

Subject: Tree and Forest Canopy Project

Report to: Planning and Economic Development Committee

Report date: Wednesday, February 7, 2024

Recommendations

1. That Report PDS 5-2024 **BE RECEIVED** for information; and
2. That a copy of Report PDS 5-2024 **BE CIRCULATED** to the Local Area Municipalities and the Niagara Peninsula Conservation Authority (NPCA).

Key Facts

- The purpose of this report is to inform Council of the recently completed Niagara Tree and Forest Canopy Assessment project.
- Tree and forest canopy is an increasingly important topic across municipalities, this project provides baseline tree and forest canopy and land classification data for the Niagara Region.
- The tree and forest canopy assessment will inform future direction and implementation of environmental projects, including the Regional Greening Initiative and support decision making for a variety of environmental planning responsibilities.
- Final land classification results indicate that overall, Niagara Region has a 25.4% tree and forestry cover.
- The data and findings from the project will be shared with the local area municipalities to support local initiatives.

Financial Considerations

The costs associated with the Tree and Forest Canopy Assessment project were accommodated within the Council approved project budget for the Niagara Official Plan.

Analysis

This report provides an overview and results of the recently completed Niagara Region tree and forest canopy (TFC) project. The main outcome of the project is a quantified

assessment of the complete regional TFC cover (Figure 1 – Appendix 1). The project also produced a land use classification spatial dataset for the extent of the Niagara Region, which has been used to generate additional information and statistics on ecosystem services, theoretical planting opportunities, and additional study avenues. The results of the project provide baseline data for the Region's current TFC, will continue to be used to identify and carry out plantings on regional properties through the Greening Initiative, and will inform future direction and implementation of environmental projects and support decision making for a variety of environmental planning responsibilities at both the regional and local levels.

TFC coverage can impact the environmental, economic, and social aspects of our everyday lives. The TFC coverage of an area has a direct relationship to the water quality of surrounding watercourses, helps prevent erosion of soil, improves air quality, lessens UV exposure through shade provision, and enhances the health and prevalence of flora and fauna ecosystems in an area, among other benefits. Residents in a well-treed area benefit from an economic perspective, by requiring less energy resources to cool their homes in summer and heat them in winter when trees provide shade and wind blocks. Municipally, trees are the least costly approach to stormwater management by reducing the amount of run-off that enters storm systems and can also act as effective buffers to urban noise levels.

TFC coverage refers to the proportion of fixed area on the ground covered by tree crowns. Coverage is inclusive of larger forested areas, as well as small tree stand areas such as hedgerows, and individual trees, such as boulevard and yard trees. A few of Niagara's local municipalities have completed work to determine local urban canopy coverage or have conducted municipal tree inventories. This project provides a consistent approach across the entire Region, allowing results and analysis to be completed on a standardized dataset. This project represents data at a 'point-in-time' with consideration of several factors which will continue to influence and have direct effects on the composition and coverage of trees across the Region, including but not limited to climate change, invasive species and tree diseases, and land-use changes.

A consultant was retained to carry out this project and commenced work in Q1 2023. The scope of the project included creating a 1 metre raster-based dataset identifying landcover classifications across Niagara Region. Six land cover classes were identified: TFC, Grass and non-treed Vegetation, Soil and Bareland, Impervious Cover, Buildings, and Water. TFC was further analyzed and a subclass identifying orchard canopy was produced to quantify where orchard canopy is a contributor to overall canopy. The land cover classes represented the landscape from a top-down perspective, i.e., in areas

where two classes overlap, such as tree canopy overhanging a roadway, only the tree canopy was represented in the land cover classification. Figure 2 (Appendix 1) shows an example of a mapped area in St. Catharines.

Various data sources were used for the project including: Ontario Road Network (2023), Hamilton-Niagara LiDAR DSM (2021), Hamilton-Niagara LiDAR DTM (2021), Bing imagery (2021), Southwestern Ontario Orthophotography Project (2020), and Niagara Region Building Footprints (2018). Using GIS based software, classification techniques were employed to generate each land cover class including segmentation of a LiDAR based height model, random forest machine learning image classification of orthoimagery, and a manual digitization of features using orthoimagery. Additionally, a QA/QC process was carried out to validate the accuracy of the classifications using random ortho-imagery point interpretation. A total of 2,163 points were manually classified to create the ground truth dataset with accuracy results indicating a 90% confidence in the land cover classification.

The final land cover classification raster covers an area of 188,188 hectares and comprises 1.88 billion pixels at a 1-meter spatial resolution.

Results and Analysis

This report provides baseline data findings and examples of types of analysis that can be completed using the data.

Final land classification results indicate that overall, Niagara Region has a 25.4% TFC cover. The full breakdown of land classifications across the Region is as follows:

Table 1: Land Classification by Type across Niagara Region

Land Classification	Total Hectares	% of Total Land
Tree and Forest Canopy	46789	25.4
Grass and non-treed Vegetation	49205	26.7
Soil and Bareland	72550	39.3
Buildings	4591	2.5
Impervious Cover	11314	6.1
Total:	184449	100%

Land classification data was further disaggregated by the 12 municipality boundaries (Table 2).

Table 2: Land Classification by Type by Municipality

Municipality	Land Area (ha)	TFC	Grass and non-treed Vegetation	Soil and Bareland	Buildings	Impervious Cover
Fort Erie	16,535	34.8%	31.8%	24.8%	2.2%	6.5%
Pelham	12,580	31.4%	31.2%	31.5%	1.9%	4.0%
Niagara Falls	20,833	30.5%	35.0%	20.9%	3.7%	10.0%
Port Colborne	12,069	28.4%	29.1%	35.7%	1.8%	5.1%
Thorold	8,332	26.6%	32.1%	31.7%	2.3%	7.3%
Wainfleet	21,626	25.9%	19.3%	52.2%	0.6%	2.0%
Grimsby	6,854	23.9%	29.7%	34.5%	3.5%	8.4%
St. Catharines	9,598	22.4%	30.3%	15.7%	10.6%	21%
Welland	8,112	22.1%	43.3%	16.2%	5.5%	12.9%
Lincoln	16,217	21.9%	22.6%	48.1%	2.4%	5.0%
West Lincoln	38,628	20.7%	18.6%	58.1%	0.6%	1.9%
Niagara-on-the-Lake	13,108	18.0%	23.4%	49.5%	2.8%	6.2%
Regional Average:	184,492	25.4% (46789 ha)	26.7% (49205 ha)	39.3% (72550 ha)	2.5% (4591 ha)	6.1% (11314 ha)

To gain a better understanding of the overall TFC in urbanized areas, where most of Niagara’s population reside, the data was additionally assessed using the boundaries of the 27 urban areas (Table 3). Overall, the average TFC coverage across all urban areas was 23.8%.

Table 3: TFC by Urban Areas

Municipality	Urban Area	TFC
Pelham	Fenwick	36.2%
	Fonthill	29.7%
Fort Erie	Crystal Beach	31.8%
	Fort Erie	36.8%
	Douglastown	21.4%
	Stevensville	25.0%
Niagara-on-the-Lake	Queenston	46.2%
	Niagara-on-the-Lake	34.5%
	Virgil	19.3%
	St. David's	23.8%
	Glendale	13.6%
Niagara Falls	Niagara Falls	25.5%
St. Catharines	St. Catharines	23.1%
Lincoln	Vineland South	31.2%
	Jordan	26.9%
	Vineland	19.9%
	Jordan Station	24.6%
	Campden	17.8%
	Beamsville	15.6%
	Prudhomes	11.9%
Thorold	Thorold North	13.1%

Municipality	Urban Area	TFC
	Thorold South	12.8%
	Port Robinson	34.0%
Port Colborne	Port Colborne	20.6%
Welland	Welland	18.7%
Grimsby	Grimsby	17.4%
West Lincoln	Smithville	10.4%
	Urban Area Average:	23.8%

Additional high-level analysis was completed using the TFC data. Analysis included intersecting various Statistics Canada levels of geography and population data with the TFC data, as well as using the grass and non-treed vegetation classification layer to determine potential planting area (PPA). The total TFC and PPA of Region owned properties was also investigated. Full results are available in Appendix 2 of this report.

Agricultural TFC

The northern extent of the region, bordering the shoreline of Lake Ontario is predominantly specialty crop agriculture. Vineyards and orchards are numerous outside of settlement areas. Orchard trees aid in the reduction of carbon dioxide alongside other tree species found in Niagara and are an important contributor to the reduction of greenhouse gases. Total TFC as reported in this project is inclusive of orchard canopy, however, additional analysis was conducted to measure the contribution of orchard canopy in areas where tender fruit agriculture is prevalent. Results indicate, total TFC coverage in the Greenbelt Plan area is 23.6%, with orchards accounting for 9.9% of this coverage (i.e., 1,165 ha of the total 11,724 ha of TFC is generated from orchard canopy). Municipalities where orchard canopy is a major contributor to overall canopy, include Niagara-on-the-Lake (23% of total canopy coverage) and Lincoln (13% of total canopy coverage). Figure 3 (Appendix 1) shows a mapped representation of the location of orchard canopy in the Greenbelt Plan area.

Ecosystem Services

Ecosystem services are the ecological benefits that tree canopy provides to humans. Results of the land classification assessment were used to gauge the ecosystem services of the existing TFC at a high level. Ecosystem services of TFC in Niagara were

quantified using i-tree Eco v6 software, produced by the U.S.D.A. Forest Service. Ecosystem Services considered in this study include carbon storage and sequestration, air quality, hydrology, and oxygen production. Full results can be found in Appendix 3 of this report.

Health Impacts

Tree Canopy can have many widespread impacts, not only on the local environment, but also on the social determinants of health of individuals in the community. Environmental, economic and social factors that are impacted by tree canopy affect the health of populations. Environmental factors can include the urban heat island effect, air quality, access to greenspace and resilience to the effects of climate change. The health outcomes impacted by tree canopy end up influencing economics related to healthcare services as increased use of services can be influenced by environmental factors. A detailed literature review on health impacts related to TFC is provided in Appendix 4 of this report.

Challenges

The current replacement value of all the trees in Niagara Region, where the replacement value is the estimated local cost of replacing a tree with a similar tree, is estimated to be \$11 billion. Significant threats to Niagara's TFC include susceptibility to pests and disease, stresses associated with climate change, invasive plant species and land-use change.

Climate change poses a number of potential impacts to TFC, affecting structure, health, distribution, and ecological function. The overall impacts of climate change are highly dependent on geography, existing species compositions, and the added presence of pests and disease.

Urban forest mortality rates have been recorded in some areas across North America, with studies suggesting the annual mortality rate of mature canopy in a forest typically ranges from 1% to 3%. In urban settings, urban tree mortality is highly variable depending on planting locations and general tree maintenance and upkeep. An aim to increase the overall regional TFC would need to account for not only identifying areas where additional tree plantings could occur, but also accommodating replacing trees lost to varying threats, land use changes and other circumstances.

Opportunities

As identified, Niagara's current TFC is estimated to be 25.4%. This baseline provides a reference point to support strategies, targets, and directions aimed at improving the overall canopy across Niagara Region. Section 3.1.25.2 of the Niagara Official Plan supports opportunities for enhancement of woodland cover, including the implementation of the Regional Greening Initiative, private land stewardship, land acquisition or dedication of private land to the Region, Local Area Municipalities, Conservation Authority, or other public or private organizations for tree planting and reforestation efforts; identification of woodland enhancement areas through the completion of watershed plans, subwatershed studies, or similar plans; or required tree and woodland protection and planting through the planning application process.

In the short term, this data quantifies the spatial distribution of TFC throughout the Region and will assist in identifying opportunities for increasing sustainable tree cover on regional properties as part of the Greening Initiative, as well as provide detailed data necessary to support targeting of future initiatives. Additionally, the Region will share the results of this study and the associated data with the local municipalities, to assist with an increased understanding of the coverage across specific areas and enable use of the information to support local initiatives.

Alternatives Reviewed

This report is for information purposes only. No alternatives were reviewed.

Relationship to Council Strategic Priorities

This report supports the following Council Strategic Priorities 2023-2026:

- Green and Resilient Region: Through identification and protection of the natural environment and facilitating the development of climate-resilient communities.

Prepared by:

Karen Costantini, MCIP, RPP
Senior Planner
Growth Strategy and Economic
Development

Recommended by:

Michelle Sergi, MCIP, RPP
Commissioner
Growth Strategy and Economic
Development

Submitted by:

Ron Tripp, P.Eng.
Chief Administrative Officer

This report was prepared in consultation with Susan McPetrie, Planner, Growth Strategy and Economic Development and Jessica Knot, Municipal Health Impacts Advisor, Public Health and Emergency Services, and reviewed by Erik Acs, MCIP, RPP, Manager of Community Planning and Angela Stea, MCIP, RPP, Director of Corporate Strategy and Community Sustainability.

Appendices

Appendix 1	Report PDS 4-2024 Figures
Appendix 2	Additional Analysis
Appendix 3	Ecosystem Services
Appendix 4	Health Impacts Review