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Current Research Summaries

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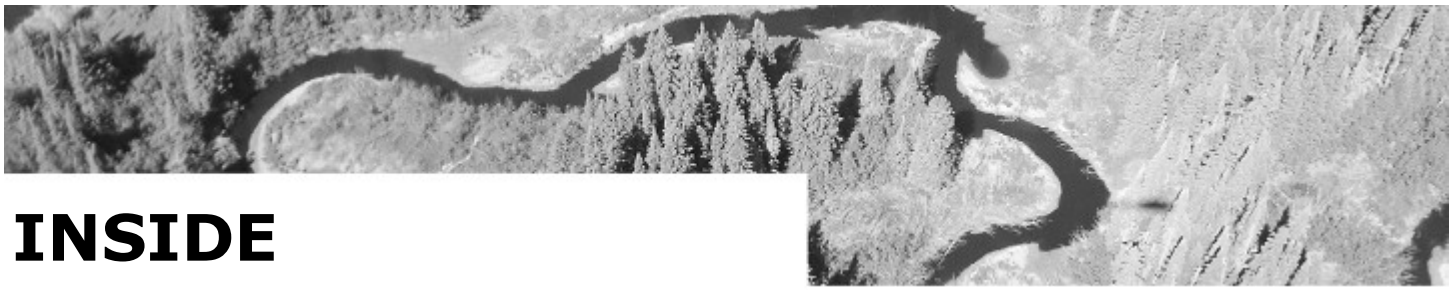

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Urban forestry research: A summary

Mike Rosen, R.P.F.

International trends including population growth and the ongoing transition from the rural to an urban economy are expanding research into urban forests in Ontario, Canada, and the world. Huge global challenges such as climate change, water scarcity, biodiversity loss, human health, poverty, COVID-19, extreme weather events and political conflicts are motivating much of the new, urban forest research. One overall trend is that urban forestry research has become truly global. A decade ago, the traditional, urban forest research journal *Urban Forestry & Urban Greening* would have published papers submitted largely from the U.S. and some European countries. Today, there is research work taking place in many countries and continents, with Asian countries (particularly China) playing a very important role (Konijnendijk, 2021).

In Canada, the reassignment of forestry within the Daniels Faculty at the University of Toronto has elevated urban forestry to one of four main programs while the Faculty works towards establishing an undergraduate B.Sc. in urban forestry. Entitled Urban Forestry and Settled Landscapes, it and Daniels' Centre for Design and Health Innovation are engaged in a wide range of urban forestry related research projects. Within Canada's other forestry faculties, the University of New Brunswick, and the University of British Columbia, both offer urban forestry as undergraduate courses. UBC developed Canada's first Bachelor of Urban Forestry (and Master of Urban Forest Leadership) and has established itself as a leader in urban forest research in Canada. Many other universities are also exploring urban forestry themes in research including Dalhousie University, Université du Québec en Outaouais/Université du Québec à Montréal, University of Manitoba, and the University of Winnipeg.

Aside from pest outbreaks, there is little in the way of urban forestry research from the federal and provincial governments in Canada, although there has been some work in studying fire risk in the "wildland-urban interface". A recent Canadian Forest Service study took the very first step of identifying Canadian research needs in urban forestry (Larouche et. al., 2021). The provincial and federal governments do not collect statistics on urban forests. From the private sector, there is little in urban forest research in Canada.

Urban forest research can be placed within five categories: social forestry, urban forest governance, human health, technical innovations, and the wildland-urban interface. In every case, concepts and axioms are attempting to connect people to urban forests (as part of nature) as never before.

Social Forestry

Because urban forests are inexorably linked with people, much of urban forest research emphasizes the social aspects of forestry – the effects of trees on the lives of people (and visa versa). This research has given rise to several axioms including the "Re-appreciation of Nearby Nature" (the ability of human society to readily access nature) "Transforming Streets into Public Spaces", "Tactical Urbanism" etc.

This has in turn inspired other global trends including "Green Infrastructure for Climate Change Adaptation and Mitigation", "Mainstreaming of Urban Nature" and "Nature-Based Thinking". Also related to the benefits and services provided by urban forests is a great deal of work looking at the environmental equity aspects of urban forestry. The COVID pandemic has led to an increasing focus on access to urban forests and their benefits,

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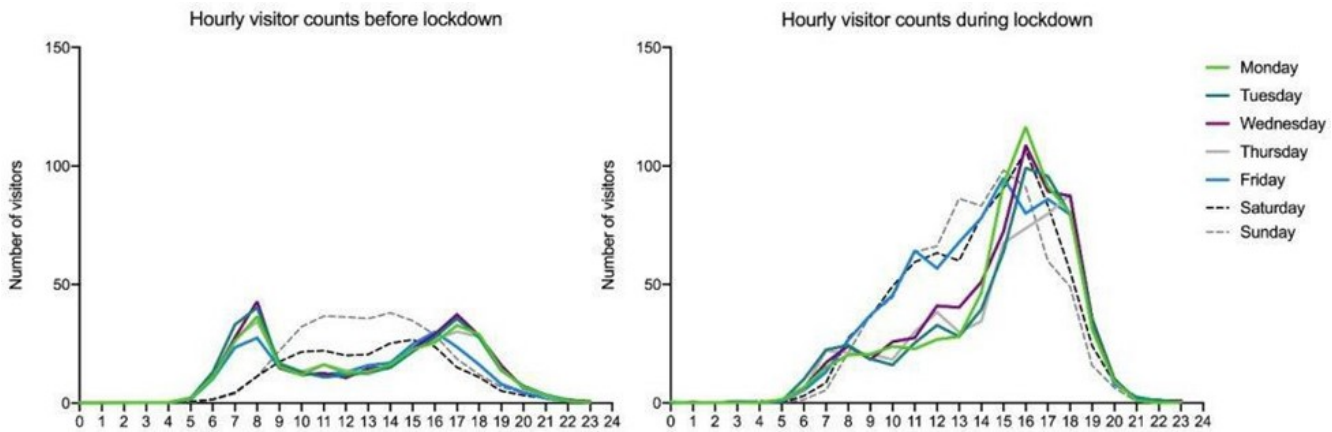

Figure 1. Kottenforst, Cologne – visitor counts before and during Covid19 http://clearinghouseproject.eu/2020/06/03/covid-19-surge-forest-visitors/

(Continued from page 3)

including improving access for marginalized communities. Urban forests are also increasingly part of wider research projects that look at "nature-based solutions" that is, using nature to deal with the great, environmental challenges society is facing.

Urban Forest Governance

There was a time when "strategic urban forest planning" was an innovative concept in urban forestry. Today, most municipalities, especially the larger ones, have urban forest plans used to implement policies and programs to promote and maintain urban forests. Some municipalities now undergo "interim strategic forest plans" to update 20-year plans as new realities (and inventory) arrive. More research is appearing that studies the governance of urban forests and looks for ways to improve while reinforcing the need for good governance and leadership (and education & training). There are other trends in urban forest governance in which research is increasingly focussing. This includes:

- Asset Management Planning – the quantitative recognition of trees as a municipal benefit to be accounted (and funded) in budgets especially considering a growing appreciation for "green infrastructure" - this is closely related to "Risk Management" for trees (as a natural asset) with research into proposed mitigation measures for their loss
- Provincial Planning Policies (Government of Ontario, 2020) - where municipalities adhere to policy direction on matters of provincial interest related to land use planning and development
- Natural Asset/Heritage Management which includes trees and forests – studying mechanisms to protect urban forests within the development scenario
- Urban Forest Certification – the third-party certification of urban forests as "sustainable" where communities are seeking a better lifestyle for their citizens and the attraction of international capital.

There also appears to be greater interest in researching credentialism for urban foresters as well as looking at the roles of various players in urban forestry: foresters, arborists, landscape architects and others.

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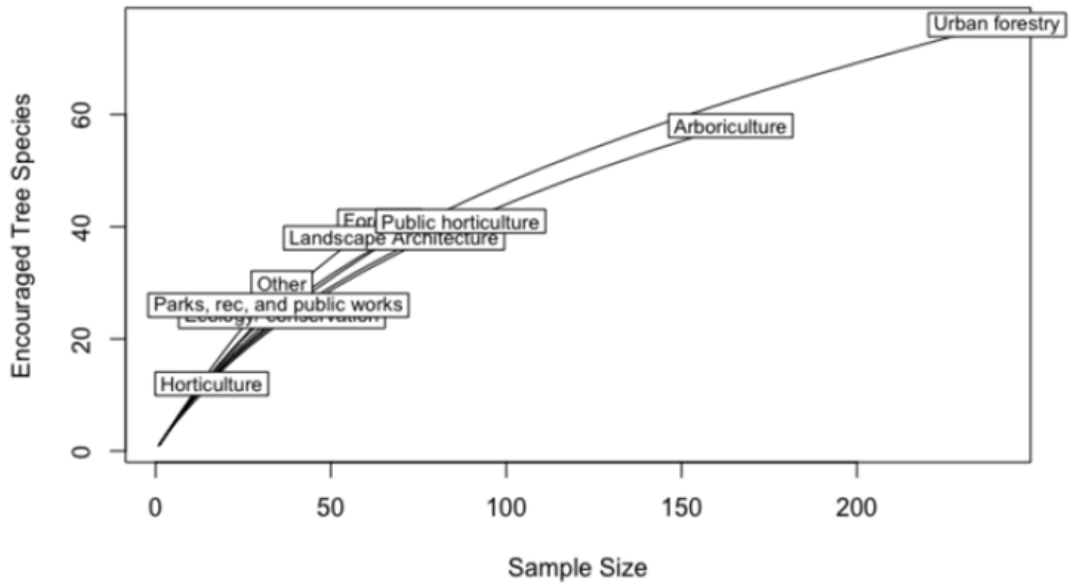

Figure 12: Rarefaction curves for the palettes of encouraged tree species identified by each professional field.

Figure 2. Example of urban forestry research on the differences between professions in the selection of urban trees. Professional fields partly hidden in the figure include Ecology/conservation and Forestry. Source: MSc. Thesis, Jehane Samaha, UBC https://open.library.ubc.ca/soa/cIRcle/collections/ubctheses/24/items/1.0380694

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Human Health

On the public health side, the link between trees and nature and mental health as well as physical health will increase in importance. Axioms like *3-30-300* (Konijnendijk van den Bosch, 2021) are gaining prominence: the ability to see three trees from your home, live in a neighbourhood with a minimum of 30% canopy cover, with the ability to walk a minimum of 300 metres to greenspace. Net "O" carbon policies in which municipalities seek to achieve some sort of "carbon neutrality" frequently involves the planting and maintenance of trees. Ongoing research into the "carbon budget of the urban forest" is a research stream as well. In general, there is in-depth multi-faceted research on the links between urban forests and various dimensions of human health and wellbeing. Examples of global collaboration such as that of Clearinghouse, an initiative of the European Union and China abounds. Here especially, the mechanisms are studied to a greater extent: what type of urban forest results in which health benefits (for whom)? etc. Much more sophisticated research is taking place on the links between urban forests and various dimensions of human health and wellbeing e.g., what type of urban forest results in which health benefits and for whom?

COVID has certainly been an incentive in encouraging studies of human activity in the outdoors. Many studies, including near the Kottenforst adjacent Cologne, Germany and others in Norway are demonstrating the importance of urban greenspace in human walking, hiking, running, and biking as a form of refuge when other activities were limited by the pandemic. This is in turn is leading to discussions and research into the mainstreaming of health criteria into public space design and management. As a result, there is a major discussion about whether the impact on public space will be transformational with fewer or more people in public, how this will inspire changes in use and perceptions of public space, whether there are implied infringements on civil liberties and what is the changing role and design of streetscapes and parks. Equity in the access to treed greenspace continues to be a topic that is meriting exploration.

Technical Innovations

Continued and improved assessment of urban forests continues to be explored. The utilization of known sensing techniques through more advanced mapping, LiDAR, Google Streetview etc., as well as the various ecosystem services urban forests provide are themes that are being explored by many.

In the future, provincial and federal governments may be obligated to develop regulations, policies, and programs to improve the urban forest – already planners are suggesting a 40% minimum forest canopy cover for municipalities (Keesmaat, 2020). Canopy cover is a simple and powerful concept, very attractive to politicians and others due to its facility of comprehension, providing a common narrative, a sense of direction in a complex governance situation and is an easy "measure of success". It can generate public support and action, can highlight the urgency of loss, and is linked to several key ecosystem service programs – in particular the well recognized iTree suite of programs which can effectively quantify urban forests – an effective benchmark.

But the drawbacks of using canopy cover are many – not all cities have the same conditions to deal with (e.g., Halifax vs. Regina) and can be problematic in terms of access to private land (in Canada 60%+ of the urban forest is privately owned). Other factors are often overlooked, especially the "on the ground" experience. Many complain that it is quantity over quality – that resilience, diversity, functionality matter and that it's not only about trees (e.g., shrubs also have a large role in urban forests), and that canopy cover is overly simplistic in relaying canopy differences by neighbourhood.

Other technical areas coming into research prominence include:

- Vertical Forests – the growing of trees in unconventional places like roofs;
- Hard surface techniques for increased tree survival (Silva cells…)
- Mycorrhizal applications for new plantings
- Species migration and climate change. Warmer temperatures, drier conditions and, perhaps most importantly, extreme weather events such as fire, violent wind, floods, heavy snow, and ice storms will take a heavy toll on urban forests

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- Seed source expertise in urban forests – explaining urban forest problems on lack of diversity or providences that are not hardy to the Canadian situation
- Infill forests – forests that are protected or in some rare cases created in "densification" projects
- Reclaimed forests
- Elevated forests
- Transplanted forests
- Imaginative forests

Linked to the above is new research into using more sophisticated ways of monitoring the urban forest, its growth etc. through concepts such as connecting urban forests to the digital world (Galle et. al., 2019).

Wildland-Urban Interface Fires

The wildland-urban interface (WUI), is defined as the area where houses are in or near wildland vegetation, is the area where wildfires pose the greatest risk to people due to the proximity of flammable vegetation (Radeloff, 2005). Fires in the WUI have become a global issue, with disasters taking place all over the world recently. The drivers of increasing WUI fire risk—increasing population and expansion of urban areas into wildlands, and climate change—are global-scale phenomena. Since the major population centres of eastern Canada live in proximity to deciduous forests, it has not emerged as much of an issue in Ontario. The same cannot be said for western Canada. In the coming decades, WUI fire risk is expected to increase both in regions with a long history of fires and in regions that have had been less affected over past decades. Despite all efforts, wildfires pose a significant challenge to the residential population, to mitigation efforts, and to existing infrastructure when located in a WUI setting. To this end research into preventing these fires is ongoing including the production of the National Guide for wildland-urban-interface fires in 2021, a record year for these fires in Canada.

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Digging into the threat of Oak Wilt to Ontario

Mackenzie DiGasparro, Program Development Coordinator, Invasive Species Centre

Oak wilt, though not currently found in Canada, is inching closer to our borders with the closest known occurrence of this tree disease being less than 1km from Windsor, Ontario on Belle Isle in Michigan. Oak wilt is a vascular disease that impacts oak trees that is caused by the invasive fungus, *Bretziella Fagacearum*. In an oak wilt infected tree, the fungus spreads through the nutrient and water transport systems of the tree, blocking natural flow to the canopy. This results in the characteristic "wilt" seen in infected trees (Figure 1). Trees in the red oak family are particularly susceptible to oak wilt mortality, with tree death occurring in as little as six weeks post infection. This is because trees in the white oak family have a built-in defense mechanism against disease. White oaks have the capacity to produce cellular distensions, called tyloses, that can isolate a pathogen from spreading further through the tree (Figure 2). This causes symptoms in white oaks to appear with slight differences from red oaks. The characteristic wilting normally seen throughout the canopy in red oaks will be isolated to individual branches or clusters of branches in white oaks.

Figure 1: Bronzing of leaves characteristic of oak wilt infections. Photo taken in August.

Oak wilt spreads through two main pathways – above ground via insect vectors, and below ground via root grafting. Root grafting describes the connections of roots underground, allowing the sharing of beneficial fungi and microorganisms, most often between trees of the same species. Unfortunately, these beneficial connections also present the risk of pathogen transmission amongst interconnected trees. Above ground spread through insect vectors is the primary pathway of concern for oak wilt spread into Canada. Sap beetles (nitidulids) in particular, have been found to be the main vector responsible for the spread of *B. fagacearum* spores. When an infected red oak dies, it will develop sporulating fungal mats, which are extensions of the fungal mycelium growing within the tree (Figure 3). The pressure pads that form from the fungal mat cause the bark of the tree to split, allowing access to the fruity smelling, sporulating mat by insects (Figure 4). Upon feeding on the fungus, spores stick to the insect bodies, giving them the capacity to carry these active spores to a healthy tree. This occurs when the insect begins to feed on the sap expelled from an open wound of an otherwise healthy tree. Similarly, to how we protect our open wounds with bandages, it is recommended to use a pruning paint to protect your red oaks from infection during high-risk seasons (i.e., spring and summer months).

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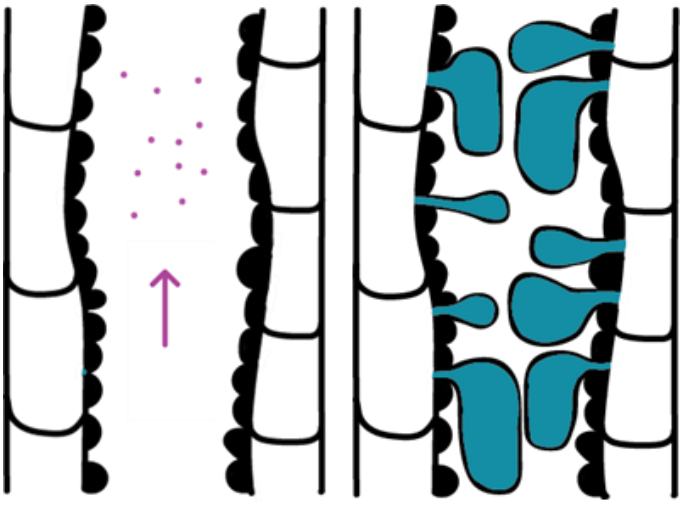

Figure 2. Left – Depiction of xylem in red oaks, without tyloses, where pathogens are free to spread through the tree. Right – Depiction of xylem in white oaks with tyloses blocking pathogen transport.

Figure 3. Oak wilt pressure pad beneath the bark.

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Figure 4. Bark splitting caused by oak wilt pressure pad.

Strong storm events, migratory birds, and firewood movement are other alternative means of spread for this disease. This makes active monitoring of oaks on your lands and eliminating firewood movement over long distances especially important to mitigate the spread of oak wilt.

Dr. Sharon Reed, of the Ontario Forest Research Institute, is considered to be a top oak wilt researcher in Ontario. In 2019, Dr. Reed collaborated with the Canadian Food Inspection Agency and Natural Resources Canada to test critical vector species for oak wilt environmental DNA (eDNA) (Oak Wilt Technical Advisory Committee, 2020). eDNA is cellular material that has been shed from an organism into the environment, that can be sampled and monitored using molecular technologies. Over the past half decade, eDNA technology has been a relatively widely used conservation tool to detect the presence of a species. Through this collaborative work, technicians baited traps across the province to collect insect vectors of oak wilt. Those insects were subsequently tested using genomic analysis to determine the presence or absence of *B. fagacearum* eDNA. Several trap locations within kilometers of the Canada-U.S. border contained insects testing positive for *B. fagacearum* eDNA. Though these positive detections of eDNA do not correlate with a positive detection of oak wilt, nor do they confirm that the fungal spores were live at the time of collection, this was an important discovery in oak wilt research in Canada. These results show that the possibility of oak wilt spreading into the province is real and that we must remain vigilant and continue to improve our methods of early detection to be able to elicit the most rapid response possible upon a positive detection.

Aside from the environmental impacts of oak wilt infecting the densest region of red oaks in the province, there are also significant potential economic impacts if oak wilt were to establish in Ontario. A recent paper published in *Nature,* "Assessing the climate suitability and potential economic impacts of Oak wilt in Canada," has shown that 12 of the top 20 urban areas in eastern Canada with the greatest potential economic impacts of oak wilt on street trees were Ontario municipalities. 222 Ontario municipalities were included in the study, with the estimated cost for removal and replacement of oak trees totaling nearly CDN$165 million. Toronto was shown to have the greatest potential impact of Ontario municipalities with an estimated cost of CDN$48.8 million, second most in Canada behind Montreal, QC. Ontario also provides over 70% of oak related gross domestic product (GDP) across the country. When considering oak as an annuity that will continue to indefinitely provide annual benefits in the absence of this disease, ongoing oak related GDP is valued at a whopping CDN$600 million. All of that said, Ontario oaks are a great provider to our economy and to the livelihood of many across the province; between diminished timber quality, tree mortality/removal, and environmental impacts associated with oak wilt, there is no doubt as to why it is considered a critical emerging threat in the world of invasive species in Ontario.

Figure 5. The sprawling red oak known as Zhelevo, found in Toronto's North York community is believed to be nearly 300 years old – older than the city of Toronto itself. In 2020, the City of Toronto, with the help of public fundraising, purchased the property on which Zhelevo sits in order to protect the tree. They plan to turn the property into a small park. Photo credit: Canadian Geographic.

If you would like to receive quarterly updates to your inbox about oak wilt, sign up to the Invasive Species Centre's Oak Wilt Wire newsletter.

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Managing plantation density for red pine: 60-Year-Old spacing trial experiment

Nelson Thiffault, Michael Hoepting, Jeff Fera, Jean-Martin Lussier and Guy Larocque, Natural Resources Canada, Canadian Forest Service, Canadian Wood Fibre Center

Based on a Fibre Facts publication available at https://cfs.nrcan.gc.ca/publications?id=40411&lang=en_CA **(English) or** https://scf.rncan.gc.ca/publications?id=40410&lang=fr_CA **(French)**

The challenge for foresters in managing red pine lies in finding the right tree spacing to optimize the use of site resources for stand productivity and health. An experiment in 60 year-old red pine plantations shows that thinning allowed for the harvest of fibre that would otherwise have been lost to mortality. Evidence of this capture of mortality was particularly strong in stands with narrower initial planting spacings. The conclusions, based on long-term data, offer advantages for management decision-making compared to approaches based on observations of unmanaged stands.

Since the 1920s, red pine has been planted extensively in the northern United States and southeastern Canada. It grows relatively rapidly compared with most North American tree species and has the potential for high value products, particularly utility poles. The species is effective in the rehabilitation of sites degraded after decades of farming activities. A red pine spacing trial experiment established in 1953 near the Petawawa Research Forest (PRF) in Chalk River, Ontario, Canada, provides valuable results to help foresters make decisions for optimal planting density and thinning strategies. The experiment includes combinations of six initial planting spacings (from 1.2 to 3.0 m) and the presence or absence of commercial thinning. The thinning was applied in 1982, 1992, 2002 and 2013, each time with the aim of reducing basal area to 37.9 m2 ha-1. Thinning was generally from below except where row thinning was required in the first entry to allow space for equipment. Researchers with the Canadian Wood Fibre Centre studied the main and interacting long-term effects of initial planting density and commercial thinning treatments on tree and stand level development in the experiment. The conclusions, based on long-term re-measured data, offer advantages for management decision-making compared to approaches based on observations of unmanaged stands with associated assumptions.

(Continued on page 10)

Figure 1. Permanent sample plot in a thinned 65-year-old red pine stand with a 1.8 m × 1.8 m initial planting spacing.

Figure 2. 2018 imagery of the red pine plantation experimental units. (Imagery provided by Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry).

(Continued from page 9)

Results

At age 60, after the latest commercial thinning in the fall of 2013, results indicated the following interactions between initial planting spacing and thinning:

1. Basal Area and Tree Size (see Figure 3)

- Average top height was 27 m for all plots. Basal area averaged 65.3 m2 ha-1 within the unthinned plots and 37.9 m2 ha-1 in the thinned plots.
- Tree size generally increased with wider initial spacing. Larger trees were observed in thinned stands.

2. Quadratic Mean Diameter (QMD – the diameter of a tree representing the mean basal area of the stand) (See Figure 4)

- The range of QMD across planting spacings was larger for unthinned stands than thinned stands.
- The greatest responses in QMD were at the narrower spacings, suggesting a stronger effect of thinning at higher planting densities.
- Much of the thinning effect can be attributed to "the chainsaw effect". That is, the immediate increase in mean tree size resulting from the practice of thinning from below that removes the smallest trees.

3. Total Standing Volume

- The unthinned stands peaked in the 2.1–2.4 m spacings with a mean total volume of 918.3 m3 ha-1.
- Total standing volume was lower in the thinned stands and did not differ significantly among all spacing treatments with a mean of 454.5 m3 ha-1.

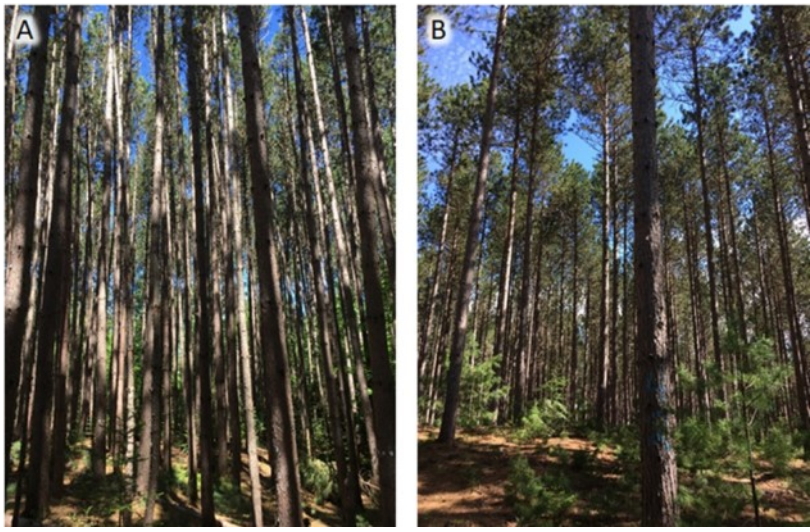

Figure 3. Examples of (A) unthinned and (B) thinned experimental units in 2018 (age 65) (Thiffault et al. 2021).

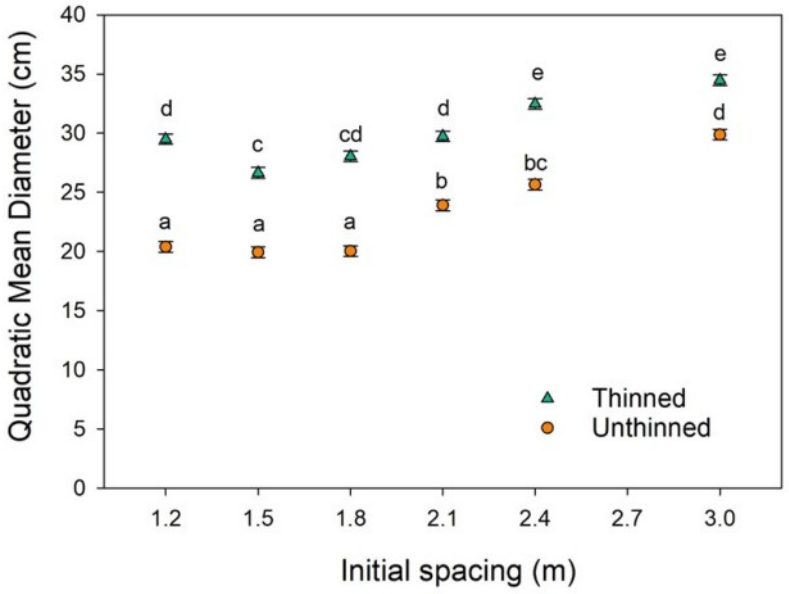

Figure 4. Interacting effect of initial planting density and a commercial thinning on quadratic mean diameter (Thiffault et al. 2021).

4. Merchantable Volume

- Was higher in unthinned stands than in thinned stands with the highest volumes found in the 2.1–3.0 m spacings.
- Merchantable volume in thinned stands was consistent across spacing treatments.

5. Net Volume Production (see Figure 5)

- Greater net volume production in thinned stands with the narrower spacings confirmed that mortality was captured. Thinning effectively reduced mortality.
- On average, 10.9 m3 ha-1 across the initial spacings were lost to mortality between 1982 and 2013 in thinned stands.

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- Mortality volume in the unthinned stands was as high as 247 m3 ha-1 in the 1.2 m spacing and became relatively close to levels in thinned stands in the 2.4–3.0 m spacings. ▪ Lower gross and net production for larger spacings suggested that thinning to the standard 37.9 m2 ha-1 resulted in under-utilized growing space.

Conclusions

Thinning allowed for the harvest of fibre that would otherwise have been lost to mortality. This capture of mortality was noted particularly in the stands with narrower initial planting spacings. A thinning effect was stronger at higher planting densities, as expressed by QMD. The larger the spacing, the less effective the thinning, as expressed by lower gross and net production, suggesting under-utilized growing space. The 2.4 m spacing was optimal in terms of tree size and total volume production among the spacings tested. The results will aid forest management decisions, especially when combined with economic considerations of silviculture costs and product prices. The dataset from this study holds further potential to support management decisions.

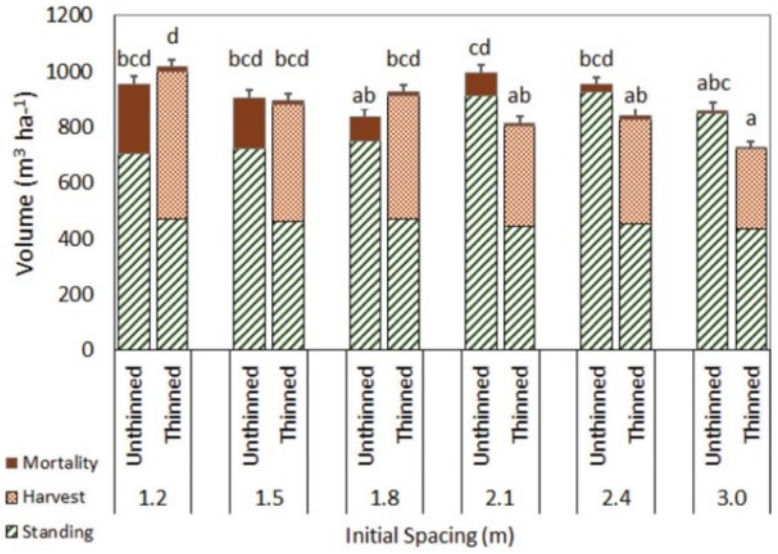

Figure 5. Interacting effect of initial planting density and a commercial thinning on cumulative gross yield (Thiffault et al. 2021).

Other recent fibre facts from Canadian Wood Fibre Centre

Biomass Storage and Safety

This fact sheet provides findings and considerations for pile management of forestry residues based on four recent scientific publications. This includes biomass storage safety, a comparison between bark and woodchip pile storage, differences in storing fresh and old woodchip piles, and pre-treatment strategies to control self-heating and optimizing biomass storage.

English: https://cfs.nrcan.gc.ca/publications?id=40353 French: https://cfs.nrcan.gc.ca/publications?id=40354

Biomass Storage and Safety. 2021. Helmeste C, Gosselin C, Bourgoin A. Natural Resources Canada, Canadian Forest Service, Canadian Wood Fibre Center. Fibre Facts 020. 4 p.

Petawawa Research Forest: Remote Sensing Supersite

This fact sheet provides an overview of the Petawawa Research Forest remote sensing supersite that was established in 2019. The supersite contains new and emerging remote sensing technologies, resulting in a large collection of data including airborne imaging systems, Light Detection and Ranging (LiDAR) data, and data from Earth Observation satellites such as Landsat and Sentinel. These data holdings, combined with permanent and temporary field sampling plots, legacy forest inventories, and management history records, provide important reference data for evaluating new tools and approaches for forest inventory and monitoring applications.

English: https://cfs.nrcan.gc.ca/publications?id=40356 French: https://cfs.nrcan.gc.ca/publications?id=40355

Petawawa Research Forest: Remote Sensing Supersite. 2021. White J. Natural Resources Canada, Canadian Forest Service, Canadian Wood Fibre Center. Fibre Facts 19. 4 p.

Recent findings from silvicultural intensity and vegetation management research

Eric Searle, Research Scientist, Great Lakes - St. Lawrence Forests, **F. Wayne Bell**, Research Scientist, Forest Ecology and Silviculture, **Holly Deighton**, Forest Research Intern, Forest Research and Monitoring Section; Science and Research Branch; Ministry of Northern Development, Mines, Natural Resources and Forestry; Sault Ste. Marie, ON

During the past three decades, forest management has transitioned from sustainable timber yield to ecosystem management-based approaches. This transition has included the promotion of emulating natural disturbance, enhancing the overall complexity of forest stands, reducing herbicide use, increasing understanding of productivity and successional theories, and considering climate change effects. To better understand how this transition has and may affect our managed forests, since the early 1990s provincial forest ecology researchers have implemented and monitored several experimental research networks across Ontario. In particular, the VMAP (Vegetation Management Alternatives Program) studies and the NEBIE (named for the five silviculture intensities investigated: natural, extensive, basic, intensive, and elite) experimental plot network have provided insights into how silviculture interventions can be used to meet the challenges posed by the transition to ecosystem management. Based on the Montreal Process Criterion and Indicators system, these networks are unique in examining the response of forest function and services to increasing silviculture intensity across Ontario. The study sites also serve as a platform to discuss forest practices with industry professionals, members of local citizen committees and planning teams, Indigenous communities, and the general public.

Figure 1. The motor manual brushsaw method of vegetation management on the left and aerial glyphosate spray on the right.

Given past (and ongoing) concerns with the use of herbicide as a vegetation management tool, a subset of the VMAP studies were designed to examine the potential tradeoffs in moving away from herbicide vegetation management in jack pine plantations and towards mechanical and site preparation-based vegetation management. Recent results from VMAP studies at Bending Lake (near Atikokan, Ont.) and E.B. Eddy (near Sudbury, Ont.) suggest that significant tradeoffs, beyond standing volume, are associated with selected vegetation management treatments. For instance, at both sites, aerial application of glyphosate as a vegetation management tool led to the tallest trees and highest merchantable volume after 25 years. However, trees in brushsaw treatment plots were taller and had more merchantable volume than those in untreated plots. Further, brushsaw treatment plots contained either similar, or higher, biodiversity than plots that were aerial sprayed. Results indicated that no one vegetation management tool can maximize all criterion and indicators at once and that, when applying stand tending treatments, forest managers must consider the trade-offs associated with their choice of tool/approach.

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The NEBIE experimental plot network was established more recently and research outputs are still preliminary. However, initial investigations based on 10th year postharvest data (the 20th year remeasurement period starts summer 2021) suggest that intensification of silviculture results in higher stocking of desired species. Understory biodiversity was affected more by local climate and site conditions than by silviculture treatments. Also, volume and species composition at the end of rotation were forecast using ZELIG -CFS, a mechanistic forest growth model developed by Natural Resources Canada. Results showed that increasing silviculture intensity led to considerably higher merchantable volume at the end of rotation (as high as 50% increase in mixedwood and 10% in conifer-dominated sites) and more consistent species composition. This work further highlighted the need for forest management models that factor in the shift towards ecosystem management, and away from sustainable timber yield, that forest management has undergone in recent decades. To be effective, future models must better incorporate multi-species uneven aged stands, silviculture treatments during rotation, and the effect of climate change.

The Forest Ecology and Silviculture Research Program is continuing to use these and other experimental plot networks to examine how the silviculture practices can be used to meet the forest management transition. Current focus includes the effects of intensification of silviculture on the invasibility of exotic species; fate of post-harvest residuals; and compositional, functional, and structural diversity of the stands. With recent remeasurements — 25 years after harvesting for VMAP and start of 20-year ones for NEBIE — these experimental plot networks will continue to yield results essential to informing forest management policies, practices, and projections. The success of both the VMAP and NEBIE projects are due to the overwhelming support from our industry partners who have contributed time and resources to their implementation and assisted in their remeasurements.

Figure 2. A white pine seedling after planting in the elite silviculture treatments at the Dryden, Ontario, NEBIE silviculture intensity study site.

For reference, selected publications from each research project are listed below. For those without direct links, email us to request copies:

VMAP

Deighton, H.D., F.W. Bell, N. Thiffault, E.B. Searle, M. Leitch, M. Sharma and J. Dacosta. 2021. Trade-offs among release treatments in jack pine plantations: Twenty-five year responses. Forests 12: 370.

NEBIE

Searle, E.B., F.W. Bell, G.R. Larocque, M. Fortin, J. Dacosta, R. Sousa-Silva, M. Mina and H.D. Deighton. 2021. Simulating the effects of intensifying silviculture on desired species yields across a broad environmental gradient. Forests 12: 755.

Bell, F.W., M. Shaw, J. Dacosta and S.G. Newmaster. 2017. The NEBIE plot network: Background and experimental design. The Forestry Chronicle 93(2): 87–94 (+ append).

Bell, F.W., J. Dacosta, S.G. Newmaster, A. Mallik, S. Hunt, M. Anand, J. Maloles, C. Peng, J. Parton, J. McLaughlin, J. Winters, M. Wester and M. Shaw. 2017. The NEBIE plot network: Highlights of long-term scientific studies. The Forestry Chronicle 93(2): 122–137.

Bell, F.W., S. Hunt, J. Dacosta, M. Sharma, G.R. Larocque, J.A. Winters, and S.G. Newmaster. 2016. Relative influence of climate, soils, and disturbance on plant species richness in northern temperate and boreal forests. Forest Ecology and Management 381: 93–105.

Spring freezing during winter-spring transition affects conifer growth in boreal Ontario

Rongzhou Man, Research scientist, Forest Research and Monitoring Section; Science and Research Branch; Ministry of Northern Development, Mines, Natural Resources and Forestry

With warming climate, spring freezing events may happen more often in boreal Ontario. As with rising temperatures and earlier spring, temperature fluctuations may also increase, i.e., unseasonably warm days followed by seasonally cold days, affecting conifer spring growth, as shown by conifer browning events in 2007 (northeast), 2012 (northwest), and possibly 2021 (Timmins and Kapuskasing areas). Compared to summer frosts that occur in patches and generally affect flushing tissues, spring freezing is less frequent but can affect large areas and damage both old and new tissues of many species (Figure 1). Beyond tree mortality, our surveys indicate that spring freezing effects on growth can last for several years.

Figure 1. Jack pine plantations damaged by 2012 freezing event in northwestern Ontario (photo by Dennis Bonner May 10, 2012).

The maximum cold tolerance of boreal trees in Ontario is generally well below the lowest temperatures in winter (Figure 2). However, trees can lose cold tolerance rapidly with increasing temperatures in spring. A former ministry research scientist, Dr. C. Glerum, monitored seasonal trends in cold tolerance for major Ontario conifers in the early 1970s. The data, which were reported by calendar date, however, are difficult to use to assess freezing damage due to interannual variations in timing of spring development. In winter 2015-16, a greenhouse experiment was established to compare changes in tissue (needle) cold tolerance of black spruce, white spruce, jack pine, and lodgepole pine (from Alberta) during the winter-spring transition. Cold hardiness assessments were initiated in early March before growing degree hours (>0 °C) accumulated and were related to changes in each species to cumulative temperatures in the greenhouse (Figure 2).

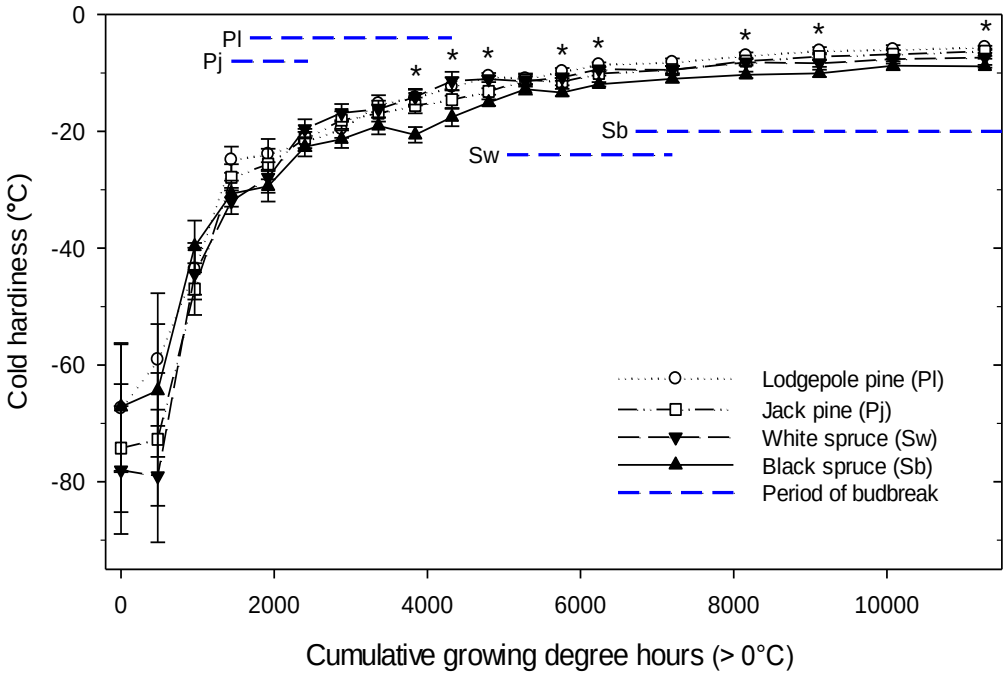

Figure 2. Cold hardiness assessment results of four boreal conifers based on changes in relative conductivity during artificial dehardening in early spring (March). Asterisks above points indicate significant differences among species.

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Unexpectedly, despite their diverse budbreak times, the tested species did not show substantial differences in spring dehardening. Comparatively, in late spring, when trees have lost much of their cold hardiness, black spruce and jack pine are 2–3 °C more cold tolerant than white spruce and lodgepole pine. This finding is consistent with field observations during spring freezing events and for black spruce is likely due to late budburst.

The dehardening curves determined from foliar samples do not show the cold tolerance of other organs, particularly buds. To test the effectiveness of tissue dehardening curves for assessing whole tree responses, freezing tests were run at two stages of spring dehardening: late March before budbreak activation (1500 cumulative growing degree hours >0 °C since January 1) and early May when pine trees had flushed and white spruce buds had started swelling (5800 cumulative growing degree hours). Freezing temperatures of ≤−25 °C in late March and ≤−10 °C in early May caused needle, bud, and seedling mortality; delayed budbreak; and reduced shoot growth. Although black spruce and jack pine had less damage than white spruce and lodgepole pine in the first year, they continued to show reduced shoot growth in the second year and the effects lasted longer. These results are consistent with the assessments from tissue dehardening curves and field reports of large-scale conifer browning in 1958, 2007, and 2012.

Spring freezing typically occurs from late March to late May, after substantial spring warming (cumulative growing degree hours >3500). The resultant damage depends on temperatures and stages of spring development; the lower the degree of freezing temperatures coupled with more advanced spring development, the more severe the damage. The tissue dehardening curves could serve as assessment tools for possible effects of freezing temperatures on the tested conifers based on stages of spring development. They may also provide some indication of responses for other boreal trees to freezing temperatures. Jack pine and tamarack break buds earlier than spruce, probably at a similar time as some early shrubs and hardwoods. Freezing temperatures that damage spruce and pine trees would also affect these early flushing shrubs and hardwoods. Although spring freezing affects many species in large areas, seedlings and small trees are generally more vulnerable, due to more advanced spring development, less cold tolerance, and more extreme microclimates near ground surface on open sites, whereas they may be protected in an understory environment. These findings align with the Ontario Tree Seed Transfer Policy that indicates southern populations generally require more cumulative temperatures to initiate growth and so would be less affected by spring freezing. Our spring dehardening studies help to not only rank tree vulnerability to guide adaptive silviculture practices for more vulnerable species, such as white spruce, but also to assess the extent of potential for spring freezing and ultimately the effects on wood supply of desired conifers.

Aerial view of damaged conifers in northeastern Ontario in 2012.

Spruce budworm and wildfire in the boreal forest

Patrick M. A. James, Institute of Forestry and Conservation, University of Toronto

The effects of spruce budworm outbreaks on wildfire have been of interest to foresters and forest managers for over a century (Graham 1923). Despite great advances in our understanding of individual disturbance regimes, and their sensitivity to climate change (Flannigan et al. 2009; Weed et al. 2013), we know relatively little about their interactions (Turner 2010). In the context of increasing frequency, extent, and severity of both wildfires and insect outbreaks, it is essential to better understand the consequences of outbreaks on wildfire activity. Indeed, the cumulative effects of insect outbreak and fire are likely greater than the sum of their part.

Figure 1. Spruce budworm killed forest.

It is intuitively appealing to expect that spruce budworm outbreaks will increase fire activity. Increases in dead and downed trees, snapped stems, and ladder fuels should all lead to increased fire activity (Figure 1). However, empirical work has not identified such a clear cause-and-effect relationship. Research on spruce budworm – fire interactions has found positive (Candau et al. 2018; Fleming et al. 2002) and negative (Pech 1987) effects. Studies on outbreaks of the closely related western spruce budworm have also generally found negative effects on fire (Flower et al. 2014; Lynch and Moorcroft 2008).

These varied responses likely arise due to the large spatial and temporal scales over which fires and outbreaks operate, as well as the highly variable nature of each individual disturbance. Local environmental conditions, including weather, can mask or amplify these potential interactions. Further, the effect of outbreaks on fuels decays over time; there is a relatively narrow "window of opportunity" during which one expects to see an effect of an outbreak on fire. Finally, there are many ways to quantify fire activity. Studies vary in whether they examine ignition probability, rate of spread, intensity, severity, or probability of escape from initial attack. There is no reason to expect that all fire regime attributes will be equally affected at the same place and time by previous outbreaks. The question therefore may not be "do spruce budworm outbreaks affect fire?" but rather, "how, when, where, and under which conditions do we expect to see fire activity altered due to outbreaks?"

We recently set out to examine how spruce budworm outbreaks affect the probability of ignition (James et al. 2017). Using historical fire ignition data (1963-2000) coupled with defoliation sketch maps across Ontario, we built a series of logistic regression models that controlled for variation in fire ignition probability due to weather. We focused this study on lightning caused ignitions in order to rule out the confounding effects of human caused ignitions. We also sought to compare the relationship between defoliation and ignition probability between seasons and between two ecoregions of Ontario (east vs. west; Figure 2).

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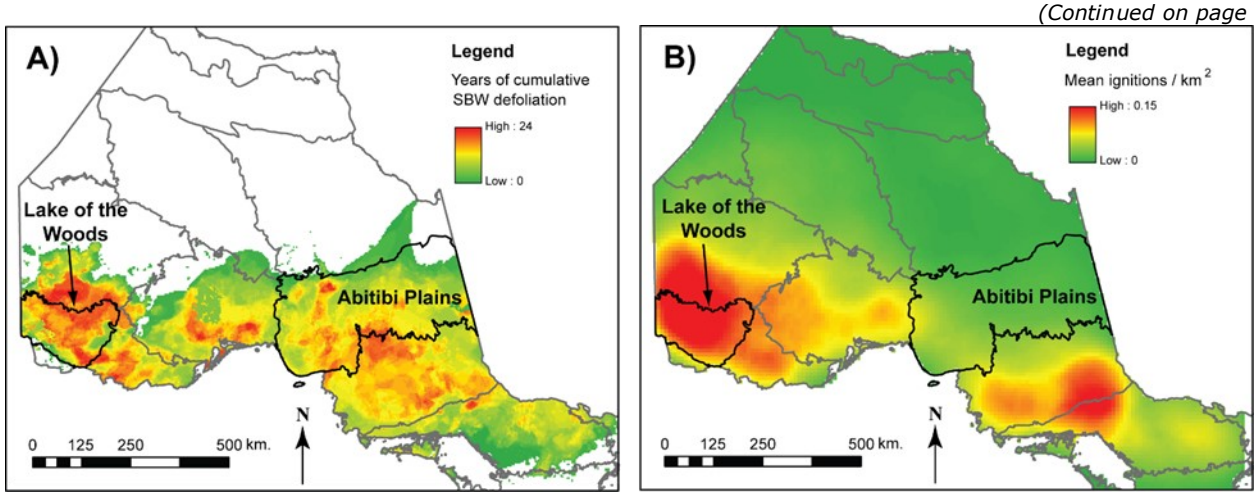

Figure 2. Eastern spruce budworm and wildfire disturbance history in Ontario. A) Cumulative defoliation between 1941 and 2000. B) Historical fire activity expressed as the number of lightning-caused ignitions per km2 from 1963 to 2000. We quantified and compared the relationship between defoliation history and fire ignition probability in the Lake of the Woods (west) and Abitibi Plains (east) ecoregions.

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In analysing over 3000 ignitions, we identified a significant increase in ignition probability 8-10 years after defoliation was first detected. This relationship was consistent for both summer and spring fire seasons and in both ecoregions. We interpret this positive effect as indicative of the timing of stand break down and fuel accumulation following the outbreak. This finding agrees well with previous work (Fleming et al. 2002) that suggested a limited window of opportunity during which the changes in stand structure and fuel loading translate into altered fire behaviour.

Unexpectedly, we also found a decrease in the probability of ignition one year after defoliation had first been detected. While we do not know for sure what is driving this effect, our hypothesis is that green-up immediately following canopy opening during an outbreak might increase site-level humidity and serve to reduce the probability of ignition. We hope to examine this interaction in more detail in the future.

We are also currently investigating the role of jack pine budworm outbreaks on fire in the northwest. Although the jack pine budworm is similar in some respects to the spruce budworm, the outbreak duration, feeding habits, and host tree architecture (i.e., spruce/fir vs. jack pine) may translate into important differences in post-outbreak fire behaviour. Ongoing work on insect-fire interactions will help us to better understand landscape-scale forest dynamics and contribute to novel fuel classifications in the next generation Canadian Forest Fire Danger Rating system.

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The long-term soil productivity (LTSP) experience: Lessons from 30 years of collaborative research

Dave Morris, Research scientist, Forest Stand Ecology Program, Centre for Northern Forest Ecosystem Research; Ministry of Northern Development, Mines, Natural Resources and Forestry, Thunder Bay, ON

After nearly 30 years, the Ontario LTSP research project is alive and well, thanks to the literally 100s of permanent/contract staff and students whose ongoing valuable contributions (field and lab) have ensured its continued success.

The impetus for establishing Ontario's long-term soil productivity (LTSP) work, a long-standing collaboration between researchers from the Canadian Forest Service – Great Lakes Forestry Centre in Sault Ste. Marie and NDMNRF's Centre for Northern Forest Ecosystem Research in Thunder Bay, was the Forest Class Environmental Assessment (EA) for Timber Management on the Crown Lands in Ontario. This multi-year (1988–1992) set of hearings examined all aspects of forest management and provided opportunity for all interested parties to voice concerns about the practices being implemented across Ontario's forested landscapes. The hearings were divided into panels focused on specific aspects of forest management, with Panel 10 addressing harvesting and forest renewal practices. A concern raised during these Panel 10 discussions related to use of the full-tree logging method (i.e., trees forwarded and processed at roadside), resulting in increased removal of nutrient-rich live crown material formerly left at the stump (referred to as bole only or tree-length harvesting). At the time of the hearings, the scientific literature did not provide adequate insight, largely because long-term empirical evidence (e.g., theoretical harvests and modelling) was lacking, and no long-term field trials were installed in Ontario or neighbouring jurisdictions to provide the empirical evidence needed to substantiate (or refute) potential productivity declines resulting from full-tree harvesting.

As part of the EA decision (Environmental Assessment Board 1994), a Term and Condition (i.e., a legal requirement) was imposed on MNR (now NDMNRF) to establish a set of research trials to evaluate the effects of increased biomass removals on long-term soil productivity, targeting soils with inherently low nutrient reserves (i.e., shallow-soiled sites, coarse-textured infertile sands, and peatlands). In response, 18 installations were established in jack pine and black spruce-dominated forest types across northern Ontario. These concerns still resonate today and are reflected in Ontario's Forest Sector Strategy (*Putting more wood to work*) and the associated Forest Biomass Action Plan, with *ecological sustainability* of high utilization biomass harvest opportunities remaining a foundation that underlies the sustainable use of Ontario's forest biofibre for a multitude of bioproducts including and beyond traditional wood products.

Figure 1. Dr. Robert (Bob) Powers participating in his passion beyond leading the long-term soil productivity network.

Ontario researchers are not alone in this quest to evaluate the effectiveness of approved sustainable forest management practices. The concept and the term *long-term soil productivity* (LTSP), and eventual study design, was initiated in 1989 as a grass roots conversation led by Dr. Robert Powers (Figure 1; Bob was the dedicated/ fearless leader of the North American LTSP network, whom we sadly lost in 2013 after a lengthy battle with a rare form of lymphoma), about the needs of forest managers in the USDA Forest Service to meet the requirements of the National Forest Management Act (NFMA) of 1976.

Soon after the USDA Forest Service LTSP project was initiated, it was expanded to include partnerships with national and international (including our Ontario contingent) researchers and resource managers to establish and maintain more than 100 LTSP core and affiliated sites across North America (Fig. 2), as well as at several international locations, including New Zealand, China, and Chile.

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This collective set of installations now comprise the worlds' largest coordinated forest research network that addresses both basic and applied science questions related to forest management and sustained productivity (Powers 2006). Much of the history of the LTSP project, definitions and standardized sampling protocols, and core treatment experimental design are described by Powers (2006), a worthwhile read. As its core design, the focus was on two soil properties: organic matter content, which is influenced by biomass removals, and soil porosity/aeration, which is influenced by machine traffic causing soil compaction. These properties influence soil productive capacity through their governance of many soil processes, such as nutrient availability, aeration, and moisture retention, and regulate net primary productivity within a climatic and soil textural framework (Figure 3).

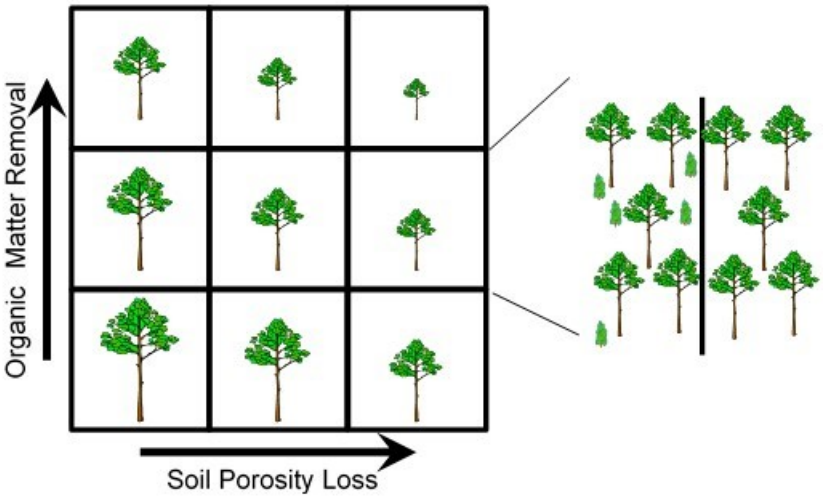

Figure 3. Range of experimental units at core locations. Inset illustrates the herbicide and non-herbicide treatments. Plots are 0.4 ha.

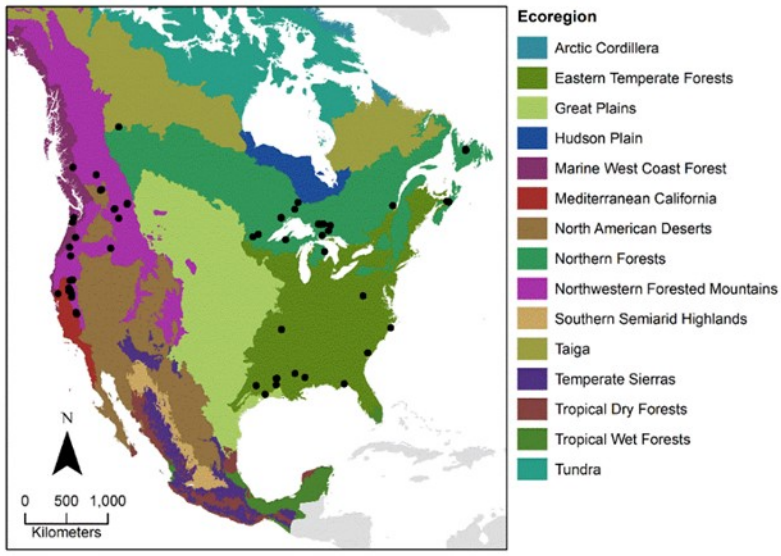

Figure 2. Location of North American long-term soil productivity study sites.

In short, core LTSP installations have three levels of organic matter removal (bole only, whole tree harvesting, and whole tree + organic matter removed) and three levels of compaction (none, moderate, and severe). As additional treatments, on many study sites each 0.4 ha plot was divided (split-plot), with herbicide applied to half the plot to eliminate competing vegetation and assess unimpeded crop tree growth vs. total vegetation growth. At affiliate sites not all core treatments were applied and, in many cases, ameliorative treatments such as fertilization or bedding were used. The collective set of treatments represent a continuum of conditions common after harvesting operations, helping to fully describe the extent of the effects that increased organic matter removals and reduced soil porosity may have on soil productivity, stand development, and crop tree growth potential across a range of forest types, soils, and macroclimates.

Beyond the long list of previous publications, of interest is a recent special issue of Forest Ecology and Management focused on LTSP: https://www.sciencedirect.com/journal/forest-ecology-and-management/special-issue/1059NQZGW2P. This collection of papers illustrate the insight provided from the LTSP research network about how different site-specific factors and their interactions mediate soil organic matter turnover, nutrient availability, microclimate (i.e., soil temperature and moisture), and competing vegetation, which collectively drive forest dynamics and site productivity leading to plausible and defensible solutions for sustainable forest management. Some results that resource managers can apply to maintain long-term productivity and carbon storage include:

- Repeated application of herbicide during stand establishment may not result in a continual increase in tree volume, and how long to apply herbicide treatments needs further evaluation (Littke et al. 2020).
- Interactions between vegetation control and soil available nutrients need further examination. Consideration of trade offs between controlling aggressive competing species and preserving plant available nutrients is warranted (Littke et al. 2021).

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- Maintaining surface organic matter horizons during harvesting is critical for long-term growth, carbon storage, nutrient retention and cycling, water conservation, and microbial functions. Given enough time, surface organic horizons will recover following disturbance (Garrett et al. 2021a, James et al. 2021)
- Over time, full-tree harvesting plus organic horizon removal has reduced soil nitrogen (N) availability more than operational tree-length harvesting and stands with understory vegetation control are now showing indications of reduced N availability (Hazlett et al. 2021)
- Deep soil compaction remains a concern for at least 30 years after harvesting and effects may extend until the next harvest, which could compound negative effects on water retention, soil aeration, root growth, and microbial activity in future stands (Busse et al. 2020).
- In New Zealand, LTSP results underpin significant changes in management of forests for supporting microbial health, and soil nutrition and soil sampling depth has been increased to recognize the importance of evaluating deep (1 m) soil carbon and nutrients (Garrett et al. 2021b).
- Understanding post-harvest responses within the context of relationships among stand development (not simply time since harvest), changes in microclimate that mediate soil processes, and resource supply and demand may provide greater insights into longer-term effects of harvesting and establishment practices (Fleming et al. 2021).
- On coarse textured, low productivity soils, organic matter removal and compaction treatments did not reduce tree height, indicating the resilience of oak and pine species in the Ozark Highlands (Lyczak et al. 2021).
- Forest harvesting, woody residue dispersal or piling, vegetation control, and regeneration practices can influence vegetation recruitment and competitive relationships, which may limit longer-term forest productivity (Harrington et al. 2020).

After nearly 30 years, the collaboration amongst motivated individuals has proven that a grassroots effort can create a network that provides key scientific data relevant to resource managers and policy makers. Our results highlight the need to develop and use best management practices that avoid soil disturbances rather than trying to mitigate impacts. For soil compaction, we found that dispersed rather than concentrated forwarding patterns and use of slash mats on trails or near landings reduce deep compaction. Harvesting finer-textured soils while they are frozen can reduce effects on soil aeration and porosity. From an organic matter retention perspective, LTSP network findings indicate that bole only and whole tree harvesting generally do not have lasting negative effects, but some regional and site-specific differences support the need for customized approaches in certain areas. In contrast, whole tree harvesting with surface organic matter removal had significant and lasting negative effects that may influence ecosystem stability. This finding suggests a threshold level for organic matter retention that likely lies somewhere along the continuum of treatments and urges a cautionary approach to adopting higher biomass utilization systems to support the bioeconomy. Ongoing measurement of the installations remains a priority, with particular emphasis on determining when soil properties return to pre-treatment levels, how the pulse disturbances affect total biomass yield at the end of the rotation, and how forest management treatments might alter soil carbon in a changing climate.

For details, see select references:

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Ontario's forest growth and yield research program

Mahadev Sharma, Growth and Productivity Research Scientist, Forest Research and Monitoring Section; Science and Research Branch; Ministry of Northern Development, Mines, Natural Resources and Forestry

Forest growth and yield (G&Y) model development in Ontario dates to the late 1940s when the first coordinated provincial studies began. Significant products from these studies were Walter Plonski's 1956 normal yield tables for the major commercial tree species and associated provincial cull tables. These yield tables were later updated and converted to metric. However, since Plonski's normal yield tables reflect tree growth in natural stands, they no longer meet the needs of foresters working to ensure a continuous flow of products and forest values, as they do not account for changes in stand composition and structure resulting from silviculture or the effects of climate change. Also, estimating sustainable wood supply requires a stand level G&Y model. For Ontario, the Modelling and Inventory Support Tool (MIST) was developed by incorporating benchmark yield curves to be used in forest management planning. However, this tool does not calculate forest growth, which is vital for any stand level G&Y model.

Over the years, a network of more than 4000 permanent sample plots (PSPs) and permanent growth plots (PGPs) have been established across the province to investigate stand dynamics, forest productivity, and basic biological processes (Figure 1). These plots provide the data to support current modelling efforts.

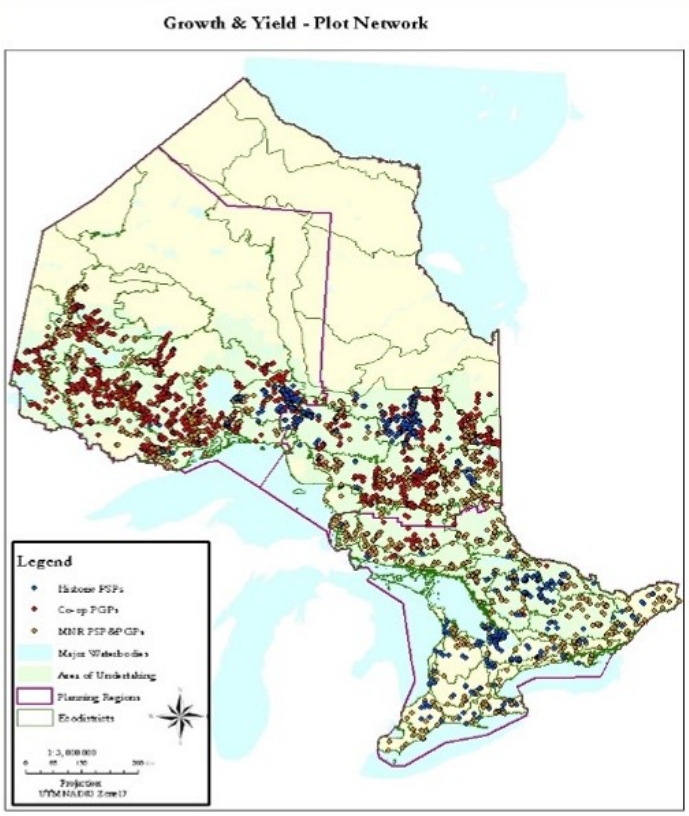

Figure 1. Distribution of the growth and yield plot network across Ontario.

Early research program efforts

Benchmark yield curves developed based on re-measurement data collected from PSP and PGP plots across Ontario were embedded into MIST to calculate sustainable wood supply. These curves were formulated by integrating individual tree models (e.g., site index, volume, taper, volume and basal area growth, and mortality). While these new yield curves were an improvement on those previously used in Ontario, they remained a work in progress. Individual tree models are the foundation of any stand level G&Y model (including yield curves), but when benchmark yield curves were first developed models that accounted for stand type, structure, and climate change were not available for all commercial tree species in Ontario. Thus, these yield curves are updated as new tree level models become available for Ontario tree species that are sensitive to a range of silvicultural treatments, including commercial thinning, and current stand structure.

Climate effects on site productivity and diameter growth

Most of the stand level G&Y models (including the yield curves embedded in MIST) are driven by site index, which is a measure of site productivity. Therefore, it is crucial to have accurate site index models to support wood supply estimates. Since site productivity is affected by climate, site index models that incorporate climate variables have been developed for jack pine, white pine, red pine, black spruce, and white spruce plantations. Similarly, new site index models have been developed for jack pine and black spruce natural stands. Climate sensitive site index conversion equations have also been developed for jack pine and black spruce natural mixed stands to estimate site index of one species relative to the site index of the other. Diameter growth is another important component of stand level G&Y models and is affected by stand type (natural vs. plantation) and climate change. Therefore, diameter growth models that incorporate climate change have been developed for jack pine, black spruce, and red pine plantations.

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Height-diameter equations

The volume of a tree is estimated by establishing its relationship with diameter at breast height (DBH) and total tree height (volume equation). The DBH can be measured quickly, easily, and accurately but measuring total tree height is relatively complex, time consuming, and expensive. Therefore, height-diameter relationship models are used to estimate heights of trees by measuring their diameters. This relationship is affected by stand type and density. As a result, height-DBH models that account for stand type and density have been developed for most of the commercial tree species in Ontario.

Taper and volume equations

Taper equations are used to estimate diameters along the bole at any given height and potential product yields from individual trees. Individual tree volumes can also be calculated using these taper equations and they provide information about tree form and can be used to estimate volume for any part of the stem. Total stand volume can be obtained by summing individual tree volumes. The taper, and hence volume, of a tree depends on tree species and stand type. Trees grown in plantations taper more than those in natural stands. Therefore, for a given DBH and total height, a plantation grown tree will have less wood volume than one from a naturally regenerated stand. Moreover, for a given tree species and stand type, taper is affected by stand density. The higher the density, the less the taper. Therefore, having taper and volume equations that are specific to tree species, stand types, and stand density would help ensure more accurate estimates of volume and wood supply. As a result, taper equations that account for stand density have been developed for jack pine, black spruce, and red pine plantations as have volume equations.

Current research

Volume equations developed by Honer in 1967 (converted to metric units in 1983) are being used in eastern Canada to calculate individual tree volumes for 21 tree species grown in natural stands. Work is underway to replace Honer's volume equations. This work will include volume equations for 5 additional tree species (two cedars, large-tooth aspen, white ash, and European larch) for which volume equations are not currently available. Similarly, site index conversion equations are being developed for black spruce, jack pine, and aspen natural mixed stands to be used in a changing climate. Recently, Forestry Future Trust approved a project to develop volume and taper equations for white pine and white spruce plantations that account for stand density. Using data collected for this project, diameter growth models will also be developed for these tree species by incorporating climate variables. This work will be completed by the end of 2024.

At that point, Ontario will have new site index/height growth and diameter growth models for all major commercial tree species (jack pine, red pine, white pine, black spruce, and white spruce) grown in plantations and site index conversion equations for jack pine, black spruce, and aspen natural mixed stands that can be applied in a changing climate. Ontario will also have newly developed inside and outside bark volume and taper equations that factor in stand type and density for these major commercial conifer species. Newly developed height-diameter equations accounting for stand type and density provide more accurate height estimates than traditional equations for all major commercial conifer and hardwood tree species. Similarly, new total and merchantable volume equations developed will be more accurate and efficient than currently available volume equations for 25 commercial tree species grown in natural stands in eastern Canada.

This work supports Ontario's Forest Sector Strategy action of applied research and best science to support planning.

Related key publications

Taper models

- Sharma, M. and J. Parton. 2009. Modeling stand density effects on taper for jack pine and black spruce plantations using dimensional analysis. Forest Science 55: 268–282.

- Sharma, M. 2020. Incorporating stand density effects in modeling the taper of red pine plantations. Canadian Journal of Forest Research doi.org/10.1139/cjfr-2020-0064

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Volume models

- Sharma, M. 2019. Inside and outside bark volume models for jack pine (*Pinus banksiana*) and black spruce (*Picea mariana*) plantations in Ontario, Canada. Forestry Chronicle 95: 50–57.
- Sharma, M. 2020. Increasing volumetric prediction accuracy – an essential prerequisite for end-product forecasting in red pine. Forests 11: 1050.

Height-diameter models (developed using PGP and PSP data)

- Sharma, M. and J. Parton. 2007. Height-diameter equations for boreal tree species in Ontario using a mixed-effects modeling approach. Forest Ecology and Management 249: 187–198.
- Sharma, M. 2016. Comparing height-diameter relationships of boreal tree species grown in plantations and natural stands. Forest Science 62: 70–77.

Diameter growth models

- Subedi, N. and M. Sharma. 2011. Individual-tree diameter growth models for black spruce and jack pine plantations in northern Ontario. Forest Ecology and Management, 261: 2140–2148.
- Subedi, N. and M. Sharma. 2013. Climate-diameter growth relationships of black spruce and jack pine trees in boreal Ontario, Canada. Global Change Biology, 19: 505–516.
- Sharma, M. 2021. Modelling climate effects on diameter growth of red pine trees in boreal Ontario, Canada. Trees, Forests and People 4: 100064.

Stand height/site index models

- Sharma, M., N. Subedi, M. Ter-Mikaelian, and J. Parton. 2015. Modeling climatic effects on stand height/site index of plantation-grown jack pine and black spruce trees. Forest Science 61: 25-34.
- Sharma, M. and D. Reid. 2018. Stand height/site index equations for jack pine and black spruce trees grown in natural stands. Forest Science 64:33-40.
- Sharma, M. and J. Parton. 2018. Analyzing and modelling effects of climate on site productivity of white spruce plantations. Forestry Chronicle 94: 173-182.
- Sharma, M. and J. Parton. 2018. Climatic effects on site productivity of red pine plantations. Forest Science 64:544-554.
- Sharma, M. and J. Parton. 2019. Modelling the effects of climate on site productivity of white pine plantations. Canadian journal of forest research 49: 1289-1297.
- Sharma, M. 2021. Climate effects on jack pine and black spruce productivity in natural origin mixed stands and site index conversion equations. Trees, Forests and People 5: 100089.

A balanced solution: Ecological offsetting in the Lake Simcoe watershed

Kate Lillie, Natural Heritage Ecologist, Lake Simcoe Region Conservation Authority

Based on a presentation provided at the Ontario Professional Foresters Association Annual Conference, April 8, 2021

Ecological offsetting is a big topic. It's not a new concept, but it is certainly something that is top-of-mind for many involved with natural resource management and the development industry these days, particularly those who live and work in and around the Greater Toronto Area. Ecological offsetting is sometimes also called ecosystem compensation or biodiversity offsetting. But these terms all encompass the same idea – *compensation for the unavoidable loss of natural heritage features from one area through the replacement or enhancement of features in another area*.

Figure 1. Map of Lake Simcoe watershed.

In the Lake Simcoe watershed (just north of Toronto) the Lake Simcoe Region Conservation Authority (LSRCA) has been implementing ecological offsetting for the past several years.

Striking the Right Balance

In response to increasing development pressure, the LSRCA formalized an Ecological Offsetting Policy (EOP) in 2017 to support an objective of no net loss of natural heritage features while working towards a net gain. LSRCA was among the first Conservation Authorities in Ontario to pursue this innovative route to finding win-win solutions.

More than 500,000 people live in the Lake Simcoe watershed, along with 1250 different plant species and more than 300 different bird, fish, reptile, amphibian, and mammal species. That is a lot of life depending on a healthy and functioning natural heritage system. Protecting what is most valuable while providing the homes, infrastructure, and other hardscapes that people need for their day-to-day lives is a delicate balance to strike. LSRCA's EOP recognizes the importance of finding the balance between economic growth and conservation. It facilitates development on strategically important land while also recognizing that not all natural heritage features can be easily replaced. The Policy is applied to development proposals that the require approval under the *Planning Act* or the *Environmental Assessment Act*. There are some exceptions though. Smaller scale developments that are in keeping with the existing use of a property, such as building a new garage on a residential lot or a new barn on an agricultural property, are exempt. The EOP applies to two main natural heritage feature types – woodlands and wetlands. These features are often protected, at least in part, by other land use planning policies, but not always. And the woodlands and wetlands that are not protected by policy were being lost from the landscape with no replacement required. That is, until the EOP was formalized. Now, where a woodland or wetland is lost, there is a requirement to replace it elsewhere in the watershed.

Is this just "Pay to Slay"?

The EOP applies a mitigation hierarchy - offsetting is only used as a last resort. Where development is proposed, before offsetting can be considered for the removal of woodland or wetland, proponents must show that all

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other options have been explored. This means that removals and impacts must first be avoided where possible. If unavoidable, they must be minimized and then mitigated. Only after these first three actions are taken can offsetting be considered. Once it has been determined that there will be an approved loss of woodland or wetland, the EOP is applied.

Who is Responsible and for What?

There are two options for meeting the requirements of the EOP. Proponents can either replace lost features themselves, or they can make a cash-in-lieu payment to LSRCA to complete this work on their behalf. Recognizing that an established woodland and wetland cannot be replaced on the landscape overnight (it takes years for a man-made feature to get back to something similar to what nature creates on its own) the Policy requires that woodland is replaced at an area ratio of 2:1 and wetland at a ratio of 3:1. So 1 ha of woodland lost = 2 ha of woodland replaced. Any vegetation protection zone that would have been applied is also accounted for and is required to be replaced at a ratio of 1:1.

If a proponent can replace features themselves, they need to follow the ratio requirements or demonstrate that what they're proposing will result in an equivalent ecological gain. In addition to physically replacing features, the Policy also requires proponents to pay an amount equal to one year's worth of the ecosystem service value for the feature being removed. It is preferred that proponents be responsible for replacing features themselves. This helps with replacing features as close as possible to where they are lost. But where it's not possible, there is the cash-in-lieu option. The cash-in-lieu value is based on the cost to recreate woodland and wetland and considers the cost of land, planning and design, site preparation and construction, plant material and administration.

Why Should Foresters Care?

Through the application of the EOP and together with the development industry, and municipal partners, LSRCA has been able to recreate woodlands and wetlands on the landscape, restoring ecological function to degraded areas and expanding the natural heritage system. In other words, fully funded new forests! With a considerable amount of growth projected for the Lake Simcoe watershed, the EOP will continue to be a critical tool for maintaining the delicate balance between natural heritage protection and economic growth and development.

Follow these links for more information about LSRCA's:

Ecological Offsetting Policy https://www.lsrca.on.ca/offsetting

Natural Heritage System and Restoration Strategy https://www.lsrca.on.ca/watershed-health/natural-heritage-strategy

Valuing Natural Capital in the Lake Simcoe Watershed Report https://www.lsrca.on.ca/Shared%20Documents/reports/Ecosystem-Service-Values.PDF

Rooted in forest advocacy: The CIF-IFC

For over a century, the Canadian Institute of Forestry/Institut forestier du Canada (CIF-IFC) has been representing forestry interests across Canada and has been a trusted voice of forest practitioners.

As the CIF-IFC is not a regulatory body or a lobby group, we occupy a unique niche in the Canadian forest sector and forestry landscape similar to advocacy organizations representing other regulated professions. Our focus includes: providing national leadership, promoting competence, forest education, recognizing achievements in forestry by both CIF-IFC members and non-members, and fostering public awareness of Canadian and international forestry issues.

We are comprised of 1,200 members spanning across 18 regional sections, from Newfoundland and Labrador to Vancouver Island, and up to the Klondike, and an international section. With such a large and encompassing reach, we truly are a coast-to-coast-to coast organization.

Foresters, forest technologists and technicians, ecologists, biologists, educators, and many others with an interest in forestry and forests have a voice in our organization. The Institute endeavors to speak out and speak up for the world class sustainable forest management practices found here in Canada.

The Institute has several standing Committees including a Forest Advocacy Committee (FAC) that meets regularly. Through the guidance of the FAC, and with a dedicated, full-time Forest Communications Advocate on staff, we are well positioned to advocate on behalf of regional and national issues affecting professionals and practitioners across Canada. We advocate using both reactive and proactive, science-based approaches. In addition, we are engaged on various national level committees, including being a member of the Canadian Forestry Accreditation Board, and the Forest Professional Regulators of Canada.

On a provincial level, the CIF-IFC has been a vocal proponent of forestry issues impacting Ontario, including providing input into the protection and recovery of black ash (*Fraxinus nigra*), supporting sustainable forest management practices in Algonquin Park, promoting silvicultural tree marking, and responding to the Government of Ontario's decision to close the Ontario Tree Seed Plant, among others. To read all of our advocacy pieces to-date, visit: www.cif-ifc.org/speaking-out.

If you have any questions or inquiries regarding advocacy, contact Matthew Perry, Forest Communications Advocate at mperry@cif-ifc.org.

New members are always welcome. Please join us so that you can give voice to the forest issues that are relevant to you and your colleagues! When you become a member and #RootedInCIF, you are joining a community of like-minded individuals who are passionate about forestry, making a real impact on forests, and expanding their forestry knowledge. For more information on becoming a member, contact Kerry Spencer, Office and Finance Manager at admin@cif-ifc.org, or visit: www.cif-ifc.org/membership-content/become-a-member.

For all the latest updates and news from CIF-IFC, follow us on Facebook, Twitter, Instagram, LinkedIn, and/or YouTube.

We also invite you to join us online for our virtual 2021 National Conference and 113th Annual General Meeting, taking place from October 6th-7th with the theme "Rooted in Resilience". Learn more or register here: www.cif-ifc.org/2021-conference-agm.

We hope to hear from you soon!

7 SECTIONS IN ONTARIO

Sections are the foundation of the Institute giving us a strong local, regional, and provincial network and presence.

Ontario Sections:

- Algonquin
- Central Ontario
- Lake of the Woods
- Northern Ontario
- Northwestern Ontario
- Ottawa Valley
- Southern Ontario

CIF-IFC INITIATIVES:

As a member you become an important part of an organization dedicated to supporting sustainable forestry and beyond, while taking strides to make a difference and inspire the next generation of forestry leaders.

We are leading the way with forward thinking through our programs and initiatives, including but not limited to:

- National Forest Week
- Teachers' Forestry Tours and teaching kits
- *Free to Grow in Forestry* initiative on inclusion and diversity
- Knowledge Exchange and Competency Training
- National Electronic Lecture Series
- Advancing a proposal to create the first national view in real time of urban forestry in Canada
- *The Forestry Chronicle*

Council Corner

Neil McLean, R.P.F., Councillor Central West

Council Corner is to provide membership with insight into what happens at OPFA Council meetings.

Meeting online has some definite practical advantages. Council has utilized those to maximum effect. Our review of the then current strategic plan began in early 2020. In November 2020, we contracted with Carla Rhyant to facilitate the development of the 2021-2026 OPFA strategic plan, which is now final and approved by council in May 2021. The plan is on the OPFA website at https://opfa.ca/wp-content/uploads/2021/06/StrategicPlan2021-2026FINAL-min.pdf. Personally, I find it remarkable that we completed all this using only online meetings.

The following is a Coles notes version of the Strategic Plan 2021-2026:

Vision

Trusted to serve the public interest by regulating Ontario professional foresters at the highest standard of ethical conduct and professional forestry practice.

Mission

To regulate and advance the professional practice of forestry in the public interest.

Strategic goal summary (for full goal statements see the plan)

- internal stakeholders' competencies are continuously advanced,
- governance documents and practices are relevant, reflect best practices and mitigate organizational risk,
- operations are implemented effectively and continuously monitored,
- awareness of the regulated profession is improved among internal and external stakeholders
- regulatory programs are managed fairly to protect the public interest.

We do all this in accordance with our Values:

- Accountable
- Committed
- Compassionate
- Competent
- Proactive
- Team Focused
- Trustworthy

Of course, our organization has numerous ongoing operational goals and initiatives, which the strategic plan neatly identifies. The current initiatives to update the Professional Foresters Act and to develop the Equity and Inclusion policies name but two important, volunteer led projects. Each of the strategic goals has a number of tactical goals. By the time you read this, Council will have started the process to implement the strategic plan. The challenges are numerous and relate mostly to balancing the priorities with resource limitations. A lot of the upcoming effort will depend heavily on volunteer effort. So, with that in mind, I trust that we can entice a healthy number of members to aid the effort.

I won't start naming names for fear of missing someone. But there is a significant number of members, a couple of dozen or so, who have contributed, and continue to contribute a lot of time and effort to our association. It is time to add some fresh faces. Our membership is strong and I'm sure that there is a lot of talent, expertise and innovative thinking; a potential for greatness in our association.

These are just some of the skills and knowledge expertise the association needs:

- Risk management
- Governance
- Compliance
- Financial acumen
- Policy development
- Training
- Cyber security
- Communication
- Marketing
- Mentoring
- Partnership building

By year end, Council will have the semblance of a road map ahead. Consider the call.

Public policy and the role of the Regulator and professional forester

Fred Pinto, R.P.F., Executive Director and Registrar, OPFA

Some professional foresters in Ontario often get worked up when issues related to their profession are debated in public. They may think that the regulator of the profession should speak up on their behalf, or that debate should be limited to only regulated professionals, or at the other extreme, prevent regulated professionals from participating in the debate.

Currently, issues related to old growth forests in British Columbia are front page news and the subject of intense public debate. To help develop workable solutions around old growth forests, the government of British Columbia appointed an Old Growth Technical Panel comprised of two registered forest professionals and three people from outside the profession.

The regulator of professional foresters in British Columbia, the Association of B.C. Forest Professionals (ABCFP), has received many messages from its registrants regarding the qualifications of the panel members. Many registrants are critical of the government's choices and feel that some members of the panel are infringing on the practice of professional forestry. Other registrants express concern that their colleagues are questioning government actions and fail to support the appointment of all panel members. In each case there is an expectation that the ABCFP would intervene in a specific way.

Christine Gelowitz, RPF, CEO of the ABCFP, has written an article that helps explain the role of a regulator in public debates related to forests. Her article is reproduced below in full with permission from the ABCFP.

Let's take a deep breath about the Old Growth Technical Panel

Christine Gelowitz, R.P.F., Chief Executive Officer of the Association of BC Forest Professionals

Staff of the Association of BC Forest Professionals (ABCFP) have received a range of concerns from registrants in recent weeks about the individuals appointed to the provincial government's old growth technical panel. These concerns range from questions about the qualification of the panel members to the requirement for anyone advising government in this capacity to be a forest professional. Others have expressed concern about registrants who are critical of the government's selection of candidates. In each of these cases, there is an expectation that the ABCFP will intervene in the matter, either through challenging government or confronting registrants who choose to openly challenge government.

Some perspective is needed.

First, the role of the ABCFP under the Professional Governance Act (PGA) is to ensure that only competent, registered forest professionals practice professional forestry. These registrants (forest professionals) are accountable to the public through the ABCFP Bylaws and the Code of Ethical and Professional Conduct. This does not mean that the ABCFP governs the opinions of forest professionals or their freedom to express different viewpoints publicly. All ABCFP registrants must carefully consider how they express these views in the public realm. However, it would be a disservice to the public interest if all open discussion about forest management was stifled by accusations of unethical conduct. Forest professionals can and should participate in robust, public dialogue about how public forests are managed because they have relevant knowledge and expertise.

Second, the government is entitled to choose its advisors on matters of public policy. In combination, aspects of the old growth panel work is anticipated to include reserved forestry practice, which only ABCFP registrants are authorized to undertake. In that regard, two ABCFP registrants are included as members of the old growth panel appointed by the government, as well as other qualified non-registrants. The PGA does not prevent such an

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occurrence, but, In fact, reinforces the ability for registrants of different professions to apply their knowledge to overlapping areas of science.

The ABCFP is also aware that the panel is supported by ABCFP registrants who work for the provincial government. The ABCFP enforces the boundaries of reserved forest practice under the Forest Professionals Regulation when there is clear evidence of infringement. This includes misuse of the protected titles or evidence that a non-registrant is doing work that only a registrant of the ABCFP is authorized to complete. The ABCFP does not believe there is evidence of practice infringement relative to the old growth panel based on currently available information.

Last, these are challenging and polarizing times in the forest and natural resource sector. The public eye has been focused on old growth protests on Vancouver Island, stirring debates that we haven't witnessed in almost 30 years. The BC Interior has experienced yet another devastating wildfire season, generating public fear of the potential for loss of life, home, and livelihood. Steps are being taken towards shared decision-making with Indigenous Peoples and the implementation of the Declaration on the Rights of Indigenous Peoples Act, which is positive and progressive, and also represents unknown, complex change. And pending forest policy changes have people wondering about the security of jobs in many rural communities.

Despite these pressures and worries, and regardless of personal views about the management of public forests, forest professionals have to step back and re-examine the public interest at this pivotal time in history. Silent forest professionals will not benefit the public. ABCFP registrants need to be engaged because they are knowledgeable and can inform the discussion. And while personal opinions of forest professionals can also help shape the dialogue and direction along with their scientific knowledge and expertise, they must always remain cognizant that determining the outcome about how BC forests will be used or managed is the role of governments in fulfilling their responsibility to interpret and respond to the desires of society. And rather than speaking out to target each other's views or ethics, forest professionals are better served to seek to understand what the owner of the resource wants from and for their forest, and help them achieve that through the sharing and application of their expertise and competency.

The diverse, informed voices of forest professionals are integral to developing sustainable long-term solutions in forest management. Despite the challenges speaking out can present, I encourage you to find meaningful ways to wade into or lead discussions, to not get caught up in opinion-based rhetoric, but rather bring data and knowledge into discussions that focus on shared solutions to best meet the evolving public and First Nations interests.

Christine Gelowitz, RPF, is the chief executive officer of the Association of BC Forest Professionals, a role she has held since 2016.

Members: Did you know?

The OPFA spends over $11,000 each year on credit card costs.
Credit cards are convenient and allow members to obtain points for future purchases but there is cost for these benefits. You can help reduce the cost to members by using cheques or e-transfers to opfa@opfa.ca for payments.

Council discussing changes to fees

Several fees will be reviewed and may be changed by Council. Council will be reviewing the cost of evaluating competencies of Associate member candidates with a limited scope of practice that do not have to undergo the national Competency Assessment Process. The cost of the Competency Assessment Process evaluation to the candidate is $500 while there is no charge to Associate member candidates with a limited scope of practice requesting to have their competency gaps assessed.

A comparison of Provisional member fees between provinces shows the fees charged by the OPFA are substantially lower. In the past OPFA Council decided to lower Provisional member application and annual fees in recognition that new members have various financial challenges and may be earning lower wages as they start their career. OPFA Provisional members currently pay a $100 application fee ($50 if they were a student member of the OPFA within 6 months of their application), $25 for their first year or part of the year for their initial year of Provisional membership. For the second and following years the annual membership fee is $100 or 16% of the practising member fee.

Other regulators of forest professionals charge a much higher fee for Provisional members. Some forest regulators charge Provisional members the same amount as practising members In British Columbia the application fee is $1000, and the annual fee is $470.61 or 83% of the fee paid by practising members. Council will be discussing what changes if any are needed to Provisional member fees.

The administration of the annual renewal of OPFA registrants is a significant workload but necessary task to ensure that the OPFA and its members are compliant with the regulations that govern our profession. A description of the process the OPFA uses to manage late reporting and the late payment of fees is described below:

Current practice for dealing with late payment of fees:

1. Nov 15 - Email reminder is sent to members who have not paid their fees. Allow up to Dec 15 to pay their fees before the late fee is applied.
2. Dec 17 - Email those who have not paid their fees to inform them that the Late Payment Fee has been applied to their account and how they can pay it.
3. Beginning of Jan an email is sent informing members who have not paid their fees that we are preparing a registered Letter of Pending Suspension.
4. Mid Feb a registered paper Letter of Pending Suspension is sent to inform them that they have 2 months to pay or their certificate of registration will be suspended. The Bylaw and the Professional Foresters Act require us to give at least 2 months' notice before the suspension takes effect.
5. Mid-March an email reminder that the Letter of Suspension is being prepared and they have 1 month to pay outstanding fees or their certificate of registration will be suspended.
6. Mid-April members are suspended and members are informed by registered paper letter. They are informed that after 6 months their membership is cancelled.
7. Mid-August email to inform members that their certificate of registration will be cancelled in 2 months. The Bylaw and the Professional Foresters Act require us to give at least 2 months' notice before the suspension takes effect.
8. Mid-October registered paper letter sent to members to inform them that their certificate of registration has been cancelled.

Current practice for dealing with non-reporting of competency information:

1. Jan 7 - General email reminder is sent to members who are required to report (Full, Associate, Non-Resident, and R.P.F. in Training with Scope) that they must report by January 15. This date is stipulated in article 18.3 of the Bylaw.
2. Feb 1- Competency reporting is assessed.

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3. Feb 10 - Targeted email reminder to those who haven't reported that the late fee will be applied soon.
4. Feb 17 - Reporting Fee is applied.
5. Feb 18 - Members are informed that the Late Reporting Fee has been applied and how to pay it.
6. Feb 25 - Email sent to those members who have reported, however, their reporting is deficient.
7. Mar 1 - Email reminder that the Letter of Pending Suspension is being prepared.
8. Mid-March registered Letters of Pending Suspension are prepared. Registrants are given 2 months to respond after which they will be suspended. The Bylaw and the Professional Foresters Act require us to give at least 2 months' notice before the suspension takes effect.
9. Mid-April email reminder that Letter of Suspended is being prepared.
10. Mid-May Letter of Suspension is mailed. Members have 6 months until their certificate is cancelled.
11. Mid-September email reminder that the Letter of Cancellation is being prepared. The Bylaw and the Professional Foresters Act require us to give at least 2 months' notice before the suspension takes effect.
12. Mid November registered Letter of Cancellation is mailed

Registrants that report or pay late place themselves and the OPFA in jeopardy with the expected duties of a regulated profession to protect the public and to be accountable for our professional work.

Three figures (See Figure 1, 2 and 3 below) help illustrate the magnitude of the issue. The number of OPFA registrants that report late or pay their fees late each year is high and needs to be reduced. The cost of the follow-up required is also high. Council will be discussing what can be done so that registrants are incentivised to pay and report on time and those that are late pay a fair share of the cost.

Figure 1. Number of members that pay late

Figure 2. Dollars owing in fees

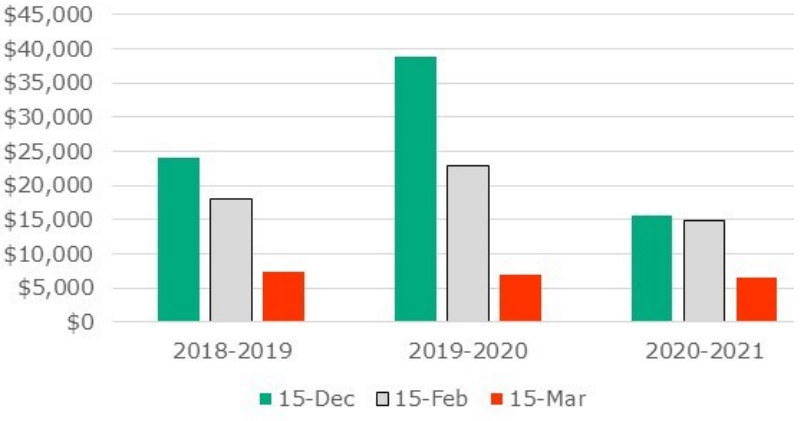
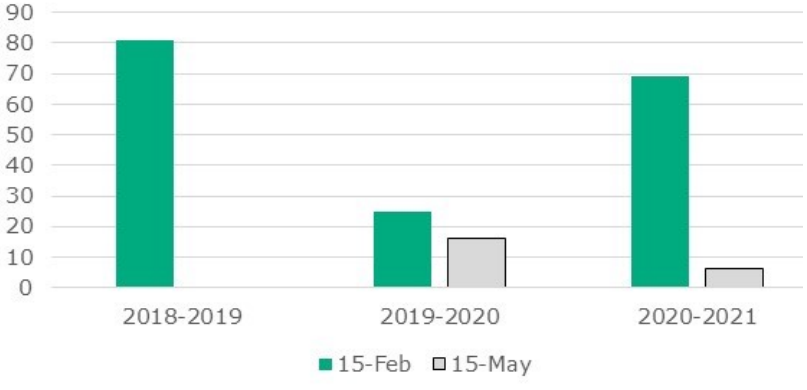


Figure 3. Number of members reporting competency support information late



READY FOR YOUR ANNUAL MEMBERSHIP RENEWAL?

In October, Members will receive Annual Membership Renewal information in the mail outlining needed actions. You will also receive an email with detailed instructions and links.

Annual membership renewal involves:

1. Reviewing and **updating your personal information-**please ensure your mailing address and other information is accurate;

2. **Paying your annual membership fees** (if applicable) for December 1, 2021, to November 30, 2022. Fees are due December 1, 2021, and are subject to a Late Payment Fee (see the current Fee Schedule) and;

3. **Completing your Competency Support Report form** (if applicable) for December 1, 2020, to November 30, 2021. Competency reporting is due January 15, 2022, and is subject to a Late Reporting Fee (see the current Fee Schedule).

The chart below summarizes what activities are required for each membership category:

MEMBERSHIP CATEGORY: **ANNUAL RENEWAL TASK:** √=required	**Student**	**Provisional (R.P.F. in Training)**	**Provisional (R.P.F. in Training with Scope)**	**Full**	**Associate**	**Non-Resident**	**Inactive**	**Life**	**Honourary**
1. Update your Personal Information	√	√	√	√	√	√	√	√	√
2. Pay your Membership Fees (by Dec. 1)		√	√	√	√	√	√		
3. Competency Reporting (by Jan. 15)				√	√	√			
4. Report that you are only working within scope (by Jan. 15)			√		√				
5. Report that you have maintained the certification needed for your scope of practice (by Jan.15)			√						

Payments may be made online (must be logged in as a Member), e-transfer (to opfa@opfa.ca), or by mailing a cheque, money order, or credit card information. Cheques and money orders must be made out to the **Ontario Professional Foresters Association** to be accepted by our bank.

Change in Membership Category-Changes to your membership category must be approved by our Registration Committee which meets approximately every two months; you will hear of the Committee's decision within 2 weeks of the meeting date. Please view the upcoming meeting dates and deadlines and plan accordingly.

Resigning-If you are thinking of resigning your membership, you must let us know as soon as possible. This will allow us to update the membership registry so that the public is aware that you no longer practise professional forestry. For you to resign while in good standing you must resign by December 1. Whether or not you are in good standing at the time of your resignation will determine the Readmission Process

Grey Areas
SML Steinecke Maciura LeBlanc Barristers & Solicitors
A COMMENTARY ON LEGAL ISSUES AFFECTING PROFESSIONAL REGULATION

Fixing Good Character Registration Requirements

by Erica Richler
Summer 2021 - No. 258[1]

As a general rule, regulators cannot discipline practitioners for conduct that occurred before they became registered: *Association of Professional Engineers of Ontario v. Leung*, 2018 ONSC 4527 (CanLII), https://canlii.ca/t/htl3k. One exception is where the applicant provided false information on their application for registration about their pre-registration conduct. However, the questions posed on the application form must then be clear and unambiguous before the regulator can act on a failure to disclose past examples of bad conduct: *Payne v. Law Society of Upper Canada*, 2014 ONSC 1083 (CanLII), https://canlii.ca/t/g6982.

Therefore it is important for regulators to screen for applicants whose past conduct suggests that they will act unprofessionally in the future. Regulators who fail to do so face considerable criticism. Even someone with good technical skills can cause significant damage through inappropriate, dishonest or abusive conduct: https://www.theglobeandmail.com/opinion/article-the-good-doctor-its-time-to-stop-treating-character-like-an/.

In the case of police officers, the evidence shows that officers who have had conduct issues in the past are much more likely to have additional complaints in the future when they move to a different jurisdiction: https://www.newyorker.com/news/us-journal/how-violent-cops-stay-in-law-enforcement.

However, in recent years, regulators have been criticized for imposing good character requirements that are misguided, ineffective, intrusive, unnecessarily traumatic and discriminatory.

Misguided and Ineffective

Many criticisms of good character registration requirements go back to the seminal article by Alice Woolley's on *Tending the Bar: The "Good Character" Requirement for Law Society Admission*: https://digitalcommons.schulichlaw.dal.ca/cgi/viewcontent.cgi?article=1911&context=dlj (now Justice Woolley).

Alice Woolley argues that the conceptual foundation of the good character approach is flawed:

> Good character is thus defined not simply as a matter of moral behaviour, but also as a matter of having the virtues which will result in moral behaviour…
>
> It is impossible to prove that conduct flows from character, and some have argued that the assertion that it does is largely indefensible… *[footnote omitted]*
>
> To the social psychologist the overwhelming empirical evidence is that it is the circumstances of the lawyer's life—the pressures, culture and temptations of legal practice—which will dictate the ethics of his practice.

[1] This is a reprinted version of a paper published by the Canadian Network of Agencies of Regulation (CNAR).

FOR MORE INFORMATION
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Alice Woolley also expressed significant concerns about how the good character process is administered:

> First, there is little consistency with respect to how past misconduct will be treated. Second, there is little consistency with respect to the significance which will be accorded to positive third party references about the applicant. Third, there is significant variation in how psychological evidence is used. Fourth, decisions often turn less on the evidence received about the applicant than on the panel's impression of the applicant as a witness during the proceeding. Finally, and perhaps most significantly, even when two cases present similarly on several evidentiary levels, inconsistent outcomes may be reached…
>
> Further, and more significantly, because law societies do not undertake independent investigation of applicants, there is no assurance that all applicants with issues arising from prior misconduct have been identified. Even a basic requirement that applicants provide a criminal record check, or a social services check, would significantly widen the scope of the law societies' inquiries. … [The] investigation of potential applicants should reach beyond the simple self-reporting system currently used.

Alice Woolley concludes:

> [T]he focus needs to be less on an applicant's "character" writ large than on her "fitness" for the ethical rigours of legal practice.

Research in the United States suggests that past criminal findings are poor predictors of future professional misconduct: Levin, Leslie, "Rethinking the Character and Fitness Inquiry" (2014). Faculty Articles and Papers. 125, cited at: https://opencommons.uconn.edu/law_papers/125.

Intrusive, Unnecessarily Traumatic and Discriminatory

The May 2021 article in Canadian Lawyer entitled *Good character, bad predictor, for law societies* cites Alice Woolley: https://www.canadianlawyermag.com/resources/professional-regulation/good-character-bad-predictor-for-law-societies/356482.

The article goes further, suggesting that the good character questions asked of applicants are too broad.

> Amy Salyzyn, an associate professor at the University of Ottawa's faculty of law, says there is a lack of evidence that the "good character" process is even effective in protecting the public. "If you look at the number of questions on the good character requirement form . . . it would be interesting to know what empirical evidence is behind [each] question," says Salyzyn. "Because the connection between those questions and future concerns aren't always evident. I think it's a part of a broader need for law societies to engage in evidence-based regulation."

Samantha Peters from the University of Ottawa law school raised the issue of the discriminatory impact of the good character requirements:

> "I understand that the good character requirement is intended to protect the public and maintain high ethical standards in the profession," says Peters. "But I think that the

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> current process, as it stands, does not fully take into account the over-policing, wrongful convictions and criminalization of everyday movements of Black, Indigenous and criminalized folks."

An earlier article in Canadian Lawyer by Naomi Sayers, an Indigenous lawyer, described the trauma of going through the good character screening process: https://www.canadianlawyermag.com/news/opinion/the-trauma-of-proving-my-good-character/275404.

In an article published earlier this year, Andrew Flavelle Martin reviewed the case law and literature on regulators asking questions about applicants' mental health: Mental Illness and Professional Regulation: The Duty to Report a Fellow Lawyer to the Law Society | Alberta Law Review. Such questions may be presumptively discriminatory and need to be worded in such a way as to not to be overly inclusive, capturing medical histories that are unlikely to be relevant to the suitability to practise the profession.

The CBC recently reported on a request for a regulator to reduce the kinds of good character information that applicants for regulation need to disclose because the questions are "an intrusion of privacy …. [and] also deter members of marginalized groups from joining the legal profession …." https://www.cbc.ca/news/canada/manitoba/manitoba-lawyers-good-character-screening-1.5954198

In the United States there has been a concern that criminal records have unduly excluded people from occupations and professions, particularly racialized and marginalized individuals. Reforms are ongoing to reduce this barrier: https://ij.org/report/barred-from-working/; https://www.clearhq.org/page-1860709.

So What is a Regulator to do?

These critiques are not entirely consistent. Some call for broader scrutiny of past conduct to identify possible concerns. Others call for more limited questions focused on the most relevant of conduct and which do not have discriminatory effect.

However, even the strongest critics seem to see some sort of ongoing role for regulators to screen the past conduct of applicants for registration. As Alice Woolley states:

> Moreover, it is possible to imagine plausible but hypothetical cases … in which maintenance of the character requirement seems essential. If, for example, a lawyer were to be disbarred by the Law Society of Alberta for misappropriation of client funds and then apply for admission to the Nova Scotia Barristers' Society, it is obvious that his admission should be denied on the basis of his character as evidenced by his disbarment. *[footnote omitted]*

A good starting point for regulators is the leading case of *Ontario (Alcohol and Gaming Commission of Ontario) v. 751809 Ontario Inc. (Famous Flesh Gordon's)*, 2013 ONCA 157 (CanLII), https://canlii.ca/t/fwk8l. That case dealt with whether a member of the Hells Angels met the "good character" requirements to obtain a liquor licence. The learning points from that case include the following:

- The test in that legislation did not even refer to "good character". Rather it took the more modern and relevant approach of asking whether the past conduct of the applicant afforded reasonable grounds for belief that the

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applicant will not carry on business in accordance with the law and with integrity and honesty.
- The regulator could look at any past conduct of the applicant, not just past conduct in the practice of the business or profession.
- The past conduct did not need to result in criminal findings.
- The analysis of the past conduct was for the sole purpose of assessing whether it was likely to affect the future conduct of the practitioner.

Also, the standard of suitability based on anticipated future conduct is less generous to the applicant than the standard for removing someone from the profession who is already a member. That a practitioner has not been removed by their current regulatory body does not mean that another regulator has to register someone with a troubled practice history: *Lum v Alberta Dental Association and College (Review Panel)*, 2016 ABCA 154 (CanLII), https://canlii.ca/t/grmxn; *Nowoselsky v Saskatchewan Association of Social Workers*, 2015 SKQB 390 (CanLII), https://canlii.ca/t/gmn1w.

See also the discussion by Rebecca Durcan about how Canadian regulators, generally, are analyzing the relevance of past conduct concerns, from whatever source, to the future professional behaviour of the applicant: https://www.clearhq.org/page-1860709.

Going beyond the guidance of the case law, regulators might consider the following:

1. The legislative test should be amended if necessary so that it is based on whether the past conduct of the applicant provides a reasonable basis to believe that their future behaviour is likely to cause harm.
2. Even though the questions posed should not be limited to criminal conduct,[2] they should be as objective as possible. For example, conduct that resulted in complaints, investigations, formal allegations, charges, tribunal findings or court findings might all be reportable.
3. The questions should capture concerns where consequences were avoided, for example, by resigning from a position or similar avoidance strategies.
4. Regulators should consider whether it is appropriate to obtain additional information beyond the applicant's self-declaration. For example, contacting prior regulators of applicants should probably be routine. Even better would be a searchable database shared with other regulators. Are internet searches appropriate? Should CanLII or other court and tribunal case databases be searched? Should criminal record checks be required?
5. The regulator should have a comprehensive published policy explaining in plain language the purpose of the registration conduct requirements, the process followed, and the considerations taken into account by the regulator. The policy should expressly address concerns about how disabilities will be accommodated and how the experience of individuals from marginalized groups will be taken into account.
6. Communications strategies should be developed to ensure that potential applicants learn of the expectations and processes early on in their education and training for entry into the

[2] In some jurisdictions, human rights provisions limit scrutiny of offence records. Those restrictions need to be honoured.

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profession. Posting a policy on the regulator's website may not be sufficient.

7. Special care must be taken in formulating the questions that will be asked about mental illness, addictions and historical conduct so as to comply with human rights obligations.
8. Regulators should carefully review their processes and language used in communicating with applicants where there are concerns, particularly where those concerns might be related to disabilities and past trauma. For example, inviting the applicant to have a preliminary telephone call before receiving a formal letter requesting additional information may be appropriate in some cases. Perhaps the regulator can offer a resource person, who is not involved in the decision making, to communicate with the applicant, if desired.
9. Investigations into concerns should be planned and focused. Requiring an applicant to report on their entire life experiences may not be necessary or appropriate.
10. Both staff conducting investigations of prior conduct concerns and decision makers on whether the applicant's past conduct creates a risk of future harm should receive training. The training should not only cover the published criteria, but should also include awareness of the impact of disabilities, race and social disadvantages on creating reportable past conduct concerns.

Regulators will continue to face competing demands in the assessment of prior conduct of applicants for registration. However, awareness of the issues should enable regulators to balance protection of the public with humane, legally defensible processes and relevant criteria.

Member News

New Full (R.P.F.) Members:

Samuel Asirifi
Rebecca Barakat
Genevieve Hennessey (Re-admitted)
Winter Lamont
Kristy Vannieuwenhuizen

Please welcome and support the following people who have been admitted into the OPFA but are not yet entitled to practice professional forestry in Ontario:

New Provisional Members (R.P.F. in Training) (may practice if under the direct supervision of a qualified member):

Jared Binguis
Sarah Grubb
Jaime Jacques
Meagan Krzywicki
Aaron Swayze

New Student Members:

Ellen Clark
Dustin Kinzett

The following people are not entitled to practice professional forestry in Ontario and are no longer a registrant of the OPFA:

Resigned, Full Members:

Brian Fox

Continuing Education

Webinars and Other Resources

Websites that offer free webinars to earn CEUs for your membership maintenance.

1. Canadian Institute of Forestry (CIF-IFC)

https://www.cif-ifc.org/e-lectures/

2. Ontario Ministry of Natural Resources and Forestry. MNRF Science Insights, contact Kristy Mckay, Science Transfer Specialist at Kristy.McKay@ontario.ca

3. Forestry and Natural Resources Webinars

http://www.forestrywebinars.net/

4. Conservation Webinars

http://www.conservationwebinars.net/

5. Urban Forestry Today

http://www.urbanforestrytoday.org/

6. Climate Webinars

http://www.climatewebinars.net/

7. Cornell University

http://blogs.cornell.edu/cceforestconnect/subscribe/

8. Forestry Chronicle

http://pubs.cif-ifc.org/journal/tfc

9. Canadian Journal of Forest Research

http://www.nrcresearchpress.com/journal/cjfr

11. FPInnovations

https://web.fpinnovations.ca/blog/

12. Tree Research and Education Endowment Fund (TREE Fund)

https://treefund.org/webinars

Coming Events

National Forest Week: Our forests - continually giving
September 19-25, 2021

http://www.cif-ifc.org/national-forest-week/

National Tree Day
September 22, 2021

https://treecanada.ca/blog/10-ways-to-celebrate-national-tree-day/

CIF-IFC 2021 National Conference and 113th AGM
October 6-7, 2021. Virtual

http://www.cif-ifc.org/2021-conference-agm/

Forests Ontario 2022 Annual Conference - Strength in Biodiversity
February 9-11, 2022

https://forestsontario.ca/en/event/annual-conference

Please send any upcoming events to opfanewsletter@gmail.com