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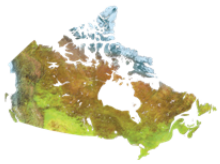
e-Bulletin

The Great Lakes Forestry Centre (GLFC)



GLFC soil scientist contributes to high school soil science

Overview

A national collaborative program is helping to expose high school teachers and students to the importance of soils and soil science education. GLFC soil scientist Paul Hazlett is part of the "Soil 4 Youth" team.

As global issues place increasing demands on soil resources, the need to provide soil science education to the next generation of soil scientists and the general public has become more important. In Canada, as in many other countries, soil science is not covered in depth in the high school curriculum. Some emphasis is usually put on the importance of soil for plant growth, but its role in maintaining other ecosystem services (such as carbon sequestration, water filtration and storage, and biodiversity) receives less attention. In 2009, a national collaborative program called "Soil 4 Youth" was established to address this issue. This program is led by Dr. Maja Krzic from the Faculty of Land and Food Systems at the University of British Columbia.

The goals of the program are to: (1) promote the discipline of soil science to high school students and teachers, (2) create open access soil education resources that can be used in high school curricula in Canada, and (3) raise awareness about the importance of soil in the context of global issues. Since the program started, a variety of soil education resources have been developed. The result is an open access website (http://soilweb.landfood.ubc.ca/youth/) that allows soil professionals to promote the importance of soils to high school students and teachers.

The website includes five main components: (1) Canadian soil science research projects, (2) resources for teachers (activities and lesson plans), (3) resources for students – this section features Johanna Curry, a GLFC soil chemist and Jessica van Frankenhuyzen, a former student with the GLFC Soil and Water Team as "people who have made soil a part of their career", (4) a question-and-answer platform involving a university soil science professor and (5) events and news, which features the program's involvement in the community as well as links to articles related to global soils issues. Paul Hazlett has collaborated with high school teachers to deliver Soil 4 Youth materials to students through the Ontario Envirothon (a hands-on environmental education program comprised of field trips, workshops and a competition).

One of the featured research projects - "Maximum Soil Squishiness" - discusses soil degradation, including compaction from activities such as forest harvesting. It includes pictures and descriptions of forest road rehabilitation and soil sampling to determine bulk density. All features of the program will help students become better informed about soil. The website even includes inspirational quotes that incorporate soil, for example: "Essentially, all life depends upon the soil ... There can be no life without soil and no soil without life; they have evolved together."(quote by Charles E. Kellogg).

GLFC's Insect Production Unit supports variety of research

Overview

Insects reared at GLFC's Insect Production and Quarantine Laboratories are used by Canadian Forest Service (CFS) researchers across the country, at other research institutes around the world as well as at universities. Scientists are using these insects to develop a greater understanding of host-pest interactions and to test new biological pest control methods. Laboratory-raised insects are also useful for product quality control and for educational and training purposes.

We distribute more eastern spruce budworm than any other insect we produce. Spruce budworm are used by researchers in the development and modification of pest control techniques. At the College of the North Atlantic- Carbonear, Newfoundland the fungus *Beauveria bassiana* is being tested as a possible control agent, while various parasitoids are being tested at the CFS Laurentian Forestry Centre in Quebec.

At the University of Laval, researchers are investigating the natural resistance mechanisms of black spruce to budworm defoliation, which are related to foliar chemistry and timing of bud break. Understanding these mechanisms of resistance will be important when developing management techniques for controlling budworm in black spruce. At the CFS Atlantic Research Centre, insects are used in studies to determine the complete sex pheromone blend of the spruce budworm and in mating disruption experiments.

Studies to better understand spruce budworm behaviour and ecology include moth dispersal studies at the CFS Pacific Forestry Centre, Victoria, B.C., budworm genetics at the Laurentian Forestry Centre and at the University of Alberta (where researchers are comparing the genetic correspondence between eastern and western spruce budworm, specifically the variation in pheromones). At Concordia University, the laboratory-reared insects are being used in a project investigating the effects of diet on oviposition behaviour of female budworm. At the University of Winnipeg, researchers are studying the role of secondary metabolites of host tree endophytes (symbiotic bacteria or fungi) on budworm diet.

The budworm larvae are also used for quality control purposes for biopesticides (Benzon Research, Inc. Pennsylvania and SOPFIM, Quebec), such as testing formulations of *Btk* to verify label potency value.

The BC Ministry of Forests is using western spruce budworm in their efforts to develop a seed orchard with budworm-resistant trees and the CFS Pacific Forestry Centre uses them to measure rates of parasitism and predation at sites where natural populations are too low to collect wild budworm.

Forest tent caterpillars are used at the University of Alberta, in a study on the effects of pathogens on caterpillar dispersal. At Concordia University, adult flight and thermoregulation behaviour in forest tent caterpillars are being studied.

Whitemarked tussock moth is sent to a laboratory in Sanitaria, Italy, and is also used in teaching laboratories at the University of Toronto to illustrate plant-animal interactions.

Uncertainty in historic burn estimates

Overview

In a recent study, researchers examined the impact of uncertainty in the estimate of long term area burned for two regions of Ontario with differing fire cycles. This information can be used by forest managers to balance economic and ecological objectives for a region.

The annual area burned by fire in Canada varies widely, from as low as 250,000 ha to as high as 7.5 million ha, depending on the weather during a particular season. There are also significant regional variations in the average amount of area burned, which can be influenced by climate, forest type and land use patterns. Forest management planners include an estimate of the mean landscape fraction burned as a way of accounting for the impact of fire in their planning unit, but in any particular year this could vary from 0 - 20%, depending on the region. Historical records are the most accurate way to examine area burned but these extend back reliably only 50 years in many jurisdictions.

The highly variable nature of the fire history of a region means that estimates of the long term average burn fraction in an area can have significant uncertainty associated with them. Typically large fires are very infrequent (<3% of total number of fires) but cause the bulk of area burned on a landscape. Earlier studies showed that as burn fraction increases, the need to incorporate fire into the forest management planning process increases. This information is important to forest mills and the communities associated with them because they require a minimum volume of wood to sustain production.

The research group chose two regions in Ontario, one with high fire activity and one where fire activity was significantly lower. They found a considerable range in uncertainty in burn fraction estimates in both regions. The study demonstrated, through the development of a series of trade-off curves, how forest managers could use the information about the observed range in possible burn fraction values for a district to balance multiple forest use objectives for a region. For example, areas that are more fire prone can maintain sustainable harvest levels while producing higher volume of wood overall than areas with lower fire return intervals; this result is because the targets for amount of old forest in fire prone regions are much lower overall.

For more information on this study, refer to the journal article.

Testing a parasitic wasp for control of emerald ash borer

Overview

A parasitoid that typically attacks emerald ash borer (EAB) in its native China is being tested at locations in Ontario and the National Capital Region. Using introduced natural enemies to control invasive species is a classical biological control strategy. The degree of success will not be known for a few years.

GLFC scientist Barry Lyons has been working with colleagues in the US, who have been testing three native parasitoids of EAB since 2007. The most promising of these, Tetrastichus planipennisi, which has been released in several states, is currently being tested in Ontario and Quebec following the protocol designed by the Animal and Plant Health Inspection Service of the United States Department of Agriculture. With approval from the Canadian Food Inspection Agency, parasitic wasps were imported into Canada from a special rearing facility in Brighton, Michigan. This non-stinging wasp is able to drill through bark to lay its eggs on EAB larvae. The wasp can complete

multiple generations each year and multiple adult wasps can emerge from one emerald ash borer larva. Lab tests have shown that it is very host specific.
In 2013, three test sites in Ontario were selected (two on Ausable Bayfield Conservation Authority property and one on private land in Lambton County). In 2014, a further five sites were chosen, including three on Ontario Conservation Authority properties (Long Point Region, Credit Valley and Upper Thames River) and two in the National Capital Region, which also involved the cooperation of the province of Quebec (Ministry of Forests and Energy). Wasps were released inside small bolts of ash wood in trees within woodlots and ash plantations at 2-week intervals during June, and again later in the summer. Each bolt contained 10-15 EAB larvae parasitized by the wasp. After 1-2 weeks, 100-150 females were expected to emerge and attack EAB larvae.
Assessments of the success of these trials have just begun at the 2013 sites. Specialized traps were set out to catch the parasitoids and determine an index of population density. Select trees were also felled to observe adult emergence in the laboratory. In the US, where trials have been underway for longer, a buildup of parasitized EAB has been very recently reported, but no major impacts on EAB populations have been observed. It is hoped that parasitoids could become one of the tools available to help mitigate the spread of this devastating pest.

GLFC researcher receives "Innovation Researcher of the Year" award

Overview

Dr. Robert Fleming was recognized by the Sault Ste. Marie Innovation Centre for his work on long-term soil productivity.

This award acknowledges a researcher who has made a substantial contribution to the science or technology sector in the Algoma District. Working with a large team of NRCan-CFS researchers, Rob Fleming has played a key role in Ontario's contribution to the decades-long North America-wide Long-term Soil Productivity study involving collaboration with provincial agencies. Results from his work have led to changes in provincial policies. His leadership extends into developing effective collaborations with stakeholder groups, and forging meaningful relationships with First Nations and community partners. He has written numerous scientific papers, made a number of international presentations, collaborated with scientists from around the world, and is recognized as a global leader in his field.

GLFC Webinar series

On January 15, 2015, Josh Johnston will give a presentation entitled: "Quantifying fire behaviour using infrared remote sensing".
CFS-GLFC lectures are presented at the Great Lakes Forestry Centre (GLFC) of the Canadian Forest Service (1219 Queen Street East, Sault Ste. Marie, ON), in the Roberta Bondar Room (A103) at 11:00 a.m. – 12:00 p.m. (Eastern time).
There is no cost to join this English-only presentation and pre-registration is not required. This lecture series is brought to you by the Great Lakes Forestry Centre (GLFC).

For more detailed information on the lectures or to add your name on our list to receive the invitation and the summary of each lecture, contact the GLFC Publication assistant at the Great Lakes Forestry Centre, by e-mail.
Within one week of the webinar, the presentation (including the audio recording overlaid with the Microsoft PowerPoint slides) will be posted for download at: ftp://ftp.nrcan.gc.ca/cfs/glfc/. All previous Webinars are also archived there.

Webinar Report: Studying the pheromone ecology of the emerald ash borer

On September 23, scientist Krista Ryall gave an update on her research on the pheromone ecology of emerald ash borer (EAB). Little was known about the chemical ecology of Buprestidae (the family of metallic wood-boring beetles to which EAB belongs) when EAB was discovered in North America. The belief at that time was that the beetles primarily use visual cues to find mates; there was little or no evidence of any pheromone-based communication. Her research over the past six years has clearly demonstrated that male EAB beetles are attracted to a female-produced pheromone, the first evidence of such a pheromone in this family of beetles. She has also identified the important factors mediating male responses to the pheromone, including trap colour, host volatiles, trap placement and release rate. This information can be used to improve early detection and management programs for EAB. In her presentation (available on the NRCan ftp site), she summarized the cumulative evidence regarding attraction of male EAB to the female-produced pheromone and highlighted some trials that produced results opposite to predictions, thus indicating how much there remains to be learned about this complex system.

Webinar Report: Towards better planning of invasive pest surveillance – novel approaches for dealing with uncertainty and tight budgets

Denys Yemshanov gave a presentation on October 15 to explain a new pest surveillance model he and his colleagues are developing. The model is based on a somewhat different principle, the Maximum Expected Coverage Problem (MECP), which meets an important decision-making objective: it maximizes coverage of potential pathways of species entry from already-infested areas, and, in turn, fully captures the high-threat infested sources (as opposed to propagule pressure-based models, which focus on uninfested destination sites). The new model shows more stable performance under a wide range of budget levels compared to the survey allocations based on the propagule pressure concept. He demonstrated the MECP approach by analysing pathways of the spread of the emerald ash borer with infested firewood that may be carried by visitors to campgrounds in central Canada and the US Midwest. The underlying surveillance model was based on a pest transmission network that involved campers traveling from approximately 6500 infested and quarantined locations in central Canada and the US to uninfested campgrounds in three Canadian provinces (Ontario, Quebec and Manitoba) and three US states (Michigan, Minnesota and Wisconsin).
Overall, the new approach offers a workable strategy for dealing with typical uncertainty about the human-mediated spread of invasive species, and makes the planning of pest surveillance campaigns less subject to possible errors in estimates of the invader's spread. The concept can be applied in

many practical situations where surveillance planning must be done under uncertainty and tight budget constraints. The full presentation is available on the NRCan ftp site.