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

Executive Summary

Region of Peel — working with you

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Overview

Climate change has already begun – and is expected to continue – to reduce liveability and pose threats to human health and to the biophysical systems humans depend upon in Peel and elsewhere. This is especially true in urban areas where environmental stressors such as heat tend to be intensified. Trees have the unique ability to moderate some of these threats by cooling and filtering the air as they live and grow. However, while climate change has increased the need for more healthy and mature trees in urban spaces, it has also made it more difficult for trees to survive in these already harsh settings. Therefore, sustaining and enhancing street and park tree populations, and the urban forest as a whole, requires a sustained commitment to providing the best possible growing conditions for trees and embracing a tree-friendly culture not just among those caring for these trees, but throughout the community.

Taking a climate-sensitive approach to urban forest planning and management is not complicated. It means continuing to implement many of the same best practices already familiar to practitioners with more emphasis on diversification, integrated planning and collaborative design. The focus should be on providing space and "habitats" for the trees, even on a small scale, that allow them to do more than just survive.

This executive summary includes:

- An overview of anticipated tree-related climate impacts in Peel.
- An urban forest planning and adaptation framework for a climate change context.
- An overview of best practices and opportunities to maximize the resilience of the urban forest, with a special focus on municipal street and park trees.

Project Rationale

The Region of Peel and its municipal and agency partners have been working collaboratively through the Peel Urban Forest Working Group since 2007 to identify and implement strategies to protect and enhance Peel's urban forest, and to help local communities adapt to climate change. These partners, through the Peel Climate Change Partnership (PCCP), continue to advance urban forestry as one of their priority action areas because it contributes to both climate change mitigation and adaptation.

The PCCP specifically identified increasing the number of healthy trees in priority areas as one of its three strategies for addressing climate change challenges. The Peel Climate Change Master Plan (2020-2030) has a goal to "protect and increase green infrastructure throughout Peel" with tree planting and a management program for new and existing trees as key actions to achieve this objective. The Peel Region Urban Forest Best Practice Guides are intended to help support and achieve these objectives.

The Peel Region Urban Forest Best Practice Guides are primarily intended for Peel's urban areas.

- Guide 1: Best Practices Guide for Urban Forest Planning in Peel
- Guide 2: Urban Forest Management Best Practices Guide for Peel
- Guide 3: Guide for Tree and Shrub Standards and Specifications for Regional Roads in Peel
- Guide 4: Potential Tree Species for Peel in a Climate Change Context
- Guide 5: Working with Trees: Best Practices for a Resilient Future

Framework for Facilitating Urban Forest Planning and Adaptation

A climate change planning and adaptation framework was developed for Peel's urban forest *(Figure 1)* to help implement best management practices. The framework is intended to be flexible and responsive to new information and changing conditions. It can be applied at the jurisdiction-wide scale and at the site-specific scale.

The circular structure of this framework embeds the principle of adaptive management. The essence of adaptive management is to learn while doing, monitor progress and be prepared to adjust as required. To learn from successes and mistakes, managers must strategically and repeatedly document actions taken, track the results of these actions, assess the results in achieving the intended outcomes and, depending on the assessment, continue or revise the approach.

Figure 1 - **Urban forest planning and adaptation framework**

Five Principles for Enhancing the Urban Forest in a Changing Climate

1

Take Action Now
The planet is on a "worst case" scenario trajectory for climate change (IPCC 2018), therefore the need to take actions to protect and enhance the urban forest has never been more urgent.

2

Seek "Best Bets, No Regrets" Actions
Choosing actions for the urban forest that can contribute to climate change adaptation or mitigation but are unlikely to have negative impacts if they fail minimizes the risks associated with the uncertainty of climate change impacts.

3

Right Tree, Right Place
It is important to understand the range of conditions a given tree species is naturally adapted to, and work to match or provide as many of these conditions as possible when selecting establishment sites in cities.

4

Plan to Adapt
There is still a great amount of uncertainty related to how climate change will impact the urban forest and how the urban forest will respond, therefore being able to collect and to respond to new information will be key.

5

Be Proactive, Be Prepared
Municipalities must actively plan and prepare for more frequent extreme events and the impacts of climate change that may negatively impact the urban forest. Time and effort invested pro-actively will save both money and resources when there is a need to respond.
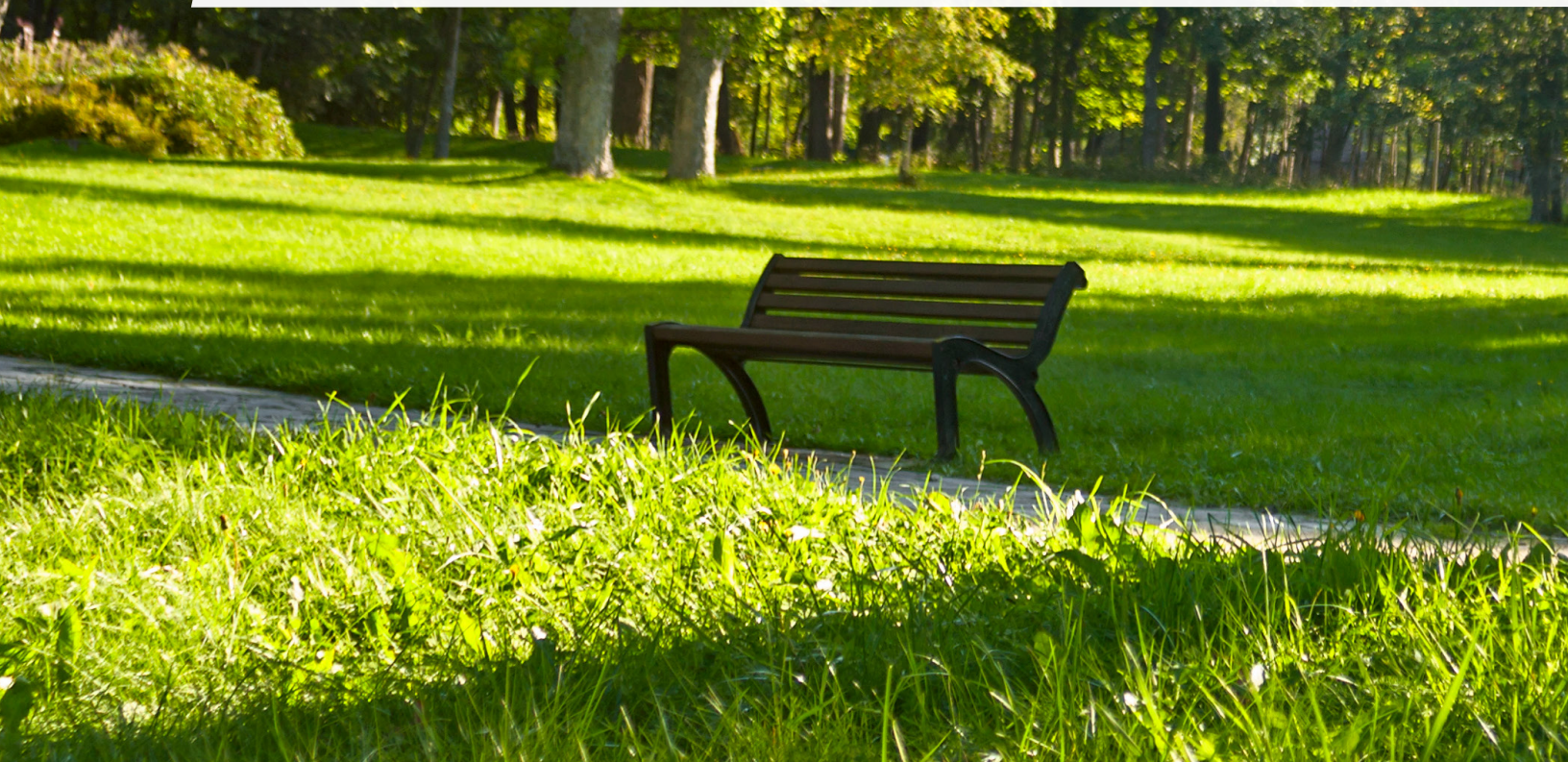
Assessment of Anticipated Climate Impacts and Vulnerabilities

Trees can help communities adapt to climate change by providing a range of services and benefits, but they are also vulnerable to environmental stressors, many of which are exacerbated by climate change. Global average temperatures could rise as much as 2 °C by the 2050's and as much as 5°C from current levels under the "worst case" scenario (also known as RCP8.5), which is the current trajectory. The projected climate in the 2050's under the RCP8.5 scenario, as shown in *Figure 2*, informed the work for this project.

Some of the potential impacts on trees and risks to the urban forest based on these projections and the current science include:

- limited tree growth and increased mortality

- uneven/failed flowering threatening seed production

- increased susceptibility to pests and diseases, and

- potential loss of certain species or genera.

The planning and adaptation framework and the recommended best management practices are intended to: (i) promote actions that both reduce and manage exposure to urban and climate change stressors, and (ii) increase the adaptive capacity of urban trees to respond to such stressors.
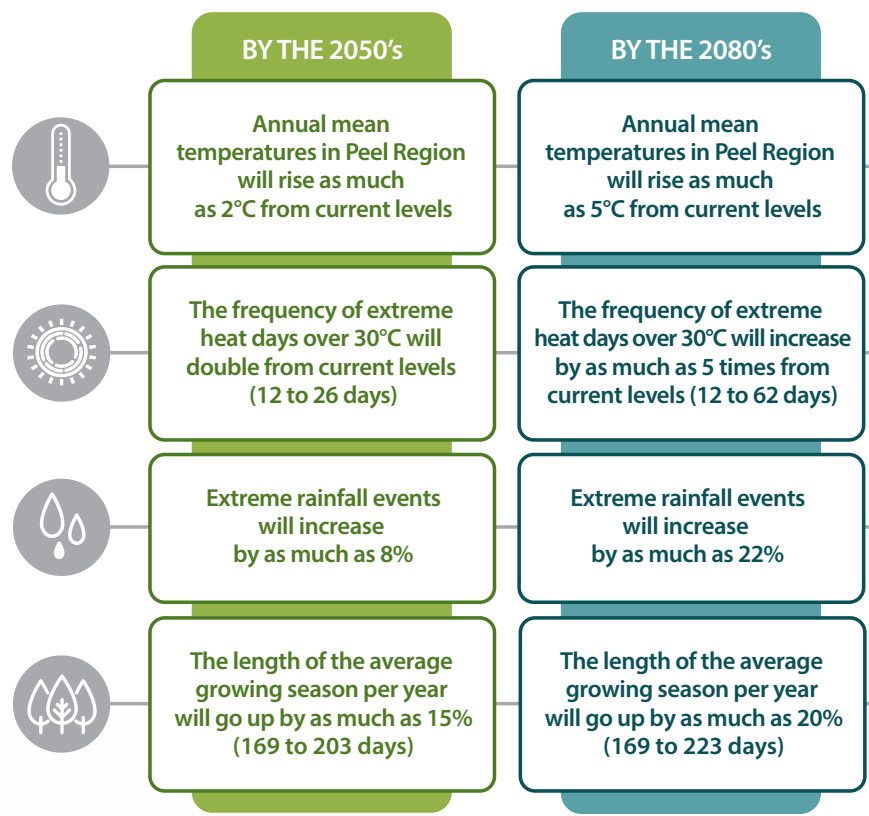
BY THE 2050's	BY THE 2080's
Annual mean temperatures in Peel Region will rise as much as 2°C from current levels	Annual mean temperatures in Peel Region will rise as much as 5°C from current levels
The frequency of extreme heat days over 30°C will double from current levels (12 to 26 days)	The frequency of extreme heat days over 30°C will increase by as much as 5 times from current levels (12 to 62 days)
Extreme rainfall events will increase by as much as 8%	Extreme rainfall events will increase by as much as 22%
The length of the average growing season per year will go up by as much as 15% (169 to 203 days)	The length of the average growing season per year will go up by as much as 20% (169 to 223 days)

Figure 2 - **Local Climate Change Impacts under RCP8.5 Scenario**
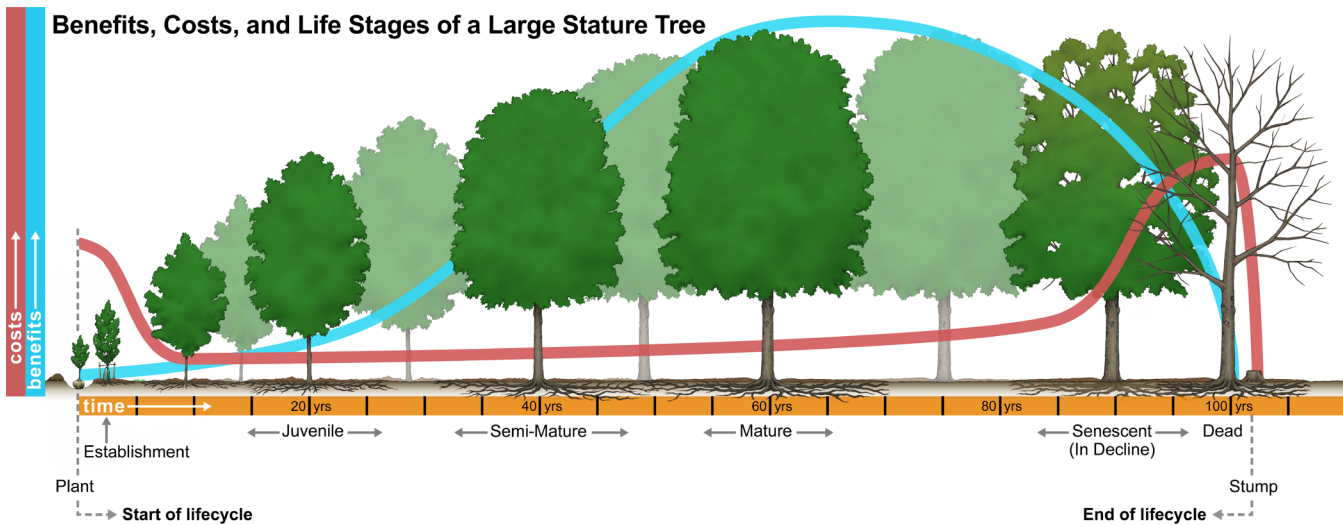
Urban Forest Best Practices and Opportunities

A fundamental best practice is having a good understanding of the state of the urban forest, particularly given the uncertainties in predicting urban forest responses to climate change. Trees are a diverse group of organisms with variable tolerances and sensitivities to environmental conditions and stressors. Therefore, having a good understanding of the trees themselves (e.g., species, size, condition) and the locations in which they are being planted or are already growing is key to supporting their successful establishment and maintaining their health.

A good understanding of the urban forest is rooted in a comprehensive inventory of municipal tree assets that is maintained and can be shared, complemented by a jurisdiction-wide urban forest monitoring program that leverages the power of remote sensing. This understanding can inform strategic decision-making for where and how best to invest in establishing additional trees and maintaining the existing trees *(Figure 3)*. It should also be supplemented by a willingness and ability to assess the site-specific context and conditions prior to investing in new plantings. (More detailed guidance is provided in Guide 2).

Figure 3 - **Illustration of typical benefits versus costs over a municipal tree's life cycle**
        (courtesy of E. Damstra, with permission)

Benefits, Costs, and Life Stages of a Large Stature Tree

time	20 yrs	40 yrs	60 yrs	80 yrs	100 yrs
	Juvenile	Semi-Mature	Mature	Senescent (In Decline)	Dead

Establishment

Plant

Start of lifecycle

Stump

End of lifecycle

costs / benefits

Key Urban Forest Best Practices in a Climate Change Context
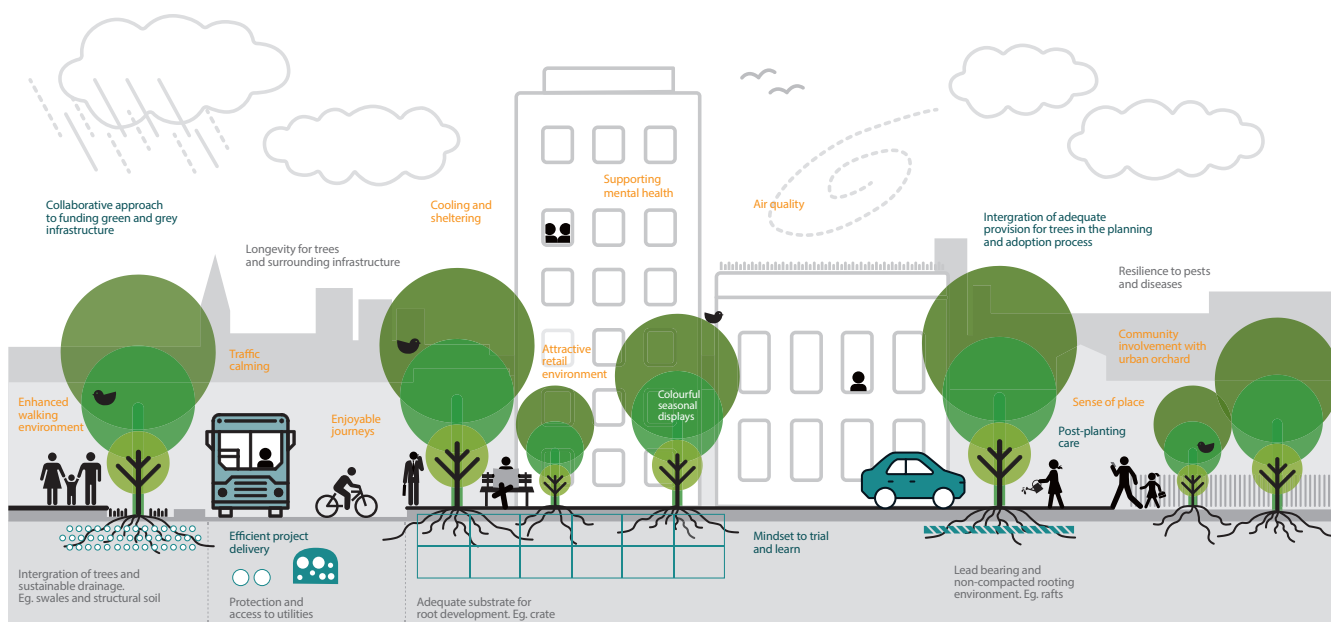
Figure 4 - **21st Century Opportunities and Challenges**

(adapted from "https://www.tdag.org.uk/tree-planning-and-development.html", Trees and Design Action Group)

The following ten best practices are key to building urban forest resilience in a changing climate and enhancing social and environmental outcomes:

1 | Value the urban forest as an asset

Incorporate the urban forest into municipal asset management frameworks to ensure trees under municipal ownership are recognized for the services they provide and as assets requiring targeted maintenance and monitoring to sustain those services.

2 | Invest strategically

Prioritize investments in actions that increase the resilience of the urban forest to current and anticipated stressors. This will maximize returns in a climate change context. For example, up-front investment in proper street and park tree species selection, establishment and good growing conditions can minimize large expenditures as trees mature *(Figure 3)*.

3 | Have a strategic plan

Develop a strategic Urban Forest Management Plan and integrate it with other jurisdiction-wide plans to protect, maintain, and establish trees in effective and locally appropriate ways. These plans can also help direct tree-related risk management and provide a framework for adaptive responses to new information and changing conditions.

4 **Enhance tree and urban forest diversity**

Incorporate structural, functional, and genetic diversity of all types and at all scales into the urban forest system to build resilience in the face of climate change. This should include the careful and gradual introduction of suitable species with ranges slightly south of the target planting area.

5 **Plan with equity in mind**

Improve the equitable distribution, availability, and quality of public greenspaces and tree cover across the jurisdiction. This may include targeting areas not immediately suitable for trees that require an initial investment and collaborative planning and design to create suitable space above and below-ground.

6 **Take an integrated approach to planning**

Align other municipal strategic plans with urban forest goals and embed urban forest objectives in all levels of planning to instill a common vision that includes trees as part of the solution to climate change challenges.

7 **Take an integrated approach to design**

Develop an integrated approach at the site-level to ensure implementation of street and park tree-friendly design through the cooperation, coordination, and expertise of multiple disciplines (e.g., urban foresters/arborists, planners, engineers, landscape architects, architects) *(Figure 4)*.

8 **Seek climate-positive outcomes**

Actively seek opportunities to moderate the urban heat island effect where it is felt by the most vulnerable people. Investing in planting trees able to reach maturity in built areas can provide significant cooling along with other services and benefits such as air quality improvements and wind breaks *(Figure 4)*.

9 **Foster a tree-friendly culture**

Develop partnerships with other public and private sector landowners to create opportunities for protecting and expanding tree cover on lands not under municipal ownership or management.

10 **Be proactive and be prepared**

Invest in proactive urban forest management to reduce the negative impacts of an urgent situation like an ice storm or a destructive pest. Have preparations in place, such as emergency plans and funds. Climate change adaptation research in Canada has shown that every dollar invested in being prepared can save between four and six dollars required in reactive emergency responses.

Call to Action

Climate change has introduced a much greater degree of uncertainty into weather patterns. These changes are expected to negatively impact both the people and the trees in our communities. This makes protecting and sustaining trees in the urban forest challenging, particularly in the most built-up areas. However, many of these challenges can be overcome with careful and collaborative planning and management undertaken at various scales with input from knowledgeable professionals. The ten urban forest best practices outlined should be used to inform municipal strategic directions.

Urban forests provide invaluable services and co-benefits that contribute directly to community health and well-being. Investing proactively in the urban forest to help make it more resilient to climate change is one of the most cost-effective actions municipalities and their partners can take to help communities adapt to climate change.

Sources of Climate Change Projections

- Masson-Delmotte, V., P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W, Auld, H., H. Switzman, N. Comer, S. Eng, S. Hazen and G. Milner. 2016. *Climate Trends and Future Projections in the Region of Peel*. Ontario Climate Consortium, Toronto, ON.

- Tu, C., G. Milner, D. Lawrie, N. Shrestha and S. Hazen. 2017. *Natural Systems Vulnerability to Climate Change in Peel Region. Technical Report*. Toronto, Ontario: Toronto and Region Conservation Authority and Ontario Climate Consortium Secretariat.

Acknowledgments