

URBAN FORESTS IN A CHANGING CLIMATE

Dr. Tenley Conway, Professor of Environmental Geography, University of Toronto Mississauga
and Jacqueline L. Scott, PhD student at the University of Toronto

Summer in Southern Ontario can bring long and dry heat waves that have many people looking for relief. One form of respite comes from the shade of trees in backyards, parks, and natural spaces in and around communities. **These trees in and around cities and communities including forests in nearby rural (or *peri-urban*) areas like those in the Greenbelt are collectively referred to as the urban forest.**

The Greater Golden Horseshoe region once had nearly continuous forest cover, representing a mixed forest that includes species of maple, ash, oak, and hemlock. After centuries of settlers clearing for agriculture and urban development, much of this forest cover was lost. Yet, some natural forest patches remain, new ones have regenerated, and many individual trees have been planted in urban and suburban communities. Today, the Greater Toronto Area has an estimated 34.2 million trees representing over 100 species in its urban forest, resulting in approximately 26% tree canopy cover across the region.



Trees have a key role in climate change mitigation and adaptation

Urban trees play an important role helping communities mitigate and adapt to a changing climate. Urban forests store carbon and reduce the amount of carbon dioxide in the atmosphere. A recent report by the City of Toronto estimated that Toronto's urban forest stores over 1.1 million metric tonnes of carbon.

Urban forests have an even larger role to play in climate change adaptation. In the Greater Golden Horseshoe, ongoing climate change is expected to cause more frequent summer heat waves and droughts, as well as more intense storms. Urban and suburban areas are already typically several degrees warmer than nearby rural areas, due to the urban heat island effect. Any additional temperature increases will worsen hot summer conditions.



Planting trees can help regulate temperature in direct and indirect ways. Large shade trees planted on the south and west sides of buildings can directly reduce temperatures, keeping buildings cooler and reducing the need for air conditioning. A recent study in Toronto found that shade from trees could make building surfaces as much as 12°C cooler. In the winter, evergreen trees planted on the north side of buildings can block cold winds, reducing heating costs and associated emissions. In 2008, it was estimated that York Region's tree canopy cover reduces energy costs by approximately \$8 million per year as compared to a scenario with no trees. In addition to shading, trees indirectly cool the air through evaporation of moisture from their leaves and branches. This is why it immediately feels cooler walking into a forest during the summer. Recent research by the Greenbelt Foundation found adding urban trees could make it feel up to 11°C cooler during a heat wave in suburban neighbourhoods in Peel Region. Research also suggests that clusters of trees have greater cooling benefits due to evapotranspiration effects than the same number of trees planted in a more disperse pattern. Protecting pocket forests, or small clusters of trees, and larger forest patches across the region safeguards these positive impacts.

Rainstorms are predicted to become more intense due to climate change. Trees can decrease flooding as their leaves and branches intercept water, reducing the amount of run-off when it rains. Trees also pull water from the soil, increasing the potential for soil to absorb more precipitation. As a result, many cities are planting trees as part of storm water management efforts!

Importantly, urban forests can help protect local biodiversity in a changing climate. For example, flowering trees provide bees with an early spring source of food before many perennial plants begin flowering. In the Greater Golden Horseshoe, red maples, Ohio buckeye, and red bud are examples of native trees that support native bees and other pollinators. Regular interactions with trees and woodlands also positively impacts human health and well-being, including mental health.

Development Threats

Urban forests are also facing several threats. One significant on-going threat in the Greater Golden Horseshoe is urban development and redevelopment. Existing trees are frequently cut down during construction of new development. While new trees may be planted, it will take several decades for them to produce the cooling and stormwater management benefits of existing mature trees. On already developed property, renovations and more significant property redevelopment is often associated with removal of trees, as property owners increase building footprints and other hard surfaces.

Climate Change Threats

Hot, dry summers

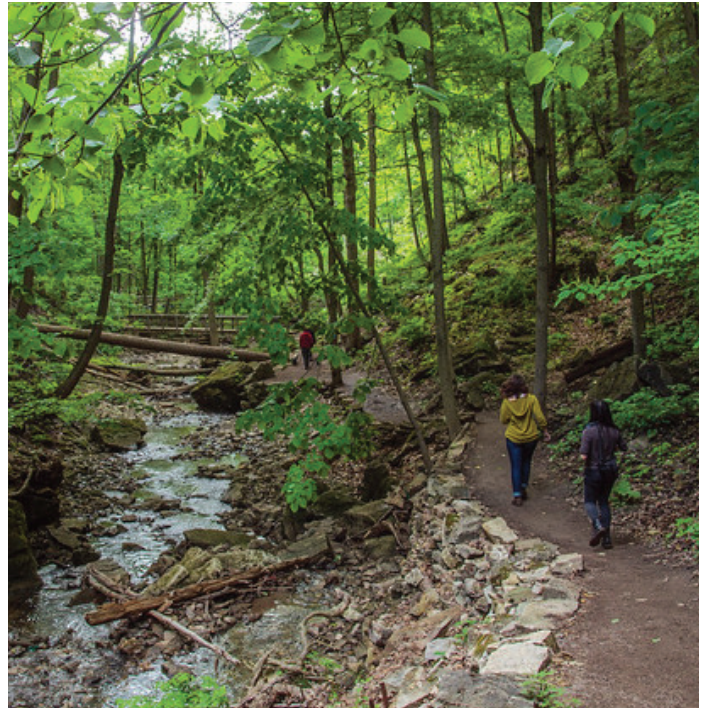
A second major threat to the urban forests is climate change itself. While trees can create more hospitable environments during heat waves, many trees will struggle to survive hotter summer temperatures, particularly when combined with drought conditions. A recent study found that the majority of common species planted in our urban forest will not be able to survive future climate conditions due to heat and water stress. While the changing climate will hurt many native species, some of the commonly relied upon non-native species, including Norway maple, are also vulnerable to projected climate conditions.

Intense storms

Urban forests are vulnerable to intense wind and ice storms. Both are projected to become more common in the Greater Golden Horseshoe due to on-going climate change. While summer drought will likely be the norm, it is also expected that infrequent but intense summer storms will occur. These storms have the potential to bring heavy wind that can damage branches and topple entire trees. During winter, some regional climate projections suggest more frequent ice storms. The weight of ice build-up can break branches and make trees weaker, thus more vulnerable in future storms.

Novel pests and diseases

Human mobility will likely enable outbreaks of novel pests and diseases that can impact the urban forests. Threats from pests and disease are not new. In the last decade, emerald ash borer has decimated ash trees across the Greater Golden Horseshoe, and much of eastern and central North America. Before that Dutch Elm Disease similarly devastated populations of native elm trees. While we cannot know for certain which pests and diseases will arrive in the Greater Golden Horseshoe, a warmer climate will allow new pests and diseases to thrive in the region.



Growing Resilient Urban Forests

One of the best strategies for protecting urban forests is to ensure a diversity of tree species are present in our urban forests. Many pests and diseases are species-specific, so incorporating a diversity of species will reduce the overall impact a novel pest or disease has on the forest as a whole. This is a lesson that many municipalities have learned from the over reliance on ash trees that resulted in substantial loss of forest cover due to the emerald ash borer.

Different species also have varied responses to long-term shifts in climate and storm impacts. Selecting a diversity of species that can withstand water stress and hot summer temperatures is important. Many municipalities in the Greater Golden Horseshoe have formally recognized the need to diversify the urban forest through their long-term management plans, taking steps to make sure no one species represents more than 5% of all trees. In addition to species diversity, there are a diversity of spaces where protecting existing trees and planting new ones will support resilient urban forests. Across the Greater Golden Horseshoe residential yards include a substantial number of existing trees and opportunities to plant additional ones. For example, in Mississauga, a city that was just recognized as a Tree City by the UN, 43% of current tree canopy cover is located on residential property and city-wide canopy cover could increase by 12 to 19% if all available spaces on residential land were planted with trees. School yards are another space that often lacks trees, and where there are clear benefits of providing shading. Finally, planting and protecting trees in areas around urban areas has the potential to contribute to mitigation efforts by storing carbon.



TREES, RACE AND BLACK HISTORY

Jacqueline L. Scott is a PhD student, at the University of Toronto. Here she explores the intersection of trees, race and Black history, part of her larger research project on how to make outdoor recreation and environmental discourse more welcoming for Black people.

Planting trees is one of the easiest ways to improve the environment in the city and to reduce the negative impact of the climate crisis. However, race shapes where trees are planted, who benefits from the trees and who takes part in tree planting.

Urban trees bring many benefits. They are pretty to look at, provide shade, lower asthma rates, reduce summer temperatures and improve air quality. Yet, the benefits are not equally distributed. Research shows that poor and racialized communities have less access to greenspace in the city, including public parks and tree canopy cover. Thus, they receive fewer benefits from them. The absence of trees is another layer of inequality in lives shaped by oppression.

In the city, tree planting can be done by the municipal government, non-profit agencies or private citizens. Race is a factor here too. Municipal tree planting is more likely to occur in rich White areas, and less likely to happen in poor Black neighbourhoods, even though it is these areas which have the greatest need for tree cover. Tree planting by non-profit groups is also less likely to occur in poor Black neighbourhoods. And home-owners, who are more likely to be White, tend to plant more trees on their property compared to renters, who are more likely to be Black or racialized. As trees improve property values, fewer trees lower the economic base and desirability of racialized neighbourhoods.

Urban trees can have a long life span, depending on if they are planted in containers, gardens, parks or ravines. One of the oldest trees in Toronto is a red oak in North York, aged 250-350 years. It is older than the city and the modern country. City trees can also function as historical markers. For example, the graceful horse-chestnut trees in Toronto were planted in the 1860s for a royal visit. They appear to be natural, but these are non-native trees from Europe, and as such reflect the ongoing settler-colonial project on Turtle Island.

Furthermore, current tree planting, whether in a front garden or on a mass scale to restore a ravine, may also reinforce settler-colonial notions of being rooted in the land. This is of course divergent with Indigenous demands for sovereignty. In other words, planting trees feels good, it is doing something when the climate crisis feels overwhelming, and, at the same time it is critical to acknowledge that the tree planting is on contested land.

Tree planting groups are mainly White, as shown by the absence of Black faces in their media communication and on their staff. This creates a visual apartheid, reinforcing the message that environmentalism, including tree planting, is a White space and activity, where Black people are seen as out of place.

There are some practical strategies, which can be used to make tree planting more welcoming for Black people. The first is acknowledging that race is an issue, as indicated by the absence of Black faces and the dominance of White ones. Second, groups need to build relationships with the Black community in areas selected for tree planting. Trusted relationships, and targeted outreach, are more likely to encourage Black people to participate.

Third, tree planting groups can increase Black community engagement by hiring Black staff to lead the project. People are more likely to support, and believe that an activity will benefit them, if they see others like themselves as the leaders.

Fourth, appealing to Black history can also increase community engagement. For example, tree planting in Cedarvale Ravine, in the Eglinton West area of Toronto, can draw on the fact that the area was a Black community hub in the 1980s. They can point out the heritage plaques and murals to Black history in the neighbourhood. Furthermore, they could also refer to Russell Hill Road, named after Peter Russell, a top government official and slave-owner in Toronto. He owned Peggy Pompadour and her children Jupiter, Amy and Milly. In 1806, he advertised for the sale of Peggy and Jupiter. The existence of the enslaved Pompadour family disrupt the common assumption that slavery did not exist in Canada. There was also Mrs. Pipkin, a servant in Spadina House in the 1870s. She escaped slavery from the USA via the Underground Railroad.

These stories illustrate the long and complex Black history in Canada. Talking about them creates a bridge that links social justice and caring for the environment. It is by knowing and appealing to this history that tree planting groups can increase Black people's interest in mitigating the climate crisis by planting trees.

WHAT YOU CAN DO



1. Protect existing trees

Everyone can advocate for local by-laws and provincial policy to protect individual urban trees and woodlands that are already providing many climate and other benefits. Learn about tree by-laws that exist in your municipality and contact your local councillor about the importance of effective tree protection by-laws. You can also support organizations like Green Infrastructure Ontario who advocate for provincial policies that protect and support urban forests.

Homeowners can protect existing trees on their property to ensure they can continue to thrive and provide climate-related benefits. If you are building or renovating a home, take steps to protect trees and their roots zones from damage due to heavy equipment. You can also organize a tree inventory in your neighbourhood, using resources like the Neighbourwoods program, to have a better understanding of the current location and health of trees.

Rural landowners can work with their local Conservation Authority to develop a forest management plan to ensure the long-term protection of trees on their property. With a management plan, many landowners may then be able to qualify for property tax savings through the Managed Forest Tax Incentive Program.



2. Plant new trees

Everyone can participate in tree planting initiatives that occur in many parks and on other public lands, often organized by local park groups, conservation authorities and NGOs focused on tree planting.

Homeowners can plant large shade trees on the south or west side of their home to maximize shading effects and reduce summer air conditioning costs. Contact your local councillor to encourage your municipality to provide a subsidize yard tree planting program to support all residential property-owners planting trees.

Rural landowners can plant a diversity of trees on their property to help restore regional forests. Many conservation authorities will provide expert advice and access to appropriate trees species that can thrive in a changing climate.



3. Water trees during droughts

Watering young trees is one of the best ways to ensure their growth. During hot dry periods it is important to water all trees to minimize drought-related stresses.

Everyone can participate in neighbourhood or local park group efforts to water trees. If your local park does not have a volunteer group engaged in tree stewardship, consider starting one.

Homeowners can monitor weather conditions and check whether the soil in your trees' root area is dry. For the first three years after planting, trees should be given 6 gallons of water, or 15 minutes with a hose on trickle, twice a week.





Additional Resources

Credit Valley Conservation Tree Planting and Restoration Services:
<https://cvc.ca/your-land-water/tree-planting-and-habitat-restoration-services>

Toronto and Region Conservation Authority Private Land and Tree Planting Program: <https://trca.ca/get-involved/private-land-grants/tree-planting-forestry/#planting>

LEAF backyard tree planting programs in Toronto, York and Durham Regions and volunteer opportunities: <https://www.yourleaf.org>

Parks People, to learn more about park stewardship groups in your area: <https://parkpeople.ca>

Green Infrastructure Ontario Coalition, to learn about urban forests in the region and related provincial policies: <https://greeninfrastructureontario.org>

Neighbourwoods, for the tools to conduct a neighbourhood tree inventory: <http://neighbourwoods.org>

KINxFOLK a local outdoor camp for Black youth to explore themselves and their community in nature to promote positive mental health <https://www.kinxfolk.com>

References

BeTop Lab at Ryerson University. 2020. *Cooling Corridors: The Role of Green Infrastructure in Building Resilience to Extreme Heat*. Working Paper Series Greenbelt Foundation. https://www.greenbelt.ca/cooling_corridors.

City of Toronto. 2013. *Every Tree Counts: A Portrait of Toronto's Urban Forest*. <https://www.toronto.ca/wp-content/uploads/2017/12/92de-every-tree-counts-portrait-of-torontos-urban-forest.pdf>.

Khan, T. and T.M. Conway. 2020. Vulnerability of common urban forest species to projected climate change and practitioners' perceptions and responses. *Environmental Management* 65(4): 534-547.

Green Infrastructure Ontario Coalition. 2016. *State of the Urban Forest in the Greater Toronto Area*. https://greeninfrastructureontario.org/app/uploads/2016/02/2876-GTA-UrbanForest_REPORT-May27_web.pdf.

Millward, A.A., M. Torchia, A.E. Laursen, L.D. Rothman. 2014. Vegetation placement for summer built surface temperature moderation in an urban microclimate. *Environmental Management* 53(6): 1043-57.

Plan-It Geo LLC. 2014. *An Assessment of Urban Forest Canopy Mississauga, Ontario*.

York Region. 2017. *State of the Forests*. https://www.york.ca/wps/wcm/connect/yorkpublic/30ee2214-00ae-4c44-a5ad-c8f7066fe8fd/State_of_the_Forest_Report+2017.PDF?MOD=AJPERES&CVID=mu8YN73.

ABOUT THIS SERIES:

The Greenbelt Foundation partnered with experts to understand how climate change is affecting our daily lives, and ways that we can individually and collectively respond to these challenges. For other installments in the series, visit www.greenbelt.ca/changing_climate



Possibility grows here.



Geography, Geomatics and Environment
UNIVERSITY OF TORONTO
MISSISSAUGA