Natural Resources Canada | Ressources naturelles Canada

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e-Bulletin

The Great Lakes Forestry Centre (GLFC)

Message from the Director General, Danny Galarneau

In 2005, with the first issue of this e-Bulletin, our aim was to keep you up to date on how Natural Resources Canada, Canadian Forest Service (NRCan, CFS) at the Great Lakes Forestry Centre (GLFC) was addressing the critical issues facing forestry in Ontario and Canada at that time. Today, over 18 years and 50 issues later, the e-Bulletin continues to let you know how we are working to answer those questions.

Over that period, many challenges facing our natural resources have intensified; global climate is changing, fire seasons are getting longer and more intense, and factors such as expansion of international trade have increased the number of invasive species threatening our forests.

At the same time, new technologies are rapidly being collaboratively developed, such as WildFireSat, the world's first purpose-built operational satellite system for wildfire monitoring, and enhanced data modelling is being used to study and quantify the impacts of these greater stresses on our resources and develop tools for better management. Researchers continue to provide expertise with invasive species threatening Canada's forests such as the development of sampling techniques for emerald ash borer (EAB) (*Agrilus planipennis*), Asian long-horned beetle (*Anoplophora glabripennis*) and hemlock woolly adelgid (*Adelges tsugae*). GLFC is a leader in insect production services and the Insect Production and Quarantine Laboratories (IPQL) is the only facility in North America that rears multiple forest insect species and the only facility in the world that mass-produces spruce budworm (*Choristoneura fumiferana*).

Our work with Indigenous communities has expanded greatly over this period. Funding continues to be provided for the national Indigenous Forestry Initiative (IFI), with an expanded mandate and new funding announced in September 2023 for three years. As well, scientists are actively working with Indigenous communities to incorporate their knowledge into the understanding of the forest.

Other research work included in our early e-Bulletins, such as the development of Canada's Plant Hardiness Zones, continue to be updated for relevance today.

I hope you find the GLFC e-Bulletin informative on the research work we proudly do in the protection of Canada's forests.

Comings and Goings

We welcome Katalijn MacAfee who recently joined GLFC as a science director, working closely with the Forest Ecosystems team and providing guidance to the analytical labs. She will also be supporting the Canadian Wood Fibre Centre (CWFC), predominantly with the Petawawa Research Forest, and in Sault Ste. Marie.

Katalijn is no stranger to the CFS, having started her career as a summer student at the Petawawa Research Forest, and then officially joining the CFS in 2007. She spent close to 10 years working with CWFC as a knowledge exchange specialist before joining a science-policy team in Ottawa where she worked on a variety of files including cumulative effects, boreal caribou and forest restoration. She is happy to be back in a science-driven team and is looking forward to working with a stellar team at GLFC!

Over 60 years and going strong for Insect Production Services at GLFC

The Insect Production and Quarantine Laboratories (IPQL) at GLFC continue to assist scientists in improving their understanding of insect pest behaviour and the development of effective control methods.

The Insect Production Services team has provided live insects to facilitate research since 1963. The specialized IPQL facilities completed in 2011, including a quarantine facility that meets strict Canadian Food Inspection Agency (CFIA) standards as a level PPC-2a facility, enhanced the capacity of the team to produce insects and allows scientists to conduct research on alien species. There are 16 programmable rearing modules that can be switched between domestic and invasive species, plus supporting facilities. This lab work allows for ongoing observations of insect behaviour, simulation of environmental variables and testing of potential control methods.

This laboratory is the only one in North America that grows multiple forest insect species and the only facility in the world that mass-produces spruce budworm. An average of 1 million spruce budworm larvae are produced annually. Researchers at GLFC have been successful in creating a strain of spruce budworm that does not require diapause, the over-wintering dormant phase, enabling researchers to wait a shorter time, no more than a few months, to determine the long-term effects of different experimental treatments.

Other domestic or native species successfully raised and currently available to researchers include western spruce budworm (*Choristoneura occidentalis*), forest tent caterpillar (*Malacosoma disstria*), white-marked tussock moth (*Orgyia leucostigma*), and cabbage looper (*Trichoplusia ni* [Hübner]), a useful "standard" insect test species around the world. The IPQL department is also growing invasive species such as EAB, Asian longhorned beetle, and brown spruce longhorn beetle (*Tetropium fuscum*) to support worldwide research initiatives. In 2016, IPQL started to grow and mass-produce parasitic wasps from China and Russia as classic biological control agents for release in Canada against EAB. Insects and synthetically prepared insect foods are available for purchase to researchers at other government agencies, educational institutions, and private companies through the IPQL website. The CFS and IPQL are committed to

providing quality grown insects for research around the globe and aim to remain on the leading edge of research in this area.

The IPQL also houses the Invasive Species Centre (ISC), a not-for-profit corporation that works to promote collaboration between multiple agencies and the public and provides a national forum for sharing information and coordinating research necessary for development of the most effective strategies for dealing with invasive pests in Canada. For more information about the Insect Production and Quarantine Laboratories, at the GLFC, contact John Dedes.

Understanding the performance of each airtanker in various wildland fire situations is important for fire management decision-makers

Colin McFayden and Dr. Mike Wotton from CFS, Jason Robinson from Ontario Ministry of Natural Resources and Forestry (MNRF), along with several co-authors from other fire management agencies in Canada and the United States, look at the water drop effectiveness of both fixed- and rotary-wing airtankers.

Airtankers are often essential for the control of wildland fires and facilitating safe ground crew suppression activities. The "Reference Guide to the Drop Effectiveness of Skimmer and Rotary Wing Airtankers" provides information and a systematic and objective method for the relative comparison of the water drop effectiveness as well as other useful information for some airtankers commonly used in the North American boreal regions. These include the CL-415, CL215 and CL215T, AT802F Fire Boss, and DHC-6 Twin Otter fixed-wing airtankers and the Bell 212 rotary-wing airtanker. The guide also provides additional resources to help with the estimation and interpretation of wildland fire factors such as fire intensity.

This guide will be helpful to those making the real-world, complex decisions in wildland fire management and will encourage a continued and meaningful dialog with the aviation community.

For more information contact Colin McFayden or Mike Wotton.

Information Report identifies path needed to ensure best uptake of WildFireSat products

Colin McFayden, Emily Hope and several members of the WildfireSat team outline the path to be taken to increase the likelihood of achieving a high level of adoption and integration in provincial and territorial wildland fire management agencies.

WildFireSat is a satellite mission of the federal government of Canada that is expected to launch around 2029. Over the past several years, the WildFireSat mission team has been collaborating with the provincial and territorial fire agencies to better understand real-world needs and work together on a pathway where those agencies can most fully benefit from WildFireSat and Earth observation data for fires in general.

The WildFireSat mission will provide ethically sound and meaningful recognition, inclusion of and support for Indigenous Peoples, their knowledge, and fire stewardship activities relative to WildfireSat.

The purpose of this document, "WildFireSat pathway for implementation and uptake in provincial and territorial fire management agencies", is to describe a synthesis of work to date on the key concepts and strategies within the WildFireSat mission that will be used to support the implementation and uptake for provincial and territorial wildland fire management agencies. It is believed that through this pathway, Canada's fire managers will become the most equipped to use satellite data of any of their counterparts worldwide, while our scientists will possess the deepest understanding possible of their stakeholder priorities. As well, the report includes a discussion of wildland fire management in Canada and other key concepts needed to move forward along the path such as knowledge exchange and capacity.

It is important to note that this engagement is not complete, and that the future direction to support the eventual implementation and uptake of WildFireSat will be navigated together with the fire management agencies.

Contact Colin McFayden or Emily Hope for more information.

WildFireSat e-bulletin – Coming soon

The WildFireSat e-bulletin is scheduled to launch in early 2024. This newsletter will highlight important information and progress about the world's first purpose-built operational satellite system for wildfire monitoring.

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WildFireSat e-Bulletin

The Great Lakes Forestry Centre (GLFC)

If you are interested in receiving the newsletter, contact WildfireSat.

Rooting depth and xylem vulnerability are independent woody plant traits jointly selected by aridity, seasonality, and water table depth

Dr. Isabelle Aubin is one of many researchers looking at 188 woody species to examine how rooting depth and embolism-resistant xylem interact with arid growing environments, seasonal precipitation changes, and water table depth.

Rapid evolution of woody taxa in arid environments are made possible by multiple traits including deep roots and embolism-resistant xylem, but little is known about how they have co-evolved across the phylogeny of woody plants or their influence on species distribution. Global trait and vegetation-plot datasets were synthesized to examine how rooting depth and xylem vulnerability across 188 woody plant species interact with arid growing environments, seasonal precipitation changes, and water table depth to influence the occurrence probability for species across all biomes. Xylem resistance to embolism and rooting depth are independent woody plant traits with no evidence of inter-specific trade-off. Increases in occurrence probabilities occurred in four scenarios: resistant xylem and deep roots in arid, seasonal climates over deep water tables; resistant xylem and shallow roots in arid, nonseasonal climates over deep water tables; vulnerable xylem and deep roots in arid, nonseasonal climates over shallow water tables; and lastly, vulnerable xylem and shallow roots in humid climates. Responses of deeply rooted vegetation may be buffered if evaporative demand changes faster than water table depth under climate change. This work shows the combined effect of drought resistance and avoidance on the global distribution of woody species across various climatic conditions.

Contact Isabelle Aubin or read the full article "Rooting depth and xylem vulnerability are independent woody plant traits jointly selected by aridity, seasonality, and water table depth".

Advancing digital soil mapping tools will improve the ability to practice sustainable forest management

Dr. Kara Webster recently made a presentation on Advanced Digital Soil Mapping in Support of Forest Resource Inventory, Planning and Decision Making as part of the Forest Resource Inventory (FRI) Knowledge Transfer and Tool Development (KTTD) webinar series hosted by Forestry Futures Trust Ontario.

Soil Information is essential for many different applications but the information that is needed may be different for each use. Understanding how soil properties vary across the landscape will improve the ability to practice sustainable forest management. However, soils are not easy to map and existing maps are at course scales. Forest soils are inferred from landscape position and vegetation associations, but they are not easily remotely sensed and mapping offers additional challenges such as the tree canopy, forest floor and complex terrain.

Digital soil mapping has developed over the last 20 years and combines field sampling of soil attributes with environmental layers. Forest soil mapping can be improved by adapting digital soil mapping to forest systems by mapping at relevant scales for forest management, such as forest units. To accomplish this, as much legacy data needs to be compiled as possible and soil data acquisition needs to be facilitated.

Dr. Webster explained how their project is focusing on 1) Compiling legacy data and facilitating soil data acquisition by developing sampling protocols and standardized approaches to soils information and preparing quick reference booklets for users in the field. They are also working on 2) summarizing key indicators or metrics of soil properties and 3) expanding soil property map products and their applications.

The Romeo Malette Forest, in Ontario, was used as a test area for the project and sample results are shown. The full presentation can be viewed on the Forestry Futures Trust Ontario website under "Workshops and Webinars" or contact Kara Webster for further details.

A case study of the Canadian Forest Service shows collaboration results in higher impact research

Dr. Heather MacDonald, Kaitlin DeBoer, and Dr. Dan McKenney study how collaboration with different partners impacts the reach of CFS research.

The CFS has a mandate to share its full breadth of scientific knowledge concerning Canada's forests broadly, with citizens, as well as narrowly, with organizations responsible for managing forests. Measuring the impact of CFS research in policy-making both nationally and internationally can be challenging, as policies may not reference research contributing to decisions.

This paper addressed two objectives: 1) To investigate how collaboration impacts the reach of CFS research; and 2) To assess whether collaboration with national and sub-national government bodies is unique to collaboration with other partners. In respect to these research questions, 1) it was determined that collaboration significantly impacts the reach of CFS research, based on citations comparing collaborative CFS research and non-collaborative CFS research. 2) Specifically, U.S. government co-authorship was the greatest single predictor of selected standardized bibliometric measures of CFS research impact. University collaboration also had a significant impact on research impact, partly through the quality of journal. While this study did not include policy and social impacts, future research will consider citations concurrently with other indicators.

It was found that CFS publications authored or co-authored with a U.S. or Canadian federal government author had significantly higher research impact. University co-authorship also increased impact, in part through the quality of publication journals. Contact Heather MacDonald for more details or read the full article "Collaboration results in higher impact research: Case study of the Canadian Forest Service".

2 Billion Trees - Knowledge exchange

The 2 Billion Trees (2BT) Science Team at the CFS is investing in applied research and knowledge mobilization to ensure all CFS and 2BT partners, stakeholders, end-users and proponents have access to the knowledge they need to succeed in their tree planting and forestry goals.

Accessing knowledge products

- All official knowledge products are available for download from the CFS Publications Database.
- Other knowledge products including videos, lectures, apps, tools, and reports that could help with organizations interested in planting trees can be found on the Canadian Conservation and Land Management Portal.
    - Please note that this link is for a third-party website with information that may not be available in both official languages. As such, NRCan is not responsible for the accuracy, currentness, or reliability of the content.

Recent Publications

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