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February 23, 2024

CL 3-2024, February 22, 2024
PEDC 2-2024, February 7, 2024
PDS 4-2024, February 7, 2024

Local Area Municipalities

Niagara Peninsula Conservation Authority

SENT ELECTRONICALLY

Tree and Forest Canopy Project
PDS 4-2024

Regional Council, at its meeting held on February 22, 2024, passed the following recommendation of its Planning and Economic Development Committee:

That Report PDS 4-2024, dated February 7, 2024, respecting Tree and Forest Canopy Project, **BE RECEIVED** and **CIRCULATED** to the Local Area Municipalities and the Niagara Peninsula Conservation Authority (NPCA)**.**

A copy of PDS 4-2024 is enclosed for your reference.

Yours truly,

Ann-Marie Norio
Regional Clerk
js
CLK-C 2024-17

cc: K. Costantini, Senior Planner
M. Sergi, Commissioner, Growth, Strategy and Economic Development
N. Oakes, Executive Assistant to the Commissioner, Growth, Strategy and Economic Development

Subject: Tree and Forest Canopy Project

Report to: Planning and Economic Development Committee

Report date: Wednesday, February 7, 2024

Recommendations

1. That Report PDS 4-2024 **BE RECEIVED** for information; and
2. That a copy of Report PDS 4-2024 **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.

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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

Appendix 1

PDS 4-2024

Report Figures

Figure 1: An area mapped with land classification data and an aerial photograph of the same area

Figure 2: Example of the land classification data overlaid on aerial photography

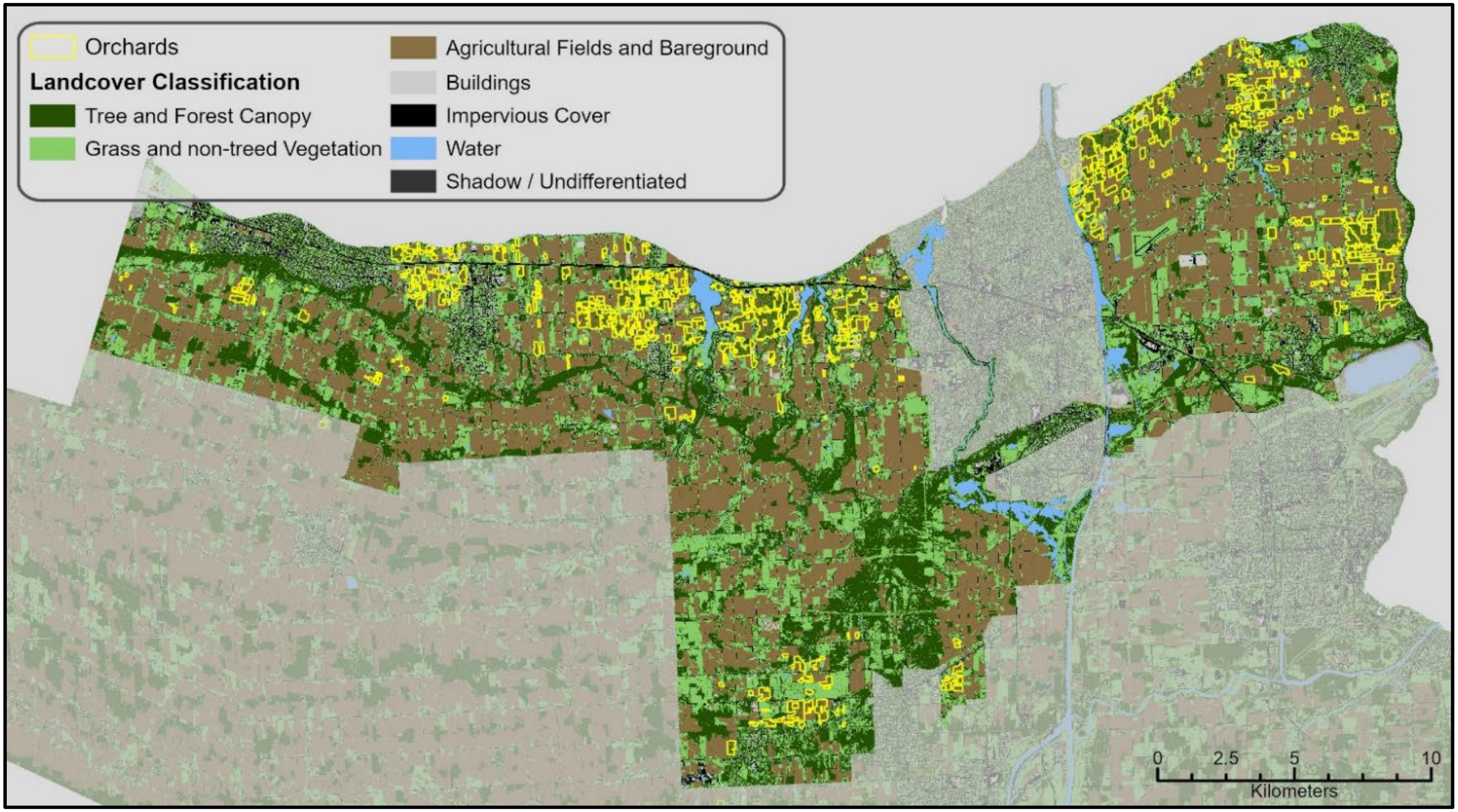

Figure 3: Orchard Canopy in the Greenbelt Plan Area

Appendix 2

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Additional Analysis

Additional Analysis

Geographic Areas

TFC distribution within urban areas was analyzed using Census based dissemination areas (DA's) as the geographical unit for analysis. Results indicate several DA's where "newer" built out residential areas had been recently established, exhibited lower overall TFC rates. This was not an unexpected result as most street and backyard trees were established post construction and have not matured enough to provide a large canopy. Older established neighbourhoods, especially those characterized by larger lots were generally found to have the highest ratios of TFC coverages (e.g., Figure 1 – the first map is a newly built neighbourhood and the second location is north St. Catharines).

Figure 1: Newly developed neighbourhood area with limited canopy coverage contrasted with an older developed neighbourhood with mature canopy coverage

DAs with a mix of commercial and residential development typically had low TFC, as the impervious surface class was very high due to parking areas (Figure 2). Rates of TFC across DAs in urban areas varied greatly (i.e., between 3.5% and 69.2% TFC), however this level of geography is valuable for providing an analysis scale appropriate for specific TFC analysis, targeting and goal setting.

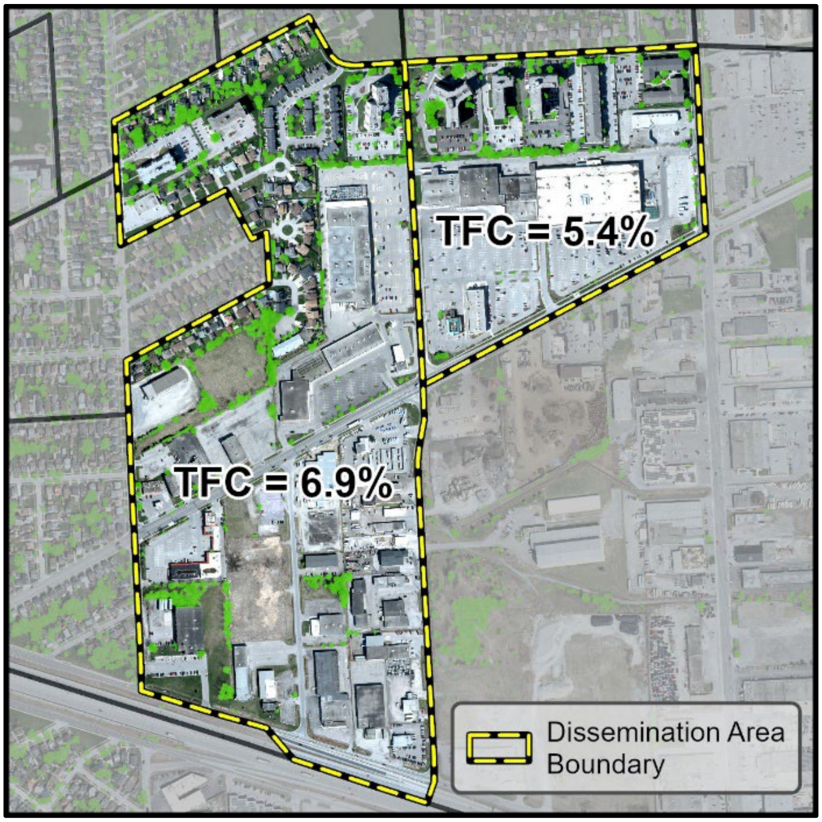

Figure 2: DAs characterized by high instances of commercial uses and impervious surfaces, resulting in low TFC rates

To characterize the relationship between population density and areas of high TFC within urban areas, the top 20 most densely populated DA's (persons/hectare – 2021 Census data) were selected. The DA's had an average 17.8% TFC cover, well below the overall regional canopy average. However, there were a few individual 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 (Figure 3).

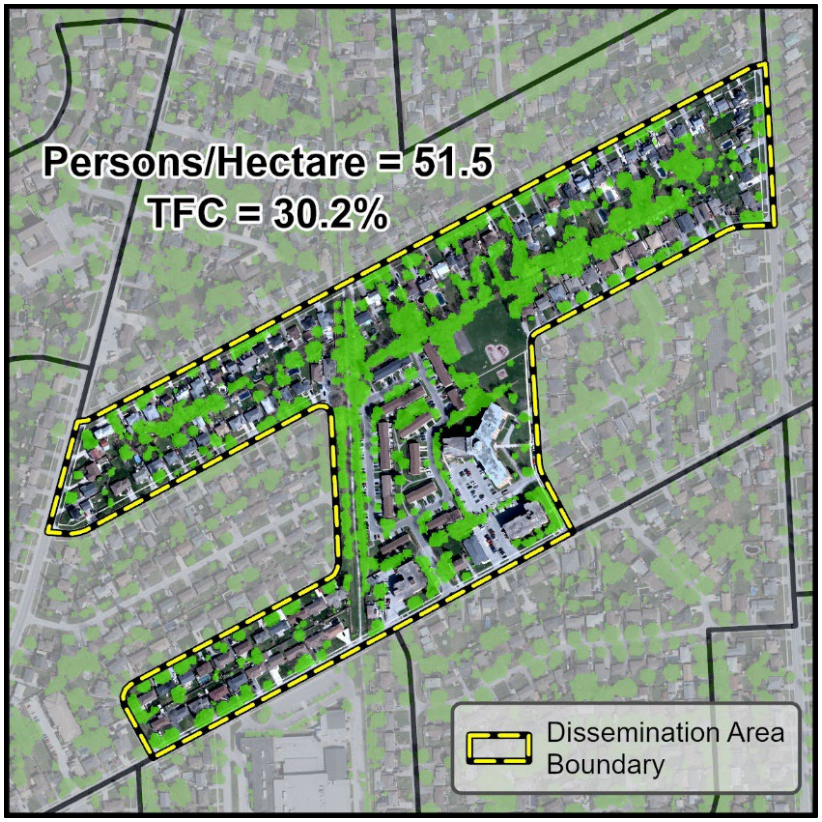

Figure 3: High population density and strong TFC coverage

Dissemination blocks (i.e., the smallest geographic area for which population and dwelling counts are shared by Statistics Canada) were also populated with TFC coverage statistics, and qualitatively mapped with a graduated colour scheme to show an increased level of information on TFC rates across urbanized areas (Figure 4). This type of information is valuable for very specific area targeting or analysis and provides greater detail on the level of cohesive coverage across an area.

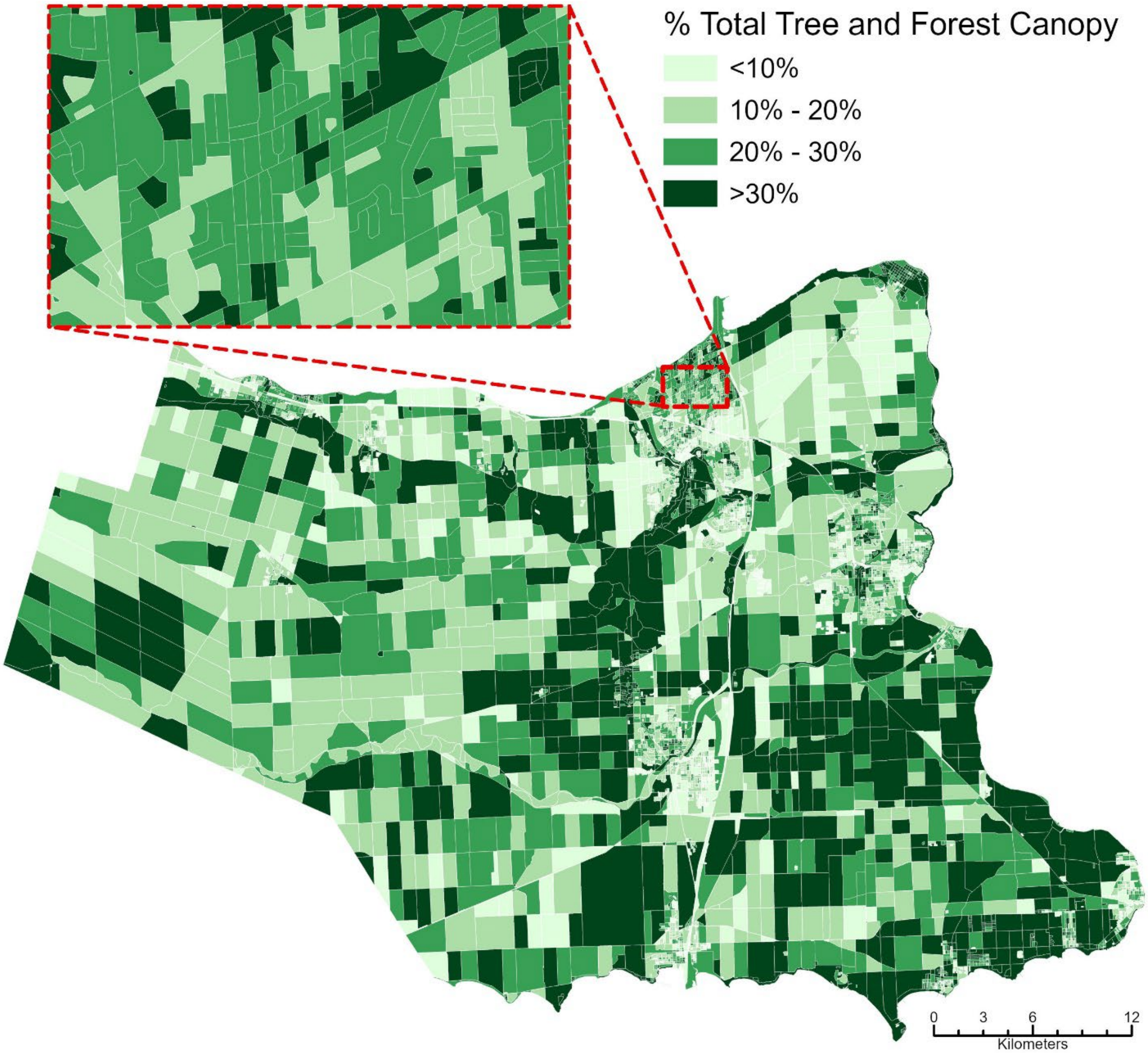

Figure 4: TFC by dissemination block

Potential Planting Area

A general approach to determining potential planting area (PPA) estimates is to examine the TFC of an area in relationship with the total grass and non-treed vegetation classification layer. Grass and non-treed vegetation areas represent land where theoretical tree planting opportunities may exist. The soil and bareland layer is typically comprised of agricultural fields, disturbed areas and gravel lots, thus it is not used in this analysis.

To accurately determine possible planting areas, grass and non-treed area data is selected and then certain lands excluded from the classification, including soccer fields, baseball diamonds and other recreational areas, railway and hydro right-of-ways, community gardens and golf courses, etc. The residual coverage is an estimated hectarage of land area that could possibly be converted to TFC. This data can be further assessed by land ownership (i.e., private land or public land) to determine where opportunities should be targeted. An example of this analysis was completed for the urban areas of Fenwick and Beamsville.

Potential planting area analysis for Fenwick and Beamsville

Urban Area	Fenwick	Beamsville
TFC	36.2%	15.6%
Total Area of UA	250.4ha	674.1 ha
PPA	95.1 ha	229.6 ha
% UA area that is PPA	38.0 %	34.1%
PPA on Private Lands	85.4 ha (89.9%)	167.1 ha (72.8%)
PPA on Public Lands (Including road ROWs)	9.7 ha (10.1%)	62.5 ha (27.2%)

Regional Property Analysis

Individual properties owned by the Niagara Region were assessed for overall TFC. This analysis is beneficial to inform the ongoing planting strategies in support of the Regional Greening initiative. The resulting overall average TFC across all Region-owned parcels was 30.5%. PPA was also determined for each property. Properties were grouped by general type with results shown below. Staff anticipate assessing this data in more detail to determine future areas of opportunity for targeted TFC increases.

Regionally Owned Properties – TFC and PPA

Niagara Region Property Type	TFC	Grass and non-Treed Vegetation (PPA)
Niagara Region Housing	26.7 %	30.1 %
Pumping stations/Water treatment plants	23.4%	41.5 %
Offices, Police Station, Ambulance Bays, Daycares	13.2 %	38.5 %

Niagara Region Property Type	TFC	Grass and non-Treed Vegetation (PPA)
Vacant lands	42.0 %	38.5 %
Other	19.2 %	43.4 %
Overall Average	30.5 %	39.2 %

Appendix 3

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Ecosystem Services

Ecosystem Services Analysis

Carbon Storage and Sequestration

Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. Trees act as natural carbon stores by capturing carbon dioxide and storing it in their biomass and in the soil as organic carbon compounds. The region's TFC carbon storage and gross sequestration rates are estimated as follows:

- Carbon Storage: 4,265.2 metric kilotons
- CO2 Equivalent: 15,639.2 metric kilotons
- Gross Carbon sequestration: 90.2 metric kilotons/yr
- CO2 Equivalent: 330.9 metric kilotons/yr

The overall valuation of the carbon storage and sequestration ecosystem services from TFC is estimated to be $489.9 million + $10.4 million/yr. These valuation estimates are based on carbon pricing of $114.87/metric ton.

Air Quality

TFC absorbs carbon dioxide, volatile organic compounds, nitrogen dioxide, and particulate matter, therefore improving air quality. The region's TFC is estimated to remove 2,757.7 metric tons/yr of pollution:

- CO: 15.15 metric tons/yr Carbon Monoxide
- NO2: 257.91 metric tons/yr Nitrogen Dioxide
- O3: 1,933.98 metric tons/yr Ozone
- PM2.5: 107.36 metric tons/yr Particulate matter less than 2.5 microns in size
- SO2: 443.31 metric tons/yr Sulphur Dioxide

Hydrology

Surface runoff from storm events is often amplified in urban areas where impervious surfaces are prevalent. Runoff can gather surface pollutants which can end up deposited in surrounding aquatic ecosystems. TFC has the ability to intercept varying degrees of rainfall. Run off avoidance also contributes to substantial cost reductions to stormwater management controls. The total avoided surface runoff from Niagara Region's TFC is estimated to be 598,000 m3/yr.

Oxygen Production

The amount of oxygen produced is directly related to the amount of carbon sequestered by trees. The region's TFC is estimated to produce 240.6 metric kilotons/yr of oxygen.

Appendix 4

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Health Impacts Assessment

Logic Model

Environmental, economic and social factors that can be impacted by tree canopy and the associated health outcomes are outlined below in Figure 1. A brief summary of recent literature on tree canopy as it relates to the identified health impacts is included below.

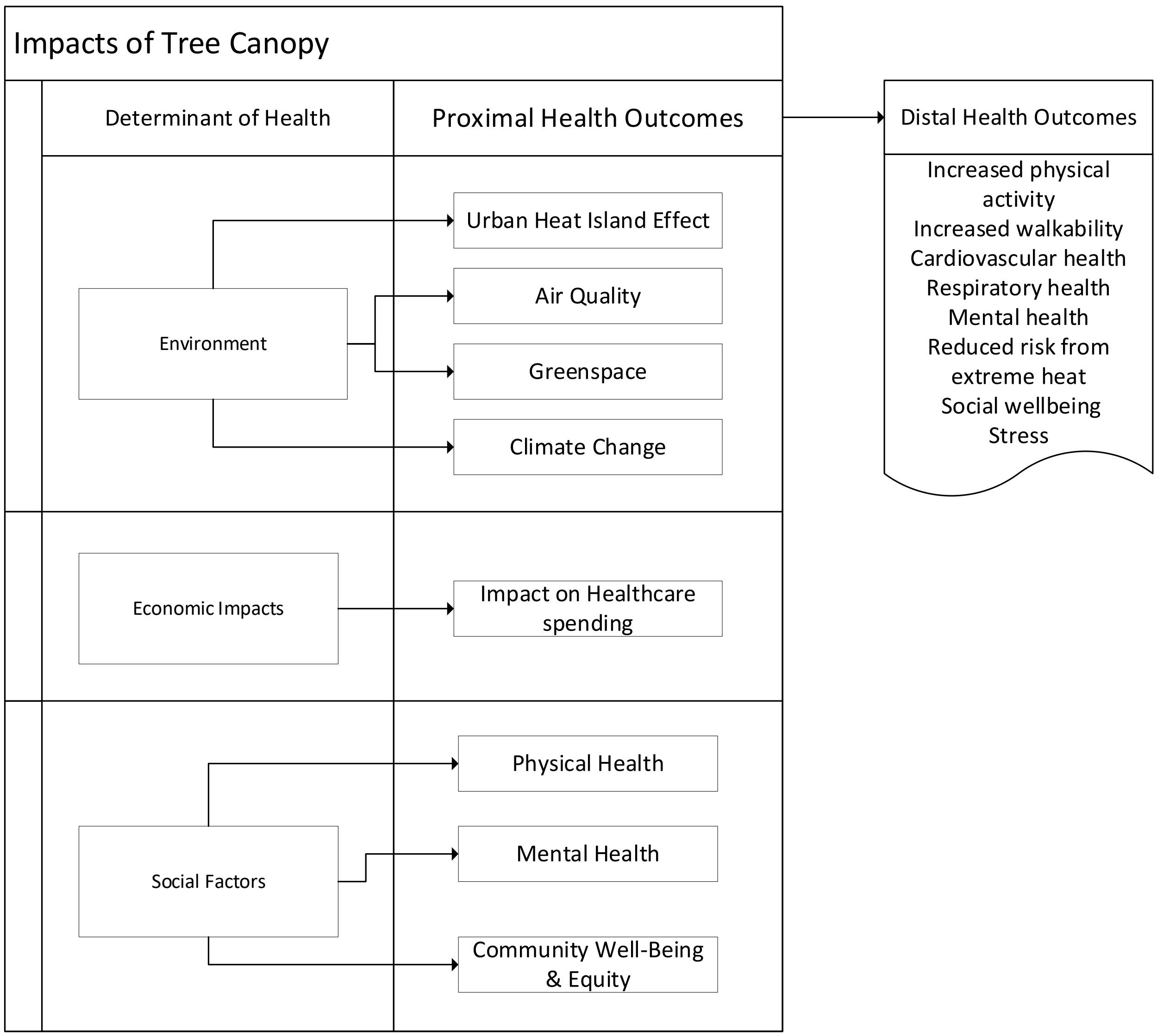

Figure 1: Logic Model

Assessment of Literature

Urban Heat Island Effect and Climate Change

The Urban Heat Island Effect is when areas in urban centres experience higher temperatures for longer periods of time, due to the lack of trees and vegetation to cool the areas, additionally these areas are often built with heat-absorbing materials.[i] This results in cities becoming hotter than rural areas and can magnify the impacts of warmer temperatures, especially during extreme heat events.[ii] Temperature increases caused by the urban heat island effect can be counteracted by having a developed tree canopy present.[iii] Increased canopy cover can reduce overall temperatures in the summer as well as reduce humidex values during a heat wave.[iv]

Serious health hazards can result from an inability to cool down or as a result of continued exposure of extreme temperatures. Swelling, heat rash, fainting and heat stroke can be caused by a heat wave, additionally, pre-existing conditions such as heart disease, kidney disease, asthma, COPD and other lung conditions can be exacerbated by extreme temperatures.[v] Higher mortality rates and increased use of healthcare services can be seen even during short-term rises in outdoor temperatures.[vi] Through a heat wave in Quebec in 2018, 86 heat-related deaths occurred.[vii] Studies have estimated that an increase in temperature of 2 – 3 degrees Celsius can translate into an increase in mortalities due to heat of 4 – 7 percent.[viii] During periods of extreme heat, increased tree canopy cover can reduce heat stress within neighbourhoods at the street level, this can result in fewer heat-related emergency room visits and heat-related mortalities.[ix,x]

Certain populations are more vulnerable to the impacts of heat waves and may be more likely to experience heat-related illness. Populations including young children, older populations, individuals with pre-exiting health conditions, socially isolated populations, individuals with mobility issues, individuals working outdoors or homeless populations are disproportionately affected by heat-related illnesses.[xi] As well, lower income populations may live in areas that lack green space, air conditioning and are without access to a pool, further impacting the health effects of extreme heat.[xii] Individuals facing mobility challenges or who are socially isolated may have a harder time accessing help or moving somewhere cooler. A higher risk may also be experienced by individuals who may have limited access or understanding of information provided by public health such as a heat warning if it is only provided in English and no additional languages.[xiii]

Urban heat islands can be reduced by expanding vegetation cover, increasing surface reflectivity of buildings and paving materials and retrofitting buildings to be more energy efficient[xiv] Building temperature can be reduced by having large shade trees planted beside them, reducing the need for air conditioning as well as blocking cold winds and lowering the cost of heating.[xv] A recent study on suburban neighbourhoods in Peel Region found that during a heat wave urban trees could make it feel up to eleven degrees Celsius cooler.[xvi] Increasing vegetative or grassy surfaces and reducing the amount of pavement or other impervious surfaces can also support decreases in temperatures.[xvii]

A study in Toronto found that neighbourhood canopy cover had a negative correlation with the number of heat-related ambulance calls.[xviii] Five times as many heat-related calls were seen from neighbourhoods with less than five percent canopy cover compared to neighbourhoods with greater than five percent canopy cover.[xix] Fifteen times as many heat-related calls were seen compared to neighbourhoods with over seventy percent tree canopy cover.[xx] Increased canopy cover could therefore result in reduced heat-related ambulance calls.

Canada will continue to see an increase in the number of heat waves that are experienced as temperatures continue to rise due to climate change. Canada will see substantial increases in daily extreme temperatures and an increase in 'hot days' where the maximum temperature is over thirty degrees Celsius.[xxi] By 2051-2080, Canadian urban centres are estimated to experience longer extreme heat events with four times as many days over thirty degrees Celsius.[xxii] Climate predictions have flagged Niagara Falls – St. Catharines as one of the top ten metropolitan areas that will be at the highest risk for average length of heat waves, highest maximum temperatures and number of very hot days.[xxiii] Communities need to build climate change resilience into their environments and tree canopy can mitigate the urban heat island effect, providing cooling and protecting people from the heat.[xxiv]

Impact on Healthcare Spending

The relationship of tree canopy and extreme heat events has also been shown to impact the usage of health care services or systems. Studies controlling for economic status and demographics have seen lower rates of utilizing mental health services and treatments in communities with higher levels of tree cover and green space.[xxv] Extreme heat events also cause health system strain through increased number of ambulance calls, increased number of visits to emergency departments and increased usage of telephone helplines.[xxvi]

Tree canopy can also support long term health impacts of populations through the positive effect it has on air quality, with urban tree cover acting as a buffer to airborne pollution.[xxvii] Increased canopy cover can filter pollutants and improve air quality, positively impacting respiratory health.[xxviii] This impact is significant as it is estimated that in Canada each year there are approximately 21,000 premature deaths related to air pollution.[xxix]

A study done on the tree canopy in Brampton, Ontario quantified the health benefits of canopy cover by determining their healthcare savings associated with reduced heat, lower levels of air pollutants, increased physical activity and improved mental health, which are all impacted by tree canopy levels.[xxx] It was estimated that a scenario with a 50 % increase in tree canopy cover (current baseline canopy cover at 18.4% increasing to 27.6% cover) could equal $2,437,363 in healthcare savings and with an 80% increase in canopy cover, savings of $3,175,826.[xxxi]

Physical Health, Mental Health & Greenspace

Urban forests have demonstrated positive effects on individual's health by improving mental health and encouraging the use of greenspace, increasing physical activity and reducing stress which are associated with preventing chronic diseases.[xxxii] Studies have demonstrated that a 30% canopy cover can provide health benefits including improved mental health, decreased incidence of heart disease, diabetes and hypertension and reduced feelings of loneliness.[xxxiii] Mood and stress have been found to be positively impacted by exposure to natural areas including community gardens, forests or parks.[xxxiv] Green space can impact individual’s social well-being by providing space for individuals to join together and socialize as well as providing opportunities for building community networks through social activities. Higher levels of reported health and well-being, mental well-being and self-reported happiness is positively associated with spending time in a green space.[xxxv]

Additionally, the impact tree canopy has on extreme heat events can also impact health through the mitigation of negative health effects experienced during extreme heat exposure. Increased mood and behavioural distress and exacerbated mental illnesses have been documented from experiencing extreme heat.[xxxvi] Heat related mental health impacts are more likely to affect seniors, individuals with existing mental health conditions or individuals with chronic diseases.[xxxvii]

Community Well-Being and Equity

Health impacts associated with tree canopy may hit certain populations disproportionately. Individuals living on lower incomes are often impacted more significantly during extreme heat events, this can be due to many reasons such as living somewhere without air conditioning, not having access to green space in their neighbourhood or not being able to access a pool.[xxxviii] The urban heat island effect will also disproportionately magnify health impacts of heat for populations living in urban areas. Social isolation and low-income were identified risk factors for individuals who died during the heat wave in Montreal in 2018.[xxxix] Public green spaces and tree canopy cover are less accessible to low-income and racialized communities in Toronto, meaning they experience less mitigation of the urban heat island effect.[xl] These inequities in the availability of tree canopy and greenspace resulting because there is increased access found in affluent areas exacerbates the negative health outcomes experienced by marginalized communities without the protective factors tree canopy provides against heat and air pollution.[xli] The ability to adapt and be resilient to the effects of climate change on health is also connected to how accessible and available emergency management and public health services are to various communities.[xlii]

With this knowledge of how different communities could be impacted by tree canopy cover, equity can be used as a factor to identify neighbourhoods that may be especially vulnerable to extreme heat. By assessing factors such as income, age, existing canopy and access to supportive community resources such as a pool, identified communities can then be prioritized for future urban tree plantings, and/or protecting of existing canopy.[xliii]

[i] HealthyDesign.City (2021) Heat Islands. https://healthydesign.city/heat-islands/
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