Comings and Goings

We welcome Phyllis Dale from the Canadian Forest Service (CFS) Headquarters, who is on an assignment with the Great Lakes Forestry Centre (GLFC) for one year as a Senior Science Advisor on caribou. We also welcome Travis Jones, Indigenous Engagement and Science Advisor, who is on a two-year secondment from Indigenous Services Canada (Indian Affairs and Northern Development). Travis will be involved in the Indigenous Forestry Initiative and Bioheat programs in the Ontario Region. He will be a liaison with industry, provincial partners, other stakeholders and Indigenous communities in Ontario to advance the mandate of the Canadian Forest Service.

We wish Steve Dominy, Director, Forest Ecology and Dr. Richard Fleming, research scientist all the best in their retirement.

Mr. Dominy has had a long and varied career in forestry. His first job with CFS was as a student. After completing his M.Sc.F. at University of New Brunswick, he spent four years working as a researcher with the Forest Engineering Research Institute of Canada (now FP Innovations). For the rest of his career he held various positions with the CFS and was involved in the Model Forests, Forest 2020, Aboriginal forestry programming, policy and knowledge transfer. His career culminated in the position of Director of the Forest Ecology Division. Mr. Dominy is looking forward to spending more time on his many interests, not least of which are being active outdoors and seeing the world.

Dr. Fleming started his career by constructing mathematical and statistical models to explore the large-scale dynamics of forest insect outbreaks and their influences on the subsequent development of large wild fires. By the late 1980s he was publishing reviews on how climate change would likely affect these dynamics and, as a result, was invited to contribute to the Intergovernmental Panel on Climate Change (IPCC). In 2007 the IPCC was awarded the Nobel Peace Prize and Dr. Fleming became the only active member of GLFC to have ever been officially recognized as a Nobel Laureate by the Government of Canada. From 2005 to 2015 he led the International Union of Forestry Research Organizations (IUFRO) Working Party on Population Dynamics of Forest Insects. Outside of work he successfully participated in many racquet sports, which he plans to continue in his retirement, as well as provide support and advice on scientific issues, especially those related to climate change. He has over 100 publications to his name.

2018 North American Caribou Workshop

Overview

The workshop attracted 500 delegates to discuss the latest caribou research and to work together to find effective management solutions for this iconic species.

The 17th North American Caribou Workshop was held in Ottawa from October 29th to November 2nd with the theme of "Working Together". With most caribou populations experiencing declines across North America, an unprecedented level of commitment, collaboration and cooperation among groups involved in their conservation is required.

In addition to current collaborative research on caribou conservation, management and recovery efforts, Indigenous elders spoke on caribou population decline and the conservation practices they have used for centuries. Poster presentations covered a range of categories including: caribou nutrition and reproduction; demographic and predator-prey models; structure of caribou populations; space use and movements; population monitoring and range planning; community-based monitoring, management, and conservation; decision making in caribou conservation (ideas and opportunities); habitat restoration and management interventions; forecasting future landscapes, impacts of disturbance; and measuring the anthropogenic footprint.

GLFC work was represented at the poster displays and at the main sessions. During the themed session on Modelling Tools to Support Decision-Making, Dr. Denys Yemshanov presented his work on "Prioritizing restoration of fragmented boreal landscapes for caribou protection: a graph-theoretic approach". Exploration of non-renewable natural resources in boreal regions of western Canada involves the creation of seismic lines to access resource deposits, which create linear disturbances in forests. Seismic lines have caused habitat fragmentation and increased predator access, leading to a subsequent decline of some wildlife populations, particularly the woodland caribou. Decision-makers strive to develop conservation strategies that can sustain these struggling caribou populations while keeping project costs within a defined budget. Dr. Yemshanov created a model to find optimal seismic line restoration strategies in the Cold Lake Area of Alberta, Canada and assess potential trade-offs with industrial forestry activities. The model reveals the trade-offs between caribou habitat restoration and protection strategies and other competing objectives in a landscape (such as industrial forest harvesting) and finds the optimal restoration solutions and habitat protection strategies that help assess the potential impacts of caribou protection and habitat restoration efforts on regional timber supply.

Under the "Forecasting Future Landscapes" theme, a poster entitled: "Modeling caribou-wood supply trade-offs under a changing climate was presented by Dr. Dan McKenney, John Pedlar, Dr. Lisa Venier, Dr. Denys Yemshanov, Kevin Lawrence, Dr. Heather Macdonald and Kellina Higgins. This work is simulating wildfire across caribou ranges under both 'climate change' and 'no climate change' scenarios. Future plans include the incorporation of harvesting and socioeconomic considerations. On the theme of 'Working Together', this study involved a sharing of data and ideas between the Canadian Forest Service, Environment and Climate Change Canada, and the Ontario Ministry of Natural Resources and Forestry.

In addition to the main conference, "family friendly" programming was held at the Canadian Museum of Nature, where ecological and cultural perspectives on caribou were presented. A pre-conference workshop on climate change was held to help ecologists better understand the uncertainties, assumptions and limitations to climate change research to improve interpretation of modelled outputs. A Talking Circle provided a unique opportunity for Indigenous knowledge holders and other conference participants to discuss approaches taken across North America in "working together" for caribou. An Indigenous Youth Caucus allowed youth to meet and discuss what they learned and to strategize on protecting the environment for future generations.

For more information about the conference and for abstracts on all the presentations and posters, visit the conference website.

GLFC hosts Ontario's Forest Health Review

Overview

Ontario's 42nd Annual Forest Health Review was held at GLFC October 25th, co-hosted by the Canadian Forest Service, the Ontario Ministry of Natural Resources and Forestry (OMNRF) and the Invasive Species Centre.

There were six presentations at the half-day session. Mike Francis (OMNRF) gave an update on major forest disturbances in Ontario. Tracey Cooke from the Invasive Species Centre spoke about their programs and outreach. Simeon Wright from the Department of Natural Resources, Michigan gave a forest health update for Michigan. Dr. Sharon Reed, a forest health research scientist with OMNRF spoke about beech leaf disease, which is a recent discovery in southern Ontario.

Dr. Chris MacQuarrie gave an update on GLFC's biological control program for emerald ash borer (EAB) in eastern Canada. Research trials with three species of parasitic wasps (parasitoids) are underway to

determine establishment in and impact on EAB populations. The goal is to find the parasitoid species best suited to the climate in Canada, where EAB life cycles can sometimes extend over a 2-year period.

Dr. Barry Cooke shared his perspective on forest health monitoring needs in a new millennium. While working in Alberta during the period 2005-2015, aerial surveillance crews brought to his attention large swaths of forests in the far northwest that were dying in a puzzling way on a scale they had not seen previously. Numerous species appeared to be affected, including black spruce, aspen and birch. It became apparent that climate change was starting to affect the boreal forest on a large scale. Forests at high latitudes and high elevations seemed to be affected most severely. It is likely that warming temperatures have caused permafrost melt and a subsequent rise in water table. This has resulted in flooding and tree mortality in low-lying areas. Water-saturated soil leads to slumping on slopes. In other areas, warmer temperatures have led to drought stress, leaving trees more susceptible to forest pests, such as mountain pine beetle and Armillaria root disease. Significant defoliators such as spruce budworm and forest tent caterpillar are being seen for the first time several hundred kilometres north of their former ranges. These changes are expected to increase in extent and severity under a warming climate. Dr. Cooke's presentation points to the need for an integrative, multi-stakeholder research effort to address climate change effects on forests. Managers must be prepared to proactively and adaptively manage forests to maintain resiliency. Dr. Cooke discussed this phenomenon with a reporter on CBC radio and it can be heard as podcast.

About 60 participants attended in-house, with another 167 phone lines attending online or an estimated 500 participants connected from remote locations.

Climate-driven shifts in forest tent caterpillar outbreaks

Overview

Forest tent caterpillar outbreaks in Alberta started fluctuating aperiodically and asynchronously after 1910. Recent research attributes changes in winter weather patterns associated with climate change as the cause.

GLFC researcher Dr. Barry Cooke used tree-ring analysis to study the patterns of forest tent caterpillar outbreaks in Alberta since the mid 1800's. His analysis showed that the dynamics of forest tent caterpillar outbreaks shifted at the turn of the 20th century from simple, cyclic outbreaks that occurred at the same time throughout the province, to patterns that are more complex. After 1910, outbreaks were not as predictable in their periodicity and were asynchronous.

The shift in pattern of outbreaks cannot be attributed to human activity on the landscape, as large-scale forest activity and oil and gas development have only been developed in the area within the last 40 years. Rather, changes appear to coincide with climate-driven winter weather variability arising at the start of the 20th century. In northern climates, winter temperature is a key factor affecting egg survival and influencing population dynamics and the variability in winter weather in this region of Alberta tends to act as a strong forcing agent on tent caterpillar cycling. In contrast, Ontario winter temperatures are neither as harsh nor as variable; consequently, the system is free to cycle and to synchronize.

This example of a population exhibiting a clear and sudden switch from simple to complex dynamic behaviour in response to global climate change has implications for management of forest disturbances. Managers of boreal mixedwoods will want to consider carefully how best to manage a forest resource that is subject to insect disturbances whose probabilities are changing in uncertain ways. Predicting the impacts of climate change on ecosystem function is going to be challenging. It may be possible to make predictions by supporting studies such as this one of long-term populations in natural environments as well as continued environmental monitoring, and the development of more sophisticated analytical methods.

For more information on this study, read the full article. A discussion on patterns of FTC outbreaks in Ontario is provided in Frontline Express #68.

Use of genomics in biosurveillance

Overview

The use of new genomic techniques in detection and monitoring of insects and diseases can be a powerful tool to improve our understanding of the threats of invasive species.

Management and regulation of invasive pests requires a detailed understanding of their biology and invasion history, but with new species, there are often gaps in our knowledge with regard to species identity, source, demographic history, and fitness. State-of-the-art genomic techniques can provide a powerful suite of tools to assist in improving diagnostics, determining routes of invasion, assessing the probability of establishment, and even identifying evidence of adaptation. Many of these tools can improve the chances of successful early intervention strategies, which are the most cost-effective means to control new invasions.

Dr. Amanda Roe and colleagues recently published two journal articles; one explores the application of genomic tools to the surveillance of invasive forest insects and a second looks at the adoption of genomic tools by end user communities. Examples are given of how genomics has been successfully used in biosurveillance, including the use of genomic markers to better understand the spread of mountain pine beetle into the eastern boreal forest. Genomics can also be used for DNA-based detection and identification of invasive species. Identification relies on genetic differences between species that can be used to develop molecular assays that classify an unknown sample as a particular species based on its distinctive genetic profile. Reduced uncertainty in sample identification can guide management and biosecurity decisions.

The use of genomic approaches in the study of forest invasive and non-native pests has been limited to date, but is on the verge of transforming the field of biosurveillance. Regulatory agencies will undoubtedly benefit from the detailed insights that genomic data can bring to biosurveillance programs. However, successful adoption and incorporation of genomic tools is not straightforward. Uptake of these techniques will be influenced by their efficiency and cost-effectiveness, as well as the willingness of end-users to incorporate new technologies within their workflow. Researchers must work together with end users to ensure standardization, validation and interpretation of genomic data to ensure that genomic biosurveillance reaches its full potential.

Intact forest landscapes: what is the ideal size?

Overview

Protecting large, intact portions of the Canadian boreal forest promotes conservation at a global scale. What is the operational feasibility?

Dr. Lisa Venier recently published a discussion paper on the intact forest landscape concept, which has become a standard measure to assess progress in global forest conservation. Intact forest landscape is a common term used in forest management and forest certification processes to draw attention to the loss of large areas of forest that have no visible human disturbance. They are generally defined as forested landscapes that are large enough to allow for all natural processes and provide habitat for all biodiversity. Science generally supports the value of maintaining intact forest landscapes. It is well recognized that they help conserve biodiversity under threat from forest fragmentation and maintain ecological processes and

ecosystem services. Intact forest landscapes also have existence value, the idea that something has value to people strictly because it exists. The precautionary principle, as stated by the United Nations, that lack of full scientific certainty shall not be used as a reason to postpone cost-effective measures to prevent environmental degradation; and the need for scientific benchmarks are two additional reasons to conserve intact forest landscapes.

In Canada's managed boreal forest, the concept of intact forests being large enough to allow for all natural processes and biodiversity is likely not logistically feasible due to the scale at which many important processes occur. For example, fire and insect damage occurs at huge scales and wildlife species such as woodland caribou are very wide-ranging. The standard operational definition of an intact forest landscape sets a minimum size threshold of 50, 000 ha, which is likely too small to meet the general definition.

Even though 50,000 ha of intact forest is not large enough to allow for all natural processes in Canada's boreal, intact forest of smaller sizes still has ecological value. Therefore, while a standardized measure is useful for global tracking of intact forest landscapes, it may not be the best approach to meet more regional forest conservation goals. Management options that incorporate local knowledge of conservation needs and the specifics of ecosystem function and composition are more likely to be effective. Forests should be managed in the context of integrated land use planning that includes protected areas, sustainable forest management, species at risk management, and ecosystem restoration. It has been suggested that conservation of intact forest landscape be included as a criterion in third party certification. This is problematic as it applies global criteria to regional issues and may constrain existing provincial integrated land use planning approaches. It does not reflect the scale and structure of current forest management processes in Canada and has the potential to significantly impact wood supply for many forest companies for whom compliance may prove to be too stringent in today's markets. A gradient of threshold sizes acknowledges that intactness can be context specific and depends to some degree on the taxa or ecological processes in question. The discussion paper highlights the importance of Canada's large intact forest landscapes and the need for suitable policy to protect them that is sensitive to regional concerns.

Creation of the Canadian Trait Network

Overview

The creation of the Canadian Trait Network and its associated website brings together three disciplinary groups working on research questions related to the traits of vascular plants, invertebrates, and non-vascular plants.

The Canadian Trait Network was recently created to serve as a hub for centralizing knowledge on functional traits of plants, invertebrates and non-vascular plants. Functional traits are important characteristics for species to reproduce and survive within a given environment. These characteristics provide essential information for ecologists to answer a broad spectrum of questions related to forest management and conservation. The Canadian Trait Network brings together the TOPIC database (Traits of Plants in Canada), which is celebrating its 10th anniversary this year, the CRITTER database (Canadian Repository of Invertebrate Traits and Trait-Like Ecological Records), which was officially launched in December 2017, and a newly formed working group on non-vascular plant traits. The network facilitates research in ecology by promoting the accessibility of trait data, providing a platform for data exchange and fostering connections within the scientific community. The network website was recently launched under the new structure.

For more information, please contact Dr. Isabelle Aubin, Science Lead for the Canadian Trait Network.

Canadian Forest Service, a member of international vegetation database

Overview

The Canadian Forest Service is a contributor to a new global initiative that brings together vegetation datasets from across the world.

Understanding which plant species grow where and why is a fundamental in ecological research. To do this work, however, requires considerable amounts of data from all across the world, of which the ability to collect the information far exceeds the capacity of a single lab. The sPlot initiative, launched at the iDiv research centre and Martin Luther University Halle-Wittenberg (Germany), is the world's first global vegetation database that contains georeferenced data of plant species from over 1.1 million plots sampled across all Earth's ecosystems. A recent paper by the sPlot initiative published in the scientific journal "Nature Ecology & Evolution" explores how global plant communities are structured in relation to environmental properties, such as soil and climate. It was found that the diversity of global vegetation can be described by only a few plant characteristics, called functional traits, from each species. One of the contributed datasets includes work led by Dr. Isabelle Aubin and improves data availability on Canadian plant species. Available to other scientists by request, the sPlot database provides unprecedented opportunities to tackle numerous biodiversity questions at a global scale. This work highlights how international collaborations could help better predict the consequences of global climate change.

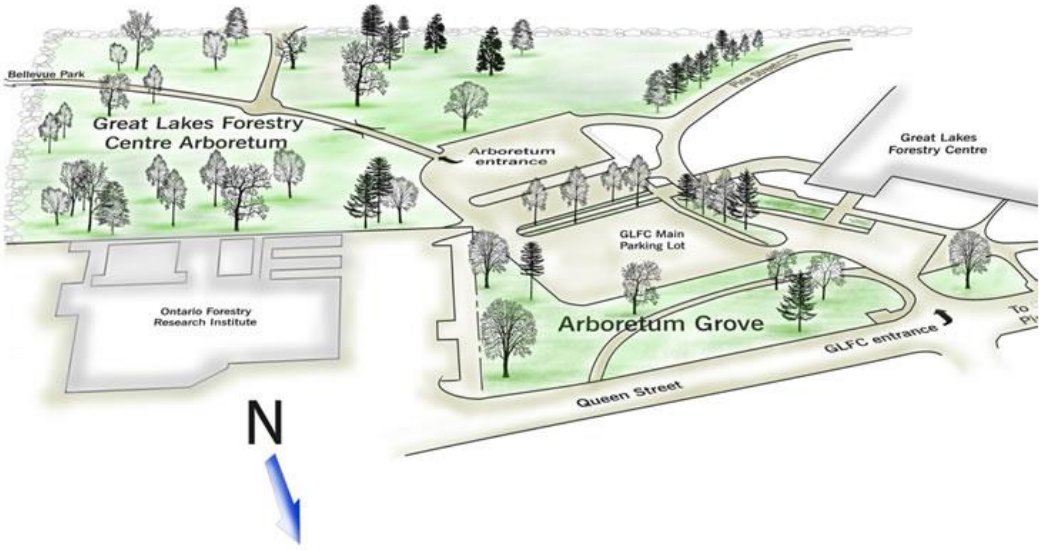
Geospatial data on the Great Lakes Forestry Centre Arboretum

Overview

Students from Sault College collected geospatial data on the trees in the GLFC Arboretum and grounds to assist with GLFC's goal to develop an electronic database.

The Great Lakes Forestry Centre Arboretum, established over 30 years ago, contains over 80 native and non-native trees. Currently, plaques are in place beside representative species to assist visitors in identifying trees. In 2017, students from Sault College collected geospatial data on the trees, which has been used by GLFC staff to develop an electronic database. This database will be used to readily locate each tree as well as to track the health, age-class distribution and species diversity in the Arboretum. A map has been created showing the location of each tree in the arboretum and surrounding grounds. In the near future, it is anticipated that this database will be available for visitors to download directly from the CFS website to learn about the various tree species.

The Arboretum is being managed to adapt to a changing climate, which also involves avoiding planting tree species that may be susceptible to current invasive forest pests. It provides a valuable educational resource for the community.



Publications of interest

- To order copies of these publications, please contact the Great Lakes Forestry Centre publications assistant.
- Publications are available in English unless otherwise indicated.

Use of ultraviolet light to improve assessments of hemlock woolly adelgid populations.

This Technical Note describes a new, more efficient technique for estimating hemlock woolly adelgid populations on twig samples. Estimates of the density of the invasive, non-native hemlock woolly adelgid are needed when deciding if control treatments are required or have been successful. Typically, the number of ovisacs on twig samples are counted to estimate population levels, which requires the ovisacs to be pulled apart to see if the nymph or adult within is still alive. However, adelgids produce a waste product called honeydew, which glows when exposed to ultraviolet light. So, if honeydew is present on the surface of an ovisac, a black light can be then used to count the number of live insects. This technique is 10 times faster than the method currently used.

Synthesis of current AshNet study designs and methods with recommendations towards a standardized protocol

AshNet is a network of Canadian government, academic, and industry researchers, foresters and policy makers investigating the beneficial diversion of wood ash, a by-product of the growing bioenergy industry, from landfills across Canada to forest soils. There are currently 14 research trials across the country that are testing the effects of wood ash application on the health and productivity of forests. This Information Report summarizes the current practices and experimental approaches across AshNet research trials and identifies recommendations and considerations towards a standardized protocol and important areas of research.

Recent Publications

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