Communicating the **BENEFITS OF THE URBAN FOREST** in a municipal context
This toolkit was created to help urban forest managers communicate the benefits, or ecosystem services, provided by urban forests in Ontario to a municipal audience by using relevant and recent research. It presents several key messages, supporting references, and a list of useful resources that can be used to develop targeted communications campaigns.

When we effectively communicate the benefits of urban forests, we can help to generate funding for both the capital and operating costs of urban forestry. In turn, this can allow managers to leverage investment into better practices that will extend the lifespans of urban trees, thereby increasing the benefits they provide. A more complete understanding of the value of ecosystem services that flow from our forests can also inform discussions about the costs and expected outcomes associated with certain urban forest management practices.

While many municipalities in Ontario currently communicate the benefits that trees provide, the messaging has not necessarily translated into proactive management practices or desired outcomes. It is unclear if ecosystem service assessments alone are generating information relevant for decision-making. Communications that connect the services provided by trees to the specific needs of a given municipality may ensure that the value of urban trees is more fully accounted for in decision-making processes. Ultimately, such information can be used by municipalities to make the case for trees as essential infrastructure that should be incorporated into asset management processes.


COMMUNICATING THE NEED FOR TREE PROTECTION AND STEWARDSHIP

Often decision makers focus on tree planting initiatives as the way to achieve urban forest benefits. The value of long-term tree protection and stewardship should be at the forefront of all communications about the benefits that trees provide.
Successful urban forestry campaigns have recognized the importance of targeting messaging to specific audiences. The economic, human health and environmental benefits of urban forests will appeal to different audiences. Care should be taken to consider the target audience, and adapt the message accordingly. This toolkit contains information that can be included in communication campaigns designed to generate greater support for urban forest management.

For more information on the strategies of different urban forestry campaigns, see the Sustainable Urban Forests Coalition’s Scan of Urban Forestry Outreach Campaigns.
Scientists project that by 2050, the average annual temperature in Ontario will increase by approximately 3.6°C, with more significant warming expected in Northern Ontario. It is also expected that the frequency of extreme heat days over 30°C will double by 2050 (12 to 26 days). These changes in temperature are expected to have significant human health impacts. For example, between 1996 and 2010, a 5°C increase in daily temperature in Ontario was correlated with 4 excess deaths daily. Given future climate projections, there will be a greater need for municipalities to invest in strategies to increase resilience to extreme heat events.

A systemic review of recent studies found that trees are particularly crucial for reducing heat stress because of their ability to provide local/neighbourhood level cooling through evapotranspiration as well as shade. Heat-related morbidity in the City of Toronto was found to be related to both tree canopy cover and hard surface cover. This study demonstrated that even a marginal increase in canopy cover to 10% may reduce heat-related ambulance calls by up to 80%. Green spaces and treed areas in particular are one of the most promising heat stress mitigation measures in urban areas.

The heat mitigation and human comfort that trees can provide in an urban area, particularly in areas of high pedestrian use, will become even more important with climate change. Protecting and enhancing the urban forest is an investment in infrastructure that has the ability to provide known health benefits to citizens, particularly to the elderly and very young who are most vulnerable to extreme heat.

1 https://www.ontario.ca/page/why-we-need-fight-climate-change
THERMAL BENEFITS OF THE URBAN FOREST

• shades grey infrastructure
• cools surface water
• cools air and land surface

• reduces heat stress on infrastructure
• reduces thermal pollution of waterways
• reduces the amount of heat absorbed by urban surfaces

• extends lifespan of grey infrastructure
• increases thermal comfort for humans
• decreases heat related illnesses

• reduces energy demand for air conditioning
• reduces pressure on healthcare system

Key Resources:
Adapting to Urban Heat: A Tool Kit for Local Governments (2012) – Georgetown Climate Center
Ontario Climate Change and Health Toolkit (2016) – Ontario Ministry of Health and Long-Term Care
The urban forest provides the following stormwater benefits to municipalities:

- physically alters rainfall path and recharges groundwater
- retains rainfall in canopy at peak flow
- stabilizes soil
- reduces surface water contaminants

Climate change has caused an increase in rainfall events across Canada, with northwestern Ontario seeing a rainfall increase of up to 50% during the spring season. Summer rainfall in Ontario is expected to change significantly, and may range from 69 mm less to 48 mm more than baseline levels by the 2080s. Furthermore, we can expect to experience much warmer winter temperatures (up to 10°C increases in northern Ontario) and more frequent and intense precipitation events in Southern Ontario by 2050. These changes to the hydrological cycle will require proactive efforts by municipalities to protect water quality and prevent flooding in urban areas.

<table>
<thead>
<tr>
<th>City</th>
<th>Change in Annual Precipitation (2020-2049)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ottawa</td>
<td>-5% to 22.3%</td>
</tr>
<tr>
<td>Thunder Bay</td>
<td>-2.7% to 9.9%</td>
</tr>
<tr>
<td>Toronto</td>
<td>-0.4% to 13%</td>
</tr>
<tr>
<td>Windsor</td>
<td>-4.7% to 23.6%</td>
</tr>
</tbody>
</table>

Table 1: Projected changes in precipitation in for Ontario cities between 2020-2049 (Source: Ontario Climate Change Data Portal, 2016)

Key Resources:

- Stormwater trees technical memo (2016) – United States Environmental Protection Agency
- Give me the numbers: How trees and urban forests really affect stormwater runoff (2017) – United States Department of Agriculture and San Antonio River Authority
- Stormwater to street trees (2013) – United States Environmental Protection Agency
- Urban Stormwater Fees: How to pay for what we need (2016) – Environmental Commissioner of Ontario

Urban trees and the soil they grow in impact rainwater and stormwater in many ways. Trees slow the rate of flow and reduce volume of rainwater transferred into municipal stormwater systems by rainfall retention in tree canopies, stemflow, throughfall, infiltration/percolation and transpiration. Urban soils are often highly compacted, leading to increased runoff. Tree roots allow water to penetrate the surface of compacted soil and can lead to infiltration increases of 69-354% under tree canopies. Incorporating trees into urban landscapes can substantially reduce stormwater runoff by improving infiltration. In experimental plots in Manchester, United Kingdom, tree pits containing small trees reduced runoff from asphalt control plots by 62%, and this reduction was largely attributed to infiltration into the tree pit.

---

Larger trees provide greater stormwater benefits. Canopy size has also been linked to lag time between the capture of rainfall during storm events and the eventual throughfall to underlying surfaces\(^{12}\). Approximately 0.2 mm of rainfall can be held for every m\(^2\) increase in leaf area\(^{13}\).

Stormwater quality is also affected by the presence of trees. Nutrient pollutants such as Nitrogen and Phosphorous are taken up by urban trees, reducing the amount entering water systems. In one study, a treed area had stormwater concentrations (averaged over time) of Filterable Reactive Phosphorus (FRP) that were reduced by an average of 80% compared to unplanted control systems\(^{14}\).

Municipalities in Ontario are facing a $6.8 billion stormwater management infrastructure deficit. The investments required to replace aging infrastructure are expected to be compounded by the added pressures of urban intensification and climate change. As infrastructure is replaced or repaired, municipalities should take every opportunity to incorporate trees and other forms of green infrastructure as part of an integrated approach to storm water management. The urban forest plays a key role in the hydrological cycle of cities and should be maintained as a critical infrastructure component of the urban water management system.

**THE WATER CYCLE & TREES**

![The water cycle and trees. Adapted from US EPA's Stormwater to Street Trees, 2013](image)

---


**MINIMUM SOIL VOLUMES: DUAL BENEFIT FOR STORMWATER MANAGEMENT**

It is well established that larger trees provide greater stormwater benefits. It is also known that to reach their full potential, trees require adequate soil volume and quality. A larger volume of quality soil is itself a tool for managing stormwater, making a strong case for municipalities to implement a minimum soil volume and soil protection policy.
The strengths of urban forests as green infrastructure are not fully realized by considering their ability to address individual municipal infrastructure needs. It is just as important to highlight the co-benefits they provide to society at no additional cost. Depending on the audience, communicating a range of benefits of the urban forest may be useful. Listed here are a few of the many additional ecosystem services that urban forests provide.

**CARBON STORAGE AND SEQUESTRATION**
Urban forests in Canada removed approximately 662.8 kt C in 2012\(^\text{15}\) and the cooling effect of trees may indirectly impact GHG emissions by reducing the demand for air conditioning during heat events\(^\text{16}\).

**AIR QUALITY**
Every year, Toronto’s urban forest intercepts 1,905 metric tonnes of air pollutants (valued at $16.9 million annually)\(^\text{17}\).

**SHADE**
Shade from trees can help reduce the amount of UV-B reaching pedestrians and can be part of a municipal sun safety strategy\(^\text{18}\).

---

\(^{17}\) City of Toronto (2015) Tree Benefits (Sequestration) Information Staff Report to Parks and Environment Committee  
Beyond physical health, urban forests provide many known benefits to human psyche and wellbeing. Even simple visual contact with plants and nature can improve human quality of life. Time spent in greenspace has been shown to improve mental and physical wellbeing across a number of dimensions, from stress reduction to increased physical activity. Behavioral and therapeutic effects have been observed when exposing people with Attention Deficit Hyperactivity Disorder (ADHD), depression and dementia to nature. Increased feelings of happiness and lower diastolic blood pressure has been demonstrated among pedestrians walking through nature when compared to those walking along a city street.

The study of our physiological response to green spaces and trees suggests that humans have evolved to have positive feelings toward the natural world. This theory, deemed *biophilia* by Edward O Wilson (1984), suggests that human evolution drives our desire to be around nature. With the known health and safety benefits of trees, there is strong support for this argument. Whatever the cause, the physiological and psychological responses of humans in nature is one of the greatest arguments for urban forest enhancement. A thriving urban forest makes for a more livable, enjoyable city.

Urban forests can also play a role in improving social health, i.e. the social connections within a community. As an example, the strength of social connections between neighbours has been linked to tree canopy cover, and the presence of trees can predict the amount of time that inner-city residents spend outside. The community building benefits that urban forests provide can make management of the urban forest easier, as a community’s attachment to place can lead to more environmentally responsible behavior.

Key Resources:
- *A healthy dose of green – Trees Ontario (now Forests Ontario)*
- *Examination of The Biophilia Hypothesis and its implications for Mental Health – Douglas Radmore, International Community for Ecopsychology*
- *The human health and social benefits of urban forests – Dovetail Partners Inc*

---

14 Clark, P., et al., 2013, Natural England Commissioned Reports, Number 137
15 Kuo, F., et al., 2004, American Journal of Public Health, 94(9), 1580 – 1586
Other Toolkits and Resources

**ICLEI - Local Governments for Sustainability’s TALKING TREES An Urban Forestry Toolkit for Local Governments**
This document is a set of fact sheets on the benefits of the urban forest. Facts with citations for various end goals including air and water quality improvement. Key points for successful policy creation and management are included.

**US Forest Service’s Urban and Community Forestry Appreciation Tool Kit**
This is another toolkit of communications surrounding the benefits of trees. The statistics sheets are good summaries of benefits and include citations. Much of the language used could be used for public education as well.

**The Social and Economic Value of Canada’s Urban Forest – A National Synthesis**
This publication from the Canadian Forest Service and the University of British Columbia provides a high level overview of the social and economic values and benefits of urban forests in Canada.

**Urban Green Infrastructure and Ecosystem Services**
This recent brief (pdf link at bottom of page) released by the Parliamentary Office of Science and Technology in the UK discusses key ecosystem services in urban ecosystems and how to plan for green infrastructure.

**Georgetown Law Toolkit for Green Infrastructure**
This toolkit covers all green infrastructure but has a lot of urban forestry specific references. The toolkit is full of resources including a section on how to communicate green infrastructure strategies.

**Using Plants to Provide Ecosystem Services**
This how-to guide by Sustainable Plant Research and Outreach includes a lot of information about the ecosystem services that vegetation can provide and is a good source of support for both tree and non-tree components of the urban forest.

**The Ontario Network on Ecosystem Services Guidance**
This website is an inventory of guidance materials relevant to ecosystem services in Ontario.

**The Sustainable Urban Forest**
The section of this report on understanding urban forest benefits lists the many benefits of the urban forest and links to studies done on urban trees as Green Stormwater Infrastructure. It also provides a list of best management practices.

**Urban Forestry/Urban Greening Research**
This website has extensive information on ecosystem services that urban green spaces provide that can be used in funding proposals and reports relating to the many benefits of the urban forest.

**Benefits of Trees and Urban Forests**
A list of research on the benefits of the urban forest, with some summary statistics.

**The value of Green Infrastructure**
General benefits and economic estimates of tree planting on water, energy, air quality, climate change, the urban heat island and livability. Project examples included at the end of the document.

**Why nature matters to health**
An evidence review published by the City of Toronto. Discusses all green spaces, with some urban forest specific references.

**Australia’s 202020 Plan for 20% more green space by 2020**
A fantastic compilation of communication resources for managers of the urban forest as well as the general public.
WASHINGTON DC
Washington DC provides credits toward stormwater fees for trees planted on private lands and trees preserved qualify for even higher credits. Both trees planted and preserved require a minimum soil volume of 1,500 cubic feet of rootable soil to be eligible for the credit.

PHILADELPHIA
The City introduced stormwater charges based on parcel size and amount of impervious surface. Part of the income from these charges pays for park staff who manage and educate on green infrastructure and urban forestry. By partnering with another department, the urban forestry department was able to make in-roads on private lands (through programs aimed at reducing impervious surface) and secure additional funding for staff.

BALTIMORE
The Baltimore Ecosystem Study is part of the The Long Term Ecological Research (LTER) Network that was created by the National Science Foundation (NSF) and is set up to obtain insight into the form and function of cities as ecosystems to better understand ecological services in cities.
Ontario groups working on Ecosystem services

ECOHEALTH ONTARIO
EcoHealth Ontario builds collaborations among the human health, social and environmental sectors with a common agenda to foster improved health and well being outcomes for Ontarians through the provision of better ecosystem quality, increased green space and enhanced access to nature.

SUSTAINABLE TECHNOLOGIES EVALUATION PROGRAM (STEP)
STEP is a multi-agency initiative developed to support broader implementation of sustainable technologies and practices within a Canadian context.

RAIN COMMUNITY SOLUTIONS
Rain Community Solutions work with municipalities, environmental groups, and property owners to reduce runoff and protect water quality by managing rain where it falls.
Let's make green infrastructure the new normal.

greeninfrastructureontario.org

This project was funded in part through Growing Forward 2 (GF2), a federal-provincial-territorial initiative. The Agricultural Adaptation Council assists in the delivery of GF2 in Ontario.