Tree Canopy Assessment

Canada's
Capital Region

Fall 2019

Ottawa   Ville de Gatineau   NCC CCN

This assessment provides decision makers with the information needed to better understand and make more informed decisions about the forests and urban trees in the Capital Region. This assessment was completed by the University of Vermont Spatial Analysis Laboratory. This project was made possible through a collaborative partnership between the National Capital Commission (NCC), the City of Ottawa and the Ville de Gatineau.

THE NEED FOR GREEN

Cities are facing a host of environmental challenges, from stormwater runoff to the urban heat island effect. At the same time, cities are seeking to become more livable and sustainable to attract businesses and residents, while ensuring equitable access to environmental amenities. Trees provide a host of ecosystem services. Their canopies provide habitat for wildlife. The transpiration process reduces summer temperatures. And research has shown that trees can even improve social cohesion and reduce crime. A healthy and robust tree canopy is crucial to the sustainability and livability of our urban areas.

TREE CANOPY ASSESSMENT

For decades, governments have mapped and monitored their infrastructure to support effective management. That mapping has primarily focused on grey infrastructure, features such as roads and buildings. The tree canopy assessment protocols were developed to help communities develop a better understanding of their green infrastructure through tree canopy mapping and data analytics. **Tree canopy is defined as the layer of tree leaves, branches and stems that provide tree coverage of the ground when viewed from above**. When integrated with other data, such as property land use or demographic variables, tree canopy maps can provide vital information to help governments and their citizens chart a greener future. Tree canopy assessments have been carried out for over 80 communities in North America. This study assessed tree canopy within the boundaries of the City of Ottawa and Ville de Gatineau, and the lands managed by the NCC.

MAPPING THE TREE CANOPY FROM ABOVE

Tree canopy assessments rely on remotely sensed data in the form of aerial imagery, and light detection and ranging (LiDAR). These data sets, which have been acquired by various governmental agencies in the Capital Region, are the foundational information for tree canopy mapping. Imagery provides information that enables features to be distinguished by their spectral (colour) properties. As trees and shrubs can appear spectrally similar, or obscured by shadow, LiDAR, which consists of 3-D height information, enhances the accuracy of the mapping. Tree canopy mapping is performed using a scientifically rigorous process that integrates cutting-edge automated feature extraction technologies with a detailed manual review and editing. This combination of sensor and mapping technology enabled the mapping of the Capital Region's tree canopy in 1,000 times greater detail than ever before. From the street tree in an Ottawa suburb to an old-growth tree in the forests of Gatineau Park, every tree in the Capital Region was accounted for.

2m
The height cut-off used for separating tree canopy from other vegetation was two metres.
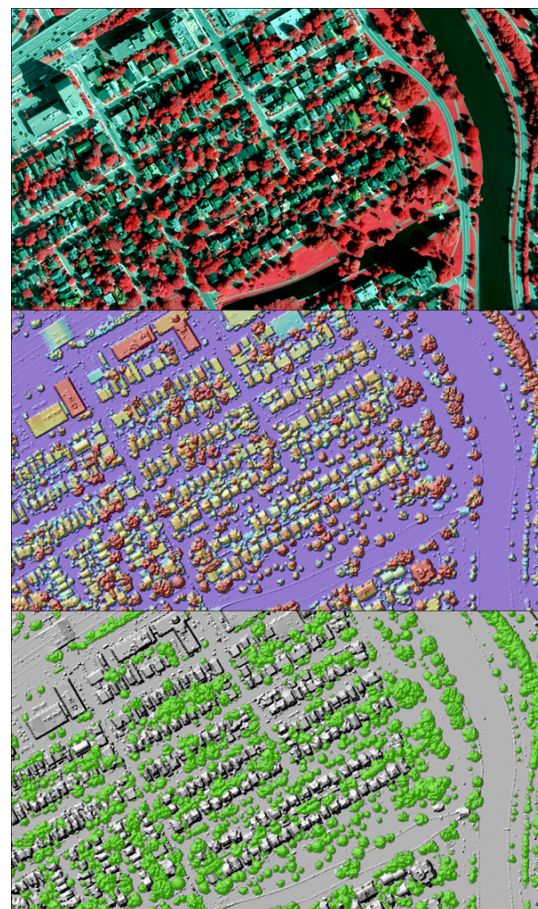

Figure 1: Imagery (top), LiDAR surface model (middle) and high-resolution tree canopy (bottom).

LiDAR data are acquired from a plane using a laser sensor. By sending out laser pulses, LiDAR is capable of generating detailed 3-D models. Unlike imagery, LiDAR is not sensitive to shadowing from the sun, making it helpful for mapping trees in downtown areas. LiDAR produces a 3-D point cloud, which is a collection of locations from which the laser has reflected off features on the Earth's surface.
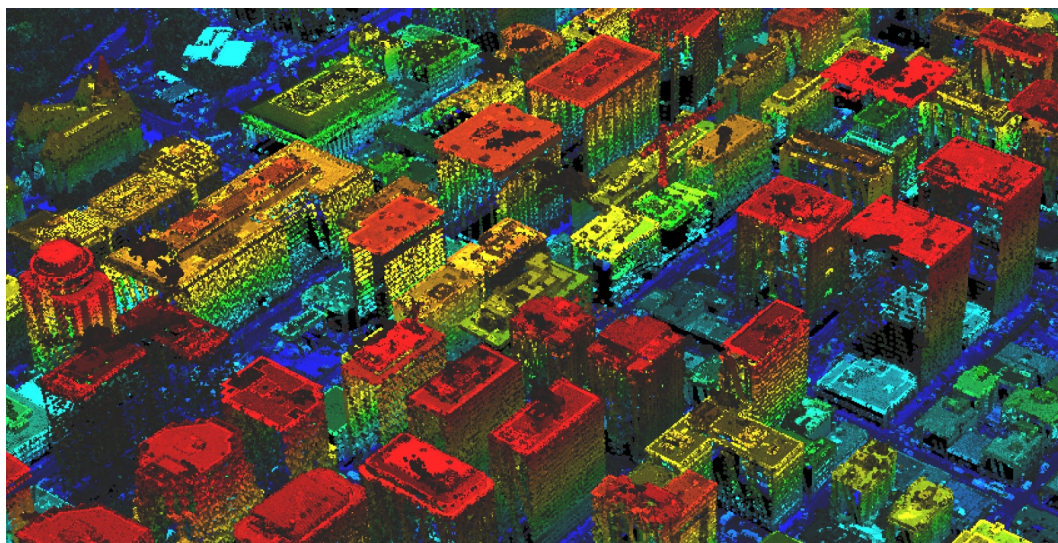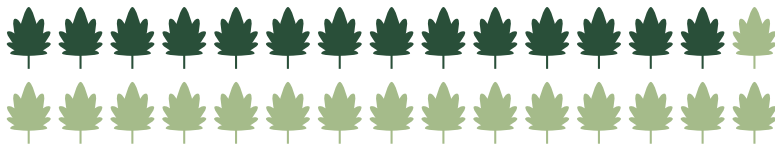

LiDAR point cloud for the Ottawa downtown area. Points are coloured by height above ground, with blue representing the lowest elevation and red, the highest.

TREE CANOPY METRICS

46%
of the land is covered by tree canopy within the boundaries of the City of Ottawa, Ville de Gatineau and the lands managed by the NCC.

Using Geographic Information Systems (GIS), the tree canopy of various geographical units was analyzed. The units ranged from the entire defined region to individual neighbourhoods. The tree canopy metrics thus indicate the total area, as well as the percentage of land covered by tree canopy for the defined area and for each geographical unit.

Partners

Three main partners undertook this tree canopy assessment within the Capital Region: the NCC, Ville de Gatineau and City of Ottawa. Ottawa has the largest area of tree canopy, primarily because of its larger land area. NCC lands have the highest amount of land covered by tree canopy, a result of the number of parks and protected areas under the NCC's management. Compared with Ottawa, Gatineau has a slightly higher percentage of its land covered by tree canopy.
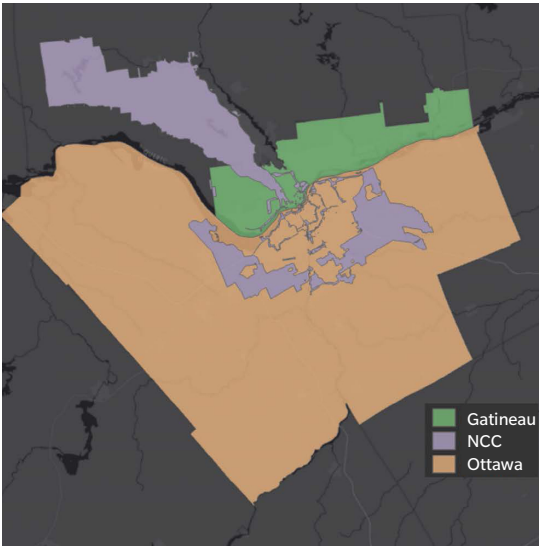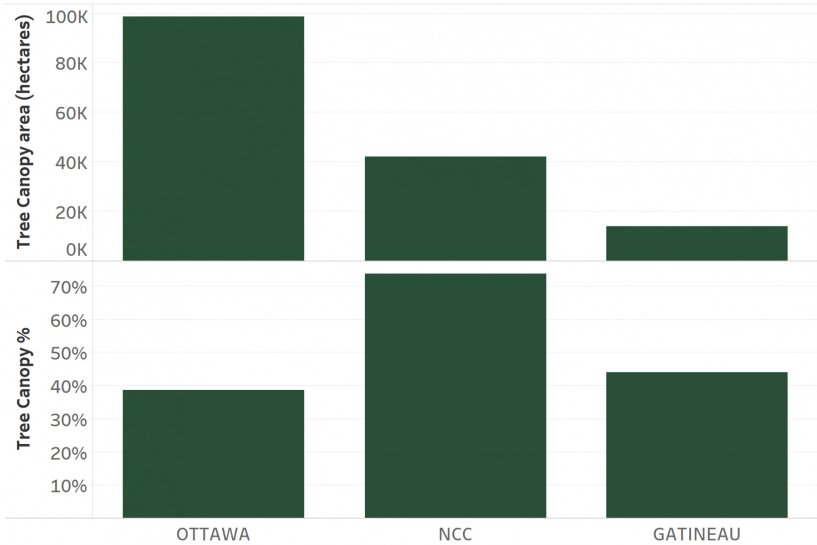
Figure 3: Partner boundaries

Figure 4: Partner tree canopy metrics

Gatineau Urban Tree Canopy

45%

Ottawa Urban Tree Canopy

31%

Urban areas do not make ideal environments for trees to thrive, but urban areas are where trees can have the most significant impact on human health and well-being. Urban density, the number of parks, management practices and land use history are factors that contribute to the percentage of tree canopy in Gatineau's and Ottawa's urban areas. In Gatineau's urban area, which includes farms and green spaces, tree canopy covers 45 percent of the land. In Ottawa's urban area, 31 percent of the land is covered by tree canopy. This includes inner urban areas bounded by the Greenbelt, as well as the suburban areas beyond the Greenbelt.

Electoral Boundaries (Wards)

Tree canopy information for each electoral boundary (ward in both the City of Ottawa and the Ville de Gatineau) provides the information elected officials need to gain a better understanding of the ecosystem services to which their constituents have access. Figure 6 shows the 10 wards with the lowest percentage of tree canopy coverage. The average tree canopy across all wards is 38 percent. The 10 wards with the lowest percentage have under 30 percent tree canopy. Figure 9 shows the tree canopy coverage for all wards in both the City of Ottawa and the Ville de Gatineau.
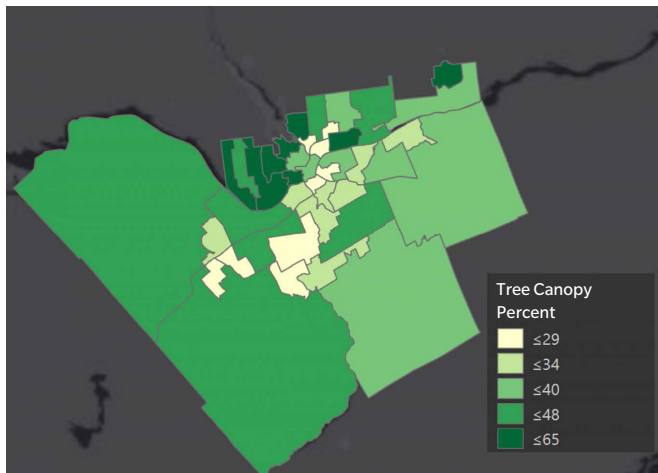

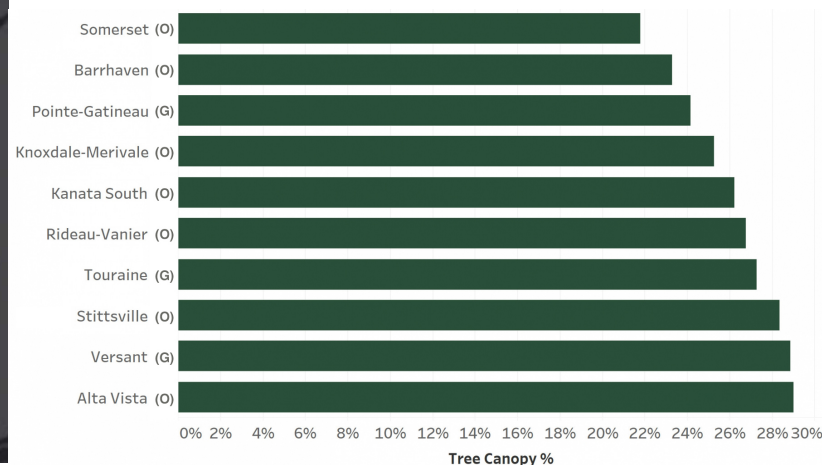Figure 5: Percentage of tree canopy by ward

Figure 6: The 10 wards with the lowest percentage of tree canopy: (O) indicates Ottawa and (G) indicates Gatineau

NCC Lands

The NCC oversees a considerable amount of land within the Capital Region. Gatineau Park alone contributes over 30,000 hectares of tree canopy. Although the areas managed by the NCC within the urbanized region have considerably less total tree canopy, they have higher-than-average amounts of tree canopy compared with the region as a whole. NCC lands are an essential resource that provides access to natural areas for residents of the Capital Region.
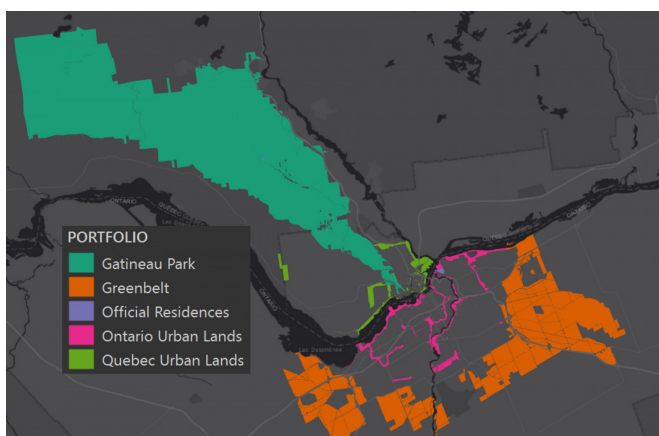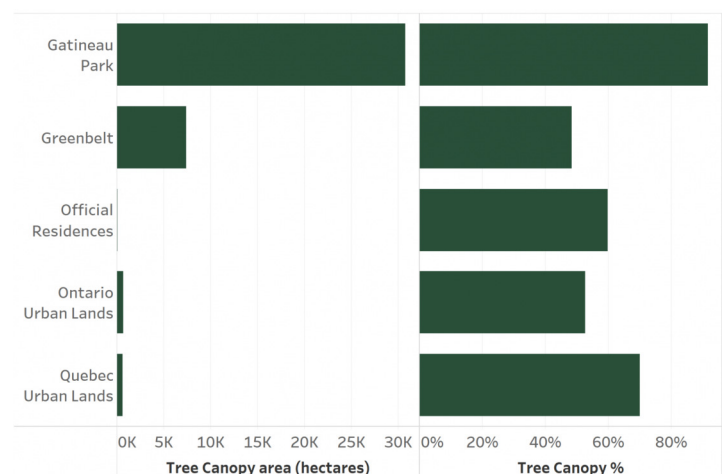

Figure 7: NCC lands by portfolio type

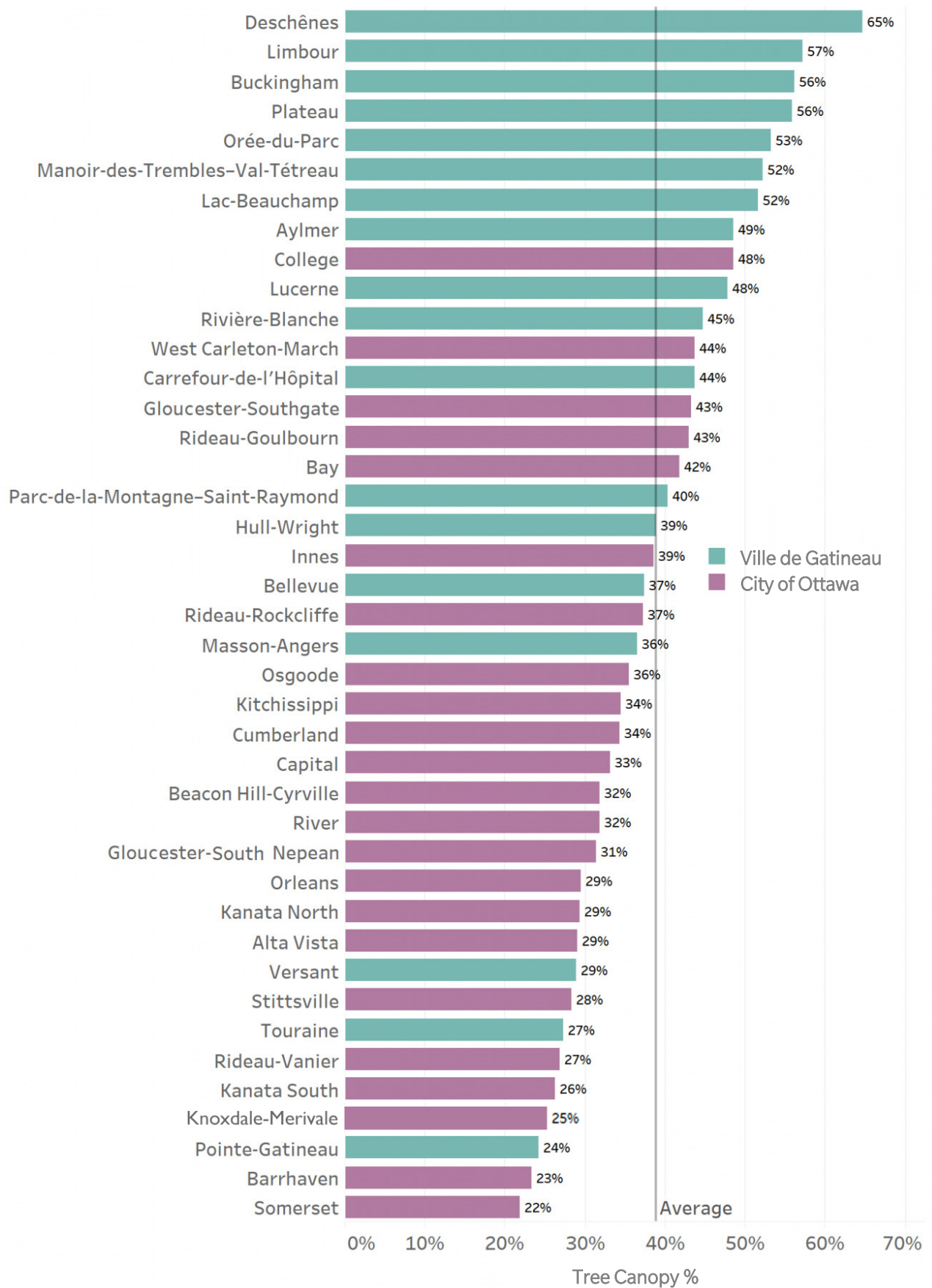Figure 8: NCC land tree canopy metrics summarized by portfolio

Figure 9: Tree Canopy by Ward

Neighbourhoods

The desirability of a neighbourhood can depend on layout, urban or rural characteristics, schools, and proximity to things like employment, restaurants and transportation. Research shows that neighbourhoods with higher amounts of tree canopy provide their residents with more ecosystem services, ranging from cooler summer temperatures to improved academic performance in children. Not surprisingly, tree canopy is considered a desirable neighbourhood trait. Within Canada's Capital Region, there are wide-ranging differences in the percentage of tree canopy in the various neighbourhoods. Some of this variation is due to the degree of urbanization and the current land use, but other factors such as housing age also play a role. For example, in Constance Bay, in Ottawa, nearly 80 percent of the land is covered by tree canopy, whereas the Orléans industrial neighbourhood has less than 10 percent tree canopy.
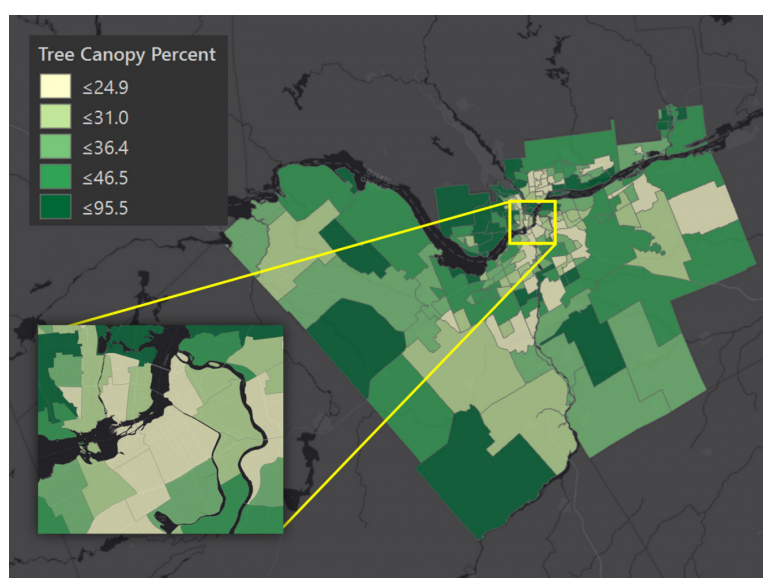

Figure 10: Percentage of tree canopy by neighbourhood

Figure 11: Neighbourhood examples: Constance Bay (80%, top left), Limbour (65%, top right), Val-D'Oise (16%, bottom left), Orléans Industrial (10%, bottom right)
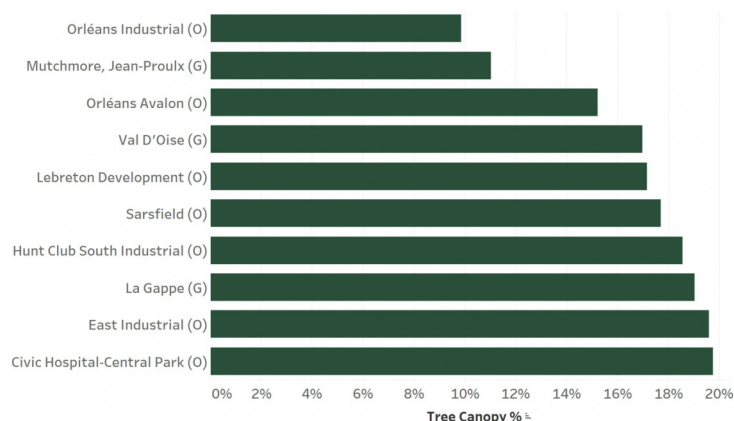

Figure 12: The 10 neighbourhoods with the lowest percentage of tree canopy: (O) indicates Ottawa and (G) indicates Gatineau
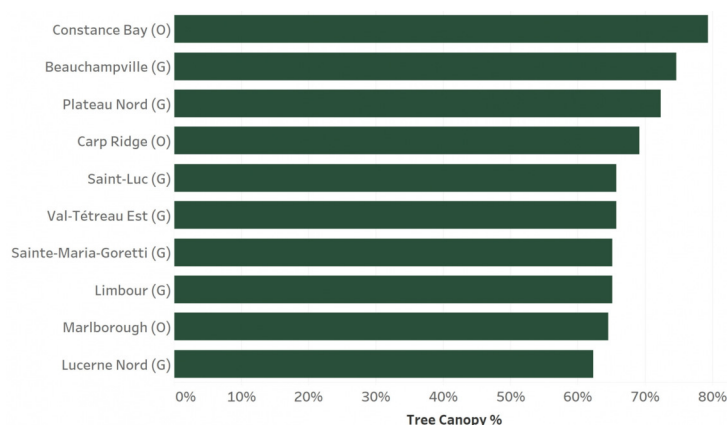

Figure 13: The 10 neighbourhoods with the highest percentage of tree canopy: (O) indicates Ottawa and (G) indicates Gatineau
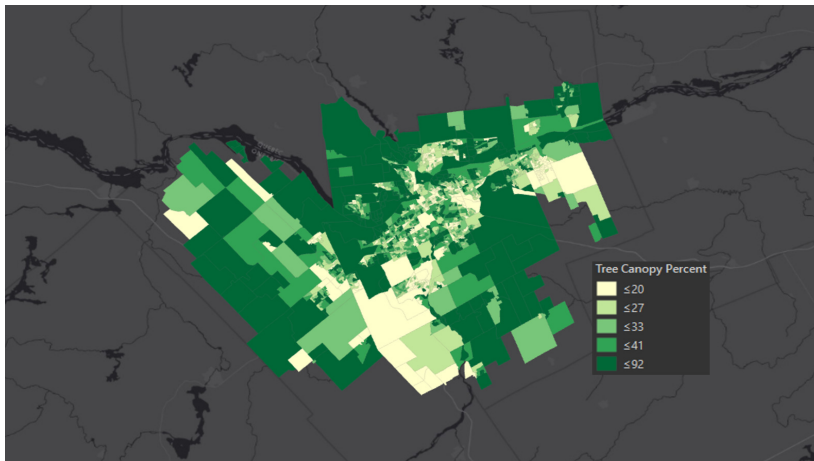
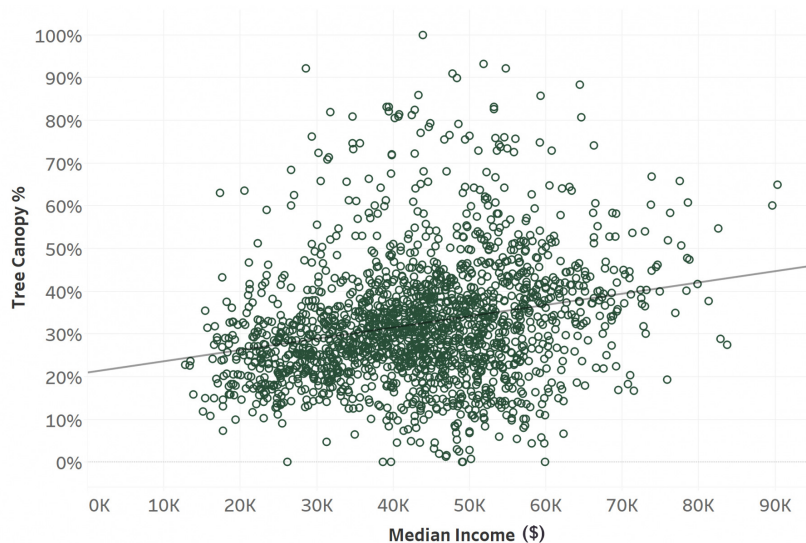Figure 14: Dissemination area percentage tree canopy

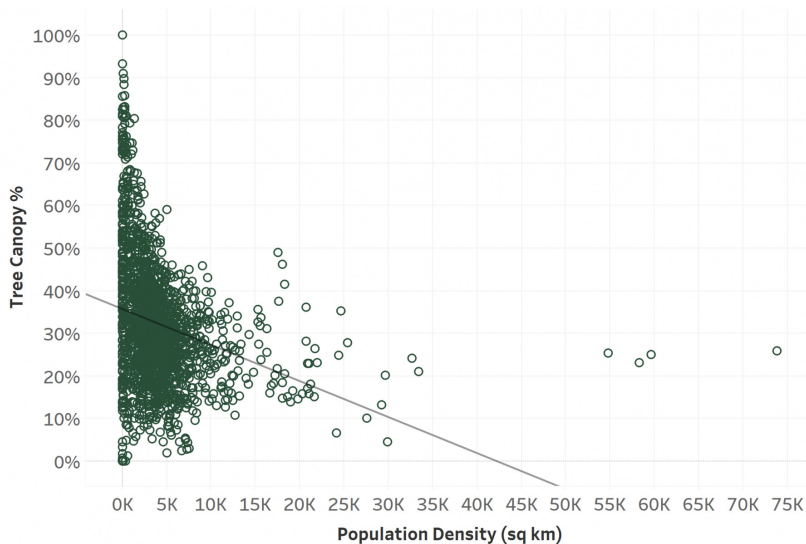Figure 15: Relationship between the percentage of tree canopy and median income

Figure 16: Relationship between the percentage of tree canopy and population density

Statistics Canada uses dissemination areas to summarize socio-demographic information. The entire country is divided into dissemination areas that have a population of 400 to 700 persons. Thus, dissemination areas in rural parts of the country have a greater land area compared with those in population-dense urban regions. While a person may not associate their home with a dissemination area, as they do with their neighbourhood, dissemination areas have a wealth of demographic information associated with them. Linking tree canopy with socio-demographic information can help highlight areas where inequities or instances of environmental injustice may be present.

This study explored the relationship between tree canopy and two variables stored within the dissemination area data set: median income, and population density. A statistically significant relationship exists between median income and the percentage of tree canopy, meaning that areas with wealthy individuals tend to have higher amounts of tree canopy. This relationship does not always hold true, as evident in some lower-income rural areas with high amounts of tree canopy, and wealthy downtown areas with lower amounts of tree canopy. A statistically significant inverse relationship exists between tree canopy and population density. Despite this relationship, there are highly populated areas that have relatively high percentages of tree canopy due to the presence of urban forests.

Zoning provides a mechanism to control the types of uses permitted in a particular land area. These uses, in turn, can significantly influence the amount of tree canopy. Industrial- and commercial-zoned areas typically have substantially less tree canopy cover than that of conservation areas. This study looked at the relationship between tree canopy and zoning in Ottawa and Ottawa's urban area. Future work will include an examination of Gatineau's zoning. Ottawa has dozens and dozens of zoning categories. To simplify the reporting, these zoning categories were consolidated into 10 general classes. For each of the 10 classes, tree canopy metrics that summarize the total area of tree canopy and percentage of land covered by tree canopy were calculated (*Figure 17*). An additional analysis computed the percentage of all tree canopy within the urbanized area that resided within each zoning class (*Figure 18)*. Land reserved for recreation or conservation (the "environmental protection" and "open space" classes) contains the vast amount of Ottawa's tree canopy. While a few government entities make decisions about the tree canopy in the lands zoned as "open space" and "environmental protection," tens of thousands of individuals make decisions about tree canopy on land zoned as "residential." These individuals collectively provide a public good which generates ecosystem services that benefit the Capital Region.
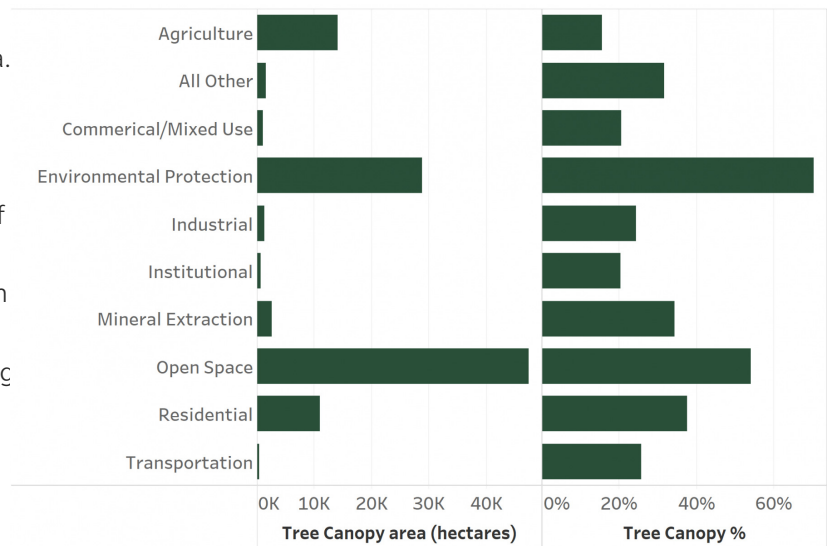
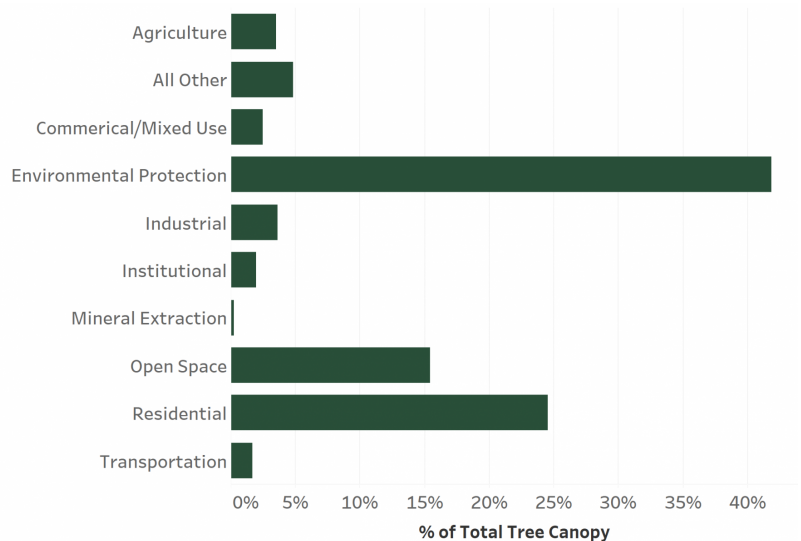Figure 17: Area and percentage of tree canopy cover by zoning for all of Ottawa

Figure 18: Percentage of total tree canopy in each zoning class for Ottawa's urban area

Within the urbanized area, lands zoned as "environmental protection" have the greatest percentage of urban tree canopy, at over 40 percent, but lands zoned as "residential" play a prominent role, with nearly 25 percent of the urban tree canopy.

FINDINGS

Overall, the region has a robust amount of tree canopy. The tree canopy managed by the partners provides important ecosystem services to the residents of the region.

The tree canopy is not evenly distributed, with many areas having far less than the regional average. This extends to ecosystem services, which are not evenly distributed.

Environmental justice issues are cause for concern, particularly the fact that wealth may provide greater access to tree canopy.

Urbanization, zoning and land use history all play a role in influencing the current state of the tree canopy.

RECOMMENDATIONS

The tree canopy assessment data should be integrated into planning decisions at all levels of government. For example, prioritizing conservation and planting initiatives.

The tree canopy should be reassessed at 5- to 10-year intervals to monitor change.

Preserving the existing tree canopy is the most effective means of ensuring future tree canopy, as loss happens at a point in time, but gain is a process that occurs over a longer period of time.

This assessment is not a replacement for field data collection on tree species, size and health.

For more information about how this assessment and data will be used:
NCC Forest Strategy
Ottawa's Urban Forest Management Plan
Ville de Gatineau's Plan de gestion des arbres et des boisés (French only)