March 29, 2022

Toronto and Region Conservation Authority

GROUNDED SOLUTIONS

Lunch & Learn for TRCA Staff

Best Practices & Strategies for the Urban Forest in a Climate Change Context

March 29, 2022

MISSISSAUGA

BRAMPTON Flower City

TOWN OF CALEDON

Region of Peel working with you

Credit Valley Conservation inspired by nature

Toronto and Region Conservation Authority

Acknowledgements

Peel Climate Change Partnership

Region of Peel
working with you

BRAMPTON
brampton.ca Flower City

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Credit Valley Conservation
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Consulting Team

BEACON ENVIRONMENTAL

GROUNDED SOLUTIONS

EcoView Consulting

mbtw wai

and many other professionals and experts involved in urban forestry from across southern Ontario, North America and beyond

Presentation Overview

1. Overview of the Project

2. Key Considerations

3. 10 Best Practices for Building Urban Forest Resilience

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Best Practices & Strategies for the Urban Forest

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PROJECT OVERVIEW

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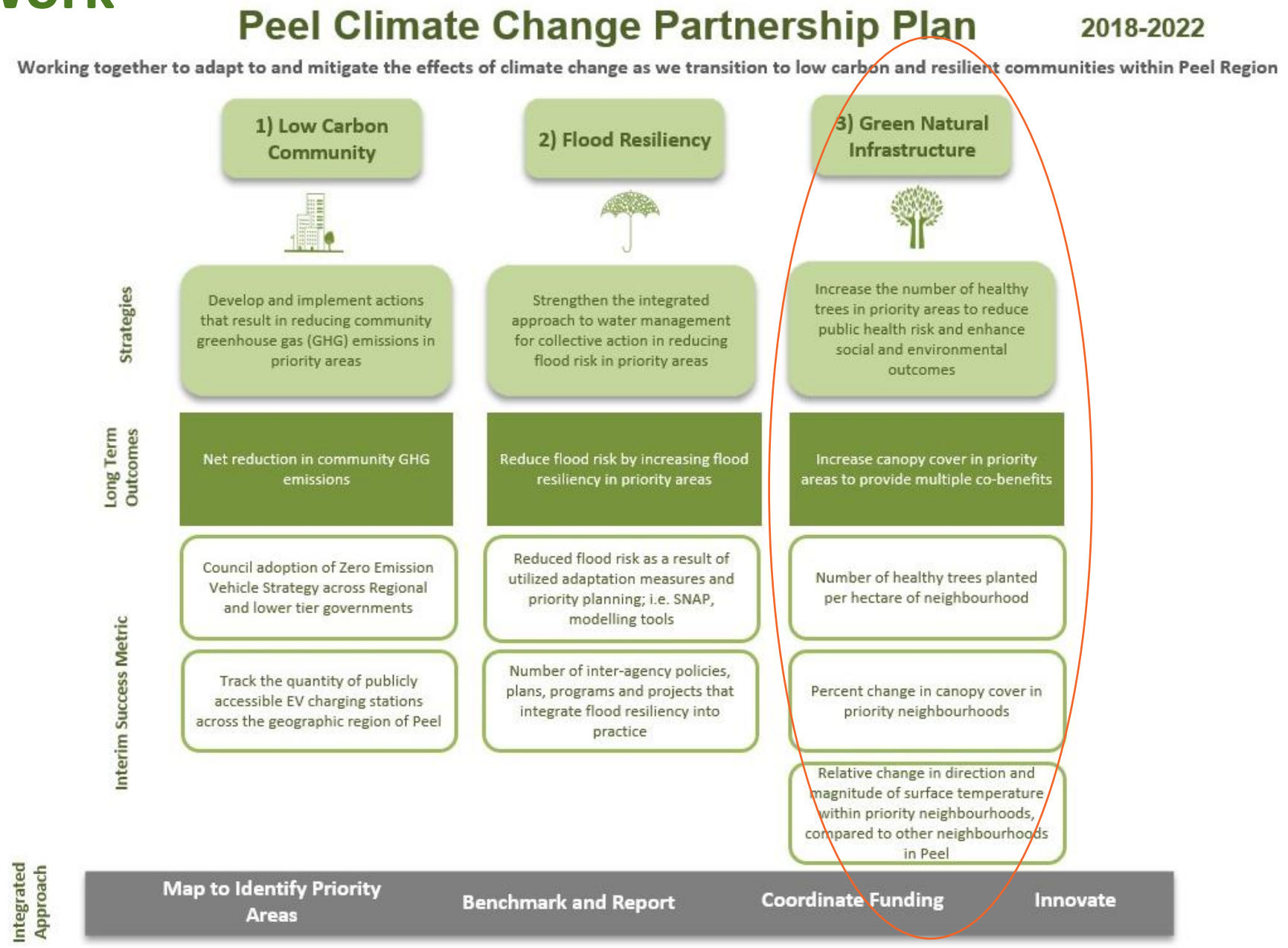
Impetus for This Work

3 Priorities

1. Reduce greenhouse gas emissions
2. Increase flood resiliency
3. Increase green infrastructure

3 Strategies

1. Low Carbon Communities
2. Flood Resiliency
3. **Green Natural Infrastructure**



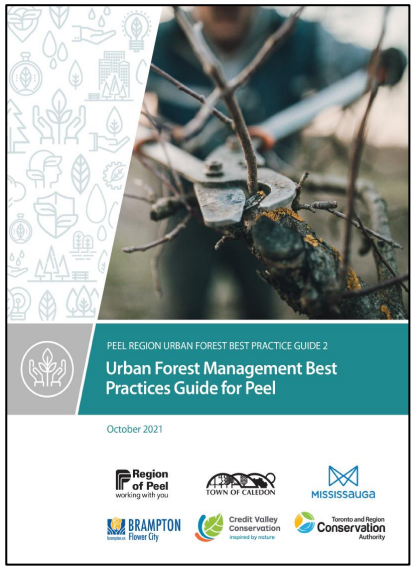
Peel Region Urban Forest Best Practice Guides Project

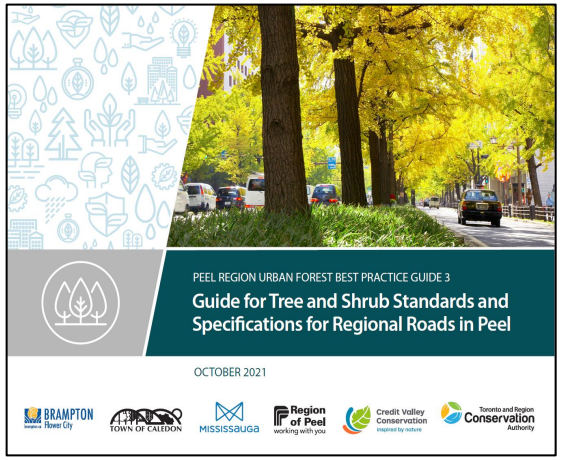
DELIVERABLES

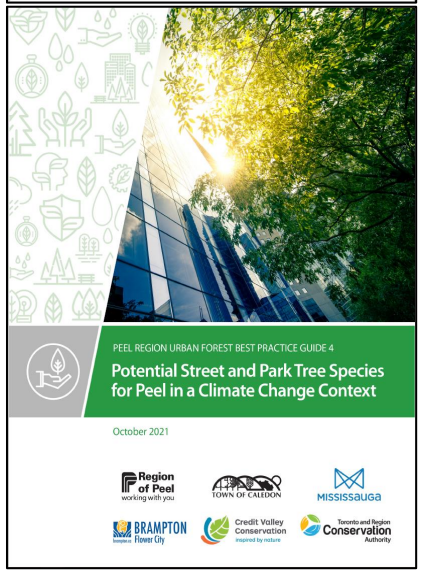
- Five distinct guides that are somewhat technical
- A 10-page public-facing summary

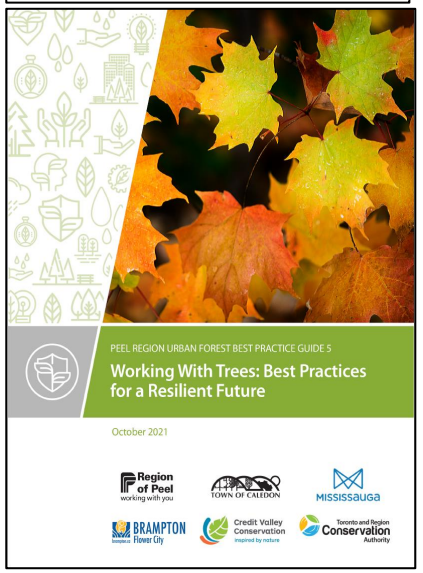
SCOPE

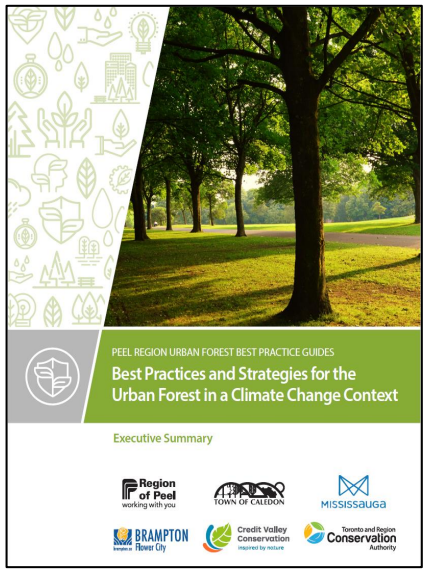
- Much of the guidance is for “individual” trees in urbanizing settings … but some also applies to natural areas
- For municipalities
- “High level” overviews that point to additional resources



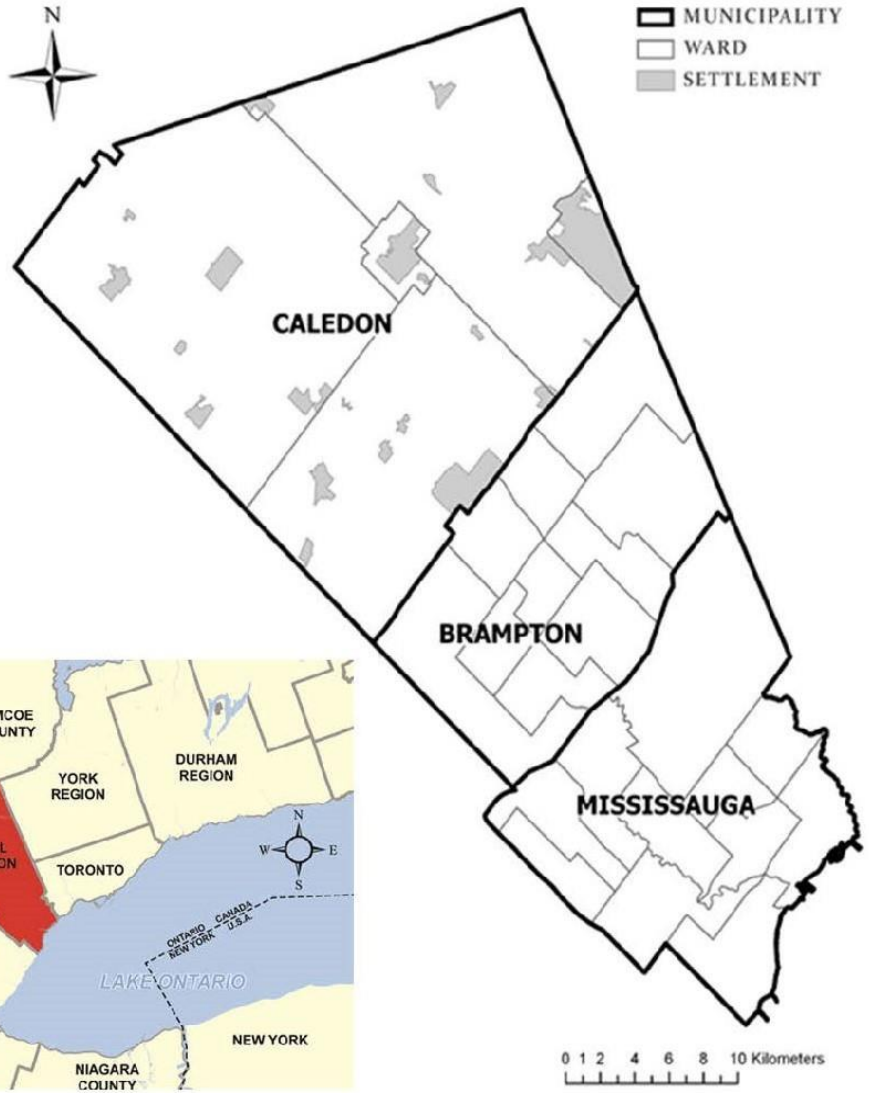






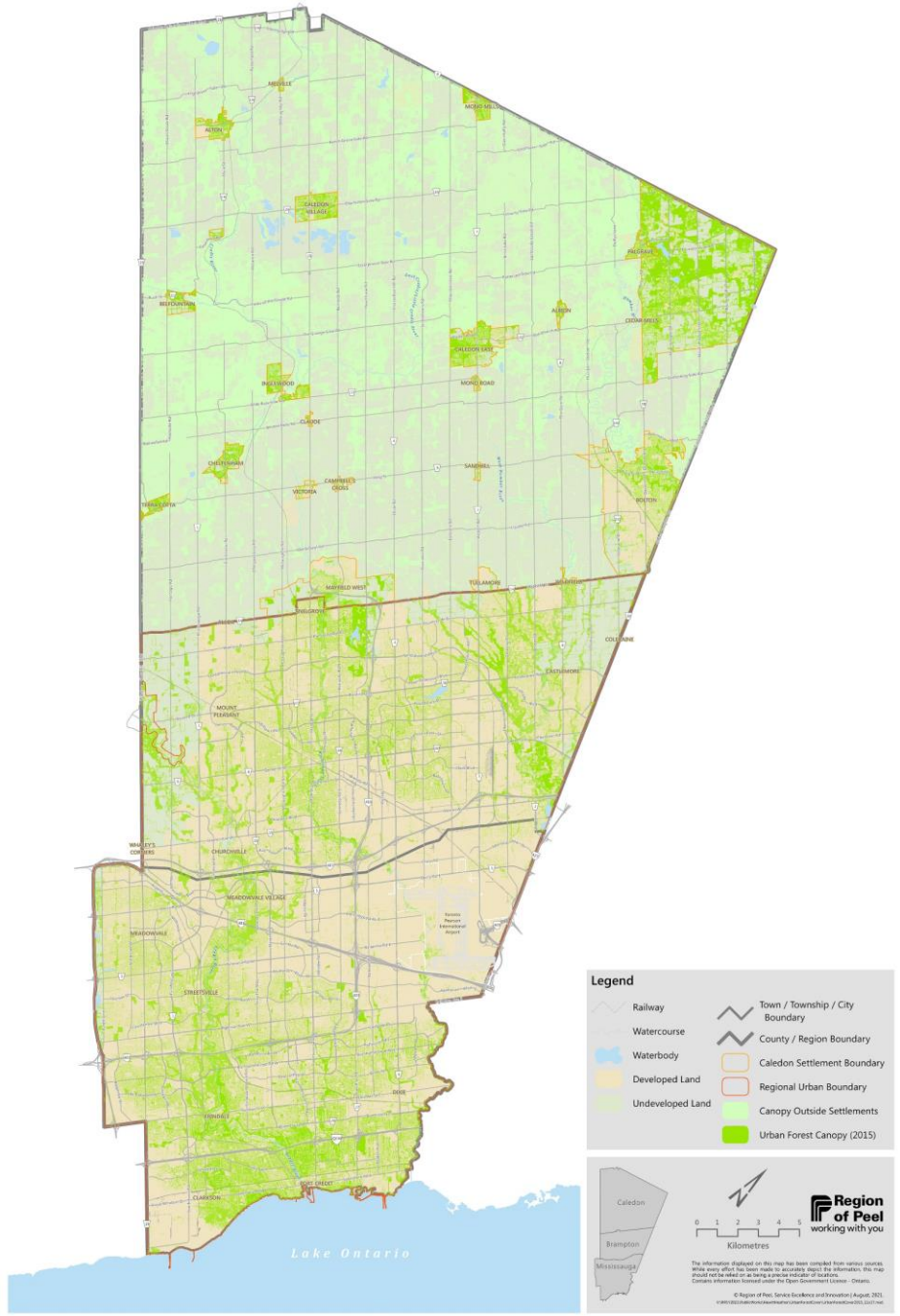


Geographic Context



Credit: *An Assessment of Urban Tree Canopy Cover in Peel 2015* (B.A. Blackwell & Associates 2017)

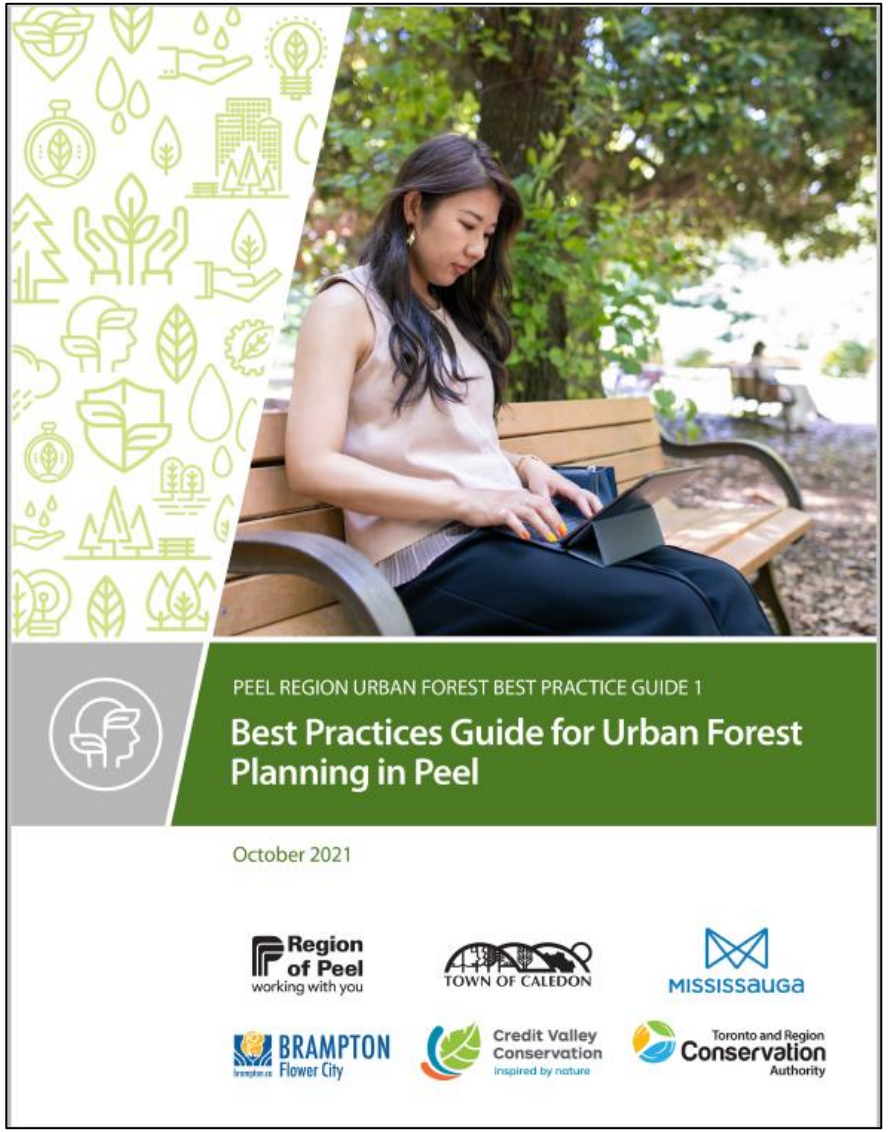
Appendix I - 2015 Urban Forest Canopy Cover in Peel Region



Guide 1: Best Practices Guide for Urban Forest Planning in Peel (225 pp.)

Focuses on planning tools that can support the urban forest

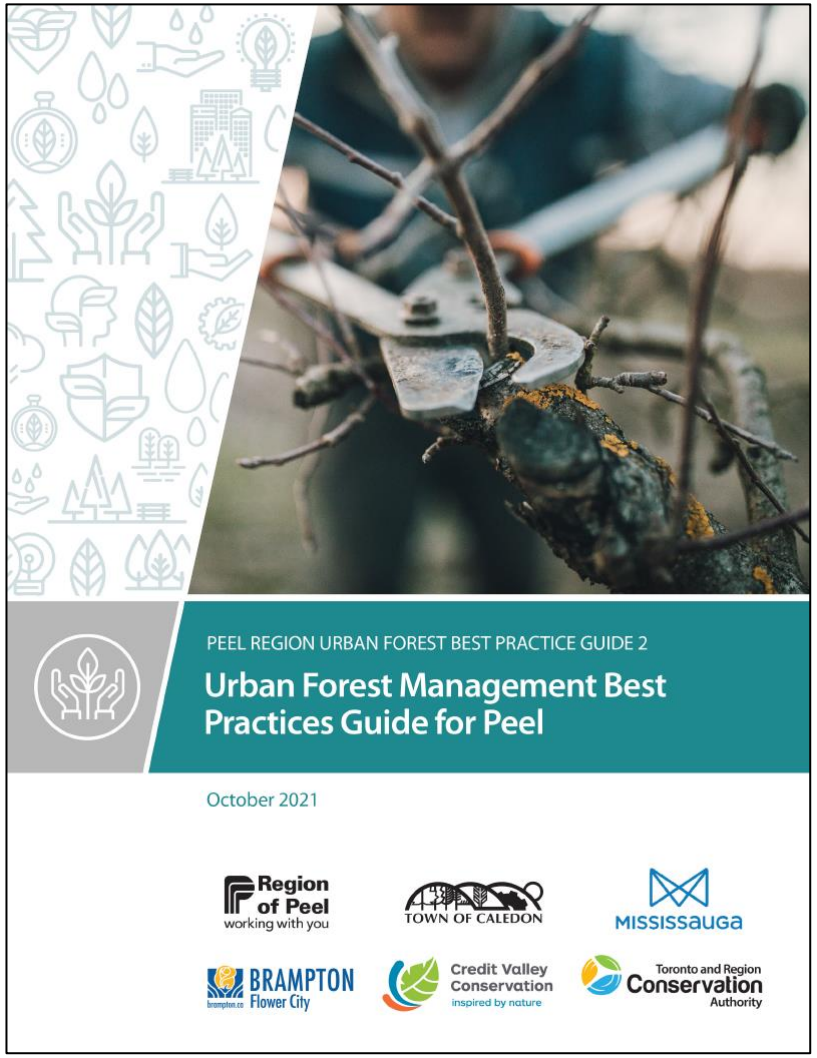
- Federal
- Provincial
- Municipal
  - Official Plan policies
  - Zoning
  - Tree / Forest By-laws
- Partnerships
- Resources



Guide 2: Urban Forest Management Best Practices Guide for Peel (175 pp.)

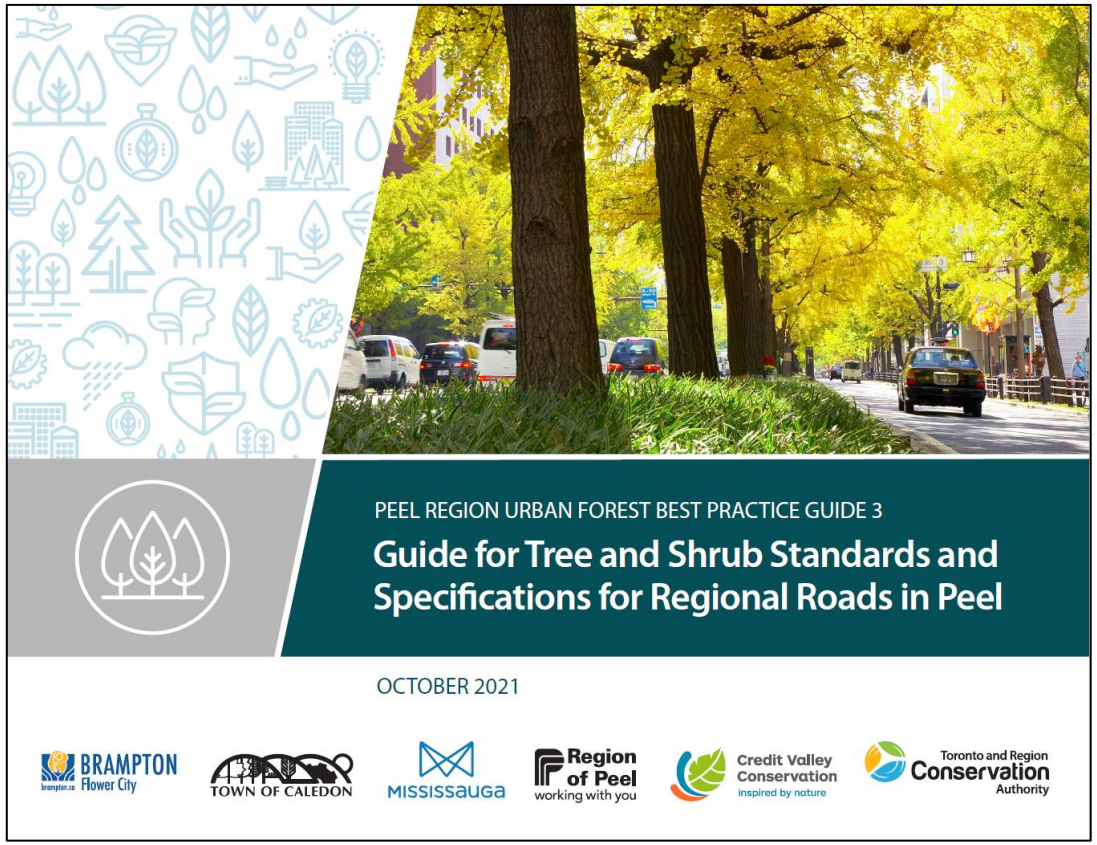
Overview of best practices for individual tree establishment throughout the life cycle:

- Municipal forestry program admin.
- Site considerations
- Seed / tree selection
- Tree establishment
  - Site prep., soils, stock handling, etc.
- Tree maintenance and management
  - Watering, pruning, pest & disease management, risk management
- Urban forest inventory & monitoring



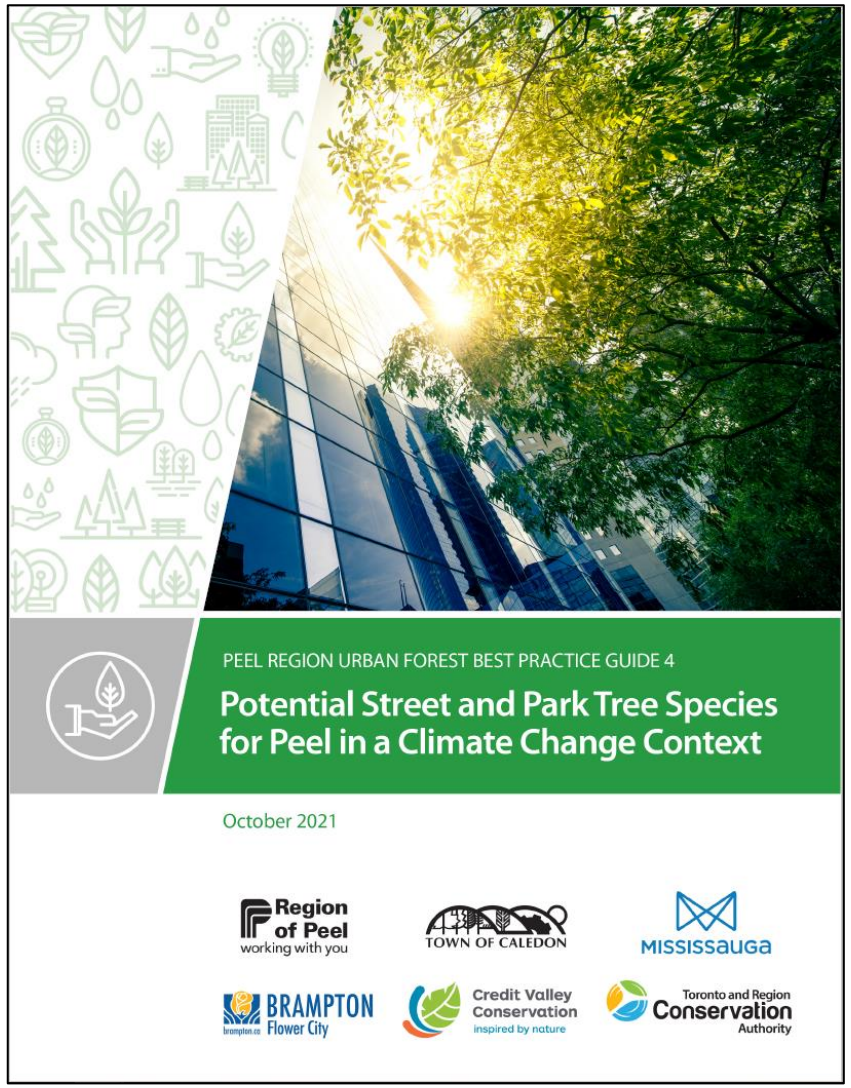
Guide 3: Guide for Tree and Shrub Standards & Specifications for Regional Roads in Peel (58 pp.)

- Overview of existing standards and specifications for tree establishment in Peel
- Guidance for the Region:
  - Standard Operating Procedures & LOS
  - Tree & shrub standards
  - Tree & shrub specifications
- Establishment details, maintenance, pest & risk management, resourcing



Guide 4: Potential Street & Park Tree Species for Peel in a Climate Change Context (139 p.)

- Overview of tree and shrub vulnerabilities based on local climate change projections (based on RCP8.5 from 2040 – 2070)
- Approach and results for vulnerability assessments of 88 species now within or currently just south of Peel
- Applied rankings of species sensitivity based on equally weighting climate suitability and drought sensitivity for trees
- Includes species range maps

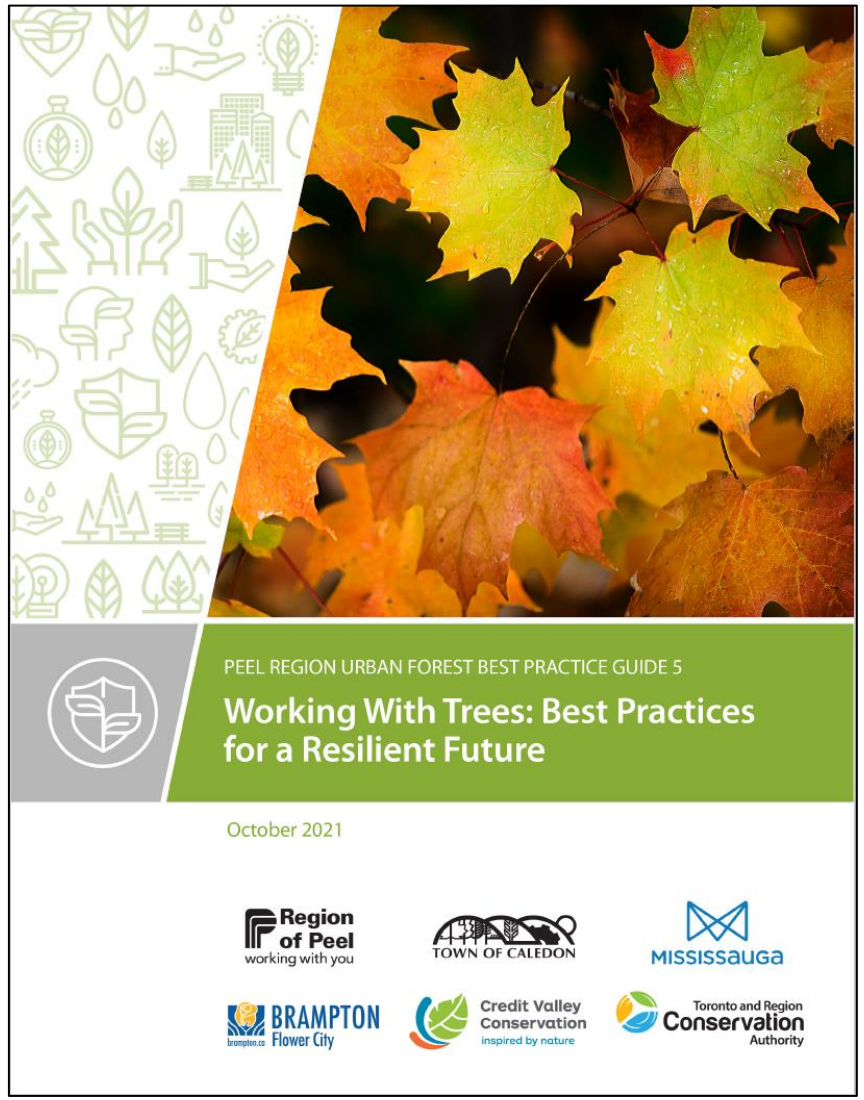


Guide 5: Working with Trees - Best Practices for a Resilient Future (85 pp.)

Builds on Guides 1 through 4

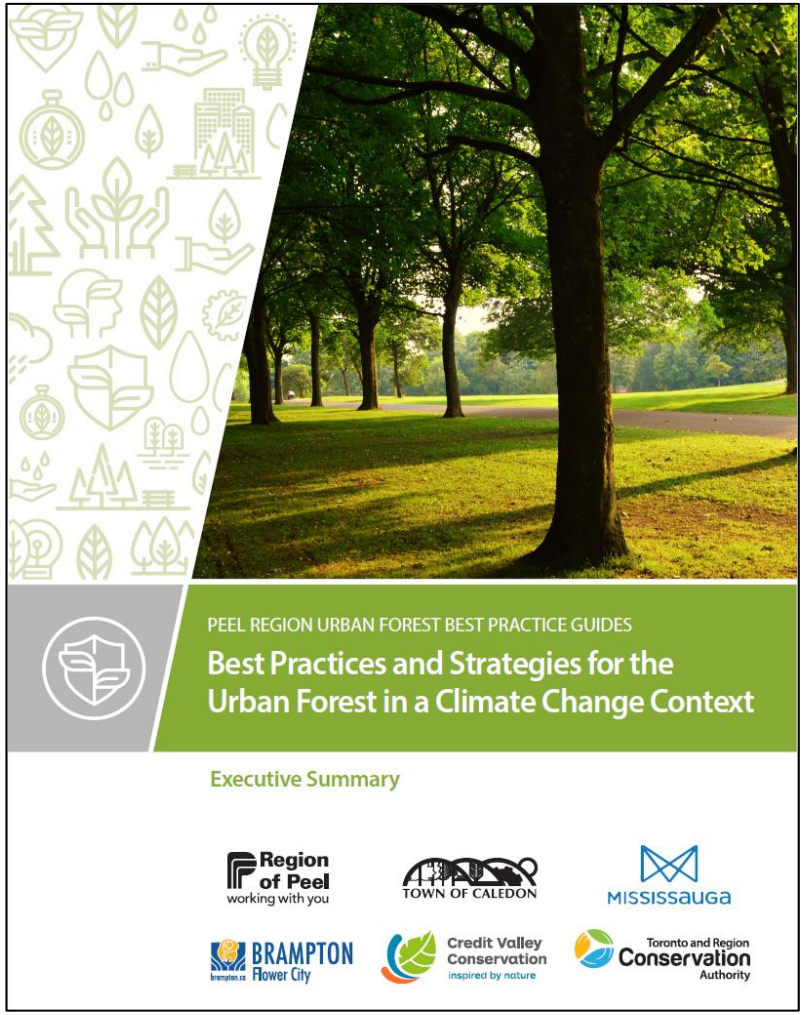
High-level strategies for growing an urban forest in a context of climate change in Peel's urban and urbanizing areas:

- Five guiding principles
- Planning & adaptation framework
- Importance of inventory & monitoring
- 10 high-level best practices / opportunities



Executive Summary: Best Practices and Strategies for the Urban Forest in a Climate Change Context (11 pp.)

- Project rationale & scope
- Framework for urban forest planning & adaptation
- Five guiding principles
- Anticipated climate vulnerabilities
- 10 strategic best practices
- Call to action



GROUNDED SOLUTIONS

Best Practices & Strategies for the Urban Forest

March 29, 2022

KEY CONSIDERATIONS

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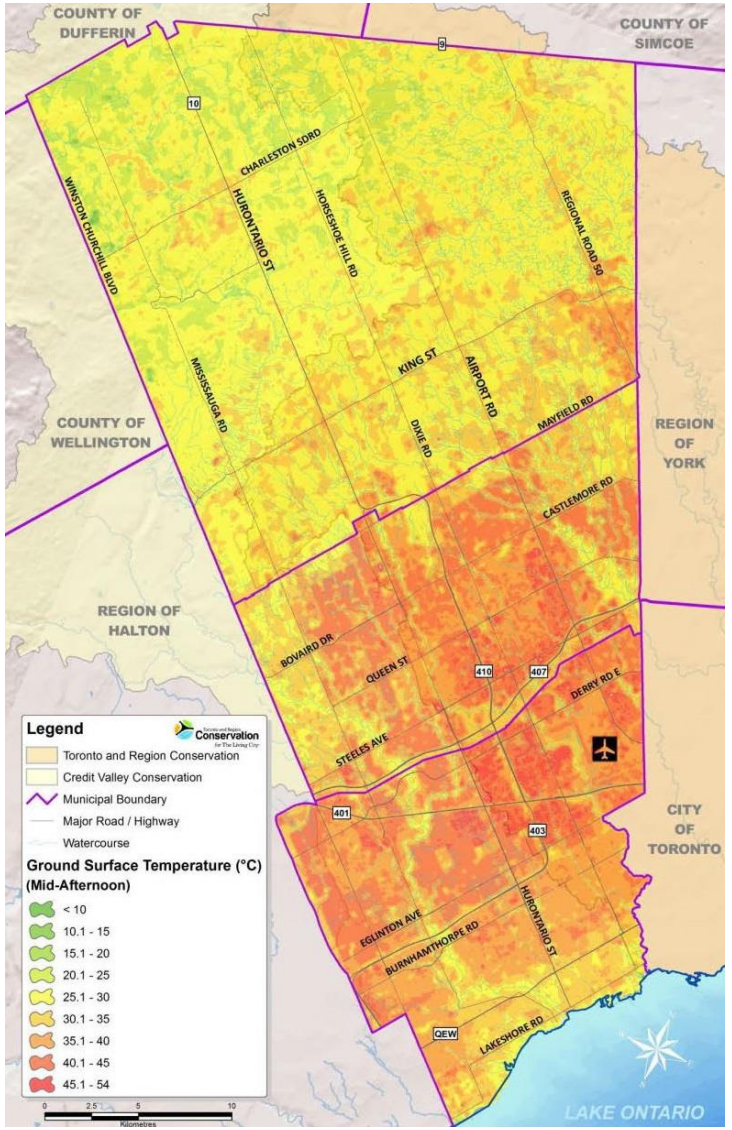
Two Urban Tree & Climate Change Conundrums

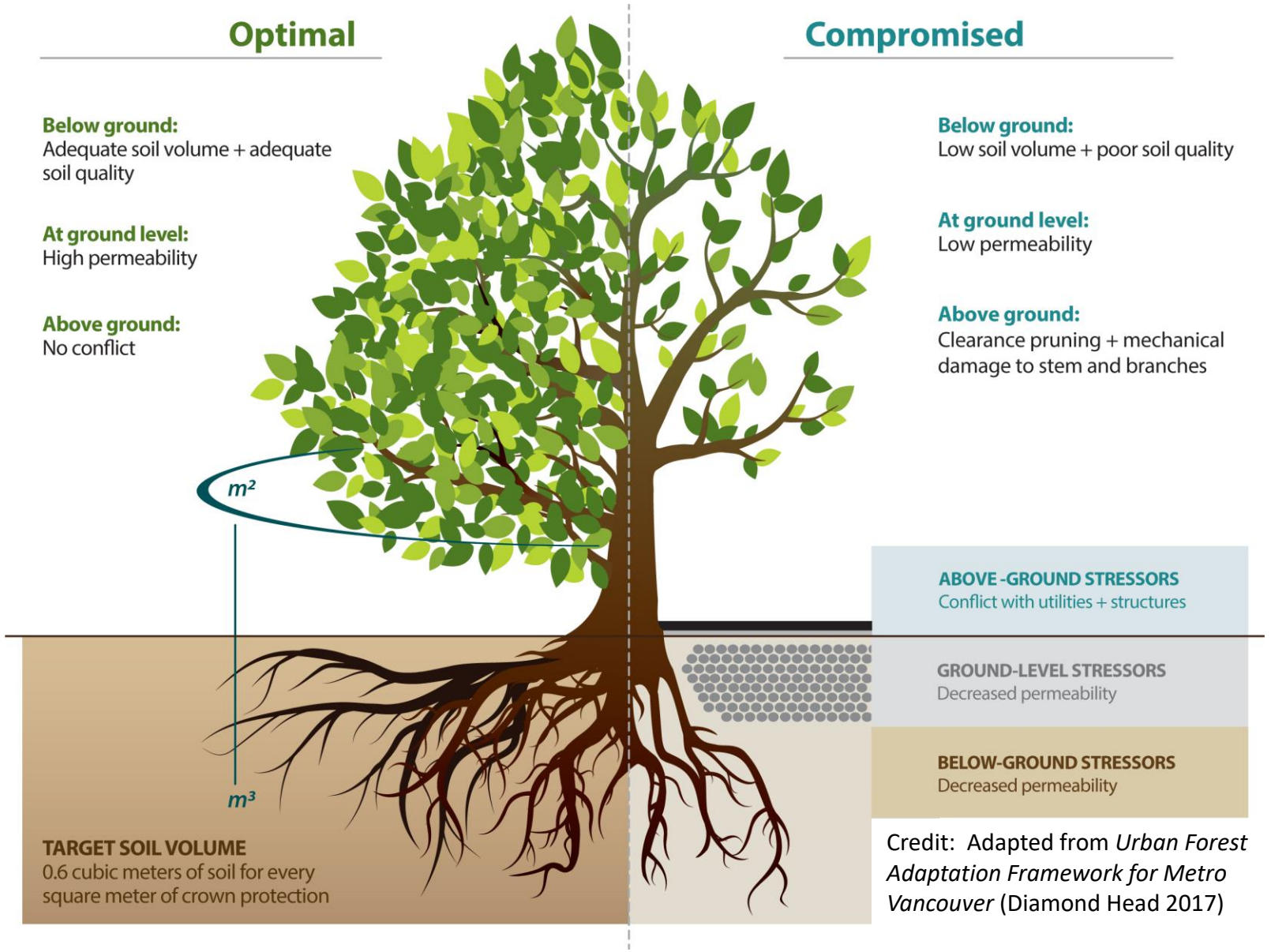
1. Trees help communities mitigate and adapt to climate change BUT are also vulnerable to the changing climate

2. The areas expected to be most intensely affected are where:
   - there are the most people (i.e., the greatest need), and
   - it can be most challenging to get trees established and sustained until maturity.



Credit: *Natural Systems Vulnerability to Climate Change in Peel Region (*Tu *et al.* 2017)

Overarching Strategy: Good Urban Forest Management



Credit: Adapted from *Urban Forest Adaptation Framework for Metro Vancouver* (Diamond Head 2017)

A basic strategy for reducing vulnerability among street and park trees is improving habitat (growing conditions) above and below ground

Some key below ground tips

- Enough space is not enough
- Treat native soils as a precious resource … avoid compaction and save the “peds”
- Water needs to get in .. AND out
- A little mycorrhizal fungi never hurt a tree

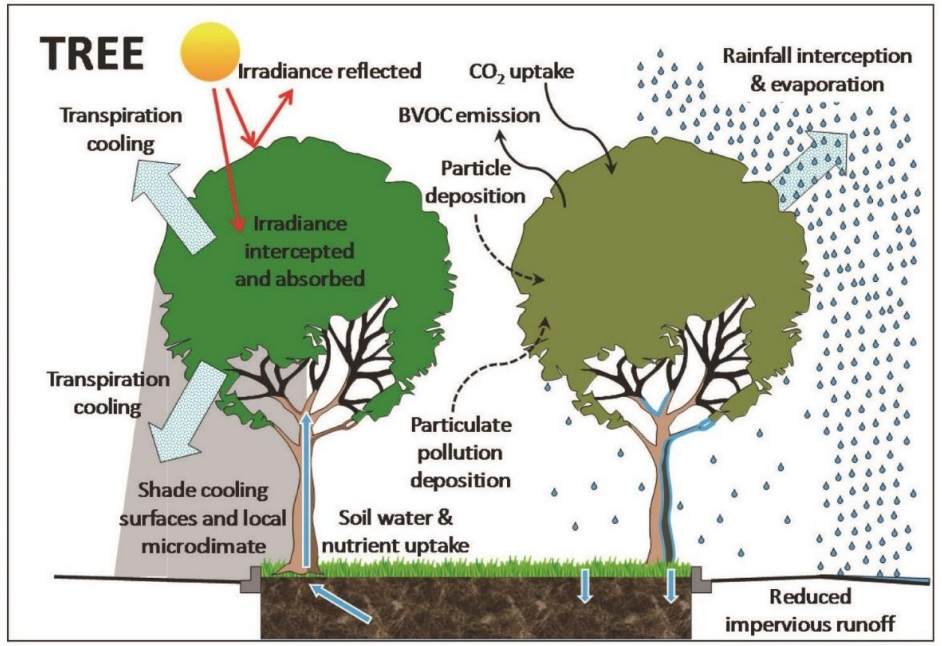
The Critical Importance of Thinking at Different Scales

Livesley, S. J., E. G. McPherson and C. Calfapietra. 2016.

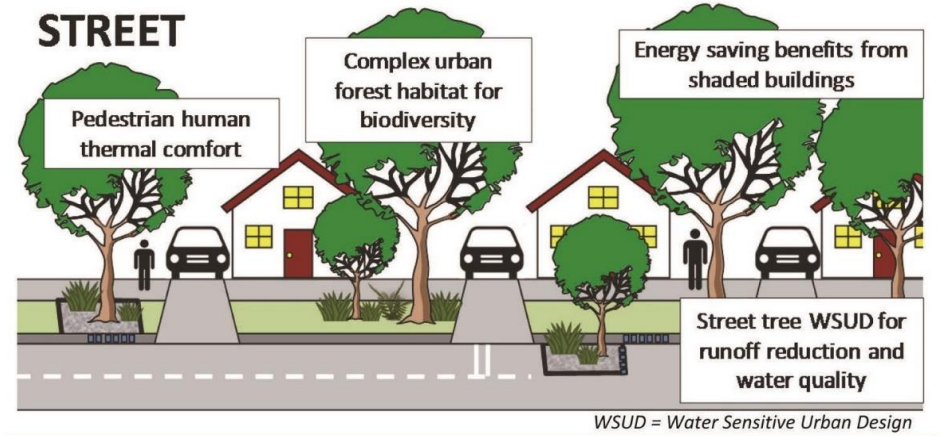
The Urban Forest and Ecosystem Services: Impacts on Urban Water, Heat, and Pollution Cycles at the Tree, Street, and City Scale.
Journal of Environmental Quality 45(1): 119-124.

USDA Forest Service Website https://www.fs.fed.us/

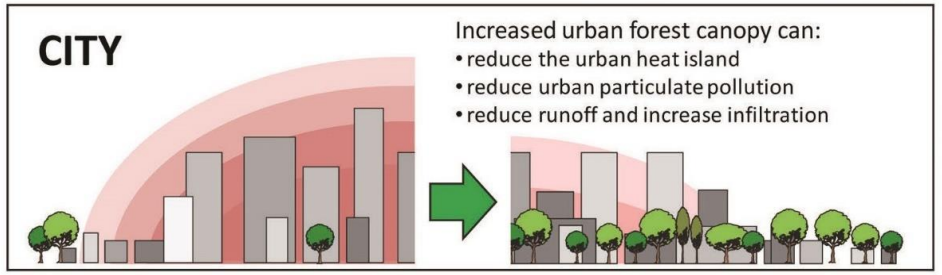
If you don't get it right at the "tree" scale you won't have it at the "city" scale … AND if you don't plan / manage strategically at the "city" scale you may not be allocating your resources to get it "right" at the tree scale



BVOC = Biological volatile organic compounds



WSUD = Water Sensitive Urban Design



Understand What You Have

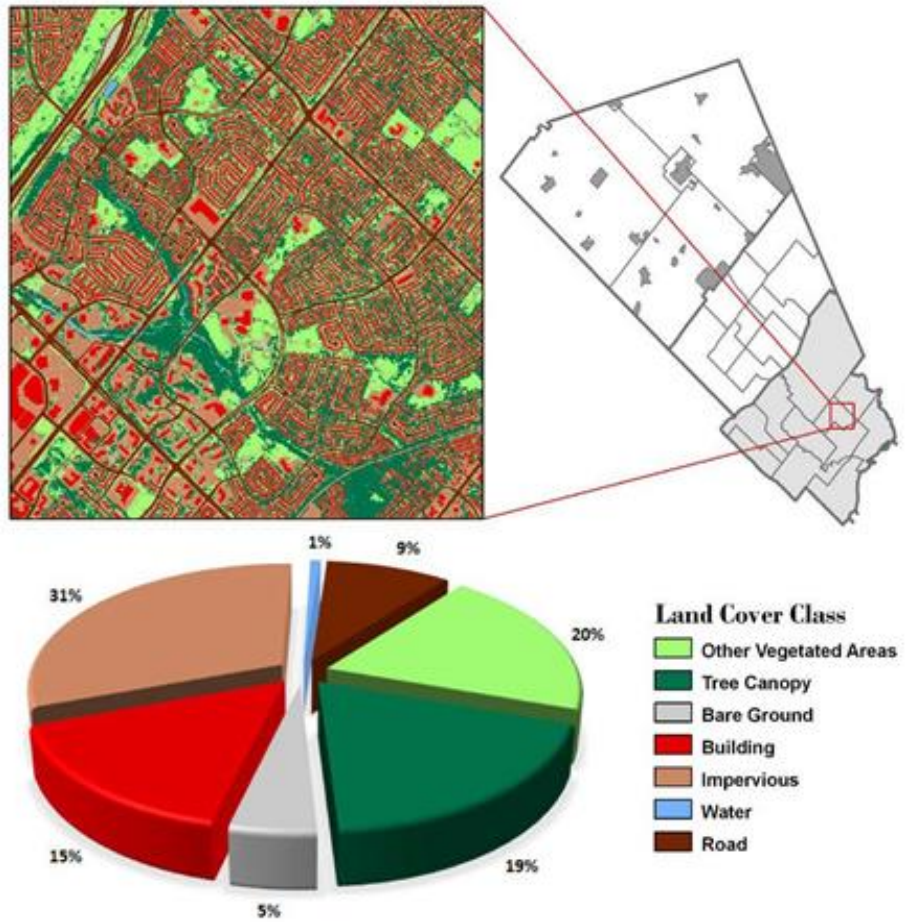
A. Inventory & Assess

Key sources of information

- A comprehensive and well-maintained inventory of municipally-owned trees assets
- A jurisdiction-wide urban tree canopy (UTC) cover assessment that is updated ~every 5 – 10 years
- Ideally, supplement with targeted data collected “on the ground”

Collect and track data

- Strategically (more is not always better)
- In a consistent, repeatable way
- In a platform that allows for: geo-referencing, analysis at different scales, sharing with others



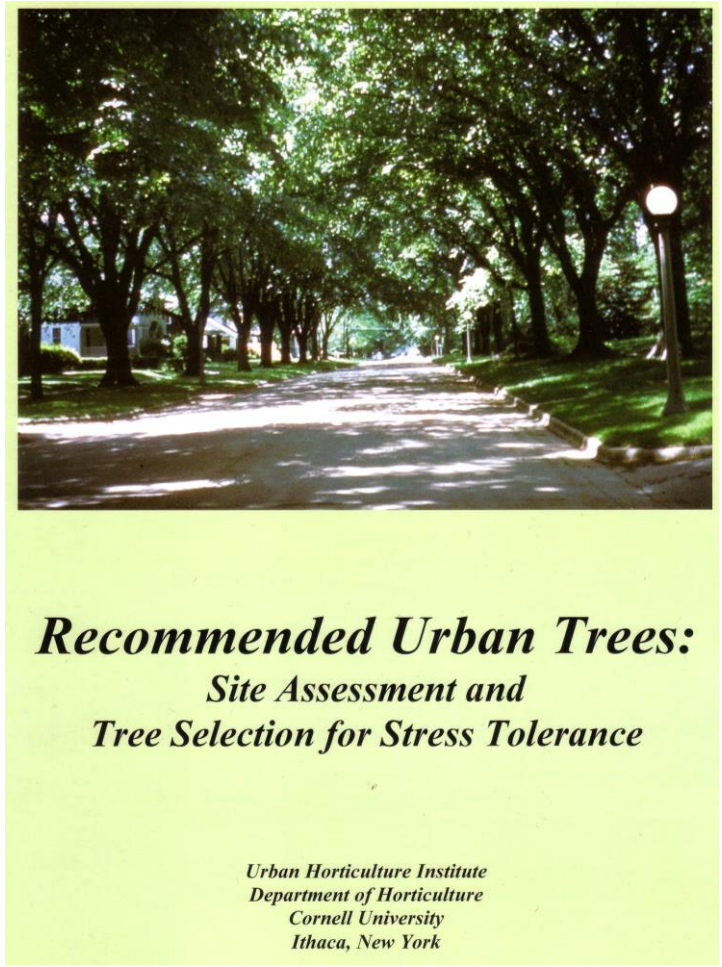
Credit: *An Assessment of Urban Tree Canopy Cover in Peel 2015* (B.A. Blackwell & Associates 2017)

Understand What You Have

B. Know Your Site

Key types of information

- **Existing conditions:** topography, soil quality, water availability and drainage, light and microclimate
- **Planned / anticipated conditions:** hardscaping, stormwater management, utilities and other infrastructure, pedestrian access, snow and salt management, new sources of shade, wind tunnels … **and don't forget about climate change …**



SITE ASSESSMENT CHECKLIST

1. Site Location _____

2. Site Description _____

3. Climate

a. ***USDA Hardiness Zone***
__6b __5b __4b __3b
__6a __5a __4a __3a

b. ***Microclimate Factors***
__Re-reflected heat load
__Frost pocket
__Wind
Other _____

4. Soil Factors

a. ***Range of pH Levels*** _____
(Note actual readings on sketch)

b. ***Texture***
__Clayey
__Loamy
__Sandy

c. ***Compaction Levels***
__Severely compacted
__Moderately compacted
__Somewhat compacted
__Uncompacted

d. ***Drainage Characteristics***
__Presence of mottled soil
__Low-lying topography
Indicator plants suggest site drainage:
__wet __well-drained __dry
Percolation test results (in./hr.)
__poorly drained (< 4"/hr.)
__moderately drained (4"- 8"/hr.)
__excessively drained (> 8"/hr.)

5. Structural Factors

a. ***Limitations to above-ground space***
__Overhead wires (height:_____)
Proximity to buildings/structures:
Other_____

c. ***Sunlight Levels***
__Full sun (6 hrs. or more)
__Partial sun or filtered light
__Shade

d. ***Irrigation Levels***
__No supplemental irrigation
__Automatic irrigation system
Irrigation amount and rate:
_____

e. ***Other Soil Considerations***
__Indications of soil layer disturbance
__Evidence of recent construction
__Presence of construction debris
__Noxious weeds present:
_____
_____
_____
_____
__Evidence of excessive salt usage
__Erosion of soil evident
__Evidence of soil contamination
__Usage that compacts soil

f. ***Specific Soil Problems***
_____
_____
_____
_____
_____
_____
_____

b. ***Limitations to below-ground space***
__Utilities marked and noted on sketch
Approximate rooting volume for site
Length:__ Width: __ Depth: __

Credit: Dr. Nina Bassuk of the Urban Horticulture Institute at Cornell University (2009)

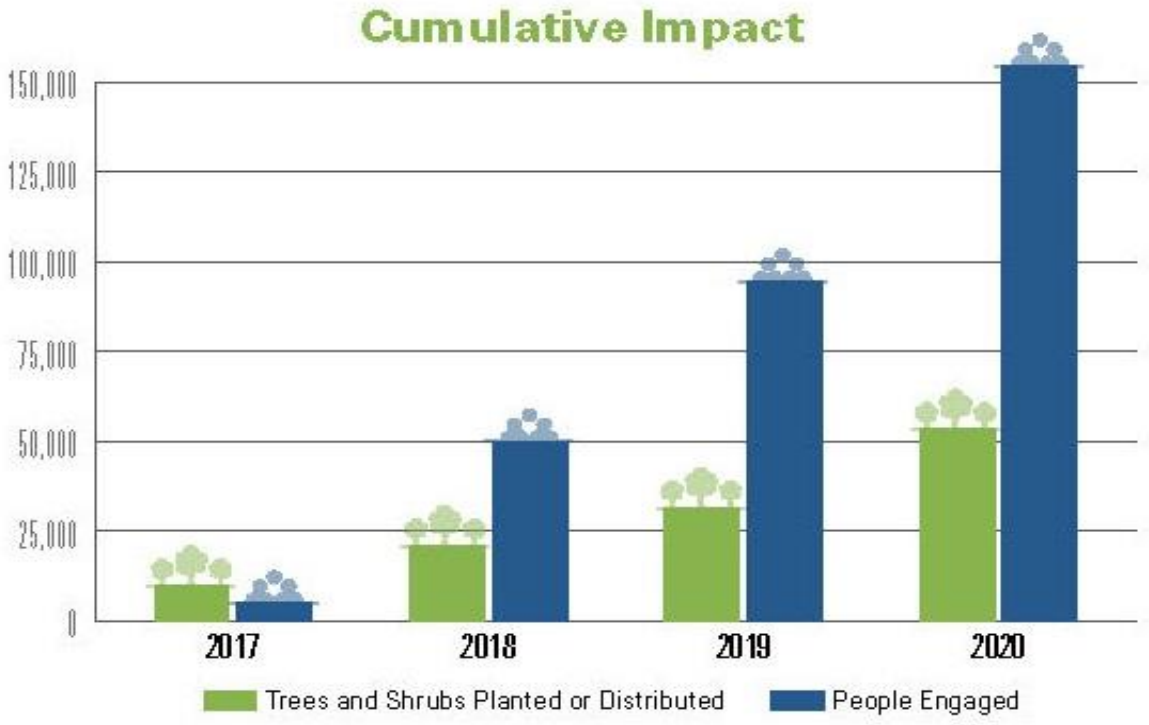
Understand What You Have

C. Track & Monitor

Key metrics in a climate change context

- Changes in extent and locations of UTC
- Trees established and survival rates, as well as trees removed
  - Including success where trees are integrated with other Low Impact Development (LIDs) measures
- Serious forest pests and diseases
- Changes in diversity – species and structural
  - "New" native species trials
  - Limited assisted migration trials
- Levels of engagement

Monitor strategically – more is not always better



Credit: *City of Toronto Urban Forestry Grants & Incentives Impact Report 2017-2020*

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Best Practices & Strategies for the Urban Forest

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10 HIGH-LEVEL BEST MANAGEMENT PRACTICES

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Region of Peel working with you

Credit Valley Conservation inspired by nature

Toronto and Region Conservation Authority

10 Best Management Practices (BMPs) / Strategic Directions for Building Urban Forest Resilience

1.	Value the Urban Forest as an Asset	6.	Take an Integrated Approach to Planning
2.	Invest Strategically	7.	Take an Integrated Approach to Design
3.	Have a Strategic Plan	8.	Seek Climate-Positive Outcomes
4.	Enhance Tree and Urban Forest Diversity	9.	Foster a Tree-friendly Culture
5.	Plan with Equity in Mind	10.	Be Proactive and Be Prepared

BMP#1: Value the Urban Forest as an Asset

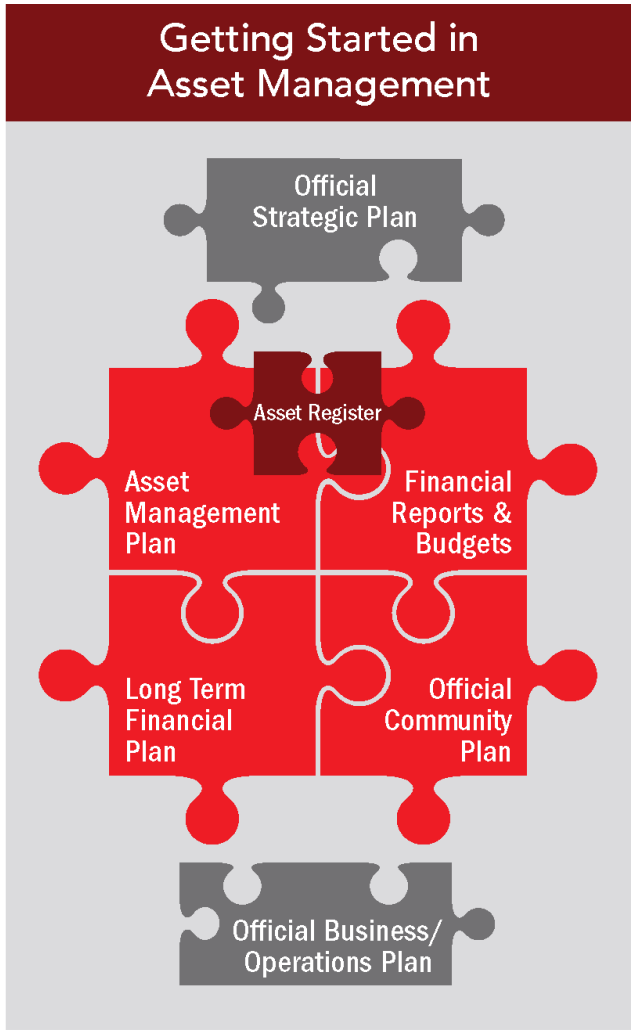
THE CHALLENGE

There are an increasing number of studies estimating the value of some of the services provided by trees BUT there continues to be a lack of:

a) full-cost accounting of all services provided by trees in cities
b) a life-cycle approach that considers the costs and benefits in a time frame appropriate for a well-established urban tree

A GOOD SOLUTION

The municipal asset management framework ...



Credit: *Asset Management 101 (FCM 2018)*

BMP#1: Value the Urban Forest as an Asset

COMPLIANCE WITH THE LEGISLATION IN ONTARIO (O. Reg. 588/17)

- 3(1) *Every municipality shall prepare a strategic asset management policy that includes* …
  - long-term financial planning
  - must consider how to address vulnerabilities caused by climate change
  - by July 1, 2024

ASSET MANAGEMENT ALIGNS WITH GOOD URBAN FOREST

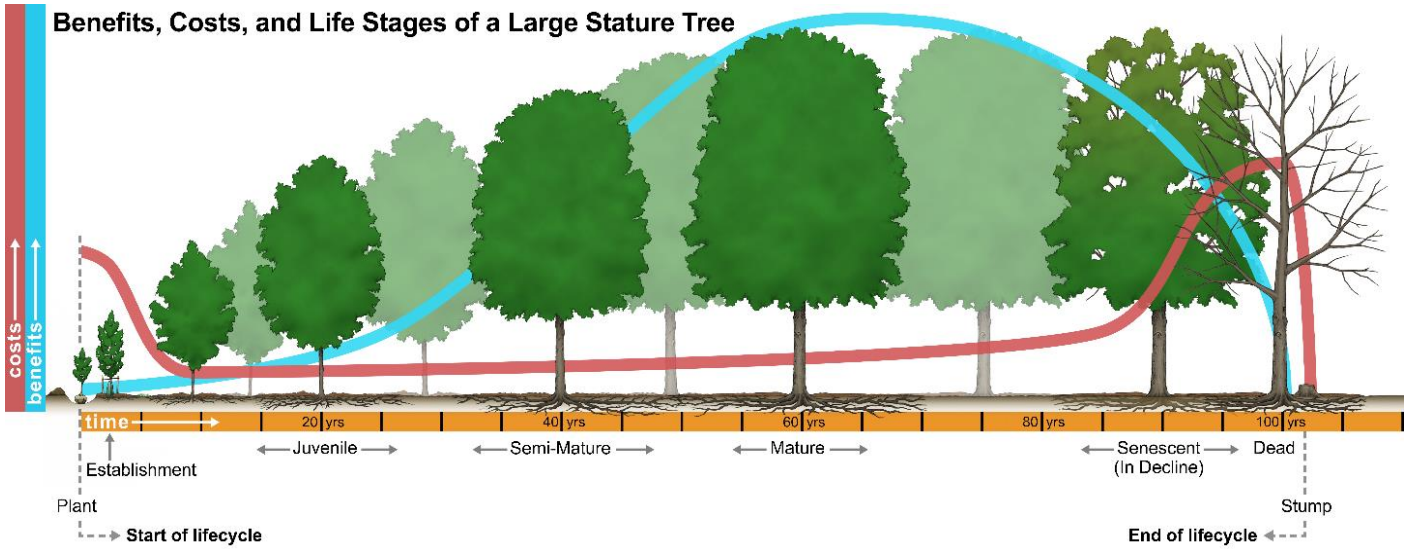
- Inventory, condition assessment, risk assessment, long-term planning, etc.

deteriorating grey infrastructure + climate change + provincial regulations = need to advance integration of green infrastructure into municipal asset management systems

BMP#2: Invest Strategically

FOCUS ON BUILDING RESILIENCE

- Proper tree selection and diversification
- Ensuring good growing conditions
- Proper maintenance when trees are young
- Prioritizing vulnerable neighbourhoods
- Planning and design that meets multiple objectives
- Broad and diversified engagement
- Proactive maintenance and preparedness



Credit: E. Damstra, with permission 2020

Credits: LEAF / City of Toronto, City of Mississauga

BMP#3: Have a Strategic Plan

A sustainable urban forest program is one that:

- ***the community can afford now, and in the future***
- ***maximizes the benefits of the urban forest***
- ***minimizes the associated risks and costs, and***
- ***has a supportive and active community.***

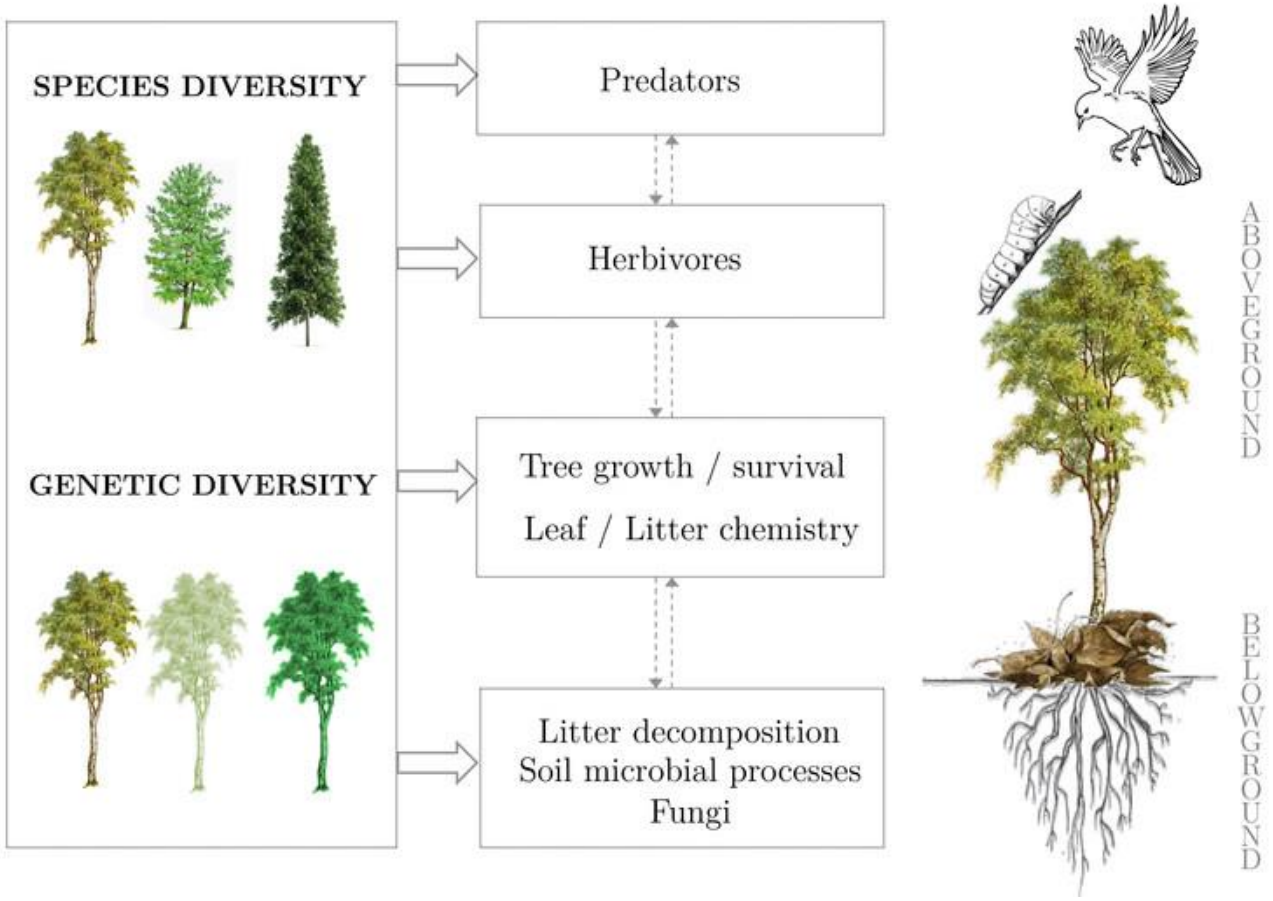
City of Kitchener's Sustainable Urban Forest Strategy 2019 – 2028

An urban forest plan or strategy can:

- Provide a basis for securing funding internally and externally
- Serve as a framework for adaptive management in response to new data, changing conditions
- Direct management of tree-related risk
- Help standardize tree-related approaches to policies and practices
- Be a tool and reference for community engagement and partnerships

BMP#4: Enhance Diversity …
of all types and at all scales

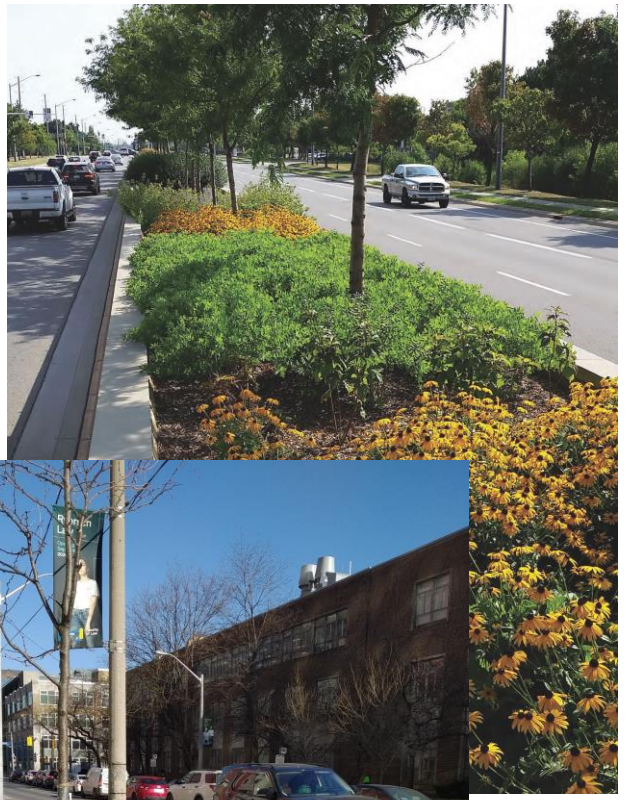
- Urban forest diversity includes: age / size, structural, species and genetic diversity
- All types of diversity should be optimized in a jurisdiction at different scales (e.g., ward, neighbourhood and street scales)
- Diversify at the genus and species levels, and within species with different provenances



Credit: Satakunta Forest Diversity Experiments (sataforestdiversity.org)

BMP#4: Enhance Diversity …
at the site scale

- Planting “nodes” or mini-communities where feasible
- Select species suited to the existing site conditions while also considering anticipated climate suitability
- Plant multiple genera, species and – if possible – provenances on a single street (can still seek similar forms for visual consistency)
- Incorporate long-lived species
- Diversify locations of new plantings strategically on streets over successive years to sustain and build age / size diversity



Credits: York Region (above), City of Toronto (below)

BMP#4: Enhance Diversity … with climate change in mind

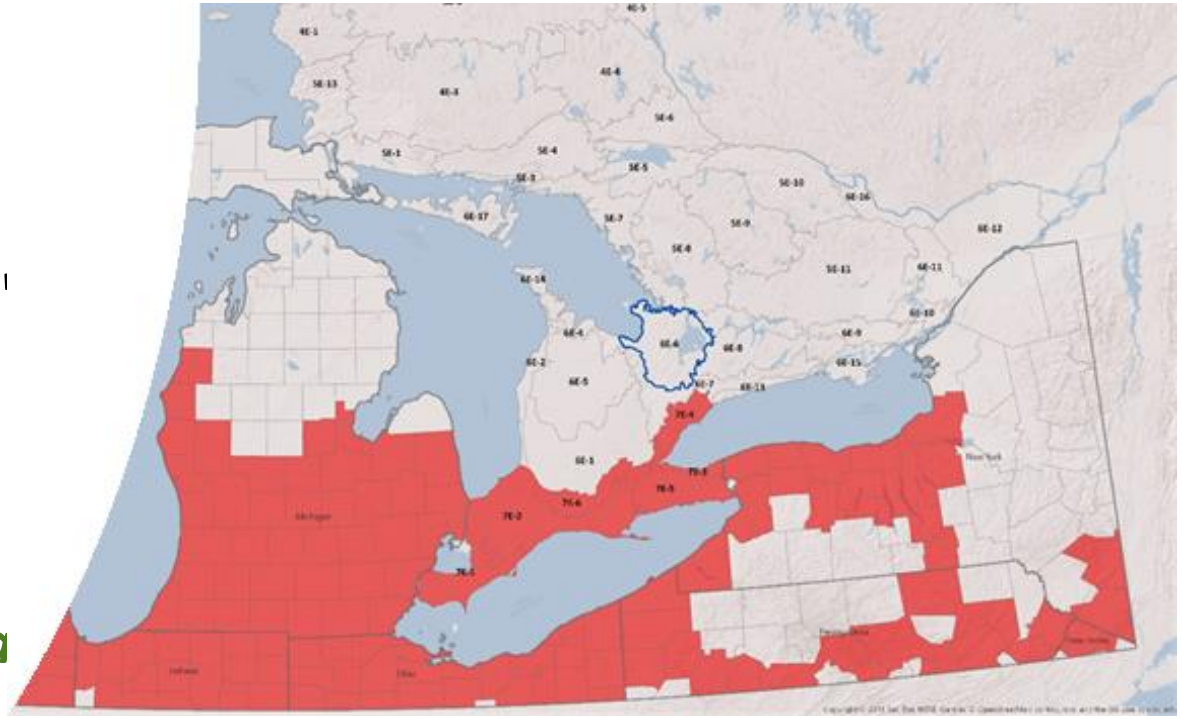
Continue to include species that occur locally and whose ranges overlap with the given site but also ...

include assisted migration – with caution

1. Focus on "assisted population migration" within the current ranges
2. Include some "assisted range expansion" (slightly south of current ranges)
3. Limit or avoid "assisted long-distance migration“ (far south of current ranges)

and consider vulnerability assessment data

MNRF Seed Transfer Policy (2020)
Parts of Illinois, Michigan, Ohio, Pennsylvania, New York (in red) correspond with potential seed collection zones for Peel

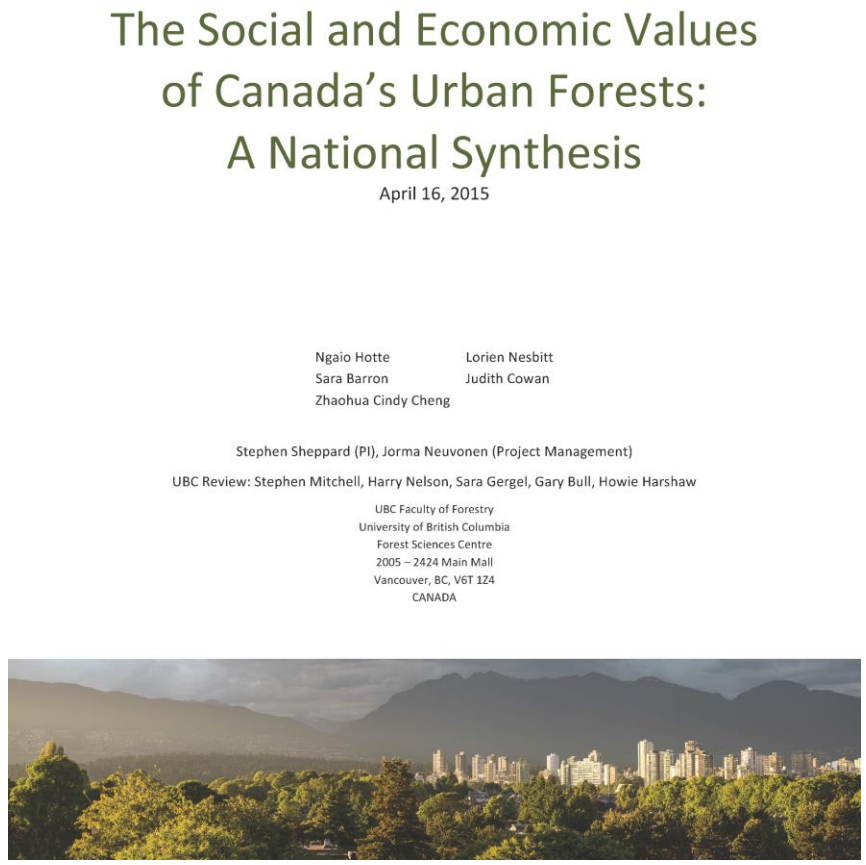


BMP#5: Plan with Equity in Mind

Why?

- Although the factors are not entirely clear, in general "*it appears that higher levels of greenery are positively associated with higher incomes and education and older neighbourhoods*".

- "*Given the many benefits provided by urban greenery [including trees], urban residents who live in ethical , democratic and sustainable societies should all have more or less equal access to urban greenery …*"


The Social and Economic Values of Canada's Urban Forests: A National Synthesis

April 16, 2015

Ngaio Hotte, Sara Barron, Zhaohua Cindy Cheng, Lorien Nesbitt, Judith Cowan

Stephen Sheppard (PI), Jorma Neuvonen (Project Management)

UBC Review: Stephen Mitchell, Harry Nelson, Sara Gergel, Gary Bull, Howie Harshaw

UBC Faculty of Forestry
University of British Columbia
Forest Sciences Centre
2005 – 2424 Main Mall
Vancouver, BC, V6T 1Z4
CANADA

Prioritizing equity when investing in green infrastructure is a "win-win" approach that can reduce health risks to some of the most vulnerable while also providing benefits to the community as a whole

BMP#5: Plan with Equity in Mind

How?

- GIS-based planning tool developed for Peel Region that allows selected environmental, economic and social measures to be (a) mapped and (b) combined to address different planning priorities

- EXAMPLE

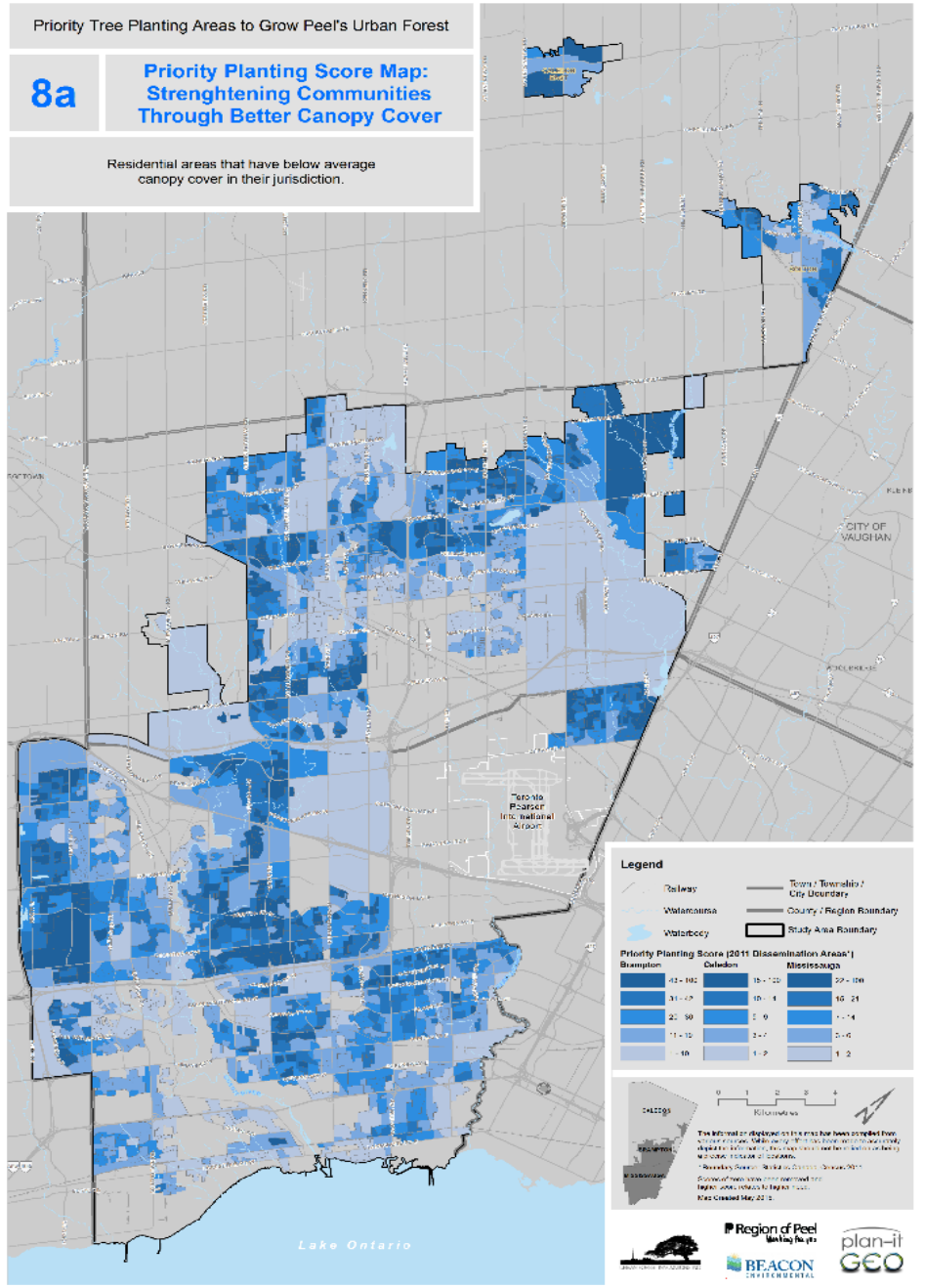
  Areas with lower than average canopy cover

  +

  Areas with lower than average household incomes

  =

  High priorities for investing in tree establishment



Credit: Priority Tree Planting Areas to Grow Peel's Urban Forest (Beacon et al., 2015)

BMP#6: Take an Integrated Approach to Planning

Municipal Strategic Plans

- Vision
- Official Plan

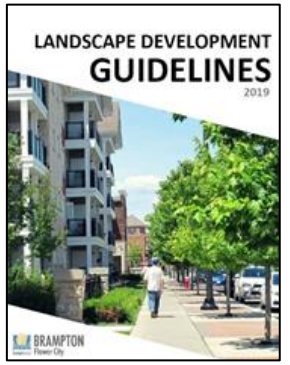
Municipal Guidelines

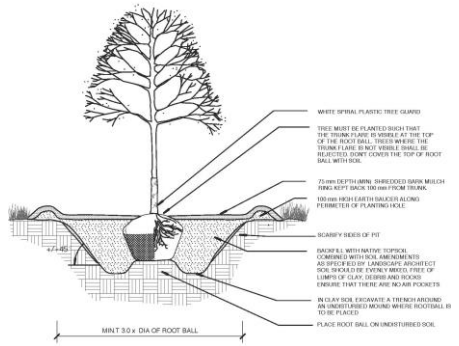
- Landscape Guidelines
- Engineering Guidelines

Municipal Bylaws, Specifications

- Tree & Site Alteration Bylaws
- Site-level Concepts & Details
- Details & Specifications

strategicplan
Our Future Mississauga





Credit: Beacon Environmental 2020

BMP#6: Take an Integrated Approach to Planning
EXAMPLE: Peel Region

Peel2051
Regional Official Plan Review and Municipal Comprehensive Review

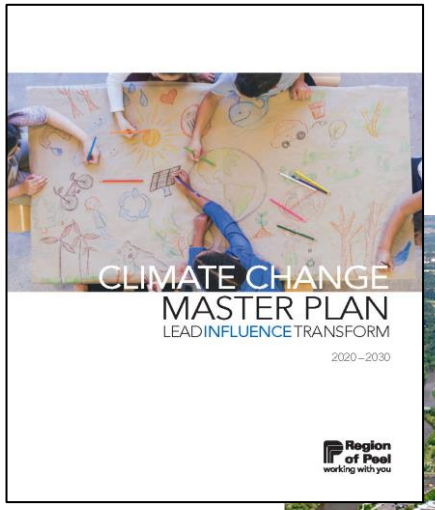
Policies

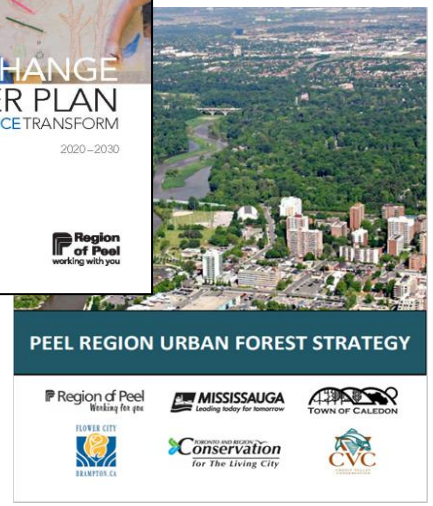
2.14.39.2 Work jointly with the local municipalities and agencies to develop *urban forest* strategies and encourage and support programs and initiatives that *protect*, maintain and enhance tree canopy in urban and rural *settlement areas*.

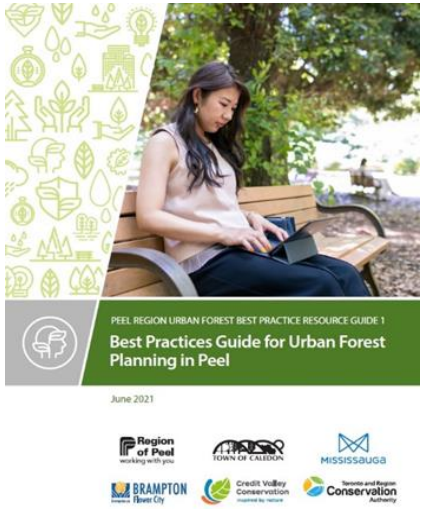
2.14.39.3 Recognize the *urban forest* as *green infrastructure* and a natural asset and provide direction to incorporate trees and wooded natural areas in municipal asset management planning.

2.14.39.4 Encourage the local municipalities to develop, maintain and implement *urban forest* management including establishing targets and the operational plans, programs and resources needed to support meeting established targets.

2.14.39.5 Direct the local municipalities to develop, review and update policies in their official plans, secondary plans, *infrastructure* plans and asset management plans to protect, maintain and enhance the extent of tree canopy cover.



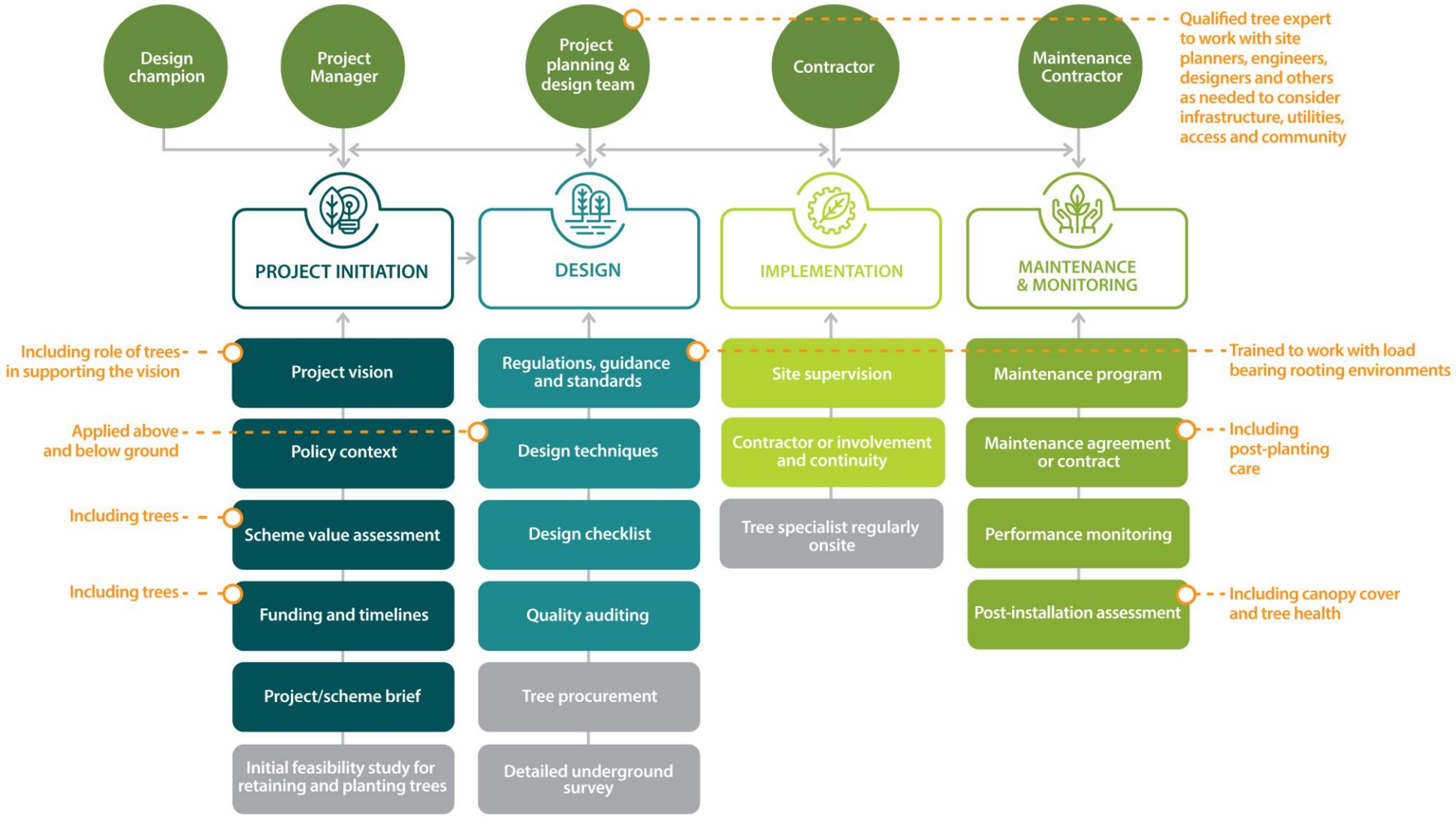




BMP#7: Take an Integrated Approach to Design

Process for Getting Trees into Hardscapes

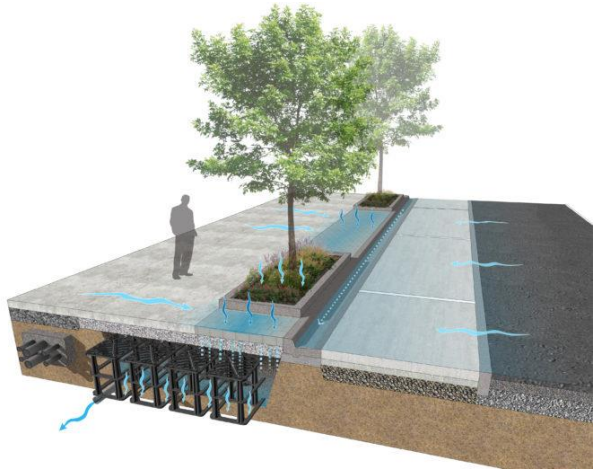
(adapted from Trees and Design Action Group, UK)



BMP#7: Take an Integrated Approach to Design

Examples of Getting Trees into Hardscapes

(adapted from Trees and Design Action Group, UK)



Credits: Town of Oakville and Silva cells™

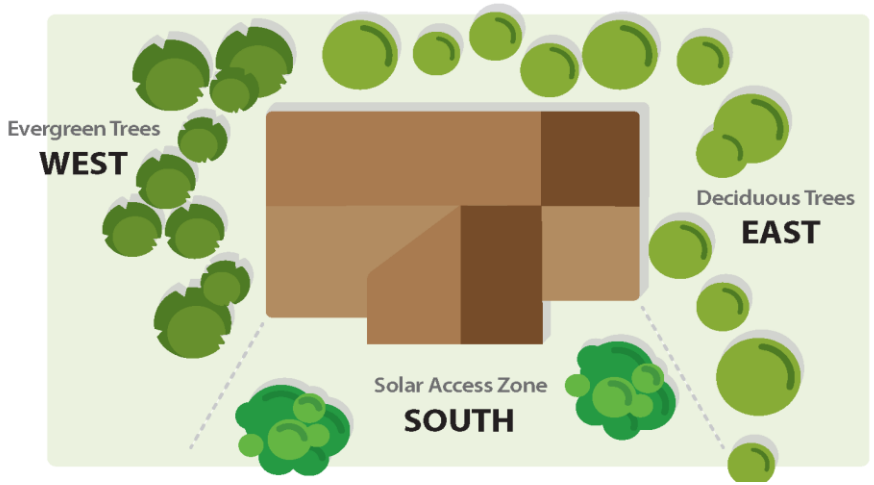
Adapted from "https://www.tdag.org.uk/trees-planning-and-development.html", Trees and Design Action Group

BMP#8: Seek Climate-Positive Outcomes

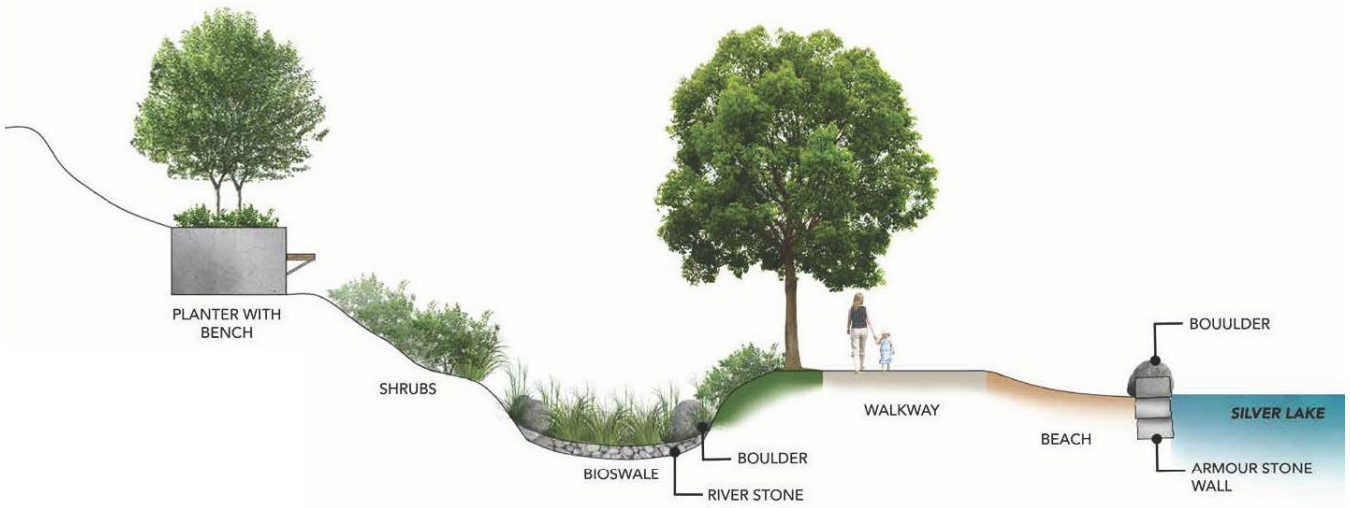
There are many opportunities in urban (and rural) areas to integrate trees into the community cost-effectively and creatively, while also meeting other municipal objectives (e.g., related to community safety, climate change).

Credit: *Design Guidebook – Maximizing Adaptation Benefits with Trees* (Diamond Head 2017)

Illustration of site-specific planting to provide wind breaks and reduce heating costs



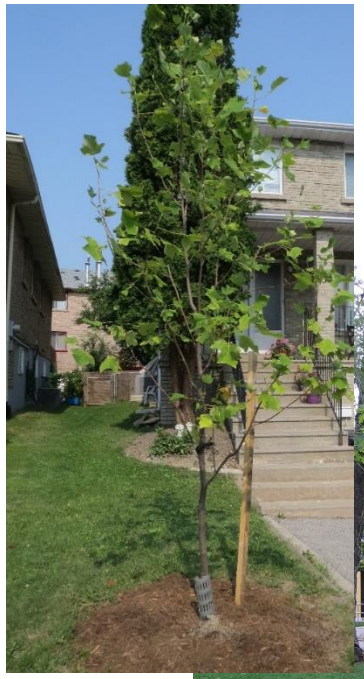
Adapted from: *Town of Caledon Comprehensive Town-wide Design Guidelines* (The MBTW Group 2017



Credit: *Green Infrastructure for Climate Adaptation* (Green Infrastructure Foundation 2019)

BMP#8: Seek Climate-Positive Outcomes

Examples of Different Tree Habitats in Urban Settings



individual trees

Credits: Examples from City of Brampton, City of Toronto

shared planting beds

Credits: Examples from City of Brampton, City of Toronto

tiny or “Miyawaki” urban forests

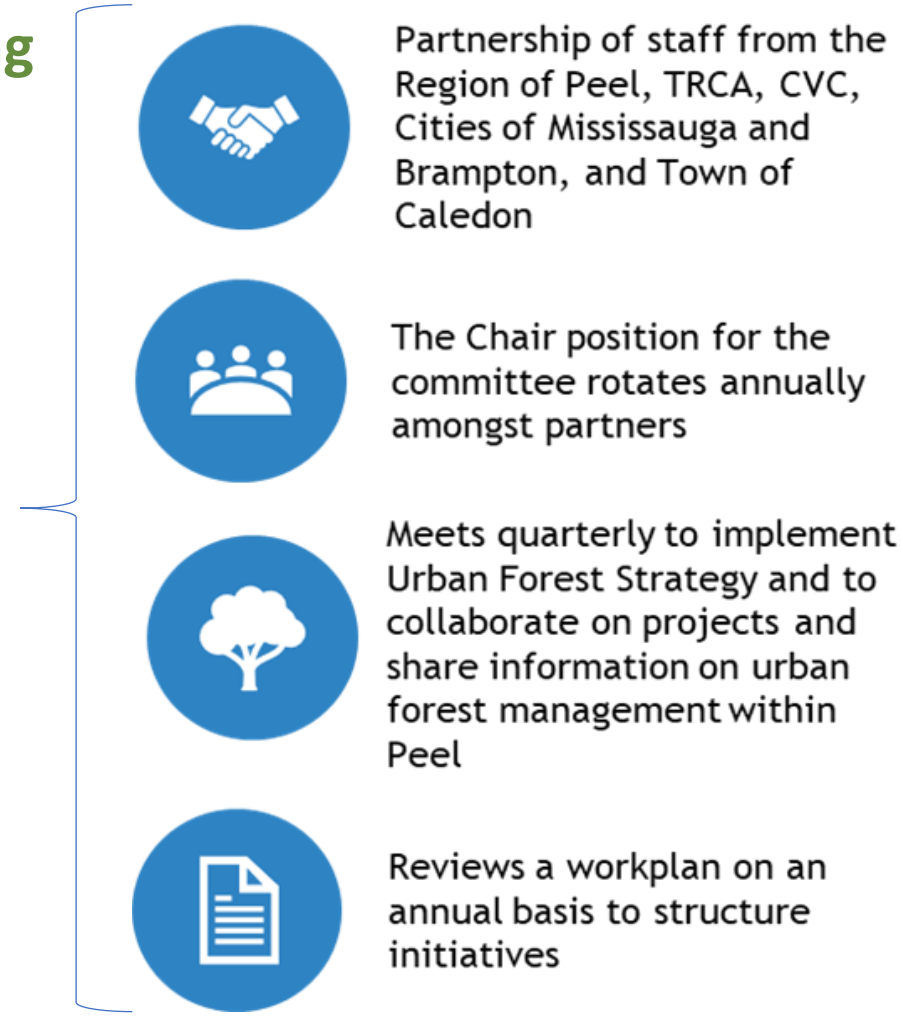
Credits: CanPlant.ca website and National Geographic website

BMP#9: Foster a Tree-friendly Culture - Internally

Engagement within the municipality / agency (among staff, managers, etc.) is just as important as engagement with external stakeholders and partners.

Project-specific examples:

- Peel Urban Forest Working Group
- Peel Climate Change Partnership



BMP#9: Foster a Tree-friendly Culture - Externally

Broad and diversified engagement within and outside the organization is essential to effective urban forest management

- Make it accessible
- Be creative
- Have knowledgeable people able to assist
- Provide follow-up

Credit: New York City Million Trees website

BMP#10: Be Proactive …

Lead by example

At the site or area-specific scale

- Multi-disciplinary review of plans early in the process
- Insist on diversification
- Require compensation
- Seek opportunities for enhancement
- Involve “tree professionals”

Credit: NYC Trees website 2020

Credit: City of Toronto 2007

At the municipal-wide scale

- Maintain a comprehensive tree inventory
- Invest in proper establishment, maintenance
- Implement a pest management program
- Undertake targeted monitoring
- Foster a "tree-positive" culture

BMP#10: … and Be Prepared

In addition to ongoing and integrated planning and management it is advisable to have:

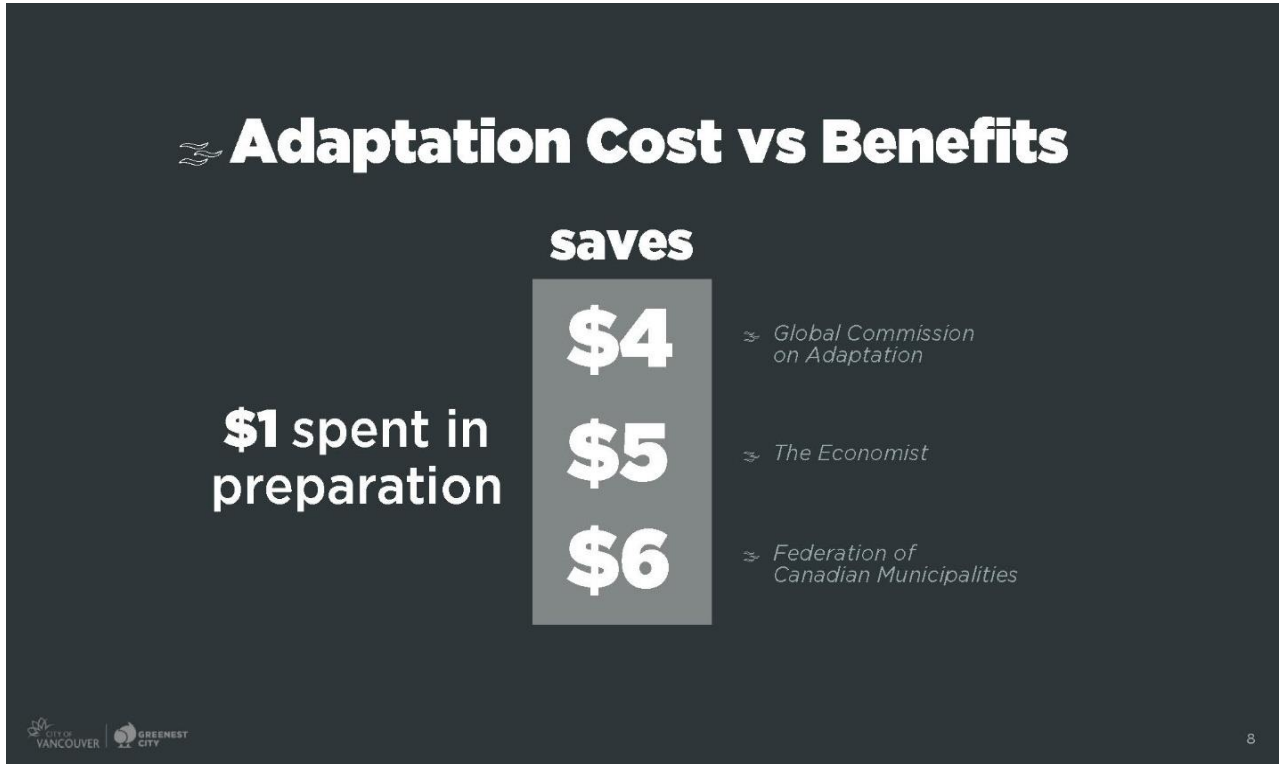
- emergency tree response plans in place to guide responses when needed

and

- emergency reserve funds to address post-emergency remediation

Credit: City of Mississauga 2012

Credit: City of Toronto 2006



Credit: City of Vancouver Climate Change Adaptation Strategy 2020 Update Presentation to Council

Key Practical Challenges Include …

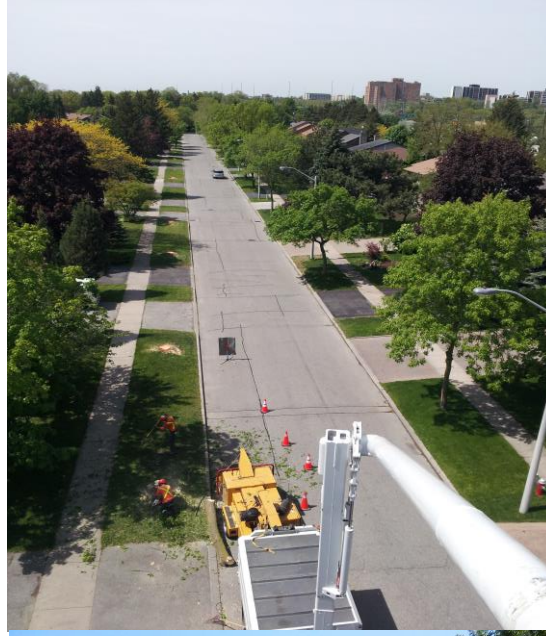
- Too many considerations … and accounting for climate change adds further complexity
- Nurseries don't track their stock or seed sources, and Federal and Provincial directives for sourcing don't exist yet
- The multi-year production process for trees makes planning difficult
- Lack of resources / support to be proactive, undertake trials, etc.

Credit: University of Guelph Arboretum Nursery, Sean Fox

Oxford County Bur Oak Seed Orchard – Assisted Migration Trial
Credit: Woodstock Sentinel Review

Key Practical Solutions Include …

- Leverage the asset management framework
- “Front-load” investment in the urban forest
- Preferentially work with nurseries that keep and provide seed and stock sourcing information
- Encourage / require good urban forest management
- Embed integrated approaches to planning and design
- Engage with agency and other partners
- Work with professionals with knowledge of species’ ranges, tolerances and sensitivities, as well as an understanding of how the climate is expected change over time
- Advocate for and provide sustained investment in strategic urban forest planning and management



Credits: City of Mississauga

Lunch & Learn for TRCA Staff

QUESTIONS?

GREAT LAKES COASTAL WETLANDS WEBINAR SERIES

1

April 4
1:00-3:30pm (EDT)

Climate Change in the Great Lakes Basin and Coastal Wetland Response Modelling

2

April 5
1:00-3:30pm (EDT)

Assessing Coastal Wetland Sensitivity, Adaptive Capacity, and Climate Change Vulnerability

3

April 6
1:00-3:30pm (EDT)

Reducing Non-Climatic Stressors, Enhancing Adaptive Capacity, and Protecting Littoral Cell Geodiversity and Barrier Landforms

4

April 7
1:00-3:30pm (EDT)

Coping with Lake Level Extremes, Managing Diked Wetlands, and Restoring Biodiversity

5

April 8
1:00-3:30pm (EDT)

Identifying Climate Refugia, and Advancing Wetland Conservation and Protection

Vulnerability Assessment Results

Solutions to Enhance Coastal Wetland Resilience

Upcoming ECS Lunch and Learns!

Wednesday, April 27
11:00am-12:00pm

Peel Ecosystem Climate Adaptation Best Practices Research

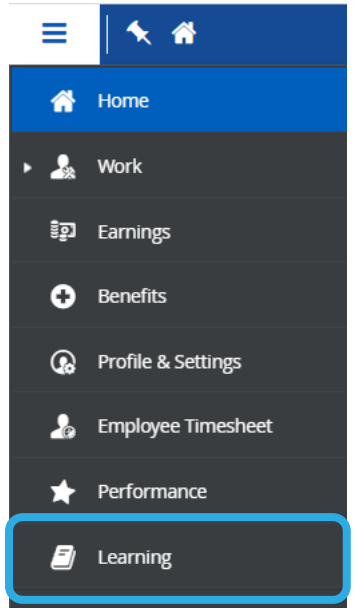
By Namrata Shrestha

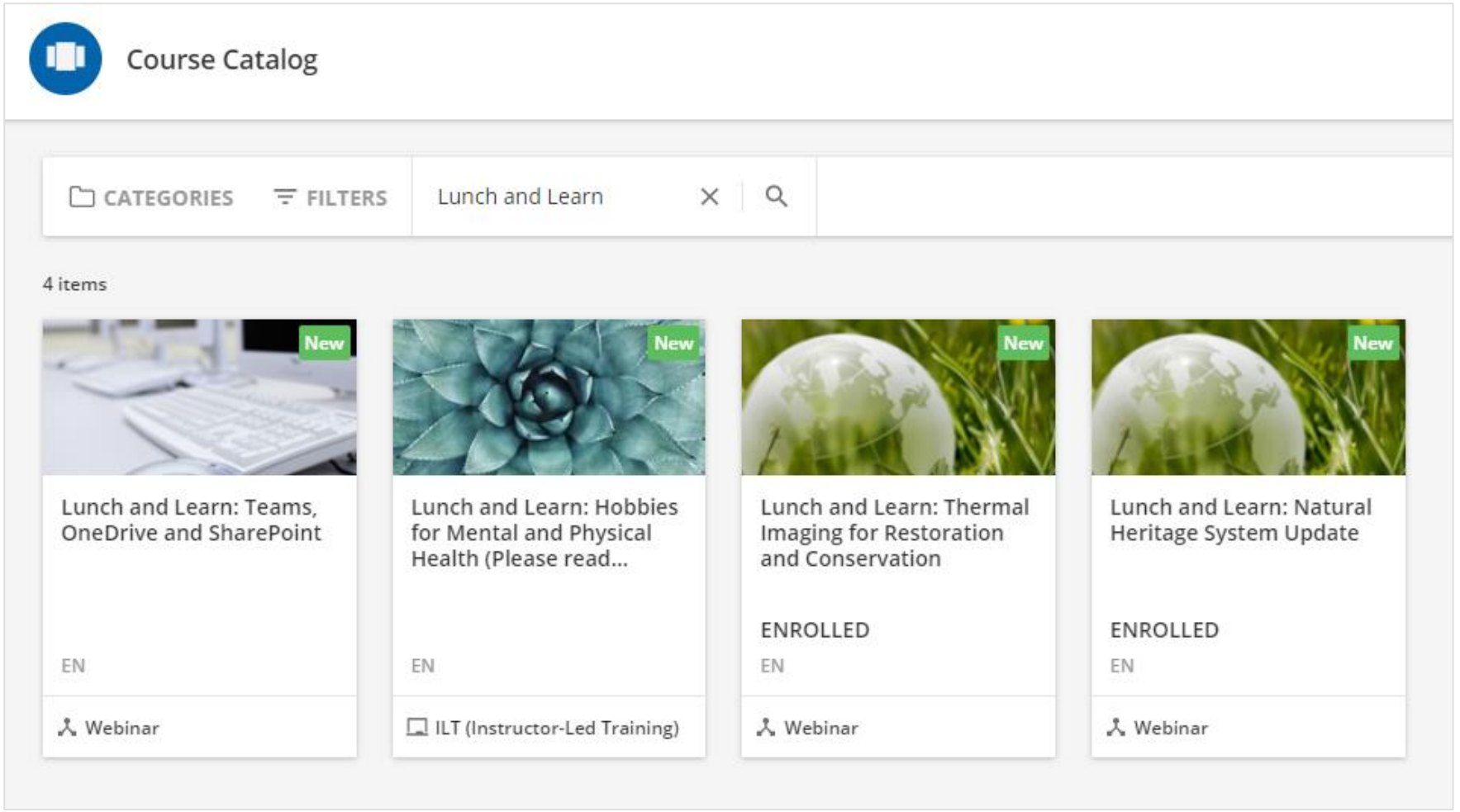
Wednesday, June 15
11:00am-12:00pm

Etobicoke Creek Water Quality Modelling

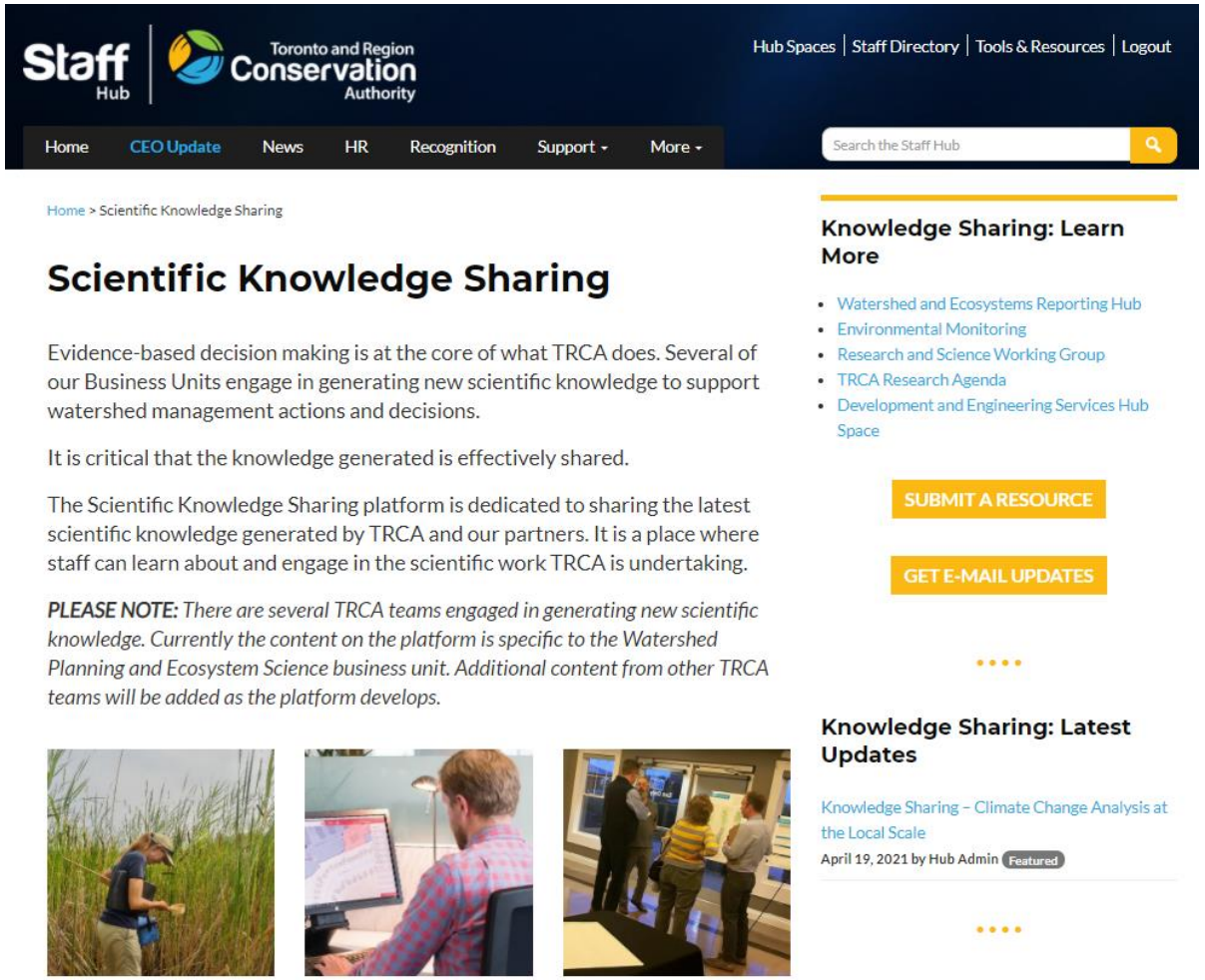
By Bhaswati Mazumder, Lyndsay Cartwright, and Krista Chomicki

Learning Management System





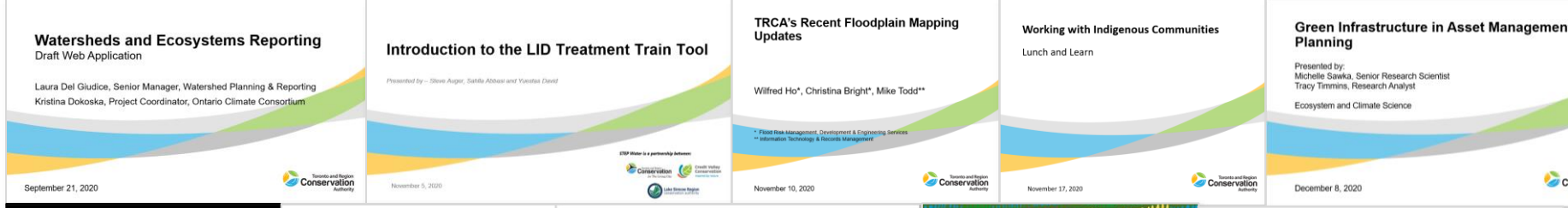
Scientific Knowledge Sharing Hub

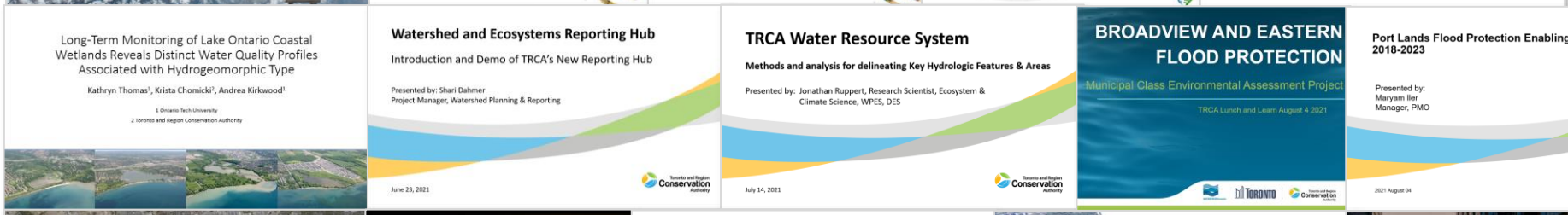


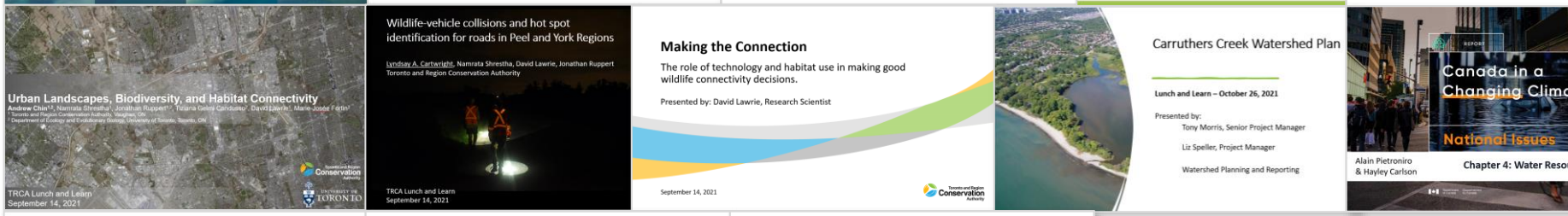
EXPLORE THE RESOURCE LIBRARY

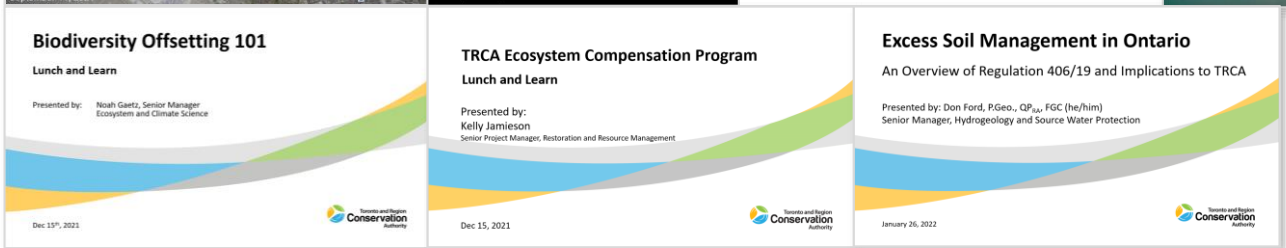
- Newsletters +
- Open Data & Information +
- Plans and Strategies +
- Presentations to Partners +
- Reports and Technical Papers +
- Scientific Papers +
- Technical Protocols & Best Practices +
- Videos +
- Webinars and Lunch & Learns +

Past Recordings









Thank you

For questions about the ECS Lunch and Learn Series, please contact:

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sharon.lam@trca.ca

Toronto and Region Conservation Authority