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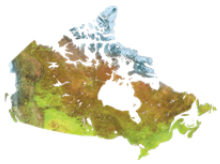
e-Bulletin

The Great Lakes Forestry Centre (GLFC)



Webinar Reports

An introduction to forest pest insect genomics

On September 17, Dr. Daniel Doucet provided an overview of the current collaborative genomic work underway on two insect pests of significance to Canadian forestry: the emerald ash borer (EAB) and the spruce budworm. Genomics, the complete sequencing of an organism's DNA, reveals important information about genes involved in various physiological processes. His work to date on the EAB for example, has centred on the function of genes in the insects' antennae, where they detect odours. These genes play a key role in EAB's ability to find food, a mate, and suitable egg laying sites to successfully complete their life cycle. Doucet is also an active participant in the sequencing and decoding of the spruce budworm genome, a collaborative effort between three CFS centres and two universities. He is particularly interested in the genomic features that are related to diapause, cold tolerance, development, and digestion. Doucet's long term goal is to use this knowledge to develop innovative tools for detection, monitoring, mitigation or management of these insects. To access the presentation go to the NRCan ftp site. (It is only available in text form due to an audio malfunction during the recording.)

Predicting spread of invasive pests

On October 1, 2013 Dr. Denys Yemshanov presented a seminar entitled: "Does diversification in invasive species surveillance make a better decision-making strategy under uncertainty?"
It is difficult to plan rapid-response pest surveillance campaigns in areas as geographically diverse as North America, especially when knowledge about a new invasive pest is scarce and imprecise. This new modelling method takes into account degrees of both risk and uncertainty that are typically associated with new pest invasions. The approach is based on the idea that diversification (like that of an investment portofolio in the financial world) can improve the assessment of risks of invasive species and allow for the most efficient allocation of resources on surveillance efforts. The model quantifies the risk that a given location would receive an invasive forest pest. As an example, an invasion risk map was created to to show the potential movement of emerald ash borer. The model took into account pathways of human-assisted spread of the pest along transportation and recreational travel networks.
To access the presentation go to the NRCan ftp site. (It is only available in text form due to an audio malfunction during the recording.)

The next webinar in the series will be held January 21, 2014 at 1:30pm EST.
Dr. Dean Thompson will present a talk entitled:
"TreeAzin as a systemic insecticide for potential use against Asian Longhorned Beetle –What we know and what we need to know"

Global wildfire season severity in the 21st century

Overview

How will global warming affect future fire activity? Scientists from GLFC's Fire and Climate Change group (in collaboration with the University of Alberta), predict fire season severity and length will increase significantly over the next century. The implications are that fire management will be even more challenging in the future.

In this analysis, potential climate change influences on global fire season severity were quantified using the Cumulative Severity Rating (CSR), a weather-based fire danger metric from the Canadian Forest Fire Danger Rating System. Three General Circulation Models (to predict climate change) and three emission scenarios (representing a range of economic and population growth patterns), were used to predict fire severity and fire season length for mid-century (2041–2050) and late century (2091–2100) relative to the 1971–2000 baseline. The results suggest significant increases in fire severity globally for all models and scenarios, but particularly for the Northern Hemisphere by the end of the century, where the CSR would be more than three times the baseline rating. With warmer temperatures, there is increased evapotranspiration, which can result in a lower water table position and decreased fuel moisture. More lightning activity is also associated with warmer temperatures, leading to increased ignitions.

Fire suppression most often fails during high intensity crown fires and the climate change scenarios from this study indicate that this type of fire behavior will occur with greater frequency in the future. If average fire intensity increases, fire suppression resources required may exceed available capacity with greater frequency, resulting in greater area burned. Modern fire management organizations already operate at near optimum efficiency, thus any further increase in fire control difficulty will likely force more fires beyond a threshold of suppression capacity.

The modelling exercise also predicted a longer fire season, as temperature is the most important variable affecting wildland fire activity and warmer temperatures generally lead to a lengthening of the fire season. This results in more fire starts and more opportunities for fires to escape control. In northern high latitudes there is expected to be an increase of more than 20 days per year by the end of the century. Some ways to help mitigate these increased fires will be to reduce human-caused ignitions through education programs, restricting or excluding the use of fire, and through enforcement of existing policies. At the local level, communities can continue to promote fuel reduction or modification practices as one way to help protect their properties and other values at high risk. Early warning systems based on fire danger will be critical to prevent disaster fires.

The results from this study provide important information for improving fire suppression planning. A greater understanding of fire patterns in the future will allow fire management agencies to reassess their policies and strategies.

Population genetics of forest insects

Overview

Looking at the genetic structure of an insect population can provide insight into its dispersal patterns and population cycles. For alien invasive species, such studies can shed light on invasion pathways and lead to better prevention and control measures. GLFC scientists have been involved in studies that have examined the genetics of two important forest pests: spruce budworm and emerald ash borer.

Spruce budworm

Research scientist Dr. Daniel Doucet recently contributed to a journal publication about the genetic variation in spruce budworm populations across North America. He worked collaboratively with scientists from the University of Alberta and the USDA Forest Service to increase the knowledge base on the fine-scale population structure of spruce budworm across North America. Spruce budworm is the most ecologically important defoliator of the boreal forest across North America and plays a major role in determining forest structure. While spruce budworm population cycles have been reconstructed and documented for the last 400 year period, less is known about the synchronization of population cycles and dispersal patterns. This is largely due to a lack of genetic markers from which fine-scaled surveys of population structure can be attained. Identifying genetic markers is an important starting point for such population studies. Genetic variation can be studied by using "expressed sequence tags" (ESTs), which are short sequences of genes that can be matched to a specific chromosome location. For this study, Doucet obtained 41,230 ESTs for spruce budworm. From these, 114 genetic markers were identified using insects collected from throughout Alberta. Results were validated using budworm from northern Minnesota. This information will complement existing resources on the genetics of spruce budworm.

Emerald ash borer

Dr. Barry Lyons, with partners from three Canadian universities and the USDA Forest Service, contributed to a journal article that compared the Asian and North American populations of emerald ash borer (EAB), using genetic markers. Forty-eight populations of EAB were sampled between 2003 and 2008 from five regions: three introduced regions (Michigan, Ontario and Quebec) and two native regions (China and South Korea). Seven genetic markers suitable for population genetic analysis were identified and used to compare EAB population structures in North America and Asia. Significant genetic variation between regions was found, but not between sample years. Results suggest that North American populations may have gone through a genetic bottleneck upon introduction to this continent. Also, individuals from different regions of North America (Ontario versus Quebec) may be associated with different regions within the native range of emerald ash borer. The markers can be used to track future invasion pathways and monitor changes in genetic variation in the new range.

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