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Forest Science Update - Winter 2018

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New information on soil, wood product, and uncertainty aspects of forest carbon

Interest in whether Ontario's forests can help the Province meet its emissions reduction targets has led MNRF researchers and partners to develop improved carbon assessment methods and tools. Their work focuses on filling gaps in data/understanding of carbon stocks and flows in Ontario's managed forests and harvested wood products, as well as expected changes in those over time. Highlights of findings from recent papers:

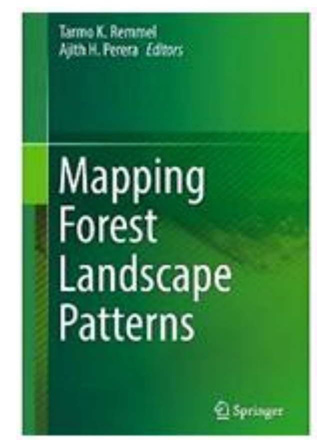
- Estimates of forest carbon balances in the Far North show that over the past century, in response to climate warming, relatively less carbon has been being stored in soil while that in vegetation remained stable. Projections show that expected changes in climate and carbon in the atmosphere during the 21st century will increase forest growth and offset carbon losses from soil and natural disturbances.

- Using harvested trees to produce solid wood products reduces greenhouse gas emissions more and faster than if the wood is used to replace fossil fuels, indicating solid harvested wood products have great potential to mitigate greenhouse gases.

- Uncertainty — for example about climate change and wildfire distribution — can be built into forest management planning, offering forest managers information needed to mitigate climate change risks.

For more information, request the research papers.

Book explores concepts and applications of mapping forest landscapes



Maps, which represent relationships in space, can be powerful tools for understanding landscapes and are being used more and more to capture and visualize a diversity of information. A recent book — a joint effort by 14 authors from Canada, the United States, Estonia, and Switzerland co-led by an MNRF researcher — explores how maps can be used to quantify the complex patterns in forest landscapes. This book will interest both developers and users of forest landscape maps.

The introductory chapter covers cartography basics including terminology, map projections, scale, and challenges of defining boundaries. Of particular interest to Ontario resource managers might be the chapters describing case study applications of using lidar, landscape metrics mapping, wildfire mapping, and automation of mapping. Emphasized throughout the book are the importance of using maps appropriately, considering scale, and understanding how errors can be magnified. The final chapter addresses how to improve forest landscape map use.

For more about this book or to order copies, visit the publisher's website.

Researchers develop more accurate stand height/site index models for natural stands

MNRF researchers have developed more accurate models for estimating stand heights. These models are *dynamic*, meaning they can be used to estimate stand height at any age and *site index* (measure of site productivity indicated by height at a given age). These models for jack pine and black spruce grown in natural stands are an improvement over previous *static* models (ones linked to a given base age so not accurate for trees much older or younger than that age).

Their main advantage is they make it possible to assess expected growth of young stands as part of *silvicultural effectiveness monitoring* (how resource managers assess how well forest stands are growing back). The models are based on data used to develop the height/age models embedded in Ontario's existing growth and yield tools — models that provide forest managers with information about how forests are likely to change over time. Researchers have also been working on growth and yield models that incorporate climate change for several boreal forest species.

Want to know more? [Request a related article](#).

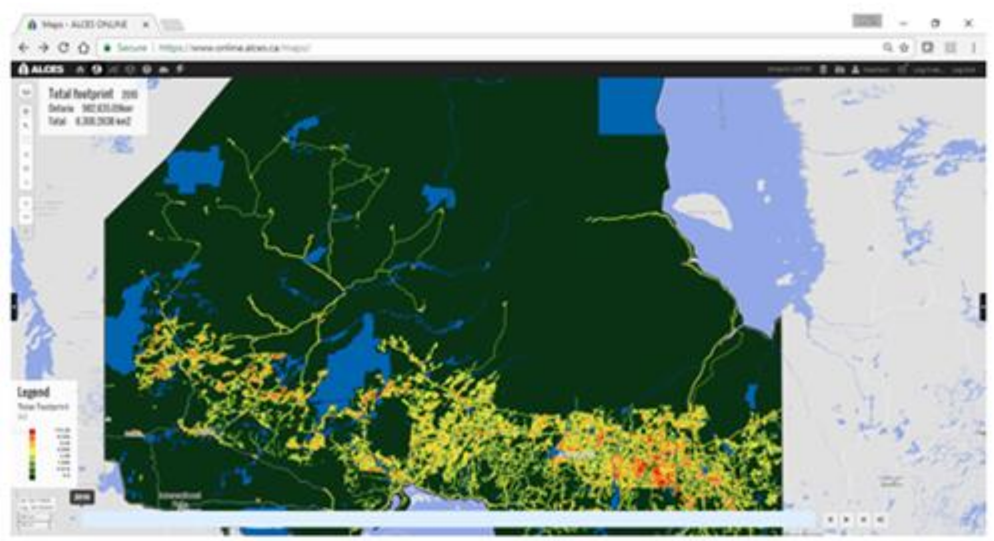
An important source of data for Ontario's growth and yield models is *stem analysis* — analyzing tree rings from cookies all along the stem to reveal tree and volume growth patterns.

Update on cumulative effects assessment in the Far North of Ontario

Over past few years, MNRF researchers and partners have been developing an approach to assessing cumulative effects in the Far North of Ontario to support Ring of Fire and community based land use planning. A summary of what they've been up to:

- Working on a pilot project to assess cumulative effects of potential development on aquatic and terrestrial ecosystem components and environmental features in the Far North, including:
  - Developing lists of terrestrial and aquatic ecosystem components and environmental features identified as priorities for planning
  - Developing conceptual models of the relationships among development sectors, drivers (e.g. road construction/water crossings), intermediate effects (e.g., habitat fragmentation/access), and system responses (e.g., recruitment/mortality)
  - Selecting ALCES Online as their analytical tool to run scenarios and illustrate the potential effects of different combinations of development activities over time
- Collecting data from various sources to accurately represent the Far North at landscape scale. This data, along with potential development scenarios, natural disturbance data, and data related to ecosystem features of interest (such as aquatic communities or wildlife species), will be run through ALCES Online to assess the cumulative effects related to each scenario.

For more information, contact us.



Screen clip from Alces Online showing total footprint for human development in the Far North of Ontario.

Far North mapping project documents permafrost decrease

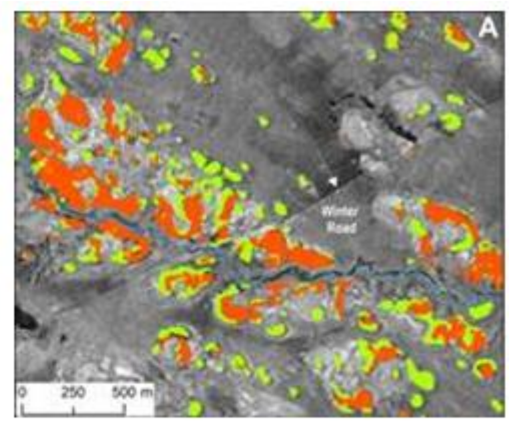
Permafrost thaw is of interest as it decreases organic matter, releasing greenhouse gases to the atmosphere. To determine long-term change in the amount and distribution of permafrost in the discontinuous permafrost zone in the Far North of Ontario, MNRF researchers have used air photos and satellite imagery to create a change map.

One challenge of mapping permafrost: It has to be interpreted indirectly based on what is visible in the image (via vegetation type and related information such as substrate type) so can't be completely automated. Researchers found that using *object-based* analysis (grouping similar pixels in a high resolution image into objects before analysis) was more efficient/effective than manually delineating palsas and peat plateaus, but historical aerial photographs provided key information for distinguishing permafrost features.

Based on a study area just west of Attawapiskat, permafrost is degrading faster than it is forming. In fact, over 57 years, permafrost in the over 400 square kilometre study area decreased by 1.2 per cent — from 4.4 per cent in 1954 to 3.3 per cent in 2011. Patterns of change indicate that degradation is faster near streams.

For details, request the journal paper.

Map showing permafrost changes in the Far North study area. Orange indicates permafrost decayed between 1954 and 2011; green indicates permafrost persisted in 2011; background is 2011 panchromatic WV-2 imagery.



Under pressure? Researchers looking at stewardship parks and conservation reserves to assess traffic/use effects

A project led by MNRF researchers will reveal more about how much Ontario's stewardship parks and conservation reserves are being used. Giving parks decision makers a better idea of how people use these areas, which are not staffed and provide no services, will help ensure these areas are managed sustainably and not at risk due to human pressures.

The key tools scientists use for this type of work are magnetic traffic counters, sensors that collect data such as traffic volume along roadways. Researchers are reviewing park management plans, consulting with MNRF parks/district staff, and looking at satellite imagery and ArcGIS layers to figure out where the greatest potential is for vehicle access in non-operating parks and conservation reserves across the province. In 2017, they installed 92 counters across the northwest and northeast regions, with 69 sites assessed. They now have data for 23 parks and 31 reserves in the North.

While formal results of this work are not yet available, researchers note the stewardship parks and conservation reserves sampled so far offer diverse and meaningful recreational opportunities, though accessibility can be tricky. The remoteness of many of the northern sites poses challenges for environmental management: The intent is to allow these lands to be enjoyed by Ontarians; however, in areas with low monitoring and enforcement capacity, creative management strategies are needed to help ensure these parks and reserves are appropriately conserved.

Site selection for the rest of the Northeast Region and for Southern Region is now in the works, including figuring out how to narrow down the list of sites to sample. Look for results of this project in late 2019.

Human use of non-operating provincial parks can have lingering effects.

Results of two moose studies reveal more about calving sites and overall populations

A clearer understanding of how cow moose pick calving sites in central Ontario

A new paper from MNRF researchers and partners reveals insights into how moose select calving sites at the southern end of their range in Ontario. Past results have varied greatly, making it difficult to conclude which factors matter most to moose.

With the current study, researchers used GPS data and locations from 2006 to 2009 in two study areas in central Ontario to locate calving sites in Algonquin Provincial Park and WMU 49. Once they determined the calving sites in both areas, they overlaid GIS layers for:

- Habitat types
- Topography (slope and elevation)
- Road types
- Forest stands of varying successional age (related to forest harvest activities or natural disturbances)
- Proximity to water

Cow moose in the two study areas shared some similarities related to site selection: They tended to prefer sites that had slight gentle slopes and were closer to conifer stands but avoided sites along water edges.

Want to know more? Read the paper online.

New paper sums up North American moose populations and harvest management

MNRF researchers and partners have published a new paper on moose populations. They report that in 2015, the North American moose population was about 1 million animals — similar to that in 2000. Moose density is believed to be increasing in nine jurisdictions (provinces/territories/states), stable in eight, and declining in 11. Over a 10-year period, hunter numbers increased by about 40,000, while total harvest did not change. Other findings:

- Some jurisdictions have seen huge increases in moose populations; in Maine and Washington State, for example, moose populations have more than doubled since 2001.
- Moose have expanded northward and been found as far north as the 67th parallel (well inside the Arctic Circle).
- Ontario is part of a group of jurisdictions in central North America where overall moose populations are declining — however, populations are expanding in some parts of this region, especially in areas of Manitoba and Saskatchewan where small farms have been replaced with large corporate farms (reduced access). Moose population change varies across Ontario, with some wildlife management zones seeing increases and others seeing decreases.
- Jurisdictions with declining populations reported that the top eight drivers were (from most to least important): parasites/ disease, predators, natural habitat loss, unregulated harvest, warming climate, increased access/vehicle technology, higher deer densities, and overharvests by licensed hunters. In 2013 Minnesota launched a moose mortality study to determine factors for their recent dramatic population decline, with early results showing parasites/disease and predators are key factors. Similar research in Maine and New Hampshire shows winter ticks are affecting calf survival and cow productivity.

The researchers also summarized how moose harvests are managed across the continent: economic impact, objectives, allocation of hunting opportunities, harvest regulation strategies, licensing, and more.

Want to know more? Read the paper online.

Monitoring crews keep an eagle eye out for Asian longhorned beetle


Is Ontario still free of the invasive Asian longhorned beetle? MNRF forest health monitoring crews are collaborating with Canadian Food Inspection Agency (CFIA) and other partners to scour the quarantine zone around the Mississauga area for signs of this destructive forest pest. The search will lead them into ravines, green spaces, boulevards, and residential backyards to ensure that it is not quietly sleeping, waiting to pounce come spring.

This pest kills a variety of hardwood trees, especially maples, elms, willows and birches. If permitted to establish in Ontario's hardwood forests, these beetles could deal a harsh blow to the province's forest products and maple syrup industries.

This beetle was first detected in Ontario in fall 2003, leading to a long eradication effort by the CFIA. After five seasons of negative survey results, Ontario was declared free of this pest in spring 2013. With another find of an adult beetle in late fall 2013 in Mississauga, the survey/eradication clock was reset.

While much of nature is asleep under a blanket of snow and ice, winter is a busy time for forest health monitoring. It is the ideal time for a bug hunt while the leaves are off the trees and the upper crown stems most visible.

Want to know more about Asian longhorned beetle monitoring? Contact us.

Taking a bite out of nature: Results of wildlife food production survey

Tree and shrub fruit production varies each year, and wildlife respond to these changes by behaving differently and producing more or less offspring. For example, black bears are more likely to conflict with humans when berries and nuts are scarce. And small mammal populations rise and fall with seed production — a lean seed year is generally followed by a population dip the following year.

To help resource managers anticipate changes in wildlife behaviour and populations, MNRF staff have been surveying fruit production by food plants in the Great Lakes–St. Lawrence (GLSL) and boreal forest regions since 2004, with a smaller area surveyed from 1998 to 2003. This year, staff from 24 MNRF districts contributed to the survey. Some key findings, which are presented in an MNRF report:

- In GLSL forests, production of *soft mast* (seeds with a soft covering, e.g., berries) was average, providing low to moderate food for black bears and small mammals.
- Food availability varied *synchronously* (trees of a given species tended to follow the same pattern) across a vast landscape including most southern and northeastern districts. Trends through time show that some tree species periodically produced simultaneous bumper crops over large areas.
- In the Northwest Region, landscape-scale patterns were less apparent — variation in fruit production was not synchronous across districts or species. In 2016, eastern boreal fruit production was low.
- In much of central Ontario, fall forage in the form of acorns was low, and beechnut quantities were average.

This data helps us better understand and predict wildlife behaviour and changes in populations. It also offers insights into how climate fluctuations and local weather conditions, plant reproductive strategies, disease, and seed predators interact to affect fruit production.

Want to know more? Request a pdf of the report.

The 1998 ice storm: A look back at what happened — and how ministry science responded

Twenty years ago, the worst ice storm in centuries struck. Maple syrup producers, woodlot/plantation owners, and homeowners watched in horror as their trees bent, groaned, and cracked under as much as 11 centimetres of ice.

Over 600,000 hectares of hardwoods were affected in Ontario alone, including many sugar bushes. These owners had some tough questions: Which trees will survive? Is it safe to tap our maples this season? How can we deal with the damage?

Within a few days, the Ontario Government and the Canadian Forest Service launched an ice storm science program. Researchers (including several from our ministry) mapped damage from the air; produced interim guidelines for affected sugar bushes, woodlots, and plantations; developed extension notes; organized workshops; and started new research projects on how to deal with the aftermath.

We checked in with some of our retired researchers, and they told us one of the major highlights of this program was what they learned through research in maple sugar bushes: They compared the effects of varying tapping intensities with the amounts of damage to tree crowns, finding that it's ok to lightly tap trees with moderate to moderately high crown damage. They also found that if a tree has severe crown damage, tap it heavily because it's not likely to survive. Lots more was learned! Check out:

- Two special issues of The Forestry Chronicle that focused on ice damage science: August 2001 | February 2003
- A Journal of Forestry article
- Ice-damage-related extension notes

Click this link to request PDFs of ministry-authored research papers.

Recent publications

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