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The Great Lakes Forestry Centre (GLFC)

Wasps are being released in Ontario to control emerald ash borer

Overview

Research staff from Natural Resources Canada, Canadian Forest Service (NRCan, CFS) have begun an experimental release of a tiny stingless wasp, Tetrastichus planipennisi, in southwestern Ontario in hopes of regulating populations of the emerald ash borer (EAB). This wasp is very host specific, parasitizing only the larvae of EAB, and we anticipate that the wasp will provide some measure of control for EAB in Canada.

In June of 2013, NRCan, CFS staff from the Great Lakes Forestry Centre began releasing a wasp, *Tetrastichus planipennisi*, in Huron County, in southwestern Ontario. This location was chosen because it has a large area of natural forest with a high concentration of ash trees and a low-to-moderate infestation of EAB. This site was also chosen because it is relatively close to where *T. planipennisi* is reared in Michigan by the United States Department of Agriculture (USDA).

This non-native wasp from Asia was approved by the Canadian Food Inspection Agency for importation and release in Canada following the successful release of this parasitoid by the USDA in the United States beginning in 2007. Only a small number of this insect was released in southwestern Ontario because only a limited supply was available from the USDA. Experiments conducted by the USDA indicated that this tiny insect (approximately 4.0 millimetres in length) readily accepted EAB larvae as hosts but did not attack any other species of insect presented to them, which demonstrated their high degree of host specificity. The adult wasp lays multiple eggs within the larvae of EAB and the wasp larvae feed on the EAB larvae, killing the host from within. The wasps subsequently emerge from their EAB host and go off in search of new EAB larvae to attack. This biological control strategy will not eradicate EAB from Canada but shows potential for controlling the populations at a manageable level.

T. planipennisi, is one of three wasps evaluated by the USDA for potential control of EAB. This particular wasp was chosen for release in Canada because it targets only EAB and seems to be well adapted to the harsh Canadian climate.

Biological control measures, such as using this wasp to control EAB, are a long-term strategy because it normally takes years for populations of the parasitoid to build up in the environment to provide any measurable control. GLFC researchers will be releasing more wasps later in the

summer of 2013 at the same location and will monitor the results of these releases to evaluate the effectiveness of this parasitoid as a control measure for EAB in Canada.

For more information on this work please contact Barry Lyons or the GLFC. Visit the CFS publications website for information on the research into EAB.

FireSmart Online: a wildfire hazard assessment tool for homeowners

This webinar was presented by Lynn Gowman, Forest Fire Research Specialist at the Canadian Forest Service, Great Lakes Forestry Centre, on May 14th, 2013.

Forest fires are ecologically and economically significant issues in Canada because up to 2.5 million hectares are burned each year and suppression costs can exceed one billion dollars annually. Although fires are a natural part of forest ecosystems, especially in areas such as the boreal forests of Canada, they can be a significant threat to rural homeowners and their property. As a result, Gowman and her colleagues have developed an online tool, based on the FireSmart program recommendations, for assessing the threats wildfires may present to a homeowner's property. This interactive tool allows the homeowner to enter information relating to the structure, site and area surrounding their property. With this information the tool will rate the risk of fire to the property, present the risk graphically and suggest changes that can be made to mitigate those risks. Recommended changes include cleaning the gutters of the home, closing in the deck attached to the home and removing woody debris on the property. The tool is expected to be available for public use in the near future. For more information about this tool please contact Lynn Gowman or visit the FireSmart Canada website.

To access this presentation please go to the NRCan ftp site.

Upcoming webinars

The next webinars in the Great Lakes Forestry Centre series will be:

Date and time	***Presenter***	***Title***
1 Oct. 2013 at 1:30 Eastern time	Dr. Denys Yemshanov	Does diversification in invasive species surveillance make a better decision-making strategy under uncertainty?
19 Nov. 2013 at 1:30 p.m. Eastern time	Dr. Fred Beall	Lessons from the long-term forest ecosystem change at Turkey Lakes Watershed

Subscribers to this GLFC e-Bulletin will receive an e-mail notification with complete details in the coming weeks.

Climate change detected at Turkey Lakes Watershed

Overview

Evidence of climate change is readily apparent at the Turkey Lakes Watershed Study (TLWS), north of Sault Ste. Marie, Ontario. Analysis of data collected over the past 30 years shows an increase in mean temperature, more frequent droughts and a shorter period of ice cover on lakes. Great Lakes Forestry Centre (GLFC) scientists have been studying the effects of these changes on forest growth and surface water quantity and quality.

The TLWS was established in 1980, initially as a response to concerns about the effects of acid rain. GLFC researchers, in collaboration with partners from Environment Canada, have measured climate variables, atmospheric deposition and water quantity and quality at the TLWS. They have also assessed tree growth on 22 permanent plots across the study area. The resulting comprehensive data set has allowed researchers to study climatic trends over the last 30 years and the effects of these trends on the forest ecosystem.

A number of observations provide evidence of a warming climate. There has been an increase of approximately 1^{o}C per decade in mean temperatures in both the dormant (November to April) and growing season (May to October). Total dormant season precipitation has declined and the incidence of severe and moderate-to-severe drought has increased. For example, there were no severe droughts during the first 15 years (1981-1995) of the study, whereas five years of the second 15-year period (1996-2010) had severe drought conditions. The date of ice formation on lakes within the watershed has gradually become later in the year and the total number of days with ice cover has declined at the rate of nearly one half a day per year over the 30-year time period of the study.

Atmospheric deposition of sulphate and nitrate, the primary ingredients of acid rain, have been measured since the study began. Sulphate deposition has declined over the 30-year study period, reflecting the reduction in industrial sulphur dioxide emissions. The ecosystem response to changes in sulphate and nitrate deposition has varied widely and demonstrates that catchment characteristics and soil properties can affect the degree of impact and subsequent recovery of terrestrial and aquatic systems.

The long-term trend in stream runoff reflects the warming climate, with water yield from headwater basins showing a decline of 3%, due to changing precipitation patterns throughout the year and increased evapotranspiration resulting from increases in overall average temperature.

The total number of days with zero stream flow has increased from 30 per year in the early years of the study to approximately 100 days per year more recently.

On the 22 permanent tree growth plots, average gross forest growth has declined. Decreased growth was not uniform across the study site due to differences in drainage in individual plots. Growth declines were greater on plots located on moister, lower slope positions than on plots on drier, upper slope positions. Five-year gross periodic increments for lower and upper slopes were 16.3 and 10.6 tonnes/hectare for the first 15-year period (1981-1995) and 10.9 and 8.8 tonnes/hectare for the 1996-2010 period, respectively. The results indicate that more productive mesic sites will be more susceptible to tree growth declines due to more frequent droughts in a changing climate than sites that that are inherently drier.

Long-term, multi department, multi-disciplinary watershed studies like the TLWS are unique and valuable scientific assets, providing insights that cannot be gained using other research approaches. Forecasting future tree growth and understanding whole ecosystem impacts are needed to ensure the sustainable use of Canadian forests and to support responsible resource development. Understanding the impacts of climate change on other forest ecosystem services is also critical to fulfilling this responsibility. For more information on the TLWS visit www.tlws.ca, contact Paul Hazlett, or visit the CFS publications database. A Frontline Express note about the TLWS will be released later this year.

CFS researchers using remote sensing to improve forest fire management in Canada

Overview

Canada has over 400 million hectares of forest to manage. The cost of fire suppression in these forests is about 1 billion dollars per annum. Use of remote sensing may provide forest fire managers with the opportunity to respond more readily and reliably to these fires. This information on forest fires will contribute to forest fire fighter safety and public health and safety.

CFS researchers are exploring how to assess the potential for active forest fire remote sensing (airborne and satellite-based) to characterize fire dynamics and behaviour. CFS is teamed up with researchers at King's College London (KCL), England. Together they are collaborating with the Canadian and Argentine Space Agencies who developed the first space-certified, uncooled thermal IR sensor. The sensor, called the New Infra-Red Sensor Technology (NIRST) was launched into space in 2010. This NIRST instrument is being tested by CFS and KCL for its ability to monitor wildland and controlled fires. The research is laying the groundwork for the deployment of additional sensors like NIRST. NIRST-like sensors have the advantage of costing much less than traditional cooled thermal IR sensors.

One of the primary focuses of the CFS research is to measure the three methods of heat transfer (radiation, convection and conduction) of a forest fire to determine what the infrared satellite observations (radiative) represent as part of the whole fire process. The goal of this research is to improve the response to wildfires in Canada. The use of remote sensing can improve the measurement of fire intensity and the rate of spread of a fire in near real-time, both critical pieces of information for a forest fire manager. This study will also provide information on the observed radiative energy and convective energy (that causes smoke to rise into the atmosphere) to better improve models on how smoke columns from forest fires are forced into the atmosphere. Because smoke is one of the leading causes of community evacuations, this information will allow better predictions of the arrival of smoke into a community and its impact on the community.

Use of remote sensing to obtain timely information on forest fire behaviour may help reduce the impact of forest fires by allowing improved response times, improved planning and decision making, and ultimately, may contribute to fire fighter safety and to public health and safety.

For more information on this work please contact Tim Lynham or the GLFC. Visit the CFS publications website for information on forest fire research in Canada.

Recent publications

Burgman, M.A.; Yemshanov, D. 2013. Risks, decisions and biological conservation. Diversity and Distributions 19: 485-489.

Huber, J.T.; Noyes, J.S. 2013. A new genus and species of fairyfly, *Tinkerbella nana* (Hymenoptera, Mymaridae), with comments on its sister genus *Kikiki*, and discussion on small size limits in arthropods. Journal of Hymenoptera Research 32: 17-44.

Lawrence, G.B.; Fernandez, I.J.; Richter, D.D.; Ross, D.S.; Hazlett, P.W.; Bailey, S.W.; Ouimet, R.; Warby, R.A.F.; Johnson, A.H.; Lin, H.; Kaste, J.M.; Lapenis, A.G.; Sullivan, T.J. 2013. Measuring environmental change in forest ecosystems by repeated soil sampling: A North American perspective. Journal of Environmental Quality 42: 623-639.

McLaughlin, J.W. ; Webster, K. 2013. Effects of a changing climate on peatlands in permafrost zones : a literature review and application to Ontario's far north. Ontario Ministry of Natural Resources, Ontario Forest Research Institute, Sault Ste. Marie, ON. Climate Change Research Report CCRR-34 168p.

Mengistu, S.G.; Creed, I.F.; Webster, K.L.; Enanga, E.; Beall, F.D. 2013. **:** Searching for similarity in topographic controls on carbon, nitrogen and phosphorus export from forest headwater catchments. Hydrological Processes DOI: 10.1002/hyp.9862

Quan, G.; Ladd, T.; Duan, J.; Wen, F.; Doucet, D.; Cusson, M.; Krell, P.J. 2013. Characterization of a spruce budworm chitin deacetylase gene: stage-and tissue-specific

expression, and inhibition using RNA interference. Insect Biochemistry and Molecular Biology 43:683-691.

Ryall, K.L.; Fidgen, J.G.; Silk, P.J.; Scarr, T.A. 2013. Efficacy of the pheromone (3Z)-lactone and the host kairomone (3Z)-hexenol at detecting early infestation of the emerald ash borer, *Agrilus planipennis*. Entomologia experimentalis et applicata 147 (2): 126-131.

Ryall, K.L.; Silk, P.; Thurston, G.S.; Scarr, T.A.; de Groot, P. 2013. Elucidating pheromone and host volatile components attractive to the spruce beetle, Dendroctonus rufipennis (Coleoptera: Curculionidae) in eastern Canada. Canadian Entomologist 145:406-415.

van Frankenhuyzen, K. 2013. Cross-order and cross phylum activity of Bacillus thuringiensis pesticidal proteins. Journal of Invertebrate Pathology 114:76-85.

van Frankenhuyzen, K.; Tonon, A. 2012. Activity of *Bacillus thuringiensis* cyt1Ba crystal protein against hymenopteran forest pests. Journal of Invertebrate Pathology 113: 160-162.

Wooding, A.L.; Wingfield, M.J.; Hurley, B.P.; Garnas, J.R.; de Groot, P.; Slippers, B. 2013. Lack of fidelity revealed in an insect-fungal mutualism after invasion. Biology Letters 9: 20130342.

Yemshanov, D.; Koch, F.H.; Ducey, M.; Koehler, K. 2013. Mapping ecological risks with a portfolio-based technique: incorporating uncertainty and decision-making preferences. Diversity and Distributions 19: 567-579.

Knowledge exchange publications

Ebling, P.M. 2013. The insect production and quarantine laboratories. Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, Ontario. Frontline Express Note 69. 2p.

MacQuarrie, C. 2013. Understanding patterns in forest tent caterpillar outbreaks: Developing effective pest management strategies. Natural Resources Canada, Canadian Forestry Service. Great Lakes Forestry Centre, Sault Ste. Marie, Ontario. Frontline Express 68. 2p.

MacQuarrie, C. 2013. Predicting jack pine budworm defoliation. Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, Ontario. Frontline Express 72 2p.

McKenney, D.; Pedlar, J.; Lyons, B.; Campbell, K.; Lawrence, K. 2013. Emerald ash borer: Economic models for homeowners and municipalities. Natural Resources Canada, Canadian Forest Service. Great Lakes Forestry Centre, Sault Ste. Marie, Ontario Frontline Express Note 70. 2p.

Proceedings of the Forest Pest Management Forum 2012/ Compte rendu du Forum sur la répression des ravageurs forestiers 2012, December 4-6 2012, Ottawa (Ontario). 2013. Natural Resources Canada, Canadian Forest Service.Great Lakes Forestry Centre, Sault Ste. Marie (Ontario), 198p.

Ryall, K. 2013. Detecting and monitoring emerald ash borer populations. Natural Resources Canada, Canadian Forest Service. Great Lakes Forestry Centre Sault Ste. Marie, Ontario. Frontline Express 67. 2p.

Thompson, D. 2013. TreeAzin - a natural systemic insecticide for use against the emerald ash borer in Canada. Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, Ontario. Frontline Technical Note 113, 6p.

Webster, K. 2013. Predicting forest soil carbon fluxes. Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, Ontario. Frontline Express 71.