summary of jack pine budworm male moths caught in the operational pheromone trap survey conducted by FPMS in New Brunswick from 1997 to 2002.

Year	Number of traps	Number (%) of plots in various ranges of moths/trap					Maximum trap catch
		0	**1 – 10**	**11 – 20**	**21 – 40**	**>40**	
1997	46	46 (100%)	0	0	0	0	**0**
1998	52	30 (58%)	22 (42%)	0	0	0	**8**
1999	51	23 (45%)	23 (45%)	4 (8%)	0	1 (2%)	**41**
2000	51	37 (73%)	13 (25%)	1 (2%)	0	0	**17**
2001	51	22 (43%)	24 (47%)	1 (2%)	4 (8%)	0	**30**
2002	51	30 (59%)	18 (35%)	2 (4%)	1 (2%)	0	**22**

Hemlock Looper: After the temporary increase in 2000, populations decreased in 2001 and 2002 to remain at endemic low levels.

The only reported outbreak of hemlock looper in New Brunswick occurred from 1989 - 1993. Controls were applied in 1990, 1991 and 1993. Based on the pheromone trap survey and subsequent egg survey in 2000, it was forecast that small, isolated patches of low to moderate defoliation might occur in southwestern New Brunswick in 2001. Indeed, an aerial survey detected 760 ha in several areas near the Maine border in the southwest. [Maine reported defoliation over 10 850 ha.] It was unclear whether the Province was facing the start of a new looper outbreak or simply a temporary spike in populations. In 2001, however, the pheromone trap survey and associated egg survey indicated that populations declined, hence no defoliation was anticipated in 2002, and control was not necessary.

Table 4. Summary of catch results in FPMS pheromone trap survey for hemlock looper from 1997 to 2002.

Year	Number of traps	Range of moths/trap*	Average number of moths/trap*
1997	103	0 – 448	92
1998	95	0 – 524	71
1999	98	3 – 411	69
2000	99	3 – 863	230
2001	199	0 – 837	89
2002	101	0 – 444	77

* Note: For 1997 to 2000, the numbers of moths/trap (using 200-µg lure) were converted to estimates of moth catches using 10-µg strength lure using the equation: $Y = 0.565 X + 1.47$, developed from a 3-year study, 1997-2000.

Pheromone Survey: A pheromone trap survey (1 Multipher trap/site, baited with 10-µg strength lures) was conducted around the Province by FPMS and by J.D. Irving, Limited on their freehold limits (data not yet available). FPMS placed traps at 105 locations and 101 were retrieved intact. The overall Provincial mean trap catch was 77 moths/trap, which was a slight 13% decrease from last year and again closely resembled the situation from 1997 to 1999 (Table 4).

Whitemarked Tussock Moth: Only a single moth was caught in the pheromone trap survey. No damage was detected during the summer. Populations remain at endemic low levels.

The last outbreak of whitemarked tussock moth occurred in the 1970s in both New Brunswick and Nova Scotia. In 1975, the area defoliated in New Brunswick was 25 000 ha, and in 1976 it was 202 400 ha. Thus, the population explosion of this insect in Nova Scotia in 1997 coupled with their forecast for 1998 caused great interest in New Brunswick. So far, however, annual monitoring has not revealed any significant populations in this Province. No defoliation was forecast for 2002, and none was detected.

Pheromone Survey: In 1998, FPMS initiated a pheromone trap survey to monitor populations of whitemarked tussock moth. In 2002, 49 Multipher traps were placed out in the southeast (mostly) and some southwestern locations in the Province. Very few moths have been caught, nor any evidence of defoliation detected. Only a single adult whitemarked tussock moth was caught in 2002 (Table 5). Populations remain at endemic low levels.

Table 5. Summary of whitemarked tussock moth pheromone trap catches from 1998 – 2002.

Year	Number of traps	Number of traps positive	Range of moths/trap
1998	59	5	0 – 4
1999	57	2	0 – 2
2000	54	2	0 – 1
2001	49	0	0
2002	49	1	0 – 1

Rusty Tussock Moth: In 2002, the percent of traps that caught moths increased to 61% from 39% last year, but the maximum trap catch and mean trap catch were still low and similar between years. No damage was detected during the summer.

This insect, of European origin, is now transcontinental in distribution. It is highly polyphagous and can attack most conifers and hardwoods. Outbreaks are usually small and of short duration, but are not common in New Brunswick, but they have been reported several times in Newfoundland. For the past four years, pheromone traps used for detecting whitemarked tussock moth also caught moths of this closely related species. In 2002, 61% of the traps again caught adult rusty tussock moth adults, up from 39% last year (Table 6). Mean trap catch was 1.5 moths/trap compared with 1.8 moths/trap last year. No damage was detected during the summer.

Table 6. Summary of rusty tussock moth pheromone trap catches from 1998 to 2002.

Year	Number of traps	Number of traps positive	Range of moths/trap
1998	59	19	0 – 9
1999	57	20	0 – 11
2000	54	14	0 – 10
2001	49	19	0 – 20
2002	49	30	0 – 18

Balsam Twig Aphid: Populations declined slightly, but appear to remain at high levels.

This insect is not a main forest pest, though it can be a major problem for the Christmas tree industry. Populations of balsam twig aphid were monitored around the Province by assessing their presence on balsam fir branch samples collected to monitor spruce budworm. Data from previous years indicate a tendency for balsam twig aphid populations to increase and decrease in general synchrony throughout the Province. Overall, results for the Province indicate that the percent of plots with detectable damage from this pest increased from 39% in 2000 to 87% in 2001, and declined slightly to 70% this year. Because the data are from a limited number of plots and local conditions vary, Christmas tree growers in all areas need to monitor closely again in 2003.

Balsam Gall Midge: Populations continued to decline suggesting a period of low levels might follow, if they follow the past trend.

This insect is also not considered a main forest pest, but like the balsam twig aphid it can be a problem for Christmas tree growers. Populations of balsam gall midge were also monitored around the Province by assessing their presence on balsam fir branch samples collected to monitor spruce budworm. As with balsam twig aphid, previous years' data indicate a tendency for balsam gall midge populations to increase and decrease in general synchrony throughout the Province. Overall, results for the Province indicate that the percent of plots with detectable damage from this pest declined from 65% in 2000 to 21% in 2001, to 9% this year. Populations could be in a period of hiatus if the past trend repeats. Nonetheless, the data are from a limited number of plots and local conditions vary, hence Christmas tree growers should continue annual vigilance.

Balsam Woolly Adelgid: A survey of 260 plots was done in southern New Brunswick in 2002 and 85 (32.7%) were positive - mostly with light levels of attack. Additional survey data have yet to be analyzed.

This is a European insect first found in the Maritimes in the early 1900's and in Québec in 1964. It only occurs on true firs of the genus Abies. The insect has a complex life cycle, and can have two or three generations per year. Over the years, it has become a pest in the Maritimes, the northeastern and northwestern States, and southern British Columbia. In eastern Canada, damage became severe in many locations during the 1960s and 1970s. In New Brunswick, its damage has been overshadowed by perennial epidemics of spruce budworm.

Severe attack can cause growth loss, dead tops, tree mortality, and the production of dense compressed wood of reduced quality for pulp. Symptoms of attack can be (a) swelling of nodes on branches causing a "gouty" appearance, or (b) patches of white 'wool-like' substance (that covers their bodies) on tree trunks.

In 2000, heavy attack and some tree mortality was reported in young balsam fir trees of varying ages, from 1-8 m tall at two sites south of Sussex. In 2001, general reports of trees with symptomatic "gouty tops" seemed to be more common throughout southern New Brunswick, though no specific survey was conducted. It has been speculated that a series of generally milder winters might be contributing to population increases, because mortality of dormant stages increases when temperatures reach –20^{o}C and is complete at –37^{o}C.

In 2002, FPMS examined 260 stands in southern NB and 85 (32.7%) were positive. In 75% of these positive stands <10% of the trees sampled had any evidence of damage, and this was predominantly light. Only 13% of the positive stands had trees with moderate damage. Further data analysis is to be conducted.

Brown Spruce Longhorn Beetle: Special traps were set out by the CFIA and CFS in the Province but results are not yet available.

This foreign pest was detected in Halifax, Nova Scotia in the spring of 2000 (suspected present since 1990 at least), and has resulted in eradication actions being initiated because of the potential threat it poses to spruce forests. In 2000, DNRE collaborated with the Canadian Food Inspection Agency (CFIA) and CFS by conducting a detection survey (funded by CFIA) for Brown Spruce Longhorn Beetle (BSLB) in New Brunswick. This consisted of placing out 'baited sticky stove pipe traps' at 31 locations around the Province, specifically near mills that had imported softwood from Nova Scotia since 1985. No BSLB adults were detected, and only 7 specimens of the 'related' native eastern larch borer were collected.

Based on research done by the CFS in 2000, it was decided that the 'sticky stove pipe traps' were not that effective to survey for BSLB. In July of 2001, the CFS reported better results with another lure and trap arrangement they were testing in Nova Scotia. FPMS obtained (from the CFS) and placed out 6 of these new traps, for subsequent collection and maintenance by CFIA and CFS who placed out another 4 new traps, for 10 in New Brunswick. No BSLB were found.

In 2002, special traps were set by the CFIA and CFS in the Province – results are not yet available.

European Larch Canker: No reported change.

This disease was first found by the CFS in New Brunswick in 1980, and ultimately a quarantine zone was implemented by the CFIA under the federal Plant Protection Act. In 1997, the CFS found one new site positive for European larch canker just outside the quarantine zone (but no change was made to the regulated area). In 1998, 1999, and 2000, surveys done by the CFS did not detect any new sites positive for European larch canker outside the regulated area. No specific survey was done for this disease in 2001 or 2002.

Scleroderris Canker of Pine – European Race: No reported change.

In 1998, the CFS had confirmed that only one site (in northwestern New Brunswick) was positive for the European Race of Scleroderris canker of pine in the Province. That conclusion was based on re-analyses of cultures that had been taken some years ago. In 1999, they again took samples from that site and two other plantations within a few kilometres. The 'original' site was again confirmed positive for the presence of the European race. And, samples from Scots pine at the second site were also confirmed to be European Race. Likewise, the third site also proved to be positive, but there it was found on red pine. This was the first significant change for this disease within the Province, since the improved method of distinguishing between the North American race and the European race has been used. No specific survey was done for this disease in 2001. In 2002, samples were obtained by the CFS from the second and third sites (i.e. scots and red pine, respectively) and both were once again confirmed to be positive for the European race of Scleroderris.

PESTS OF HARDWOODS

Forest Tent Caterpillar: No significant areas of defoliation were reported in 2002. A pheromone trap survey was initiated to establish baseline data in advance of the next outbreak. A total of 130 traps were set out and all but two were retrieved. Some 87.5% of the traps caught moths, with the highest catch being 51 moths. These levels are not perceived to indicate impending defoliation in 2003.

This insect generally defoliates poplar, but will attack numerous hardwood species during an outbreak. The most recent outbreak lasted about 6 years (from 1991-96), as did the preceding outbreak (from 1979-84). The former outbreak peaked at about 400 000 ha and the latter peaked at about 1.4 million ha. If this trend repeats itself, this insect might not become a problem for several more years.

No defoliation attributed to forest tent caterpillar was noted in 1998, and only 250 ha of defoliation were recorded near Bathurst in 1999. In 2000, a few small, localized areas of hardwood defoliation were detected in the northeastern part of the Province during the aerial survey (total area was only 800 ha). In 2001, no areas of defoliation were mapped from the air, though it was recorded by ground observations in the northeast, apparently less severe than last year. In 2002, no significant defoliation was reported.

Pheromone Survey: In anticipation of the next outbreak of forest tent caterpillar, FPMS set out 130 Unitraps (traps and lures from Phero Tech Inc.) at 130 locations around the Province to establish baseline data for comparison in following years. All but two traps were retrieved and 87.5% caught moths. The maximum trap catch was 51 moths, which is not perceived to indicate any impending defoliation in 2003.

Satin Moth: No significant areas of defoliation were reported in 2002.

This insect primarily feeds on leaves of poplar and willow. At the end of the last outbreak of the forest tent caterpillar, defoliation by satin moth was detected for several years. In 1998, an aerial survey detected defoliation over approximately 33 800 ha, mostly in the same general areas attacked the previous year. In 1999, defoliation was again detected (18 021 ha) – this time distributed over wide areas in northern New Brunswick and subsiding in the southeast. One area (4 833 ha) in the southwest had dead poplar evident, most likely the result of repeated defoliation by satin moth and possible earlier weakening by forest tent caterpillar, coupled with drought for long periods in the previous two summers.

In 2000, small, scattered patches of defoliated poplar were detected at various locations (total area ~ 8 000 ha) during the aerial defoliation survey, but no large, contiguous areas were noted. In 2001, no defoliation was recorded; and likewise in 2002.

Greenstriped Mapleworm: This insect caused defoliation to ~ 40 ha (defoliation was last reported in 1997).

This is a native insect that attacks all species of maple (red and sugar being preferred) and occasionally other hardwoods. Outbreaks are usually not extensive and last only 2 to 3 years, though some tree mortality has been reported in from Ontario to Nova Scotia, including New Brunswick. In New Brunswick, defoliation has been reported for 1937, 1956, 1976-79, 1993-94, and 1997. In 2002, defoliation was reported over ~ 40 ha.

Gypsy Moth: Significant changes happened 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, up from 1164 ha last year. This has 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 were again found in the Woodstock area in the west-central region (last detected in 1995). The Canadian Food Inspection Agency had discussions with two forest Marketing Boards about federal regulations governing the movement of wood from designated infested parishes to non-infested areas. Fall egg-mass surveys revealed major population increases in the general Grand Lake – Washademoak Lake areas. Barring a catastrophic collapse (e.g. over winter mortality, or large build-up of natural bio-controls next summer), the majority of the survey evidence indicates that more defoliation will occur in 2003 and populations could expand if control measures are not initiated where threatening populations have been found. There has been heightened public awareness leading to questions about possible Government intervention.

Over the past two decades, Gypsy Moth (GM) has gradually extended its range within southwestern and south-central New Brunswick. In 2001, populations finally increased in several local areas to levels that caused severe defoliation large enough to be mapped from the air. Fall surveys indicated the potential for similar or even more damage in 2002 unless weather and natural bio-controls caused levels to decline. That did not happen, and defoliation expanded. About 40 landowners engaged BioForest Technologies to treat their properties (total ~30 ha) with *B.t.* (applications were made by Forest Protection Limited).

In 2002, the following Gypsy Moth surveys were conducted:

1. Aerial Survey: Around Maquapit Lake – Grand Lake – Washademoak Lake
2. Pheromone Trapping:
    (a) General – Early Detection
    (b) Miramichi City – Intensive Detection

3. Egg-mass/Life Stage searching:
   (a) Permanent Locations
   (b) Miramichi City
   (c) Woodstock and Upper Northampton
   (d) Maquapit Lake – Grand Lake – Washademoak Lake.

Aerial survey: An aerial survey resulted in mapping defoliation over a gross area of 2061 ha, compared to 1164 ha last year. This was anticipated based on defoliation and egg-mass surveys done in 2001. These areas were again mainly distributed along the shorelines of Maquapit Lake, Grand Lake, and Washademoak Lake. Trees mostly affected were oak, poplar, and birch, though in several cases on private property white spruce and white pines were heavily attacked. This marked the most significant increase by this pest in New Brunswick since its presence was re-discovered in 1981 (after an absence of some 40 years).

Defoliation expanded outward from sites damaged in 2001, and several new locations were detected, especially west of Lower Gagetown and nearby at Elm Hill, and on the east sides of Grand Lake and Washademoak Lake. Affected areas are still mainly private property, i.e. the area of Crown land defoliated is ~ 70 ha this year *cf.* ~ 50 ha last year. Barring significant mortality of egg masses this winter and high levels of larval mortality next summer; one might expect a repeat situation in and around the same affected areas in 2003. Some parasitism and disease were detected in ground surveys this summer, though it is uncertain whether levels will cause the population to collapse. It usually takes several years for that to occur.

Pheromone Trapping: (a) General – Early Detection: FPMS set out 110 Delta pheromone traps outside known infested areas as part of an early detection survey conducted in New Brunswick since 1996. Approximately 5-fold and 3-fold increases were noted in the average number of moths caught in 2002 versus 2000 and 2001, respectively (Table 7). Numbers could have been higher because some traps became saturated as evidenced by catches up to 6-fold higher in Multipher traps set at a few locations (and personal observations of moths entering and leaving traps with fewer than 20 moths in them). These results are not surprising considering the amount of defoliation in the past two years. A number of pheromone traps were also placed out by the CFIA and CFS/Parks Canada, but results are not yet available.

Table 7. Results of gypsy moth pheromone trap early detection surveys done by FPMS from 2000 to 2002.

Year	Number of traps		Number of male moths/trap*					Total male moths	Male moths /trap
	Placed	Missing	0	1 – 5	6 – 10	11 – 20	20		
2000	103	6	68 (*70.1*)	20 (*20.6*)	3 (*3.1*)	3 (*3.1*)	3 (*3.1*)	175	1.80
2001	110	5	55 (*52.4*)	36 (*34.3*)	5 (*4.8*)	7 (*6.7*)	2 (*1.9*)	296	2.82
2002	110	3	39 (*36.5*)	17 (*15.9*)	12 (*1.2*)	19 (*17.7*)	20 (*18.7*)	1034	9.66

** Percentages in italics*

(b) Miramichi City – Intensive Detection: FPMS also placed out another 100 pheromone traps as part of a delimitation survey in Miramichi City. In three consecutive prior years, higher numbers of moths than in surrounding areas were detected at a trapping location in Miramichi City, yet searches had not detected any GM life-stages. The delimitation survey revealed several areas with higher trap catches, and subsequent searching in these areas detected GM life-stages (see following).

Life-stage/Egg-mass Survey*:* (a) Permanent Locations: Since 1995, FPMS has annually monitored 75 permanent sites located in five counties to assess population changes in areas where gypsy moth populations are known to occur (note one site was inaccessible in 2001, and replaced in 2002). At each location, "timed-searches" are done and the findings expressed as number of new egg masses/person-hour searching. In 2002, despite decreases in the percent of sites having new egg masses in three counties (Table 8), egg mass densities actually increased in all but Charlotte County (Table 9). Average densities increased by 120% in Queens, 230% in Kings, 270% in York, and 340% in Sunbury.

Table 8. Percentage of sites with new egg masses (NEM's) at sites visited each year from 1995 to 2002.

	Percentage of sites with NEM's							
Counties	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001***	**2002***
Charlotte	86	64	47	59	55	68	64	36
Queens	97	79	30	52	79	94	97	100
Kings	100	33	40	17	50	33	83	67
York	83	50	67	33	67	67	50	67
Sunbury	100	50	50	50	75	88	100	88
Overall	**93**	**55**	**47**	**42**	**65**	**70**	**79***	**75**

* *(Note: the same 75 sites were searched each year, though one was inaccessible in 2001, and re-located in 2002).*

Table 9. Number of new gypsy moth egg masses/person-hour (NEM/PH) searching at sites visited each year from 1995 to 2002.

	Average number of NEM's/person-hour searching							
Counties	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001***	**2002***
Charlotte	10.87	4.54	2.65	3.74	2.55	17.75	9.20	5.50
Queens	54.19	11.27	3.49	2.93	12.90	59.84	485.40	608.00
Kings	13.67	0.67	1.29	0.25	1.17	4.49	18.00	40.83
York	14.91	6.91	3.00	4.06	6.83	32.33	20.70	56.50
Sunbury	81.73	79.50	6.50	1.20	4.00	20.88	34.00	117.38
Overall	40.10	9.70	3.50	2.90	8.60	39.00	225.50*	289.44*

* *(Note: the same 75 sites were searched each year, though one was inaccessible in 2001, and re-located in 2002).*

(b) Miramichi City: Based on results from the intensive pheromone trapping survey, ground searching was conducted in areas with the highest catches within Miramichi City (Newcastle Parish, Northumberland County). As a result, a total of 24 new and 12 old egg masses were discovered at two sites (not far apart) thus confirming the presence of gypsy moth for at least one previous year. This represents the farthest north-easterly distribution of reproducing gypsy moth populations within the Province to date.

(c) Woodstock and Upper Northampton: During the regular fall survey, 5 new and 3 old egg masses were found in Woodstock at a location known to have been positive on one prior occasion in 1995. Later in the winter, we were informed by the CFIA that another location was found to be positive at Upper Northampton, about 3 km southeast of Woodstock. Subsequent searching revealed 4 locations, including one that had more than 100 new egg masses plus numerous old egg masses (indicating that populations have been present for at least a year before). The other sites only had a few new and old egg masses.

(d) Maquapit Lake – Grand Lake – Washademoak Lake: Because of the great increase in damage mapped from the air within the general vicinities of these lakes in 2001 and 2002, it was decided to intensively survey these areas to assess egg mass densities. Using the defoliated area as a base, lines were drawn 1 km and 3 km around them, and search sites were distributed throughout the zones depending on accessibility. Overall 555 sites were searched, *viz*. 294 within the 1-km zone; 241 between 1 km and 3 km; and 20 beyond 3 km.

To get an estimate of population density, counts of egg masses were tallied during "timed walks". At each location, two people each walked the same two transects for 5 minutes and each person counted the Old Egg Masses (OEM) and New Egg Masses (NEM). Each pair of counts for each transect were averaged, and the resulting two estimates were averaged, and then expressed as the average number of old or new egg masses/5-min walk. Results are summarized in Tables 10 and 11. In addition, at 56 locations, two 0.01-ha plots were established and all the egg masses counted to correlate with the timed-walk data. This revealed that timed-walk counts of 10 egg-masses/5-min walk roughly equated to about 800-1000 egg masses/ha, and this is often regarded to be a general threshold above which defoliation will become noticeable (i.e. generally 30% or more).

Gypsy moth egg masses may contain 1000+-eggs/egg masses, with about 500 eggs on average. Thus, 'large' egg masses indicate 'healthy' gypsy moth populations, and 'small' egg masses indicate declining, or 'unhealthy', populations. Also, one might assume that populations are increasing if the number of new egg masses is greater than the number of old egg masses. In addition, conversely one might assume that populations are declining if the number of new egg masses is less than the number of old ones. Consequently, relative egg mass size was recorded, as well as the number of old and new egg masses. We used <20 mm (i.e. about the diameter of a nickel, or ~3 cm^2) to indicate small egg masses, and >25 mm (i.e. about the diameter of a Canadian 1 dollar coin, or ~5 cm^2) to indicate large egg masses. Based on relationships derived in our investigations in 1993 and 1994, the smaller diameter egg masses probably contain ≤ 300 eggs/egg mass, and the larger ones probably contain ≥ 450 eggs/egg mass.

No egg masses at all were found at 28% of the sites (Table 10), but were found at 72% of the sites. Thus, it appears that detectable gypsy moth populations are somewhat common throughout the general survey area. Only old egg masses were encountered at 3% of the sites (Table 10). Based on the size criteria at the 382 sites, which had new egg masses, only unhealthy new egg masses were found at 1% of the sites; both unhealthy and healthy egg masses were found at 12% of the sites; and healthy only new egg masses were found at 87% of the sites.

At 117 sites, the egg masses found were all new (Table 11), thus suggesting these sites to be newly infested. At 265 locations, both old and new egg masses were found. Of these locations, 11% had more old egg masses than new egg masses; 9% had equal numbers; and 80% had more new egg masses than old egg masses. These data suggest that populations are increasing.

Table 10. Summary of egg mass densities based on the average of two 5-min walks at each site.

Average number of egg masses/5-min walk (range)	Number of Egg Masses					Total
	No Egg Masses	Only Old egg Masses	NEM's unhealthy only	NEM's unhealthy and healthy	NEM's healthy only	
0	156	17	-	-	-	173
1 – 9	-	-	0	8	193	201
10 – 19	-	-	0	5	34	39
20 – 49	-	-	0	10	44	54
50 – 149	-	-	1	11	45	57
>149	-	-	4	10	17	31
Total number of sites	156 (28%)	17 (3%)	5 (0.9%)	44 (8%)	333 (60%)	555
Total sites with NEM's	-	-	5 (1%)	44 (12%)	333 (87%)	382

Table 11. Comparison of egg mass densities where new egg masses (NEM) were detected.

Avg. number NEM / 5-min. walk (range)	Only NEM's	Number of OEM's > NEM's	Number of OEM's = NEM's	Number of NEM's > OEM's	Totals
1 – 9	95	15	21	69	200
10 – 19	3	7	0	30	40
20 – 49	2	6	1	45	54
50 – 149	9	1	0	47	57
>149	8	0	1	22	31
Totals	117 (31%)	29 (8%)	23 (6%)	213 (56%)	382
Both OEM & NEM	-	29 (11%)	23 (9%)	213 (80%)	265

For the 29 locations where there were more old egg masses than new egg masses, the ratios were calculated to determine the magnitude of apparent population decline. The numbers indicated that declines ranged from as little as 6% to as much as 99% with an overall average decline of 58%. Unfortunately, these numbers which suggest declining populations only apply to a small part of the total number of sites examined (i.e. 11%) and do not indicate an area-wide decline.

For the 213 locations where there were more new egg masses than old egg masses, the ratios were calculated to determine the magnitude of the apparent population increases. Those numbers indicated that increases ranged from 120% up to 21300% with an average increase of 2030%. Such values strongly suggest healthy populations capable of great expansion in 2003.

Beech Bark Disease: Mortality of beech was reported in hardwood stands in northwestern New Brunswick.

This disease is of European origin and is known to occur in New Brunswick, Nova Scotia, Prince Edward Island, Ontario, Québec, and the northeastern United States. Reports of beech mortality in northwestern portions of the Province were received late in the field season. One sample was confirmed (by CFS) as having the disease.

Butternut Canker: No reported change.

In the United States, the disease has been decimating butternut stands; thus, it could pose a long-term threat to native butternut stands that contribute to the natural biodiversity of New Brunswick's forests. This fungal pathogen was confirmed present for the first time in this Province at 5 locations in 1997 (K. Harrison, CFS-Atlantic, pers. comm.). One site is located about 12-km north of Woodstock and four sites are located close together about 12-km beyond that near Stickney (Carleton County), in the western part of the Province about 20-km north of Woodstock. These sites are about 25-35 km from Houlton, ME where the disease has previously been found by Maine authorities. No new areas of infection were reported by the CFS based on their efforts in 1998, 1999, or 2000. No specific surveys were done for this disease in 2001 or 2002. The implication of this disease in New Brunswick remains unclear, and there have been no quarantine actions taken by CFIA.

SEED ORCHARD PEST MONITORING & NURSERY PEST SUPPORT

Monitoring was done in DNRE's 1st and 2nd generation Seed Orchards and pest management support was provided to DNRE's tree Nursery at Kingsclear. One of the 2nd generation jack pine Seed Orchards had high populations of a sawfly *(Neodiprion* sp. prob. *abbotii)* 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 happened to be found on a jack pine at Wheeler Cove seed orchard, but further searching did not find any more. This orchard is on the north side of the Mactaquac Headpond across from a campground where gypsy moth has been detected for several years. It is speculated the larva could have been wind blown to the orchard after egg hatch.

Nova Scotia Report

Eric Georgeson, Provincial Entomologist, Nova Scotia, Department of Natural Resources

Eric Georgeson, provincial entomologist, will give an update of some forest pests in Nova Scotia based on observations and surveys conducted to the end of October.

In addition, he will give an update on the Brown Spruce Longhorn Beetle situation for the province. A brief summary of the first year of a three-year study of *Hylobius congener* in a cutover will also be given.

Rapport De La Nouvelle-Écosse

Eric Georgeson, entomologiste provincial, Nouvelle-Écosse Département des resources naturelle

Eric Georgeson, entomologiste provincial, fera le point sur certains organismes nuisibles forestiers qui sévissent en Nouvelle-Écosse en se basant sur les observations et relevés effectués jusqu'à la fin d'octobre.

Il fera également état de la situation du longicorne brun de l'épinette dans la province. Enfin, il brossera un tableau de la première année d'une étude triennale sur *Hylobius congener* menée dans un parterre de coupe.

Newfoundland: Status of Forest Insect Activity in 2002 and Preliminary Outlook for 2003

Hubert Crummey, Dept. of Forest Resources & Agrifoods - Corner Brook

ABSTRACT

On-going infestations of two insect pests (hemlock looper and balsam fir sawfly) continued in 2002 in various locations in insular Newfoundland (NF). Only a few small pockets of yellowheaded spruce sawfly infestation were reported in central NF. The Department of Forest Resources & Agrifoods (DFRA) carried out an operational control program on aproximately 116,600 hectares (ha) against the hemlock looper on the Northern Peninsula, in western, central NF, and Bay d'Espoir (southern NF) Both Mimic and B.t.k. were used except for B.t.k. only in southern NF. A small operational control program using Neemix 4.5 was also carried out against the balsam fir sawfly in western NF on approximately 2,600 ha. The annual aerial defoliation survey documenting the 2002 forest insect activity showed most of the hemlock looper defoliation occurred within the forecast area and mainly in areas outside treatment blocks. The balsam fir sawfly caused significant moderate and severe defoliation in western NF, but continued to decline in southern NF (Bay d'Espoir). No control program was conducted against the yellowheaded spruce sawfly.

Terre-Neuve : Le point sur les ravageurs forestiers en 2002 et prévisions préliminaires pour 2003

Hubert Crummey, ministère des Ressources forestières et de l'Agroalimentaire de Terre-Neuve - Corner Brook

RÉSUMÉ

Les infestations par l'arpenteuse de la pruche et le diprion du sapin ont continué en 2002 dans plusieurs localités de la province. La tenthrède à tête jaune de l'épinette a été signalée uniquement dans quelques petites enclaves du centre de la province. Le Ministère a mis en oeuvre un programme de lutte contre l'arpenteuse de la pruche visant quelque 116 600 ha répartis entre la péninsule nord, l'ouest et le centre de la province et la région de la baie d'Espoir, dans le sud. Toute cette superficie a été traitée au Mimic et au B.t.k., sauf à la baie d'Espoir, où seulement le B.t.k. a été appliqué. Dans le cadre d'un autre programme, de moindre envergure, ayant pour cible le diprion du sapin, environ 2 600 ha ont été traités au Neemix 4.5 dans l'ouest de la province. La cartographie aérienne annuelle de la défoliation par les insectes forestiers montre qu'en 2002, l'arpenteuse de la pruche a causé des ravages surtout dans les régions où son activité avait été prévue, à l'extérieur des surfaces traitées. Le diprion du sapin a causé encore en 2002 une défoliation modérée à grave sur des superficies importantes dans l'ouest de la province,

mais il est toujours en déclin dans le sud (baie d'Espoir). Aucune mesure n'a été prise contre la tenthrède à tête jaune de l'épinette.

HEMLOCK LOOPER

Control 2002:
The Department (DFRA) carried out an operational control program for hemlock looper in 2002 with eighty-one (81) blocks totaling approximately 116,600 hectares (ha) being treated. Blocks were located mainly on the Northern Peninsula, western, central, and southern NF. [See attachment]

Spray aircraft consisted of sixteen (16) Dromader M18s from Supermarine in Ontario. Deer Lake airport was used for western NF areas with Stephenville Airport used for calibration, Buchans airstrip for central NF, Bay d'Espoir airstrip for southern NF, and Sandy Cove (Northern Peninsula – west side) and Main Brook (Northern Peninsula – east side) airstrips were used for the Northern Peninsula treatments. Four (4) helicopters were used for supervision and support. Operations were carried out from July to early August. The season was approximately two (2) weeks behind that experiences the past few years.

Two main products were used for hemlock looper control: an earlier application of Mimic (tebufenozide) and B.t.k. as the major treatment.

Mimic:
Mimic treatment consisted of fourteen (13) blocks (approx. 19,260 ha) in one (1) application at 70 grams a.i. per ha as follows:

N. Peninsula:	2 blocks (2,780 ha)
Western NF:	3 blocks (6,325 ha)
Central NF:	4 blocks (7,550 ha)
	9 blocks (16,655 ha)

Treatment was slightly later than proposed (at egg hatch) due to the asynchrony between larval emergence and the flaring of fir shoots (i.e. a suitable target for droplet deposit).

An additional four (4) blocks received an early single application of Mimic at 70 grams a.i. per ha plus an application of B.t.k. late in the program to offset untreated buffer zone areas and to further reduce residual looper populations levels. Thus:

Mimic + B.t.k.:

Western NF:	2 blocks (755 ha) with B.t.k. at 30 BIU / ha
	2 blocks (1,850 ha) with B.t.k. at 40 BIU / ha
	4 blocks (2,605 ha)

B.t.k.:
The main component of the B.t.k. treatment was with Foray 76B (B.t.k.) although a small area (500 ha) was also treated with Bioprotec HP to test it operationally. In addition, one small block (300 ha) was treated in western NF with an experimental B.t.k. formulation from Valent BioSciences. The B.t.k. treatments were as follows:

Northern Peninsula:	16 blocks (36,375 ha)
Western NF:	30 blocks (34,464 ha)
Central NF:	17 blocks (20,820 ha)
Bay d'Espoir:	5 blocks (5,726 ha)
	68 blocks (97,385 ha)

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. Two (2) small areas received a third (3rd) application following rain after the second (2nd) application.

Some proposed treatment areas were dropped from the program as a result of lower population levels, as well as for priority and logistical reasons.

There were some weather delays resulting in later treatment, but overall the weather was better than the past few years. However, weather did affect the arrival of two teams (4 aircraft each) early in the program, which delayed ideal treatment of some areas.

Results:
As indicated earlier, there was asynchrony between shoot development and insect emergence resulting in a delay in application of Mimic. In the meantime, looper larvae were still feeding and causing damage to the developing needles. Some pre-treatment defoliation was noted in many areas. However, it appeared that both the Mimic and the B.t.k. treatments worked well, and reduced population levels and prevented additional significant defoliation. In many areas, as noted in 2001, a complicating factor in the control program was the presence of other defoliators in treatment areas, namely: blackheaded budworm, rusty tussock moth, and in western NF: balsam fir sawfly. Combinations of these insects, depending on location, caused concern for tree viability and influenced observed results.

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.

Defoliation 2002:
The 2002 moderate and severe hemlock looper defoliation forecast was for approximately 190,000 ha to be affected. [Hemlock looper maps]. The looper caused moderate and severe defoliation within the forecast boundaries. Most of the observed defoliation occurred outside of treatment areas. [Hemlock looper maps]. Final area figures are still being compiled. In various locations, defoliated was the result of a combination of insects, i.e. balsam fir sawfly, blackheaded budworm, and rusty tussock moth, depending where these were located.

Outlook for 2003:
Based on locations of infestation during the summer of 2002 and observed moth activity, the number of sample points was increased for the fall forecast survey. The outlook is that the infestation will continue on the eastern side of the Northern Peninsula, in western and central NF and about the same in eastern NF. It is expected that the infestation in Bay d'Espoir (southern NF) will decrease.

BALSAM FIR SAWFLY

Control 2002:
The DFRA carried out a small operational balsam fir sawfly control program on approximately 2,600 ha in western NF in 2002 using the botanical insecticide Neemix 4.5. [Balsam fir sawfly maps] Some problems encountered in 2001 with the formulation and equipment compatibility were addressed and mitigated against in 2002. This included delivery of product in smaller containers to allow for pre-mixing agitation and the use of T-Jet Nozzles and flushing of system with water after each spray period to minimize seal problems.

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).

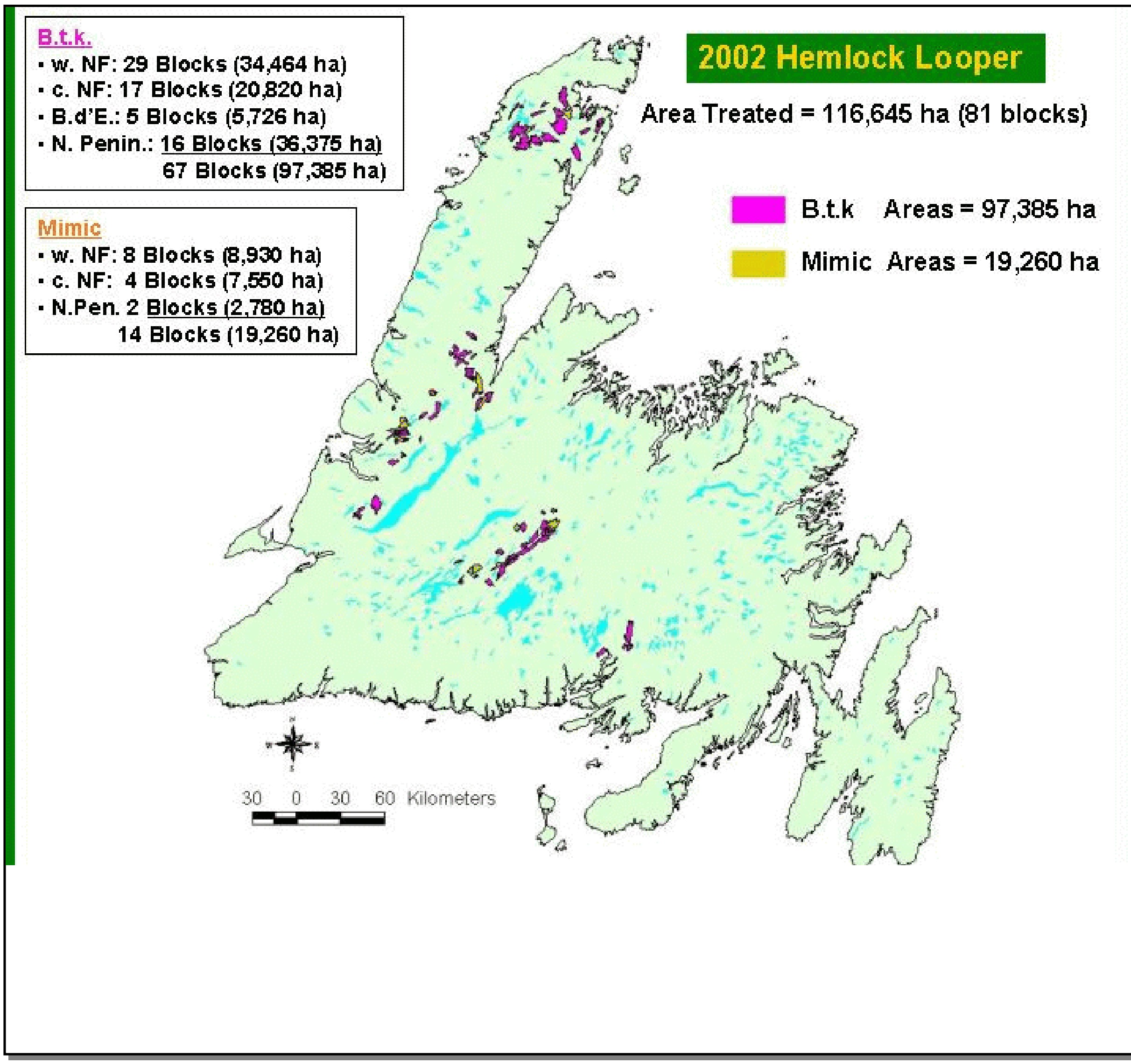
Defoliation 2002:
The 2002 moderate and severe defoliation forecast was for approx. 57,400 hectares in western NF and approx. 8,100 hectares in Bay d'Espoir [balsam fir sawfly maps]. In 2002, the balsam fir sawfly caused moderate and severe defoliation in areas forecast, particularly in western NF and the infestation in Bay d'Espoir (southern NF) continued to decline. [Balsam fir sawfly maps]. Final area figures are still being compiled.

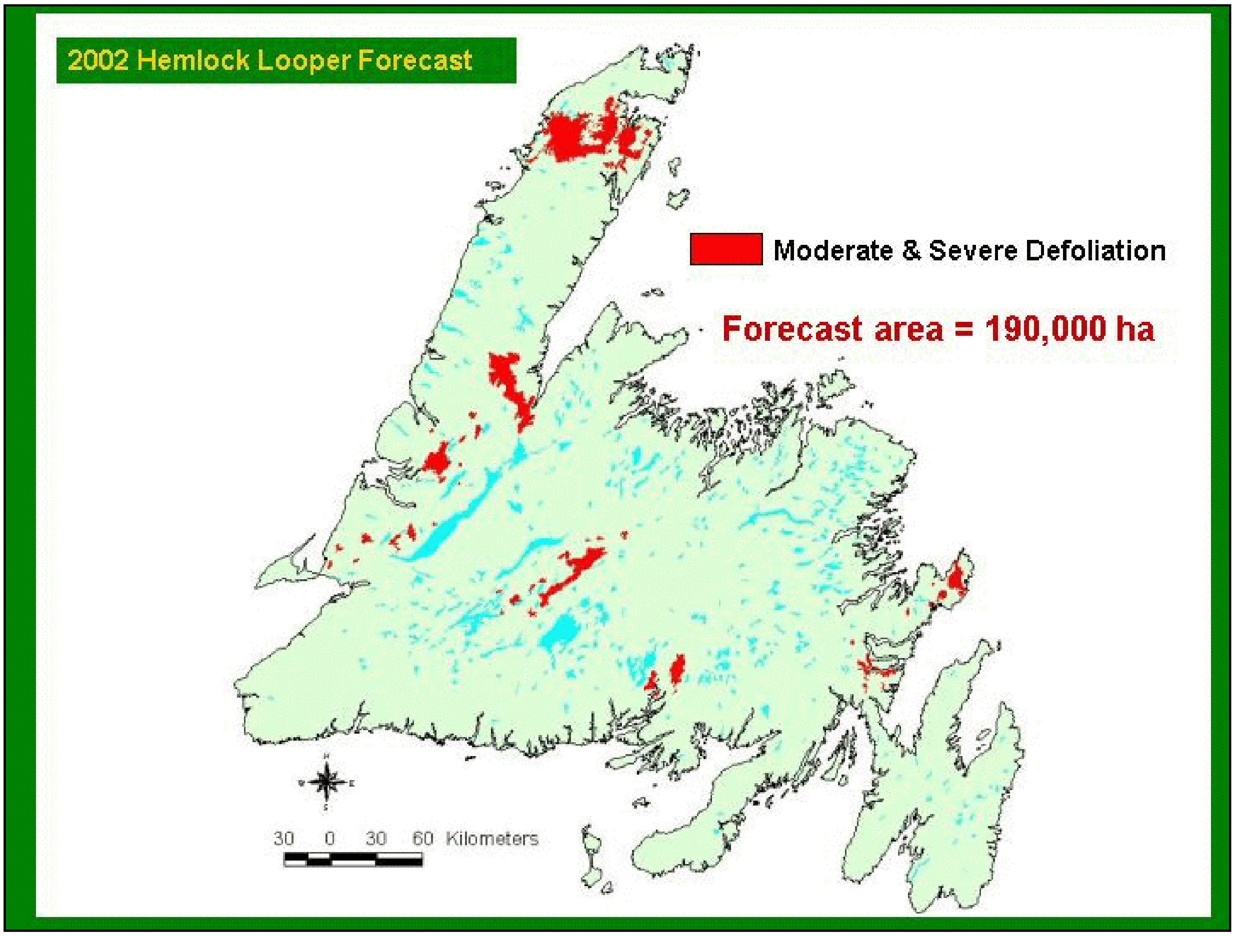
Outlook for 2003
The infestation in western NF is expected to continue with predicted moderate and severe defoliation on the leading edge of the 2002 infestation. These are mainly second growth balsam fir stands, much of which has been thinned at considerable expense. In Bay d'Espoir, the infestation appears to be breaking up and will likely collapse.

YELLOWHEADED SPRUCE SAWFLY
No control activity was carried out against this insect in 2002. Only a few pockets of infestation were reported in 2002 with localized damage to natural and planted young Black Spruce stands in central NF. It is not expected that this insect will cause significant damage in 2003, although some small pockets may occur.

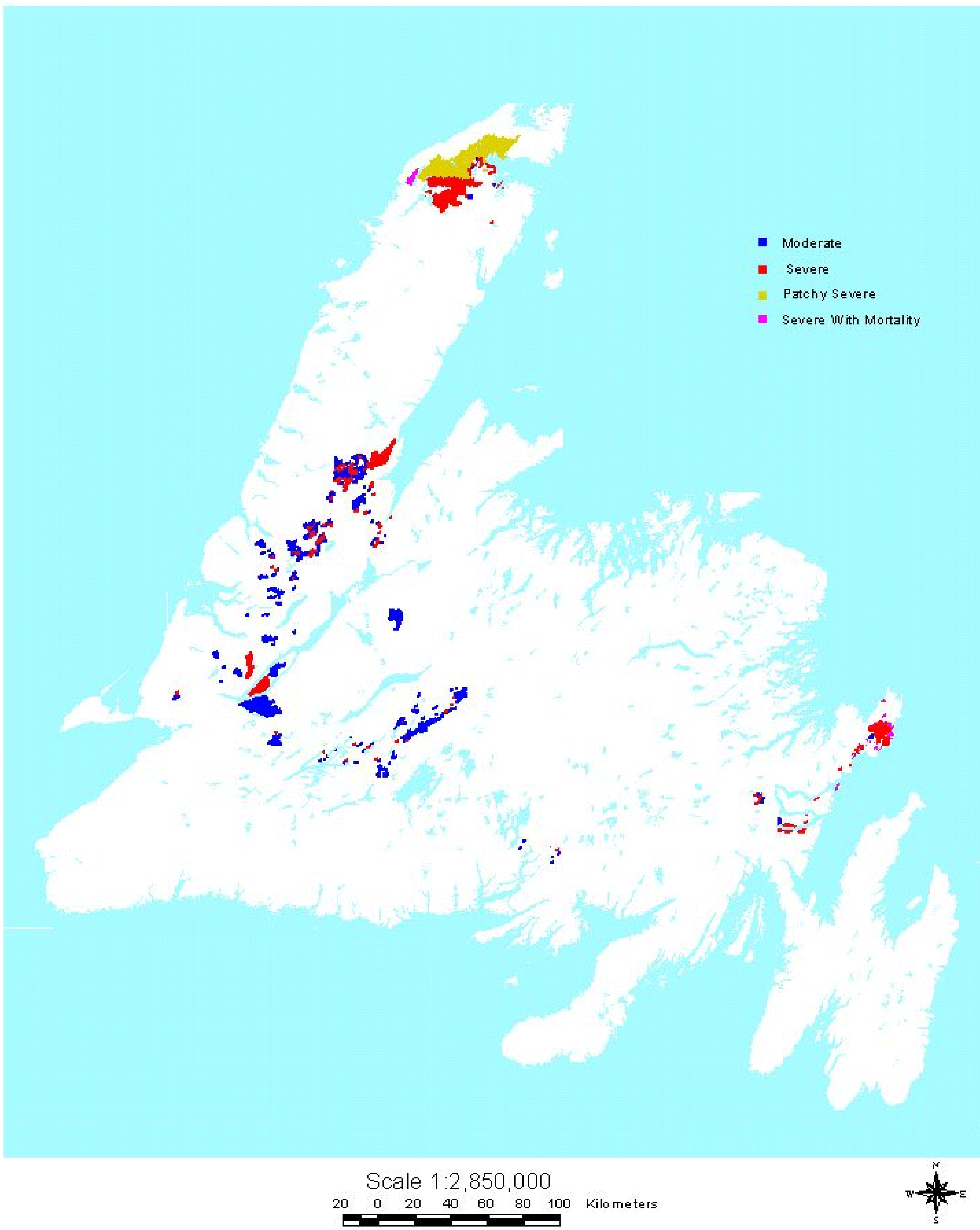
OTHER INSECTS
A number of other insects are of concern in that either separately or in combination with other insects, they are capable of causing impacts on the forest. The blackheaded budworm and the tussock moth are being detected over more areas on the Island. In addition, the rusty tussock moth is being detected in more areas, particularly in western NF. These insects will be further monitored.

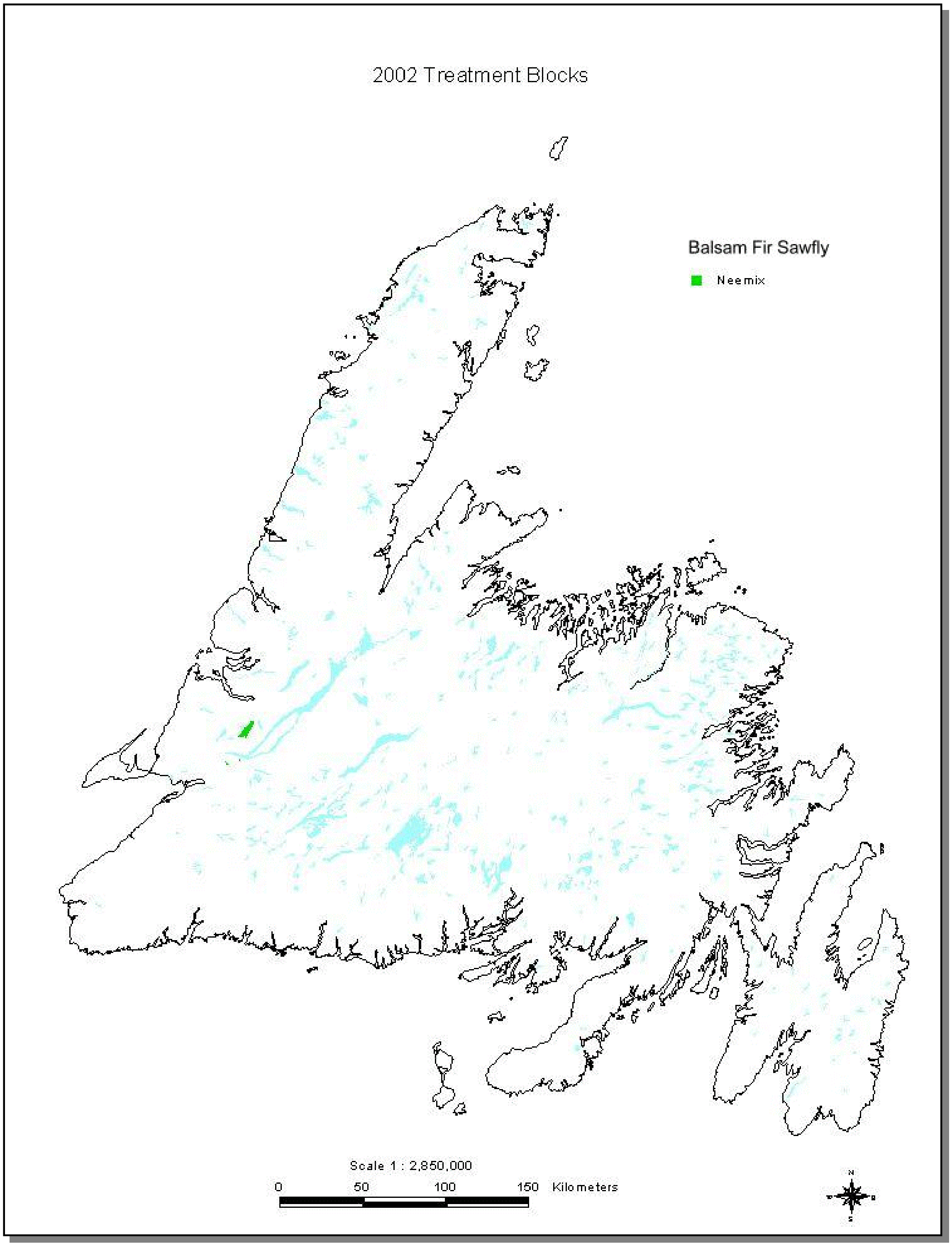
In 2002, as in 2000 and 2001, pheromone traps were put out to monitor male moth activity of the spruce budworm. Thirty-seven (37) locations were monitored, two (2) traps per location. Although at low levels, male moths were captured at 23 of these sites. The maximum average number of moths recorded per trap was 31.5. This was a decrease in number of positive traps and in the average number per trap over levels recorded in 2001. These levels are not of biological concern now. Monitoring will continue.

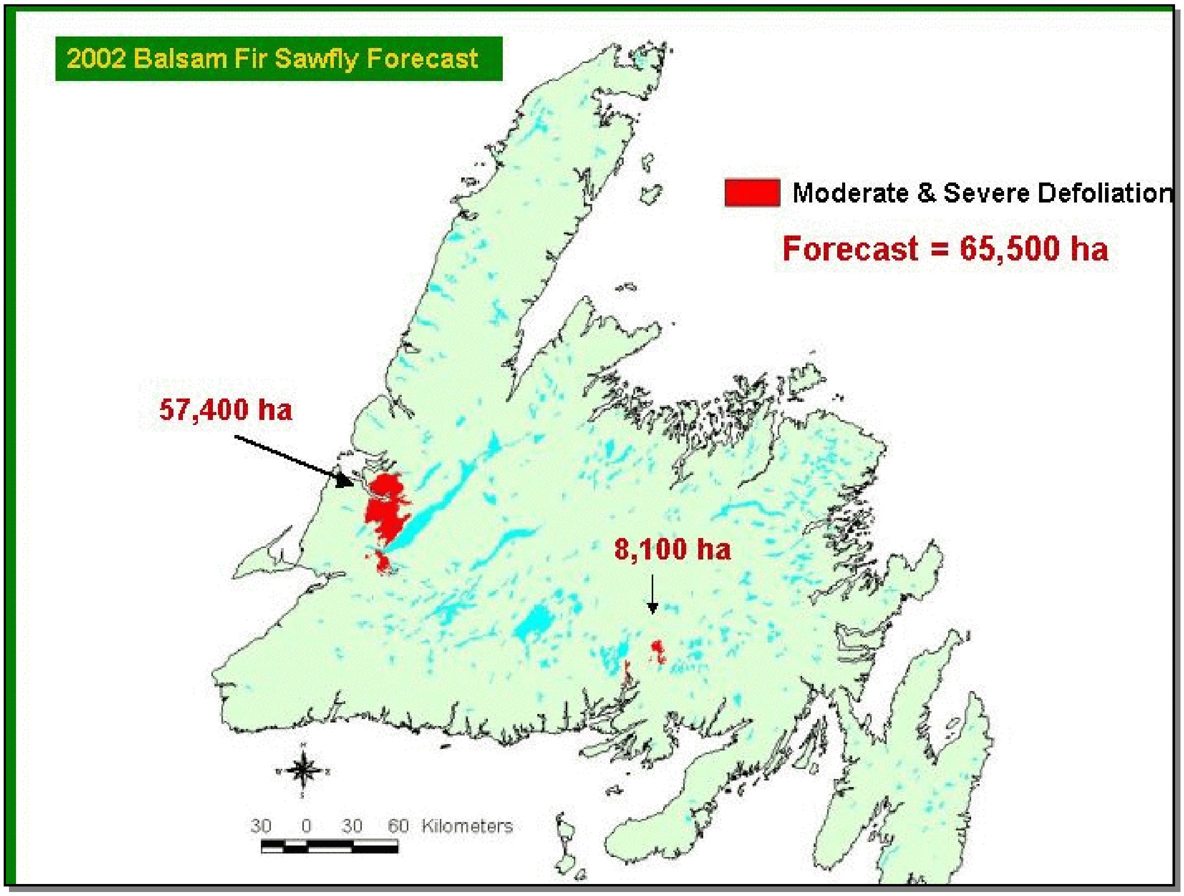


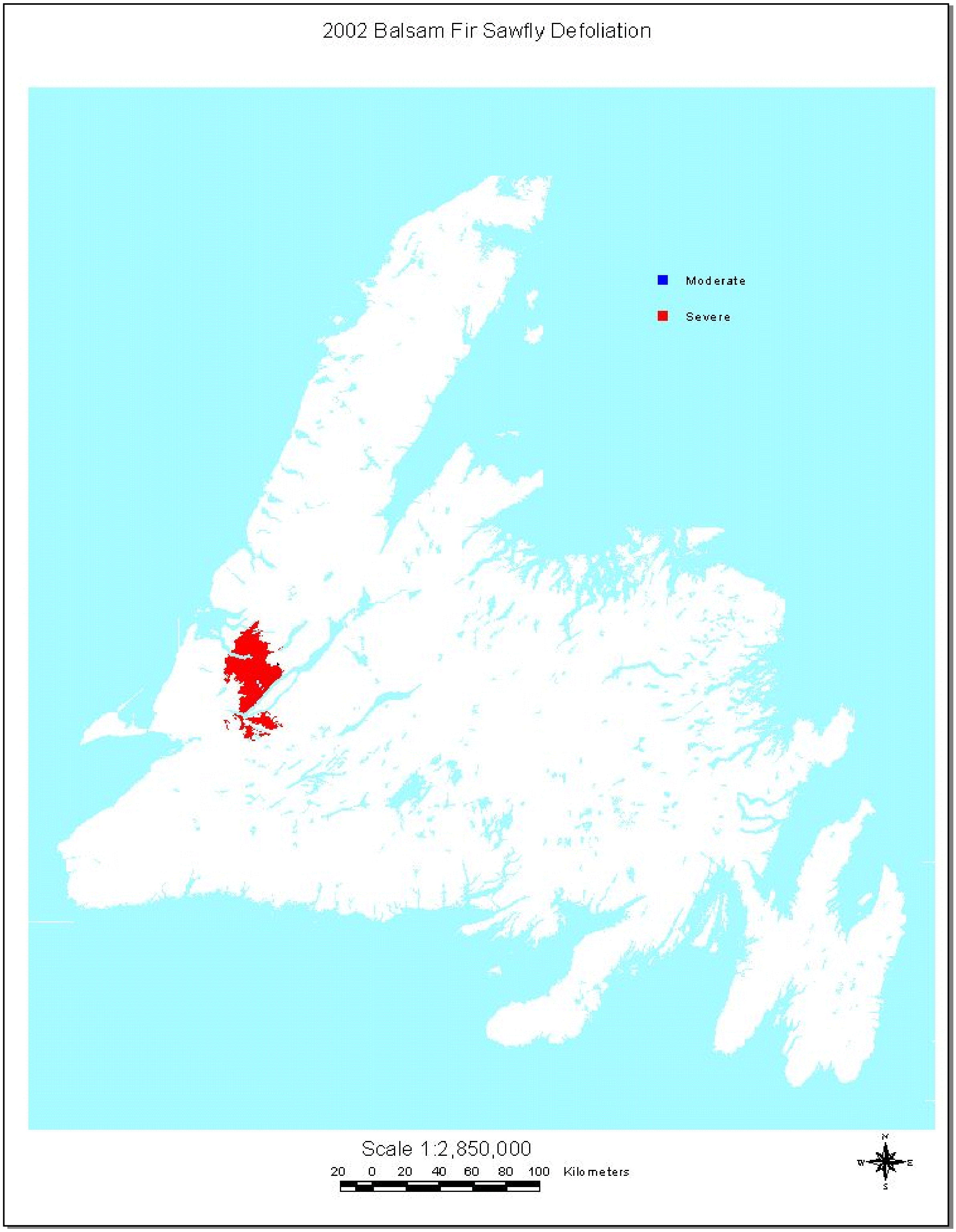

2002 Hemlock Looper Forecast
Moderate & Severe Defoliation
Forecast area = 190,000 ha
30 0 30 60 Kilometers

2002 Hemlock Looper Defoliation




2002 Treatment Blocks
Balsam Fir Sawfly
Neemix
Scale 1 : 2,850,000
0
50
100
150
Kilometers


2002 Balsam Fir Sawfly Forecast
Moderate & Severe Defoliation
Forecast = 65,500 ha
57,400 ha
8,100 ha
30 0 30 60 Kilometers


2002 Balsam Fir Sawfly Defoliation
Moderate
Severe
Scale 1:2,850,000
20 0 20 40 60 80 100 Kilometers

OPERATIONAL PERSPECTIVE –

Applying the Tools, Technologies, and Strategies of IPM

PERSPECTIVE OPÉRATIONNELLE –

Application des outils, des techniques et des stratégies de lutte intégrée contre les ravageurs

The Spruce Budworm Management Program in Saskatchewan: 1998-2002

Joe Meating, BioForest Technologies Inc., Sault Ste. Marie, ON

ABSTRACT

Before 1998, the budworm management effort in Saskatchewan generally reflected the relatively small impact this pest appeared to be having on the forest. By the late 1990s, it became evident that the spruce budworm problem was not going to go away and was beginning to have serious impacts on the abundant mature spruce forest in some parts of the province. In 1998, Saskatchewan Environment (SE) embarked on a much more intensive and aggressive program to manage the budworm outbreak. Key elements of the new program include:

- Development of a spruce budworm management policy;
- Systematic and intensive aerial surveys to map defoliation and host mortality;
- Expanded L2 surveys to provide detailed population forecasts;
- Establishment of a budworm impact plot network to monitor forest condition across the province;
- Aggressive foliage protection spraying program to maintain forest health;
- Extensive use of the ADAM Field Kit to assess operational and experimental spray deposit;
- Implementation of the Spruce Budworm Decision Support System to enhance the protection strategy:
- Active support for experimental trials for the development of new Btk formulations;
- Development of an environmental management system for aerial spraying and budworm management;
- Establishment of multi-year contracts with the private sector to provide all biological surveys, timing, and assessment of the operational spray programs, aerial application, and Btk supply.

The province assigned a Spruce Budworm Coordinator to oversee the project and fulltime technical support was provided. In 2000, the Insect and Disease Specialist was added to the program to provide additional scientific expertise. This cost-effective approach provided the SE program with additional expertise devoted to budworm management and forest protection.

Le Programme de répression de la tordeuse des bourgeons de l'épinette en Saskatchewan : 1998-2002

Joe Meating, BioForest Technologies Inc., Sault Ste. Marie, ON

RÉSUMÉ

Avant 1998, les efforts de lutte contre la tordeuse des bourgeons de l'épinette déployés en Saskatchewan étaient généralement proportionnels à l'impact relativement peu important que ce ravageur semblait avoir sur les forêts de la province. Dès la fin des années 1990, il est devenu manifeste que le problème posé par la tordeuse des bourgeons de l'épinette ne disparaîtrait pas et que ce ravageur commençait à avoir de graves répercussions sur les nombreuses forêts d'épinettes mûres de certaines régions de la province. En 1998, le ministère de l'Environnement de la Saskatchewan a entrepris un programme de lutte contre la tordeuse des bourgeons de l'épinette beaucoup plus intensif et énergique. Les éléments clés de ce nouveau programme sont les suivants :

- Élaboration d'une politique concernant la répression de la tordeuse des bourgeons de l'épinette;
- Réalisation de relevés aériens systématiques et intensifs afin de cartographier la défoliation et la mortalité des hôtes;
- Élargissement des relevés des larves hivernantes (L2) afin d'établir des prévisions détaillées des populations;
- Implantation d'un réseau de placettes d'évaluation de l'impact de la tordeuse afin de surveiller l'état des forêts dans l'ensemble de la province;
- Programme énergique de pulvérisation et de protection du feuillage afin de garder les forêts en santé;
- Utilisation à grande échelle de la trousse de terrain ADAM afin d'évaluer le dépôt de gouttelettes lors de pulvérisations opérationnelles et expérimentales;
- Mise en œuvre du système d'aide à la décision sur la tordeuse des bourgeons de l'épinette afin d'améliorer la stratégie de protection;
- Soutien énergique des essais visant à mettre au point de nouvelles formulations du *B.t.k.*;
- Élaboration d'un système de management environnemental pour les pulvérisations aériennes et la répression de la tordeuse des bourgeons de l'épinette;
- Passation de contrats pluriannuels avec le secteur privé qui effectuera tous les relevés biologiques, déterminera le calendrier et évaluera l'efficacité des programmes opérationnels de pulvérisations et des applications aériennes et fournira le *B.t.k.* à cette fin

La province a nommé un coordonnateur de la répression de la tordeuse des bourgeons de l'épinette pour superviser le projet et a fourni un soutien technique à plein temps. En 2000, un spécialiste des insectes et des maladies des arbres s'est joint au programme qui profitera ainsi d'une expertise scientifique additionnelle. Grâce à cette approche axée sur la rentabilisation, le programme du ministère de l'Environnement profite d'une expertise additionnelle en matière de répression de la tordeuse des bourgeons et de protection des forêts.

Prescriptions for Integrated Pest Management Solutions

David McManama, Certis USA, Columbia, MD

ABSTRACT

Nature produces some of the most effective pest control and crop protection compounds on Earth. The Earth's biological systems–plants, animals, microbes–have developed ingenious ways to protect themselves from insects and diseases. Driven by the need of growers who practice Integrated Pest Management (IPM) and organic food and fiber production, companies throughout the world have researched and harnessed these hidden powers of nature to develop a new crop protection industry referred to as the "biopesticide industry." Today these companies in aggregate represent an estimated $250 million industry which is projected to grow at rate faster than conventional crop protection products. This relatively new industry has attracted the attention of global companies that wish to access and further develop the technology. Certis USA, a wholly owned subsidiary of Mitsui & Co, has taken steps to enter the industry using biopesticide products as its foundation in creating IPM solutions.

As stated, plants, animals, and microorganisms have developed a multitude of ingenious ways to combat insects and diseases. These survival strategies have produced some of the most effective pest control compounds on earth. Certis brings these highly effective compounds to growers.
The current Certis line of biopesticide and botanical products has these characteristics in common:

- Nature-based: Derived from naturally occurring microorganisms and compounds
- Effective, economical and easy to use
- Safe and environmentally sound:
    - Target specific insect pests with a minimal impact on beneficial insects
    - Minimal toxicity and residue to humans and the environment
    - Minimal potential of insect-resistant buildup

Many of the Certis products are certified for organic use and most are exempt from tolerance requirements by the U.S. Environmental Protection Agency with no pre-harvest intervals and minimal re-entry limits.

We at Certis are working to become the leading company in the Specialty crop and Niche crop market sectors providing our customers with access to "Integrated Pest Management" solutions.

Solutions de lutte intégrée contre les espèces nuisibles

David McManama Certis USA, Columbia, MD

RÉSUMÉ

Certains des composés les plus efficaces pour lutter contre les ennemis des cultures sont d'origine naturelle. Les organismes vivants - plantes, animaux, microbes - se sont petit à petit dotés de moyens ingénieux pour se prémunir contre les insectes et les maladies. Poussées par les besoins des agriculteurs qui suivent les principes de lutte antiparasitaire intégrée (LAI) et l'essor de la production d'aliments biologiques et de fibres organiques, des entreprises du monde entier se sont lancées dans des recherches pour mettre à profit ces facultés que recèle la nature et lancer une nouvelle industrie de la lutte antiparasitaire : celle profit ces facultés que recèle la nature et lancer une nouvelle industrie de la lutte antiparasitaire : celle des biopesticides. Aujourd'hui, ces sociétés forment ensemble un secteur industriel dont la valeur est évaluée à 250 millions de dollars et qui est appelé, selon les prévisions, à connaître un taux de croissance supérieur à celui de l'industrie de la lutte antiparasitaire classique. Les biopesticides ont retenu l'attention d'entreprises internationales désireuses d'accéder à cette technologie et de la perfectionner. Certis USA, filiale en propriété exclusive de Mitsui & Co, a fait en sorte de s'intégrer à cette industrie en émergence : elle conçoit des solutions de LAI reposant sur les biopesticides.

Comme on l'a dit, les plantes, les animaux et les microorganismes ont cultivé une multitude de moyens de protection astucieux contre les insectes et les maladies, et de ces stratégies vitales sont issus certains des composés les plus efficaces pour lutter contre les espèces nuisibles. Certis met ces puissants produits à la portée des agriculteurs.

Les produits botaniques et les biopesticides actuellement proposés par Certis ont en commun les caractéristiques suivantes :

- D'origine naturelle : Dérivés de composés et de microorganismes présents dans la nature
- Efficaces, économiques et faciles à utiliser
- Sans danger pour l'environnement et la santé humaine :
    - Ciblent des insectes nuisibles en particulier; ne nuisent à toutes fins pratiques aucunement aux insectes utiles
    - Toxicité minime pour l'homme et l'environnement; résidus négligeables dans l'organisme humain et l'environnement
    - Possibilité quasi inexistante que se forge une résistance chez les insectes visés

Nombre des produits Certis peuvent être utilisés sur les produits biologiques puisqu'ils sont homologués à cette fin, et la plupart ne sont pas assujettis aux seuils de tolérance fixés par l'Environmental Protection Agency des États-Unis; ainsi, il n'y a pas de délai de non-traitement avant récolte, ni de délai minimal de sécurité après traitement. Certis propose à ses clients des solutions de lutte antiparasitaire intégrée, et ne perd pas de vue son objectif : devenir le chef de file des secteurs des cultures spécialisées et des produits-créneaux en agriculture.

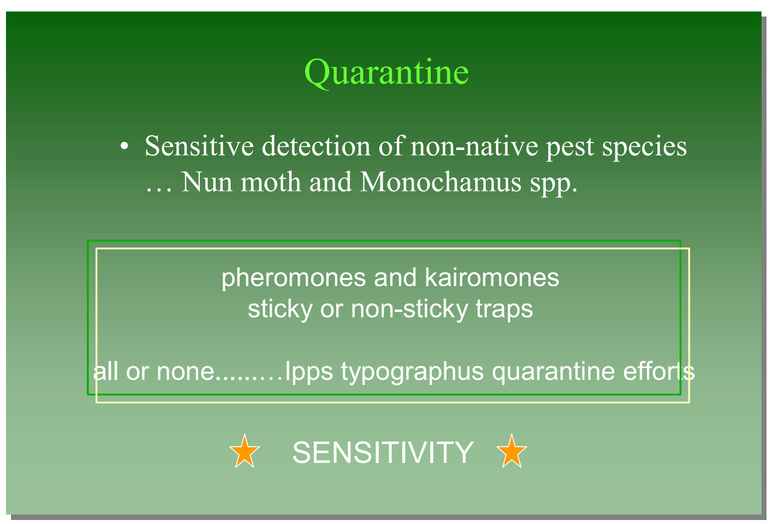
Monitoring Insect Populations Using Semiochemicals

Stephen Burke, Phero Tech Inc. www.pherotech.com

ABSTRACT

Semiochemical technology as been in development for at least three decades. Pheromones and kairomones are the semiochemicals that have seen the most commercial development and application. Semiochemicals are used for three basic purposes quarantine, monitoring and direct control.*

a) Quarantine: Pheromones and kairomones are formulated into slow release devices (lures) and used in traps for early detection of non-indigenous insects. This market has grown quite dramatically in the last few years. Pheromones typically are very strong attractants but very species specific. Examples are gypsy moth versus a closely related species, the nun moth. Subtle differences in chemical structure such as optical rotation (+ vs racemic disarlure) and the addition of synergistic pheromones enable us to target only one of these species in a quarantine program. Chemical purity is extremely critical to the performance of pheromone lures. Kairomones are far less attractive and species specific, however, for many insects either pheromones have not yet been identified or they simply do not use pheromones in their communication. Therefore, kairomone attractants are all we have. Appropriate kairomone blends that closely mimic the host's natural release have proven effective in quarantine efforts. Currently, ports of entry are being monitored for non-indigenous large wood borers (Buprestids and Cerambicids). Quarantine detection also includes North American pest insects that are not indigenous to certain regions. A recent example is the detection of Douglas-fir beetle in Minnesota attacking eastern larch. For quarantine, personnel there are two competing interests. On the one hand, they want highly attractive traps (so no introductions go undetected) and, for convenience, so species specific that staff do not have to closely examine the catch to identify individual species that may look very similar. On the other hand, staff would like to put out as few traps as possible so having a trap that catches everything has merit. Alternatively, the quarantine market, the cost of the trapping system is of a lesser concern as long as the systems work very well. Every captured insect is important and you do not want to miss any. This allows the manufacturer to input more costly features that work to enhance performance.



*Semiochemicals are naturally occurring bioactive chemicals used by organisms to communicate and perceive their environment. Pheromones are semiochemicals used amongst members of the same species. Kairomones are semiochemicals released by the organism to the disadvantage of the emitter. For example, trees release kairomones and many other compounds to reduce stress such as dehydration. Insects capitalize on this to their own advantage.

b) <u>Montoring:</u> Pheromone and kairomone lures are used in traps to monitor populations of indigenous pest insects or non-indigenous insects that have become established in the area.

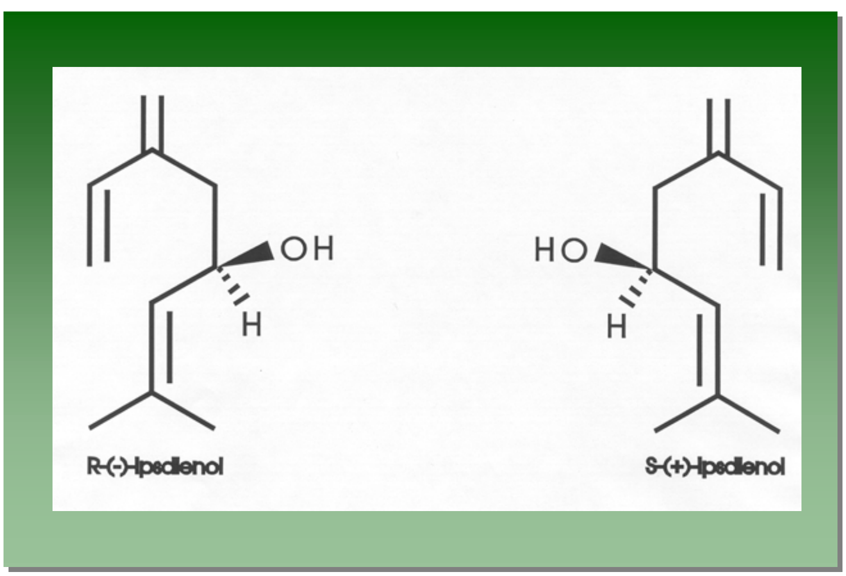
Monitoring information can help determine where pest populations are the highest. This can help forest managers determine where they want to allocate their limited resources to get best effect. Monitoring can also help pinpoint timing of insect development to determine such things as timing of attack flights, damaging larval stages or when the pest is most exposed and vulnerable to pesticides or other controls. In areas with significant variation in elevation and aspect, this information can be critical.

Monitoring can be a convenient way to determine the success of control programs. For example, a nuclear polyhydrosis virus (NPV) is used to control Douglas-fir tussock moth, principally the larvae. Pheromone trap catches of resulting adults can be used to determine reduction in populations and captured adults can be sampled for relative level of viral infection.

Pheromones again are more attractive and species specific than kairomones. For example, there are many Ips species in North America. In areas where they are sympatric they typically respond to very specific pheromones such as (+) ipsdienol or (-)ipsdienol. #**(+)** and (-).

If attracted to the (+) enantiomer, the (-) enantiomer can be highly repellant. Some pheromones are less specific such as frontalin, which can attract a number of Dendroctonus bark beetle species in large quantities.

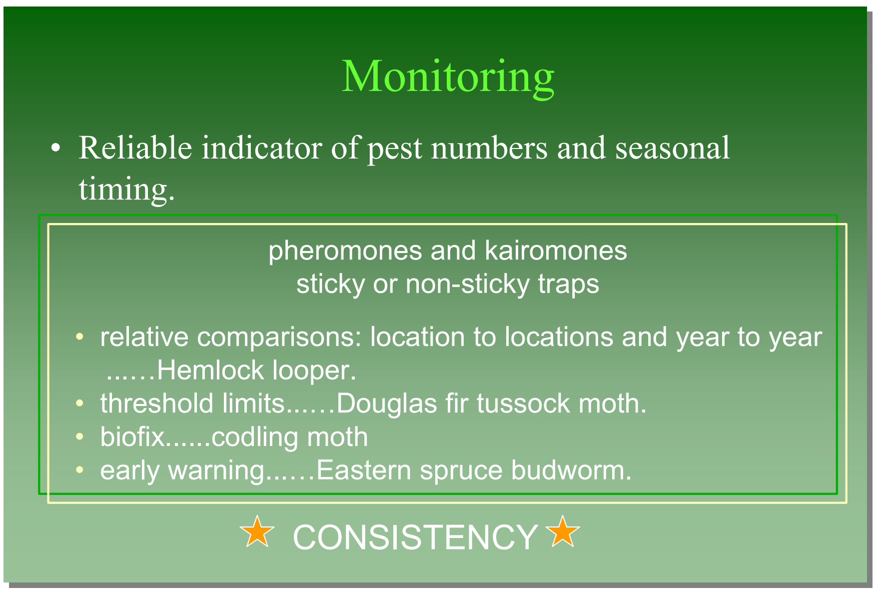
Again, kairomones are useful when there are no identified pheromones or as synergists for pheromones. For example, most coniferous or deciduous large wood borers have no identified pheromones. Of particular interest and concern are Monochamus species that can vector pinewood nematode. Also, catches of many indigenous ambrosia beetles (eg Trypodendron and Gnathotricus spp.) can be enhanced by the addition of ethanol and alpha-pinene to the pheromone (lineatin and sulcatol respectively).



In the case of monitoring, high catches are not necessarily the goal. For hemlock looper it was determined that, a lure containing 10ug of pheromone gave better diagnostic information that one containing 200ug even though the higher dose lure would catch more moths.

Catch data has been used to determine damage thresholds (catch number above a determined threshold number will indicate damage levels high enough to warrant control action). Catches have also been used with degree-day data to "biofix" damaging life stages. Much of this work has been spearheaded in orchard situations (e.g. codling moth).

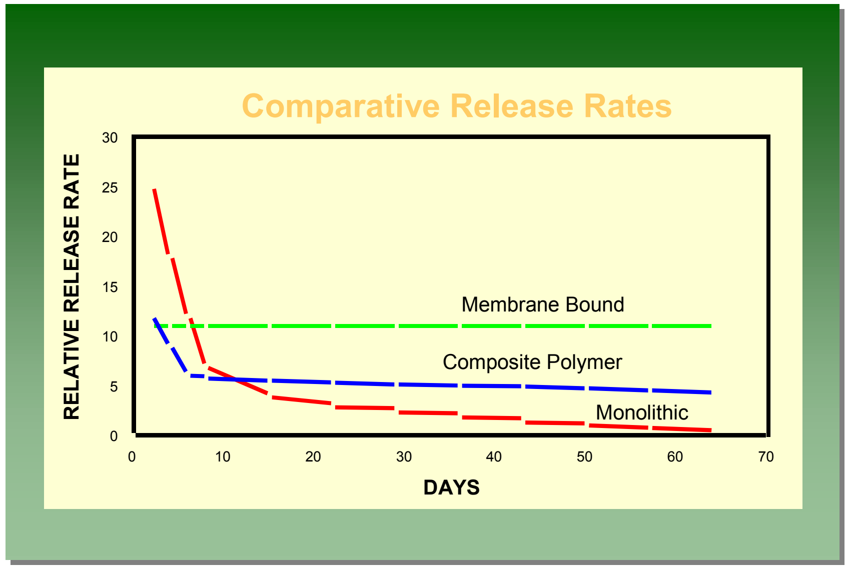
For extensive monitoring programs, lure and trap costs are a significant consideration. As a result, many inexpensive systems show up in the market with mixed results. Chemical purity and release device technology may be compromised. I will have more to say about this in a moment.



c) <u>Direct control:</u> Time constraints do not permit me to delve into this application; however, here are some import useful points to compare and contrast with quarantine and monitoring. There are numerous approaches to using semiochemicals for direct control such as, mating disruption (e.g. codling moth), mass trapping, (e.g. ambrosia beetles) and repellancy (e.g. MCH for Douglas-fir beetle). Mostly, chemical purity and release device requirements are not as stringent and there is a critical requirement to keep costs down and competitive with the other control alternatives.

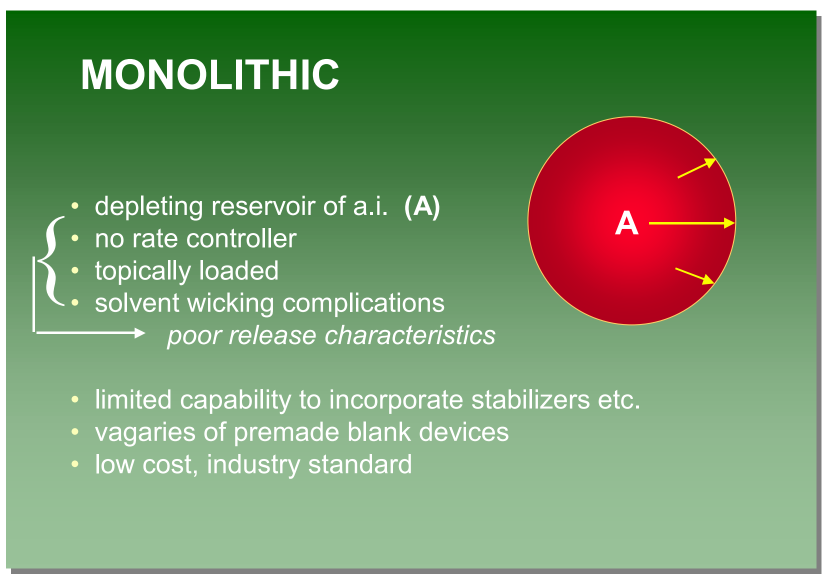
Lure technology is critically important for quarantine and monitoring purposes yet is often overlooked. Three basic lure types that have become popular: 1) Monolithic, 2) Composite and 3) Membrane Bound. Typical release curves are shown on the representative graph.

The ideal release curve is flat and is best emulated by the membrane bound device. The least desired is the rapidly changing release rate of the monolithic lure. Changes in the release rate compromises the catch data. Catches within the first week cannot be compared to catches in the fourth week because of a significant change in lure performance.



1. Monolithic: This is a solid, homogeneous release device that is usually preformed and topically loaded with pheromone chased by a solvent. The physical characteristic of the device is the reason for the rapid reduction in release rate. In an ideal situation the pheromone reservoir within the release device would remain constant (an infinite reservoir) and the concentration of pheromone, in the immediate vicinity of the lure, would extremely low. In a monolithic, lure the reservoir is always decreasing in concentration thus the equilibrium is always changing.

The solid matrix of monolithic devices is usually pre-formed then the pheromone I solution is loaded on. The solvent evaporates and the pheromone wicks close to the outer surface. This accentuates the rapid "blow off" of pheromone.

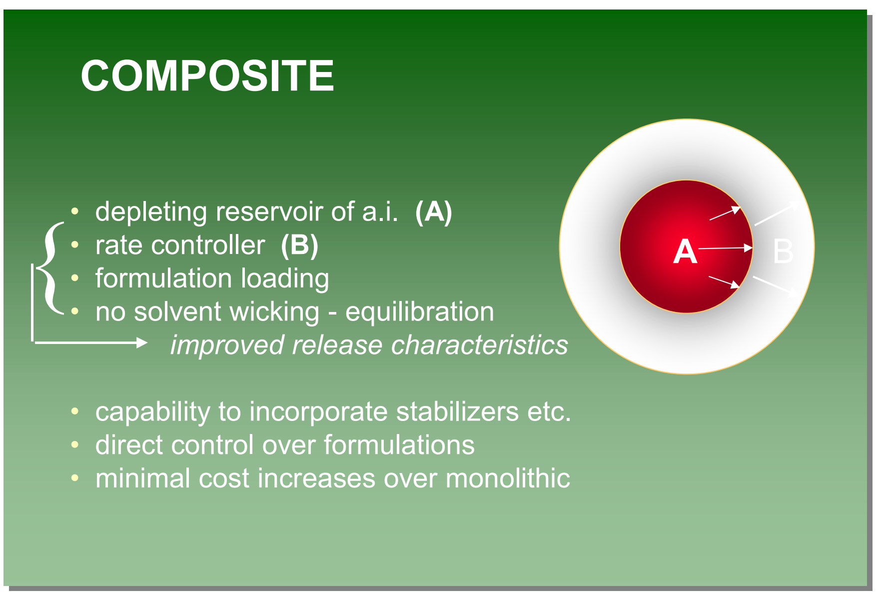


In addition, pre-formed solid matrices offer little opportunity to introduce stabilizers to combat degradation by UV or oxygen radicals

The most popular monolithic lures are made from red rubber septa. These were designed as small stoppers for vials of aqueous solutions; they were not designed for pheromone release. Red septa are made from vulcanized rubber, in chemical terms a rather bombastic process. All types of impurities and unreacted functional groups (like sulphur linkages) work to degrade or bind pheromones. So why are they so popular? They were the first devices researchers reached for, they have a handy cup to assist loading, and they are inexpensive.

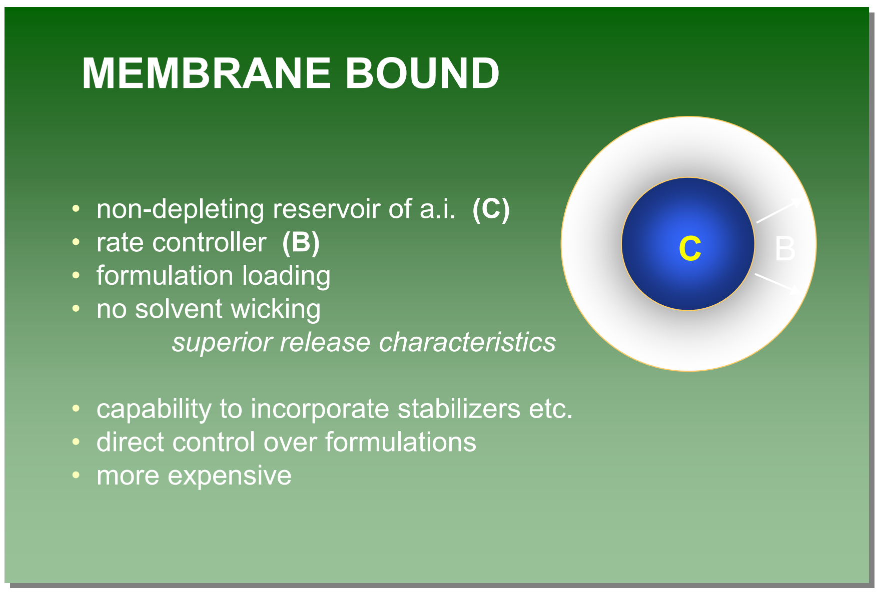
2. Composite: This is a two-part lure having an inner reservoir and an outer release membrane. If the release membrane significantly slows down the release from the reservoir the membrane becomes the rate controller. As such it retains the concentration in the reservoir longer and maintains the equilibrium longer. The pheromone is mixed with an unpolymerized plastic and let set inside the outer membrane. This improves the homogeneity in the reservoir, eliminates the wicking effect and allows for the inclusion of stabilizers. A composite lure design greatly improved field performance of a lure for forest tent caterpillar. The pheromone contained a conjugated double bond and an aldehyde function making it quite unstable under environmental conditions.

Typically, Composite lures are more expensive than traditional monolithic devices but costs can get quite competitive if made in large volumes.



3. <u>Membrane Bound:</u>
The reservoir of this lure is usually liquid (neat semiochemical) or in semi chemical in a solvent. Release is controlled by a membrane. Until the reservoir runs out it behaves like an infinite reservoir so the equilibrium remains constant. This device type also allows for the addition of stabilizers.

Membrane bound devices are usually more expensive but improved performance can offset costs. In addition, it is often the best device type when high release rates of carmines are required, such as ethanol or alpha-pinene (50mg to 1000mg per day).



In summary, lure technology is an important factor to consider particularly when implementing quarantine or monitoring programs. There is an old saying that is appropriate for this technology "you get what you pay for".

Development of Forestry Applications Using Hyperspectral Data

Dendron Resource Surveys Inc

ABSTRACT

Dendron Resource Surveys Inc. is a technical support group specializing in the application of geomatics (remote sensing, aerial photography, GIS) to forest resource management. As part of efforts to stay at the leading edge of remote sensing applications with relevance to the forest sector, Dendron is leading two projects involving hyperspectral data:

Project 1: Hyperspectral Indicators of Forest Condition: Jack Pine
Project 2: Tree Species Identification Using Hyperspectral Data

Primary Collaborators:Dendron Resource Surveys Inc.
•Ontario Forest Research Institute (OFRI)
•Earth Observation Laboratory (EOL), York University
•Canada Centre for Remote Sensing
With financial support from:
•The Earth Observation Application Development Program of the Canadian Space Agency and the Centre for Research in Earth & Space Technology (Crestech)
and forest industry support expressed by:
•Domtar Inc.

The bulk of the research work is being conducted by OFRI and EOL, with Dendron becoming familiar with the data and processing techniques.

Of particular relevance to forest pest management is the potential of hyperspectral imagery to monitor forest biochemical attributes, and thereby have utility for such tasks as the monitoring of forest health and the early detection of stress. Project results from the Jack Pine project show that spectral reflectance is an indicator for pigment content of needles. This has considerable implications for the development of forest health rating systems.

At the Forest Pest Management Forum results from this ongoing research, work will be on display and project participants will be on hand to discuss the work. Imagery will include airborne (CASI) and spaceborne (HYPERION, AVRIS) data.

Remote Sensing Tools for Monitoring and Assessment Something Old and Something New

Carol Hopkins, Remote Sensing Analyst, Dendron Resource Surveys Inc.

The presentation provided a brief overview of a couple of Dendron efforts relevant to Integrated Pest Management:

- Large-scale aerial sampling photography (LSP) in operational use as a tool to quantify jack pine budworm damage,
- Hyperspectral imagery to assess the physiological condition of jack pine, a collaborative Research & Development effort 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.

Développement d'applications forestières faisant intervenir des données hyperspectrales

Carol Hopkins, analyste en télédétection, Dendron Resource Surveys Inc.

Présentation sommaire de deux projets réalisés par Dendron dans le domaine de la lutte intégrée contre les ravageurs forestiers

- Photographie aérienne à grande échelle comme outil de quantification des dégâts causés par la tordeuse du pin gris
- Imagerie hyperspectrale appliquée à l'évaluation de l'état physiologique du pin gris; projet de recherche-développement mené en collaboration avec l'Institut de recherche forestière de l'Ontario et le laboratoire d'observation de la Terre de l'Université York, avec l'appui de l'Agence spatiale canadienne et du Centre canadien de télédétection.

Patterns of defoliation by western blackheaded budworm, *Acleris gloverana*, in juvenile western hemlock, Haida Gwaii (Queen Charlotte Islands), British Columbia

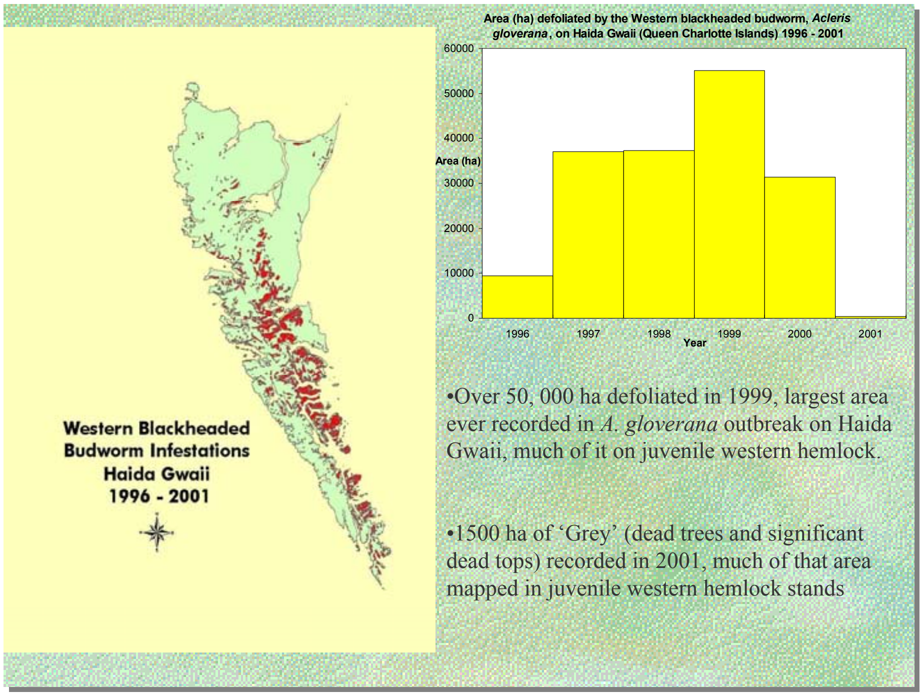
R. Turnquist and V. Nealis, Natural Resources Canada, Pacific Forestry Centre, Victoria, BC

The western blackheaded budworm is defoliator native to the Pacific Northwest that periodically causes defoliation; primarily in mature to overmature western hemlock, throughout British Columbia.

The budworm does feed on other species, including white spruce, and has been noted as damaging Sitka spruce during outbreaks on the coast, however, western hemlock is it's main host. The Canadian Forest Service, through the Forest Insect and Disease Survey, (FIDS) has records of defoliation caused by *A. gloverana* on Haida Gwaii dating to the late 1920's. During these outbreaks, a sawfly, *Neodiprion tsugae*, is associated with the budworm.

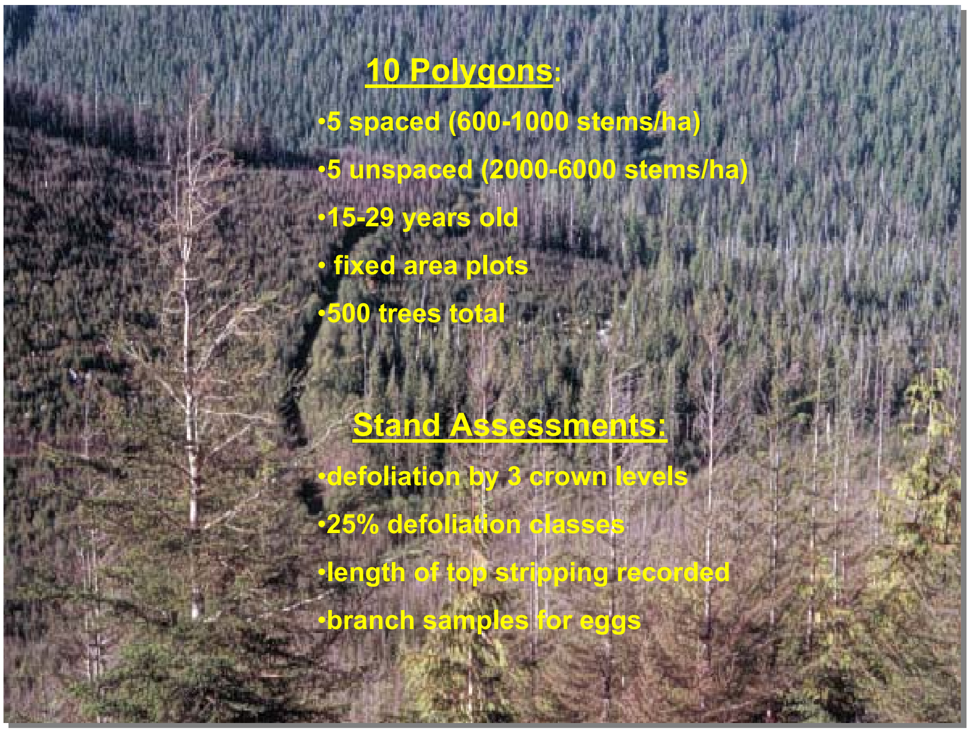
Since the budworm feeds primarily on new foliage and the sawfly on older foliage, the combination of the two can cause severe defoliation, and complete stripping of foliage on trees in infested stands.

The western blackheaded budworm has appeared with regularity every decade since the late 1920's's, except for the 1960's, on Haida Gwaii (FIDS/CFS). During this last outbreak, which lasted from 1996-2001, the defoliation patterns that occurred led us to initiate the study we are currently involved in. As I have already mentioned, the budworm has primarily been a pest of older trees. This most recent outbreak, however, saw a large area of juvenile western hemlock (15-30 years of age) defoliated. Over 50,000 hectares (ha) of western hemlock were defoliated at the peak of the outbreak in 1999, much of this in juvenile stands. Significantly, during aerial surveys in 2001, the last year of the outbreak, about 1500 ha of grey, (mainly dead trees or significant dead tops), was mapped, again, mainly in juvenile stands



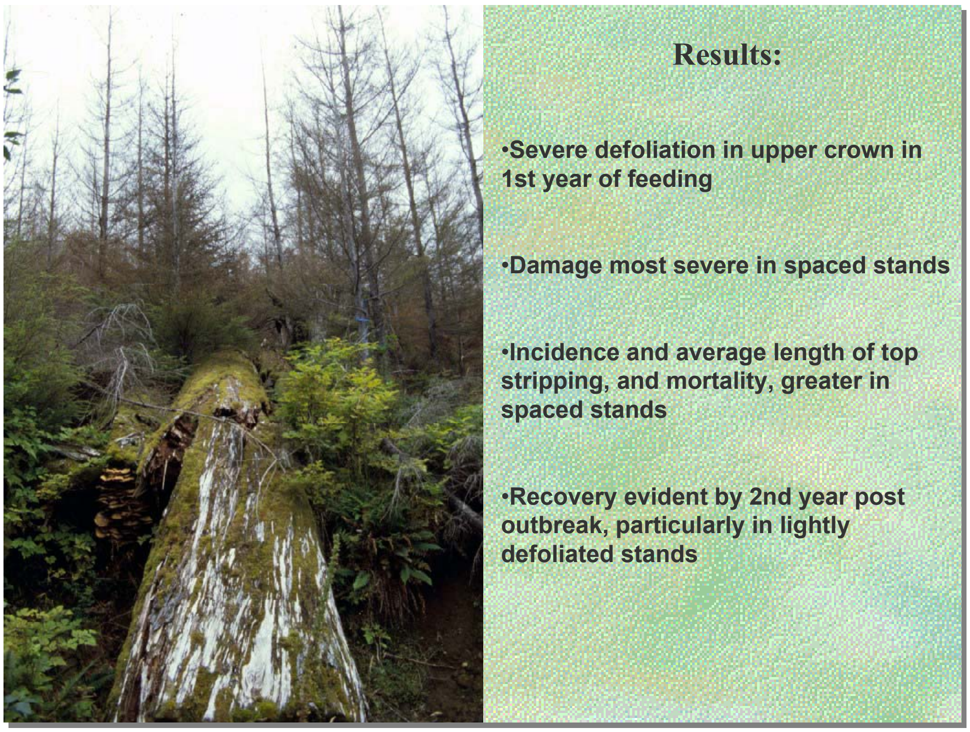
The large area, and intensity, of defoliation in juvenile hemlock led us to establish a series of plots in this age type. We were interested in determining levels of defoliation in these juvenile stands, and following the defoliation through to the end of the outbreak and beyond, to see what the long term impact of defoliation would be in western hemlock of this age class. The Archipelago of Haida Gwaii is mainly comprised of two Islands, Graham in the north and Moresby in the south. Our plot network is located on the northeastern part of Moresby Island. We used large-scale (1:50,000) aerial survey maps, augmented by ground truthing, to determine the locations (polygons) where these plots were established.

We selected ten polygons dominated by western hemlock between 15 and 29 years of age for damage appraisal in 1998, the first year that aerially visible defoliation was recorded in the area of our plot network. Five of the polygons had been spaced to between 600 and 1060 stems per ha just prior to the outbreak. Tree density in the unspaced polygons ranged from 1840 to 6400 stems per ha. We established five fixed radius plots in each of the ten polygons. Defoliation was assessed on 500 trees.



The plots in these polygons were established along contours, so that elevations did not vary significantly within sample areas. We recorded severity of defoliation by three crown levels, upper, middle and lower, at first by 10% classes, but this was later modified to 25% classes, similar to the Fette's method of determining current defoliation. Where applicable, the lengths of stripped tops were recorded. These observations have been made annually, since 1998. We also, from 1998-2000, obtained a mid-crown branch sample from each plot to assess the use of eggs as a predictor of future insect density, based on the established FIDS method.

Results from these plots show that defoliation in the first year was most severe in the upper crown, and that the defoliation was most severe in the spaced vs. the unspaced stands. Top stripping, but no mortality was recorded in the first year of the infestation. In the first year, top stripping was recorded on up to 90% of plot trees in four of five spaced sites. In the unspaced sites, only one stand had top stripping, on 40% of plot trees. In the second year of infestation (1999), severe defoliation progressed into the middle and lower crown thirds.



Top stripping increased in the second year, especially in spaced stands. All five spaced polygons had top stripping recorded, on up to 88% of plot trees, while only 3 of the 5 unspaced stands had top stripping, affecting up to 80% of plot trees. One hundred percent-defoliated trees (dead) were recorded in the second year, in one spaced stand. Elevation seemed to play a role in intensity of defoliation as well. Plots at higher elevations (i.e. 300-450m) in both spaced and unspaced stands were, overall, more severely defoliated.

Populations in our study area collapsed in 2000, and in that same year, top kill and mortality became evident. In 2001, top kill, ranging from an average of 0.1 to 4.5 m, was recorded on up to 80% of plot trees, in eight of the ten sites. Top-kill was recorded in all of the spaced stands, but in only three of five unspaced stands. The average length of top-kill was greater, by nearly 3 times, in spaced vs. unspaced stands. As well, the mean proportion of live crown 100% defoliated was also greater in spaced stands. Our 2002 observations, just recently completed, show little change from the 2001 data. Top kill is still evident in stands that previously had top-kill recorded, and recovery from top-kill has not occurred.

Mortality was recorded in two spaced, and one unspaced polygon in 2001. By 2002, mortality in the one unspaced stand was 4 % and 8% at one of the spaced sites. The other spaced site has 52% mortality. This polygon is a spaced stand at the highest elevation of all our polygons. In 2000, following two years of severe defoliation, 26 % of the plot trees at this site was dead. This increased to 42% in 2001 and 52% in 2002. Mortality at this site may increase, as 8% of the remaining live plot trees are 100 % defoliated for 90-95% of their live crown length. (This in trees averaging 7m in height).

While top killed trees may not die, they will suffer significant height and radial growth loss. Some of the more severely top killed trees will have lost one quarter to one half of their height growth that was established prior to the outbreak (this in 5-10 m tall trees). Tree form and the quality of wood products available from these trees will be poor. Our study to date indicates that spacing of juvenile western hemlock before an outbreak of the western blackheaded budworm is detrimental to tree and stand health.

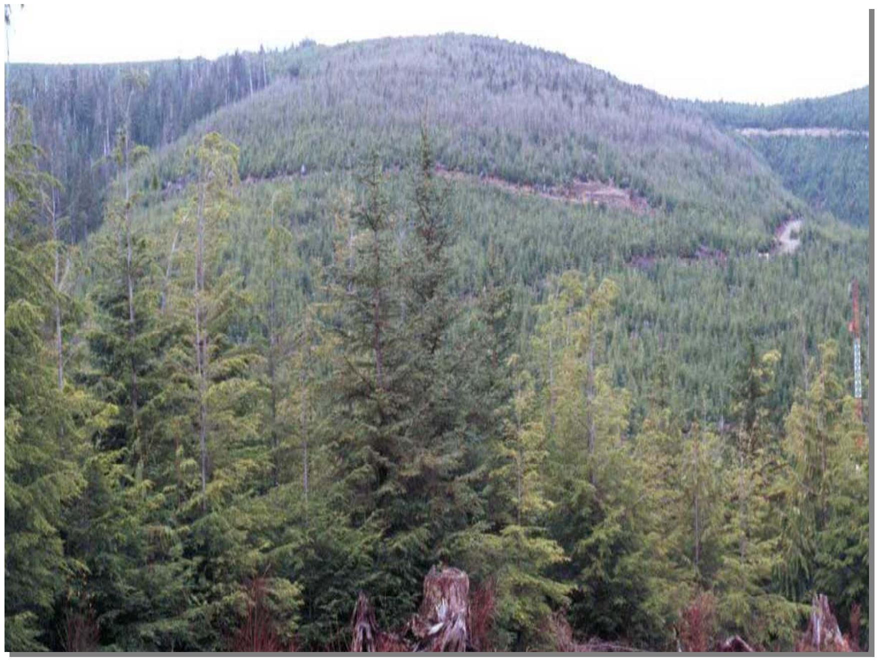
Top Kill

- Eight of ten sites, all 5 spaced and 3 of 5 unspaced, have top kill
- Mean length of top kill in spaced stands ranges from 0.1- 4.5m, in unspaced stands range is 0.01-0.9m

Mortality

- Mortality recorded in three sites to date, one unspaced stand and two spaced stands
- Only one site with significant mortality, a spaced stand, the highest elevation of all sites, 52% of trees dead in 3rd year post outbreak

The significant levels of defoliation and top-kill recorded in these juvenile stands attracted the attention of the two major forest licence holders on Haida Gwaii, Western Forest products and Weyerhaeuser Canada Ltd. As a result, we were able to obtain funding to establish a much larger and statistically rigorous network of plots in spaced and unspaced stands on both Moresby and Graham Islands. A total of 30 polygons were selected for this enlarged plot network. The plot design for the larger study is a stratified, 2-stage random design with age and spacing as strata. Initial results from this larger study confirm the data from our smaller, original study. Spaced stands suffer overall higher levels of defoliation and top-kill, and potentially mortality, than unspaced stands.

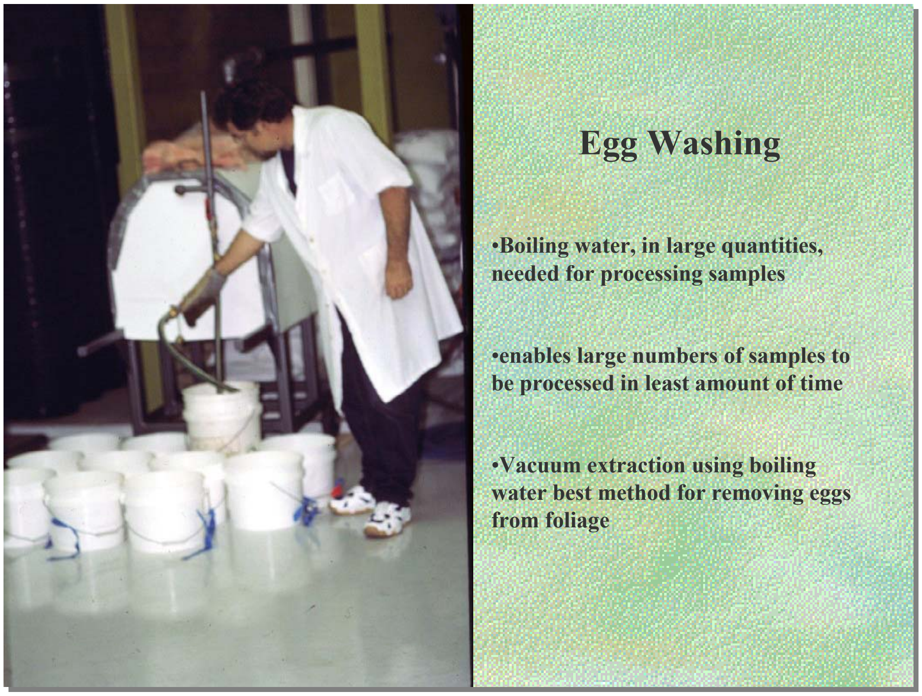


As mentioned earlier, branch samples were collected at these sites in order to predict population densities for the following year. Western blackheaded budworm eggs are generally laid singly on the underside of hemlock needles.

Egg (branch) samples from infested stands can provide a good estimation of populations in subsequent years. The Pacific region FIDS group has used egg samples as an estimate of subsequent defoliation since the 1970's, using a technique established at PFC. This technique involves using large quantities of boiling water, (provided by raw steam) for washing foliage samples. Samples were immersed in boiling water, stirred and let sit for about 10 minutes and then washed through a vacuum extraction process, with the resulting detritus (containing eggs) washed onto filter papers for counting.

At PFC, the vessel that had provided the boiling water was declared unsafe. Because of this, and the small sample size initially involved, we tested an alternate method to washing, as well as a modified branch washing method, for predicting defoliation.

The two methods we tested were: one using hot, but not boiling, water, followed by the vacuum extraction process; and the other method was a visual examination of foliage for eggs. As part of the methodology, we removed the needles containing eggs found during the test methods, and then re-washed the already examined foliage using the boiling water and vacuum extraction method. In both cases, about 1/3 more eggs were found when the traditional boiling water method was applied to these same samples.

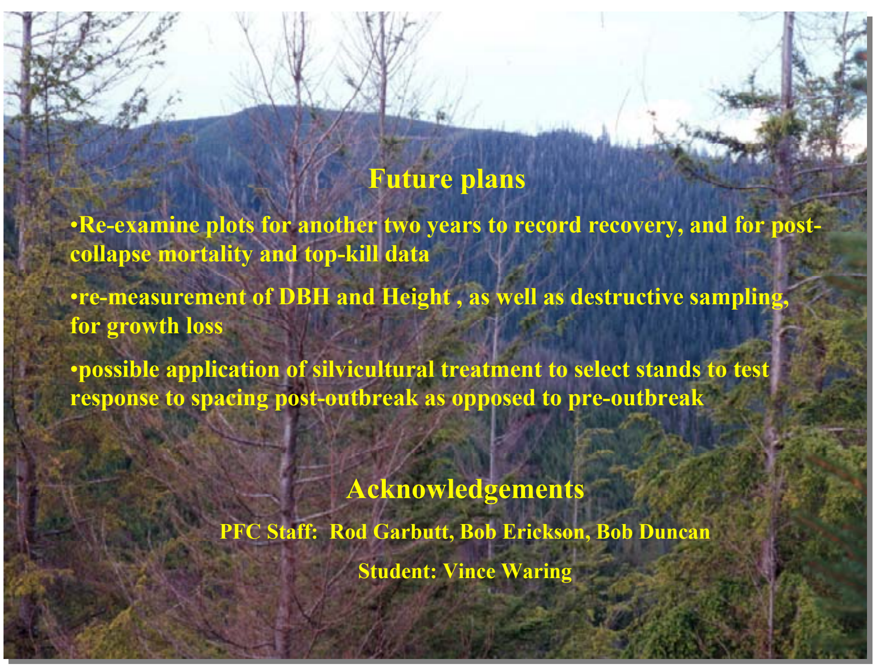


This re-evaluation of the egg washing process confirms that a boiling water wash followed by a vacuum extraction process onto filter papers for counting is needed in order to obtain the most accurate count of eggs from branch samples. This is necessary if you want to try to predict defoliation in subsequent years based on egg counts.

In order to process the number of samples needed to obtain accurate estimates of egg densities for predicting future defoliation, a large, safe, uninterrupted supply of boiling water is needed. A vessel was constructed by the engineering department at PFC to provide such a source of boiling water, and has been used successfully since 1998 to wash large numbers of foliage samples.

The average number of eggs per 45-cm branch sample was used by FIDS for many years as a predictor of future population densities. The defoliation predictions were based on foliage samples from, and compared to, defoliation on mature trees. When our results from juvenile stands were compared to these standards, egg densities from juvenile stands always overestimated, or were accurate for, predicted defoliation in subsequent years. Our accuracy was best when predicting light, not bad when predicting moderate, and not so good when predicting severe, defoliation, using the established FIDS standards. A complicating factor with our egg predictions was the fact that populations were in decline following two years of increases, when we did the second year of egg sampling, and these declining populations may have affected subsequent defoliation predictions. However, after studying all the predictions from egg samples, and the subsequent defoliation data from these and other sites on Haida Gwaii, we have concluded that a re-calibration of defoliation predictions for juvenile stands, based on egg samples, is needed.

In the future, we hope to continue to examine both our original plots, as well as the expanded network of plots for a few more years to determine rates of and length of top-kill and mortality, as well as recovery, in these stands. We would also like to eventually re-measure DBH and as well, as obtain cookies or increment cores to determine growth loss. In the expanded network of plots, besides the above, we hope to, with the assistance of Weyerhaeuser and Western Forest Products, apply silvicultural techniques i.e. spacing, to selected stands to test response to spacing post-outbreak as opposed to spacing pre-outbreak.



SESSION VI –
GLOBALIZATION AND FOREST PESTS

Chair: Dr. André Gravel
Vice-President
Canadian Food Inspection Agency

SÉANCE VI –
LA MONDIALISATION ET LES RAVAGEURS FORESTIERS

Président: André Gravel
Vice-président
Agence canadiennes d'inspection des aliments

SESSION VI - SÉANCE VI

UNITED STATES REPORT

Mary Ellen Dix, USDA Forest Service, Forest Health Protection, 1601 North Kent Street, Arlington, VA 22209

ABSTRACT

The presentation focused on the main invasive insects and diseases that have affected the United States in 2002. These were the gypsy moth, Asian longhorned beetle, hemlock wooly adelgid, western bark beetles, emerald ash borer, Port-Orford cedar root disease, Butternut canker, and sudden oak death. The highlights are summarized below.

In 2002, area of gypsy moth defoliation increased by 40,000. Gypsy moths on over 300,000 acres were treated with Dimilin, Gychek or other methods. Pheromone flakes were used to slow-the-spread of Gypsy moths into uninfested areas.

Nearly half of the native range of eastern hemlock in the United States is now infested with Hemlock wooly adelgid (HWA) (*Adelges tsugae)*. HWA lacks natural enemies in eastern North America capable of controlling building populations. The Forest Service and state partners are working to establish a host-specific complex of natural enemies. During 2002, innoculative releases of a Japanese coccinellid predator (*Pseudoscymnus tsugae*) were continued in the east. Virginia Polytechnic Institute and State University initiated mass rearing of the coccinellid *Laricobius nigrinus*. The Forest Service developed mass rearing methodologies for coccinellids in *Scymnus* species.

The Emerald Ash Borer (*Agrilus planipennis*), a burprestid beetle, native to China and Taiwan is widespread in five southeastern counties surrounding Detroit, Michigan. The beetle infests green, white, black, and horticultural varieties of ash. The State of Michigan has established a quarantine that prohibits movement of ash trees, limbs, firewood, logs, and untreated ash lumber to areas outside of the specified regulated counties.

The Forest Service, Animal and Plant Health Inspection Service (APHIS) and the states are conducting pilot tests for rapidly detecting and monitoring exotic scolytids in the Western, Northeastern, and Southern United States. Pheromone traps were placed in forests near ports, wood handling facilities and urban forests. The scolytid *Xyleborus similes* in Texas and the scolytid Xyloborus glabratus *in Georgia were detected for the first time in the United States. Also, Mississippi State University scientists identified the scolytid Xylosandrus mutilatus* in seven Mississippi counties. The success of the 2001 and 2002 pilot tests demonstrate the feasibility of a regionally coordinated monitoring protocol.

Phytophthora ramorum, the causal agent of Sudden Oak Death (SOD), has been isolated from tan oak, coast live oak, California black oak, Shreve's oak, Rhododendron spp., bay laurel, California buckeye, California huckleberry, and madrone. Laboratory tests also indicated that northern red oak and pin oak are as susceptible as tanoak and coast live oak. In California, 20 million acres were surveyed for SOD and twelve counties are currently infected. In Oregon,

SOD was eradicated from 9 sites totaling 40 acres. A framework for detection of *Phytophthora ramorum* (sudden oak death) in forests and nursery's was developed during 2002 and will be implemented on a national scale in 2003. Presence of likely hosts in the understory and overstory, locations of ornamental nurseries receiving SOD host stock, and climatic factors were used to assess forests at risk to SOD or nurseries risk. The Forest Service and the State Departments of Forestry will survey high risk forests. APHIS and the State Departments of Agriculture will survey rhododendron nurseries.

Rapport des Etats-Unis

RÉSUMÉ

L'exposé portait sur les principaux insectes et pathogènes qui ont sévi aux États-Unis en 2002, notamment la spongieuse, le longicorne asiatique, le puceron lanigère de la pruche, les scolytes de l'ouest, l'agrile du frêne, le pourridié du cyprès de Lawson, le chancre du noyer cendré et la maladie de l'encre des chênes rouges (« mort subite du chêne ») Voici un résumé des propos.

En 2002, la spongieuse a continué sa progression, défoliant une superficie de 40 000 acres. Plus de 300 000 acres ont été traités au Dimilin, au Gychek ou par une autre méthode pourenrayer ce ravageur. Des paillettes renfermant des phéromones ont été utilisées pour freiner sa progression.

Près de la moitié de l'aire naturelle de la pruche du Canada aux États-Unis est infestée par le puceron lanigère de la pruche (*Adelges tsugae)*. Dans l'est de l'Amérique du Nord, ce ravageur n'a pas assez d'ennemis naturels pour empêcher sa prolifération. Le Forest Service et les États concernés travaillent en collaboration au développement d'un groupe d'organismes ennemis de l'espèce. Au cours de 2002, les lâchers de *Pseudoscymnus tsugae*, une coccinelle prédatrice du puceron lanigère de la pruche, se sont poursuivis. Le Polytechnic Institute et l'Université d'État de Virginie ont commencé des élevages massifs de la coccinelle *Laricobius nigrinus*. Le Forest Service a mis au point des méthodes d'élevage massif de coccinelles du genre *Scymnus*.

L'agrile du frêne (*Agrilus planipennis*), un bupreste indigène de Chine et de Taiwan, est répandu dans cinq comtés autour de Detroit, au Michigan. Cet insecte s'attaque au frêne vert, au frêne blanc, au frêne noir et aux diverses variétés horticoles du frêne. L'État du Michigan a déclaré une quarantaine interdisant tout transport de ces essences sous formes d'arbres entiers, de branches, de grumes, de bois de chauffage et de bois d'œuvre non traité hors des comtés réglementés.

Le Forest Service, l'Animal and Plant Health Inspection Service (APHIS) et les États concernés mènent des essais pilotes pour la détection rapide et la surveillance d'espèces exotiques de scolytes dans l'ouest, le nord-est et le sud des États-Unis. Des pièges à phéromones ont été placés dans la forêt près de ports, d'installations de manutention de bois et d'espaces boisés en milieu urbain. Ces essais ont permis la détection pour la première fois aux États-Unis du *Xyleborus similes*, au Texas, et du *Xyloborus glabratus*, en Georgie. En outre, des scientifiques de l'Université du Mississippi ont repéré le *Xylosandrus mutilatus* dans sept comtés du Mississippi. Les résultats des essais pilotes menés en 2001 et 2002 établissent la faisabilité de protocols régionaux de surveillance.

Le *Phytophthora ramorum*, pathogène causant la maladie de l'encre des chênes rouges, ou mort subite du chêne, a été détecté sur le lithocarpe de Californie, le chêne de Californie, le chêne de Kellogg, le chêne de Shreve, plusieurs espèces de rhododendrons, le laurier de Californie, le marronnier de Californie, l'airelle ovale de Californie et l'arbousier d'Amérique. Les analyses de laboratoire ont montré que le chêne rouge et le chêne des marais sont aussi sensibles que le lithocarpe de Californie et le chêne de Californie. En Californie, une campagne de recherche a été menée sur 20 millions d'acres de terrain pour déceler la présence de la maladie, et le pathogène a été détecté dans douze comtés. En Oregon, le pathogène a été supprimé dans neuf foyers d'infestation totalisant une superficie de 40 acres. Un plan pour la détection du *Phytophthora ramorum* dans les forêts et les pépinières, mis au point en 2002, sera mis en œuvre à l'échelle nationale en 2003. La présence d'espèces pouvant servir d'hôte au pathogène dans l'étage inférieur et l'étage supérieur du couvert forestier, la position géographique des pépinières d'ornement recevant des plantes pouvant servir d'hôte au pathogène et les facteurs climatiques ont été pris en compte dans l'évaluation visant à déterminer les forêts et pépinières à risque. Le Forest Service et les départements de foresterie des États surveilleront les forêts à haut risque, tandis que l'APHIS et les départements de l'agriculture des États surveilleront les pépinières de rhododendrons.

Globalization and Forest Pests: Europe

Hugh Evans, Forest Research, Alice Holt Lodge, Wrecclesham, Farnham, Surrey, GU10 4LH, United Kingdom. hugh.evans@forestry.gsi.gov.uk

ABSTRACT

Trade at a global scale is increasing dramatically and, either directly or as packing material, wood is often involved in this trade. Not surprisingly, forest pests have entered these pathways of dispersal and have colonized new countries, often with significant consequences for forests and woodlands in the new locations. The country at risk most frequently carries out assessment of the risks from exotic pests but it is equally valid to consider the problem at source. This has the advantage of assessing risks where a pest already occurs and where knowledge of biology and ecology are well developed. Through international cooperation, this knowledge can be used to address risks in a receiving country and to develop mitigation measures to reduce those risks.

Mondialisation et ravageurs forestiers : Europe

Hugh Evans, Forest Research, Alice Holt Lodge, Wrecclesham, Farnham, Surrey, GU10 4LH, Royaume-Uni hugh.evans@forestry.gsi.gov.uk

RÉSUMÉ

Le commerce international connaît un essor spectaculaire et le bois, directement ou indirectement (comme matériel d'emballage), en est souvent un élément. Comme il fallait s'y attendre, les ravageurs forestiers ont emprunté ces voies d'introduction pour coloniser de nouveaux pays et y ont souvent de graves répercussions sur les forêts et les terrains boisés. Ordinairement, le pays menacé évalue les risques que posent ces ravageurs exotiques. Toutefois, l'examen du problème à la source est tout aussi valable, car il présente l'avantage d'évaluer les risques dans le milieu même où un ravageur est présent et où sa biologie et l'écologie sont bien connus. Par le biais d'une coopération internationale, ces connaissances peuvent servir à aborder les risques dans un pays hôte et à élaborer des mesures d'atténuation de ces risques.

Identification of hazards and risks from potential quarantine pests

The process of Pest Risk Analysis is similar on a global scale and is generally carried out to comply with the recommendations of the International Plant Protection Convention (IPPC). Regional Plant Protection Organizations (RPPOs) have, in the main, worked on the concept of known threats that have a number of common parameters:

- The potential pest organisms are clearly defined pests in the countries of origin and their taxonomic positions are well established. Knowledge of the biology and pest status of the organism in its home range is good and can be supported by sound observation and published documentation.

- There are clearly identifiable pathways for transfer of the putative pest to the receiving country and there is information on the volume of trade along each pathway.
- The potential performance of the organism in the ecoclimatic range within the receiving country can be estimated from extrapolation, modeling and, where there is other evidence of successful establishment, comparison with the new range of the pest.

Such pest-based risk assessments are relatively easy to carry out and all RPPOs routinely carry out the process and it is not surprising that the lists of prohibited or controlled organisms is remarkably similar internationally, at least for a number of serious forest pests. The *Least Wanted* list of pests produced by the Canadian Food Inspection Agency contains a number of serious pests of European origin that are also on similar lists in the USA, United Kingdom, Ireland, Australia, New Zealand and South Africa. This is based both on the known hazards associated with the organisms and on the regular interceptions of the pests during quarantine inspections. Measures to retain freedom from these pests are in place internationally, especially for the bark and wood-boring insects that are associated with wood as a product and, particularly, in packaging. New international standards for the latter category have been agreed and are encompassed within International Standard for Phytosanitary Measures (ISPM) 15, published by the IPPC (http://www.ippc.int/IPP/En/default.htm). Although the measure is currently suspended because of technical difficulties with the mark to be used to identify the procedures, the process itself is being implemented gradually. For example, China has introduced the ISPM 15 requirements for all packaging wood imported to China, thus requiring active treatments such as Heat Treatment or fumigation to be carried out.

Pest Risk Analysis: Case studies of two European bark beetles *Dendroctonus micans* and *Ips typographus*

The process of risk assessment is often more qualitative than quantitative because there is no *a priori* means of verification that the extrapolation from known ecology in the home range of the pest will translate directly to establishment and impact in a new range. However, a factor that has received scant regard is the concept of a threshold population size for establishment in a new location. This can be illustrated by reference to two important European bark beetles *Dendroctonus micans* (great spruce bark beetle) and *Ips typographus* (eight-toothed European spruce bark beetle), the latter species being included in virtually all quarantine lists in temperate countries.

Table 1 summarizes the main ecological and biological features of the two organisms and illustrates some of the critical differences between them. Some of these factors might explain the fact that *D. micans* has successfully spread, with international trade, into a number of new areas despite never having been intercepted during quarantine inspections, whereas *I. typographus* has not established in new areas despite frequent interceptions.

In this comparison, the attack strategies for living trees that might be well defended with active resin systems are very different between the two bark beetles. In the case of *D. micans*, it uses a solitary attack strategy for all trees and can withstand and overcome tree defenses without the aid of associated staining fungi (Evans & Fielding, 1994). By inference, this species of beetle would only require a very small pioneer population to establish in a new location. This appears to be borne out in practice as evidenced by the continuing expansion of its range and its relatively recent arrival in Great Britain, probably in 1973, but only detected in 1982. In contrast, *I. typographus* uses a combination of early male arrival, production of an aggregation pheromone and presence of a fungal associate to overcome tree defenses, even in weakened or freshly dead trees. In relation to direct attacks on living trees, the threshold is high (>400 beetles m^{-2}). The key question for establishment, therefore, is how many are needed to establish on weakened trees? In such cases there is still a requirement for multiple arrivals but, clearly, the number will be very significantly smaller than that required on healthy trees. However, there is little information on this aspect because most effort has gone into determining the thresholds on living trees (Christiansen & Bakke, 1988). It is not unreasonable to assume that the threshold will be measured in tens rather than units and would also require synchrony of male and female emergence and migration to potential breeding sources. It is surprising to note that, despite the many years of records of *I. typographus* being transported in international trade, it has never successfully established outside its home range.

Table 1: Ecological and biological factors affecting the establishment potential of the European bark beetles *Dendroctonus micans* and *Ips typographus*

Factor	*Dendroctonus micans*	*Ips typographus*
Population behavior	Continuous low level presence with limited tree mortality	Eruptive behavior arising from increases in breeding material, local population build-up and mass attack on surrounding healthy trees
	Infrequent outbreaks result from several years drought or poor forest management predisposing trees to attack	Population increase correlated with forest size and tree age, drought and forest management
	Larvae feed gregariously and exhibit altruistic behavior resulting in limited competition for resources	Separate egg niches keep *I. typographus* larvae apart; location by natural enemies is reduced.
Generations	12 months to 36 months with overlap	1 or 2 (rarely 3) generations per year
	Adults emerge any time from spring to autumn	Synchronized adult emergence (spring and summer emergence peaks)
Attack patterns	No fungal associates	Blue stain fungus carried by adults, helps to overcome host defenses and speeds up tree mortality
	Multiple broods on same or neighboring trees, totaling up to 300 eggs per female	Up to 120 eggs per gallery, up to 3 galleries on separate trees following re-emergence of females
	Females prefer weakened stems but can attack fully healthy trees	Endemic populations: attacks on dying or dead trees. Number required is uncertain but is much higher than *D. micans*
	Threshold on living trees ≥ 1 female	Epidemic populations: mass attacks on healthy trees. Threshold on living trees >400 adults m^{-2}

Expecting the unexpected

As discussed above, much of the PRA process relies on identification of known threats and on being able to predict whether those threats will be realized in a new geographical location. However, not all organisms are identified through this process. Some are not considered to be threats because of apparent low hazard rating in the country of origin. In such cases no PRA is carried out and the impact of these incursions is normally only detected after significant damage has already taken place. A good example of such an unexpected threat is the brown spruce longhorn beetle *Tetropium fuscum* that has been causing damage in Point Pleasant Park in Halifax, Nova Scotia. This longhorn beetle is a secondary component of the forest ecosystem in Europe and is not regarded as a pest in its home range. However, it is attacking still living trees in Nova Scotia and has resulted in tree mortality, thus requiring considerable remedial action to contain the pest. Such organisms are difficult to deal with, not only because they are not identified as potential threats before arrival, but also because there is often no clear management strategy available for dealing with the new association. Such has been the case in Nova Scotia where management measures have had to be developed *de novo*.

In relation to current plant protection policies it is valuable to consider the status of some organisms and to determine whether enough effort is being put in to learning from new associations that may be more damaging than in the countries of origin. Retrospective PRAs may provide some insights into the pathways and, particularly, into whether there were common factors that could have improved prediction of the threat. In this respect, there are many organisms of European origin that could pose threats in new locations, especially to the extensive forests of North America. Table 2 provides selected listings of European insects that range from known, through intermediate, to unexpected threats. The known threats are universally recognized as potentially serious incursions and considerable efforts are expended globally in preventing transfer along pathways. Organisms posing intermediate threats are often either relatively innocuous or are under effective management in their countries of origin. In addition, there are recognized differences in the ways in which the organisms act or are perceived, in relation to markets or ecosystems affected, in the receiving country. Thus, for example, *Tomicus piniperda*, although recognized as a problem in Europe is managed effectively by rapid removal of breeding material from sites so that emergent adults are not able to cause shoot pruning damage to nearby standing trees. This option is not always available and the acceptable damage threshold may differ in new locations, as is the case with pines grown for Christmas trees in the USA where even cosmetic damage can be significant. Unexpected threats can arise a number of causes including heightened impact in the receiving country (*Adelges piceae* and *Tetropium fuscum*), a switch to an exotic host in the native country (introduction of lodgepole pine as an exotic host in Great Britain) and simply as a completely new, previously unrecognized pest (*Cameraria ohridella* in Europe). There is no doubt that other surprises will appear at regular intervals and it is, therefore, important to learn from these unexpected threats so that ecological factors that might explain the change in risk status can be recognized and included in future PRAs.

Table 2: European forest pests in relation to Known, Intermediate and Unexpected threats to North American forests

Species	Order: Family	Hosts	Description
Known Threats			
Dendroctonus micans	Coleoptera: Scolytidae	All species of spruce, occasionally *Pinus sylvestris*	Solitary attack bark beetles. Kills trees but only occasionally in high numbers.
Ips typographus		All spruce species	Mass attack bark beetle. Kills many trees
Lymantria dispar	Lepidoptera: Lymantriidae	Very wide range of deciduous trees and shrubs. Asian strain also attacks pine.	Regular defoliation leading to reduced tree growth and occasional death. Public health concerns because of irritating hairs. Asian strain more serious.
Lymantria monacha		Wide range of conifers and deciduous trees.	Severe defoliation leading to reduced growth and tree death, especially in spruce. Synchronized outbreaks over wide areas.
Intermediate Threats			
Tomicus piniperda	Coleoptera: Scolytidae	Pines, especially *Pinus sylvestris*	Some damage to tree crowns. In Europe, regarded as technical pest (secondary attack + blue stain on wood). Effects more serious in North America (especially in Christmas tree production)
Ips sexdentatus		Pines	Regarded as secondary pest leading to technical damage to felled timber
Cryptococcus fagisuga	Homoptera: Coccidae	Beech – *Fagus* spp.	Some damage and loss in Europe on *F. sylvatica*. Eastern North America: severe effects of scale and fungus on poorly defended American beech (*F. grandifolia*). First in Halifax, NS.
Unexpected Threats			
Adelges piceae	Homoptera: Adelgidae	True firs (*Abies* spp.)	Minor significance in Europe. Major pest in North America (crown dieback and tree death of several species of fir).
Tetropium fuscum	Coleoptera: Cerambycidae	Pines	Secondary and of no consequence in Northern Europe (native). Significant damage and tree death in Nova Scotia.
Panolis flammea	Lepidoptera: Noctuidae	Pines	No effects on native Scots pine (*P. sylvestris*) in Great Britain. Severe attacks and tree death on introduced lodgepole pine (*P. contorta*).
Cameraria ohridella	Lepidoptera: Gracillariaceae	Horse chestnut (*Aesculus hippocastanum*) and *Acer* spp.	Newly described in Macedonia (1985). Rapid spread to reach western Europe; Britain and Denmark in 2002. Early loss of leaves and reduced tree growth especially apparent in urban environments.

Conclusions

Known threats remain, correctly, the main focus for Regional Plant Protection Organizations and the measures introduced to prevent their spread will provide some elements of cross-protection for organisms on the same pathways. The commonality of pathways for a wide range of organisms with similar ecological niches suggests that moves towards commodity-based pest risk assessments could at least reduce the numbers of unexpected incursions through improvements in mitigation measures, including the current introduction of heat treatment as recognized procedure for packing wood.

Intermediate and unexpected threats are more difficult to deal with, especially if the pathways are different. In such situations, it may be more difficult to justify introduction of phytosanitary measures because the pest is not recognized as significant in its country of origin, even though evaluation may suggest that the threat is greater in the receiving country. For example, would it have been possible to justify phytosanitary measures for *T. fuscum* based purely on the known pest status in Europe? More international collaboration to address the *unexpected* should enable improvements in the ability to predict potential changes in pest status under new ecological conditions. Improvements to modeling and increasingly sophisticated use of GIS can be incorporated into the evaluation processes but it is important for those carrying out PRAs to work with scientists in the native ranges of the pests. Such international collaboration adds value to existing science and also increases the likelihood of recognizing and reacting to new threats and avoiding too many surprises.

Acknowledgements

I am grateful to Guy Bird and his colleagues for my invitation to attend, for support from CFIA and for making the meeting an enjoyable and rewarding occasion. Thanks also to Lee Humble for continuing valuable discussions and exchanges of ideas on invasive forest pests.

Reference

Christiansen, E. & Bakke, A. (1988). The spruce bark beetle of Eurasia. In *Dynamics of Forest Insect Populations: Patterns, Causes, Implications*, ed. Berryman, A. A., pp. 479-503. Plenum Press, New York.

Evans, H. F. & Fielding, N. J. (1994). Integrated Management of *Dendroctonus micans* in Great Britain. *Forest Ecology and Management* 17-30.

SPECIAL FEATURE

Chair: Paul Addison
Director General
Canadian Forest Service
Pacific Forestry Centre

SÉANCE SPÉCIALE

Président : Paul Addison
Directeur général
Service canadien des forêts
Centre de foresterie du pacifique

The following report is excerpted from an article published in The Forestry Chronicle, May – June 2003.

The Forest Pest Management Forum – Moving into the 21st Century based on 50 years of information sharing

Guy K.M. Smith
Chief, Marketing and Technology Transfer Section
Natural Resources Canada
Canadian Forest Service
1219 Queen St. E
Sault Ste. Marie, (Ontario)
P6A 2E5

Charlotte A. Sharkey
Web Content Marketing Support Officer
Natural Resources Canada
Canadian Forest Service
1219 Queen St. E
Sault Ste. Marie, (Ontario)
P6A 2E5

Joseph Boivin
Technology Transfer Intern
Forestry Research Partnership
Canadian Ecology Centre
P.O. Box 430
6905 Hwy 17 West
Mattawa, ON P0H 1V0

Intensive Forestry – Managing Fiber Means Managing Pests - A report from the Special Feature at Forest Pest Management Forum 2002

To remain globally competitive, Canada's forest industry is increasing efforts to apply intensive forest management (IFM). Experience suggests that in some areas, intensive treatments can open stands to increased risk of pest damage and associated volume and quality losses. In response to this issue, the special feature at this year's Forum examined the link between IFM planning and pest management. Beginning with a series of presentations, the session then broke into two groups whose aim was to identify priority issues for future national level discussions dealing with IFM and pest management. The following is a review of the presentations, followed by a summary of the output from the discussion sessions.

Presentations

Roger Whitehead, from the CFS Pacific Forestry Centre, provided a western Canadian perspective. In his presentation, he noted that more than 60% of the land allocated for timber harvest in western Canada has not yet been logged for the first time, and therefore has had very low intensity management. He then described how the current MPB epidemic in B.C. is a direct result of too much undeveloped and unmanaged old pine on the landscape. According to Mr. Whitehead, transition to a more intensely managed forest should eventually eliminate significant losses to MPB in the commercial forest if we follow crop plans that shorten rotation length and produce a landscape mosaic with stands diverse in age, species composition and size. In the short-term, partial cutting entries in maturing stands may hold some timber in the scheduling queue while higher risk stands are removed. Prescriptions of 4- or 5-meters spacing would hamper dispersal and host selection of MPB, because of increased light, temperature, and wind speed in a stand. Enhanced tree vigour in spaced stands, as shown through higher resin flow rates, would also improve tree resistance to MPB.

From the opposite end of the country, George VanDusen of Corner Brook Pulp and Paper Limited in Newfoundland also showed a link between tree spacing and susceptibility to pest damage. However, in the Newfoundland example the relationship between spacing and stand susceptibility was opposite to the B.C. example. It was found that spaced stands of balsam fir appeared to be more susceptible than un-spaced stands to damage caused by balsam fir sawfly (BFS). Since 1996, Newfoundland has seen an unprecedented outbreak of BFS. Corner Brook Pulp and Paper is collaborating with researchers from the CFS, University of New Brunswick, and Newfoundland Forest Service to identify and develop effective and acceptable control methods. Studies aim to improve understanding of pest-host interactions of the BFS, and to test potential control agents, such as Dylox, NEEM, and *B.t.k.* The most promising control agent under development is a naturally occurring virus. The company hopes there will be a temporary registration through the PMRA by 2004 for the virus, and ultimately full registration.

Paul Wooding, manager of forestry certification and market access for Canadian Forest Products Limited (CANFOR), provided insight into forest certification and examined the links between certification, IFM, and pest management. His presentation reviewed several certification systems such as the International Organization for Standardization (ISO), the Canadian Standards Association (CSA), the Sustainable Forestry Initiative (SFI), and the Forest Stewardship Council (FSC). Mr. Wooding pointed out that the marketplace could soon demand certified forest products. Meeting the certification standards will require management for a broader range of forest values, which will present challenges for intensive forestry and pest management.

To offer the perspective from a very intensively managed system, Cees van Oosten, from SilviConsult Woody Crops Tech Inc., described risk management issues for short rotation intensive culture of hybrid poplar in B.C. Hybrid poplar on farmland with rotations of 12 years or less can qualify as a farm crop and do not fall under forest regulations. Therefore, plantation managers could use pesticides, approved for hybrid poplar, to deal with insect pests; however, now hardly any pesticides are registered for use on hybrid poplar. According to Mr. van Oosten, most risks associated with the system can be managed through a well-designed selection and breeding program, an appropriate clonal deployment strategy, good site selection, and proper cultural practices. Proper management of this short rotation system can yield a cost competitive source of a variety of forest products. The plantation system could also be used for carbon sequestration and has excellent potential in phytoremediation. Hybrid poplar also offers opportunity for riparian management.

Discussion Groups

After lunch, attendees broke into groups and discussed IFM and pest management. The aim was to identify priority issues, ask pertinent questions, and make recommendations for future national IFM discussions. Group discussion focused around several issues: ecological, policy and economics, planning, political, certification and market acceptance, public perception and public education, and operations. The following is a review output from the discussion groups.

Ecological

The lack of information about practicing pest management in a "non-natural" forest was identified as a major issue. There is a need for more scientific monitoring, especially given the increased risk of pest outbreaks in an intensively managed forest. Forest managers may have to adopt an adaptive approach to deal with pest management issues if IFM becomes more pervasive in Canada. Climate change may also affect management strategies. In summary, the group stated that scientific research is needed to help understand the effects of IFM. The scientific community also needs to define what "sustainable" means in an IFM context, as opposed to sustainable management of natural-origin forests. The question this group directed towards further national-level discussions of IFM was, "Can intensive forest management be sustainable forest management?"

Policy and Economics

An understanding of the factors that will drive IFM policy direction is needed; these factors range from extensive issues such as achieving conservation objectives, to intensive issues such as meeting the demand for wood supply. Policy issues might develop out of the fact that some IFM systems could produce a genetically modified material in the future (e.g. hybrid poplar). Varying policies for IFM on private versus crown land may become an issue of concern. There would be a direct effect on production, incentives, taxation, and management if intensively managed plantations gain farm status and are considered crops. From an economic standpoint, there will be a need to identify incentives or disincentives regarding the allocation of "best land" sites for IFM. In summary, with an understanding of the factors that drive policy related to IFM, certain incentives would be needed to ensure IFM meets its objectives. The question posed by the group was, "Who will pay for the investment dollars needed for IFM?"

Planning

In such a large country, regional differences would require the development of a common language for conducting IFM planning. The timing of IFM planning would be of concern, since forest management varies with location. Careful planning of plantations would be necessary to ensure that carbon sequestration strategies meet appropriate objectives. The issue was raised of whether land suitable for practicing IFM would be located near markets. This group concluded that a long-term focus, coupled with effective short-term planning tools and flexible approaches, are critical if IFM is to be effectively implemented across a country as large as Canada.

Politics

The increased risk of pest damage associated with intensive treatments would require more widespread use of federally approved pesticides. This may be of concern from a political perspective, given public concern over the use of pesticides. This discussion raised several questions. Would IFM and pest management be politically or socially driven, or would it be based on best practices? What are the political realities of jurisdiction? Federally, who has responsibility for forest stewardship? In summary, several political issues must be addressed for progress to be made with IFM in Canada.

Certification and Market Acceptance

There is a need to understand the constraints posed by certification. Societal demand for certified products is likely to exert a greater influence on the market in the near future. How do we build the tools that respond to certification? How do we modify or influence the standards to keep or add essential tools? Certification presents both a constraint and opportunities for pest management and IFM. It is important to understand the certification process and to develop tools and approaches to respond to it.

Operations

Meeting certification standards requires a reduction in the number of tools that can be used for pest management. With fewer tools, coordinating and integrating pest management and forest management may be increasingly difficult. How do we develop pest management methods in an IFM context with fewer tools due to certification? An additional issue may involve the quality of second growth wood or plantation wood. This prompts a question regarding the extent to which we will move to intensive management. In addition, where are the skilled forest workers who will conduct IFM? In summary, implementing pest management in an IFM context will mean finding ways to operate with limited tools and many constraints.

Conclusions based on discussion groups

Insect pests influence IFM planning at both ends of the country. Case studies show that because of variation in forest types and insect pests across Canada, an effective strategy for one part of the country may be a source of problems in another. We are challenged by the size of our country and the diversity of its forest types. This challenge is but one of the complexities that face mangers and policy makers as they plan and develop intensive forestry prescriptions and programs. The session at Pest Forum 2002 resulted in a set of questions and a framework for more focused discussion of the topic.