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The Great Lakes Forestry Centre (GLFC)

Comings and Goings

We welcome Danielle Hudson, Physical Hydrologist; Patrick Deane, Forest Fire Research Specialist; Emily Smenderovac, Bioenergy Analyst; Matthew Ansell, Forest Fire Modeling Specialist; Colin McFayden, Forest Fire Knowledge Exchange Project Leader; and term staff Dr. Morgan Crowley, Forest Fire Research Scientist; Dr. John Boakye-Danquah, Research Scientist; and Kerry Perrault, Indigenous Liaison for the Cumulative Effects project.

We wish a happy retirement to Lillian Pavlik, Molecular Virology Technologist; Kevin Lawrence, Geographical Information Systems Analyst; and Sharon Hooey, Tissue Culture Technician.

Introducing two of GLFC's newest research scientists

Dr. Morgan Crowley uses remote sensing observations from multiple satellites to support fire monitoring and management.

Dr. Crowley is a new member of the WildFireSat mission and will lead Tier 2, which will focus on fire behaviour monitoring through data synthesis with other satellites. As part of this, she is working on a framework and methodology for synthesizing data and communicating uncertainties from multiple satellites for operational fire monitoring. Prior to joining GLFC, Morgan finished her PhD in Renewable Resources at McGill University in March 2022. In her PhD, she used Google Earth Engine to reconstruct burned area progressions with Landsat, Sentinel-2, and MODIS data in collaboration with researchers from the Pacific Forestry Centre. Morgan is also working to increase accessibility to cloud-based remote sensing through open-access data and resources. As part of this, she helped co-edit a newly launched Earth Engine textbook www.eefabook.com and is a contributor to the "Ladies of Landsat" community that works to builds inclusivity in the geosciences. For more information, contact Morgan.

Dr. John Boakye-Danquah will explore tools and methods for advancing cumulative effects assessment.

Dr. Boakye-Danquah research broadly focuses on human dimensions of environmental change and how collaboration between different knowledge systems and/or actors improves the sustainability of socioecological systems. Specific research areas include forest ecosystem services and human well-being; sustainability of small-scale forest landscapes; forest certification; vulnerability and sustainability assessment; and social diversity and inclusion in the natural resource sector. In particular he is interested in how to advance inclusion in science. For more information, contact John.

Can Canadian tree species migrate fast enough to keep up with climate change?

Recently conducted simulations of range shifts via natural migration and suitable climatic habitat show limited ability of Canadian tree species to keep up with climate change.

Previous work, including work from the CFS, used species distribution modelling (SDM) to better understand how climate affects where tree species grow and how those suitable climate conditions could change in the future. These earlier models found that the climate where tree species currently grow (i.e., suitable climate) could shift by hundreds of kilometers in Eastern Canada by the end of this century. However, few models include species-specific migration ability, precluding the ability to evaluate whether trees can track projected changes. A project led by Dr. Laura Boisvert-Marsh and her collaborators, including John Pedlar, Dr. Isabelle Aubin, and Dr. Dan McKenney, conducted simulations of tree migration for 10 tree species over 90 years using more realistic range shifts based on species-specific migration ability and climate suitability. An important aspect of this work is the development of a novel method that integrates readily available information from the scientific literature (common seed fall distance, migration velocity, and traits related to long-distance dispersal) into kernels that quantify the species-specific probability of tree dispersal events. The study found that the simulated shifts at the northern edge did not keep pace with climate change for all 10 tree species, even under more moderate climate change scenarios. Moreover, large portions at the rear edge (southern Quebec and southern Ontario) become partially or completely climatically unsuitable for many tree species by the end of the century. This study underlines the limited extent to which trees will be able to track climate change via natural migration, informing forest conservation and restoration efforts in light of projected changes.

Read the full publication "Migration-based simulations for Canadian trees show limited tracking of suitable climate under climate change" or contact Laura Boisvert-Marsh or Isabelle Aubin.

New study finds that viruses play a large role in regulating forest carbon cycling in aquatic ecosystems

A recently published study shows that viruses play a major role in the global carbon cycle, by changing the structure and function of microbial communities that decompose forest leaf litter in lakes.

GLFC scientist Dr. Erik Emilson has been collaborating with Dr. Lucas Braga and other scientists at the University of Cambridge over the past several years, and together they designed a unique lake sediment mesocosm experiment to study how forest leaf material decomposes in lakes. Through several publication over the past few years, they have found that forest composition changes affect the microbial communities living in sediments to the degree of altering carbon dioxide and methane emissions from lakes at globally significant rates.

More recently, the wealth of high-resolution genomics and molecular data that the scientists collected from the mesocosm study was re-investigated by an environmental virologist, Dr. Braga, who co-authored this report with Dr. Emilson and others. In this study, researchers found 156 different viruses living in the sediments, many of which are unique to these habitats. Results of the study also showed that the viruses affected the type of carbon that was present

in the water by rewiring microbial metabolism, and by killing microbes and reducing overall decomposition of forest leaf litter. This viral-mediated effect was big enough to have measurable effects on water clarity and to offset some of the global changes observed in forested lakes over the past few decades. Results of this study suggest that viruses have a bigger role in natural systems than was previously thought. By acting like predators of bacteria, they feedback onto the role that aquatic bacteria play in breaking down forest runoff and influencing the global carbon cycle.

Read the full report on the role that viruses play in regulating forest carbon cycling in aquatic ecosystems, which was published in PNAS (Proceedings of the National Academy of Sciences of the United States of America). For more information contact Erik Emilson.

Studying wolves in the Algoma Highlands

Wildlife biologist Phil Wiebe has been involved in a wolf study in collaboration with the Algoma Highlands Conservancy (AHC) and other partners.

In May 2021, a three-year collaborative wildlife research project was started by the AHC with the purpose of learning how wildlife interacts with various human-made landscape features within the southern Algoma Region. The project was initiated by two retired CFS research scientists: Dr. Kees vanFrankenhuyzen and Dr. Dean Thompson and by Paul McBay, retired MNRF forester. Five sites were chosen that contain a variety of human-made features, including high voltage transmission line corridors, extensive networks of forest roads and trails, wind turbines, and agricultural land. All these landscape variables are likely to influence habitat availability and use by various wildlife species both directly and indirectly through interactions that are not well understood. Phil advised on experimental design and animal capturing procedures and has assisted with field activities in all aspects of the study.

Data is being gathered on the presence and movements of species such as moose, bear, fox, bobcat, wolves and coyotes by using a combination of ground observation, trail cameras, satellite telemetry and DNA analysis. These advanced technologies allow accurate identification and monitor local wildlife communities within the study sites. Wolves are of particular interest because they play a critical role as apex predators in healthy well-functioning ecosystems.

In March 2022, two wolves were radio collared, including a young female nicknamed "Ruby", who has travelled 2500 km in four months, with a total straight-line distance of about 1000 km. The journey included crossing the Ottawa River, requiring her to swim 500 – 1000 m through flowing water. Extreme long-distance travel can be a result of juvenile grey wolves looking for a mate and a new territory. This type of movement, known as dispersal, is crucial to ensuring a balanced ecosystem. Travelling long distances and settling into new habitats allow animals to avoid competition, reduce their risk of inbreeding and access fresh resources. However, long-distance dispersal also involves a greater risk of mortality through energy expenditure, predation, unfamiliar habitats, landscape features and human conflict.

"Ruby", the wolf that was radio collared.
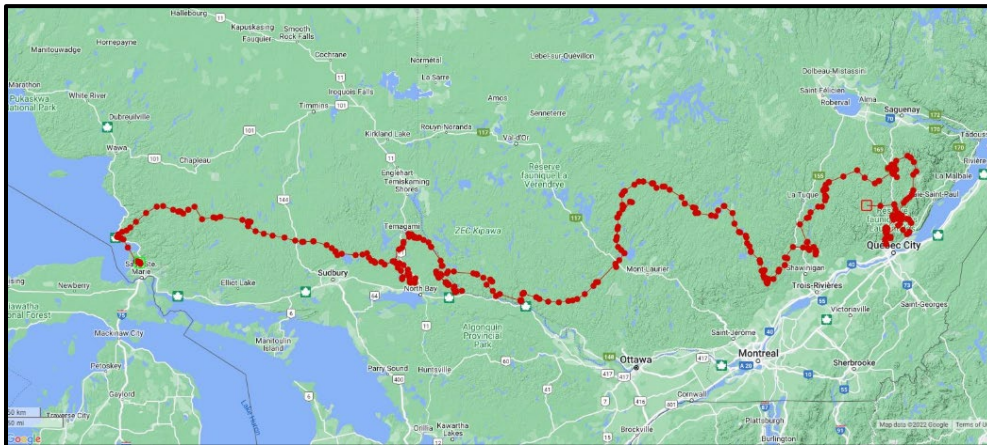
Ruby's 2,500 km trek east from her capture location to the Laurentide Wildlife Reserve in Quebec.

Gaining a better understanding of how all these wildlife species interact with one another, move through and use various habitats, and respond to human-induced changes in the landscape is fundamental to protecting ecosystem integrity. Results from this study will also help inform managers on potential mitigation measures to reduce interactions between predators and species at risk, such as boreal woodland caribou, that have been recently increased due to human disturbance. To learn more about Ruby, follow the AHC blog posts. For more information on the project contact Phil Wiebe.

Insect trapping with the Algoma Highlands Conservancy

GLFC entomologist Dr. Amanda Roe partnered with the Algoma Highlands Conservancy to establish a study that will monitor insect diversity over time.

Declining insect populations have become a significant concern in recent years, especially with increasing pressure of climate change, habitat degradation, and pollution. Population reductions and biodiversity loss in this essential community will have far reaching effects on ecosystem functions and services, so understanding the cumulative and interactive effects of these stressors on insect diversity is critical to help mitigate these losses. However, detecting changes in insect communities requires baseline biodiversity data and long-term monitoring.

A new project is underway to develop a pan-Canadian baseline of insect diversity. This work is part of a Genomics Research and Development Initiative (GRDI) Shared Priority Project called GenARCC (Genomic Adaptation and Resilience to Climate Change), which leverages genomic resources to predict the biological impact of climate change on Canada's ecosystems. The project is a multi-agency collaboration led by Agriculture and Agri-Food Canada that will collect standardized insect samples from a range of habitats over the next 5 years. These collections will form the foundation of a comparative baseline of insect diversity across Canada.

Sites were selected that were likely to still be accessible and relatively undisturbed for the foreseeable future. With this in mind, the team partnered with Algoma Highlands Conservancy (AHC) to create a monitoring site north of Sault Ste. Marie, Ontario. AHC is a not-for-profit corporation that was established to protect the integrity of a section of the Algoma Highlands. AHC encompasses ~1,180ha, and consists of a mosaic of hardwood forests, sheer rock cliffs, and wetlands. By partnering with AHC, local baseline insect biodiversity data can be provided that can be used to track temporal changes in insect species and populations at this site.

This summer, AHC and GLFC deployed Malaise traps (tent-like contraptions) to collect standardized flying insect samples throughout the season. When insects fly to the peak of the trap, they are trapped in a sample jar, then collected and preserved for analysis. Field crews set up two traplines to explore spatial variation in insect diversity, one along the base of Robertson Cliffs and another at the top. Samples were collected twice a week from June to September, which will allow quantification of temporal changes in insect populations throughout the season. Typically, Malaise trap samples require time-intensive sorting and identification. Here, metabarcoding will be used, a high-throughput sequencing approach using a standardized molecular marker, to streamline identification and diversity assessment. Ultimately, the plan is to return to the selected sites over time (5 to 10-year intervals) to repeat the sampling and assess for any changes in diversity.

Partnerships with NGOs such as AHC provide unique research opportunities to document the vast biodiversity of our local environment and contribute to our understanding of the impact of anthropogenic change on our insect communities. For more information contact Amanda Roe.

Field crew installing lower Malaise trapline.

Active Malaise trap.

Former CFS employee leaves legacy of trees

Overview: The late Robert (Bob) Diotte wished to recognize the French and Finnish contributions to Sault Ste. Marie and the surrounding area by having trees planted after his passing.

Each of the planting sites chosen has a direct or indirect connection to the Finnish and French-Canadian settlements in the area. In addition to the grounds of the Great Lakes Forestry Centre, planting locations to date include: École publique Écho-des-Rapides; the Ontario-Finnish Resthome; Sault College; Parks Canada - Sault Ste. Marie Canal; and Algoma University. Two tree species were selected: bur oak *(Quercus macrocarpa)* and Freeman "Autumn Blaze" maple (*Acer* x *freemanii*) – a hybrid of silver maple and red maple. Both trees are native to Canada and are especially tolerant to adverse soil and climate conditions including drought, high levels of soil moisture and road salt. Many of these trees will likely be exposed to these conditions, given their planting locations.

Bob passed away in December 2016 at the age of 77. He entered the federal civil service as an information officer in his hometown of Sault Ste. Marie in 1967 before moving to Ottawa in 1974. He worked in communications for several ministries including Forestry Canada, which would later become the CFS. Bob volunteered for a number of local charities, so it is fitting that his legacy will live on in Sault Ste. Marie for generations to come. He must have been fond of the Greek proverb: "A society grows when people plant trees in whose shade they will never sit."

Recent Publications

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