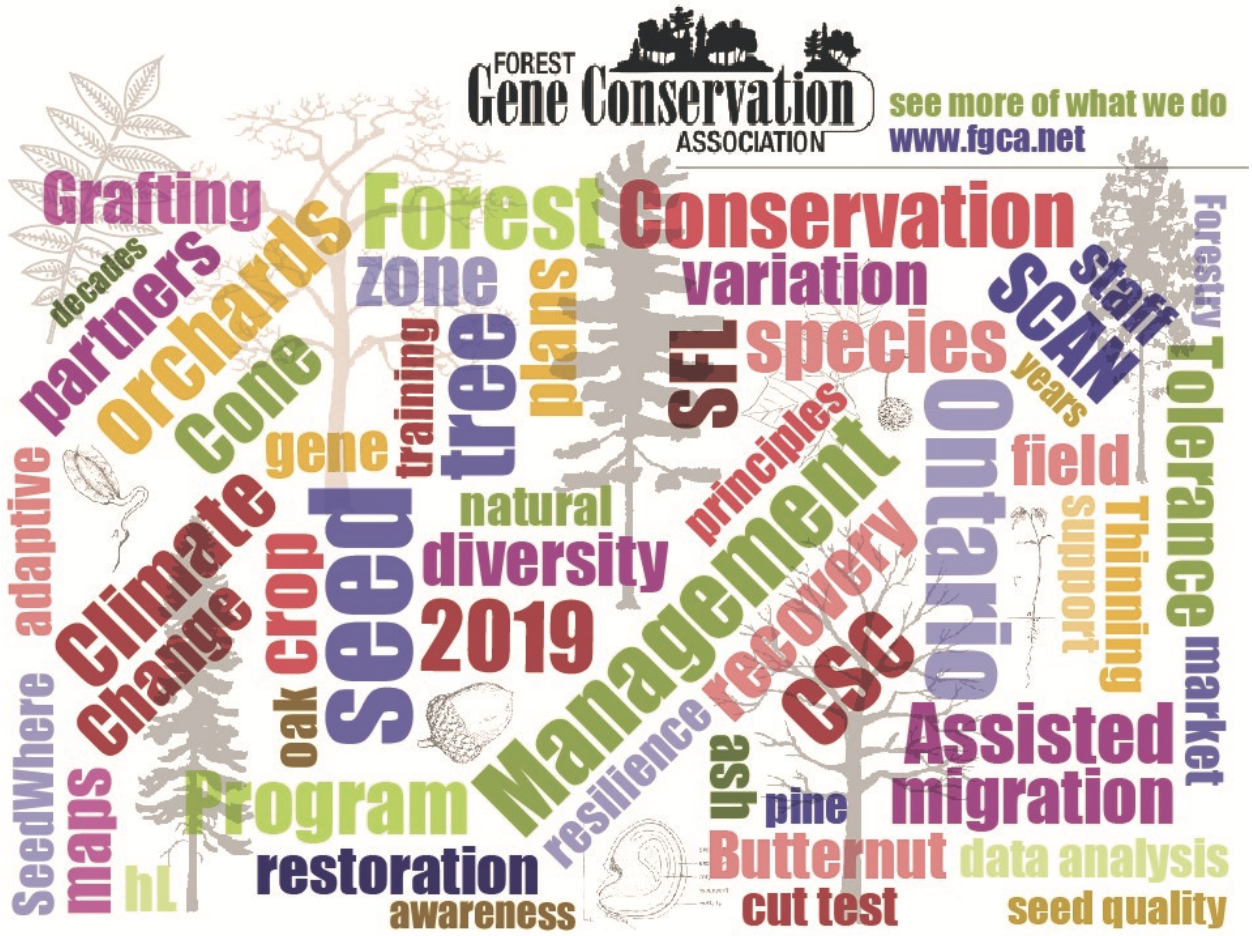


2019-2020 ANNUAL REPORT

FOREST
Gene Conservation
ASSOCIATION

275 County Rd 44, Kemptville, Ontario K0G 1J0

www.fgca.net

MESSAGE FROM THE PRESIDENT - GARY NIELSEN

We are truly living in interesting times. As the FGCA closes out its operating year the world seems a little more fragile now that it did at the start. I hope you and your families have been able to weather the storm. You will know that pretty well all of what concerns the FGCA and its members has been totally off the radar while the world deals with the Covid-19 Pandemic. I, for one, do not think this is a bad thing.

Much is being written about the opportunity for Canada and the world to emerge from the lockdown period with new energy and new direction. Governments have the option to direct stimulus investment in greener, sustainable technologies and programs. I believe that we will have an opportunity to be heard by a much wider and more attentive audience that we have had in decades. I believe that tree planting for climate change adaptation, public demand for seed source identification, support for recovery programs for Trees in Trouble and a desire to understand the role of genetics in sustaining biodiversity will be front line issues.

A window of opportunity for FGCA is coming, I believe that we are ready.

MESSAGE FROM THE GENERAL MANAGER - BARB BOYSEN

In my last year at the helm of the FGCA, I look back to 1994 and a nascent FGCA with plans for gene conservation in southcentral Ontario's forests. At the time I naively expected them to be achieved in 5 years, maybe 10. Certification of seed source - following the loss of the provincial tree planting program, to help nurseries and customers recognize the importance of adapted seed sources. Well-funded recovery programs underway for butternut and Carolinian species (pre-ESA 2008). All local and regional partners fully engaged with gene conservation via our efforts to increase awareness, change attitudes and facilitate action.

After 25 years, I think we have made significant progress increasing awareness and changing some attitudes. But regarding actions - or at least results, the reality is that even as our capacity increased, so did the challenges - increased land use pressures and loss of natural areas, negative effects of climate change and invasive alien species, and less support from governments. In the end what really changed was my expectations.

What didn't change is my hope for the future, as captured in our new ***FGCA Strategic Direction - 2020 to 2025***

> ***Our Vision:*** *A genetically diverse, resilient forested landscape in Southern Ontario that supports healthy ecosystems, healthy people and a healthy economy.*

FGCA is in good hands to deliver this new Strategic Direction - those of our Board, our members and staff, now including our new CEO, Kerry McLaven. We are hopeful that our key partnerships will continue - with the Ontario government and their support via the Forestry Futures Trust (FFT) for forest genetic resource management, and with Forests Ontario and their leadership in forest renewal. Together we can continue to work on the many challenges ahead. Read on to learn how busy we were in 2019-2020 - 27 pages - and that's a summary! And please join us in 2020-2021 - busy doesn't even begin to describe it.

FGCA'S 2019-2020 PROGRAM PRIORITIES

We focused on our 4 Strategies, newly confirmed in the *FGCA Strategic Direction 2020 to 2025*

- Species Conservation
- Seed Management Expertise
- Climate Change Adaptation
- Education and Advocacy

Changes to Address

- Ontario Tree Seed Plant closure and new seed management approaches by NGOs and the industry
- ESA 10-year Review with Government focus on economic efficiencies and a move to Ministry of Environment, Conservation and Parks (MECP) oversight
- New Ontario Forest Sector Strategy: focus on Crown Land, maximizing growth, harvest and economic opportunities
- Rebuilding communications after changes within the Ministry of Natural Resources and Forestry (MNRF) and MECP
- Support for the Ontario Biodiversity Strategy and Council

Opportunities

- Ontario Tree Seed Stewardship Initiative: an FGCA - Forests Ontario MOU to support forest renewal
- Conservation Authorities: significant local expertise and support for all FGCA programs
- National Tree Seed Centre, Canadian Forest Service and Natural Resources Canada - partnership in conservation, seed expertise and science support
- Forest renewal sector: building relationships and expertise in a fully private sector
- Post-Secondary Institutions: opportunity for promotion of basic FGRM principles
- Landowners: building links to southern forests, their organizations and local governments
- Outreach: to better explain our unique mandate to define and practice of forest gene conservation

Human Resources

We significantly increased our delivery capacity via full and part-time employees and dedicated contractors located across our geography:

General Manager (GM): **Barb Boysen** (retired June 2020)
Species Conservation & Administration Coordinator: **Heather Zurbrigg**
Seed and Climate Change Coordinator: **Melissa Spearing**
Central Ontario Program Coordinator: **Greg Bales**
Central Ontario Operations Technician: **Madelaine Danby**
SW Ontario Program Coordinator: **Kristen Sandvall**
Butternut Archive Program Manager: **Rose Fleguel**
Eastern Ontario Operations Technician: **Briana Heuving**
Eastern Ontario Operations Technician: **Becky McLaurin**

BOARD OF DIRECTORS

Our Directors volunteer their time in significant ways, guiding the development of our new *FGCA Strategic Direction - 2020 to 2025*, and in nine new Committees supporting the programs within our 4 Strategies.

Gary Nielsen, Climate Change Specialist (retired), FGCA President (**Executive Committee**)
Matt Mertins, R.P.F., Mazinaw-Lanark Forest Inc., FGCA Vice-President (**Executive Committee**)
Nancy Young, R.P.F., City of Ottawa, FGCA Secretary (**Executive Committee**)
Kerry McLaven, R.P.F. in Training, MFC, Forests Ontario, FGCA Treasurer (**Executive Committee**)
Ed Patchell, CEO, Ferguson Forest Centre/Ferguson Tree Nursery, (Past President)
Steve Smith, Forester, Urban Forestry Consultant/Society for Ecological Restoration Ontario Chapter
Terry Schwan, R.P.F., Forestry Consultant
John Enright, R.P.F., Upper Thames River Conservation Authority
Rob Davies, OPFA Associate Member, Forester, Essex Region Conservation Authority
Brent Forbes, R.P.F., Nursery Manager, Somerville Seedlings
Aron Fazekas, Ph.D, The Arboretum, University of Guelph

PROGRAM COMMITTEES & ADDITIONAL MEMBERS

Additional FGCA members and associates contributing their expertise are bolded.

Species Conservation Committees

- **Species Conservation Committee:** Chaired by Dr. Aron Fazekas with **members Dr. John Ambrose, Brandon Williamson**, supported by FGCA staff (Heather Zurbrigg, Kristen Sandvall and Barb Boysen).
- **Butternut Recovery Committee**: Chaired by Nancy Young, with Terry Schwan, John Enright, **Brandon Williamson, Nathan Munn** supported by FGCA staff (Heather Zurbrigg and Barb Boysen).

Seed Management Expertise Committees

- **Seed Collection Area Network (SCAN) Committee:** Chaired by Gary Nielsen, with Kerry McLaven, Ed Patchell, Matt Mertins, **Jeff Sharpe** supported by FGCA staff (Melissa Spearing and Kristen Sandvall).
- **Ontario's Natural Selections Program Committee:** Chaired by Brent Forbes, with Ed Patchell, Rob Davies, Kerry McLaven, supported by FGCA Staff (Melissa Spearing and Barb Boysen).

Climate Change Adaptation Committees

- **Climate Change Strategy Committee:** Chaired by Terry Schwan, with Dr. Aron Fazekas, Steve Smith and **Mark McDermid** (Forests Ontario), supported by FGCA Staff (Melissa Spearing).
- **Climate Change Trials Committee:** Chaired by John Enright, with Rob Davies, Gary Nielsen and Terry Schwan, supported by FGCA Staff (Kristen Sandvall).

Education and Advocacy Committee: Chaired by Matt Mertins, with Steve Smith, Kerry McLaven, and Nancy Young, supported by FGCA staff (Melissa Spearing).

The following sections include a summary, as well as operational highlights about the individual programs. For detail contact www.fgca.net. **If you are interested in a particular Committee-led project, we would be very pleased to have you join us as a member!**

SPECIES CONSERVATION

AT RISK SPECIES PRIORITY SETTING

The newly established **Species Conservation Committee** picked up on work from several years ago to develop species ranking criteria to formulate action plans, and this work will continue in 2020-2021. Feeding into this work FGCA and our partners contributed significantly to an updated Canadian CONFORGEN survey and the 2012 FAO report on "State of Canada's Forest Genetics" to be released in 2020.

FGCA also provided a detailed response to the ERO posted ESA 10-year review. We have extensive experience with the ESA butternut regulations and are greatly concerned that there has been no report on the effects of 10 years of permitted removals of thousands of healthy butternuts nor on the results of the overall benefit activities.

Otherwise, 2019 projects with at-risk species were opportunistic. FGCA fielded inquiries about beech bark disease resistant seed and stock from Bruce Peninsula National Park and received updates on of Beech Leaf Disease from Sharon Reed, MNRF Science in February 2020. Ex situ seed banking efforts were combined the Certified Seed Collection workshops and Ash Conservation Project (see below) spearheaded by Melissa Spearing and Kristen Sandvall to send Carolinian species of concern to the National Tree Seed Centre (NTSC):

- Cucumber Tree – 11 Seedlots (largest single-tree collection received to date by NTSC) from University of Guelph Arboretum, which spawned new seed storage and dormancy breaking research by Melissa Spearing and Kathleen Forbes (NRCan) (Figure 1).
- Tulip Tree – 14 seedlots from the orchard at University of Guelph Arboretum, also largest source-identified single-tree collection provided to NTSC to date.

Figure 1. *Magnolia acuminata* proof-of-concept experiment in relieving stratification requirements using liquid nitrogen. Photo by Katherine Burgess, NTSC.

BUTTERNUT RECOVERY

The **Butternut Recovery committee** oversees elements of this large program, which is otherwise managed by Heather Zurbrigg and involves all staff.

We have long been supported by great American colleagues who have decades more experience with the butternut canker. In July 2019 Barb Boysen, Heather Zurbrigg, and Rose Fleguel travelled to Purdue University to be newly inspired by these colleagues (Figure 2). Thanks to Dr. Carrie Pike USFS for organizing and Dr. Jean Romero-Severson, Notre Dame

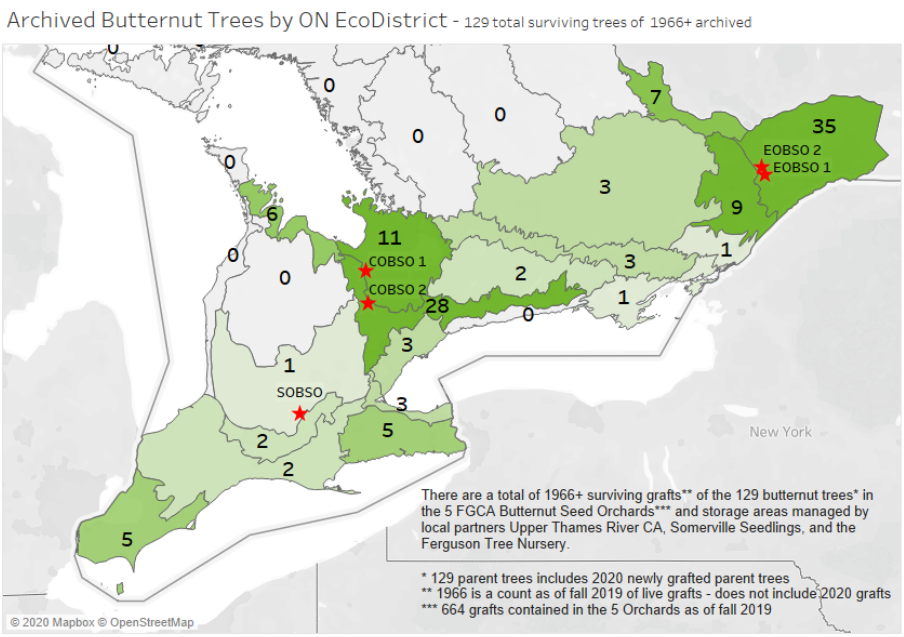
Figure 2. FGCA visits the Purdue butternut archives and breeding program, July 2019. Photo by Barb Boysen.

University for her leadership to focus everyone's efforts.

ARCHIVING PROGRAM

Our long-term goal is to plant a total of 4,200 grafts representing 420 unique butternut parent trees. This includes on average 10 grafts each of 20 putatively canker-tolerant butternut trees per each of the 21 Ontario ecodistricts where butternut historically occurs. Such numbers increase our odds of capturing what we hope is genetic tolerance to the canker, and a breadth of population diversity that occurs in 420 unique individuals across these areas. The map below (Figure 3) shows the number of parent trees archived to date from each ecodistrict as well as the general location of our orchards. You can see our success in the darkest green areas, especially where we have had great support from the Rideau Valley Conservation Authority and former Ontario Stewardship Councils.

In our five seed orchards grafts represent 129 trees which we have currently archived, with varying degrees of success. This includes the 17 trees we grafted in April 2019; 14 parent trees were located via our landowner outreach program and three were from ESA permitted development sites. 17 additional trees had scions collected in March 2020, and were grafted in April 2020. Archiving is fraught with challenges, but our staff and partners are becoming increasingly adept at managing climate change induced severe heat, droughts, frosts, and storms as well as animal and insect predation. Add pruning to maintain strong crowns for seed production, and we are busy!



# of Parent Trees by EcoDistrict

EcoDistr_1	EcoDistrict	
Null	Lacking Data	2
Bancroft	5E.11	3
Barrie	6E.6	11
Charleston Lake	6E.10	1
Essex	7E.1	5
Grimsby	7E.3	3
Havelock	6E.9	3
Kemptville	6E.12	35
Kincardine	6E.2	0
London	7E.6	2
Meaford	6E.4	6
Mount Forest	6E.5	0
Niagara	7E.5	5
Oak Ridges	6E.7	28
Oshawa-Cobourg	6E.13	0
Pembroke	6E.16	7
Peterborough	6E.8	2
Picton	6E.15	1
Smiths Falls	6E.11	9
St. Thomas	7E.2	2
Stratford	6E.1	1
Toronto	7E.4	3
Grand Total		129

Figure 3. Summary of FGCA's Ontario Butternut Recovery progress to June 2020. Acronym for orchard locations include Eastern (E), Central (C) and Southern (S) Ontario Butternut Seed Orchard (OBSO) sites.

This year staff and contractors visited over 12 sites and found several promising new trees. But it is getting harder to find such trees. Butternut natural regeneration is scarce for several reasons. And healthier trees are being lost to old age, illegal or preemptive cutting, and ESA permitted removals (Category 2 trees cut and then replaced by planting seedlings from the general population). **If you know of any healthier butternuts - cankered but still**

thriving, and especially if they are close to struggling cankered trees, and in one of the under-represented ecodistricts, please contact heather@fgca.net

BUTTERNUT SEED

Our ultimate goal is to produce seed from the archived putatively tolerant trees in our Butternut seed orchards, and plant this seed across the Ontario butternut range. We will be seeking partners and landowners interested in managing and monitoring their survival, and especially their tolerance to the canker. To date a few small seedlots have been produced in EOBSO 1. Seed was sown, tracked by parent tree, and planted for monitoring in the orchards. No collectable crop was produced in 2019.

A small FGCA wild crop seed and seedling program provides stock in the meantime for projects in central and southwestern Ontario. We otherwise support the program of our partner, the Rideau Valley Conservation Authority (RVCA) in eastern Ontario. Ours and RVCA's seed tree criteria is strictly followed - parent trees must be healthier butternut (though not necessarily canker free), DNA tested to be native, wild growing and distant from areas likely to have hybrids (no urban trees). Our policy is to sell the seedlings to ESA permit holders with proceeds contributing to overall butternut recovery. Where landowners had a species stewardship ethic, we sold seedlings at a subsidized price. FGCA has contract grown two seedlots for availability 2019-2021 with Somerville Seedlings (bareroot, early spring sales) and Ground Covers Unlimited (remaining Somerville stock potted into Rootmakers for extended season sales). **Contact** heather@fgca.net **if you are interested in purchasing or distributing this limited stock.**

Figure 4. Early pollination success of seed on a natural Butternut tree, Point Pelee National Park, June 2019. Photo by Barb Boysen.

DNA TESTING

FGCA assisted MNRF's Ontario Forest Research Institute (OFRI, Sault Ste Marie) for the past 2 years with Butternut DNA testing administration to allow them to focus on scientific procedures and report results of pure versus hybrid butternut samples. In 2019, almost 400 tests were requested, mostly by development proponents prior to submitting permit applications to remove healthier butternut trees. In the fall of 2019, OFRI determined they could no longer provide the DNA testing service. Since then, Heather Zurbrigg has worked with Dr. Aron Fazekas, University of Guelph to determine the potential for DNA testing services to continue. DNA tests are essential to help ensure that we only invest our limited resources in pure native butternut trees.

In the meantime, FGCA has been promoting information on phenotypic characteristics of butternut, the hybrids and exotic *Juglans* species. FGCA is also working to warn people about the misuse of the DNA test results:

1. Some growers described seedlings as DNA-tested, however, the results only apply to the parent tree, and if that tree is not well-isolated from any hybrids their seed could be hybrid.
2. Some growers advertise 'certified' stock, but the DNA test is not a certification, which implies there is oversight, inspections, and audits. To date the OFRI lab had to assume the samples were from the trees

described on the submission form. Consumers have to assume that the seed being described is from that tested tree.

These are important considerations for butternut recovery because the ESA permits and regulation allow healthier trees to be removed if butternut plantings are done, so those plantings should be done only with pure stock.

BUTTERNUT DATA MANAGEMENT

FGCA has accumulated a significant amount of data from landowner outreach and the archiving program. This year a concerted effort was made, led by Kristen Sandvall and supported by all staff to develop a robust Microsoft Access database to support better analysis and more efficient reporting.

BUTTERNUT HEALTH ASSESSOR (BHA) WORKSHOPS

FGCA under contract with MNRF and MECP delivered eight workshops in the Hamilton, Peterborough and Kemptville areas to refresh current BHAs and teach new ones. The significant administrative workload was managed by Heather Zurbrigg and FGCA's Barb Boysen, Greg Bales, and Kristen Sandvall worked with butternut experts Terry Schwan, Rose Fleguel and Steve Pitt, to deliver the training, ensuring participants were taught about the species and recovery along with the ESA regulations. All FGCA staff are re-designated or newly designated BHA's. FGCA submitted a final report to MECP with recommendations for regular BHA communications and audits, as the ESA's ability to protect butternut is hugely dependent on BHA integrity and expertise.

ASH CONSERVATION

An FGCA Ash Conservation Program Proposal was to have been developed, building on 2018 reports of lingering ash. However, 2019 proved to be a bumper ash seed year, and FGCA reserve funding was combined with NRCan funding to support seed collection in new areas for the National Tree Seed Centre (NTSC), particularly of black ash which only sets seed every 5-7 years. Emerald ash borer was also discovered in Killbear Provincial Park, Parry Sound area September 2019. Melissa Spearing coordinated reports following extensive national news coverage in August and communicated the need to partners and staff to collect seed and DNA samples for shipping to Fredericton, New Brunswick. In tandem with 2019 Certified Seed Collector (CSC) Workshops, FGCA staff helped secure the following for long-term conservation and research:

- Black Ash (*Fraxinus nigra*) (Figure 5, Figure 6) – 49 seedlots from new ecodistricts at high risk of emerald ash borer decline, all by staff and contractor Rose Fleguel
- White Ash (*Fraxinus americana*) - 37 seedlots by staff, William Boddy, Anne Lennox, Eleanor Reed and St. Williams Nursery and Ecology Centre.
- Green Ash (*Fraxinus pennsylvanica*) – 15 seedlots by staff, William Boddy, Anne Lennox, Kayanese Ecological Services and private landowners.
- Kristen Sandvall investigated reports from member Dr. **John Ambrose** of the last known area of seed production for pumpkin ash (*Fraxinus* profunda) in Rondeau Provincial Park. Only 1 small seed collection

Figure 5. Collecting Black Ash seed in the Ottawa Valley region, October 2019. Photo by Melissa Spearing.

exists at NTSC and all former viable mature populations are dead, though some regeneration may be of pumpkin at these sites.

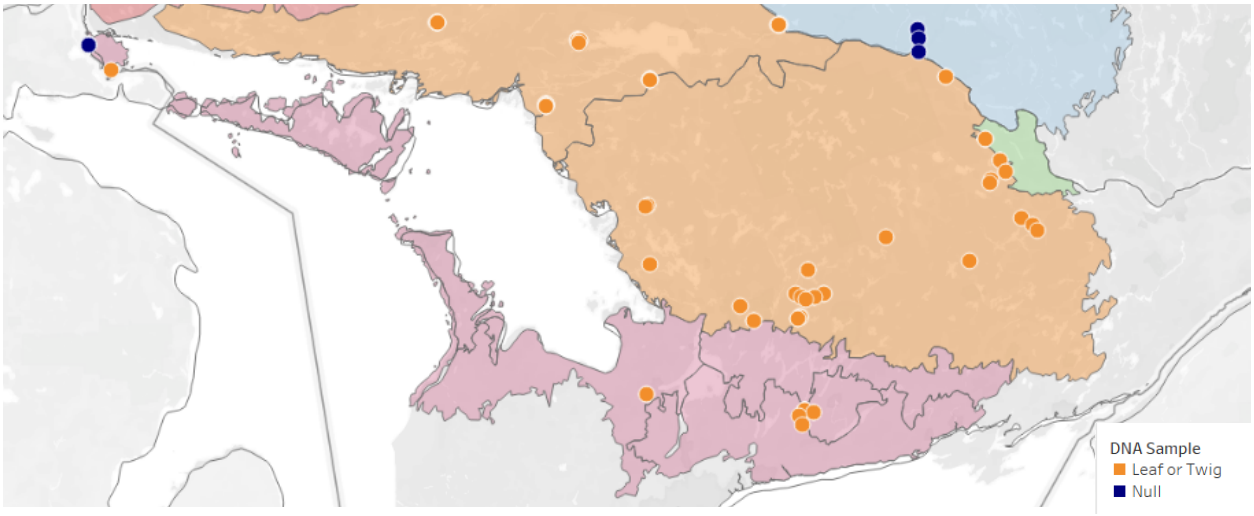


Figure 6. Central Ontario black ash (*Fraxinus nigra*) seed and DNA collections made by FGCA and NTSC staff, partners and landowners. Tableau map produced by Melissa Spearing with NTSC data. Blue dots are collections made in the early 1990s by the Canadian Forest Service.

SEED MANAGEMENT EXPERTISE

SEED STRATEGY

Two documents guide this program: MNRF FGCA 2017-2021 partnership for Forest Genetic Resource Management with MNRF's Southern Region SFLs, that provides core and project funding, as managed by the Forestry Futures Trust (FFT). And the Ontario Tree Seed Stewardship Initiative (OTSSI) 5-year MOU with Forests Ontario (FO) (2018-2022) outlines a key partnership that will help us make progress.

EXPERT SEED MANAGEMENT SUPPLY SYSTEM DEVELOPMENT FOR CROWN FORESTS

2019 FFT project (#5) funds supported this project, the beginnings of which were set in a January 2019 Sustainable Forest License (SFL) members meeting following a preview of the Forests Ontario Seed Management Database and in anticipation of new tracking requirements of the draft MNRF Seed Transfer Policy. FGCA began consultation with Forests Ontario in developing a system to manage the needs of local and regional partners regarding seed demand, supply, and transfer, and to develop options for collaboration where possible, while addressing their individual needs. Forests Ontario assisted several SFLs with combined collection contracts and processing in Fall 2019 after transfers were approved by MNRF Integration Branch.

Early in 2020, the FFT funds allowed us to further develop core Seed Management Database functions SFL members expressed interest and FGCA will collect feedback on. This work is continuing into 2020-2021:

- Seed owner logins (six SFLs and FGCA) to view seed surpluses with seed to storage management options.
- Seed cost tracking for all inputs with new seedlots and incurred costs on old lots.

- Planning and tracking local and climate-ready seed and stock based on draft MNRF Seed Transfer Policy and SFL Forest Management Plan objectives. Replace old Collection Type codes with SCAN or MNRF Forest Genetics Layer OGF_ID.
- Reference historical OTSP yield data from each seed zone or orchard to plan future collection contracts.
- Current surplus seed inventory with prices by source, tied to the MNRF Seed Transfer Spatial Tool using Tableau to provide a report on Gower rankings by seedlot when requested for a particular SFL.
- Requisition surplus seed from any storage location.
- Generate invoices and annual summaries, in a format compatible with SFL's AR-3 reporting.
- Enhance FGCA's ability to manage new or existing clonal seedlots for SPAs and operational trials wherever processed or stored.

In support of the management of the above system, Melissa Spearing continued to develop her skills for trouble-shooting seed management problems, particularly where the new chain of custody is resulting in seed quality, germination testing issues, and implications to stock production targets not meeting FMP objectives. The following training by expert organizations was accessed by:

- Mark McDermid and Melissa Spearing who attended a 2-day intensive seed conservation course held by the Alberta Tree Improvement & Seed Centre in March 2019.
- Melissa Spearing received training in seed analysis and germination testing standards, resulting in a certificate from the American Official Seed Analysts (AOSA) Seed Technology Course, April 2020.

ONTARIO TREE SEED STEWARDSHIP INITIATIVE (OTSSI)

Whereas; the GOAL of the OTSSI is to create and deliver a native seed management system for Ontario that will provide a sufficient and secure supply of viable, locally adapted, biologically appropriate native seed…"

Work on this goal which included a business plan to fund the OTSSI, was significantly curtailed by:

- The April 2019 cancellation of Ontario government support for FO's 50 Million Tree Program.
- The OTSP equipment and seed inventory auction in October 2019. Though businesses benefitted individually, capacity to act on a regional scale to benefit all was lost. Excess seed was sold to agencies beyond Ontario, though some samples were procured by the NTSC.

FGCA and FO continued to collaborate on opportunities to act on the goal of this Initiative including:

- The National Tree Seed Centre provided FGCA members and source-identified growers in Southern Ontario the opportunity to acquire small scale cone tumblers from a custom manufacturer in Fredericton.
- Providing supportive background information to NRCan's mandated 2 Billion Trees by 2030 Initiative
- Working with Colleges where occupational training would support OTSSI's future needs;
- Connections to FGCA's special conservation seed collection and banking activities
- Seed collector network support via the Ontario's Natural Selections CSC training efforts (see below)
- Providing seed deployment advice (see below)
- Managing the use and development of the Seed Collection Areas Network (SCAN) database [see below).
- Additionally, FGCA and FO are well coordinated on training and seed supply thanks to this MOU in 2020. Continued support from new seed processors and the National Tree Seed Centre with data and high-quality seed processing support helps all future outcomes for seed and stock in Ontario.

SEED TRANSFER ANALYSIS SERVICE

FGCA provided advice to members and partners this year, as in past years, regarding seed and stock movement to ensure adaptation to current and future climates and resilient new forests. FGCA continued to support and enhance spatial tools that support these recommendations for source-appropriate seed. This advice is dependent on the seed sector's capacity to identify and track the identity of seed source and the planting agencies ability to describe the planting sites. It is aided by science that describes the response functions of the various and unique species. Where significant progeny testing or other science about response functions are lacking, FGCA relies on NRCan's SeedWhere Tool and MNRF's Seed Transfer Policy Spatial Tool rankings in Tableau. The new policy's switch to ecodistrict based divisions as opposed to the 1996 MNRF tree seed zones was an added dimension to adjust to. Melissa Spearing, assisted by Kristen Sandvall led this program and became much more skilled with Tableau data integration and mapping in 2019, to also add FGCA SCAN data to best-ranked ecodistrict sources.

Where FGCA has offered this advice for free, in early 2020, we undertook a contract to do a higher-risk climate change and seed procurement option analysis for the Petawawa Research Forest (PRF). PRF is installing a large trial of prescribed Resistance, Resilience and Transition options. All treatments feature southern seed sources, with initially white pine, red oak, white oak, American chestnut and pitch pine, to be procured in 2021, with five additional species to follow. The contract helped to further the contacts within the US Lake States seed network via Dr. Carrie Pike, US Forest Service seed orchard managers and State Tree Improvement Cooperative contacts. New GIS data layers were provided from the US Climate Change Tree Atlas. Table 1 highlights the importance and ease of access to FGCA's Seed Collection Area Network database, and white pine seed orchard stock, as well as FGCA's partner agencies maintaining natural forest cover as feasible sources for PRF in the short-term.

Table 1: Agencies involved in seed collection, supply of stock or tree improvement within climatically similar areas of PRF's future climate and one or more species of interest.

Agency	Average of Feasibility Rank	Count of Species
Forest Gene Conservation Association SCAN Database	1.5	8
Essex Region Conservation Authority	1.6	5
St. Williams Nursery & Ecology Centre	2	4
Saratoga State Nursery, New York	2.5	4
Sheffield Seed Company, New York	3.75	4
Forest Gene Conservation Association Seeds Orchards	1	2
Forests Ontario (Seed Inventory or Contract Collectors)	2	2
Grand River Conservation Authority Burford Tree Nursery	3	2
Hardwood Tree Improvement and Regeneration Centre, Indiana	3	2
Better Forest Tree Services, Pennsylvania	4	2
Clements State Tree Nursery, West Virginia	4	2
Jasper-Pulaski State Nursery, Indiana	4	2
Vallonia State Nursery, Indiana	4.5	2

ONTARIO'S NATURAL SELECTIONS (ONS) CERTIFICATION PROGRAM

The Ontario's Natural Selections Seed Source Certification Program manual has a large scope. Review of this scope and market feasibility began this year and will continue into 2020-2021, assisted by the new ONS Committee. The ONS Program is intended to support the private sector in developing and marketing their source-identified stock of native species in the following three areas.

CERTIFICATION PROGRAM REVIEW

The ONS Committee started to the full scope of the program. It was determined that for growers, there has never been a business case that had room for the costs of certification. Everyone has their own tracking system/database management, from hardcopy paper, Excel, GroWare, Access, etc, and chain of custody is mostly manual transmission on receipt. FGCA continues to promote the benefits to seed source tracking to private land agencies and restoration specialists, but the CSC program is the strongest element in demand. Training in ONS standards will benefit collectors and growers, and links will be made to the FO Seed Database, to SCAN, and to local partners who can provide third party oversight of the system. The Committee will review the ONS Manual (2002) to determine if the trademark should be upheld and to explore opportunities with other certification systems.

SEED MANUAL DISTRIBUTION

This year seed manuals were sold via website requests and via Forests Ontario to increase its distribution and use. FGCA Directors were also provided with several copies each to use to raise FGCA's profile and support future sales, for example to colleges to support course work. Previously efforts were begun to produce an online seed manual but due to existing inventory of hard copy manuals, this has been postponed. Melissa has updated single species' pages that are always available to FGCA Board and Trainers on a Google Shared Drive.

CERTIFIED SEED COLLECTOR (CSC) TRAINING

Melissa Spearing and Kristen Sandvall assisted by Heather Zurbrigg delivered a robust Certified Seed Collector program in 2019, supported by workshop fees, seed manual sales, core FFT funds and in-kind assistance from partners and hosts. Over 50 people participated in three live all-day CSC theory webinars, including SFL staff, host, nursery and Forests Ontario staff. FGCA also began to request and organize seed collection video clips on an unlisted YouTube Channel, and additional videos will be uploaded once edited from the 2019 workshops.

CSC training highlights include:

- 83 applications via a web form helped focus on areas with the greatest need
- CSC Trainers and FGCA members provided seed sourcing areas and recommended species to focus on
- 31 participants wrote the exam and became Certified Seed Collectors: over half being working professionals.
- Overall satisfaction via post-exam survey was high and workshops were enjoyed.
- Kristen Sandvall converted the hard copy exam format into a digital Google Forms Exam with auto marking assistance and bulk mark release.
- Delivery of FGRM and CC workshop to Forests Ontario and City of Toronto Forestry staff September 19th.

- Four hands-on collection workshops for new CSCs (Hagersville (Figure 7)/St. Williams, Guelph Arboretum (Figure 8), Ganaraska Forest Centre and Ferguson Tree Nursery).

SEED COLLECTION AREA NETWORK (SCAN)

Figure 8. CSC field exercises at the University of Guelph Arboretum, September 23, 2019. Photo by Sean Fox.

Figure 7. Cut testing exercises at the Hagersville Community Centre, September 20, 2019. Photo by Kristen Sandvall.

SCAN was initiated several years ago with much assistance from the MNRF and local partners. Existing SCAN spatial data was used to overlay and recommend known areas of seed collection for Seed Transfer Analysis projects where source-identified seed bank inventory is lacking. General outreach efforts and presentations resulted in messages of encouragement to address SCAN gaps from interested organizations and landowner groups. In order to capitalize on interest in filling known species gaps in seed zones, Melissa Spearing, assisted by Kristen Sandvall created an initial plan to update the former paper forms with a technology review of options and costs, including Terraflex (no longer supported by MNRF), Survery123 and ArcGIS Collector.

The SCAN Committee noted that the forest renewal sector needs SCAN was developed for has changed significantly, and determined that a review was needed to ensure relevance to the sector. Forests Ontario assisted with a journey mapping exercise which will be used to develop an action plan for 2020-2021.

WHITE PINE SEED ORCHARDS

There are seven white pine seed orchards managed by FGCA and local partners, five managed in the SFL areas and three in southern Ontario. While their original tree improvement objective was compromised by 10 years of little management, they are increasingly valued as significant reservoirs of southern Ontario's white pine gene pool. The previous objective to rogue 75% of the plus trees for genetic gain in growth is no longer a valid objective. What hasn't changed is their value as seed production areas for local forest restoration and now also for assisted migration. FFT project funds were approved to continue to support remedial thinning to maintain their seed production potential as well as their diversity. FGCA maintained ArcGIS software to support the white pine seed orchard spatial files, thanks to a not-for-profit license with Forests Ontario. Additional functionalities for mobile/dynamic data collection/updates were researched in preparation for future data collections needs for many FGRM sites.

ORCHARD MANAGEMENT

Due to limited resources and greatly increasing operational costs, the seven orchards were ranked for FFT fund investment according to their local and potential use in new ecodistricts for SFLs as approved by the new MNRF Seed Transfer Policy. The completion of intended operations was further compromised by a mild 2019 2020 winter and reduced window of frozen conditions.

FFT 2018 project hold over funds and 2019 project funds were used to support the following operations of these orchards ranked from 1 (high priority) to 7 (lower priority).

1. **Cayuga Seed Orchard (7E)** is the most southerly orchard and has the most potential to supply assisted migration programs with high value seed. Bulk progeny planted in 2009 in Renfrew County is already outperforming local stock. Managing this orchard to bank seed in the long term and for immediate testing in some areas of the SFL units is recommended. There are at least 370 trees to be thinned according to the 2017 marking plan. An ice storm in early December damaged some trees and broke tops, and then a warm winter precluded thinning operations. A plan has been made to coordinate the thinning work with the maturing of a potential cone crop in 2020.

2. **Scugog Island Seed Orchard** (6E West, sister to Glencairn) has the second highest potential for assisted migration into central Ontario's crown forests now and in the future. The orchard's marking was to result in 33-40% of the original stocking. Large Norway spruce hedges were also marked to improve access and crown development in the largest blocks. Some thinning operations were completed in the largest blocks, and the results will be assessed in 2020-2021.

3. **Glencairn Seed Orchard** (6E West, sister to Glencairn) is similarly ranked to Scugog but has had less intensive management and to date has produced fewer and poorer cone crops. Still its potential to supply central Ontario forests with seed for assisted migration is high. In winter 2019 2020 18 blocks in Glencairn Seed Orchard (6E West) were marked in preparation for a local contractor to quote.

Figure 9. Contract thinning operations in Scugog White Pine Seed Orchard, March 2020. Photo by Dan Nimigon.

4. **Taylor Lake Seed Orchard** (6E East) has value for immediate movement into all of central Ontario's crown forest areas. A 2017 thinning was the second thinning in this orchard. The need for a third thinning will be assessed in spring 2020, to potentially coordinate with the harvest of a developing cone crop.

5. **Conger Seed Orchard** (Georgian Bay - 5E west) is managed by Westwind Forest Stewardship and is a unique, smaller orchard that has been thinned more often than the other orchards. Its value for assisted migration is lower than the following orchards but it bears reviewing. The results of a bulk seed lot and Year 2000 clonal seedlots in two realized gain trials and two progeny trials will be reviewed to help set its value to central Ontario crown forests. Seed transfer into Northeastern Ontario could be a profit generating plan that could help Westwind with their seed management budget.

6. **Grattan Seed Orchard** (5E, sister with Snowdon and Crowe River) was visited by Melissa Spearing with Ottawa Valley Technician Kayla Raycraft to determine orchard maintenance needs which included finishing labelling some parts of the orchard, and removing logs and brush-hogging. A few additional dead trees were noted.

7. **Snowdon Seed Orchard** (5E, sister with Grattan and Crowe River) was assessed in July 2019, by Melissa Spearing and Bancroft Minden Forest Company (BMFC) technician Jake Haynes, to assess the 2017 thinning effects. This orchard is valuable as a seed production area, but the intensive management is not warranted due to heavier blister rust incidence which appears to be due to site factors (the same clones in Grattan Seed Orchard suffer far less blister rust). FGCA will work with the BMFC to forecast cone crops to market in northeastern Ontario.

8. **Crowe River Seed Orchard** (5E, sister with Grattan and Snowdon) also under the management of the Bancroft Minden Forest Company (BMFC) warrants the least management due to poorer access and little management to date. This orchard is valuable as a seed production area. FGCA will work with the BMFC to forecast cone crops and market those crops to clients in northeastern Ontario.

COLLECTABLE ORCHARD SEED

- **2019 cones** were non-existent in all orchards, as reported by FGCA and SFL staff crop forecasting.
- **2020 conelets** in Taylor Lake, Scugog and Cayuga show potential for a 2020 collection (Figure 10).

Figure 10. Scugog white pine orchard conelets brought down in 89J block after thinning, May 2020. Photo by Melissa Spearing.

BANKED ORCHARD SEED

FGCA Bulk Seed Orchard Seedlots

- In 2019, 101.13 kg of FGCA's 2017 Cayuga Seed was sold to Somerville Seedlings, Ferguson Tree Nursery, Forests Ontario, Ottawa Valley Forest Inc and a reference sample sent to NTSC.
- 159 kg of 2017 Cayuga cleaned seed remains, along with 12.16 kg of 2017 Glencairn Seed Orchard seed and 40 kg of Taylor Lake Seed Orchard seed. This inventory will be managed in the FO Seed database.

FGCA Clonal Seed Orchard Seedlots

- After MNRF clarified that their new Genetic Seed Archive would not support external clients in April 2019, FGCA negotiated an MOU with the National Tree Seed Centre in Fredericton to store 529 open-pollinated clonal seedlots (Yearr 2000 Taylor Lake, Conger and Grattan, and Year 2017 Cayuga) in a special reserve research collection.
- FGCA purchased sealable aluminum foil bags and compatible heat sealer to retain seed viability in exchange for the NTSC cataloguing, checking moisture content, thousand seed weight and current weight of all lots prior to resealing.

ORCHARD SEED VALUATION

A new seedlot valuation exercise was initiated this year to determine future replacement costs for the FGCA seed in storage. Early indications suggest full bearing of costs on the private sector will be 2-4x former MNRF-priced seed value in the near future. FGCA's seed sale policy is to make seed available at cost to members who have contributed to the orchard management and who have a mandate for forest renewal in Ontario. But the seed services sector has changed greatly and there is uncertainty with regards to current standards and costs for:

- Cone collection and shipping that will maintain cone and seed quality over hundreds of kilometers
- Cone handling and processing that will maintain seed quality
- Long term seed storage and testing

WHITE PINE SEED ORCHARD STOCK

WHITE PINE SEED ORCHARD REALIZED GAIN TRIALS (RGT)

There was no activity in two white pine RGTs at the Ferguson Tree Nursery and Gratton Seed Orchard sites other than a quick assessment to determine the need for thinning. In 2020, data collection will be done. As well, trees will be marked for thinning to maintain the integrity of the trials.

CAYUGA WHITE PINE SEED PRODUCTION AREAS

The heavy 2017 Cayuga Seed Orchard cone crop in the southwest resulted in 164 clonal seed lots and 259 kilograms of bulked seed. Application to the FFT in 2018-2019 and in 2019-2020 resulted in two funded initiatives using this seed to establish at least three Cayuga Assisted Migration Seed Production Areas, one in the west to supply the western SFL areas, and two in the east to supply the eastern SFL areas (currently with larger white pine planting programs). The SPAs were designed to be similar to a seed orchard and separating seedlings from the same family, tracked by individual tree identity to allow tracking of performance (if resources allow) and planted at wide spacing for large crown development for long term seed production.

In 2019 the container stock was grown by Ferguson Tree Nursery, overwintered and then packaged for planting in four sites which were prepared for planting. Half of the clonal seedlot stock produced is assigned to the four sites. Additional sites will be sought with other interested partners. Excess stock will be transplanted with FTN for 2021 additional site planting as well as refill of 2020 plantings as contingency against hot, dry spring mortality.

- Westmeath 4 ha site, Renfrew County: site preparation, 18 complete Cycdesign blocks of 90 plus tree grouped families to minimize future inbreeding.
- North Grenville 2 ha site, Kemptville: site preparation, 7 complete and 1 incomplete Cycdesign blocks of 90 plus tree-grouped families (Figure 11).
- Taylor Lake 2.5 ha site, Lanark County: site preparation, 12 complete and incomplete Cycdesign blocks of 90 plus tree-grouped families, planted May 13, 2020 (Figure 12).
- Glencairn 2 ha site, Simcoe County: site prepared by Somerville Seedlings; up to 10 complete or incomplete Cycdesign blocks of 90 plus tree-grouped families.

This edge facing woodlot long side

Kemptville NW Corner = 9x10 x 7 reps (1 split 3 ways) x 4 seedlings per spot

Row ->	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Tree #	Rep 21 (20U)										Rep 20 (20T)										Rep 19 (20S)									
1	80	89	2	66	76	88	30	67	27	24	88	55	80	26	53	78	59	9	8	58	89	18	43	68	57	58	80	76	65	49
2	18	61	55	47	71	26	15	59	78	52	18	17	83	11	48	37	74	22	38	64	72	47	20	8	32	41	31	81	23	85
3	9	6	34	83	39	8	43	12	35	68	36	73	29	28	27	49	39	62	60	65	15	38	17	27	16	69	83	75	33	61
4	45	16	5	32	7	58	63	79	50	72	19	23	82	42	4	79	33	12	43	14	37	78	12	66	3	71	50	29	22	25
5	10	38	84	23	49	77	13	22	57	82	6	31	90	25	61	10	87	69	50	3	4	86	35	84	64	67	5	77	6	13
6	70	28	36	53	60	42	90	31	11	73	35	45	47	30	85	5	21	15	71	72	11	87	70	54	19	42	56	24	9	62
7	1	85	74	87	14	48	3	20	19	33	63	57	7	2	46	20	44	34	16	66	39	63	74	7	44	21	48	73	46	90
8	25	62	69	40	75	54	37	86	4	56	70	13	32	76	56	68	89	54	41	86	14	30	79	52	2	59	34	53	51	55
9	65	29	17	21	46	41	51	64	81	44	1	84	52	24	51	77	81	40	67	75	40	1	88	10	26	28	60	45	36	82
	Rep 24 (20X)										Rep 23 (20W)										Rep 22 (20V)									
1	74	6	26	48	75	27	23	79	69	29	49	71	68	56	20	16	76	58	90	57	15	39	47	26	6	50	56	52	71	12
2	70	50	58	87	56	12	44	52	86	78	87	23	85	62	15	54	84	36	44	67	49	90	63	81	35	82	19	18	54	32
3	4	17	1	67	13	19	64	55	35	38	61	74	63	42	35	17	75	29	10	77	86	34	9	46	5	43	33	61	7	67
4	89	22	31	33	14	72	18	71	16	73	30	8	32	79	64	83	31	69	88	43	88	65	41	85	28	74	89	27	44	78
5	9	32	66	3	57	84	15	24	2	21	2	82	39	86	27	78	89	26	53	9	11	48	31	68	4	75	23	36	3	17
6	11	60	46	76	36	62	20	43	7	10	48	24	4	18	45	37	21	38	65	81	84	57	24	2	80	1	53	72	10	51
7	47	90	88	49	41	30	53	39	5	61	7	59	73	11	28	70	50	46	51	66	55	21	45	14	42	30	58	77	62	20
8	8	25	83	45	80	68	85	81	28	59	13	19	12	80	55	52	3	25	47	1	73	40	29	59	66	38	16	87	64	69
9	54	77	82	65	37	42	40	51	63	34	40	5	33	60	34	41	6	72	22	14	76	70	37	13	25	22	79	83	60	8
	Rep 25 (20Y)																													Tree #
7	61	77	42	46	5	44	32	43	88	65	27	4	64	73	87	45	75	55	71	40	74	80	10	21	81	86	30	26	53	58	1
8	76	15	47	19	89	39	85	31	25	63	24	17	67	84	1	54	9	56	29	50	14	3	37	90	13	78	20	22	51	57	2
9	60	41	34	35	83	36	69	2	28	68	70	38	23	18	12	79	11	62	48	59	16	49	6	52	72	66	33	7	82	8	3

Figure 11. CycDesign randomized complete block trial design for Cayuga families planted May 2020 at the North Grenville site.

Figure 12. FGCA Eastern Ontario Technician Becky McLaurin safely social distancing while planting Cayuga white pine at Taylor Lake seed orchard, May 13, 2020. Photo by Briana Heuving.

WHITE SPRUCE SEED ORCHARD

FFT provided funds for this project in 2018. The Westmeath white spruce seed orchard contains representatives of a gene pool that has over several decades demonstrated significant gains when tested across North America. After many years of neglect, Ottawa Valley Forest Company (OVF) and FGCA resumed its management to identify grafts and thin them to maintain live crown for seed production. 2018 operations were stalled due to early snow. In July 2019, Melissa Spearing visited the Beachburg Orchard with Kayla Raycraft, OVF, to orient planting maps and review thinning plans (Figure 13). Crop forecasting was also done in 2019 but cones had low seed set and insect damage, so no cones were collected. Availability of affordable contractors delayed progress till late fall, but then significant progress was made. A final inventory will be done in 2020, resources permitting.

Figure 13. Before (2018 site visit, left) and after (2019 site visit, right) thinning natural ingress from the white spruce grafted orchard blocks to ground-truth remaining clones with Kayla Raycraft, Ottawa Valley Forest Company forester. Photos by Melissa Spearing.

CLIMATE CHANGE ADAPTATION

ESSEX REGION CLIMATE CHANGE ADAPTATION STRATEGY

Melissa Spearing assisted by Kristen Sandvall worked with FGCA member Rob Davies and the Essex Region Conservation Authority (ERCA) to plan for climate change adaptation in Canada's most southern forest. Work was based on a review of FGCA's *Adapting to a Changing Climate: A Report for Southern Region Sustainable Forest License Holders* (March 2017). The project has formed the basis for future efforts with other southern Ontario agencies and synthesis will form a new report and interactive toolbox in 2020-2021.

The foundations for this project were already in motion in early 2019 when the 50 Million Tree Program was considering seed purchases to meet the draft Seed Transfer Policy requirements. FGCA and Forests Ontario collaborated with MNRF's Ken Elliott and Betty Van Kerkhof, as well as USFS Region 9 Regeneration Specialist Dr. Carrie Pike and the late Rick Sheffield in Locke, NY. Based on a review of the 2017 FGCA report, ERCA determined their main goals were to:

- Use current-state-of-climate-knowledge to assess vulnerability of their last four years of planting by species and volume and determine if and when the planting mix should change (Figure 14). Compare this to the results presented in 2005 for Tree Seed Zone 38 FGCA Survey by Brian Swaile.
- Inform other ERCA initiatives with Clare Saunders, Climate Change Adaptation specialist working with climate models and outreach efforts with local municipalities on green infrastructure.
- Have Rob Davies review FGCA's FGRM Checklist Appendix D, Section II to gauge strengths and weaknesses of ERCA's existing programs in contributing to forest health and resilience and identify opportunities.
- Review lessons learned in FGCA's Assisted Migration trials to guide ERCA's plans to potentially establish and managed SPAs for strategically selected species to alleviate seed collection and acquisition challenges.
- Review vulnerability of major Carolinian and potential transition species for restoration use, highlighting current-state-of-knowledge in the US and FGRM-related SARO recovery plan needs.

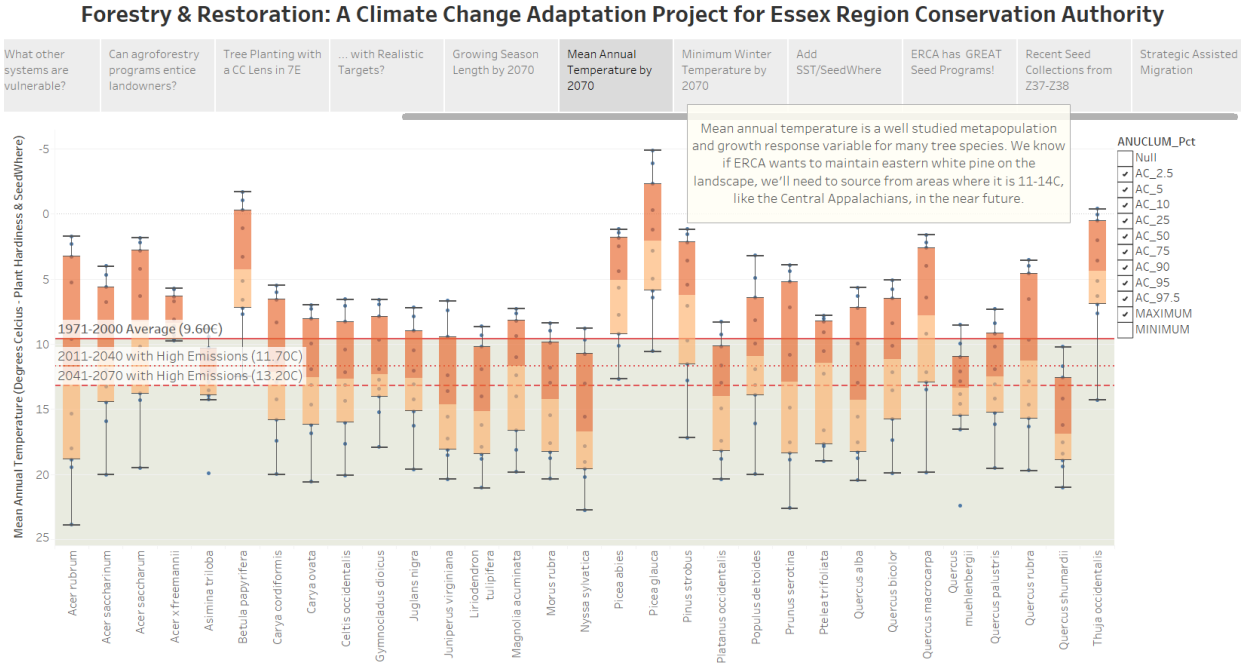


Figure 14. A Tableau boxplot of ERCA's primary restoration and SARO species of interest's climatic ranges of mean annual temperature under historical and average predicted high emissions values (horizontal Mean Annual Temperature for Essex, ON taken from SeedWhere). Boreal-adapted species are out of their core climate envelope by 2040, though white cedar is still valuable as 22% of ERCA's current planting projects (primarily hedges, windbreaks) and has yet to show signs of maladaptation or poor seed viability.

Developing this plan connected FGCA with the USFS Climate Change Tree Atlas researchers and new data products, and Dr. Isabelle Aubin and Laura Boisvert-Marsh, NRCan Forest Ecologists who have developed the Forest Vulnerability Tool which provided additional data.

NIPISSING FOREST RESOURCE MANAGEMENT CLIMATE CHANGE ADAPTATION STRATEGY

This project was supported by FFT project funds. In the FGCA's FFT-supported report *Adapting to a Changing Climate: A Report for Southern Region Sustainable Forest License Holders* (March 2017), next steps included:

- Communication of this report to central Ontario Crown forest managers and FGCA partners, via printed copies or electronic PDF. This document was well-shared with new SFL staff, Community Forest Managers, federal and US contacts after the Adaptive Silviculture Workshop (July 2019, Pembroke) identified climate-ready seed as one of the accessible climate change mitigation options to foresters in Central Ontario.
- Follow up on opportunities and barriers to its use.

SFLs have been asking for assistance to apply the March 2017 CC report. Due to workload and other challenges, it is difficult for staff to become fully engaged in gene conservation and climate change. Focusing on their own SFL's unique forest and challenges facilitates their uptake of the recommendations in the short and long term. Nipissing Forest Resource Management Inc (NFRM, Callander, ON) was available this year, after FMP approval.

Melissa Spearing and NFRM's Andree Morneault met in June 2019 to review Version 1 and discuss climate change objectives in their 2019-2029 approved FMP. After addressing potential climate impacts to NFRM's management unit, the FMP's Section 16 states *[…], it is recommended to supplement planting programs with tree seedlings from seed zones that are south (within projected climate-appropriate zones) of traditional zones on the Nipissing Forest. The indicator for this target is to supplement seed sources with up to 10% seed from additional recommended climate-appropriate zones. This objective is to be assessed for the Year-5 management unit annual report and the management unit annual report for the final year of plan implementation*."

Specifically, Andree asked FGCA to refine and revisit Table 3 of the 2017 FGCA CC report for her FMP goals, planting numbers by species and ecodistrict, and to offer options for procuring a 10-15 year seed bank of suitable options and genetic value. The FMP has a target of 600 ha of operational southern seed sources established by 2029, with the first large planting site to have alternating mixes of 50%-50% local - non-local sources versus local-only. This reduces the risk of plantation failure due to extreme episodic events. To ready NFRM's seed bank, climate-ready seed needs were planned using:

- White pine (Pw) stock 300,000 – 33.3% in each Ecodistrict 5E.6, 5E.10, 4E.4
- Red pine (Pr) stock 300,000 – 50% in 5E.6, 25% in 5E.10, 25% in 4E.4
- White spruce (Sw) stock 60,000 – 50% in 5E.6, 25% in 5E.10, 25% in 4E.4
- Jack pine (Pj) stock 60,000 – 98% in 4E.4
- Jack pine (Pj) aerial seeding 2,100,000 seeds – all in 4E.4

Melissa Spearing assisted by Kristen Sandvall prepared the analysis and Executive Summary request which provides a table of suitable seed in storage may be available or collections planned in 2020-2021. It also lists rationale for ranking seed sources to MNRF, from highest to lowest genetic value. The Executive Summary will be distributed to SFL members upon approval and feedback from MNRF Integration Branch, and continued work on Version 2 of the Central Ontario Report for SFLs to continue with Westwind Forest Stewardship in 2020-2021.

SOUTHERN ONTARIO ASSISTED MIGRATION TRIALS

Between 2010 and 2016 FGCA established 5 assisted migration trials with local partners across southern Ontario. These trials were established primarily to investigate the process of assisted migration and to demonstrate generally that the climate is changing and that different sources of seed will be needed to support local afforestation programs. The trials were thus also designed to potentially become seed production areas.

They are past the establishment phase, but still face challenges. FGCA and local hosts continue to add to our list of lessons learned in the establishment and management of assisted migration plantings. Kristen Sandvall, Barb Boysen, Briana Heuving, Becky McLaurin, Gary Nielsen and John Enright and UTRCA staff all assisted with this year's efforts. Challenges have included:

- Offsite species selection and poor stock quality
- Unknown genetic quality of seed sources - e.g. was seed from a diverse healthy large stand or one tree?
- Effects of inconsistent tending and animal browsing
- Distant stock acquisition – issues with stock quality, shipping distance, pests despite adherence to phytosanitary certificates
- Misidentification and mix-ups with target species discovered after establishment. Problems realized this year with Tennessee sourced stock at the Holst and St. Clair Region Conservation Authority sites:
    - Red oak is a mix of red, Shumard oak and potentially hybrids, posing thinning challenges (Figure 15).
    - 15% of the white oak trees are blackjack oak (*Quercus marilandica*), significantly shorter and scrubbier, and have now been removed
    - Black oak and bur oak instead of swamp white oak

Figure 15. Close-up examination to discern red oak (left) from probable Shumard oak (right) in our oldest assisted migration trial plot. Photo by Kristen Sandvall.

After 10 years, the oldest trial with landowner Phil Holst had high survival especially in the local ON source and thinning was needed ahead of schedule to ensure development of large canopies for seed production. Barb Boysen and Kristen Sandvall worked with Upper Thames River Conservation Authority (UTRCA) foresters John Enright and Jay Ebel to mark the trees. In 2019-2020, UTRCA's media department produced two excellent videos highlighting the work to date with the Holst and Oxford County trials (below).

DATA COLLECTION AND EARLY RESULTS

Melissa Spearing supported inquiries from other agencies (NRCan, BC's AMAT trial, US trials) to work on standardized data collection and analysis. Data sheets ready for GIS mapping were prepared with Kristen Sandvall.

Results

Interpreting the results must be done understanding that they will have been confounded by:

- Stock quality and unverifiable exact genetic sources (labelled only to US State, presumed local to the nursery of origin, as recommended by NRCan)
- Different growers and different stock quality and handling issues in acquisition and short-term effect on survival and growth.
- Mortality due to tending challenges and animal predation, not necessarily different climate.

Holst Red and White Oak trial (2010) Kristen Sandvall and Emma Davis (University of Guelph Arboretum Post-doc Fellow) measured the red oak in Spring 2019. Emma used a R statistical analysis package and prepared a slide deck of significant findings and photos presented at the June 2019 AGM (Figure 16). Significant differences on local (Z37) vs Pennsylvania (PA) and Tennessee (TN) sources:

- ON White oak survival higher than PA; PA shorter (3.77 m) than ON (4.25 m) and TN (4.35 m).
- Many TN white oak had lammas growth into early November causing tip dieback (Fall 2018)
- ON red oak was significantly taller than PA and TN (6.86, 5.69 and 5.45 m respectively)), had far less dieback than TN sources and broke bud much earlier than southern provenances. Analysis was done prior to realizing the Shumard oak and hybrid component of these blocks.

Oxford County Bur Oak trial - A 2019 assessment along of 4 transects showed few differences at this very exposed site. Survival was similar for all sources, and again, bud break was along a latitudinal trend with local stock breaking bud first, followed by PA and TN. Silver maple planted to add diversity is beginning to interfere with the neighbouring oak plots and must be thinned. Complete data collection vs transects is needed for proper statistical analysis.

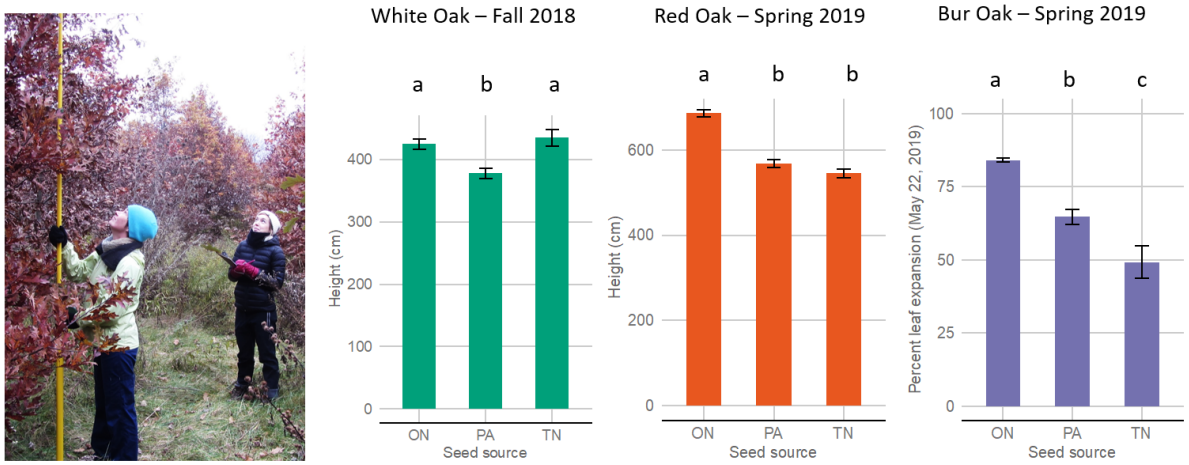


Photo by John Enright, UTRCA. Data analysis by Emma Davis, PhD, R Studio.

Figure 16. Melissa Spearing and Emma Davis measuring the Holst white oak plots, November 2019.

SEED PRODUCTION

It is very early days for the hardwood assisted migration trials, but a small amount of seed had been produced in the Holst orchard. As per protocol in our Ontario's Natural Selections Manual, any seedlots will be well described noting their climate source, the parent tree performance on the particular site conditions which will allow people to judge whether it would be suitable for their planting site needs. This is particularly important where there may be red x Shumard crosses (a natural hybrid).

ASSISTED MIGRATION TRIAL NETWORK FOR SFL PRIORITY SPECIES

This program was supported by FFT Project funds (Project #6). SFLs are increasingly interested in assisted migration and are looking to the FGCA and southern afforestation partners for strategic sources of high-quality seed. Ottawa Valley Forest began as early as 2016 to trial two southern seed zones against local red oak, and FGCA will work with them on a monitoring system in line with the above Southern Ontario Assisted Migration Project. This work is also supported by other FGCA projects including the Climate Change Adaptation Strategies, SCAN and the Expert Seed Management Supply System with Forests Ontario.

White pine is a major reforestation species in central Ontario and the four southern Ontario white pine seed orchards are a significant, valuable source of high-quality seed for central Ontario assisted migration. FGCA, supported by FFT funds is providing the seed and stock and planning advice over three years to create a network of operational assisted migration plantings with FGCA's SFL members. The SFLs have agreed to plan, plant, tend, manage and monitor 1 to 2 ha block plantings of southern stock as part of their operational white pine plantings. The good 2014 and 2017 crops collected and banked by FGCA and Forests Ontario provided the actual seed to begin this project. In 2019-2020:

- 3 bulk orchard seedlots were sown by Ferguson Tree Nursery and will be available for planting in 2021
    - Cayuga Seed Orchard (Site Region 7E)
    - Scugog Seed Orchard (Site Region 6E West)
    - Taylor Lake Seed Orchard (Site Region 6E East)
- SFL partners reviewed their 2021 and 2022 planting plans and to select candidate white pine sites.
- Melissa worked with NRCan and CFGA contacts to review methodology for new untested orchard population deployment mapping.

EDUCATION AND ADVOCACY

FGCA WEBSITES

Management of our two webpages www.fgca.net and www.ontariosnaturalselections.org are facilitated by a Google Analytics account managed by Melissa Spearing. The Ontario Woodlot Association and Forests Ontario have been significant boosters of our website content, and more effort is planned for 2020 particularly to blog regularly about our programs. Between March 2018-2020, there were over 29,300 unique visits. The most frequent reasons for people to visit fgca.net, in order of % of visits were:

1. Butternut Recovery Program
2. Ash Seed Collection & Survivor Tree blog posts
3. What You Can Do re Seed Collection
4. Contact Us page
5. Climate Change
6. Annual Reports
7. Native Species Information Table
8. Certain Ecodistrict Native Species' Guides - (6E-8, 6E-7, 7E-4),
9. Assisted Migration Guidelines

PRESENTATIONS

An External Strategy Document for 2019-2025 was prepared to help determine which events to participated in. A 3:1 ratio of attendance at primarily professional vs private landowner (PL) events was established to guide staff and the General Manager. Staff participated and delivered 23 professional and 4 Private Land events; and Board members used FGCA presentations for three additional events. Topics included Assisted Migration, Butternut Recovery, and Seed Collection.

UTRCA assisted FGCA with the production of new display banners for events, focusing on Butternut Recovery (Figure 17), Climate Change Adaptation, Trees in Trouble, and Tree Seed Management and Expertise - one for GLSL species and one for Carolinian species. Melissa Spearing also received files and seed samples from NTSC to produce tri-fold displays and produce sealed samples for general use/CSC workshops in 2020.

FGCA staff also attended events hosted by Carolinian Canada, the Eastern Ontario Model Forest and the Society for Ecological Restoration - Ontario Chapter.

Figure 17. John Enright, UTRCA Forester and FGCA Director representing Conservation Ontario, with a new partnership display banner for the Butternut Recovery Program, at an event in Ingersoll, February 2020.

2019 FGCA ANNUAL GENERAL MEETING AT POINT PELEE NATIONAL PARK

The AGM was organized by local Board member Rob Davies, Essex Region Conservation Authority. The AGM included field tours of the Park to see butternut and red mulberry, as well as ERCA forest renewal efforts with local landowners (Figure 18). Presentations included:

- Managing Seed under Climate Change, Melissa Spearing
- Assisted Migration Trials monitoring and results update, Kristen Sandvall

Figure 18. Group photo of FGCA Board, Members and Guests at the June 2019 AGM (left). Staff member Melissa Spearing hugging a black cherry tree in a private woodlot (right). Photos by Barb Boysen.

- Butternut Recovery Update, Barb Boysen

MEMBERSHIP IN KEY ASSOCIATIONS

FGCA retained active membership with the Ontario Biodiversity Council, Forests Ontario, and the Canadian Forests Genetics Association (CFGA). Barb Boysen, Heather Zurbrigg and Melissa Spearing provided a program update to the CFGA Tree Seed Working Group News Bulletin No. 68 ahead of their biennial conference.

Melissa Spearing assisted in the delivery of the 2019 Tree Seed Working Group Workshop in Quebec and was nominated as an active member to the Executive for the next conference.

ADMINISTRATION

As the FGCA program has become more complex and as we have had the opportunity to hire employees and work with long term expert contractors, the administration demand of our not-for-profit corporation has also grown. Our Administration Coordinator Heather Zurbrigg managed the following with the support of Contract General Manager Barb Boysen and the Executive Committee of the Board of Directors. To help further with the development of FGCA capacity to address our Vision and Mission, a Business Development Board Committee was struck chaired by Gary Nielsen, with Ed Patchell, Kerry McLaven, and Barb Boysen

FINANCIAL MANAGEMENT

This program area includes management and reporting of FGCA finances via Quickbooks, HST collection and remittance, insurance, the new requirement for an annual full Audit, Telepay services, contract Accounting assistance to set up new Chart of Accounts and manage payroll.

HUMAN RESOURCES

This program area includes management of full and part-time staff and their office administration needs, as well as management of contractors. A Human Resource draft strategy is in development to address job and contract specifications, oversight, performance reviews, health and safety and succession and training planning.

BOARD MANAGEMENT

This program area includes support of the Board of Directors and in particular four Board meetings per year and increasing the involvement of the Board via committees described throughout this report. Meetings have primarily been held virtually via Google Meet and our not-for-profit use of G Suite for Business.

PLANNING AND REPORTING

Forestry Futures Trust reports were submitted as required. This year we also created an *FGCA Strategic Direction - 2020 to 2025* and it is helping to focus and plan in an uncertain future. The COVID crisis has revealed just how uncertain it can be. But it also showed how we were increasingly working and communicating in an e-world, which we've transitioned staff and the Board well to already. FGCA will continue to harness available remote and cloud technology to help us span our geography and connect to our southern Ontario members and associates.

END OF REPORT