



**Protecting the Future of Our Forests:
A Strategy to Suppress a Spruce Budworm
Outbreak**



Protecting Our Forests
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A Strategy to Suppress a Spruce Budworm Outbreak

8:00 - 9:00am Registration

Moderator: Kristian Moore

Kristian Moore started working for the department of Natural Resources (DNR) in 1986, he graduated from the Maritime Forest Ranger School in 1989. In 2007, Kristian graduated from Saint Thomas University with a BA in Criminology (with Distinction). He has held a number of different roles/positions within DNR since then. He has worked at the Air Tanker Operations Base, Forest Management Branch with the Mapping and Pest Management Sections, as a Forest Warden and Forest Ranger; he was the Provincial Manager of Conservation Enforcement, Provincial Manager of Wildland Fire Management, and Regional Director. Kristian is currently working as the Executive Director of Regional Operations, Support Services, Fish and Wildlife.

9:00 Kristian Moore, New Brunswick Department of Natural Resources: Opening Remarks and Welcome

9:05 Spruce Budworm Update Video

9:10 Drew Carleton, New Brunswick Department of Natural Resources

Drew received his MSc. in Entomology from the University of New Brunswick in 2007. He has worked in integrated forest pest management since then, focusing on pests of economic concern to the Maritime region including native species such as hemlock looper, spruce budworm and yellowheaded spruce sawfly, as well as invasive species such as balsam woolly adelgid, brown spruce longhorned beetle and emerald ash borer. Drew worked on the ACOA program as a biologist for two years, developing the Budworm Tracker program and coordinating other research programs before taking on his current role as Provincial Entomologist in the fall of 2015.

“SBW Status in NB in 2016 and the Outlook for 2017”

The last outbreak of Spruce Budworm (SBW) in the eastern Canadian Provinces and State of Maine (1967-1990) peaked at over 50 million hectares and destroyed hundreds of millions of cubic metres of spruce-fir wood volume. The current outbreak began in Quebec in 2007 and has been steadily approaching the New Brunswick borders ever since, threatening our forests. In 2015, for the first time in two decades, visible signs of damage by SBW were reported in the forests of northern New Brunswick. This presentation will give an update of SBW monitoring that was conducted in NB in 2016 with an outlook of what might be expected in 2017.



9:25 Dr. Dave MacLean, University of New Brunswick

Dr. David MacLean is Professor at the University of New Brunswick, where he was Dean of the Faculty of Forestry and Environmental Management from 1999-2009. Prior to that, he spent 21 years as Research Scientist with the Canadian Forest Service, researching spruce budworm impacts, modeling, and decision support. In 2008 he was awarded the Canadian Forestry Scientific Achievement Award.

“Spruce Budworm Early Intervention”

A spruce budworm infestation is threatening the forests we rely on for recreation and to drive our economy, with an estimated \$10-15 billion of spruce budworm impacts over 30 years at stake. A spruce budworm outbreak in Quebec has been increasing since 2009, and resulted in 6.3 million hectares defoliated in 2015. Spruce budworm populations are at lower levels but are also increasing in northern New Brunswick. The Healthy Forest Partnership has come together to conduct pioneering research into ways to proactively control spruce budworm. The Healthy Forest Partnership is a consortium of federal and provincial government, forest industry, and five universities that are conducting a 4-year, \$18 million project testing a new early intervention strategy against spruce budworm. The early intervention strategy includes 1) intensive monitoring and early detection, 2) small area target-specific use of Bt or Mimic biological insecticides to reduce SBW ‘hotspots’, and 3) tools/techniques to disrupt budworm moth mating and migration. I will describe spruce budworm research trials conducted over the last 2 years, results to date, and plans for 2016. Good results have been achieved after the first 2 years of treatments.

9:55 Dr. Rob Johns, Canadian Forest Service

Dr. Johns received his PhD in biology from the University of New Brunswick in 2007 and has been with the Canadian Forest Service in Fredericton since 2009. His research focuses on insect-plant interactions, population and community ecology, and the development of management strategies for forest insect pests.

“Mass Moth Dispersal: Is it the Achilles Heel of Early Intervention Strategy?”

Spruce budworm populations have been rising and spreading for more than a decade and outbreak in New Brunswick appears imminent. How we manage spruce budworm outbreaks has been the subject of some debate over the past 50 years, though in general it has been grounded in our understanding of how and why populations rise and fall in the way that they do. With reference to more than 50 years of research, I will discuss the underlying nature of spruce budworm outbreaks (as we understand it) and highlight the various components needed for this strategy to be a success.

10:25 Questions

10:35 Break

10:50 Dr. Rob Johns, Canadian Forest Service

“How do Spruce Budworm Insecticides Work? Basic Biology and Water Testing.”

People have many questions around the two insecticides currently registered for suppressing spruce budworm: *Bacillus thuringiensis kurstaki* (Btk) and tebufenozide (Mimic). What are they? How do they work? How specific are they to spruce budworm? Why do we say they don’t pose a risk to humans or other animals? Where do these products end up in the environment? In this talk, I will address these questions and discuss the results of water monitoring from areas treated in 2015.



11:10 Dr. Micheal Stastny, Canadian Forest Service

Dr. Michael Stastny joined the Canadian Forest Service as a Forest Insect Ecologist in 2016, after a three-year postdoctoral fellowship at the University of Ottawa. Initiated into research on forest pests as an undergraduate at Simon Fraser University during the mountain pine beetle outbreak in British Columbia, he received his doctoral degree in Ecology and Evolutionary biology from Cornell University. He is a broadly trained community ecologist with research experience from three continents, specializing on interactions between insects and plants, and their implications in the context of environmental change.

“Spruce Budworm Early Intervention Strategy: A Tool to Conserve Critical Habitats and Ecological Integrity of Forest Watersheds?”

Control strategies in spruce budworm (SBW) pest management, including the Early Intervention Strategy (EIS), rely on the use of two insecticides, Btk and tebufenozide, to suppress SBW populations in treated areas. The ecological risks of these insecticides have been studied in detail and shown to be limited to a rather narrow range of localized non-target effects, mostly on co-occurring caterpillars. However, the broader ecological benefits of EIS - the prevention of SBW outbreaks and significant balsam fir and spruce mortality - have not been evaluated. This presentation reviews the non-target effects of EIS in comparison to the potential impacts of uncontrolled forest pest outbreaks on the functioning of the forest ecosystem and watersheds. It then introduces a novel research project aimed at providing experimental assessment of the role of EIS in the preservation of the ecological integrity of forest watersheds.

11:40 Mr. Peter Amirault, Forest Protection Limited

Peter obtained a Bachelor of Science in Forestry from UNB (80) and a Masters (UNB) in 84 both specializing in Forest Entomology. In between he worked for Georgia-Pacific in New Brunswick as an all-purpose Forester. After obtaining his Masters he served briefly as a Research Assistant at UNB before relocating to Alberta in 1985. In Alberta he was a Forest Insect & Disease Specialist with Forestry Canada in Edmonton (Northern Forestry Center). In 1991 it was back to NB to assume the position of Operations Manager with Forest Protection Limited, where he remains to this day.

Forest Protection Limited is a speciality air service that provides forest protection services to the Province of New Brunswick and elsewhere. As Operations Manager he is responsible for the safe and efficient delivery of pest and fire control programs.

“Aerial Application of Insecticides Including Pheromones”

In support of research objectives associated with the project Early Intervention to Suppress a Spruce Budworm Outbreak, Forest Protection Limited (FPL) conducted aerial applications in Quebec and New Brunswick. In Quebec areas with established or rising populations were treated with either Btk (Foray 76B – 4 areas) or Pheromone (Disrupt Bio-Flake SBW – 5 areas). In New Brunswick where populations were still endemic in 2014, 3 areas were treated with Tebufenozide (Mimic 240 LV). Applications were conducted as directed by product labels and as allowed under Provincial Permits. Advances in the specialized equipment used in aerial application and strategies employed in support of aerial application projects are reviewed. In addition best practices and quality control initiatives are discussed.



11:55 Dr. Dan Quiring – UNB/ERSI

Dr. Dan Quiring, President, Entomological Research Services Inc. (ERSI) and Honourary Research Professor, Faculty of Forestry and Environment Management, University of New Brunswick (UNB). Dr. Quiring retired from his position as Professor of Forest Entomology at UNB during summer 2013. During his 27 years at UNB, he established and directed a very active centre for forest insect ecology and pest management.

“Use of Endophytic Fungi in IPM against SBW”

Plants commonly form mutual associations with microbiological organisms and these associations are thought to benefit both parties: plants provide microbes with protection and photoassimilate in exchange for increased tolerance of the host to biotic and abiotic stresses. Certain mutualistic associations between plants and microbes are particularly well characterized and, in some instances, are exploited for commercial benefit. Associations between endophytes (fungi that live inside needles) and conifers, however, are a class of mutualisms less well understood, but demonstrate potential for commercial application. Previous research efforts have concentrated on isolating endophytes of spruces and pines and identifying metabolites that are toxic to common conifer needle insect and disease pests, in particular spruce budworm (*Choristoneura fumiferana*) and white pine blister rust (*Cronartium ribicola*). This work has led to the development of novel technologies whereby nursery-grown seedlings are treated with beneficial endophytes with the assumption they will form long-term associations with their host and provide an increased level of tolerance toward needle pests. To understand the effect of endophytes on budworm, manipulative field studies were carried out with spruce budworm larvae placed on young white spruce trees, previously treated (as seedlings in the nursery) with one of 3 unique toxin-producing endophyte strains and on control trees. Results of these studies, carried out between 2010 and 2016, suggest that trees with endophytes are often subjected to lower levels of defoliation, due to reduced budworm survival (endophytes 11|1, 22E1 and 05-037A) or increased tree tolerance (endophyte 22E1 and 05-037A).

12:10 Emily Owens, Forest Protection Limited

Emily began her career in Fredericton at UNB in the faculty of Forestry as an entomology lab manager focusing on pests such as spruce budworm and balsam woolly adelgid. Then, based out of the Yukon, she worked for the University of Alberta on a mammal project focused on the population dynamics of red squirrels. Eventually, she returned Fredericton to work at CFS to work on invasive pests such as BSLB and *Beech flea weevil*. Currently, Emily works for Forest Protection Limited on the SBW EIS project focusing on moth migration and coordinating the Citizen Science: Budworm Tracker Program.

“Citizen Science: The Budworm Tracker Program”

Citizen Science is an increasingly valuable approach where scientists and citizens join forces to address difficult and important scientific problems. Budworm Tracker is a prime example of this approach and offers the opportunity for citizens to help monitor spruce budworm moths in eastern Canada. The response of the public has been outstanding and I will be presenting some background on the project, highlight some recent insight provided by this collaboration, and offer the opportunity for new citizen scientists to join our team.

12:25 Kristian Moore, NB DNR: Questions and Wrap-up

12:40 Lunch (Provided)

Simultaneous Translation Provided



Early Intervention Strategy to Suppress a Spruce Budworm Outbreak Project Summary

1. Spruce Budworm population dynamics during the rise of an outbreak

(Researcher: Dr. Jacque Régnière)

The research will address questions regarding what Spruce Budworm (SBW) density to initiate an Early Intervention Strategy (EIS), what products may be most effective, and what are the consequences of control options on natural enemy populations attacking SBW in subsequent years.

2. Impacts of EIS on SBW and associated natural enemies

(Researchers: Dr. Rob Johns, Dr. Veronique Martel, Dr. Eldon Eveleigh, Dr. K.S. McCann, Dr. Deepa Pureswaran)

The research will test the efficacy of control options and evaluate possible unintended impacts on very low density Spruce Budworm (SBW) and its parasitoid complex. It will include detailed assessment of proposed Early Intervention Strategy (EIS) and other pesticide and pheromone trials of increasing sizes from 2014 to 2017.

3. Barcoding: Innovative DNA-based diagnostic for SBW & its natural enemies

(Researchers: Dr. Alex Smith, Dr. Eldon Eveleigh, Dr. Rob Johns, Dr. Veronique Martel, Dr. K.S. McCann)

The research will develop novel genomics tools to quantify and identify parasitism of SBW larvae and pupae. This will permit identification of parasitoids in larvae killed by treatments and explicitly evaluate the impact those treatments have on the natural enemy community of SBW. This technology will then be used in the above "SBW population dynamics" project.

4. Aerial application of pesticides and pheromones

(Researchers: Mr. Peter Amirault, Mr. Jerry Cormier, Mr. Luc Amos-Binks)

The research will begin an SBW EIS trial on 5,000 ha in northern NB in 2014 and conduct *Bacillus thuringiensis* (Bt) and pheromone control trials on low populations in Quebec. Continued trials using increasing sized blocks (total 15,000ha 2015, 30,000ha 2016, 80,000ha 2017) of pesticide and or pheromone will then be conducted.

5. Epicenter formation and migratory behavior of adult SBW moths in eastern Canada

(Researchers: Dr. Rob Johns, Dr. Deepa Pureswaran, Dr. D. R. Gray, Dr. Lucie Royer, Dr. Dan Kneeshaw, Dr. Patrick James)

The research will monitor SBW moths over large areas, and provide insight into migratory behavior from 'epicenters' and the associated formation of epicenters.

6. SBW sex pheromone: effect of blend composition on mating

(Researchers: Dr. Peter Silk, Dr. Eldon Eveleigh, & others)

The research will develop and register a more potent 4- component sex pheromone blend for use in mating disruption of SBW and evaluate whether pheromones promote dispersal of female moths.

7. Use of endophytic fungi to reduce SBW impacts

(Researchers: Mr. Greg Adams, Miller, Dr. Dan Quiring, Dr. Andrew McCartney)

The research will expand our knowledge of the impact of inoculating reforestation seedlings of spruces with insect toxin-producing endophytic fungi. Although a plant/fungi interaction has been commercialized for other species, this is the first application in forest trees.

8. Modeling and DSS/ economic analyses

(Researchers: Dr. David MacLean, Cr. Chris Hennigar, Dr. Van Lantz, Dr. Udayalakshmi Vepakomma, Leading Edge Geomatics, Mr. Bo Zhang)

The research will develop SBW population-derived defoliation scenarios for alternative EIS strategies, integrate insecticide efficacy models, develop and test models of SBW 'hot-spot' protection decisions and optimum operational blocking, and evaluate effects of alternative SBW control strategies in NB timber supply, cost-benefits, and economy-wide impact.

9. Communications

The details of the research will be communicated to the public and stakeholders. Details will include: infestation rates and locations, impacts to human health and the ecosystem, and treatment options.

The Healthy Forest Partnership



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