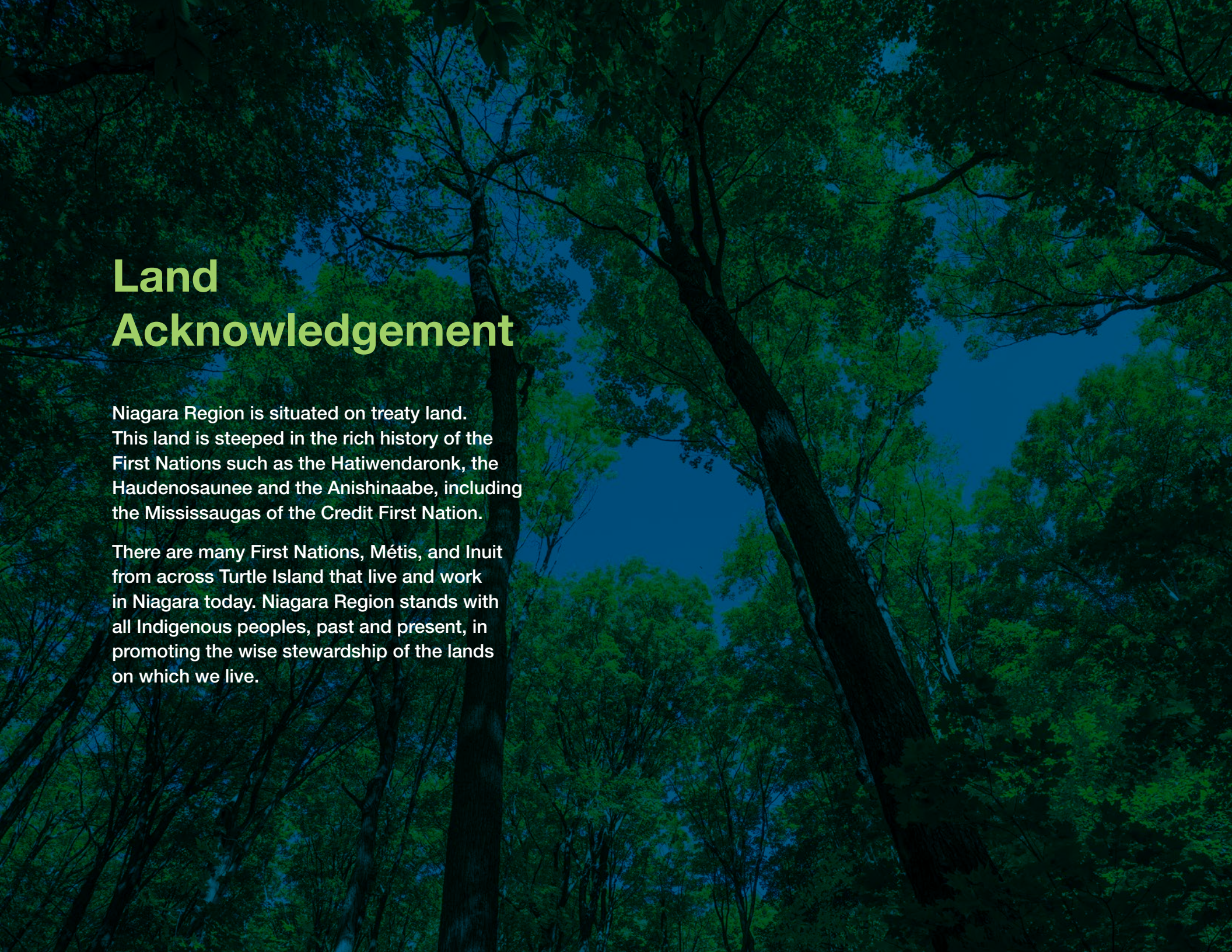
Tree and Forest Canopy

Summary Report

2024

Niagara Region



Land Acknowledgement

Niagara Region is situated on treaty land. This land is steeped in the rich history of the First Nations such as the Hatiwendaronk, the Haudenosaunee and the Anishinaabe, including the Mississaugas of the Credit First Nation.

There are many First Nations, Métis, and Inuit from across Turtle Island that live and work in Niagara today. Niagara Region stands with all Indigenous peoples, past and present, in promoting the wise stewardship of the lands on which we live.

What's inside

01

Introduction

Niagara's landscape is rich in diversity, encompassing a blend of urban and rural areas along with a variety of natural features such as woodlands, wetlands, beaches, and grasslands.

However, like numerous municipalities across Ontario, this diverse landscape and the interconnected human and ecological systems it supports are confronting escalating challenges.

Escalating challenges

Growing population demands

Intensifying development pressures

Transformation by a changing climate

Boosting wellbeing and sustainability

Trees contribute positively to physical and mental well-being. Developing a robust tree canopy is crucial for enhancing the sustainability and livability of Niagara.

Understanding Tree and Forest Canopies

Tree and forest canopy means the amount of ground area that is covered by the branches, leaves, and overall crown of the trees when viewed from above.

As these issues persist, the role trees and forests have in fostering a healthy and resilient region becomes increasingly important.

As integral components of Niagara's green infrastructure, trees deliver a wide array of ecosystem services.

Niagara's green infrastructure depends on trees to provide environmental benefits

1. Provide shade and shield from wind
2. Regulate summer temperatures
3. Assist in effective stormwater management
4. Store and sequester carbon
5. Filter airborne pollutants
6. Safeguard water quality
7. Support biodiversity by providing habitats for various species
8. Stabilize soils and prevent erosion

How to help our trees

Plant native trees, protect existing trees, water young trees during periods of low rainfall, protect tree stems and roots from damage during construction and landscaping, respect tree by-laws, participate in community tree planting events, consider transplanting instead of removing trees.

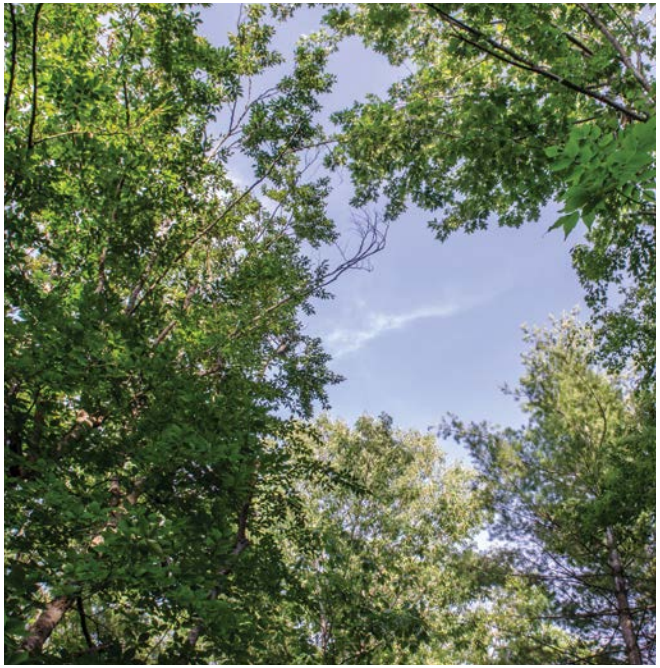
Data from the Tree and Forest Canopy Assessment

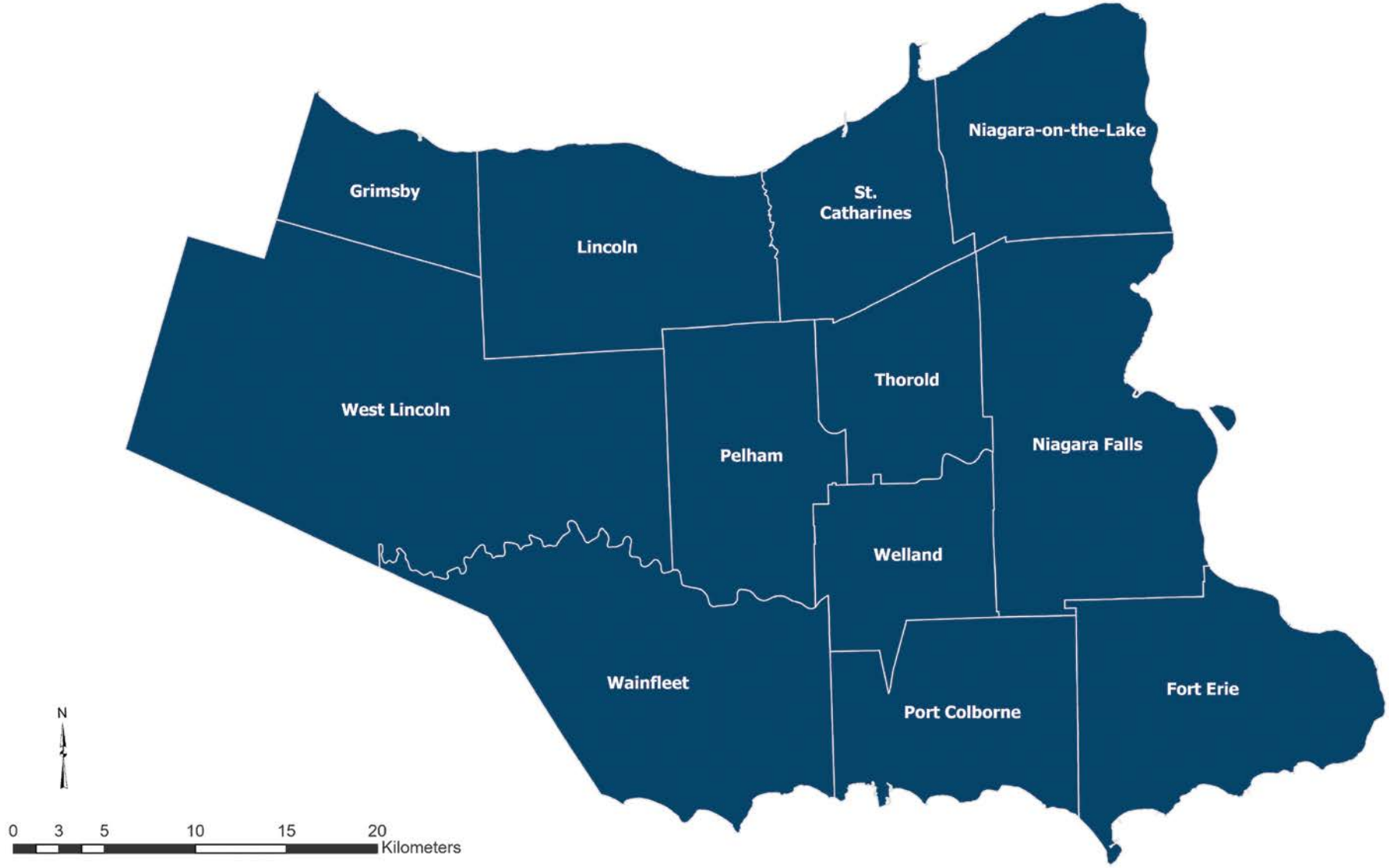
To gain a deeper understanding of the current state of the canopy, Niagara Region undertook an assessment to quantify and map the tree and forest canopy cover across the region.

This assessment encompasses not only larger forested areas, but also smaller groups and individual trees, such as boulevard and yard trees.

The data gathered through the assessment serves as a baseline measure of the region's canopy coverage. It offers insights into the ecological services and benefits provided by the region's tree and forest vegetation.

This data identifies areas of dense canopy cover and areas that may require conservation efforts or tree planting initiatives. It plays a vital role in understanding habitat availability and connectivity for wildlife species. Ultimately, this information will be instrumental in guiding sustainable land use planning and implementing practices that promote environmental stewardship.





Map 01

Niagara Region Municipal Boundaries

- Municipal Boundaries

02

Methodology

In 2023, the Tree and Forest Canopy Assessment used LiDAR and Orthoimagery from 2020 and 2021 to understand the coverage of trees and land classification within Niagara Region.

Understanding Orthoimagery and Light Detecting and Ranging (LiDAR)

Orthoimagery provides detailed aerial views of the landscape that have been processed to remove distortions and allow uniform measurements of distance across the image, enabling identification of land features and classes.

Light Detecting and Ranging (LiDAR) uses laser pulses to create highly accurate 3D maps of the terrain, which can be used to measure the height and density of vegetation.

Data Integration and Analysis

Using Geographic Information System software and classification techniques, this data was integrated and analyzed to generate a one-metre, raster-based dataset identifying land cover classifications for the entire Niagara region. Raster data allows for detailed maps to illustrate the distribution of these land classifications across the landscape.

Benefits of mature trees

A City of Toronto study titled “Every Tree Counts” compared the environmental performance of a 2.54 centimetres in diameter tree to a 76.2 centimetres diameter tree. The larger, mature tree was able to intercept ten times as much air pollution, store up to 90 times more carbon, and possess a leaf area as much as 100 times the size. Most trees take 20-30 years to mature depending on the type, the surrounding conditions like the climate and seasons, and how well you care for them.

The tree and forest canopy assessment categorized each one square metre pixel into one of six land cover classes

These land cover classes represent a top-down perspective of the landscape.

For example, areas where two classes overlap, such as tree canopy over a road, only the tree canopy is included in the land cover classification.

This method allowed for a comprehensive and systematic analysis and visualization of the spatial data.

Tree and forest Canopy

Buildings

Impervious cover

Soil and bareland

Water bodies

Grass and non-treed vegetation

03

Regional Canopy Cover and Land Cover Classification

The tree and forest canopy assessment results indicate that 46,789 hectares of the region is covered by tree canopy, accounting for 25.4 per cent of the region's total land area.

This data serves as a baseline for future evaluation of growth or decline in regional canopy.

While total tree canopy coverage is a key outcome of the tree and forest canopy assessment, information about the other land classes also offers valuable insights into vegetation cover and land use.

The full breakdown of land classifications across the region are **on page 12**.

Map 02

Niagara Region Tree and Forest Canopy

- Tree and forest canopy
- Municipal boundaries

Land Classification Breakdown

25.4%

Tree and forest canopy

Tree and forest canopy account for 25.4 per cent of the region's total land area. This equates to a total of 46,789 hectares of area covered by tree canopy.

39.3%

Soil and bareland

Makes up the largest land cover class at 39.3 per cent and includes agricultural lands.

Although this class incorporates some non-agricultural bare soil area like construction sites, it also underscores the substantial agricultural presence in the region.

2.5%

Buildings

Occupy 2.5 per cent of the region's land area.

These surfaces, serve as critical indicators of urbanization and development.

6.1%

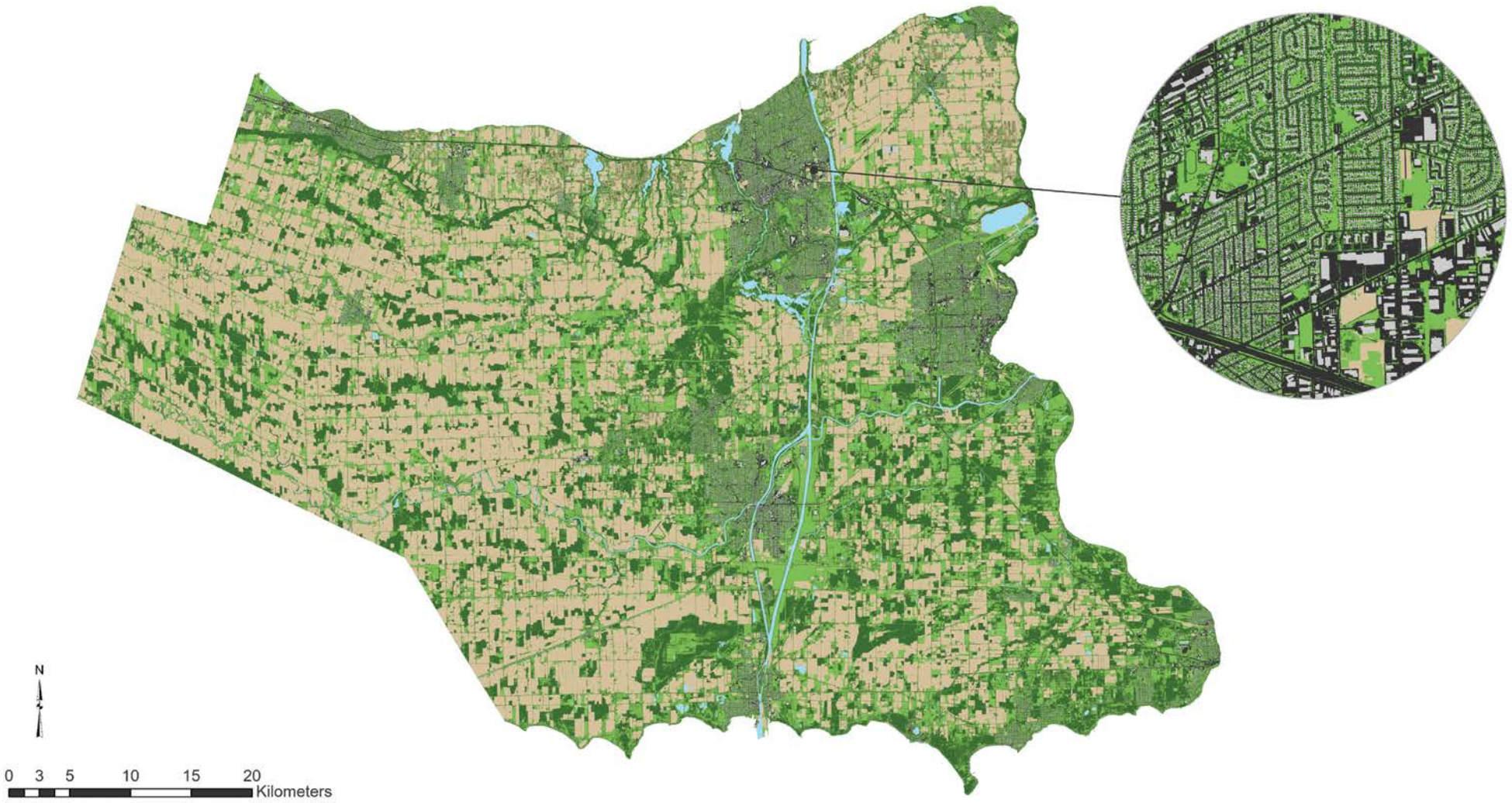
Impervious cover

Covers 6.1 per cent of the region's land area. Including constructed surfaces that prevent the infiltration of water into the soil. They include paved areas, such as roads, sidewalks, driveways and parking lots. These surfaces serve as critical indicators of urbanization and development.

26.7%

Grass and non-treed vegetation

Covers 26.7 per cent of the region's land area. Including manicured grass, pasture, shrubs, and all non-treed vegetation less than three meters in height. These areas provide various environmental benefits, including soil erosion control and improved water infiltration, while also enhancing the aesthetic appeal of the landscape.



Map 03

Niagara Region Land Classification

- Tree and forest canopy
- Soil and bareland
- Buildings
- Impervious cover
- Grass and non-treed vegetation

04

Distribution of Canopy Cover

The distribution of tree and forest canopy coverage across the region is not uniform, due to variations in landscape characteristics and land use patterns

Examples of factors that impact the landscape:

1. Urbanization
2. Agricultural Activities
3. Natural Features

As a result, certain areas have denser tree coverage than others.

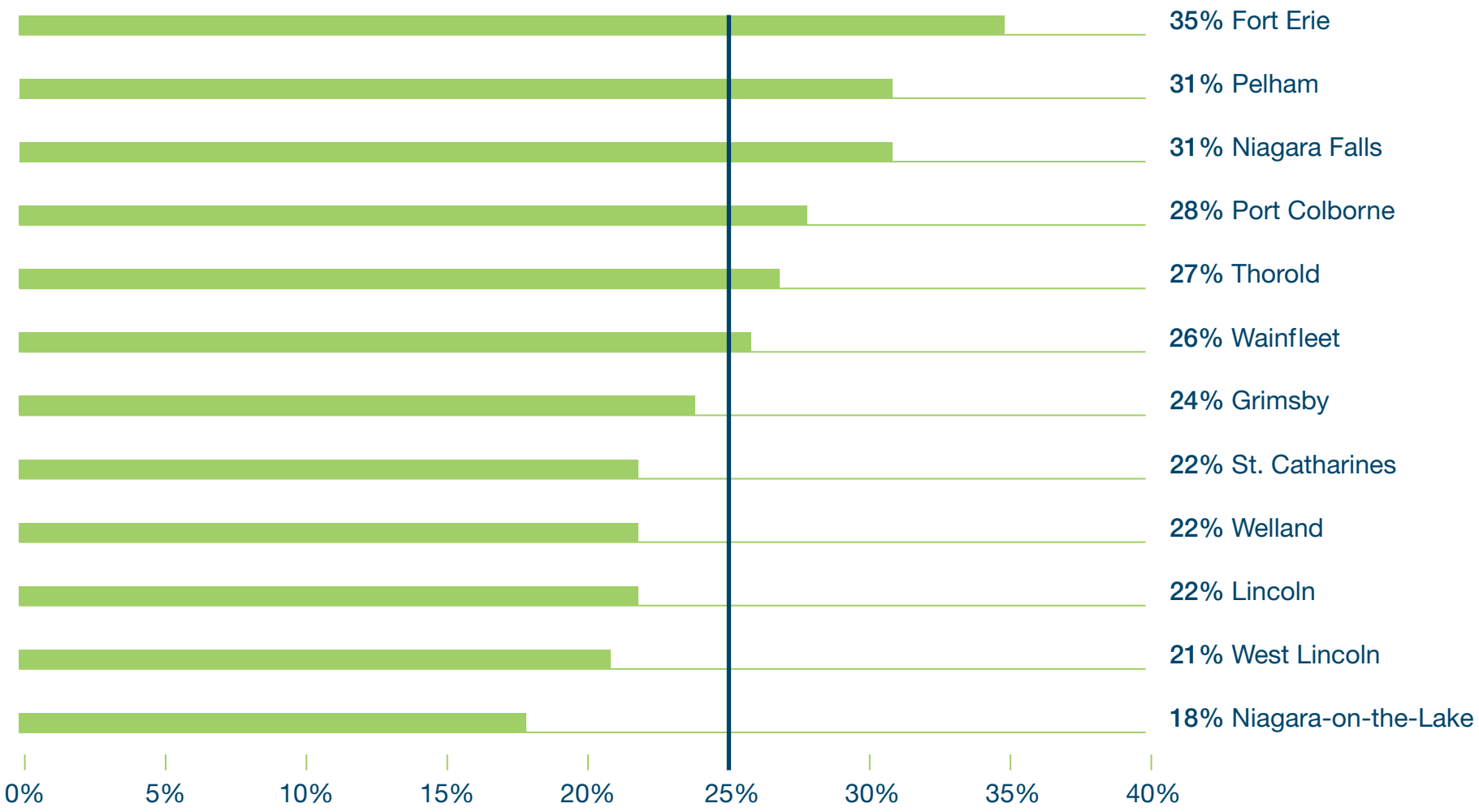
The data from the tree and forest canopy assessment can be analyzed at different geographic scales, and in combination with other land use information to better understand the differences in canopy distribution. In addition, it informs conservation and management strategies to enhance overall tree canopy health and coverage across the landscape.

Canopy Coverage by Municipality

Tree canopy distribution varies between the municipalities within the region, reflecting the differences in their landscapes, demographics and economic activities.

Graph 01 shows the percentage of tree and forest canopy coverage in each of municipality in the region.

Overall, six of the municipalities have a higher canopy coverage than the regional average, with Fort Erie having the highest percentage of canopy cover in the region at 35 per cent.



Graph 01

Municipal Tree and Forest Canopy Coverage

- Tree and forest canopy coverage
- 25% Regional tree canopy coverage average

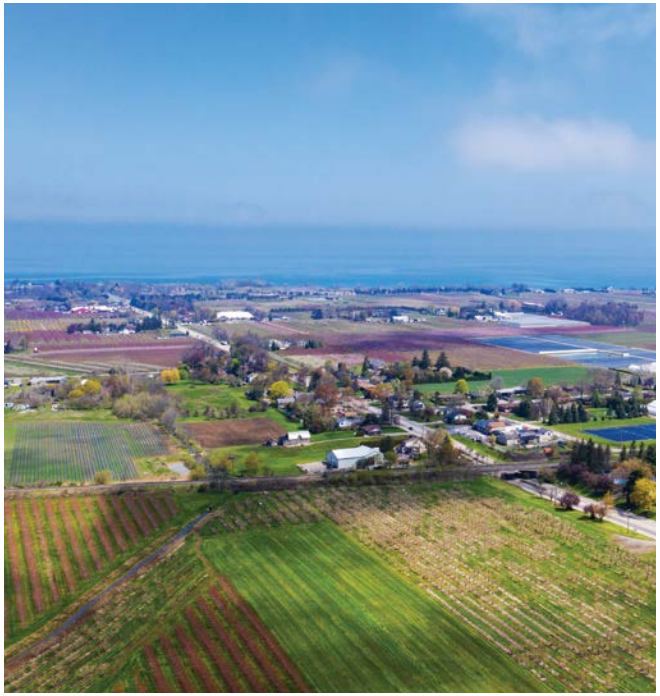
Land Cover Classification by Municipality

The total coverage for the other land cover classes is shown in **Table 01**.

As expected, predominantly rural municipalities have the highest percentage of soil and bareland.

In West Lincoln, this land cover class constitutes 58.1 per cent of the land area. Rural municipalities also had the lowest percentage of grass and non-treed vegetation land cover.

More urbanized municipalities, with larger populations, have the highest coverage of grass and non-treed vegetation. Impervious cover is also highest in these municipalities, particularly in St. Catharines, Niagara Falls and Welland.



Municipality	Land area (hectare)	Tree forest canopy	Grass and non-treed vegetation	Soil and Bareland	Buildings	Impervious cover
West Lincoln	38,628	20.7%	18.6%	58.1%	0.6%	1.9%
Wainfleet	21,626	25.9%	19.3%	52.2%	0.6%	2.0%
Niagara Falls	20,833	30.5%	35.0%	20.9%	3.7%	10.0%
Fort Erie	16,535	34.8%	31.8%	24.8%	2.2%	6.5%
Lincoln	16,217	21.9%	22.6%	48.1%	2.4%	5.0%
Niagara-on-the-Lake	13,108	18.0%	23.4%	49.5%	2.8%	6.2%
Pelham	12,580	31.4%	31.2%	31.5%	1.9%	4.0%
Port Colborne	12,069	28.4%	29.1%	35.7%	1.8%	5.1%
St. Catharines	9,598	22.4%	30.3%	15.7%	10.6%	21.0%
Thorold	8,332	26.6%	32.1%	31.7%	2.3%	7.3%
Welland	8,112	22.1%	43.3%	16.2%	5.5%	12.9%
Grimsby	6,854	23.9%	29.7%	34.5%	3.5%	8.4%
Regional Average	**184,492**	**25.40% (46,789 hectare)**	**26.70% (49,205 hectare)**	**39.30% (72, 550 hectare)**	**2.50% (4,591 hectare)**	**6.10% (11,314 hectare)**

Table 01 Municipal Land Cover Classification

Canopy Coverage by Dissemination Areas and Dissemination Blocks

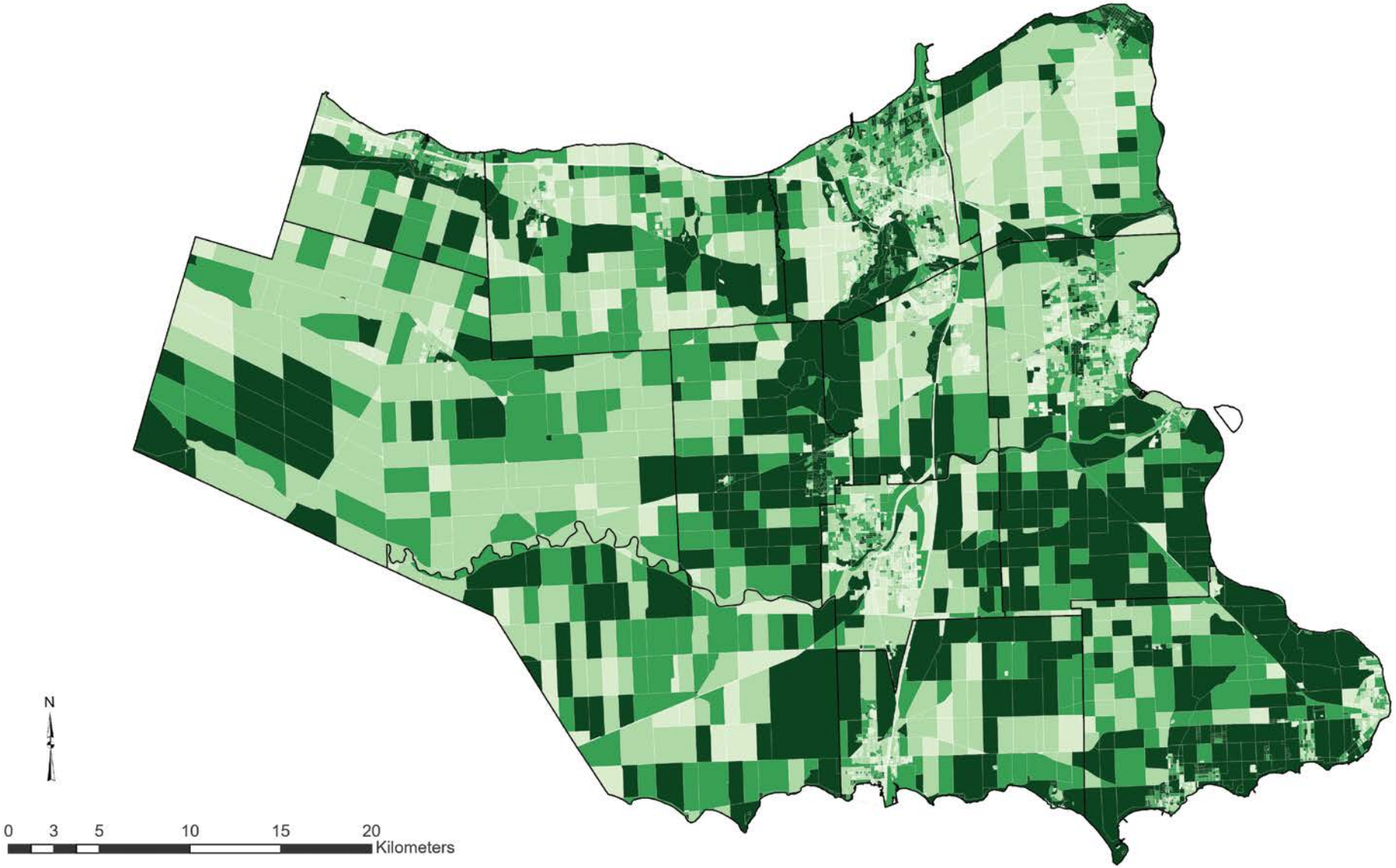
Tree and forest canopy distribution can be analyzed using census-based dissemination areas and blocks as the geographical unit of analysis. This provides a more refined and detailed spatial division compared to municipal boundaries.

Dissemination areas and blocks are smaller and more homogeneous in terms of land use, population density and other characteristics, enabling an assessment of tree and forest canopy cover and its relationship to various environmental and socio-economic factors at a local level.

This can also assist with more targeted interventions and policy decisions related to tree planting and restoration.

Examples of key findings from preliminary analysis at this level include:

Dissemination blocks, the smallest geographic area for which population and dwelling counts are disseminated by Statistics Canada, have been populated with tree and forest canopy coverage statistics, which are qualitatively mapped with a graduated colour scheme to show the distribution of tree and forest canopy rates across the region.



Map 04

Niagara Region Tree and Forest Canopy Dissemination Blocks

- <10%
- 10 - 20%
- 20-30%
- > 30%

Old and New Residential Neighbourhoods

Several dissemination areas, where newer residential neighbourhoods were recently established, showed lower overall tree and forest canopy rates. This outcome was expected, as many street and backyard trees in these areas were planted post-construction and have not yet matured enough to provide a large canopy. Conversely, older neighbourhoods, especially those with larger lots generally exhibited the densest tree and forest canopy coverage.

Image 01 shows an aerial perspective of old (right) versus new (left) neighbourhood canopy.

Image 02 shows old (right) and new (left) subdivision comparison.

Image 01

Image 02

Mixed Use Areas

Dissemination areas with a mix of commercial and residential development typically have low tree and forest canopy, as the impervious surface class is very high due to occurrences of parking areas.

Population Density

Across Niagara region's urban areas, the top 20 most densely populated dissemination areas (persons/hectare) based on 2021 Statistics Canada Census data, have an average 17.8 per cent tree and forest canopy cover.

However, there are some examples throughout the data of areas with high population densities and strong canopy coverages, demonstrating that in some cases high canopy rates can co-exist in areas of high population densities.

Image 03 shows high density, high canopy area

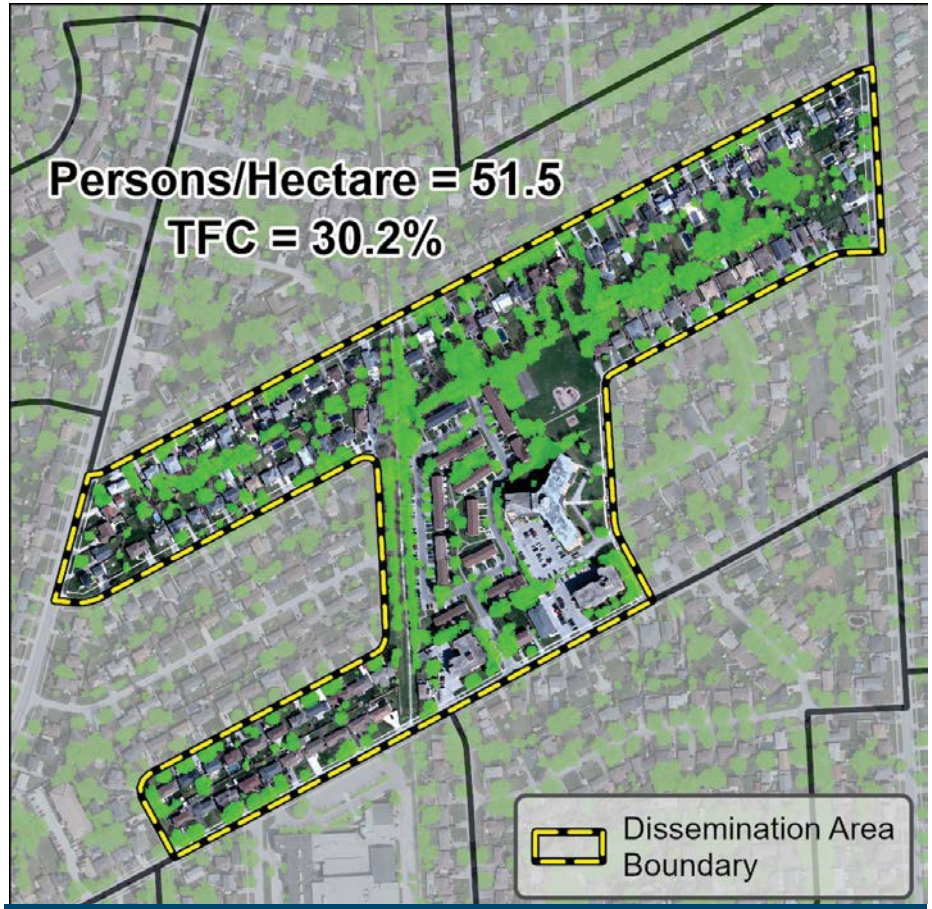


Image 03

Agricultural Areas

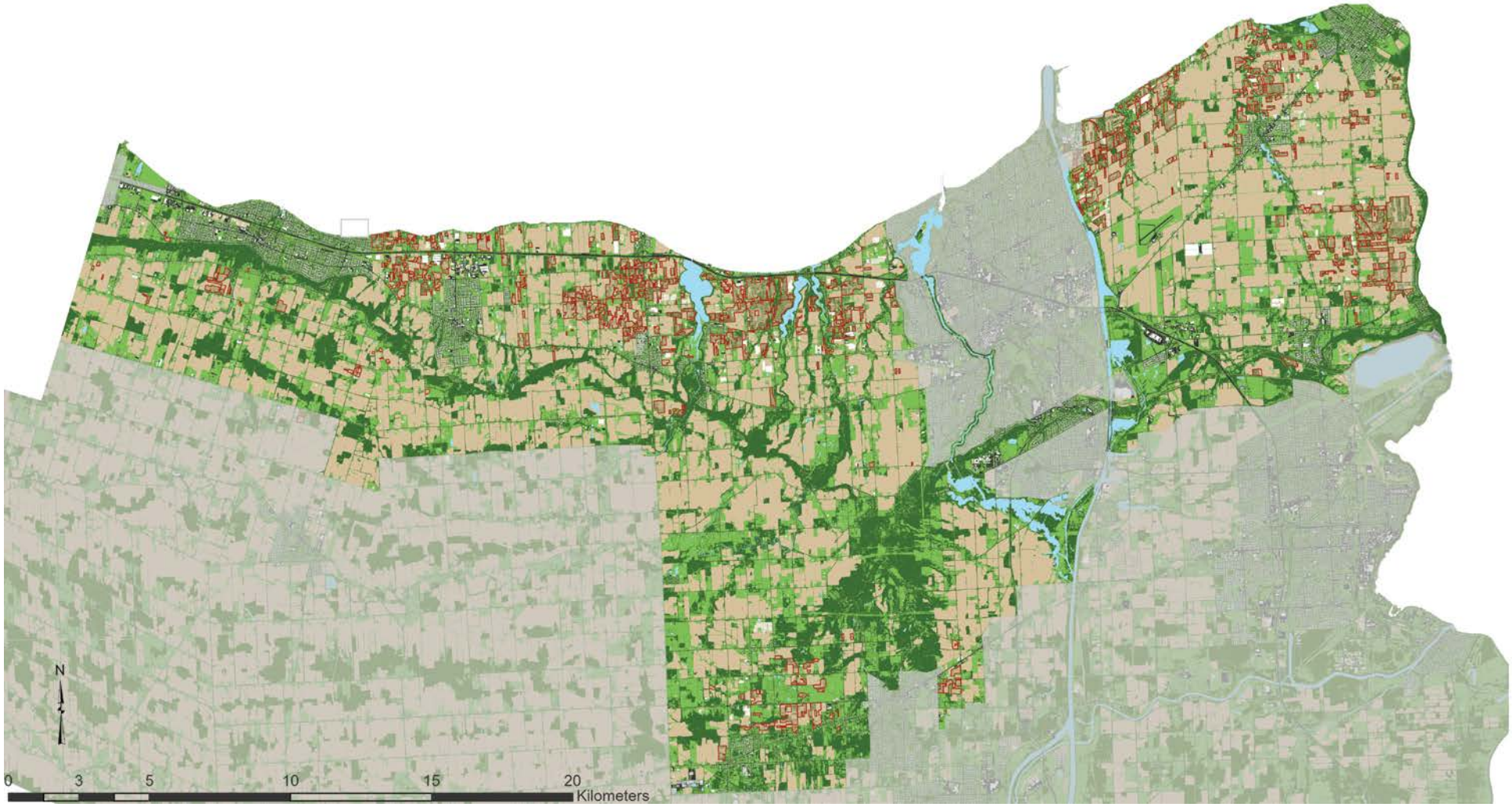
Agricultural lands are a vital component of both the economic and natural land base in Niagara. In addition to its primary role in food production, these lands support wildlife habitat, promote water infiltration and can contribute to carbon sequestration.

Through the land classification process, much of the region's agricultural area was categorized as soil and bareland or, in the case of pastures, grass and non-treed vegetation. However, it is important to note that there is tree canopy within the agricultural areas in Niagara.

In the northern part of the region, bordering the shoreline of Lake Ontario, specialty crop agriculture is prevalent with vineyards and orchards being common outside of settlement areas. Orchard trees are an important contributor to climate change mitigation through sequestration and storage of carbon dioxide from the atmosphere.

As shown in **Map 05**, these agricultural lands are included within the Greenbelt Plan area, a provincial policy area aimed at protecting and preserving green space, farmland and watersheds.

Total tree and forest canopy coverage in Niagara's Greenbelt Plan area is 23.6 per cent. Orchards account for 9.9 per cent of this canopy, which equals 1,165 hectares. Municipalities where orchard canopy is a major contributor to overall canopy, include Niagara-on-the-Lake and Lincoln, where orchard canopy makes up 23 per cent and 13 per cent of the total canopy in these municipalities, respectively.



Map 05

Niagara Region Tree and Forest Canopy Greenbelt Area | Land Classification

- Orchards
- Soil and bareland
- Tree and forest canopy
- Grass and non-treed vegetation
- Impervious cover
- Buildings
- Water

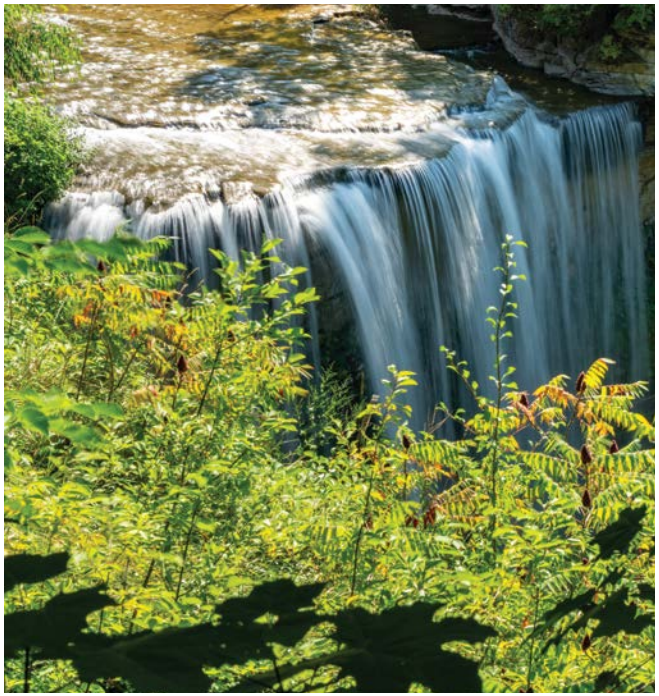
Urban Areas
Tree and Forest Canopy in Urban Areas

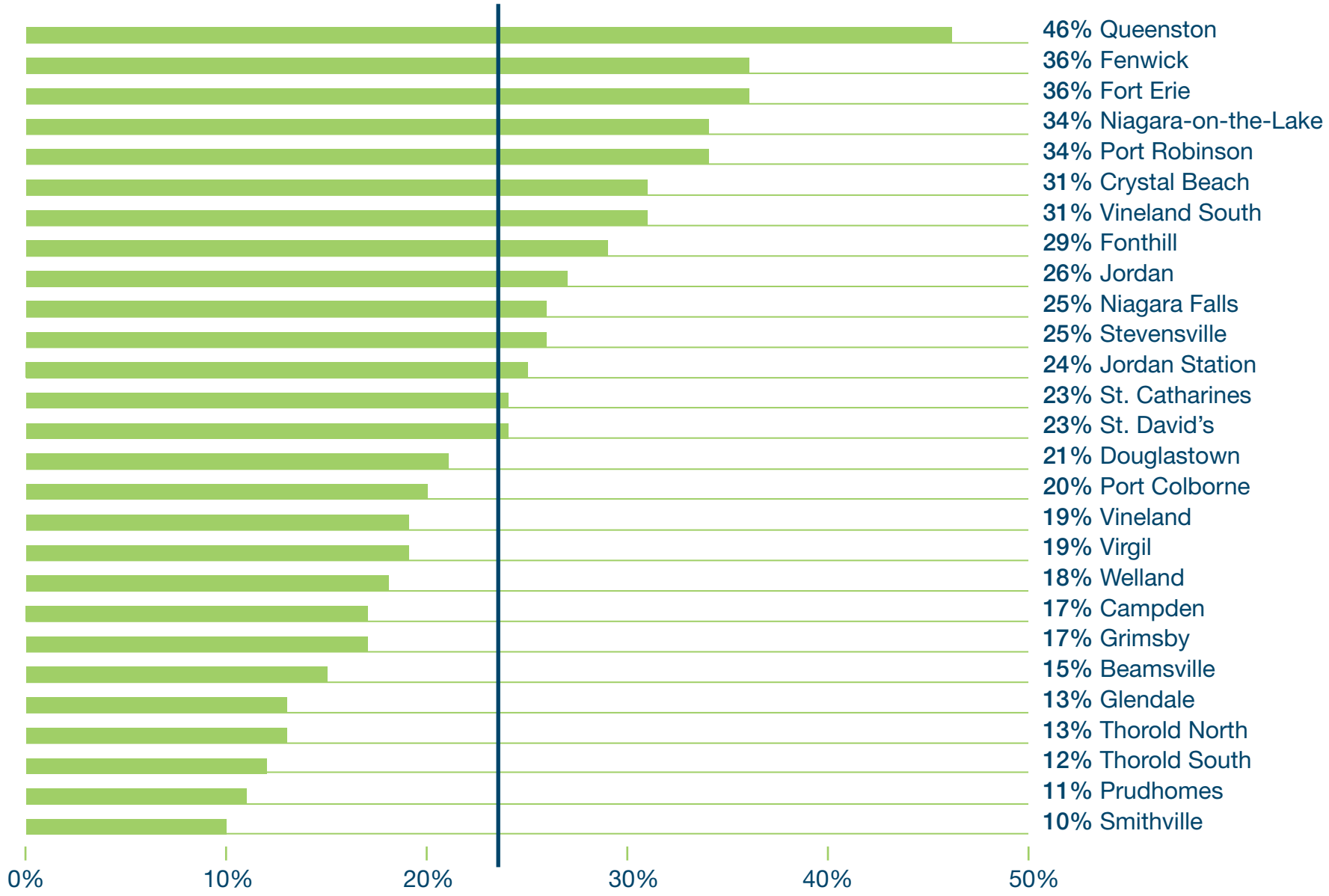
While canopy distribution in urban areas can often be less continuous and dense than in rural areas, it nonetheless plays a critical role.

Tree canopy in urban areas links the natural and built environments and contributes to the well-being of residents. It provides shade and lowers ambient air temperatures, mitigating the urban heat island effect.

Canopy in Niagara's urban areas varies greatly, between 10.4 per cent and 46.2 per cent tree and forest canopy cover.

The average tree and forest canopy coverage over all the urban areas is 23.7 per cent as shown in **Graph 03.**





Graph 02 Tree and Forest Canopy Coverage in Niagara's Urban Areas

— 23.8 per cent average tree and forest canopy in urban area

● Per cent tree and forest canopy

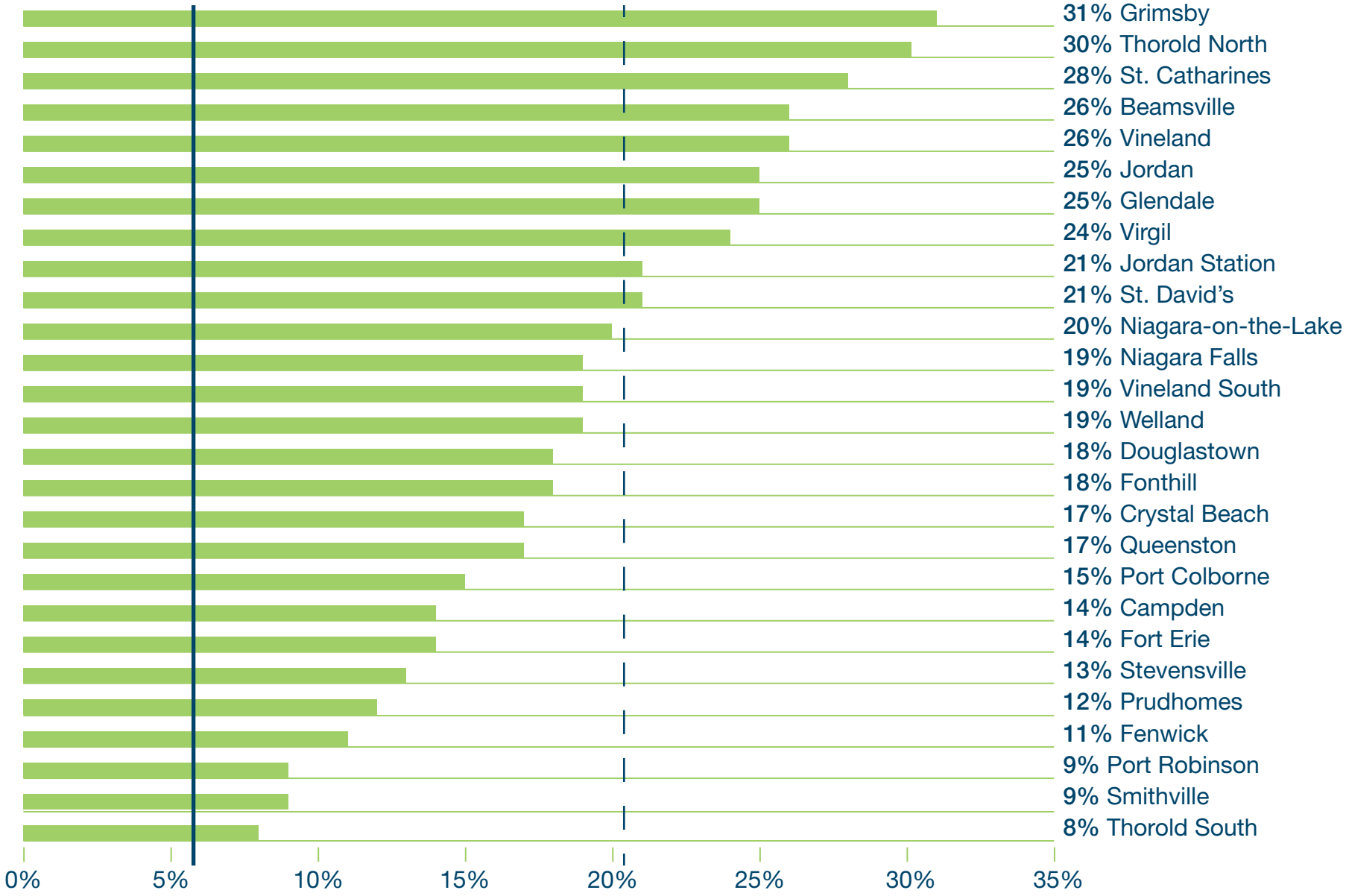
Impervious Surfaces in Urban Areas in Niagara

Niagara's urban areas are the settlement areas where development has been directed and concentrated.

As expected, these areas have a higher level of impervious surface coverage than the rest of the region. The average impervious surface cover for all the urban areas is 20.3 per cent.

The impervious surface coverage in each urban area is shown in **Graph 02**. These surfaces alter the natural hydrological processes, contributing to increased stormwater runoff and reduced groundwater recharge.

Increased imperviousness also results in increased temperatures compared to surrounding rural areas creating what is known as the 'urban heat island' effect.



Graph 03

Impervious Surface Cover in Niagara Region's Urban Areas

- Per cent of impervious cover in urban areas
- 6.1 per cent average impervious cover in region
- 20.3 per cent average impervious cover in urban areas

05

Canopy Benefits

Trees and forests offer multiple benefits to individuals and communities. Beyond the beauty trees bring to their surroundings, they also provide essential ecosystem services that enhance wellbeing and quality of life.

Among the many benefits trees provide, key services include:

Improved air quality

Increased canopy cover can filter pollutants and improve air quality, positively impacting respiratory health.

Each year, the region's trees and forests absorb an estimated 2,757.7 metric tons of air pollutants including carbon monoxide, ozone, sulfur dioxide and nitrogen dioxide through their leaves.

Additionally, they produce and release approximately 240.6 metric kilotons of oxygen every year.

Carbon capture and storage

Trees act as natural carbon stores by capturing carbon dioxide and storing it in their biomass.

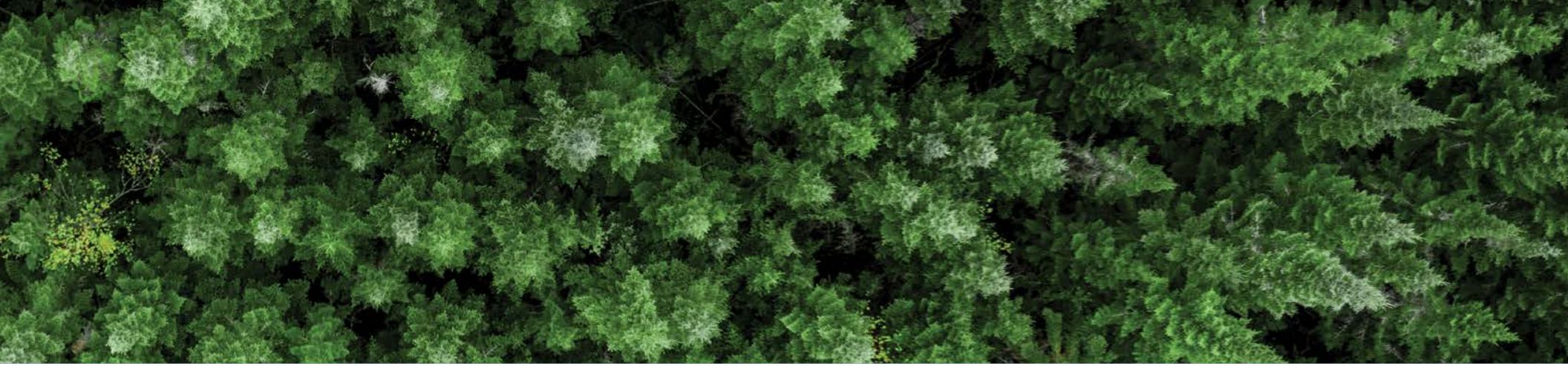
Trees accumulate more carbon as they grow, which is why mature trees are important carbon stores.

Trees in Niagara region capture 330.9 metric kilotons of carbon dioxide equivalent each year and store 15,639.2 metric kilotons of carbon dioxide equivalent.

Providing shade and reducing energy use

Climate change means the risk of more frequent, persistent, and intense heat events will increase in some areas. Increased canopy cover can reduce overall temperatures in the summer as well as reduce humidex values during a heat wave.

Strategically planted trees can lower indoor temperatures and reduce the need for air conditioning. In winter, trees planted as windbreaks can reduce heat loss from buildings and lower home heating bills.



Absorbing stormwater and improving water quality

Significant surface runoff from storm events can occur where impervious surfaces are the primary land cover. Surface runoff in urbanized areas can gather surface pollutants and deposit them into adjacent aquatic ecosystems. Surface runoff may also cause channels to exceed capacity causing flooding.

Tree canopies intercept precipitation, lessening and slowing runoff, while the roots of trees promote infiltration and water storage in the soil, also reducing flood risks. Avoided surface runoff is calculated based on the amount of rainfall intercepted by leaves. The total avoided surface runoff from Niagara region's tree and forest canopy is estimated to be 598,000 cubic metres every year.

Improved mental and physical health

Studies have demonstrated that increased canopy cover and access to greenspace improve physical, emotional, mental and social well-being.

Regularly spending time near trees and greenspace has been linked to improved mental health. It can reduce stress, anxiety and depression, while promoting a sense of well-being.

Access to greenspace also encourages physical activity such as walking, running or cycling; leading to a more active lifestyle. This reduces the risk of chronic diseases, including heart disease and diabetes.

Providing wildlife habitat

Trees and shrubs can support a wide diversity of wildlife, including birds, pollinators and other insects. Many different types of animals depend on trees for food, water, or places to raise their young. Trees can also be used for resting, shelter and as a place from which to hunt or capture prey.

Standing dead and dying trees or trees with dead branches, are important for wildlife in both natural and landscaped settings. Birds, small mammals, and other wildlife use these trees for nests, nurseries, storage areas, foraging, roosting and perching.

06

Challenges

The estimated replacement value of all trees in Niagara region, which represents the local cost of replacing a tree with a similar tree, is approximately $11 billion.

Threats to Niagara's tree and forest canopy, include susceptibility to pests and disease, stresses associated with climate change, invasive plant species and changes in land use

Invasive Plant Species

Invasive non-native vegetation is considered a significant threat to biodiversity and can severely impact the regeneration of native vegetation in treed areas. Several non-native vegetation species have capabilities to out compete native plants for nutrients and water.

They may establish quickly in areas where there has been native tree-die off (such as ash dominant forests) and suppress the regeneration and growth of native tree species, thereby reducing native tree and forest canopy cover.

Understanding Native and Invasive Species

A native species is defined as a species living within its natural range that is naturally self-sustaining.

An invasive species is defined as a non-native species that aggressively out-competes native species and comes to dominate the ecosystem.

Climate Change

Climate change has the potential to significantly impact Niagara's tree and forest canopy, affecting structure, health, distribution, and ecological function.

The specific impacts of climate change vary depending on factors such as geography, existing species compositions, and the prevalence of pests and disease.

Negative impacts of climate change on tree and forest canopy

1. Increased water stress in trees from prolonged drought conditions, causing wilt and increased susceptibility to pests and disease.
2. Climate facilitated increased expansion and movement of pests into the Niagara region.
3. Altered phenology such as the timing of leaf emergence, flowering, and leaf fall. This can disrupt the interactions between tree species and organisms that rely on these temporal cycles.
4. Increased wildfire risk from dry forest conditions.

Pests and Diseases

The most significant pests and diseases affecting Niagara's tree and forest canopy, include longstanding pests such as the Spongy Moth and Emerald Ash Borer. Additionally, potential future threats come from Oak Wilt and the Spotted Lanternfly.

The Spotted Lanternfly primarily poses a threat to grapevines and orchards. Without early detection and rapid response, these pests can lead to high tree mortality, severe declines in native tree species and substantial economic losses to agricultural operations.

07

Niagara's Changing Tree and Forest Canopy

Forecasting tree and forest canopy growth and decline over time can help guide forestry management and tree planting decisions.

Forecasting tree and forest canopy growth and decline over time can help guide forestry management and tree planting decisions.

Niagara's tree and forest canopy is variable throughout the region and is subject to a wide array of natural stressors (such as soil moisture, extreme weather events, insects and disease) and human stressors (such as land use changes and forestry management practices) that can affect canopy over time.

Detailed modelling and forecasting of tree and forest canopy change in Niagara were outside of the scope of the tree and forest canopy assessment.

However, as an exercise to understand the potential scale of tree planting required to increase tree and forest canopy, a simplified mortality forecast was used to estimate the potential loss and replanting needed to maintain or increase Niagara's urban tree and forest canopy over the next 30 years.

The estimated planting scenarios apply only to the urban areas Niagara region, inclusive of all 27 urban areas.

In urban settings, tree mortality is highly variable depending on planting locations and general tree maintenance and upkeep.

To help estimate the annual mortality rates of trees in Niagara's urban areas, data from the City of Guelph's 2023 One Canopy Tree Planting Strategy and the City of Toronto's 2018 Canopy Study were used as a reference.

Based on this data, a mortality rate of 3.3 per cent was applied to trees in developed areas (including, residential, commercial, industrial, park and street trees) and a mortality rate of 1.4 per cent was used for trees in more natural areas (including, trails, ravines and small urban forests).

There are an estimated 514,000 urban trees in developed areas and 420,213 urban trees in natural areas. In total these trees cover 8,379 hectares of land.

Data at a Glance

3.3%
mortality rate for trees in developed areas

1.4%
mortality rate for trees in more natural areas

514,000
urban trees in developed areas

420,213
urban trees in natural areas

in total these trees cover
8,379 hectares
of land in Niagara region

Morality Forecasting and Planting Scenarios

To maintain or increase canopy coverage, trees lost to mortality must be replaced. In the forecast exercise, the maintenance and increases in tree and forest canopy are all due to tree planting.

However, natural regeneration would be expected in some natural urban areas (for example where mowing and tree removals are not occurring regularly) and would potentially offset some of the required planting.

This forecast highlights the importance of ongoing tree planting efforts. Growing the region's tree and forest canopy will require continued efforts to increase and encourage tree planting on both public and private lands.

Future follow-up studies that continue to monitor the region's canopy coverage could provide greater insight into how the tree and forest canopy is changing over time and inform tree planting and protection strategies.

Planting scenario	Maintain existing urban tree forest canopy at 23.7%	Increase urban tree forest canopy to 25%	Increase urban tree forest canopy to 30%
Current urban area tree forest canopy	23.7%	23.7%	23.7%
Yearly tree planting required	22,845	24,604	31,184
Urban area tree forest canopy in 30 years	23.7%	25.0%	30.0%
Urban area canopy area (hectare)	8,379	8,852	10,623

Table 02 Mortality Forecasting and Planting Scenarios

08 Conclusion

The tree and forest canopy assessment offers critical data to understand Niagara's existing canopy. It not only provides a baseline to inform planning and urban forestry management decisions, but it also underlines the significant value of Niagara's trees and the importance of maintaining and increasing canopy throughout the region.

Our next steps

Niagara Region will continue to analyze the study data and share findings with local municipalities and the public.

Staff will integrate the data into planning and decision-making.

Data will support tree planting and protection programs on Regional properties.

Map Disclaimer

Disclaimer applies to all maps in this report 2024 Niagara Region and its suppliers. Projection is UTM, NAD 83, Zone 17. The Niagara Region makes no representations or warranties whatsoever, either expressed or implied, as to the accuracy, completeness, reliability, currency or otherwise of the information shown on this map.

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