Natural Resources Canada | Ressources naturelles Canada
The Great Lakes Forestry Centre (GLFC)
e-Bulletin
Issue 39, January 2020
Canada

Comings and Goings

Welcome to Ms. Angela Majic and Dr. Brian Kielstra.

Angela Majic joined the Great Lakes Forestry Centre (GLFC) as the Senior Policy Advisor, effective October 18, 2019. She was previously working at Natural Resources Canada headquarters in Ottawa. Angela has a BA from Algoma University, a Diploma in Public Policy and Administration from the University of Guelph, and a Master's Degree in Political Science from Carleton University.

Brian Kielstra started as a Post-Doctoral Research Scientist in the Cumulative Effects program on November 4, 2019. He is interested in the cumulative effects of natural and anthropogenic stressors on terrestrial and aquatic ecosystems at landscape scales. Brian completed his Ph.D. at the University of British Columbia, his M.Sc. at Queens University, and his B.Sc. at the University of Guelph.

Wildland Fire Canada 2019 conference held November 18-21 in Ottawa

Kudos to GLFC's, Mike Wotton, research scientist and Natasha Jurko, geospatial fire technologist, and to Ontario Ministry of Natural Resources and Forestry (OMNRF) Bill Cole, science and technology program leader, for leading the organization and delivery of a very successful Wildland Fire Canada 2019! This biennial conference brings together a network of fire management agencies from across Canada. Mike Wotton took the stage as the conference chair, and GLFC fire scientists contributed widely to this year's conference with the theme "New Paths, New Partnerships", highlighting research and technology on wildland fire initiatives as well as working to forge strong new partnerships in the fire community.

Wildland fire is ecologically essential for forest health in Canada, but can also be a threat to public safety, forest communities, timber values and infrastructure. Fires can result in evacuations, health impacts due to smoke, property loss, and loss of employment and business income. Members of the GLFC fire research team were able to share the progress on many of their projects. While the descriptions below identify the key contact person at GLFC, for each component, almost all of the work is collaborative.

The Government of Canada, with GLFC's Josh Johnston, research scientist, as the lead, is developing a satellite system dedicated to wildfire monitoring that will be launched in 2024. Data acquired with the WildFireSat will provide fire monitoring information on location and intensity of fires for the whole of Canada on a daily basis, more specifically in the afternoon when fire activity is at its peak. This promising new source of operational fire intelligence will allow wildfire managers near real-time access to information within 30 minutes of its acquisition. The data will also be used for carbon emission reporting and smoke and air quality forecasting purposes.

Apart from its direct benefits, WildFireSat is meant to serve as a stepping-stone towards the achievement of a longer-term goal: the realization of a future, potentially commercial satellite constellation that would provide global, continuous, near real-time wildfire monitoring services.

In anticipation of the wider use of satellite-based data to support situational awareness during fire suppression, fire researchers tested the potential accuracy of satellite-based rate of spread approximation techniques using simulation methodology. Tom Schiks, PhD student, presented on the influences of spatial and temporal scales of image acquisition, knowing that using erroneous, obscured or missing data can lead to dubious inferences about fire growth.

Vast quantities of imagery in multiple spectral bands including visible and infrared have been collected to study fires. These data are often interpreted using manual or semi-automated methods such as analysis tools in a Geographic Information System, freehand vector drawing and human visual interpretation. Application of computer vision techniques to fire imagery is an expanding field. Alan Cantin, forest fire

geospatial analyst, is testing of multiple methods to improve speed and accuracy for segmenting forest fires from thermal infrared imagery. The most reliable and best tactical techniques will be implemented in a single automated computer program.

Fire researchers are working to continually improve warning and danger rating methods. With the long history of quality data now available and the changing climate, it may be time to revisit some components of the fire weather index, the main 'face' communicating hazard to the public through its Low, Moderate, High and Extreme categories. In Ontario, the thresholds that determine these categorizations date back to the 1970's and many other jurisdictions in Canada have a similar history. Chelene Hanes, physical scientist, is using a modelling technique to explore how the occurrence of human-caused spring fires is influenced by the previous fall's Drought Code, overwinter precipitation and Fine Fuel Moisture Code. Eight regions in Alberta and Ontario were studied and while the effects varied by region, the previous year's drought did have an effect on spring fires, indicating the need for a method to account for the previous season's drought code.

Tom Sywstun, forest fire systems modelling specialist, is working on a national scale fuel type map. It is designed to be a 250 m-resolution grid-based map that extends over the land area of Canada and 50 km into the contiguous United States and Alaska, compatible with the forest inventory-based variables. The map is needed for Canada-wide projections of daily fire behavior potential and for longer term risk analyses. It will also be useful in jurisdictions that do not have provincial/territorial forest inventory information, or where there are gaps in coverage.

Developing accurate estimates of current and future fire risk will help fire management agencies identify and prioritize critical at-risk areas. Xianli Wang, research scientist, has been developing a series of Canada-wide, baseline fire characteristics and fire risk maps for current and future climate change scenarios across Canada. At a landscape scale, he is looking into fire risk and evacuation capabilities in isolated, high-risk communities. The project incorporates community-specific variables beyond the standard Wildland-Urban-Interface (WUI) concept and will investigate the triggers for evacuation calls, which are crucial for the safety and security of Canadians in the isolated communities.

Sandy Erni, post-doctoral research scientist, provided an overview of her work on quantifying fire risk. The implementation of such a standard would be helpful during times of complex decision-making in fire suppression.

On a lighter note, Natasha Jurko presented a poster on "Flammagenitus", the World Meteorological Organization's new name for pyrocumulus or pyrocumulonimbus clouds, referred to as "pyroCb's" in the wildfire world. These impressive clouds that build from the heat of a wildfire can tower as high as 15 km and reach the lower stratosphere. They can be responsible for intercontinental smoke transport, create their own lightning and even start new fires. The term in Latin means "generated from heat" but is largely unknown in the fire community. Consult the spring edition of the Canadian Wildland Fire and Smoke Newsletter to read the full article.

62nd Annual Forest Pest Management Forum held in Ottawa December 3-5, 2019

The Forum is the largest and most significant gathering of forest pest management experts, managers, and practitioners in Canada. The objective is to share information on current and future pest conditions, pest control operations and environmental issues. GLFC entomologists contributed to this year's conference.

Chris MacQuarrie, research scientist, provided an update on the management of emerald ash borer, the most significant forest pest in eastern Canada that has killed hundreds of thousands of trees since the time it was discovered in Windsor, Ontario in 2002. In recent years, management research of the insect has

included the release of biological control agents throughout Ontario, Quebec and, in 2019, New Brunswick, including the successful introduction of two larval parasitoids *Tetrastichus planipennisi* and *Spathius galinae*, and an egg parasitoid *Oobius agrili* at multiple sites. Research into the ecology and management of the insect within the expanding range has shown that the polar vortex of early 2019 may have significantly decreased the overwintering survival of EAB in the northern part its range in Canada but less so in the south. However, these estimates of overwintering mortality may need to be modified based on evidence of increased cold tolerance in one population in western Canada.

Chris also shared his work on collaborative sampling for cottony ash psyllid (CAP) (*Psyllopsis discrepans*) across Canada. CAP is a non-native pest of black ash (*Fraxinus nigra*), Manchurian ash (*Fraxinus mandshurica*) and Mancana ash (*F. mandshurica* 'Mancana') in western North America. Recent outbreaks in Edmonton, Saskatoon, Winnipeg, Montana and North Dakota have resulted in high ash mortality and significant expenditures by communities to manage and remove dead and dying trees. Infestations of the insect in Canada have been reported dating back to the early 2000s but only as far east as Winnipeg. In the summer of 2019, a cross-Canada survey using a network of collaborators to determine the range and phenology of the insect across the country was initiated. A related project using samples from this survey will examine the population genetics and bacterial associates of CAP.

Jeff Fidgen, biologist, shared his work on detecting the hemlock woolly adelgid (HWA) with sticky traps. HWA is a non-native pest of hemlocks (*Tsuga* sp.) in eastern North America that has killed up to 95% of the eastern hemlocks in some forest stands in the U.S. It is difficult to detect at low density because it tends to concentrate in the upper crown, which is out of reach for most foliage sampling tools. However, tiny first instar nymphs, called crawlers, often dislodge from the upper canopy and fall to the ground. He assessed the efficacy of sticky traps in intercepting these dislodged crawlers when HWA densities were low. He found that traps needed to be in the field for only 5-6 days, provided that this period coincided with the peak of crawler activity. Placing a group of two traps on the periphery of hemlock stands at 1 km intervals during peak activity of the crawler stage of the sistentes generation can be an effective way to detect the presence of HWA. More information on HWA management options, a technical note on these detection tools and other HWA publications is on our website.

A day on the land in Garden River First Nation

A greater understanding of Indigenous perspectives was gained from a unique day on the land, where scientists and elders had a chance to meet in the forest and discuss issues of concern.

On September 17, 2019 representatives from the local Indigenous community, Garden River First Nation (GRFN)/Ketegaunseebee, met with staff from GLFC and together spent a "Day on the Land" listening to Indigenous voices. It began on the Garden River First Nation Pow Wow grounds with a Water Ceremony by Counsellor Sue Ann Bell-Chiblow. Participants then walked through the old growth white pines where Indigenous Knowledge Keepers and scientists engaged in informal discussions to share their perspectives.

A sharing circle allowed the 70 participants (including staff from the GLFC, Invasive Species Centre, the Ontario Forest Research Institute, Sault College and GRFN youth) to present their thoughts on the day. It was felt that by actually meeting on the land, a greater connection between Forestry Centre staff and GRFN community members was forged.

The day concluded with a visit to a sacred place, Ketegaunseebee's "Trap Rock". Discussion here included shared forestry and environmental concerns. Ideas for possible future projects included:

1. collecting white pine seed, greenhouse rearing and planting project to regenerate white pine at GRFN;

2. together establishing plots in GRFN to monitor vegetation changes over time, regenerating and improving the quality of trees for forestry on the north side of the highway; and
3. looking for ways by which to incorporate Traditional Ecological Knowledge into the development of herbicide alternatives.

Plans for a "Part 2" and continued discussion are underway but immediate connections and reconciliation were gained from this "Day on the Land". For more information contact Travis Jones, indigenous engagement and science advisor.

GLFC to contribute weather data to a community collaborative

A precipitation measurement station has been installed at GLFC and measurements will be shared with a volunteer network.

GLFC will soon start contributing weather observations to CoCoRaHS: the Community Collaborative Rain, Hail and Snow Network that measures, records and maps volunteer observations of precipitation across Canada and the United States in real time. The network is a unique, non-profit, community-based group of volunteers of all ages and backgrounds interested in providing more high quality observations of precipitation. The network is always looking for more volunteers, so GLFC has signed up. Researchers at GLFC have been involved in climate mapping for over 20 years and their work is widely used throughout North America. Two examples are The Climate Atlas of Canada (climate atlas) and Climate Data Canada (climate data) web portals. These are great resources for people interested in Canada's climate and how it may change in the future.

Installation of a CoCoRaHS rain gauge at GLFC.

The Cumulative Effects Program Workshop

Cumulative effects research will help ensure that environmental aspects are considered in resource development, and will help maintain the environmental reputation of the natural resource sector, ensuring competitiveness.

The CFS Cumulative Effects (CE) Program held a Research Coordination Workshop in Ottawa, November 5-7, 2019. Around 40 CFS staff attended the workshop, including many CFS scientists, several researchers from Environment and Climate Change Canada working on caribou and researchers from across NRCan working on cumulative effects to support regional assessment.

A key outcome of the workshop was the strengthening of current partnerships and identification of future opportunities to collaborate on research projects related to CE and caribou. Building on the recently released CE National Research Agenda, the workshop identified and explored gaps and priorities for caribou and CE research. These included indigenous engagement, knowledge and data sharing, multi-species approaches, social science, and tools/techniques to avoid, minimize, and mitigate cumulative effects on forest ecosystems in the context of resource development activities.

The workshop also featured well-received panels on data sharing and indigenous engagement. Researchers gained knowledge and tools on how to develop a data plan, how to contribute to open data platforms, how to engage with indigenous peoples and organizations as part of their research, and how to consider indigenous knowledge when trying to address research questions. The panels served as a good starting point to address identified gaps in data storage capacity, data sharing agreements with provincial and territorial partners, and guidance and support for Indigenous engagement in research.

Federal – Provincial Research Agreement recently updated

Representatives from GLFC and the Ontario Forest Research Institute, conveniently situated next door to each other, recently met to provide updates on the status of their respective projects.

The Memorandum of Understanding Concerning Cooperation in Forestry (MOUCCF), established in 1943, continues to be an effective means of fostering collaboration between the Ontario Ministry of Natural Resources and Forestry (OMNRF) and Natural Resources Canada's Canadian Forest Service (NRCan-CFS). The current MOUCCF covers the period 2016-2021. The agreement facilitates the sharing of information on priorities, organizational changes, and key research projects being undertaken within each organization and encourages new opportunities for collaboration.

NRCan-CFS and MNRF collaborated on 23 projects in 2018-19. Many of these projects included partners from Indigenous communities, academia, non-governmental organizations and the forest industry. Major achievements and research findings continue to be communicated through presentations and publications within each organization, at international conferences, and through informal conversations and published in both internal documents and peer-reviewed journals. All activities undertaken through the MOUCCF are in line with current federal and provincial priorities.

Collaboration focuses on, but is not limited to, the following priorities: Sustainable Forest Management, Forest Health and Productivity, Information and Knowledge, Wildland Fire, International Issues, Health and Safety, Human Dimensions, and Sharing Equipment and Expertise.

Highlights from this year's agreement included:

- Twenty-year assessments of white pine shelterwood studies led to changes in harvesting and silviculture guidelines for the Great Lakes-St. Lawrence and boreal forests.

- Preliminary results from studies of biomass removal and wood ash application showed that spreading post-industrial bioash on forested lands appears to be a viable practice.
- LiDAR was shown to be a cost-effective forest inventory method for detecting and assessing habitats for birds and stream invertebrates.
- Multi-year studies provide knowledge of distribution and habitat needs to refine policies and practices for the coexistence of harvesting and forest dwelling caribou along Lake Superior.
- Community engagement and information sharing activities with Indigenous communities were carried out by staff in both organizations to facilitate participation in forest monitoring, science activities, business planning and joint ventures in the forest sector.
- Early detection and diagnostics of forest insect and disease issues is facilitated by an effective collaborative partnership among the Invasive Species Centre, federal and provincial staff.
- A suite of major detection tools (e.g., traps, lures and remote sensing applications for emerald ash borer and hemlock woolly adelgid) were developed.
- A 2017-18 annual report on forest health was prepared and distributed widely.
- Procurement and analytical methods were shared between federal and provincial analytical labs resulting in time and financial savings.
- Collectively, project results influenced changes in forest management practices and policy at both provincial and federal levels that increased fibre availability while protecting the environment.

Webinar on a model to protect caribou habitat connectivity

On December 4, 2019 scientist Denys Yemshanov, research scientist, presented his modelling work on caribou habitat connectivity in managed forest landscapes.

Industrial forestry in boreal regions increases fragmentation and may negatively impact the viability of some wildlife populations, particularly the woodland caribou, *Rangifer tarandus*. Caribou protection measures often call for changes in operational forestry practices, which may increase the cost and/or decrease the availability of timber supply. Denys presented a linear programming model and case study that explored trade-offs between caribou habitat protection and harvest objectives. The habitat protection objective is formulated as a spatial network connectivity problem, while the timber harvesting objective maximizes net revenues from timber harvests subject to even harvest flow constraints, harvest volume targets and other environmental sustainability constraints.

The case study examined this problem in the Armstrong-Whitesand Forest of northwestern Ontario, a boreal forest area with prime caribou habitat. His problem formulation also incorporates Ontario's Dynamic Caribou Harvesting Scheduling (DCHS) concept – a harvest policy that is currently in place that aims to balance harvesting and caribou protection objectives in northern boreal regions. In the study area, the implementation of DCHS appears to have relatively minor impact on timber supply cost. Comparatively, maximizing the protection of caribou habitat would lead to a more noticeable increase of the timber unit price. The model is generalizable and can be adapted for practical applications of assessing habitat recovery and industrial harvest goals.

His presentation is posted for download and all previous webinars are also archived there.

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

Could ash application emulate wildfire effects?

Research scientist Paul Hazlett co-authored a recent journal article that examined whether the application of bioenergy ash would emulate the effects of wildfire on upland forest soil chemical properties. His analysis showed that both wildfires and bioenergy ash can reduce forest floor C and N pools, but losses of C and N following wildfires are much greater. From the perspective of maintaining soil C and N stocks, therefore, timber harvesting followed by ash application may present benefits when compared to burning by wildfires. Both wildfires and bioenergy ash applications increase extractable P, exchangeable Ca and pH in surface mineral soils. Although bioenergy ash applications can trigger larger increases in available P and pH in surface mineral soils than wildfires, controlling dosage rates could be used to attenuate some of these effects.

New Knowledge Exchange Products

GLFC recently published two Frontline Express reports: 2-page publications that provide a summary of scientists' work in a less technical language than may be in journal articles. There is also a new GLFC Information Report.

Frontline Express #84 summarizes the results of an investigation into the carbon stocks present in boreal mixedwood forests. Results showed that carbon stocks and the rate of carbon absorption were higher compared to other boreal forest types. This information may be useful in forest management decisions and practices for Canada's boreal forest, such as in relation to restocking and timing of harvesting to optimise carbon sequestration and climate change mitigation.

Frontline Express #85 outlines the use of new DNA-based techniques to measure bioindicators of forest integrity are outlined. Data from these studies can provide important information on changes in the biodiversity in soil or water in response to alternative forest management practices. The development of these methods results in cost-effective, ecologically relevant, sensitive and standardized indicators, which is an essential component of biomonitoring.

There is also a new GLFC Information Report, co-authored by Kim Chapman, biologist, and Ken Baldwin, forest ecologist, provides a comprehensive overview of the Canadian National Vegetation Classification (CNVC), including its rationale, history, partnerships and methodology. It presents the classification framework and documents methods employed for the development of the CNVC system, including information sources and the expert review process. It also describes CNVC products to date, which are available on the CNVC website and on our publications website.

Recent Publications

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