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Comings and Goings

We wish our Director General David Nanang all the best as he moves on to a new position, welcome Dr. Louis-Etienne Robert and extend congratulations to Bill de Groot for his 2018 CFS Merit Award and recent scientist emeritus status.

David Nanang, Regional Director General of GLFC has accepted a position at the Department of Fisheries and Oceans, effective September 23, as the Regional Director General for the Central and Arctic Region in Sarnia, Ontario. David has been with CFS-GLFC since 2009, serving as Director of Forest Ecology for three years and then as Regional Director General for seven years. He was also the national lead for the Cumulative Effects Program. Danny Galarneau, currently the Director of Planning and Operations at GLFC, will be assuming the duties of Acting Director General pending a competitive process.

We welcome Dr. Louis-Etienne Robert to the Integrated Pest Management Division. He will be working as a term research scientist with Dr. Barry Cooke on the spruce budworm early intervention project, developing population models to assess the interaction between budworm and other ecosystem processes. He has a Ph.D. in Biological Sciences from the Université du Québec à Montréal and a Bsc. in Environmental Sciences from McGill University. He was most recently a statistician at the Institut National de Santé Publique, Québec, working on environmental risk factors of chronic diseases. Previously, he was a post-doctoral associate of Dr. Patrick James at Université de Montréal where he taught statistics and worked on the interaction between spruce budworm outbreaks and forest fire. During these post-doctoral years, he also completed his work on the influence of landscape structure on spruce budworm and forest tent caterpillar outbreaks.

Dr. Bill de Groot was awarded a CFS Merit Award for his many contributions to wildland fire research. Since joining the CFS in 1985, Dr. de Groot's research interests have been in the areas of fire danger rating, fire behaviour, and fire effects modelling. Much of his work has been in developing national and international research applications of the Canadian Forest Fire Danger Rating System for fire management. More recently, his research has focused on studying forest carbon storage and vegetation dynamics under changing fire regimes and modelling wildland fire carbon emissions. Dr. de Groot became a scientist emeritus in June 2019 after 34 years of fire research with CFS.

A tribute to the late Dr. Gerald Robert Wyatt

Dr. Gerald Wyatt, a Canadian biochemist who worked for the Canadian Forest Service in Sault Ste. Marie in the 1950s, passed away in March at the age of 93. He is famous for having helped in the discovery of DNA's double helix.

Upon the establishment of the Insect Pathology Research Institute in Sault Ste. Marie, Ontario, the Canadian Forest Service recruited Dr. Gerald (Gerry) Wyatt, after receiving his Ph.D. from Cambridge University. The mandate of the Institute was the use of environmentally benign microbial agents to manage and control forest insect pest. Gerry worked as a research scientist at the Institute from 1950 to 1954, where he studied the biochemistry of DNA from insects and insect viruses.

Dr. Gerry Wyatt (centre) with CFS researchers (left to right) Drs. Sardar Sohi, Basil Arif, Arthur Retnakaran and John Cunningham.

Coincidentally at that time, James Watson and Francis Crick were attempting to interpret the structure of DNA at Cambridge University and eventually concluded that the DNA molecule exists in the form of a three-dimensional double helix. Watson and Crick developed a theory about DNA, that each of their four bases were bound to each other. The structure of DNA itself however remained a theory until Gerry went on to study the content and ratios of the four DNA bases (adenine, guanine, thymine and cytosine) in 11 insect viruses. After much research, Gerry concluded that there is always the same amount of adenine as thymine, as well as the same amount of cytosine as guanine.

Gerry published his findings (The Nucleic Acids of some Insect Viruses. 1952. J. of General Physiology 36:201-205), which quickly received wide acclaim. One can only imagine the joy of Watson and Crick when they read Wyatt's findings, providing them with a proof on how the DNA strands were bound to each other. Watson and Crick went on to publish the famous manuscript in *Nature* on the "The Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid", where Gerry Wyatt's paper was one of only six references cited. James Watson and Francis Crick went on to receive the Nobel Prize in 1962.

Gerry passed away on March 28, 2019 at the age of 93. His friends and colleagues at the Department of Biology, Queen's University held a befitting memorial to celebrate the accomplishments of this remarkable scientist – accomplishments that started at the Insect Pathology Research Institute in Sault Ste. Marie, Ontario.

GLFC signs Memorandum of Understanding with provincial research institute and two local academic institutions

On May 2, the Great Lakes Forestry Centre (GLFC) signed a five-year Memorandum of Understanding (MOU) for Research, Innovation and Education with the Ontario Forest Research Institute (OFRI), Algoma University, and Sault College.

The MOU is aimed at identifying current and potential areas of collaboration between the four institutes and increasing opportunities for all organizations to share expertise and resources in research, innovation and education initiatives. It recognizes the potential for this relationship to assist each organization in

more efficiently and effectively meeting their respective needs, in strengthening forest science research, education and commercial development in Canada, and encouraging economic growth in the community and beyond.

The MOU provides a variety of opportunities and benefits for all organizations involved. There will be increased opportunities in natural resources, environmental science and forest science research and education that may exceed what the organizations could do separately. There will also be increased sharing of intellectual and technical resources, including faculty and staff expertise and sophisticated research infrastructure and equipment and research sites.

Finally, the development of collaborative research projects, including more competitive research grant proposals as well as the increased participation of GLFC and OFRI researchers as adjunct professors contributing to active mentoring of undergraduate and graduate students, will support an increased collaboration of forest science research and education.

Together, Algoma University, Sault College, GLFC and OFRI will continue to advance forestry research, collaboration and education within Sault Ste. Marie and throughout Canada.

New satellite will help fire managers and scientists monitor wildfires from space

The satellite, planned for launch in 2024-2025, will be used to detect and monitor wildland fires in near real-time, providing valuable information to fire suppression operations.

Forest fire activity across Canada has rapidly been increasing over the last few years due to the effects of shifting climatic conditions, such as shorter winters, hotter summers and less precipitation. Initial attack crews can easily be overwhelmed when there is a large number of new fires and during high intensity fires. Some of these fires escape and can quickly become large, dangerous and very costly to control. An increase in extreme fire events has been seen recently in many parts of the country, including the Fort McMurray and Chuckegg Creek fires in Alberta and throughout much of Ontario's cottage country last summer (Bracebridge, Muskoka Lake, and Parry Sound).

Once operational, data from the new WildFireSat mission will contribute to improved Air Quality Health Index forecasts and air quality advisories.

The Canadian Space Agency has signed a new agreement with the Canadian Forest Service for the design of a satellite mission with GLFC's Dr. Josh Johnston as the principal investigator. The mission combines the expertise of Natural Resources Canada, Environment and Climate Change Canada, the Canadian space

industry and academia. WildFireSat is a dedicated fire-monitoring satellite to provide Canadian fire managers with the best information possible to support emergency fire management. In its finished state, it will involve one or more microsatellites that will be equipped with thermal infrared sensors to measure the heat released from wildfires.

The satellite mission will enable fire managers to monitor all wildfires across the country in near real time, providing valuable information for decision-making strategies. It will assist mangers in suppressing the most dangerous fires, while monitoring others needing less intervention. In addition to improvements in wildfire management, WildFireSat data will also improve the representation of wildland fires in Environment and Climate Change Canada's air quality forecast system, resulting in higher quality Air Quality Health Index forecasts and air quality advisories. In all, it will be a valuable contribution to a new federal government strategy aimed at reducing the impact of wildfires on the Canadian economy and improve the well-being of Canadians across the country through increased safety and security.

Conference on Hemlock Woolly Adelgid Management

Forest health biologist Jeff Fidgen and IPM Director Dr. Taylor Scarr attended the Fifth Annual Hemlock Woolly Adelgid (HWA) Managers' Meeting in Holland, Michigan in late July, to discuss operational issues and needs associated with implementing HWA management programs. The meeting was co-hosted by Michigan, Ontario, and CFS-Great Lakes Forestry Centre.

There were 80 attendees from 39 separate organizations. Participants were able to share progress on research, biological control measures and management of HWA. The US Forest Service's Hemlock Woolly Adelgid National Initiative was established in 2003 and this was the fourth annual meeting held by HWA program managers to discuss operational issues and needs associated with implementing HWA management programs on public and private lands.

HWA is an invasive aphid-like pest from Japan that was first found near Richmond, Virginia in the early 1950s and has since spread across the eastern US. This pest was first detected in Canada in southern Ontario in 2012 with one infestation found in the Etobicoke area of Toronto. A second infestation was found in 2013 in the Niagara gorge below Niagara Falls. Infested trees at both sites were removed under direction of the Canadian Food Inspection Agency (CFIA). In 2017, a fairly large infestation was found in Nova Scotia affecting hemlock over much of the southwest part of the province. Then in 2019, CFIA again found HWA in the Niagara Gorge, and in a nearby wooded area. Given the ability of this insect to persist at low populations and the continual pressure from invasions from the U.S., HWA is expected to continue to invade and spread in Canada. Thus, Canada and the affected provinces need an effective management response, supported by research and collaboration with the U.S. to retain the viability of hemlock in eastern forests. This includes early detection and rapid responses to new infestations and long term management to limit the impact of HWA.

The topical insecticides being used in the US are effective and relatively inexpensive, but are not registered for use in Canada. The insecticides TreeAzin and Ima-jet can be injected into individual trees, but they are very costly compared to the topical treatments. Alternative strategies for combating the pest are required and biological control is likely the best option. In BC, where HWA is a naturalized species, two insect predators, *Laricobius nigrinus* and *Leucopis* spp., have been found feeding on HWA, and have potential as biological control agents. These predators have been released in the eastern US. However, research needs to be done on how these might be produced and released in Canada to mitigate HWA impacts here.

It is expected that HWA will be as potentially damaging to hemlock as the emerald ash borer is to ash, though losses will likely be more protracted due to severe winter cold, which limits population growth and range expansion. However, the southern half of Nova Scotia, New Brunswick and Ontario have

climates conducive to successful HWA populations and significant losses of eastern hemlock are predicted. To meet the challenges of managing HWA, Canadian researchers, regulators, and resource managers will need to collaborate on investments in research, staff expertise, and facilities to develop a made-in-Canada response to HWA detection, control, and management.

A decision framework was recently published to help forest managers in eastern Canada prepare for the decisions and challenges that they will face, from prevention, detection, and control, to hemlock ecosystem restoration and management program evaluation.

How do forest management practices affect carbon cycling in freshwater ecosystems?

Research is ongoing in the Batchawana River watershed of Lake Superior to ensure forest management practices minimize greenhouse gas emissions and protect freshwater resources.

GLFC researcher Dr. Erik Emilson is leading a project with co-investigators from the University of Cambridge, and a Ph.D. student funded through a prestigious Gates Cambridge Scholarship, to investigate the effect of management practices on carbon cycling in forested watersheds. Canada's forests hold the majority of the world's freshwater resources, and recent studies have shown the importance of lakes, rivers, streams, and wetlands in contributing to global carbon cycles. Canada, as global leader in the forest economy, in tandem with its water-rich forest landscape, provides fertile ground for an investigation of how forestry management practices influence the balance between carbon emissions from freshwater ecosystems and the atmospheric carbon captured by forests.

Over the summer, four guest researchers from the University of Cambridge have been working at GLFC with Dr. Emilson and his team to collect samples from streams, rivers, and forest soils within the Batchawana River watershed, including the Turkey Lakes experimental area. The researchers have collected samples from over 200 sites within the watershed and have installed over 160 soil water samplers in the forest floor of Algoma forest stands.

Using advanced molecular-level analyses in collaboration with laboratories in Germany in addition to cutting-edge microbial genomics approaches, Dr. Emilson and his collaborators seek to unravel the processes that control carbon cycling on its hydrological journey from upland to stream, and, in turn, how management practices may affect the transformation of carbon along this pathway. Dr. Emilson is working with local forest management companies – Clergue Forest Management and Boniferro Mill Works – to coordinate collections around ongoing harvest in the area. As an extension to this work, Dr. Emilson is also collaborating on a project led by researchers at Laurentian University to understand the role that forest reclamation plays in carbon cycling in freshwater systemsThe Turkey Lakes experimental area is a reference site for this work.

GLFC arboretum tree inventory now available electronically

Information about trees in the GLFC arboretum can now be accessed online through a web link to a Google map created for this information.

The geospatial database was established with the assistance of students from Sault College's Forest Conservation Program and the site allows arboretum visitors to see the location of each tree. To aid in identifying or matching up the tree to the location on the map, there are plaques and pictures for some of the trees. It also allows visitors to learn about interesting features within the arboretum, such as memorial trees and the person honoured, outlining their contribution to GLFC. Information on some more unusual species, such as ginkgo and northern catalpa is provided. What was originally a paper pamphlet is now electronic, allowing continuous updates as new trees are planted or others succumb to

drought, disease such as Dutch elm disease or insect attack such as emerald ash borer. The arboretum houses over 80 native and non-native trees from various regions across Canada in anticipation of a changing climate. Trees from southern Ontario such as black cherry, black oak and bitternut hickory have been planted to see how well they fare. While Ontario prohibits planting non-native species on Crown land, an arboretum provides a living library of trees and shrubs. Some species, such as such as whitebark pine are at risk in their native habitat, so the arboretum may act as a potential seed source in the future. If you have Google maps on your mobile device and use the link to the GLFC tree inventory, you will be able to navigate to each of the trees while on site, take a tour, see points of interest and photos of former staff who are memorialized. If you prefer, information about the arboretum can still be accessed through our publications website.

Canadian scientists launch Flora of Newfoundland and Labrador website

Susan (Sue) Meades, a freelance botanist and botanical illustrator, and her husband William (Bill), a retired Canadian Forest Service Director from GLFC were the scientists behind this new website.

Originally from Flatrock, Newfoundland, Sue and Bill moved to Sault Ste. Marie in 1995 where Bill worked at GLFC as the Director of Forest Ecology until his retirement in 2009. Sue worked as an adjunct professor at Algoma University for 11 years, where she developed the Northern Ontario Plant Database website and continued doing fieldwork in Newfoundland and Labrador.

Both Bill and Sue have published extensively on the Newfoundland flora. Bill's major research included phytosociological descriptions of Newfoundland's heathlands and forests and publication of the *Newfoundland Forest Site Classification Manual*. Sue was the primary author of the *Annotated Checklist of the Vascular Plants of Newfoundland and Labrador*.

The **Flora** website is a work-in-progress that Sue and Bill are committed to completing. It provides the province of Newfoundland and Labrador with an effective resource for highlighting the beauty of the province's flora. It will also assist in teaching students how to accurately identify the area's floral resources and provide information to resource managers on described vegetation communities. Lastly, their hope is that it will prompt future botanists to continue adding to the knowledge of Canada's easternmost province.

The website includes the following elements:

- The **Annotated Checklist of the Vascular Plants of Newfoundland and Labrador** (S.J. Meades and L. Brouillet 2019).
- **Descriptions** of native NL forest species, with digital images of habitats and close-ups of diagnostic features.
- **Keys** and comparison charts to NL plant families and species, along with an **Illustrated Glossary**.
- A **Photo Gallery** of primarily native wildflower species.
- Additional keys, descriptions and images posted on an on-going basis.

For more information, visit the Flora website or contact Sue Meades.

Publications

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

Publications of interest

Can ice roads be improved to withstand a warming climate?

Computer modelling techniques were used to determine the feasibility of using various ice covers to reinforce bridges on ice roads.

GLFC systems modelling specialist Ning Liu collaborated with colleagues from Environment and Climate Change Canada, the Global Institute for Water Security, and NOR-EX Engineering Ltd. to examine the the feasibility of reinforcing water crossings on ice roads.

Although winter ice roads are an economical and effective means of providing reliable transportation links to remote regions for resource extraction and moving people and goods, they are highly dependent on adequate weather conditions. Climate predictions shows trends towards increasingly warmer winters and it is expected that, in the next 25 years, Canada will see a 13% reduction in winter road accessible land area. Operators establishing ice crossings over rivers and lakes have been facing increased pressure to deliver higher volumes of goods and larger loads in challenging climatic conditions. A question arose from industry: "is there a way to safely provide additional bearing capacity in ice covers and assist with extending operating seasons, possibly through reinforcing the ice?" This study investigated this operational challenge by developing a model to simulate ice reinforcement theories using computer modelling techniques.

An ice reinforcement modelling tool was successfully created and results showed that reinforcing materials were able to stiffen the ice cover, enabling a larger surface area to carry the load. The test results also indicated that the reinforcing material must be considerably stiffer than the ice. These simulations serve as an initial step in evaluating different reinforcement materials and methodologies. Further research is needed to verify the feasibility of using a variety of materials as reinforcement to increase the safe bearing capacity of ice covers as well as evaluate different applications and orientations of the reinforcement to achieve the best outcome. Full-scale field trials will also be required prior to providing a tested solution for commercial use.

Does condition of host tree affect host emerald ash borer performance?

A recent publication by GLFC entomologist Chris MacQuarrie examined the effect of host condition on performance of adult emerald ash borer (EAB).

For invasive species, how successful adult insects are in various life history processes influences how well invaders can colonize and reproduce. Previous studies have examined the effect of host condition on larval performance. This study was designed to test how the health of an ash tree influences the condition of adult EAB that develop within it. Healthy trees were girdled to simulate poor host condition and then both artificially and naturally infested by EAB. The ensuing adults that developed and emerged were then assessed for their success in terms of number, lifespan, size, mating success and fecundity. The results showed that more insects emerged from damaged trees, that they were slightly larger but did not live as long. However, these effects were not strong and it appears that performance of insects on healthy trees is similar to the performance of insects on damaged trees. This finding has applications in predicting how

EAB populations grow during different phases of an outbreak or new infestation where trees may be declining in condition.

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