Natural Resources Canada | Ressources naturelles Canada

Issue 45, February 2022

e-Bulletin

The Great Lakes Forestry Centre (GLFC)

Comings and Goings

We welcome David Young and say farewell to Ken McIlwrick.

David Young, from Garden River First Nation, is the Acting Indigenous Science Advisor and Regional Liaison Officer. David started his new role at the Great Lakes Forestry Centre (GLFC) on November 22. He was previously at the Northern Forestry Centre where he worked on engaging with remote Indigenous communities regarding wildfire evacuation risk.

We wish Ken McIlwrick all the best in his retirement. Ken worked for GLFC for over 20 years. He is a wildlife field biologist with outstanding expertise in bird song recognition and avian ecology.

North American Forest Ecology Workshop 2022

Dr. Lisa Venier is the Chair of the organizing committee for this year's workshop, which is being planned by a team of Canadian federal, provincial and university researchers.

The mission of the North American Forest Ecology Workshops is "to bring researchers, academicians, and managers together to foster dialogue and discussion of current issues related to basic and applied research in forested ecosystems in North America." The 2022 meeting will be the 13th bi-annual meeting. The theme for this year's workshop is **Turning Ecological Answers into Forest Management Actions**. The conference, originally scheduled to be held in-person in Sault Ste. Marie, Ontario, will be held virtually June 19-23, 2022. The virtual conference will include four keynote addresses. Dr. David Lindenmayer from the Australian National University will speak on "Challenges for forest biodiversity conservation, forest management, and forest restoration in a time of fire". Dr. Deborah Dumroese of the US Forest Service will present on "The North American Long-Term Soil Productivity Experiment: Is it still relevant after 30 years?". Dr. Jill Johnstone (freelance researcher from Whitehorse, Yukon) will talk about "Changing climate, disturbance, and vegetation succession in northern boreal forests". Dr. Eliot McIntire of the Canadian Forest Service (CFS) will discuss "Bringing open science, open models and nimbleness to forest ecology and land management". There will also be 10 special sessions on topics from ecosystem recovery after disturbance to natural disturbance emulation in a time of climate change.

For more information, visit the NAFEW website.

GLFC scientists partnering with universities in research and knowledge exchange

GLFC researchers are active at a number of Canadian universities, including ten in Ontario as well as a few international ones, where they play an important role as adjunct professors and mentoring graduate students. In this and future issues we will highlight a few of these collaborative efforts.

Forest fire researcher Dr. Mike Wotton has his office at the University of Toronto, where he is an associate professor in the Faculty of Forestry and leads a joint CFS-University of Toronto program at the faculty that focuses on forest fire behaviour research. GLFC's Dr. Josh Johnston also contributes to the fire program by giving guest lectures on current fire topics, including technologies such as satellites, unmanned aerial vehicles, infrared detectors, image processing and artificial intelligence.

A number of scientists give occasional lectures to students on the latest developments in the area of sustainable forest management. Some of these include: Dr. Lisa Venier, who shares her knowledge in forest biodiversity and sustainable forest Management; Dr. Jason Leach lectures on how forest change is impacting forest-water interactions and how sustainable forest management can help moderate these impacts; Dr. Kara Webster speaks about natural and human disturbance on water and nutrient cycling in forests and peatlands; and Dr. Isabelle Aubin specializes in tree vulnerability to climate change, collaborative science and best practices for data sharing. Dr. Effah Antwi has lectured at Dalhousie University on the assessment of cumulative effects of multiple disturbances on forestland in Canada.

Other universities with courses in entomology are able to invite GLFC entomology researchers to share their areas of expertise with students in this important field. Dr. Chris MacQuarrie gives lectures on forest pest management and on biological control, while Dr. Daniel Doucet has spoken on insect cold tolerance and response to insecticides.

Two scientists have international affiliations: Dr. Erik Emilson is a graduate advisor at the University of Cambridge, England and Dr. Jeremy Allison is affiliated with the University of Pretoria, South Africa. This relationship started in 2014 with collaborative experiments examining the factors that limit population growth in *Sirex noctilio*, a woodwasp that kills pines and has invaded South Africa and North America. Due to the complementary skill sets and shared interests of the CFS and University of Pretoria, the collaboration grew to include co-advised postdoctoral researchers and graduate students. Prior to the pandemic, reciprocal exchanges between GLFC and the University of Pretoria occurred annually. In 2021, the collaboration graduated two co-advised PhD students in the fields of forest entomology and health.

Beech Scale: an insect to watch for

Beech scale is an introduced insect that damages beech trees; this damage can lead to beech bark disease.

The insect was introduced to North America in the late 1800's and has spread throughout eastern Canada. Beech scale feeds by piercing through the bark of a tree and sucking plant juices. This damage has little effect on the tree, but can cause wounds and cracks in the tree, which can allow certain fungi to enter and infect the tree. Once infected, trees begin to decline and can eventually die from beech bark disease.

To minimize damage, beech management should focus on cost effective, landscape-level measures such as the preservation, propagation and planting of trees resistant to the disease or the removal of heavily damaged trees. Removal of damaged trees reduces the basal area of susceptible beech in the stand. The removal program should include the treatment of stumps with herbicide to kill regenerating sprouts and prevent the emergence of disease-susceptible beech thickets. Under-planting affected stands with resistant beech seedlings is a viable restoration strategy in sites where beech was formerly dominant. Local forestry professionals may provide assistance with developing an ecologically sound beech management plan.

The new Frontline Express publication on Beech Scale describes the biology, impact and management options for beech scale.

Effects of wood ash addition on soil characteristics in managed forests

A recent study that examined soil characteristics on AshNet experimental sites showed that ash amendment did not have significant effects on soil organisms or nutrients.

As global energy production shifts towards carbon-friendly options, biomass energy is a growing market that will potentially produce a lot of wood ash as a waste product. Countries in Europe recognize ash as an effective soil amendment. Many countries apply ash from biomass energy production to forest soils to return nutrients to the soil. In Canada, ash is applied as a liming agent in agricultural soils, but the application in forest soils is subject to different regulations. Ash can be applied to forest soils in Canada, but our regulations require updating. Ash is classified as a biosolid waste product in most provinces, making it difficult to receive approval to apply it in forests.

Currently, there is no policy specific to the use of wood ash as forest amendment and ash needs to meet provincial policies designed for industrial waste products for its use in forest management. AshNet is a collaborative effort that uses a network of studies in forests across Canada to assess the impacts of wood ash amendment, in order to help inform policy specific to wood ash. A recent study sampled soils from eight AshNet experimental sites where

different amounts and sources of wood ash were applied to soils. It used metabarcoding (which uses DNA to assess the presence of organisms) and enzyme analyses (used to measure nutrient cycling) to see whether organisms respond to ash amendment.

The study found that though there may be some differences in enzymatic activity when ash was applied to forests, the way that enzymatic activity changed following the addition of ash was not the same at all sites. The differences between two plots at a particular site were often greater than the effects of ash addition. The structure of soil communities (arthropods, general eukaryotes, bacteria and fungi) did not change with ash addition either. Thus, wood ash amendment is likely to have some temporary effects on nutrient turnover in soils, but it is unlikely that there are permanent changes to the soil ecology. While the study was limited in some respects (i.e., most of the sites had a recent ash addition and all of the forests were managed forests) these results show that ash amendment is not likely to cause changes to the soil ecology, or only produce small results that are highly dependent on site characteristics. Additional studies on site attribute interactions may be required to identify what site considerations, if any need to be considered in the design of ash-specific policy.

For more information, contact Emily Smenderovac.

Forest defoliator outbreaks alter nutrient cycling in northern waters

A recently published study showed how defoliation of forests by insects can change water quality in lakes.

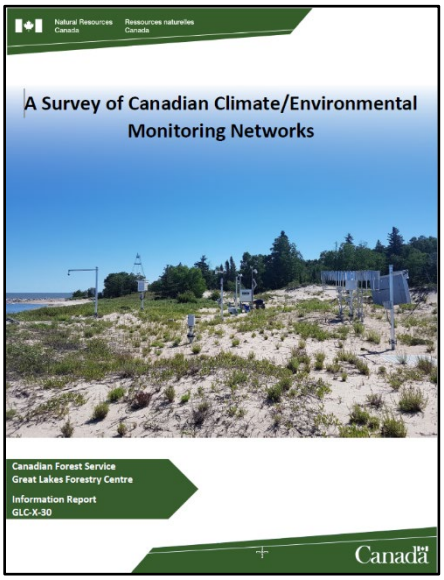
The article was published in the scientific journal **Nature Communications** and included GLFC authors Dr. Erik Emilson and Ron Fournier, with collaborators from the University of Cambridge and Laurentian University. The study investigated how defoliation of forests by insects can change water quality in lakes, using 32 years of data from long-term ecological research. The study would not have been possible without long term monitoring data from the GLFC-led Turkey Lakes Watershed, as well as from the CFS-led Forest Insect and Disease Survey (FIDS) Aerial Monitoring Data, and provincial Forest Health Aerial Monitoring data.

By looking at temporal and spatial relationships between defoliation and lake water quality, the researchers found that organic carbon in the lakes (dissolved organic runoff from forest soils) was reduced by as much as 32%, and that nutrients (specifically dissolved nitrogen) increased as much as 112% when defoliation was severe. These changes to carbon and nitrogen in lakes resulted primarily from runoff of frass (insect droppings), and were found to be at levels high enough to significantly impact regional carbon budgets in lakes. For example, the nitrogen-rich frass can fertilize microbes in lakes, then release carbon dioxide into the atmosphere, offsetting the carbon captured by algae.

In 2020, Ontario recorded 585,000 hectares of forest defoliation by the insect *Lymantria dispar dispar*. Outbreaks of this invasive insect and the native forest tent caterpillar (*Malacasoma disstria*) occur at least every five years and climate change is predicted to increase the area in Canada where outbreaks can occur. The results of this study suggest that these insect outbreaks are an underappreciated driver of biogeochemical cycles in forest catchments for the boreal ecozone. Read the full article on how Forest defoliator outbreaks alter nutrient cycling in northern waters or contact Erik Emilson for more information.

A survey of Canadian climate/environmental monitoring networks

GLFC's Heather Macdonald, Dr. Dan McKenney and Kelly Mitchell, along with a colleague from Environment and Climate Change Canada recently published an Information Report that summarizes certain environmental monitoring collections across the country.



Environment and Climate Change Canada's (ECCC) Centre for Climate Services provides Canadians with data, information and support to consider climate change in their decisions. In collaboration with Natural Resources Canada (NRCan), a survey was undertaken to help identify data sharing opportunities with weather and climate monitoring networks across the country. This work supports the ECCC's Collaborative Monitoring program, which aims to strengthen the national capacity to monitor weather and climate through collaboration with provinces and territories, federal departments, as well as other network operators/data owners (e.g., academia, regional/municipal governments, Indigenous organizations, private sector). Among other benefits for NRCan, this kind of collaborative effort helps to identify datasets that could be useful to supporting climate mapping relevant to sustainable development in the forest and other sectors.

The report summarizes the results of a survey of 99 municipal/regional governments, academia, and private organizations about weather stations. The survey was conducted between January and February 2021. Out of 99 responses, 66 reported collecting precipitation data, compared to 48 for air temperature, 37 for snow, 31 for wind, and 30 for humidity. With respect to water, there were 36 organizations recording data on surface water, 32 on stream discharge, 29 for ground water, and 26 for water temperature. Most organizations were open to sharing their data and expressed interest in having access to other organizations' data as well. A key recommendation is to continue outreach to encourage data sharing from these and other networks.

Access the full report: "A survey of Canadian climate/environmental monitoring networks" or contact Heather Macdonald for more information.

New tool to help species selection for restoration

PlantR *is an interactive planning tool that helps resource managers select the most appropriate species mixtures to plant in order to achieve specific restoration goals.*

This virtual thinking tool is designed to improve the integration of ecosystem services in restoration programs. The tool also accounts for key operational constraints defined by the user, including budget, number of species to plant, and a choice of ecosystem services to consider. **PlantR** can also be used to inform landscape-level restoration programs by creating custom species mixes for several sites, each with specific restoration objectives.

The tool combines a trait-based approach with modern modelling techniques. Plant functional traits can be used to determine the ability of a species to provide an ecosystem service. For example, a species' leaf nitrogen content impacts its leaf litter decomposition rate, which is important to soil health. The tool uses trait-function relationships to generate cost-effective combinations of plant species designed to optimize multiple ecosystem services in restored landscapes.

The practicality of the tool was demonstrated by generating a series of species mixtures for forests damaged by copper-nickel smelters at the northern edge of the deciduous forest within the City of Greater Sudbury, Ontario. **PlantR** was developed in close collaboration with stakeholders to ensure it would meet their needs. Five ecosystem functions identified by stakeholders as a priority for this region were: rapid establishment of vegetation cover, soil building, biological soil health, resistance to invasion by exotic plants, and ecosystem resilience. In time, the tool will be updated to incorporate additional functions, restoration contexts and habitat types.

For more information on the use of the tool, contact Isabelle Aubin.

The State of Canada's Forests 2020 Report

The latest annual report on the state of Canada's forests offers a national snapshot of the social, economic and environmental status of forests and forestry in Canada. The report presents current information on trends and statistics related to sustainable forest management in Canada and provides comprehensive data sources and information**.** The theme of this edition is "Canada's forests: adapting to change". The report also includes feature articles, including one on how Canada will use satellite data and artificial intelligence to fight forest fires, which highlights the work of GLFC fire scientists. The State of Canada's Forests 2020 report is available online.

Recent Publications

Bognounou, F.; Venier, L.A.; Van Wilgenburg, S.L.; Aubin, I.; Candau, J.-N.; Arsenault, A.; Hebert, C.; Ibarzabal, J.; Song, S.J.; De Grandpré, L. 2021. Early avian functional assemblages after fire, clearcutting, and post-fire salvage logging in North American forests. Canadian Journal of Forest Research 51(3): 393-407.

Erdozain, M.; Kidd, K.A.; Emilson, E.J.S.; Capell, S.S.; Kreutzweiser, D.P.; Gray, M.A. 2021. Elevated allochthony in stream food webs as a result of longitudinal cumulative effects of forest management. Ecosystems.

Fidgen, J.G.; MacQuarrie, C.J.K. 2021. Beech Scale. Frontline Express 91. Natural Resources Canada, Canadian Forest Service. Great Lakes Forestry Centre, Sault Ste. Marie, Ontario. 2p.

Hanes, C. C.; Wotton, B.M.; McFayden, C.; and Jurko, N. 2021. An approach for defining physically based Fire Weather Index System classes for Ontario. Information Report GLC-X-29. Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre. 35 p.

MacDonald, H.; McKenney, D.W.; Confalone, K.; Mitchell, K. 2022. A Survey of Canadian Climate/Environmental Monitoring Networks. Information Report GLC-X-30. Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre. Information Report GLC-X-30. 75 p.

Venier, L.A.; Walton, R.; Brandt, J.P. 2021. Scientific considerations and challenges for addressing cumulative effects in forest landscapes in Canada. Environmental Reviews 29(1): 1-22.

Woodman, S.G.; Khoury, S.; Fournier, R.E.; Emilson, E.J.S.; Gunn, J.M.; Rusak, J.A.; Tanentzap, A.J. 2021. Forest defoliator outbreaks alter nutrient cycling in northern waters. Nature Communications 12:6355.

Subscribe/Unsubscribe

To subscribe or unsubscribe to the GLFC e-bulletin, please send an email to nrcan.ebulletin_glfc-ebulletin_glfc.rncan@canada.ca with your full name, email address, mailing address and organizational affiliation.