Spruce Budworm Early Intervention: The Next Phase

February 20th, 2019
9:00am to 12:00pm
Université de Moncton,
Edmundston, NB

Protecting our Forests

HealthyForestPartnership.ca

Spruce Budworm Early Intervention:

The Next Phase

8:30 - 9:00am Registration

Moderator: Bernard Daigle, Canadian Forest Service

Bernard (Bernie) received his BSc. in Forestry from the University of New Brunswick in 1978. Following graduation, he worked for private woodlot owner organizations in Nova Scotia and New Brunswick. In 1985, he joined the Canadian Forest Service as a Forestry Officer working ten years on the Forest Resource Development Agreements and fifteen years as lab supervisor at the National Tree Seed Centre. Bernard is currently looking after knowledge exchange activities for the CFS in the Atlantic Region.

9:00 Chris Norfolk, New Brunswick Department of Energy and Resource Development: Opening Remarks and Welcome

Chris Norfolk is the Director of Forest Planning and Stewardship Branch with the N.B. Dept. of Energy and Resource Development. He holds a BSc in Forestry and Environmental Management from the University of New Brunswick and is a registered professional forester in the province of N.B.

9:05 Dr. Véronique Martel, Canadian Forest Service

Véronique Martel has a BSc in Biological sciences from Université de Montréal (2001) as well as a MSc (2003) and PhD (2007) in entomology from McGill University. She did her graduate studies in behavioural and physiological ecology of reproduction in parasitoids. After her studies, she did two postdocs in Europe: the first in Sweden and the second in France. She started as a research scientist at the Laurentian Forestry Centre (Canadian Forest Service) in 2011 where she mainly works on the ecology of forest pests' natural enemies, including the spruce budworm.

"Understanding Spruce Budworm Outbreaks: A Historical Perspective"

Spruce budworm is the defoliating pest of spruce and fir in eastern Canada and has been the subject of scientific inquiry for more than a century. This work has produced answers to a variety of questions: What is budworm? Are outbreaks caused by human activities? What drives outbreaks to rise and what causes their collapse? This talk will cover these topics. She will begin with a review of the budworm's basic biology and discuss historical evidence for budworm outbreaks reaching back nearly to the previous Ice Age. She will also outline to some of the major scientific theories seeking to explain why budworm outbreak cycles occur and how these perspectives shape our approach to managing outbreaks.

9:25 Chris Norfolk, New Brunswick Department of Energy and Resource Development

"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 more than 8 million hectares defoliated in 2018. Spruce budworm populations have been maintained at lower levels but are forecasted to increase in northern New Brunswick. The Healthy Forest Partnership is conducting pioneering research into ways to proactively control spruce budworm. The early intervention strategy includes 1) intensive monitoring and early detection, 2) targeted use of biological insecticides to reduce SBW 'hotspots', and 3) extensive research efforts on population spread and outbreak effects. I will describe spruce budworm research trials conducted over the last 5 years, results to date, and plans for 2019. Good results have been achieved after the first 5 years of treatments.

9:45 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.

"Efficacy of the Early Intervention Strategy: Is it 'working'?

After five years of research developing the Early Intervention Strategy the most basic question that arises is 'Is this approach working?'. The short answer is 'results are promising'. The long answer is also 'results are promising', but with more ecology talk to explain why. I will explain the underlying biological basis for how we manage wildlife – whether they be salmon, moose, or budworm – and how we try to use this information with the aim of keeping populations stable. Dr. Johns will then discuss some of the recent evidence for success in the ongoing EIS program, as well as some of the challenges that still lie ahead.

10:05 Dr. Sara Edwards, Forest Protection Limited

Dr. Edwards recently completed her PhD at the University of New Brunswick where she specialized in entomology, biostatistics and quantitative genetics. She is currently working as a post doctoral fellow as part of the Healthy Forest Partnership, where her current research is focused on best management practices for spruce budworm management.

"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. 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 during the past three years of the EIS project.

10:20 Break

10:45 Dr. Michael Stastny, Canadian Forest Service

Dr. Michael Stastny joined the Canadian Forest Service as a Forest Insect Ecologist in 2016. Initiated into research on forest pests during the outbreak of mountain pine beetle in British Columbia, he received his doctoral degree in Ecology and Evolutionary biology from Cornell University. He is a broadly trained ecologist with research experience from three continents, specializing in interactions between insects and plants, and ecological responses of forests to environmental change.

"Can't see the forest for the trees? – Broader ecological implications of spruce budworm control"

Targeted use of narrow-spectrum insecticides employed in the control of spruce budworm helps minimize environmental risks, and avoid outbreaks of other potentially destructive pests that could attack weakened trees. Careful monitoring of treatment efficacy also helps to reduce non-target effects on natural enemies of spruce budworm that regulate its populations. Prevention of tree damage in forest watersheds could serve as a tool to maintain the ecosystem functioning of these critical habitats during outbreaks, preventing negative impacts on riparian food webs, nutrient cycling and hydrology, and cold-water fish habitats. Research into these broader ecological risks and benefits continues to shape Integrated Pest Management against spruce budworm in New Brunswick forests.

11:05 Emily Owens, Canadian Forest Service

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 wooly adelgid. Then, based out of the Yukon, she worked for the University of Alberta on a project focused on the population dynamics of small mammals. Eventually, she returned Fredericton to work at the Canadian Forest Service as a contract biologist to focusing on integrated pest management and to work on both invasive and native pests such at BSLB and Beech flea weevil. Currently, Emily works for the Canadian Forest Service focusing primarily on the SBW EIS project including moth migration dynamics and coordinating the Citizen Science project called "the Budworm Tracker Program.

"Communications and Citizen Science"

The Healthy Forest Partnership communications committee is a group of experts committed to engaging and involving the public in our spruce budworm early intervention research program. Our goal is to keep all interested parties informed of ongoing research and results, and provide the public with the opportunity to speak to and hear from our scientists and experts and about early intervention strategy. One of the ways the communications committee engages the public is through its citizen science program: The Budworm Tracker Program. In this program, hundreds of citizens help researchers monitor spruce budworm populations and detect moving moths, which may be contributing to the spread and rise of the current outbreak. This talk will highlight the committee's communications strategies, how we inform the public, and our efforts to share our science.

11:20 Drew Carleton, New Brunswick Department of Energy and Resource Development

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 wooly adelgid, brown spruce longhorned beetle and emerald ash borer. Drew worked on the EIS program as a Biologist programs before and now works for the Province as the Forest Health Manager.

"A Year in Review: Timeline for a treatment program"

The EIS program is a complex network of inter-link projects and processes that require coordinated efforts of multiple groups to deliver a successful research and treatment season. Here we present a high-level overview of a year in EIS program.

11:35 Chris Norfolk, NB ERD: Questions and Wrap-up

Simultaneous Translation Provided

SBW EIS Phase II Research Project

The EIS option aims to either interrupt or delay the course of a SBW outbreak through targeting 'hotspots' or 'epicenters' when population densities are still very low. These epicenters are hypothesized to serve as emitter sites from which adult SBW moths migrate, enhancing recruitment rates in surrounding low density populations, and ultimately escalating densities above levels that can be controlled by natural enemies.

For EIS to work, we must address several significant knowledge gaps about how to implement EIS and what some of the inadvertent consequences might be:

1. how large do treatment areas have to be to offset the impact of immigrant SBW moths from nearby outbreaks (i.e., north of the NB border)?
2. are there potential negative consequences of EIS, in particular for natural enemies of SBW in treated areas? Does EIS have positive effects for habitats and conservation?
3. how to identify potential epicenters and predict how they will spread?
4. what are the best products or combination of products and treatments for EIS?

To date, the EIS approach appears to be working. Key successes include reducing SBW populations in treated blocks and avoiding serious defoliation and resulting wood supply losses. Procedures and processes have been developed to detect and treat hotspots. However, the research must continue.

The research program is divided into 10 constituent projects, as described below. In this proposal we have provided budgets for each project for years 2018-2021, and assumed a notional R&D budget of $2 million/year for years 2022-2025.

Project	Investigators	R&D Topics Addressed
Project 1.0. Efficacy, treatment optimization, and non-target impacts of Early Intervention Strategy in Atlantic Canada	***V. Martel (LFC) & R. Johns (AFC)*** *E. Moise, J. Bowden, M. Stastny, E. Eveleigh, E. Owens (AFC) D. Pureswaran J. Delisle, M. Cusson (LFC) S. Heard (UNB) P. James (U. Montreal) A. Smith (U. Guelph)*	Continue efficacy trials to evaluate EIS to reduce larval survival and moth dispersal in order to reduce population rise and spread. Refine treatment protocols to improve efficacy of treatments. Evaluate natural enemies' attacks on SBW. Identify immigrant moths from mass dispersal events and determine importance of larval survival increase vs. moth immigration. Estimate parasitism rates from field data collected in efficacy trials to determine if treatments have a negative impact on SBW parasitoids. Determine potential non-target treatment effects on non-budworm moths and how to limit these impacts.
Project 2.0. Modeling spruce budworm population dynamics	***B. Cooke (GLFC) & J. Régnière (AFC)*** *B. Sturtevant, H. Thistle, J. Charney, G. Achtemeier (USFS) R. Saint-Amant, Y. Boulanger (LFC)*	Develop a SBW population dynamics predictive model that would describe spatial and temporal patterns of outbreaks (local dynamics and moth migration), and allow testing of management strategies through simulation on an appropriate spatial-dynamics platform.
Project 3.0. DSS, operational blocking/ prioritization, and impact modeling for EIS	***D. MacLean (UNB)*** *C. Hennigar (UNB) J. Gullison, A. Dick (NBDERD) L. Amos-Binks (FPL) U. Vepakomma (FP-I)*	Incorporate into the SBW DSS effects of hardwood content in reducing SBW defoliation & a new SBW population model appropriate for EIS projections. Refine optimum operational blocking heuristics and use in planning EIS treatment blocking. Measure defoliation and tree response in plots in QC & NB and develop refined DSS impact relationships. Develop new growth loss and mortality factors.
Project 4.0. Best Management Practices for Early Intervention Treatments and Operations	***G. Cormier (FPL) & A. Willett (JDI)*** *A. Morrison (FPL) L. Amos-Binks (FPL) R. Johns, M. Stastny, E. Owens (AFC)*	Conduct pesticide (Btk and tebufenozide) and pheromone trials of EIS to suppress SBW populations. Determine best practices for application of insecticides to lower cost of large scale EIS & increase available sessions for insecticide application. Test effects of application timing, application rates, material, rainfastness, aircraft track spacing, meteorological conditions, etc.
Project 5.0. Tracking insect outbreaks: using the Budworm Tracker citizen science program to study budworm dispersal and enhance public engagement	***D. Pureswaran (LFC)*** *&* ***R. Johns (AFC)*** *V. Martel (LFC) P. James (U. Montreal) E. Owens, M. Stastny, I. DeMerchant, J. Allison J. Bowden (AFC) C. MacQuarrie, J.-N. Candau (GLFC)*	Continue outreach & public engagement in the Budworm Tracker program. Use genetics to assess population connectivity among sites. Provide a genetically-informed model of effective dispersal capacity. Assess whether low-density populations (e.g., southern NB, NS) are independent populations or whether they are in fact the offspring of migrants from the outbreak epicentre in QC.
Project 6.0. Monitoring and identification of SBW mortality agents using molecular assays	***M. Cusson (LFC) & A. Smith (U. Guelph)*** *E. Eveleigh R. Johns (AFC) V. Martel, P. Tanguay (LFC)*	Refine & enhance species-specific and hierarchical molecular assays to assist in identifying SBW mortality agents. Evaluate rates of parasitism and parasitoid composition in the SBW larvae collected from the EIS efficacy component Evaluate levels of parasitism and pathogen loads in L2s from branches collected in fall or winter. Develop a simplified, "bulk" version of the assays.

Project	*Investigators*	R&D Topics Addressed
Project 7.0. SBW pheromone studies	***P. Silk & E. Eveleigh (AFC)*** *L. Roscoe, P. Mayo, W. MacKinnon, G. LeClair, M. Williams, Gl. Forbes, M. Brophy, K. Burgess, R. Lamb (AFC)*	Test the hypothesis that the new 5-component sex pheromone blend of the SBW will significantly reduce the mating success of feral SBW populations at low to moderate densities. Develop an attract-icide formulation with the 5-component sex pheromone blend. Identify and develop uses for male pheromone of SBW.
Project 8.0. SBW pest management as a conservation tool for critical habitats and ecological integrity of forest watersheds	***E. Emilson (GLFC) & M. Stastny (AFC)*** *M. Gray, S. Heard, K. Kidd, T. Linnansaari (UNB)* *R. Johns (AFC)* *L. Venier (GLFC)*	Determine the impacts of SBW outbreaks, and conversely, experimentally test the potential benefits of EIS treatments, on riparian canopy and understory vegetation, riparian bird habitat & communities, water quality and hydrologic functioning of forest streams, structure and functioning of aquatic and riparian food webs, and critical fish habitat and fish health in forest streams.
Project 9.0. Forecasting for EIS in the context of climate change	***J.N Candau(GLFC), M. Stastny & E. Moise (AFC)*** *J. Bowden, R. Johns, M. Rhainds, A. Roe (AFC)*	Improve forecasting and decision-making essential for successful implementation of EIS under changing environmental conditions, by better forecasting of the timing of SBW development (phenology), and improved forecasting of SBW performance and survival in the context of EIS treatments.
Project 10.0. Developing an adaptive and intelligent SBW defoliation detector	***U. Vepakomma (FPI)*** *S. Haddad, G. Costanzo, D. Cormier (FPI)* *R. Johns (AFC)* *D. MacLean (UNB)* *D. Kneeshaw (UQAM)*	Develop a generalised defoliation detection method, apply and test it for SBW defoliation (current and cumulative defoliation) and implement for a medium resolution publicly available satellite data.

Note: Project PIs are in bold.

Affiliation abbreviations: **AFC** – Canadian Forest Service, Atlantic Forestry Centre; **LFC** – Canadian Forest Service, Laurentian Forestry Centre; **GLFC** – Canadian Forest Service, Great Lakes Forestry Centre; **JDI** – J.D. Irving, Limited; **FPI** – FPInnovations

The Healthy Forest Partnership