STATE OF THE URBAN FOREST IN THE GREATER TORONTO AREA

INTRODUCTION

In established parts of the Greater Toronto Area (GTA), the urban forest lines many of our streets and creates a tapestry of colour and texture in our parklands and natural spaces. It also grows in our backyards and on school grounds. This greenery produces the clean air we breathe and provides refuge against the heat of summer in the concrete jungle.

From the soil through to each tree and shrub – including every species, size or setting – the urban forest benefits our communities.

Our urban forest is a vital asset. But unlike the highways commuters travel on to and from work every day, or the massive bridges that span our rivers and ravines, they are not managed as integral infrastructure in a city. While much emphasis is placed on improving roads, transportation and public utilities, little, if any attention is paid to sustaining or improving urban forests, even though they are an essential part of our living green infrastructure network.

Our urban forest is an important solution for mitigating and adapting to the ever-worsening problem of climate change. A healthy urban forest acts as a critical part of a city's defense system against the impacts of climate change by:

- cooling communities in extreme heat;
- preventing flooding;
- reducing the 'heat island' phenomenon.

When municipal, provincial and federal leaders acknowledge the importance of trees by supporting initiatives to expand and enhance the urban forest, we all benefit. And we all can play a part. Growing the urban forest requires having the vision to see trees as an essential part of city infrastructure.

Breathing new life into the health and strength of our trees and soils will take a multi-pronged approach, which includes, but is by no means limited to:

- pursuing urban planning and design policies that incorporate the urban forest into new and retrofit development plans
- involving community members in the stewardship of the urban forest
- engaging in research partnerships that more clearly identify links between urban forest health and public health

It is time to treat our trees as important assets. Our urban forest is valuable infrastructure that we can't afford to lose.

HOW DECISION MAKERS CAN SUPPORT THE URBAN FOREST:

- Champion policies and practices that help more trees grow to maturity in more locations.
- Sustain investment and support proactive management.
- Develop community engagement programs that empower more residents.
- Encourage applied research and monitoring that provides information needed to respond to new and existing threats.

INTENT OF THE REPORT

This report is meant for decision makers at all levels of government. Policy leaders can use this report to build more detailed and community-specific policies and programs. It provides an overview of the state of the GTA s urban forest, highlights some of the key benefits it provides, and outlines the challenges and opportunities associated with growing our urban forests.

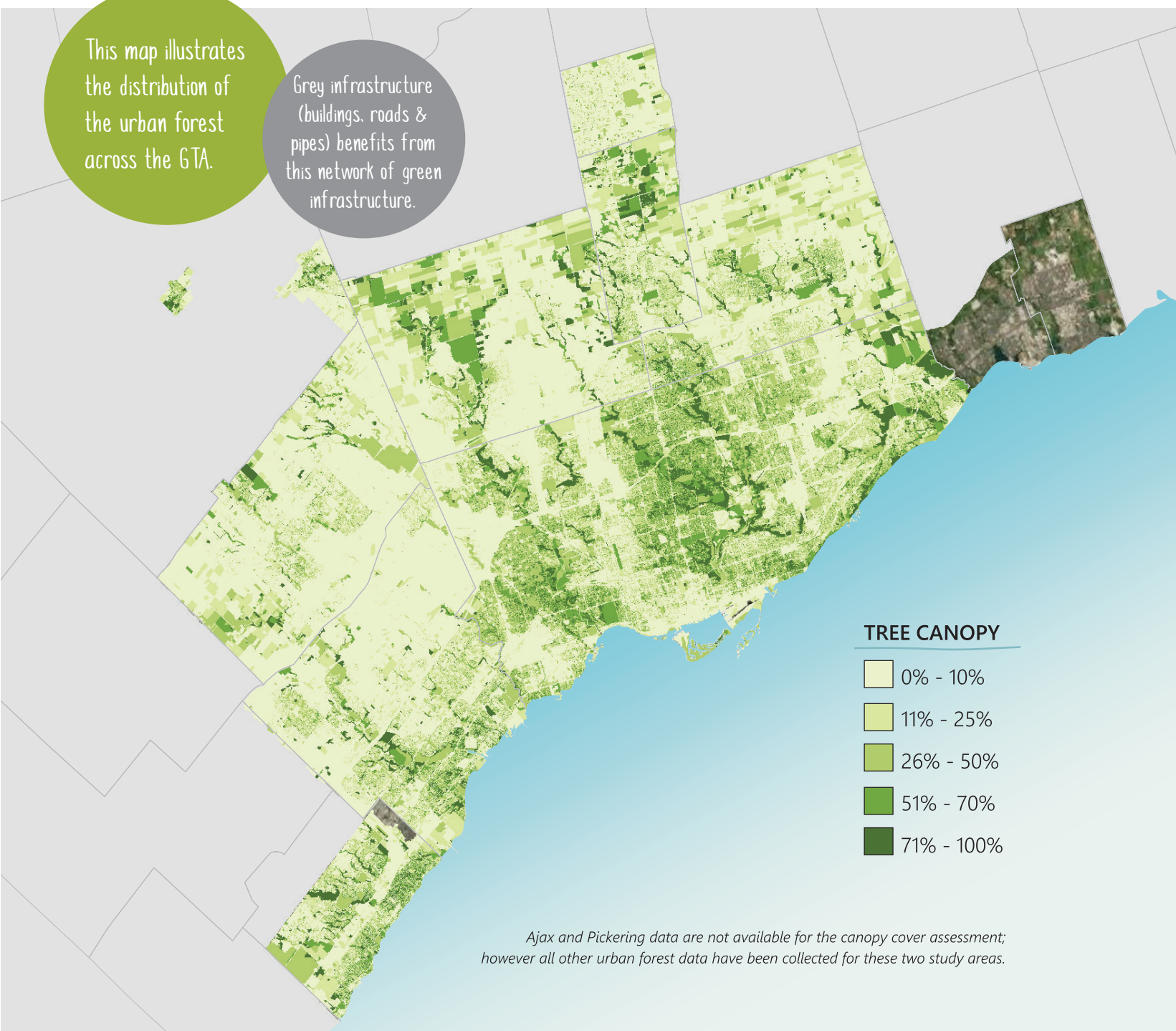
SETTING THE STAGE

34.2 million. That's the approximate number of trees in the GTA. Together, they provide canopy cover for 26 per cent of the total land area. And if that number surprises you, at an estimated $14.2 billion, the cost of replacing those trees should do the same. But far more would be lost if these trees were destroyed or removed. Countless ecosystems, supporting bird, insect, amphibian and mammal habitats would be devastated as well. And the benefits on which we've come to depend, including community beautification, shading, stormwater management, would also disappear. The total value of many of these benefits defies calculation.

Our urban forest is the back bone of a living green infrastructure system and is part of the solution to the challenges of urbanization that municipalities face every day. It spans streetscapes, natural areas, woodlots, backyards, commercial zones, and school yards, providing essential services to communities across the GTA.

This map illustrates the distribution of the urban forest across the GTA.

Grey infrastructure (buildings, roads & pipes) benefits from this network of green infrastructure.



Ajax and Pickering data are not available for the canopy cover assessment; however all other urban forest data have been collected for these two study areas.

BENEFITS OF OUR URBAN FOREST

Improving Public Health

Research supports what we already know intuitively – trees improve our health and wellbeing. The GTA's urban forest removes nearly 4,000 tonnes of atmospheric pollution annually; over half of this pollution (approximately 2,300 tonnes) is ground level ozone. This is important because ozone is the primary component of photochemical smog, which can damage our respiratory system, reduce lung function and inflame airways. Academic researchers have also found clear connections between urban forests and improved concentration[1], stress reduction[2], a lower risk of depression[3], enhanced cardiovascular health[4] and stronger bonds between community members[5].

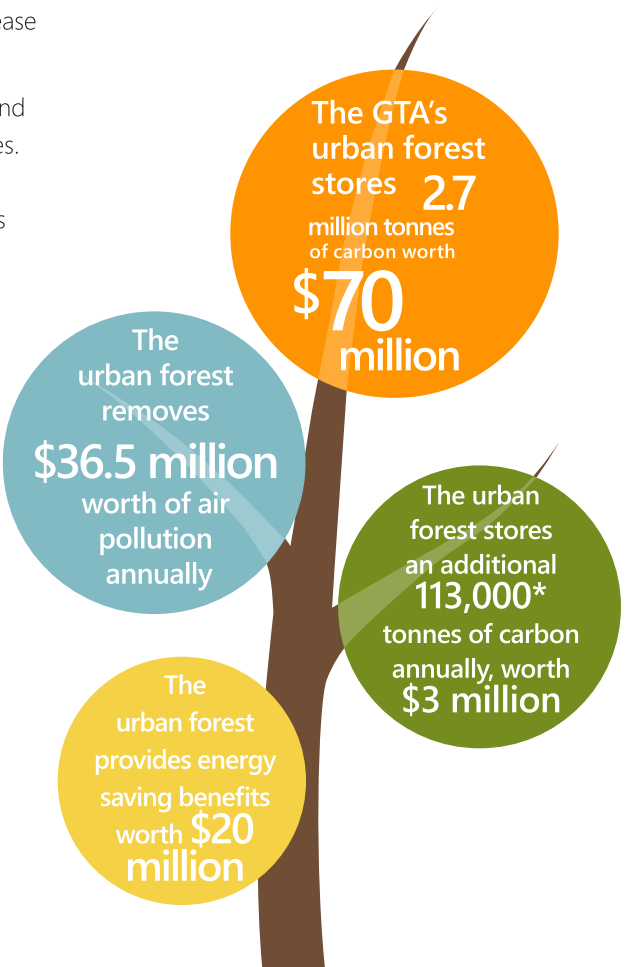
"Given the growing evidence of the many health benefits of the natural environment, including the urban forest, there is a need for more research and for developing public policy aimed at restoring, protecting, and enhancing urban forests."

~Dr. David Mowatt,
Former Chief Medical Officer of Health (Ontario).

Mitigating Climate Change

We can take action to address climate change by reducing or preventing the release of greenhouse gas emissions - typically referred to as climate change mitigation.

The urban forest can support climate change mitigation efforts by absorbing and storing carbon dioxide, the primary greenhouse gas emitted by human activities. In addition, trees can reduce energy demand for cooling by shading buildings during summer months and offset demand for heating by acting as windbreaks during winter months. These savings help to prevent greenhouse gas emissions associated with the energy production required to cool and heat buildings.



[1] Kaplan, R. (1993). The role of nature in the context of the workplace. Landscape and Urban Planning 26, 1-4: 193-201. [2] Hartig, T., Evans G.W., Jamner L.D., Davis D.S., and Gärling T. (2003) Tracking restoration in natural and urban field settings. Journal of Environmental Psychology, 23: 109-123. [3] Bratman, G. N., Hamilton, J. P., Hahn, K. S., Daily, G. C., & Gross, J. J. (2015). Nature experience reduces rumination and subgenual prefrontal cortex activation. Proceedings of the National Academy of Sciences, 112(28). [4] Donovan G.H., et al. (2013). The relationship between trees and human health: evidence from the spread of the emerald ash borer. Journal of Preventative Medicine 44(2): 139-45. [5] Peters,K. , Elands, B. ,Buijs,A.(2010) Social interactions in urban parks: Stimulating social cohesion?. Urban Forestry & Urban Greening, 9(2) 2010:93-100.

* This number represents gross carbon sequestration. This means it does not account for the loss of carbon due to tree mortality. Therefore the number is an overestimate, especially where communities are losing trees due to disease or poor growing conditions. The loss of trees limits the urban forest's potential to provide this important ecosystem service.

Adapting to Climate Change

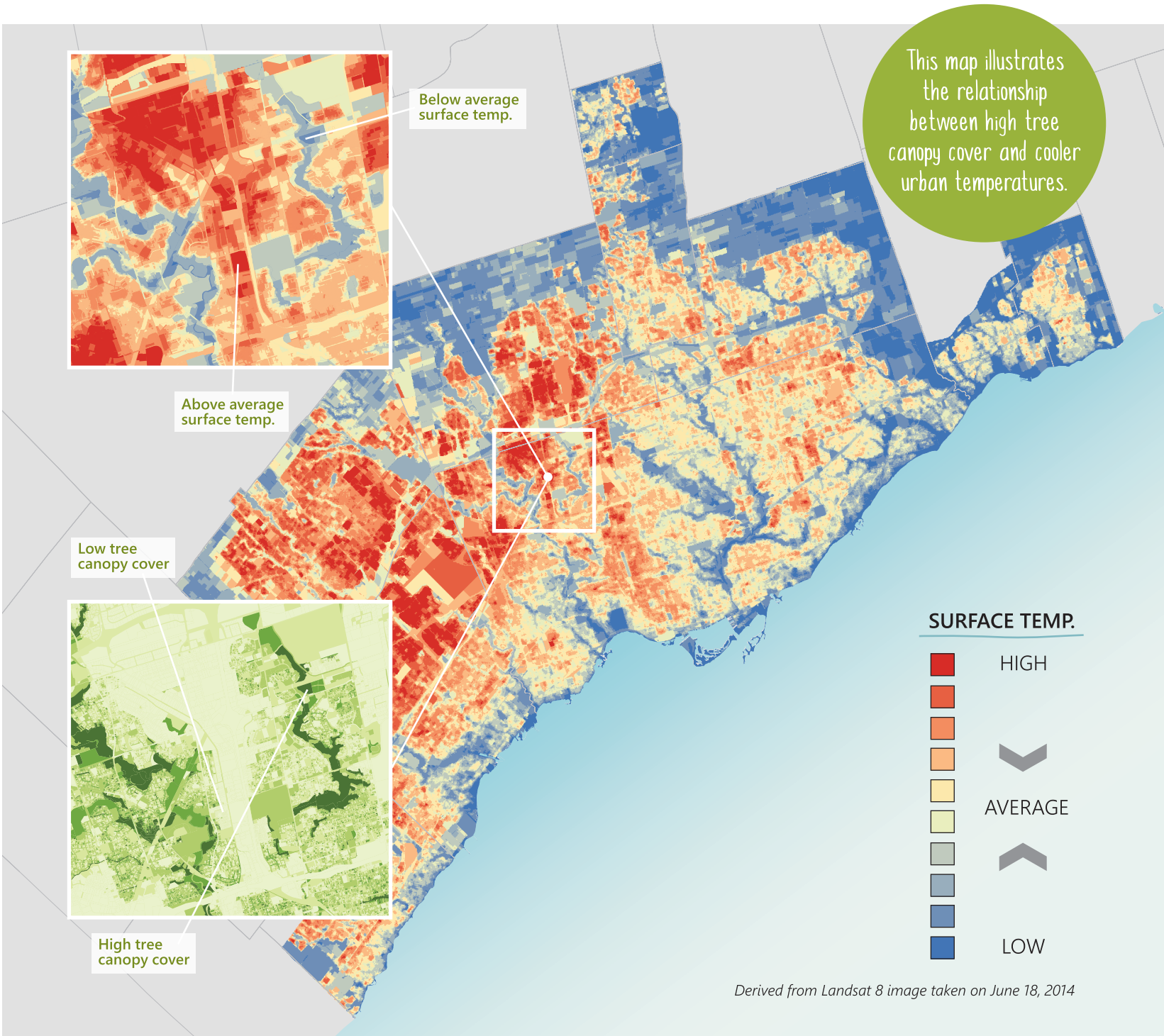
The urban forest can support climate change adaptation efforts by cooling our cities and helping to reduce flooding.

Stormwater Management

The risk of more frequent and severe flooding from extreme rainfall is one of the most pressing challenges associated with climate change that we face in the GTA. The urban forest can lessen the impacts of flood events by intercepting rainfall, increasing on-site infiltration, stabilizing slopes and preventing erosion.

Reducing the Urban Heat Island Effect

In years to come, global climate change will continue to bring to the GTA more extreme weather, including drought, major storm events and hotter summer temperatures. Exacerbating these conditions is the 'urban heat island effect', whereby urban areas are hotter than surrounding rural areas. This is due to the predominance of heat absorbing surfaces, like pavement, so commonly found throughout cities. An expansive, healthy urban forest can reduce the urban heat island effect by shading paved surfaces and reducing the heat transferred to surrounding buildings and the local atmosphere. In addition, the water vapour that is steadily released by trees cools the air and creates more comfortable conditions during hot weather.

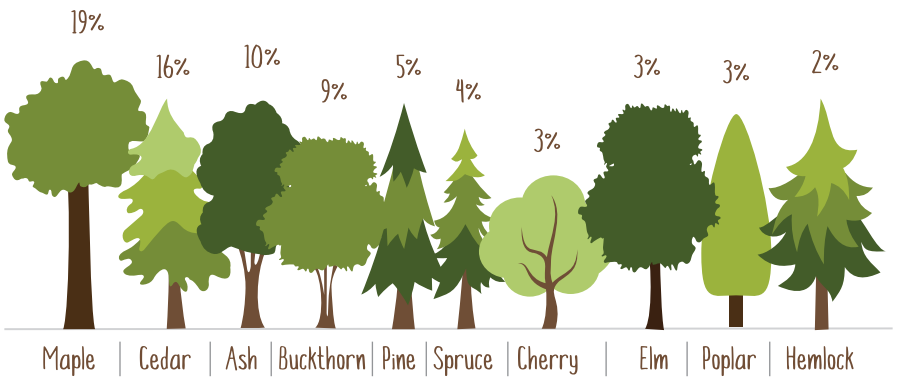


GROWING OUR REGION'S URBAN FOREST

Enhancing Species Diversity

The GTA urban forest is currently dominated by maple, cedar and ash tree species. Increasing diversity can help to ensure that a greater number of trees will survive a wide range of disturbances. It will also help achieve greater overall biodiversity within our urban ecosystems. Municipal leaders can encourage tree planting lists that include a wider variety of suitable native species, achievement of more ambitious diversity targets, and establishment of trees that are well suited to the current and future climate of the region.

Top ten most common trees in the region.



Helping Trees Reach Maturity

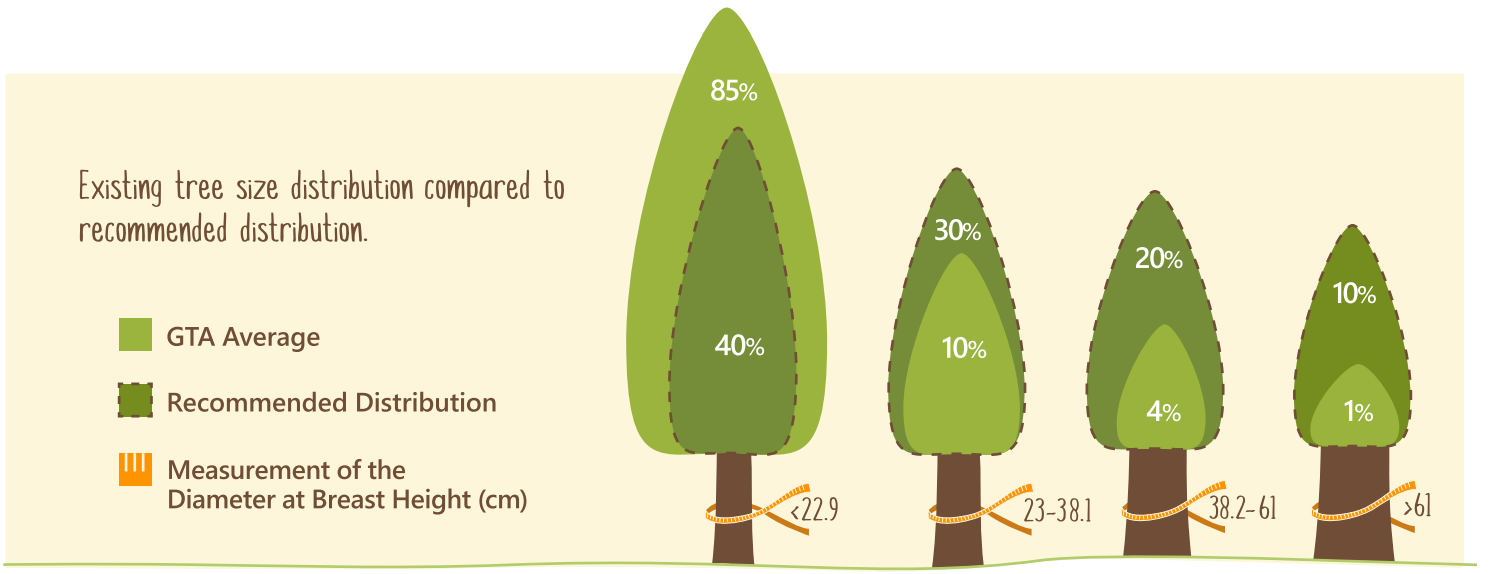
All trees are good trees, but the size and health of a tree greatly affect the benefits it provides. Large, mature trees deliver greater household energy savings, air and water quality improvements, runoff reduction, visual impact, property value enhancements and carbon storage and sequestration capacity. In fact, one large healthy tree can store approximately 65 times more carbon and remove 15 times more air pollution annually than one small tree. Furthermore, the stormwater management performance of urban forests is increased drastically if stormwater runoff can be directed to larger soil volumes that support mature trees.

The emerald ash borer, an invasive wood-boring beetle, is destroying native ash trees in the GTA. Tolerant of a wide range of growing conditions, ash trees are common along streets, in parks and throughout natural areas.

This means that the loss of these trees will be keenly felt. Approximately 3.2 million ash trees (10% of the total tree population) in the areas summarized in this report may be killed by this beetle.

The majority of trees in the GTA fall into the smallest size category (85%). This is a combination of small tree species, young saplings in natural areas, which is a healthy sign, and stunted trees not reaching their growth potential. Only 1% of trees fall within the largest size category compared to the recommended 10% distribution. This demonstrates that trees in many areas lack the growing conditions and protection measures necessary to support their long-term survival. To maximize the benefits provided by the urban forest, it is crucial to provide the ingredients needed to allow trees to reach maturity. Such ingredients include progressive soil standards and strong tree protection by-laws.

Existing tree size distribution compared to recommended distribution.



Surviving in the Urban Environment

Urban trees face major challenges in the city – notably poor soil quality, inadequate soil volumes and restricted growing space. Urban development practices often remove nutrient-rich top soil and restrict or redirect the flow of water. These changes put newly planted and well established trees at risk because they may be deprived of the water and nutrients needed to survive.

Trees that line city streets often have very little room in which to expand their roots and branches. Restricted space together with poor soil quality creates an inhospitable environment for trees. These challenges can be addressed by using urban design practices to ensure that trees have all the ingredients to thrive, including soil quality and volume, water, space, protection during construction, and regular maintenance.

Fostering Community Engagement

Growing the urban forest involves far more than tree planting initiatives. Equally important are efforts to protect and maintain existing trees. In fact, protecting the trees that are already in the ground may be the most effective strategy we can use to reach canopy cover targets. The largest proportion of our existing trees is located on residential land. This means that the residents of the GTA are the most influential stewards of the urban forest. Their cooperation is essential. Interest and capacity at the community level can be fostered through targeted programs that provide support to homeowners and tenants – whether in the form of training, subsidies, outreach campaigns, or other initiatives.

Urban forest stewardship strategies can be strengthened by gathering different perspectives across our communities. Collaboration between a diverse mix of residents, citizens, scientists, non-profit organizations and government officials can help to generate a wide range of creative solutions to the many complex problems we face.

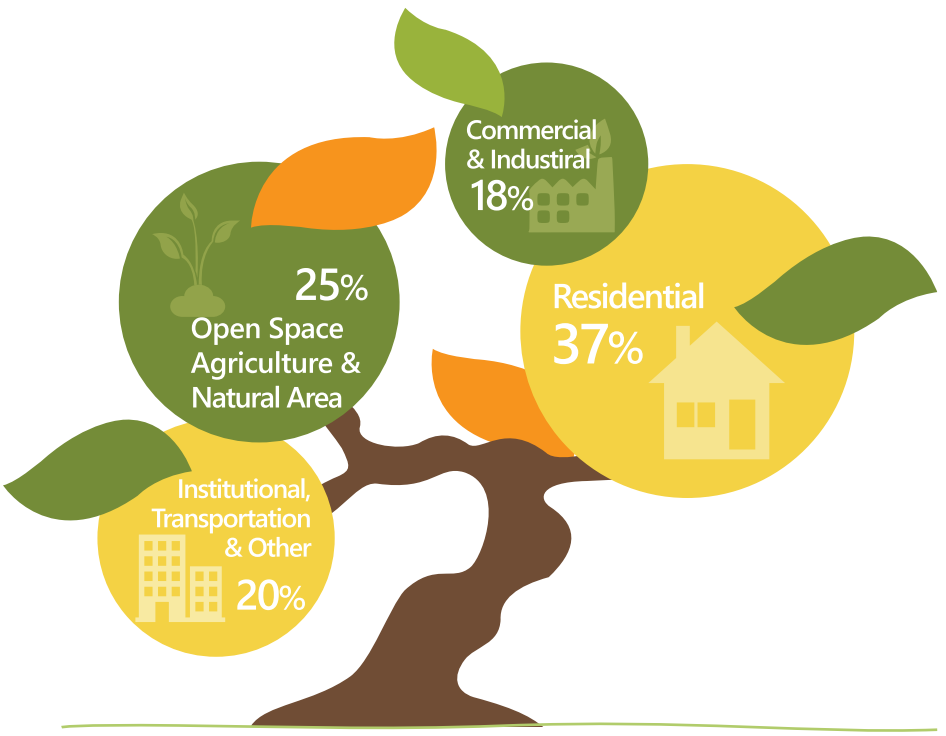
Understanding Environmental Equity

When it comes to our urban forest, there are the 'have' neighbourhoods and the 'have nots'. Tree distribution across cities is not equal, leaving some residents cut off from the benefits they provide. As in many North American cities, high-income neighbourhoods in the GTA are more likely to enjoy greater canopy cover.[7] An unequal distribution of ecosystem services can exacerbate the health risks to which low-income communities are predisposed, deepening disparities in quality of life between the rich and poor.

In the GTA, high-income neighbourhoods have more politically influential resident associations that can advocate for the protection and expansion of canopy cover in their communities.[8] In addition, residents in these areas are more likely to own their homes, rather than rent, which means they can more easily undertake landscaping on their properties and access planting programs that offer subsidized trees.

There are no easy solutions to the problem of inequality, and tree planting alone will not resolve the social injustices present in the GTA. But we can try to better understand the social and political roots of the problem. And we can make sure that we prioritize tree planting and maintenance initiatives in communities that need it most.

Tree Canopy Distribution by Land Use



[7] Schwarz, K., Fragkias, M., Boone, C. G., Zhou, W., McHale, M., Grove, J. M., ... Cadenasso, M. L. (2015). Trees Grow on Money: Urban Tree Canopy Cover and Environmental Justice. Plos One, 10, e0122051. [8] Conway, T. M., Shakeel, T., & Atallah, J. (2011). Community groups and urban forestry activity: Drivers of uneven canopy cover? Landscape and Urban Planning, 101, 321–329.

MAXIMIZE THE BENEFITS OF TREE PLANTING

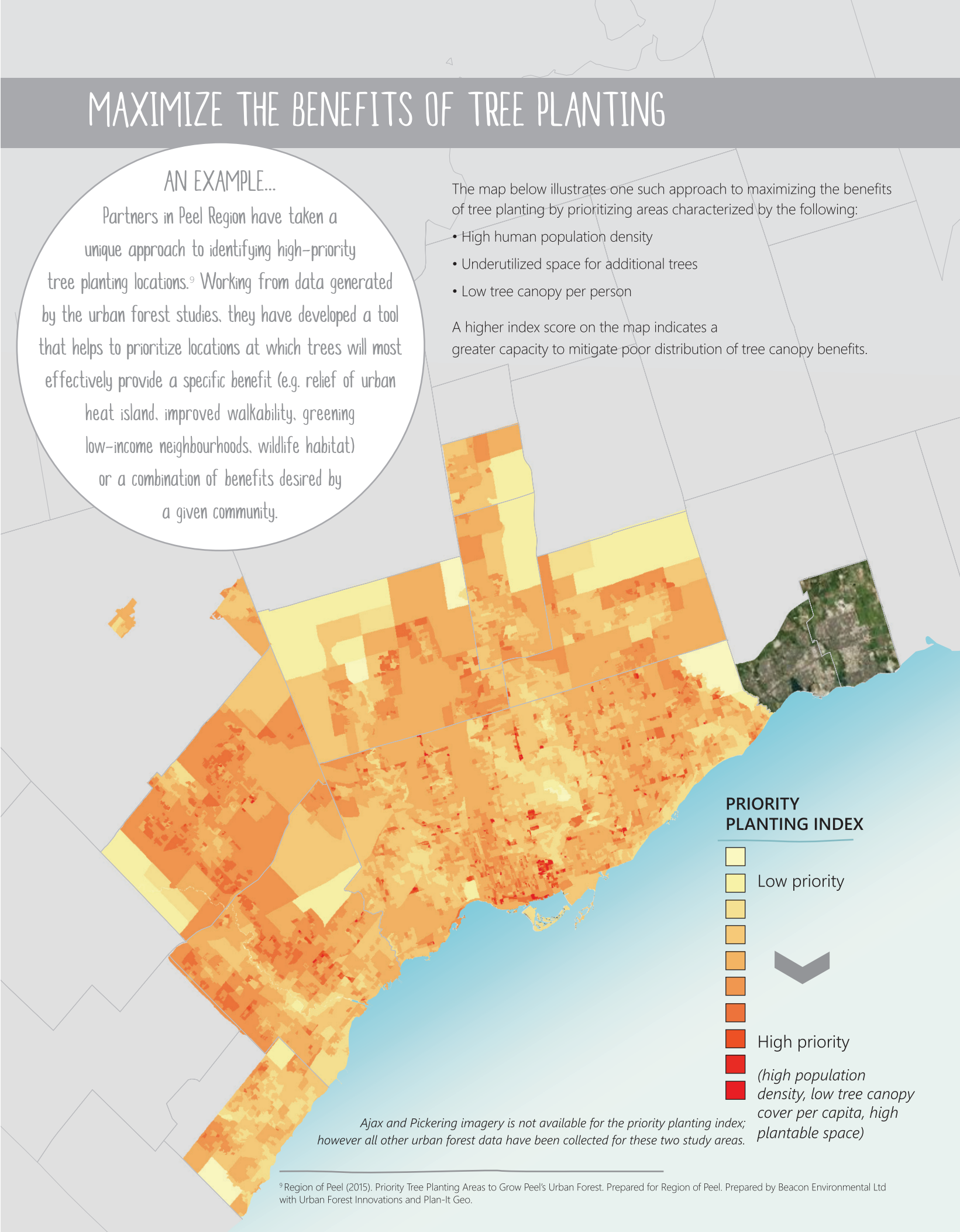
AN EXAMPLE...

Partners in Peel Region have taken a unique approach to identifying high-priority tree planting locations.[9] Working from data generated by the urban forest studies, they have developed a tool that helps to prioritize locations at which trees will most effectively provide a specific benefit (e.g. relief of urban heat island, improved walkability, greening low-income neighbourhoods, wildlife habitat) or a combination of benefits desired by a given community.

The map below illustrates one such approach to maximizing the benefits of tree planting by prioritizing areas characterized by the following:

- High human population density
- Underutilized space for additional trees
- Low tree canopy per person

A higher index score on the map indicates a greater capacity to mitigate poor distribution of tree canopy benefits.



Ajax and Pickering imagery is not available for the priority planting index; however all other urban forest data have been collected for these two study areas.

[9] Region of Peel (2015). Priority Tree Planting Areas to Grow Peel's Urban Forest. Prepared for Region of Peel. Prepared by Beacon Environmental Ltd with Urban Forest Innovations and Plan-It Geo.

WHAT WE NEED TO DO

Growing the GTA urban forest will take sustained effort on the part of community leaders who share a vision for healthier, greener cities where trees are considered an asset that is just as valuable as other capitally funded and supported infrastructure in our communities (like our roads, sewers and public facilities). In order to expand and sustain healthy, diverse urban forests in our region, we must work together towards the following goals. Each governing body, from municipal, regional, provincial and federal government can use these goals to identify ways to support the urban forest in their respective jurisdictions.

Develop & Enforce Strong Policy & Legislation

Policy makers, managers and political leaders at all levels of government can develop policies and programs that make it easy to implement cost-effective and naturally resilient green infrastructure solutions that will help us to address our most pressing priorities. We then need to ensure policies are practiced and enforced. This can include pursuing creative urban planning and design policies that incorporate the urban forest into new and retrofit development plans.

Invest in Green Infrastructure

When we invest in the urban forest we are investing in a form of capital infrastructure that provides solid economic returns, including reduced lifecycle costs of grey infrastructure, avoided flood damage costs, increased worker productivity and satisfaction[2], and higher rental rates and consumer spending in commercial spaces[3,4]. Investment is needed from all levels of government to support strong municipal forestry programs that enable staff to move beyond reactive management approaches that can address only the most urgent matters, to proactive strategies that help our urban forest become resilient in the face of change. We can also fund the capacity building efforts of non-profit organizations that are mobilizing residents and building community leaders. All these investments need to be integrated over the lifecycle of the trees.

Empower Community Members

We can find new, more meaningful ways to involve members of the community in the stewardship of the urban forest, extending their involvement beyond tree planting initiatives to include community-led planning, monitoring and maintenance. We can also provide tools and resources that help community members better understand the specific maintenance needs of the trees in their yards and communities.

Support Research & Monitoring

We can design and support monitoring programs that help municipalities, regulatory agencies and community groups identify and respond to new risks, challenges and opportunities. We can measure our performance and critically evaluate all programs designed to enhance the resilience of both the urban forest and our communities. We can also engage in research partnerships that more clearly identify causal links between urban forest health and public health, as called for by leaders in our public health agencies.

[1] USEPA. 2010. Municipal Policies for Managing Stormwater with Green Infrastructure. EPA-841-F-10-004. [2] Kaplan, R. 1993. The Role of Nature in the Context of the Workplace. Landscape and Urban Planning, 26, 1-4: pp.193-201. [3] Wolf, K. L. 2005. Business District Streetscapes, Trees And Consumer Response. Journal of Forestry, 103, 8: pp.396-400. [4] Laverne, R. J., and Winson-Geideman, K. 2003. The Influence of Trees and Landscaping on Rental Rates at Office Buildings. Journal of Arboriculture, 29, 5: pp.281-290.

IN CONCLUSION

Our urban forest provides a multitude of benefits that support shared priorities of stakeholders across the region, including public health, climate change adaptation and mitigation, social justice and sustainable urbanization and intensification.

This report has provided an overview of the current state of the urban forest in the GTA. It provides both a snap shot of information and a broad set of goals that senior decision-makers can use to build support for policies and programs to grow healthy urban forests and build sustainable communities.

PARTNERING FOR A HEALTHIER URBAN FOREST

From 2005 to 2014, municipalities, regional governments and Conservation Authorities from across the Greater Toronto Area (GTA) collaboratively conducted a series of urban forest studies. These studies identified the value of trees in our communities and the general health of our urban forests. Partners included the City of Toronto, Regions of Peel, York and Durham, and the area municipalities of Oakville, Mississauga, Brampton, Caledon, Vaughan, Richmond Hill, Markham, Aurora, Ajax and Pickering, as well as Credit Valley Conservation, Lake Simcoe Region Conservation Authority, Central Lake Ontario Conservation Authority and Toronto and Region Conservation Authority.

This report provides a snap shot of information from these urban forest studies. A much more detailed picture can be found in the technical study reports prepared for each participating municipality.

Green Infrastructure
ONTARIO COALITION

PARTNERING AGENCIES:

Aurora
Town of Ajax By the Lake
Brampton Flower City
Town of Caledon
Durham Region
Markham
Mississauga
Oakville
City of Pickering
Region of Peel Working for you
Richmond Hill
Toronto
Vaughan
York Region
Lake Simcoe Region conservation authority
Central Lake Ontario Conservation
CVC Credit Valley Conservation
Toronto and Region Conservation for The Living City

Writing and technical analysis was conducted by Meaghan Eastwood, Elizabeth Oakley, Vadim Sabetski, Lionel Normand, and Michelle Sawka.

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Maps: World_Imagery – Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

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