

Forest Pest and Disease Workshop 2012



Presented by Fundy Model Forest
February 15, 2012
Hugh John Flemming Forestry
Centre
Fredericton, N.B.



A workshop for managers,
technicians, landowners, and
other forest practitioners

Continuing Education Credits:
ARPFNB: 18
CIF: 5



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“Healthy communities within a working Acadian Forest managed using the principles of sustainable forest management.”



9:00–9:15	<p>Welcome—Dr. Dave MacLean, President Fundy Model Forest Hon. Bruce Northrup, Minister, Natural Resources New Brunswick</p>
9:15–9:45	<p>Summary of forest pest conditions in New Brunswick in 2011 and outlook for 2012—Jeremy Gullison, New Brunswick Department of Natural Resources (DNR)</p> <p>This presentation reports the status of forest pest populations in New Brunswick in 2011 based on monitoring done by DNR's Forest Pest Management Section with forecast of pest conditions in 2012. Spruce budworm, forest tent caterpillar, gypsy moth and balsam fir sawfly are some of the pests that will be discussed.</p> <p>Speaker—Jeremy Gullison is from Stanley, New Brunswick. He graduated from University of New Brunswick (UNB) with a BSc in Forestry in 1998 and received a MSc in Forestry from UNB in 2002. He joined DNR in 2001 as a Forest Management Planner and became part of the Forest Pest Management Section in 2006. His primary expertise is in forest modelling and GIS analysis including pest decision support systems. Jeremy supervised the implementation of DNR's pest monitoring surveys in 2011.</p> <p>Contact: Jeremy.Gullison@gnb.ca</p>
9:45–10:15	<p>Balsam woolly adelgid update—Dr. Dan Quiring, Faculty of Forestry and Environmental Management, UNB</p> <p>Contact: quiring@unb.ca</p>
10:15–10:30	<p>Break</p>
10:30–11:00	<p>The next spruce budworm outbreak in New Brunswick: Anticipatory, reactive, or crisis management?—Dr. Dave MacLean, Faculty of Forestry and Environmental Management, UNB</p> <p>It has been almost 20 years since the end of the last spruce budworm outbreak in New Brunswick in 1993, and unfortunately indications are that it may be returning. In the past, spruce budworm outbreaks in New Brunswick have been preceded by those in Quebec, and area of moderate-severe (30-100% of current-year foliage) defoliation in Quebec has increased from less than 3000 hectares in 2003, to over 300,000 ha in 2009, 750,000 ha in 2010, and 1.6 million ha in 2011. Dave will describe spruce budworm outbreaks and their impacts on stands in New Brunswick, and recent projections of likely effects on timber supply, sustainable harvest levels, direct and indirect economic impacts, and jobs. How can new decision support tools be used to reduce losses to budworm while reducing use of insecticides, especially given current government budget cuts? What are management options for dealing with spruce budworm? There have been considerable research advances to better deal with spruce budworm management over the last two decades, but will we have anti-cipatory, reactive, or crisis management of the next outbreak?</p> <p>Speaker—Dr. David MacLean is Professor at the UNB Faculty of Forestry and Environmental Management, where he was Dean of from 1999-2009. Prior to that he spent 21 years as a Research Scientist with the Canadian Forest Service. Through the 1990s, he coordinated Canada-wide research networks to (1) develop GIS-based</p>

decision support systems for four of Canada's major insect pests, and (2) determine silvicultural approaches to integrated insect management.

Dave is President of the Fundy Model Forest and a member of the Executive Committee of the Canadian Model Forest Network. He and his graduate students have conducted research projects on sequestration of carbon by forests, TRIAD zoning approaches to forest management, effects of silviculture and management on biodiversity, and decision support systems for pest management. In 2008 he was awarded the Canadian Forestry Scientific Achievement Award by the Canadian Institute of Forestry.

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Advancements in impact analysis methods and protection planning software for forest pests—Dr. Chris Hennigar

11:00-11:30

The *Accuair™ Forest Protection Optimization System (ForPRO)* is a new software tool that streamlines prediction of stand impacts for a variety of insects (eastern spruce budworm, jack pine budworm, eastern hemlock looper, and balsam fir sawfly) and enables seamless integration of stand impact predictions within forest estate planning models built with Remsoft's Spatial Planning System. This tool extends conceptually from the Spruce budworm Decision System and was developed in part with support from SERG-International and the Atlantic Innovation Fund from 2008-2011. ForPRO can assist land managers in quantifying marginal benefits (i.e., timber volume in m³/ha or value as \$/ha) of protecting forest stands against insect defoliation, and with Remsoft integration, can be used to search for cost effective forest-pest management strategies that minimize harvest or other non-timber losses under deterministic or stochastic disturbance events. Between 2009-2011, ForPRO was used to estimate spruce budworm impacts on harvest in New Brunswick by UNB and the New Brunswick Department of Natural Resources (DNR) and in Quebec by the Canadian Forest Service. It has also been implemented in Newfoundland by Dr. Javed Iqbal at UNB in collaboration with the Newfoundland DNR for hemlock looper and balsam fir sawfly outbreaks.

Ongoing ForPRO development of an operational blocking tool designed to optimize the benefit-cost ratio (maximize economic returns and minimize treatment costs) of spatial spray block designs is under way. The tool utilizes simulated annealing in combination with other heuristic search rules to create and explore alternative aerial blocking patterns that improve the overall solution. The cost algorithm, which considers aircraft flight plan and spray constraints, continues to be refined with input from Forest Protection Limited and NBDNR Pest Management staff. These emerging approaches for minimizing losses to large insect outbreaks will be introduced and discussed in the context of past and present pest planning.

Speaker—Chris Hennigar received his BScF in 2003 and PhD in Forest Management in 2009 from UNB. He currently holds an Industrial NSERC post-doctorate fellowship and an Honorary Research Associate position within the Faculty of Forestry and Environmental Management, UNB. Chris's past and present research focuses on stand growth and yield modeling, quantifying natural disturbance impact on forest values, and forest carbon life-cycle management. He is also the sole proprietor of a software and consulting business, FORUS Research, which specializes in developing efficient applications and approaches for stand and forest modeling.

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11:30-12:00	<p>Invasive alien species of quarantine significance—Gregg Cunningham, Forestry Specialist, Plant Health and Biosecurity, Atlantic Area, Canadian Food Inspection Agency</p>
	<p>Speaker—Summers growing up in Glassville, Carleton County, New Brunswick drew Gregg Cunningham into the study of Agriculture at the Nova Scotia Agricultural College where he received a BSc in Agriculture, with a major in Plant Protection in 1986. Gregg began his career with an arboricultural firm where he worked as a supervisor for two years. He joined Agriculture Canada in 1988 as a Primary Products Inspector, which included three years as Plant Protection Inspector in the Halifax District. In 1992, Gregg became the Plant Protection Officer for Nova Scotia Region, a position he held with Agriculture Canada/CFIA for nine years. During this time, Gregg completed course work towards a MSc in Plant Protection at Macdonald College of McGill University. In 2000, Gregg became spokesperson for the Brown Spruce Longhorn Beetle (BSLB) Taskforce, while also playing a key role with the coordination of the response to this pest. In the spring of 2002, Gregg moved into his current position as Forestry Specialist for the Atlantic Plant Products Program Network of the Agency.</p>
	<p>Contact: Gregg.Cunningham@inspection.gc.ca</p>
12:00-1:00	<p>Lunch break</p>
1:00-2:45	<p>Concurrent Session 1—Research—Moderator John Henderson, Canadian Forest Service</p>
<p>New Brunswick Room, Atlantic Forestry Centre</p>	<p>Influence of tree condition on the preference and performance of the brown spruce longhorn beetle in Atlantic Canada—Leah Flaherty, UNB</p>
	<p>In its native Europe, the brown spruce longhorn beetle (BSLB) is not considered a pest, as it primarily infests weakened or recently cut Norway spruce. In Canada, this exotic wood-boring beetle has been reported to attack several species of apparently healthy spruce, and has been classified as a quarantine pest by the Canadian Food Inspection Agency since 2000. This research evaluates the influence of tree condition on the preference and performance of BSLB in Atlantic Canada. Performance was evaluated with and without exposure to natural enemies. Results indicate that adult BSLB land more frequently and lay more eggs on experimentally stressed compared to healthy red spruce trees. This beetle can colonize healthy trees, but their survival is very low compared to their survival on stressed trees. Development also takes longer on healthy compared to stressed trees, although emerging adults are larger. Natural enemies causing mortality of BSLB included two native parasitoids and woodpeckers. When populations of parasitoids are high, more mortality occurs on stressed compared to healthy trees. Timing of attack also had a large impact on BSLB performance, and will be discussed.</p>
	<p>Speaker—Leah Flaherty is originally from northern Alberta, but has lived in the Fredericton area for 10 years. She obtained her BScF and MScF from the Faculty of Forestry and Environmental Management at UNB in 2005 and 2007, respectively. Before beginning a PhD at UNB in 2008, she worked as a mountain pine beetle survey training coordinator at the Grande Prairie Regional College in Alberta. Her current PhD research focuses on the population ecology of the brown spruce longhorn beetle in Atlantic Canada.</p>
	<p>Contact: Leahelizabethflaherty@gmail.com</p>

**Developing methods for slowing the spread of the brown spruce longhorn beetle—
Jon Sweeney¹, Peter Silk¹, Marc Rhainds¹, Wayne MacKay¹, Ed Kettela¹, Robert
Lavalée², and Claude Guertain³**

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² Natural Resources Canada, Canadian Forest Service, Sainte Foy, QC,

³ Institut Armand-Frappier, Laval, QC

The brown spruce longhorn beetle (BSLB), *Tetropium fuscum* (F.) has been established in Nova Scotia since at least 1990 and as of September 2012 has been detected in nine counties of Nova Scotia, as well as Kouchibouguac Park, New Brunswick. The BSLB attacks and kills red, white and black spruce in Nova Scotia; stressed trees are most susceptible to attack and colonization. The goal of this research is to develop tools and methods for suppressing BSLB population and slowing its spread in North America. Research has focused on two pheromone-based strategies (mass trapping, mating disruption) and studies have been recently initiated on auto-dissemination of pathogens and stem-injection of insecticides. Pheromone-based mating disruption shows the most potential to date as a method for suppressing BSLB populations: aerial applications of pheromone in biodegradable Hercon Bioflakes® significantly reduced BSLB mating success in 2009, 2010 and 2011. Mass trapping of BSLB at a density of 100 pheromone-baited traps per ha significantly reduced infestation levels but a density of 25 traps per ha did not. The concept of auto-dissemination is to attract BSLB to a pheromone-baited trap fitted with a chamber containing spores of a native fungal pathogen, from which contaminated beetles escape and transmit the pathogen to other BSLB, thereby suppressing the population. This study is in early stages but results to date will be presented. Finally, field trials are planned for 2012 to test stem-injection of TreeAzin for protecting spruce from BSLB colonization. TreeAzin is an insecticide with very low mammalian toxicity produced from Neem trees that has been demonstrated to be very effective at protecting ash trees from emerald ash borer.

Speaker—Dr. Jon Sweeney received his BSc (Hons) in Biology from Simon Fraser University and his PhD from the Faculty of Forestry, University of British Columbia. His thesis was on the pheromone-mediated behavior of the western spruce budworm. Jon did post-doctoral research on the biology and management of seed and cone insects with Gordon Miller at Pacific Forestry Centre in Victoria, and has been employed with Natural Resources Canada, Canadian Forest Service in Fredericton, since 1989, where he has studied the ecology and management of seed and cone insects, the effects of forestry practices on ground beetle species diversity and composition, and most recently, the ecology and management of invasive species, specifically the brown spruce longhorn beetle, *Tetropium fuscum*, recently discovered established in Nova Scotia. Jon is also an Adjunct Professor in the Faculty of Forestry and Environmental Management at UNB.

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1:00-2:45

New Brunswick
Room, Atlantic
Forestry Centre

**Enhancement of seedlings with natural endophytic fungi to improve tolerance to
insects and disease—Greg Adams, J.D. Irving, Limited (JDI)**

Endophytic fungi live inside tissues of many (most) plants from seaweeds to grasses to trees (hardwood and softwood). Their mutualistic relationships with host species are well understood in some plants (grasses in particular) and not at all in others. Foliar endophytes live inside needles of conifer trees and investigations about them began in the region in the 1980s when spruce budworm epidemics were rampant.

1:00-2:45

New Brunswick
Room, Atlantic
Forestry Centre

Some strains of endophytic fungi found in white spruce, balsam fir and other species were discovered that produce anti-insectan compounds. It was speculated that they could be implicated in some of the variability in damage associated with spruce budworm attack.

JDI began a collaborative research partnership with Carleton University and UNB to explore the potential anti-insectan endophytes as a means to improve the tolerance of seedlings to insect attack as part of a long-term commitment related to integrated pest management. Progress and accomplishments since 1998 are reviewed as well as future challenges and application of knowledge.

Speaker—Greg Adams manages JDI forest research and development projects, seedling production and tree improvement programs. He holds an MScF degree specializing in forest genetics and tree improvement from UNB and a BscF from Lakehead University. He is also a New Brunswick registered professional forester.

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1:00-2:45

Concurrent Session 2—Management Implications—Moderator Nairn Hay, FMF

K.C. Irving
Theatre

Balsam woolly adelgid gouting interferes with the performance and preference of subsequent defoliators—Dorthea Grégoire, Dan Quiring and Lucie Royer

The balsam woolly adelgid (*Adelges piceae*) is an invasive forest pest that has spread prolifically through eastern North America. In Newfoundland, over 80% of balsam fir have symptoms of feeding (gout) by this adelgid. Through a series of sleeve cage experiments the researchers have tested the hypotheses that gout influences both the performance and preference of two subsequent defoliators of balsam fir; balsam fir sawfly (*Neodiprion abietis*) and eastern spruce budworm (*Choristoneura fumiferana*). While both defoliators experience a reduction in performance (decreased larval survival in sawfly and decreased pupal weight in budworm), the preferences of larvae (feeding) and adult females (oviposition) differ. Sawfly larvae show an age dependent preference for gouted foliage while budworm are non selective. Female sawfly actively avoid ovipositing on gouted branches while inexperienced budworm prefer it.

Speaker—Dorthea Grégoire was born and raised in rural southeastern Manitoba where she developed a fascination for plants and insects. In 2004 she moved half way across the country to Sackville, New Brunswick to attend Mount Allison University. Four years later, in 2008, Dorthea completed a BSc with Honours in Biology and a minor in Geography and Environment. She immediately jumped into graduate studies at UNB where she is currently working on a PhD examining the host-plant mediated interactions between herbivorous insects on balsam fir.

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1:00-2:45

Baculoviruses and the population cycles of two insect herbivores of balsam fir—Dr. Christopher Lucarotti, Senior research scientist, Insect Pathology, Natural Resources Canada, Canadian Forest Service - Atlantic Forestry Centre

K.C. Irving
Theatre

The balsam fir sawfly (*Neodiprion abietis*) and the spruce budworm (*Choristoneura fumiferana*) are two insects that feed on balsam fir (*Abies balsamea*) and experience population outbreak periodicities of approximately 15 and 35 years, respectively. Balsam fir

sawfly population outbreaks can cause defoliation over tens of thousands of hectares, most recently (since 1990) in precommercially thinned stands of balsam fir forests in Newfoundland and Labrador. During the last spruce budworm outbreak (1978–1992), some 58 million hectares of boreal forest were adversely affected, mostly in eastern Canada. Balsam fir sawfly populations are regulated, almost exclusively, by a gamma-baculovirus (NeabNPV), but spruce budworm populations are impacted by a large and diverse array of pathogens and parasites where an alphabaculovirus (CfMNPV) and a betabaculovirus (ChfuGV) appear to play only minor roles. Balsam fir sawfly larvae feed openly and in groups only on balsam fir foliage that is 1-year-old and older thus facilitating the spread of the contagious, midgut-infecting NeabNPV. Budworm larvae, however, overwinter as second instars in hibernacula, mine into needles in spring, and individually construct feeding tunnels in the expanding buds as third instars. This cryptic and solitary habit likely limits opportunities to transfer CfMNPV and ChfuGV horizontally. Spruce budworms may also feed on white (*Picea glauca*) and black spruce (*Picea mariana*) in addition to balsam fir. The differing habits and evolutionary histories of the balsam fir sawfly and spruce budworm have likely influenced not only the roles of the baculoviruses affecting them but also their susceptibility to other pathogens and parasites.

Speaker: Dr. Christopher Lucarotti grew up in Toronto. He obtained a BSc in Botany (1974) from Southampton University, Southampton, United Kingdom, followed by a MSc (1977) and a PhD (1981) in Biology, McGill University, Montreal, Canada, and a Post-doctorate (1981-1984) in Entomology, University of California at Riverside, USA. He has held his current position with the Canadian Forest Service since June 1989 and has been an adjunct professor, Department of Forestry and Environmental Management, UNB since June 1999. Before joining the Canadian Forest Service, he was an assistant and then assistant professor of Biology at Mount Saint Vincent University, Halifax, Nova Scotia. He is a member of the editorial board of the Journal of Invertebrate Pathology.

His research interests include insect pathology, molecular biology, biological control, and ecology; and the impact of naturally-occurring, microbial pathogens on insect populations and the potential of specific fungi, protozoa, bacteria and viruses for use in biological control through studies on their life cycles, cytology, molecular genetics, epidemiology and methods for mass production and application. He has worked on mosquitoes and a number of forest insect pests including the balsam fir sawfly, hemlock looper and spruce budworm.

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1:00-2:45

K.C. Irving
Theatre

Genetically-based resistance of balsam fir (*Abies balsamea*) to three insect pests— Sara Fraser

Balsam woolly adelgid (*Adelges piceae*), balsam gall midge (*Paradiplosis tumifex*) and balsam twig aphid (*Mindarus abietinus*) are major pests in balsam fir Christmas tree plantations. Tree farmers want to develop breeding programs to produce improved seed stock and increase insect resistance. To test the hypothesis that insect resistance is under genetic control and to evaluate the potential to breed insect-resistant trees, I measured the frequency of symptoms associated with feeding by each insect on balsam fir clones in New Brunswick and Nova Scotia tree orchards. Preliminary results suggest that there is genetically-based resistance of balsam fir to twig aphid and balsam gall midge. Thus, there is potential to select trees resistant to these two pests.

1:00-2:45

K.C. Irving
Theatre

Speaker: Sara Fraser was born in Newfoundland and moved to New Brunswick as a young child. She has always had a strong interest in science and after high school attended UNB and completed a BSc in biology (with a concentration in aquaculture and fisheries). After university she spent time working on various projects at UNB. These projects included working with migratory seabirds, wild Atlantic salmon and anaerobic digestion of aquaculture waste. In the spring of 2010, she started her MSc project at UNB in forest entomology, looking into heritability of insect resistance of balsam fir trees to three insect pests.

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2:45-3:00

Break

3:00-3:45

Panel Discussion—Moderator Nairn Hay, Fundy Model Forest
What are the implications of the impact of the pests and diseases facing the Acadian forest? What management strategies may be employed?

Panel— Drs. Dave MacLean and Dan Quiring, Faculty of Forestry and Environmental Management, UNB; Dr. Jon Sweeny, Canadian Forest Service; and Gregg Cunningham, Canadian Food Inspection Agency

3:45-4:00

Conclusion