Natural Resources Canada Ressources naturelles Canada

Issue 46, June 2022

e-Bulletin

The Great Lakes Forestry Centre (GLFC)

Spongy moth selected as the new common name for *Lymantria dispar*

“Spongy moth” was chosen by the Entomological Society of America (ESA) to replace the previous name, "gypsy moth," which was removed because it was considered a derogatory term for the Romani people.

The name spongy moth reflects an important feature of the insect’s biology, which is the sponge-like egg masses where the insect spends 10 months of its life cycle. It is also a translation of the French name "spongieuse". The primary way the spongy moth spreads is via egg masses that are incidentally transported on firewood, outdoor equipment, and vehicles. Thus, the public‘s ability to recognize the egg masses is essential in slowing its spread. Spongy moth, which is now widespread in the northeastern United States and eastern Canada, costs hundreds of millions of dollars each year in damage as well as in prevention and control efforts.

The name "spongy moth" was recommended by a working group that included more than 50 scientists and professionals who work in research or forest management settings in both the United States and Canada, as well as Romani scholars working on human rights issues. GLFC’s Dr. Chris MacQuarrie was part of this group. More than 200 name proposals were evaluated, and a list of seven finalist names was shared with these groups for consideration before the final decision was made.

The name spongy moth will now be adopted for use in articles published in ESA's scientific journals and in presentations, social media, and public policy documents. While use of the new name may take some time, ESA encourages other organizations and individuals who work in research or management of
L. dispar to transition to the use of "spongy moth" as time and resources allow. GLFC has updated its Frontline Express to reflect the name change.

Emerald ash borer tolerates cold surprisingly well

A recent study published in Current Research in Insect Science *shows that emerald ash borer (EAB) can adapt to temperatures as low as -50°C, which is about 20 degrees colder than originally thought.*

GLFC entomologists Drs. Chris MacQuarrie and Amanda Roe collaborated with Brent Sinclair from Western University to study how EAB populations survived an extreme polar vortex event in Winnipeg, Manitoba in 2019. Previously, Sinclair showed that EAB from southern Ontario died when winter temperatures dropped to -28°C. In this new study, researchers compared the cold tolerance of Winnipeg insects and to those from southern Ontario. On average, the Winnipeg insects froze at -46°C, with some surviving at temperatures down to -50°C. These results were significantly lower than previously published results.

The next year, the team explored how these Winnipeg EAB became so cold tolerant – was it adaptation or evolution? Insects from Winnipeg were split into two groups — one was exposed to a southern Ontario winter and the other exposed to Winnipeg-like conditions. The southern Ontario group were only able to survive temperatures of about -30°C, while the Winnipeg group survived the extreme winter temperatures seen previously. These results surprised researchers and showed that EAB were able to quickly adapt their physiology to respond to local environmental conditions. This plasticity or flexibility in EAB cold tolerance means that this invasive species can survive in Canada anywhere ash can grow. Researchers will use this information to help predict EAB survival in northern locations, which will contribute to risk assessments for forest management. Winnipeg, like many other western cities have a large component of ash in their urban canopy, and EAB poses a significant threat to these communities.

Read the full article on how Plasticity drives extreme cold tolerance of EAB during a polar vortex.

Plant hardiness zones map continues to be widely publicized

The Plant Hardiness Zones map will be included in Home Depot's "Veggie and Herb Gardening Calendar", which has some 555,000 subscribers.

Canada´s plant hardiness zones are well known to Canadian gardeners and provide insights about what can grow where. The original hardiness indices and zones were developed in the early 1960´s by Agriculture Canada scientists using regression models of several climatic parameters and plant survival data from numerous locations across the country. Since that time, Canada´s climate has changed, and climate mapping techniques have significantly improved. GLFC's Dr. Dan McKenney and his team have done multiple updates to the original work using thin plate splines – a sophisticated modern mathematical modeling approach. Their historical climate models are widely used to support research and Canadian Climate Atlas websites like Climate data for a resilient Canada and Climate Atlas of Canada. The most recent updates to Canada's plant hardiness zones utilized climate data from the 1981 to 2010 period was published in the journal Bioscience. Another update using the latest 30 year period (1991 to 2020) is pending – stay tuned! Visit Canada's Plant Hardiness Zones website and see more than just the hardiness zone map. Explore 1000s of individual species models for trees, shrubs, grasses and perennial flowers. These models help with decisions like the "Right Tree in the Right Place", a critical goal of NRCan's 2 Billion Tree program.

Fine tuning the Drought Code to better prepare for the fire season

GLFC fire researcher Chelene Hanes has been working to better understand how overwintering the Drought Code can help predict fire potential in the spring.

The fire season of 2021 was exceptionally hot and dry in parts of the country and Ontario was no exception. Drought Code (DC) levels (part of the Canadian Forest Fire Danger Rating System) were well above their 30-year maximums. The DC tracks moisture in heavier fuels on the forest floor and is also used to carry over drought from one fire season to the next. This overwintering adjustment was developed in the 1970s after drought conditions in Ontario led to busier than usual fire seasons. Since that time, there have been many questions by fire management agencies on when and how to apply the adjustment. Some agencies do not use it at all. A recent publication by Chelene Hanes, as part of her PhD at the University of Toronto, showed that high DC values in the fall can lead to a greater number of fires the following spring in some regions, providing validation that overwintering the DC is indeed needed under certain circumstances. Based on these findings and the dry conditions last summer, Aviation and Forest Fire Emergency Services (AFFES) in Ontario asked for assistance in determining the need for and a process to accurately overwinter the DC in Ontario.

In response, a moisture sampling protocol was developed to help AFFES monitor and assess drought conditions and ensure any bias they may have previously introduced, by not overwintering the DC, does not occur. Moisture content sampling sites were selected in each of the restricted fire zones across the province that still had above normal DC values last fall (four in the Northeast and seven in the Northwest Regions). Within each zone, three sampling sites were selected that were within 40 km of provincial and federal weather stations and snow monitoring locations. Soil moisture content samples were taken at each site, using handheld soil moisture probes in addition to destructive organic soil samples. Destructive samples were processed at a GLFC lab over the winter to calibrate the probes and characterize the sites. The overwinter adjustment is a rough approximation of the mechanisms that affect winter and spring moisture transfer due to evaporation, sublimation, discharge and percolation; therefore, over the winter months researchers have also been monitoring snow conditions. Once the snow melts and soils thaw this spring, the sampling protocol will be repeated to determine moisture changes overwinter to ensure starting DC values in Ontario are accurately represented, reducing any bias in the fire danger rating predictions. The data collected will also supplement the permanent organic soil moisture monitoring stations that have been running since 2017 near Chapleau and 2019 near Dryden. This data will be used to eventually develop a new overwinter adjustment. In the spring, GLFC researchers will also be helping Alberta Agriculture and Forestry start a similar DC moisture sampling protocol.


Determining soil moisture content of the forest floor using probe (left) and destructive sampling (right).

New models developed to enhance sustainable forest management

GLFC researchers are developing new tools to better understand the effects of harvesting on environmental sustainability. One focuses on water resources and the other takes into account provincial sustainability criteria, including caribou habitat protection, while maximizing harvest revenue.

Dr. Jason Leach and collaborators with the University of Waterloo Hydrology Research Group have developed a modelling tool, called Robin, that predicts how changes in forest cover, due to harvesting, wildfire and climate change, might impact downstream water availability and flood and drought risk. The ability to rigorously simulate forest-water interactions is critical for informing effective land management. Existing hydrologic models oversimplify how forests change through time, particularly during regeneration following disturbance. The newly developed model fully couples hydrology and forest disturbance and growth algorithms; therefore, providing practitioners robust tools to predict how potential cumulative effects across forested watersheds will impact water resources over short-term (seasonal) and long-term (decades to centuries) time scales. These advances are incorporated into Raven (raven.uwaterloo.ca), an open source hydrologic modelling framework that is widely used by practitioners and researchers for informing sustainable water management in Canada and beyond.

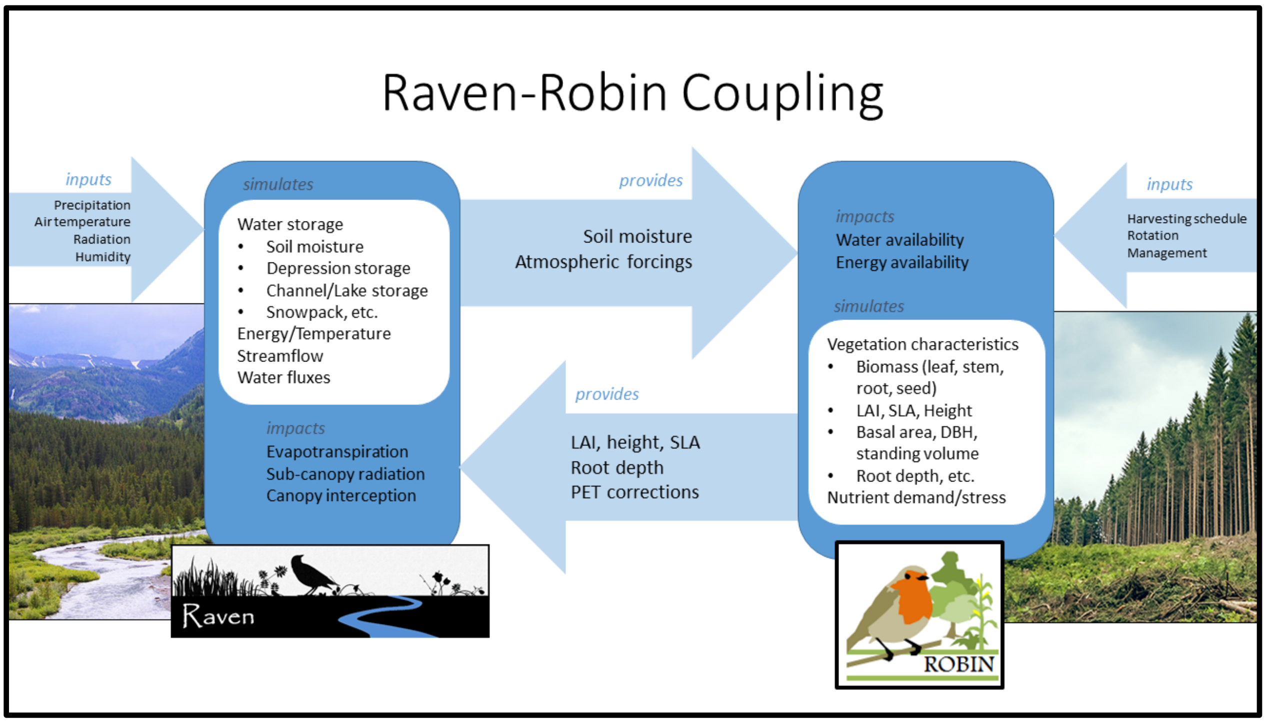

Diagram showing how the hydrologic model (Raven) and forest growth model (Robin) are conceptually linked (image by the University of Waterloo Hydrology Research Group).

Dr. Denys Yemshanov is developing a timber supply model that will assist the forest industry in minimizing timber supply costs from harvests while taking into account environmental sustainability constraints such as caribou habitat protection requirements.

There is an ongoing collaborative study in Ontario's Armstrong Forest focussed on assessing the caribou protection policies while keeping the forest management in compliance with the provincial guidelines, and accounting for environmental sustainability constraints. This work is first of its kind as researchers try to assess the cost of current caribou protection policies to the forest sector and explore the potential cheaper alternatives for the industry. Previously published models, which considered an interplay between caribou protection and harvesting, also used a set of environmental sustainability constraints but not as extensive as in the current study.

New Information Report on spruce budworm – wildfire interactions

Frequent large fires are linked to severe defoliation by spruce budworm and climate change is expected to affect where and how these interactions occur.

Canada's forests endure natural disturbances annually, contributing to the overall health and structure of the forest. In central Canada, the boreal forest is affected annually by both wildfires and forest pests such as spruce budworm. Over the last few decades, GLFC scientists have discovered that the damage by the cyclical outbreaks of spruce budworm can contribute to the frequency and intensity of wildfires. This information report reviews the interaction of these two disturbance regimes as well as the way they interact with each other in the forest. The report also considers the implications climate change is predicted to have on both wildfires and spruce budworm outbreaks, and how that may in turn affect their interactions in the forest.

As disturbance regimes change, forest management techniques will need to adapt. Researchers are currently developing a landscape-scale tool that will improve assessments of fire risk in the period following spruce budworm outbreaks.

Read the full report on Natural Disturbance in Central Canada's Forests: Spruce Budworm – Wildfire Interactions in a Changing Climate. Contact Jean-Noel Candau for more information.

Recent Publications

Azeria, E. T., Santala, K., McIntosh, A. C., Aubin, I. 2020. Plant traits as indicators of recovery of reclaimed wellsites in forested areas: Slow but directional succession trajectory. Forest Ecology and Management, 468, 118180.

Duell, M.E., Gray, M.T., Roe, A.D., MacQuarrie, C.J.K., Sinclair, B.J., Plasticity drives extreme cold tolerance of emerald ash borer (Agrilus planipennis) during a polar vortex. Current Research in Insect Science 2 (2022) 100031.

e-Bulletin. The Great Lakes Forestry Centre Issue 43, June 2021. 8 p.

e-Bulletin. The Great Lakes Forestry Centre Issue 44, December 2021. 9 p.

Fewster, V.; MacQuarrie, C.J.K.; Candau, J.-N. 2022. Natural Disturbance in Central Canada's Forests: Spruce Budworm – Wildfire Interactions in a Changing Climate. Information Report GLC-X-31. Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre. Information Report GLC-X-31. 14 p.

Morgenstern, E.K.; Wang, B.S.P. 2001. Trends in forest depletion, seed supply, and reforestation in Canada during the past four decades, The Forestry Chronicle, vol 77, no 6, pp. 1014–1021.

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