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The Great Lakes Forestry Centre (GLFC)

Comings and Goings

There have been significant changes to the management team at the Great Lakes Forestry Centre (GLFC) as well as a retirement.

We are pleased to announce that Danny Galarneau is the new Director General of GLFC. He was previously the Director of the Planning and Operations Division, a position he held for seven years.

There have also been further leadership changes at GLFC. We are pleased to announce that Dr. Sonja Kosuta has accepted the position of Director of Partnerships, Planning and Operations. In addition, Dr. Dan McKenney has accepted the role of team lead/Director of the new division of Integrative Ecology and Economics, while continuing his contributions as a research scientist. Tracey Cooke has accepted the role of Director of the Forest Ecosystems Division. Tracey comes to us most recently from the Sault Ste. Marie YMCA, where she was the Chief Executive Officer. Tracey is no stranger to GLFC, as she led the team at the Invasive Species Centre from 2015-2019 as they grew the work of the organization to a nationally recognized invasive species policy and management centre of excellence.

We welcome Victoria Fewster, forest health biologist. She is working with Dr. Chris MacQuarrie in forest insect ecology research. She also will be the liaison with provincial forest management agencies to address questions around forest health and insect monitoring. Victoria comes to us from the Ontario Ministry of Natural Resources and Forestry where she worked in various capacities in wildlife biology and management.

Dr. Paul Hazlett, Forest Soils Scientist, retired after 38 years at GLFC. His research focused on terrestrial/aquatic linkages in forest ecosystems and the impacts of atmospheric deposition and forest management practices on nutrient cycling and forest soil sustainability. Thank you Paul for your many, many years of research dedicated to forest soil ecology and sustainable resource management!

Satellite images of global forest cover provide new insights

In a recently published journal article, Dr. Heather Macdonald and colleagues analyzed how satellite images over the past thirty years suggest that a global forest transition has occurred.

British geographer Alexander Mather introduced the term “forest transition” in 1992 to describe a pattern observed in a number of European countries, namely, a shift from shrinking to expanding forest areas. Mather observed a pattern where poor agricultural land abandoned by humans regenerated and contributed to a rebound in forest cover. This inflection point, from declining to expanded forest cover, was termed by Mather a “forest transition”. Since 1992, a significant literature has amassed, documenting forest transitions around the world.

More recently, satellite data have contributed new insights related to the forest transition concept, particularly in quantifying slow changing trends at the global scale. A 2018 Nature article by Song and colleagues concluded that global tree cover expanded between 1982 and 2016, based on analysis of Landsat, Google Earth and other satellite data. While this study confirmed tropical deforestation, it also contradicted other major studies that found global declines in forest cover. The implications of a global forest transition are significant and the change in forest area might constitute the “missing global carbon sink” identified by Le Quéré et al. in a study of the Global Carbon Budget in 2017.

This review presents a view on how satellite data is transforming the literature on forest transitions, as well as exploring the limits of what remote sensing data can tell us. Specifically, satellite data provide less information about biodiversity in forests. Despite the challenges in incorporating information about multiple dimensions of forest transitions, syntheses of forest transitions studies are useful and help shape better reforestation programs. The forest transition concept has proved useful in many contexts, as evidenced by over 3,000 peer-reviewed articles on this topic. Based on the body of evidence presented, afforestation strategies that support expansion or restoration of existing forests are most likely to help to maximize biodiversity benefits.

Read the full article about: "Envisioning a global forest transition: Status, role, and implications", or contact Heather Macdonald.

Does Asian longhorned beetle (ALB) still pose a significant threat to Canadian hardwoods?

In a recently published journal article, GLFC's John Pedlar and colleagues assessed current and future ALB risks for eastern Canada and evaluated potential economic impacts in both urban and natural settings.

The study examined the import-based likelihood of ALB introduction for various urban centres and determined success of insect establishment by generating current and future climate suitability maps. Results showed that for the current period, climatic suitability for ALB was highest in southern Ontario, but is projected to expand significantly northward and eastward by mid-century. High likelihood of ALB introduction was associated with large urban centres, but also smaller centres with high levels of pest-associated imports.

For urban areas, potential costs for the removal and replacement of ALB-impacted street trees ranged from CDN$8.6 to $12.2 billion, with the exact amount and city-level ranking depending on the method used to calculate risk. On the industry side, potential losses of merchantable maple timber were estimated at CDN$1.6 billion using provincial stumpage fees and CDN$431 million annually when calculated using a combination of economic and forestry product statistics. The gross value of edible maple products, which could potentially be affected by ALB, was estimated at CDN$358 million annually. These estimated values can help inform the scale of early detection surveys, potential eradication efforts, and research budgets in the event of future ALB introductions.

Read about "Potential Economic Impacts of the Asian Longhorned Beetle", learn more about ALB, or contact John Pedlar.

Asian long-horned beetle recently declared eradicated from southern Ontario

GLFC's Director of Integrated Pest Management Dr.Taylor Scarr recently discussed the status of ALB with Toronto media.

Asian long-horned beetle (ALB) was first discovered in 2003 in Toronto and Vaughan, ON. Dendrochronology work by Dr. Jean Turgeon showed the insect had been present since 1998 or before. This invasive insect, native to China and the Korean peninsula, likely arrived on wooden shipping crates or pallets. Since 2004, Canada and the U.S. have required that any wooden crates coming from outside North American be heat-treated to kill anything they might contain.

ALB lays its eggs in the bark of hardwood trees. The larvae hatch and bore into the tree where they feed under bark and tunnel into the centre of the tree. Several years of infestation will ultimately kill the tree. Maple is one of the insect's preferred hosts, making this insect a serious threat to the maple syrup industry. Other hardwoods, especially poplars, willows, and birches are also attacked.

The Canadian Food Inspection Agency (CFIA) led an aggressive survey and tree cutting program that culminated in the insect being declared eradicated in 2020. Dr. Jean Turgeon chaired the science advisory panel that included CFIA, Ontario Ministry of Natural Resources and Forestry, cities of Toronto, Vaughan, and Mississauga, Toronto and Region Conservation Authority, University of Toronto, and US Department of Agriculture. The program began with surveys to delineate the infested area, followed by cutting and chipping some 28,000 trees between 2003 and 2007. Infested trees and any host trees within 400 metres were also removed, as it is not possible to detect all the infested trees in a survey. After five years of surveys that found no more beetles or infested trees, the beetle was declared eradicated in the spring of 2013. The caveat at the time to remain vigilant for signs of the beetle proved to be true. ALB was found again later the same year in Toronto and Mississauga likely as a remnant of the 2003 infestation. That discovery initiated a second eradication program in the winter of 2014. This time the cutting radius to remove all host trees around infested trees was increased to 800 m. After five years of negative surveys, CFIA declared the insect eradicated from Canada.

Vigilance is still necessary, as people may have inadvertently spread the beetle, or there could be introductions of this beetle independent of the 2003-2020 infestation. For example, in 2019, ALB was intercepted at a warehouse in Edmonton.

Costs and benefits of regulations for controlling emerald ash borer (EAB)

The Canadian Food Inspection Agency (CFIA) asked researchers from the Canadian Forest Service to evaluate the net benefits of current quarantine regulations in place to slow the spread of EAB. A recently published report summarizes their findings.

GLFC's Emily Hope was the principal author of the report, which was a collaborative effort between researchers from GLFC and the Pacific Forestry Centre (PFC). The CFIA asked for an economic perspective on the Canadian regulations that limit the spread of EAB. The Canadian question was prompted by a pending decision by the United States Animal Plant Health Inspection Service (APHIS) to rescind its national EAB regulations.

The question posed by the CFIA was dealt with in two parts. The PFC group estimated various costs of regulation including those borne by the CFIA and the direct, immediate costs felt by industry. This was completed via in-depth discussions and a survey of industry and CFIA representatives. The GLFC group estimated the benefits of regulation via a Monte Carlo model (a model used to predict the probability of different outcomes) that looked at how various levels of regulation effectiveness would affect the spread of EAB across the country. The value of EAB damage was estimated under different assumptions about regulation effectiveness. The benefits of regulation (i.e., the value of delaying the spread of EAB across the country) were then compared to the costs of regulation.

Results suggest if regulatory measures have even a 10% effect in slowing EAB spread to places not already infested, then the effort could be economically efficient, although the regulations as modeled did not completely stop EAB movement. It follows that delaying damage to ash street trees and rural ash alone is large enough in most cases to justify continuing EAB regulation. Read the full report about the Economic Analysis of EAB Regulations in Canada, or contact Emily Hope.

Emerald ash borer biocontrol program continues in the spring of 2021

A parasitic wasp Tetrastichus planipennisi to control emerald ash borer (EAB) will be released at a site in the city of Pembroke, where EAB was recently detected by OMNRF field staff and verified by CFS.

Eulophid wasp (*Tetrastichus planipennisi*) for biological control of EAB.

In the upcoming field trial, the tiny, non-stinging wasp that attacks the larvae will be released as a natural control agent against EAB, which continues to kill ash trees as it spreads in Canada. Municipalities are faced with the cost of treatment of live ash trees or removal of dead and dying trees. EAB was first confirmed in North America in 2002 and by 2008 it was detected in Ottawa. Researchers from GLFC have been conducting parasitoid releases in Ontario since 2013. The site in Pembroke is a new parasitoid release location for 2021. To-date, 26 sites have been established in Ontario, Quebec and New Brunswick, at which a total of 179,000 wasps have been released.

The research site in Pembroke will not be harvested or developed for the next four or five years. This will allow time for the wasps to establish and for researchers to conduct follow up studies to determine the effectiveness of the wasps in controlling EAB. For more information on the project, contact Gene Jones.

Assessing the climate suitability and potential economic impacts of Oak wilt in Canada

Much of the oak in eastern Canada could be susceptible to oak wilt in the next two decades due to climate change, which could have significant economic consequences.

Oaks (Genus: *Quercus*) are an important group of trees in Canada. They are represented by nine species in the eastern portion of the country (several of which are found only in southern Ontario); one species, Garry oak (*Quercus garryana*), is found in southern British Columbia. Oak wilt is a significant disease of oaks that can cause tree mortality. It's ability to kill trees, plus its management requirements (e.g. restrictions on time of year when trees can be pruned) make it a growing concern to the CFIA, provinces, utility corridor managers, landowners, urban foresters and arborists, and the lumber mills. The probability of it invading Canada is extremely high, given that the disease is present in all states bordering the province of Ontario and has been detected on an island in the St Clair River, between Michigan and Ontario, and within 600 m of the city of Windsor. A recent study, led by GLFC researchers John Pedlar, Dan McKenney, and Emily Hope, examined the potential economic impacts of this disease should it become established in Canada.

Understanding the climatic suitability of an area for a potentially invasive species is important because it helps to define the geographic area at risk. Based on known occurrence locations, species distribution models indicated that suitable climate conditions currently exist for the fungus (*Bretziella fagacearum*) that causes oak wilt to become established in southern Ontario. The climate of southern Ontario is also suitable for the two main sap-feeding beetle species (*Colopterus truncatus* and *Carpophilus sayi*) that act as vectors and carry the fungus from tree to tree. Under climate change, much of the oak range in eastern Canada is projected to become climatically suitable for these species within the next two decades. The models suggest that there may be refugia for bur oak (*Quercus macrocarpa*) in Manitoba and for Garry oak in British Columbia, though these findings are tentative due to the significant uncertainty associated with climate change projections.

Researchers also assessed several potential economic impacts of the disease, including costs related to the removal and replacement of high-value street trees and lost forestry revenues. Based on estimates from an urban tree survey, potential costs for the removal and replacement of oak street trees is expected to vary between CDN$266 and $420 million. The timber value of oak in eastern Canada was estimated at CDN$126 million using provincial stumpage fees and as a CDN$24 million annual contribution to national Gross Domestic Product (GDP) when calculated using a combination of economic and forestry product statistics. Ecosystem services can be challenging to quantify in economic terms, but a preliminary assessment suggested an annual value of CDN$41 million for CO_2 sequestration, storm water runoff, and air pollution removal by oaks in eastern Canada. These values can help inform the scale of eradication and/or management efforts in the event of future oak wilt introductions.

Read the full article on Assessing the climate suitability and potential economic impacts of Oak wilt in Canada or contact John Pedlar.

Forest harvesting changes how long water spends in a watershed

Forest hydrologist Dr. Jason Leach carried out a study to better understand how forest harvesting alters the time water spends in a watershed and what this means for stream water quality.

The time it takes water to travel through a watershed, from when it enters as rain and snow, flows through soils, and ultimately leaves as streamflow, can strongly influence stream water quality. It is well established that harvesting mature trees changes the water balance of a watershed, primarily by decreasing how much water is transpired back into the atmosphere by vegetation. However, it is less clear how forest harvesting might change the time water spends in the soil and what this might mean for how stream water quality responds to harvesting.

To address this knowledge gap, Jason and colleagues used 30 years of chloride measurements (a naturally occurring water tracer) in rain, snow and streamflow from 12 forested watersheds in the Turkey Lakes Watershed Study to estimate the average time water spends in these catchments. Three of the watersheds were harvested in 1997, which provided an opportunity to assess how water travel times change following harvesting. They found that all three harvested sites saw water spend a shorter amount of time in the watershed, compared to unharvested sites. Because water is spending less time in the watersheds following harvesting, it has less opportunity to chemically interact with soils. These harvesting-induced changes in hydrology help provide mechanistic explanations for some of the water quality changes typically seen following forest harvesting.

For more information, contact Jason or read the article: "Travel times for snowmelt-dominated headwater catchments: Influences of wetlands and forest harvesting, and linkages to stream water quality".

A v-notch weir installed at the Turkey Lakes Watershed used to monitor streamflow and water quality.

Recent Publications

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