TREE CANOPY ASSESSMENT

For

CITY OF COLLEGE PARK, MD

By SavATree Consulting Group

In collaboration with University of Vermont Spatial Analysis Lab

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Collge Park Tree Canopy Assessment

Why is Tree Canopy Important?

Trees provide many benefits to communities, such as improving water quality, reducing stormwater runoff, lowering summer temperatures, reducing energy use in buildings, removing air pollution, enhancing property values, improving human health, providing wildlife habitat, and aesthetic benefits[1]. Many of the benefits that trees provide are correlated with the size and structure of the tree canopy which is the layer of branches, stems, and leaves of trees that cover the ground when viewed from above. Therefore, understanding tree canopy is an important step in urban forest planning. A tree canopy assessment provides an estimate of the amount of tree canopy currently present as well as the amount of tree canopy that could theoretically be established. The tree canopy assessment can be used by a broad range of stakeholders to help communities plan a greener future.

[1]National Research Council. *Urban Forestry: Toward an Ecosystem Services Research Agenda: A Workshop Summary*. Washington, DC: The National Academies Press, 2013.

How Much Tree Canopy Does College Park Have?

An analysis of the city's tree canopy based on land cover data (Figure 1) derived from circa 2018 data found that 1341 acres of the city is covered by tree canopy (termed Existing Tree Canopy). This represents 38% of all of the land within the City (Figure 2). An additional 43% (1545 acres) of the city's land area contains space to accommodate tree canopy (termed Possible Tree Canopy). Within the Possible category, 28% (1009 acres) of total land area was classified as Vegetated Possible and another 15% (536 acres) as Impervious Possible. Establishing tree canopy on areas classified as Impervious Possible will have a greater impact on water quality and summer temperatures while planting on Vegetated Possible (grass/shrub), will generally be easier. 19% (742 acres) of the city is generally not suitable for establishing new tree canopy (buildings and roads).

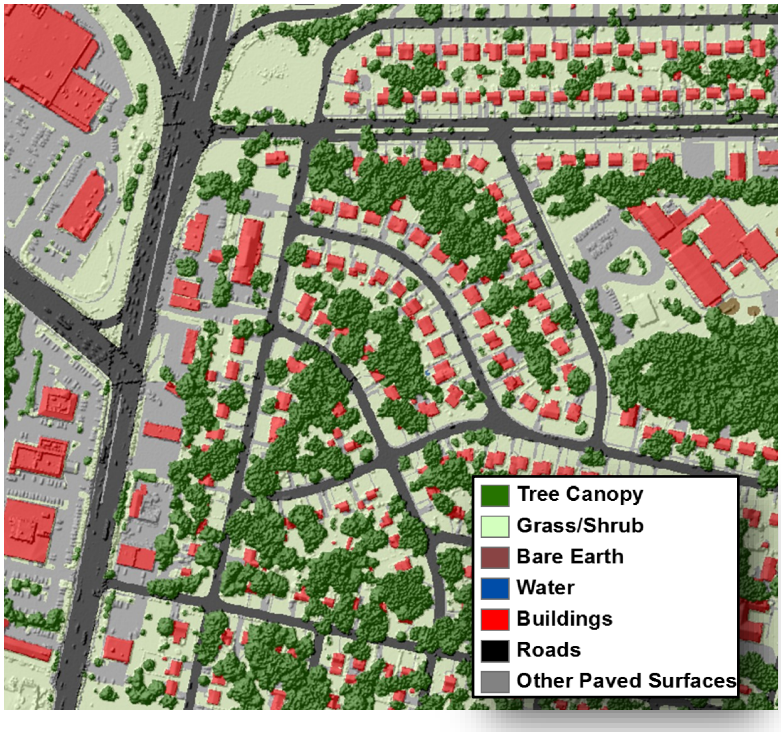

Figure 1: Example of the land cover derived from high-resolution imagery for this project.

About the Project

This project applied the USDA Forest Service's Tree Canopy Assessment protocols to the City of College Park. The analysis was conducted using imagery and LiDAR acquired in 2017 and 2018, respectively.

SaveATree, in collaboration with the Spatial Analysis Laboratory (SAL) at the University of Vermont's Rubenstein School of the Environment and Natural Resources, carried out the assessment. Data from 2009, 2014, and 2018 were used.

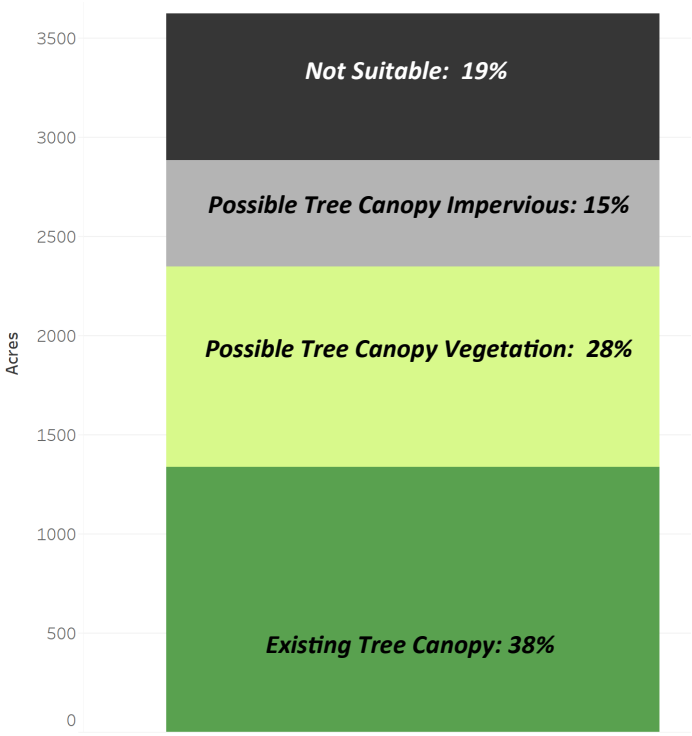

Figure 2: Tree Canopy metrics showing the total acres of land area covered by each category.

Key Terms

Tree Canopy: Tree canopy is the layer of branches, stems, and leaves of trees that cover the ground when viewed from above.
Land Cover: Physical features on the earth mapped from aerial or satellite imagery, such as trees, grass, water, and impervious surfaces.
Existing Tree Canopy: The amount of urban tree canopy present when viewed from above using aerial or satellite imagery.
Impervious Possible Tree Canopy: Asphalt or concrete surfaces, excluding roads and buildings, that are theoretically available for the establishment of tree canopy if improvements were made.
Vegetated Possible Tree Canopy: Grass or shrub area that is theoretically available for the establishment of tree canopy.
Not Suitable: Areas where it is highly unlikely that new tree canopy could be established (primarily buildings and roads).

Tree Canopy Height

Knowing the height of the tree canopy can be of value for a variety of uses, ranging from locating large trees for preservation to estimating the age of a forest stand. The tree canopy dataset was divided into polygons approximating individual trees by using a combination of high-resolution imagery and LiDAR. Each one of these polygons was then assigned average and maximum height information from the 3D LiDAR data that were collected in 2018 (Figure 3). The resulting tree polygon database can be used to visualize the tree canopy in three dimensions or to carry out various analyses, such as estimating biomass, finding the tallest trees, or computing the number of trees over 100 feet. The vast majority of trees in the city range from 40 to 80 feet in height (Figure 4).

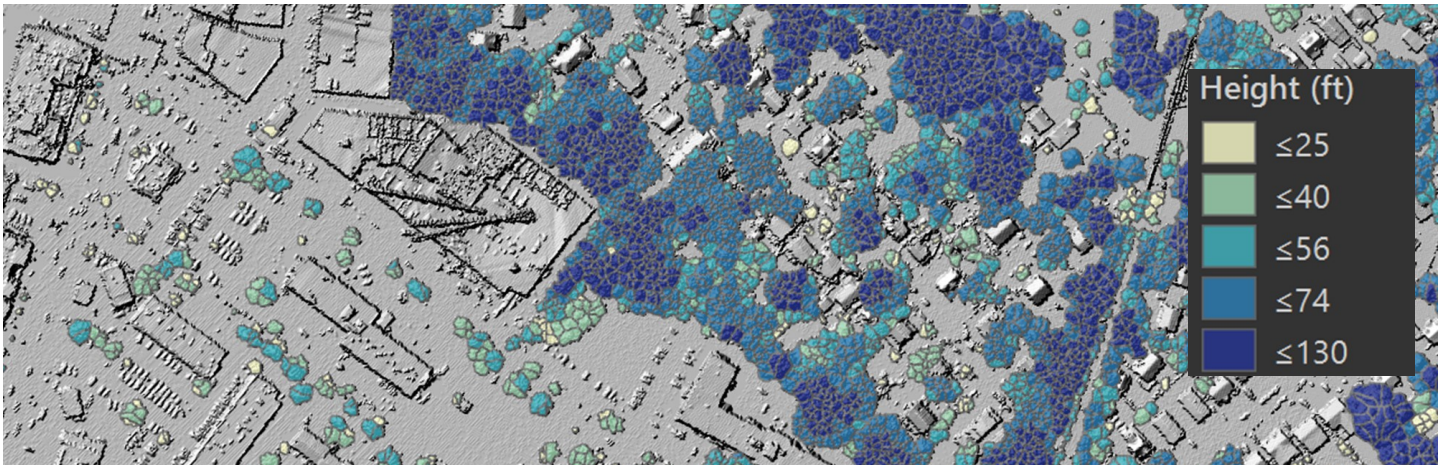

Figure 3: Maximum canopy height for individual trees.

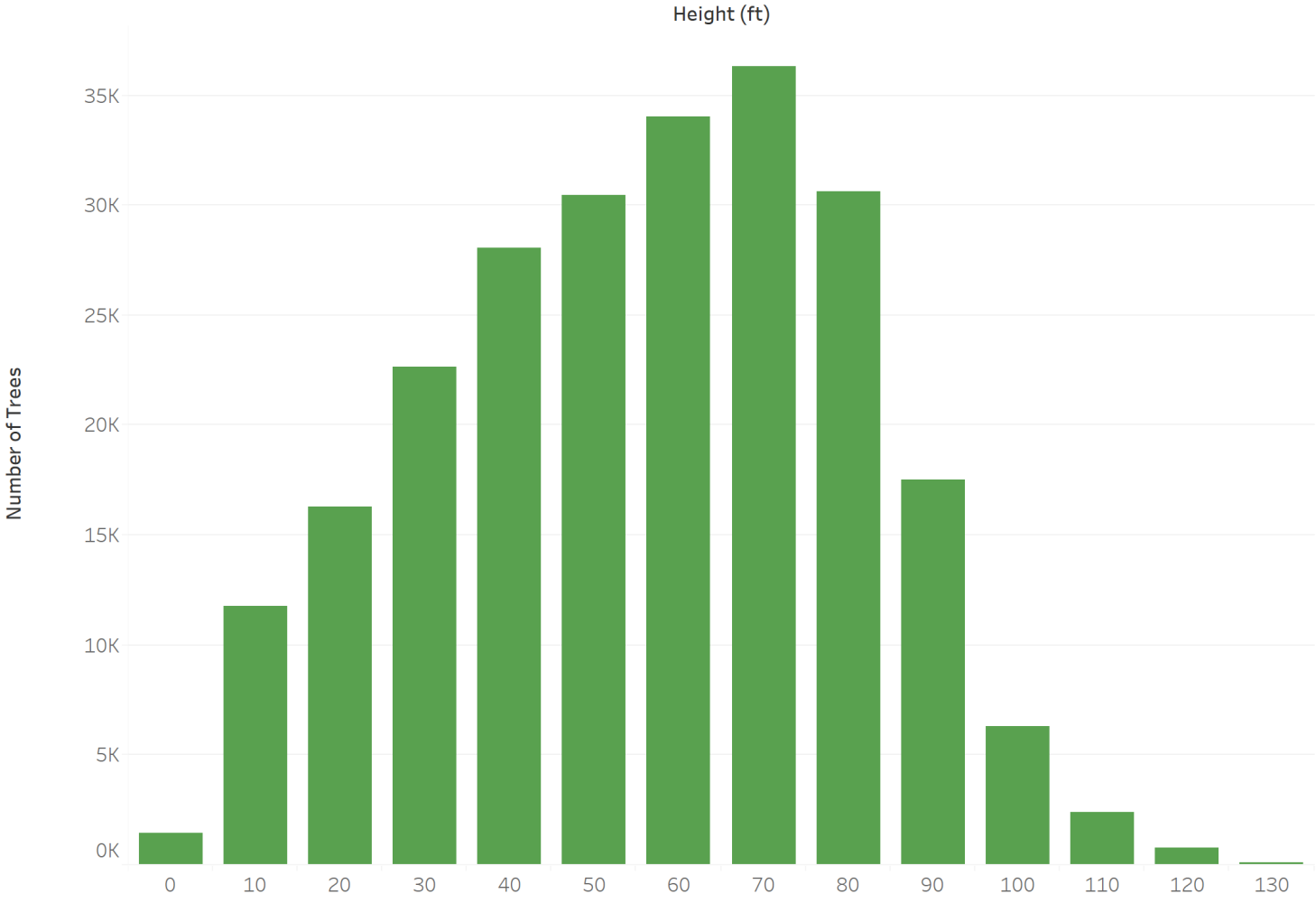

Figure 4: Count of tree canopy segments by max height class. The height of the bar reflects the number of tree canopy segments in each one of the 10 ft height classes.

Forest Patch Analysis

Not all tree canopy provides the same ecosystem services. Larger forested patches are associated with improved wildlife habitat and watershed health, among other positive attributes. This forest patch analysis partitioned the tree canopy into three classes based on their size, shape, and density: 1) small 2) medium, and 3) large. In general, small patches represent small, individual trees, medium patches represent clumps of trees, large patches contains few edges and more core tree canopy (Figure 5). The large patch class contains the most tree canopy, followed by medium, then small (Figure 6).

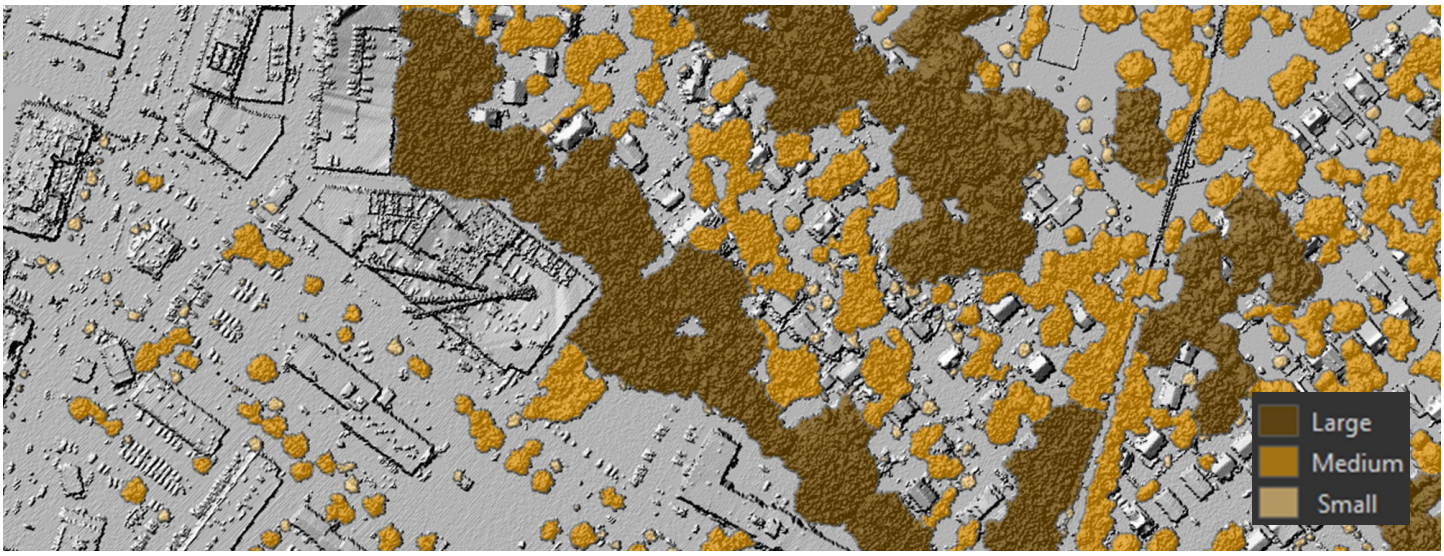

Figure 5: Forest patch classes, in which the tree canopy is subdivided into one of three categories.

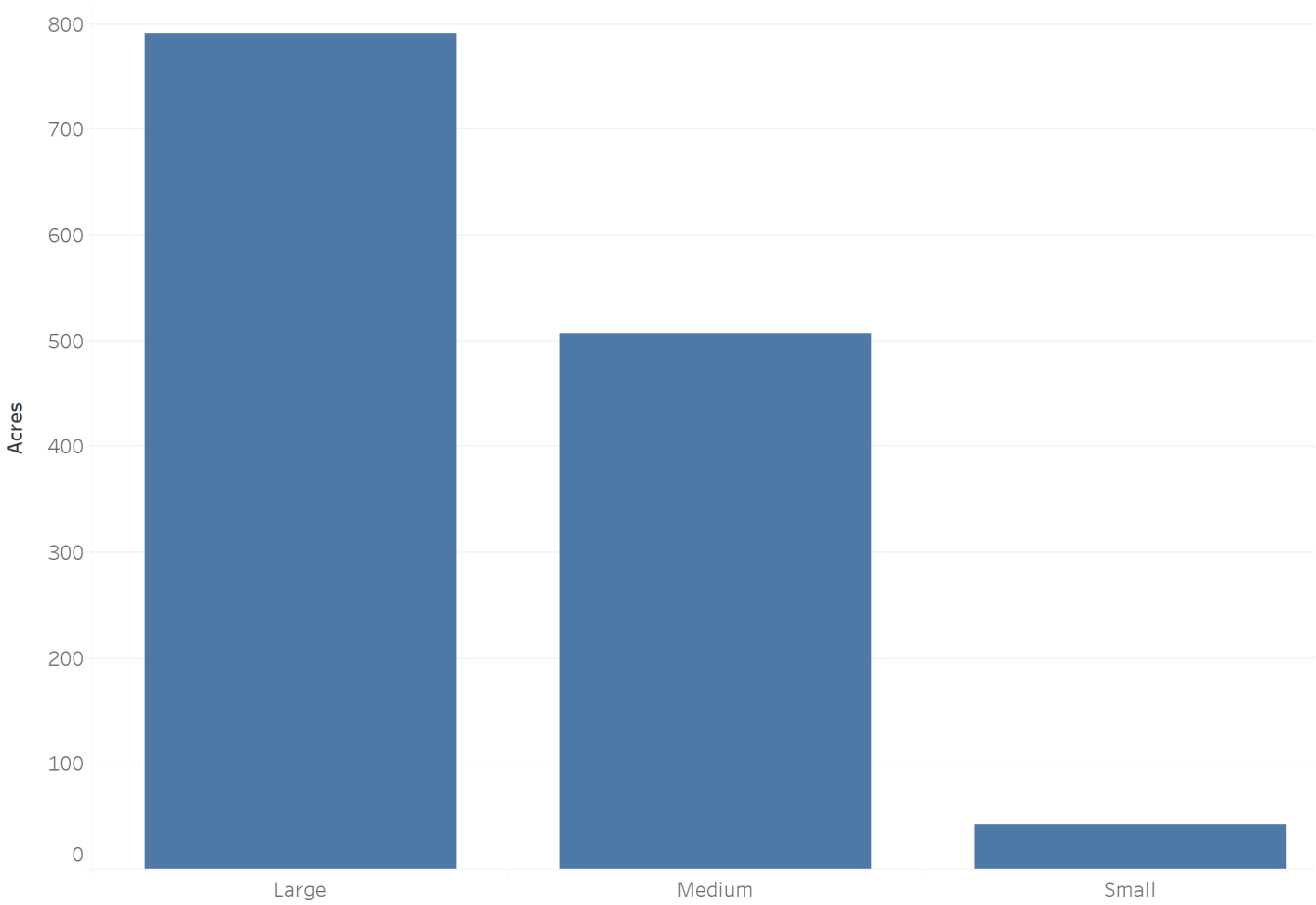

Figure 6: Number of acres in each forest patch class.

Zoning Metrics

Understanding the relationship between zoning and tree canopy can provide insights into how development patterns influence the existing tree canopy as well as informing strategies for preserving tree canopy and establishing new tree canopy. College Park is comprised of five general zoning classes (Figure 7). The vast majority of existing tree canopy in the city falls within residential zoning, which is also the dominant land zoning class in the city (Figure 9). The most room to plant new trees also resides within the residential zoning class. Residential zoning has more of its land area covered by tree canopy than any other zoning class. 43% of residentially zoned land is covered by tree canopy. The rights-of-way (ROW) contain the next largest amounts of both existing and possible tree canopy. With 24% of the ROW covered by tree canopy, the street trees provide an important contribution to the overall tree canopy. Not surprisingly, mixed use, commercial, and industrial zoning classes have a relatively low percent of their land covered by tree canopy. With most of the city's existing and possible tree canopy falling on residentially zoned land, it is clear that residential areas are crucial when it comes to preserving and increasing the city's tree canopy.

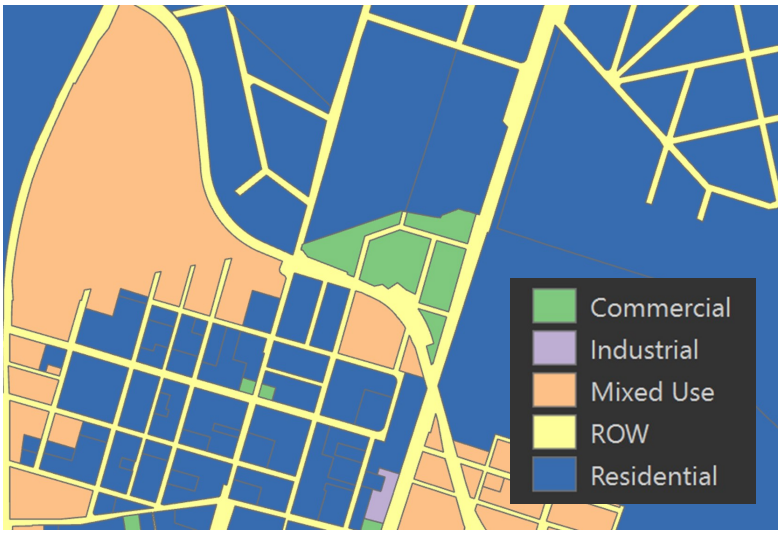

Figure 7: Zoning classes.

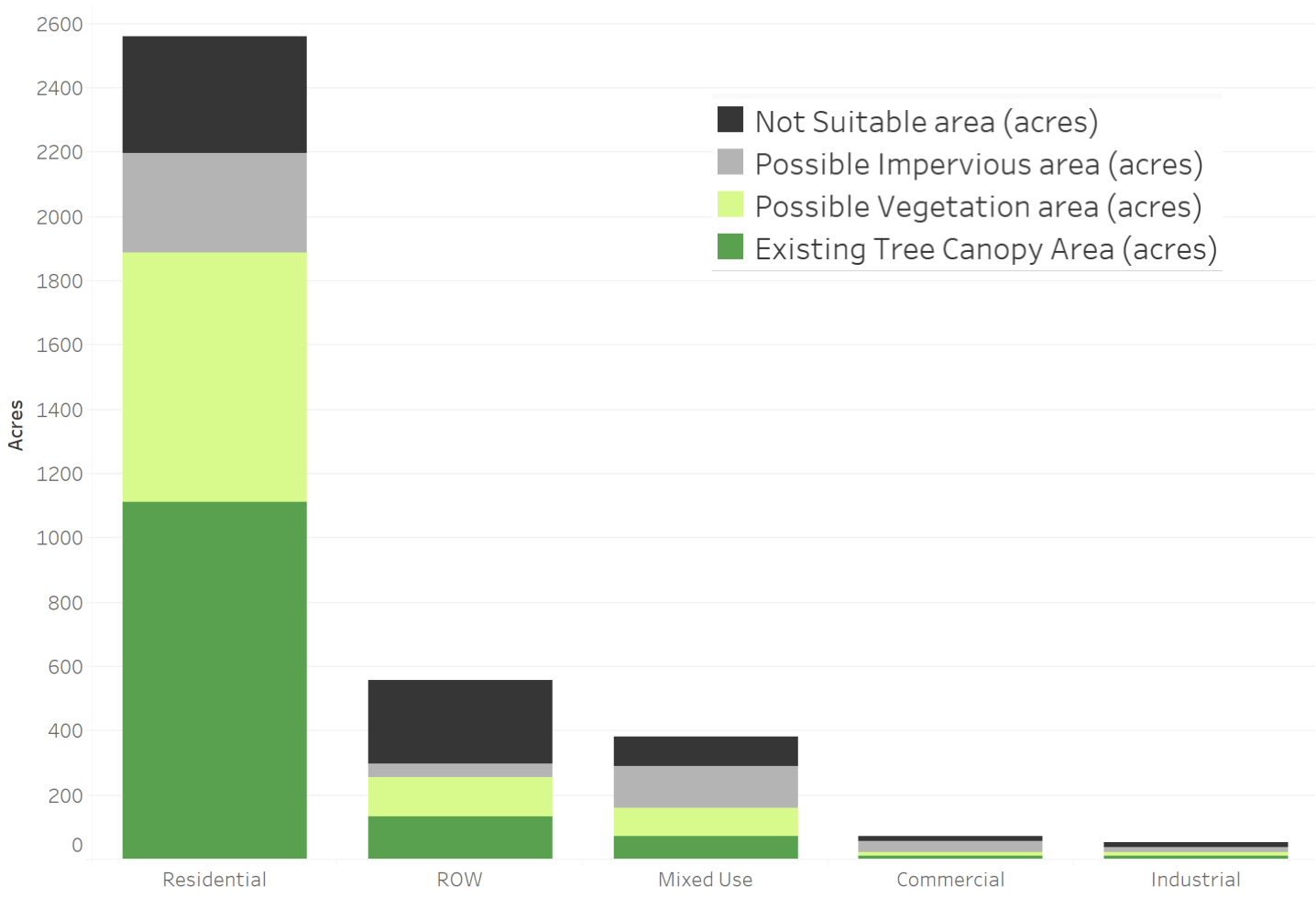

Figure 8: Tree canopy metrics summarized by land use.

Zoning Metrics

Figures 9 and 10 display the relative percentage of land for existing and possible categories, respectively. This provides additional insights into the relationship between existing/possible tree canopy and zoning that can be obscured by looking at the total area estimates (Figure 8).

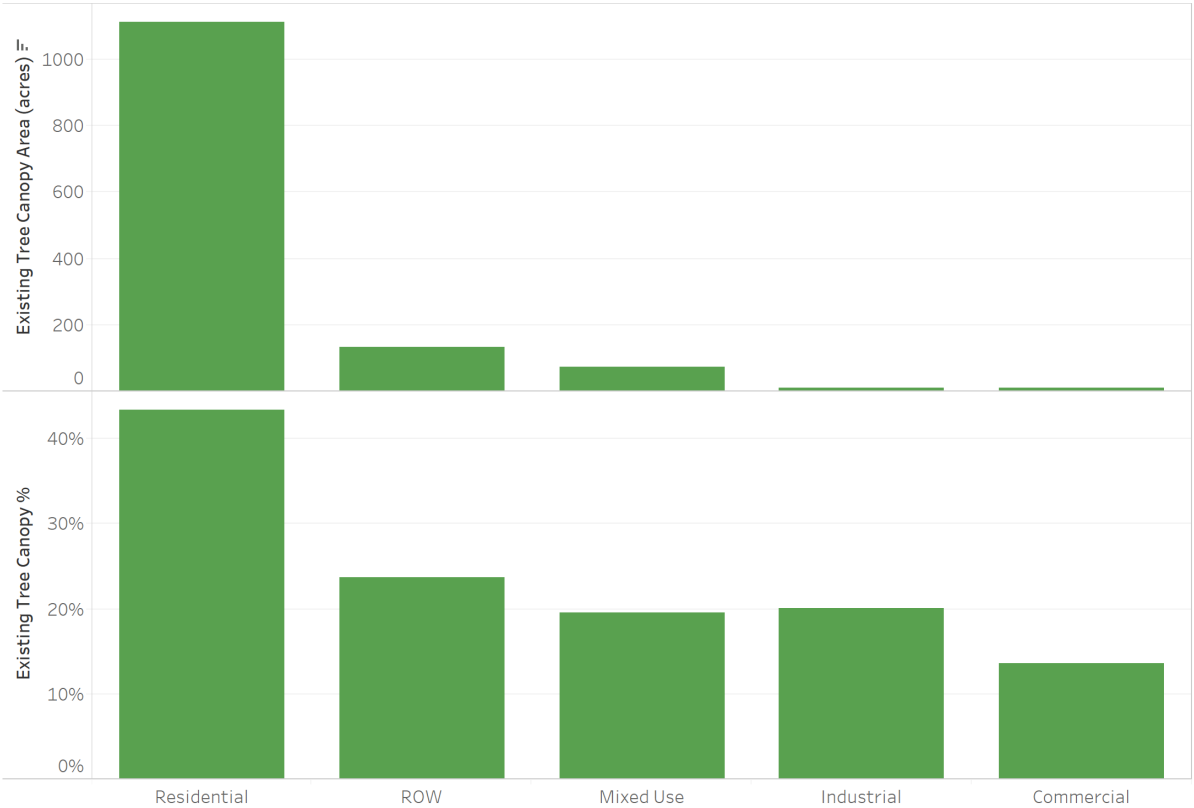

Figure 9: Existing tree canopy relative area metrics summarized by land use.

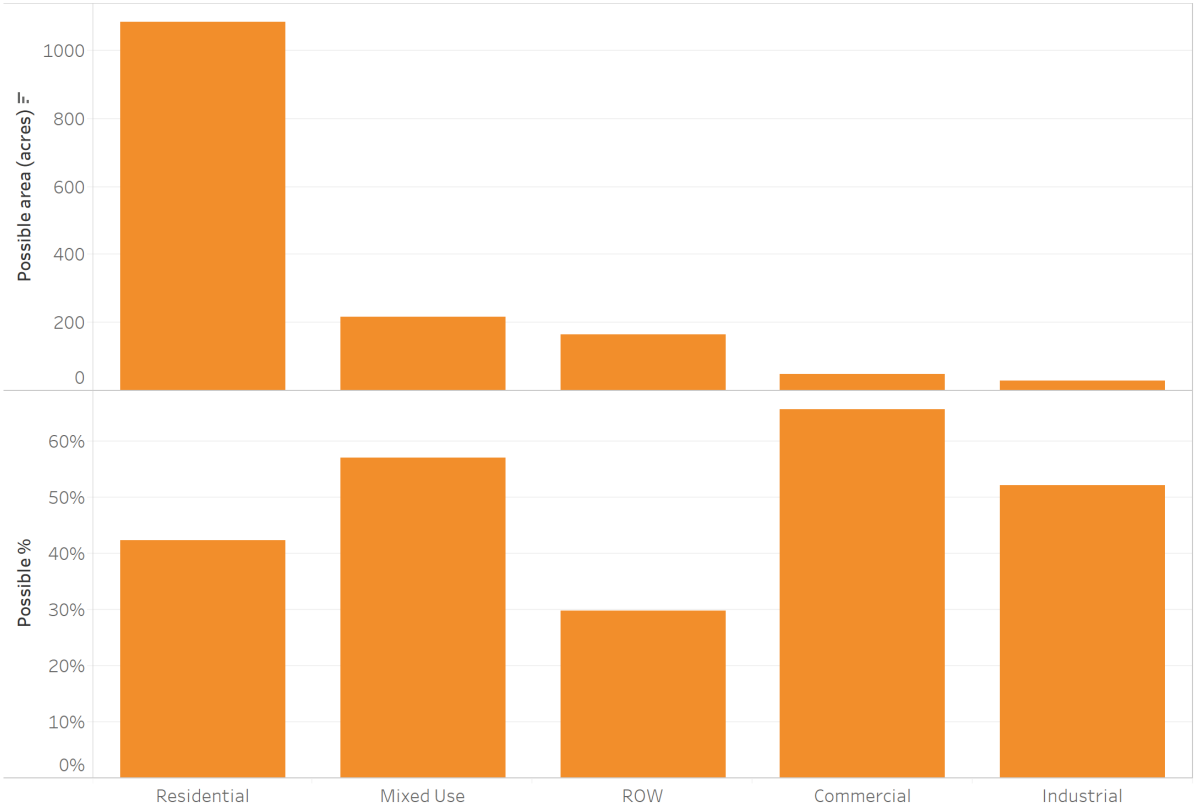

Figure 10: Possible vegetation tree canopy relative area metrics summarized by land use.

Ownership Metrics

This study distilled the city's parcel ownership data into six general ownership types in the city. Ownership describes who controls the tree canopy. The city has limited regulatory influence and control over land owned by the University of Maryland, MNCPPC, the State of Maryland, and the Federal Government. Rights-of-way (ROW) represent a unique ownership type along the city's transportation corridors. The "Other" category in this analysis included all remaining land, the vast majority of which is private residential. 42% of the city's tree canopy is in the Other ownership class followed by the University of Maryland, which controls 27% of the city's tree canopy. MNCPPC controls 18% of the city's tree canopy. The State and Federal governments contain less than 3% and less than 1%, respectively.

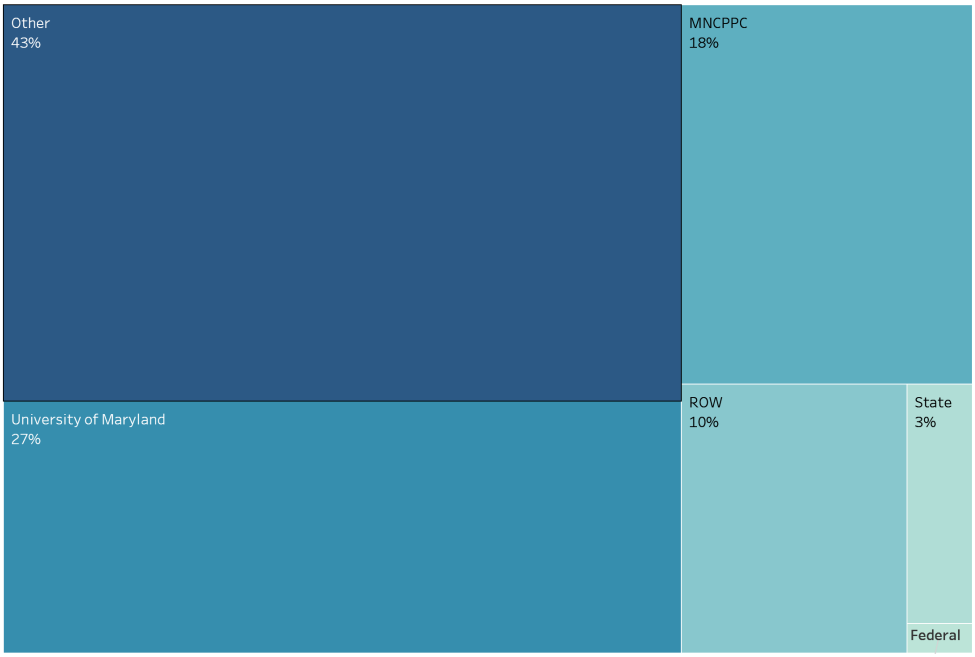

Figure 11: Percent of the city's tree canopy that falls within each ownership class.

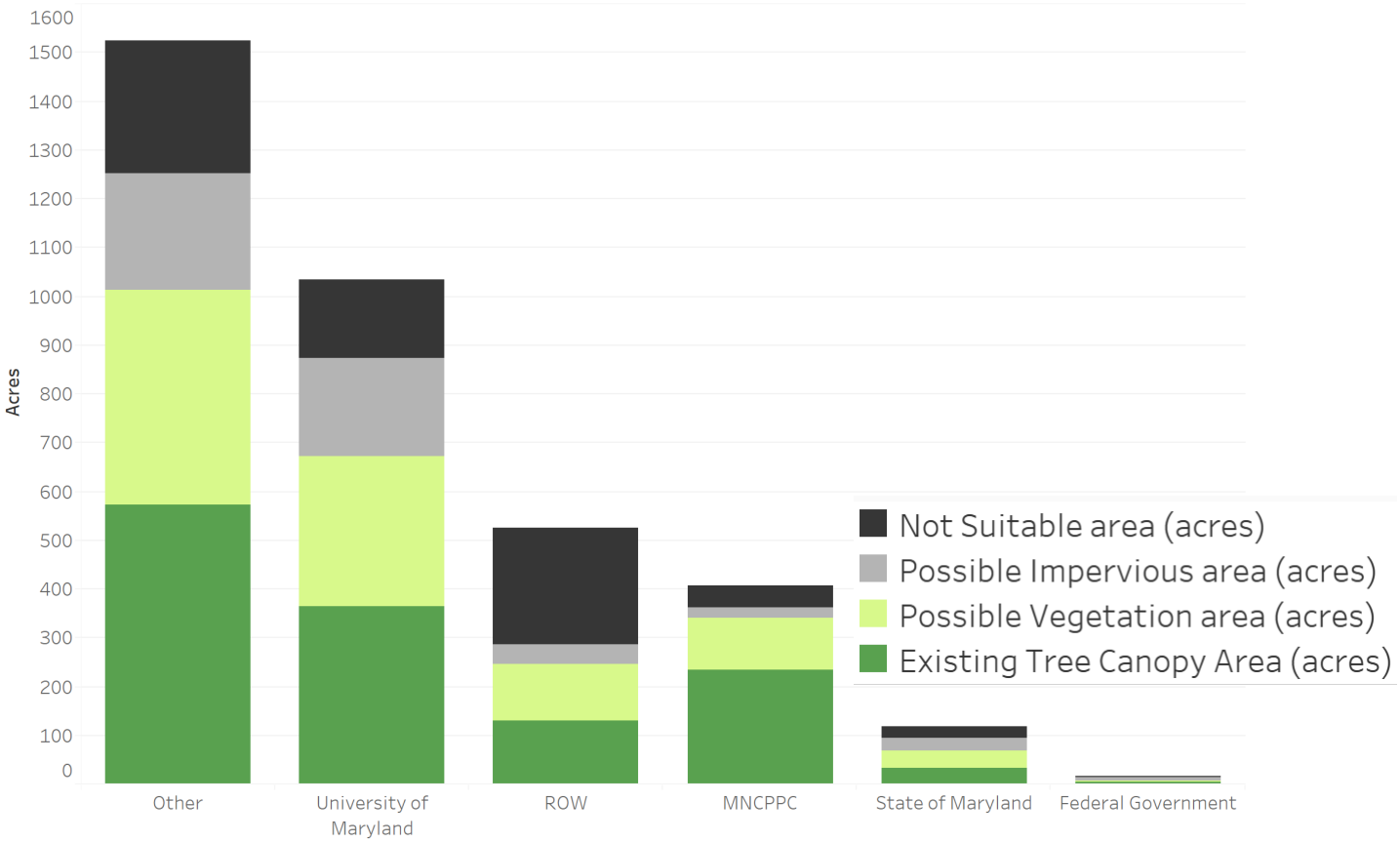

Figure 12: Tree canopy metrics summarized by ownership type.

Districts

Tree canopy varies by district. District 4 has the highest percentage of its land covered by tree canopy (41%), and District 2 has the lowest percentage of its land covered by tree canopy (32%). These relative percentages are influenced by land use and ownership, with District 4 containing large, continuous tracts of forest owned by the University of Maryland. District 2 contains most of the city's commercially and industrially zoned land, which tend to have lower amounts of tree canopy. It is also likely that renters vs. owner-occupied influence the amount of tree canopy, with renters, particularly students enrolled in college, less invested in the care and maintenance of the trees on the properties they occupy compared to owners. Despite the differences across the districts they all have similar percentages of their land available for the establishment of new tree canopy. Increasing tree canopy will require a localized approach, with the more forested areas free to expand if left alone and the urbanized areas requiring targeted plantings.

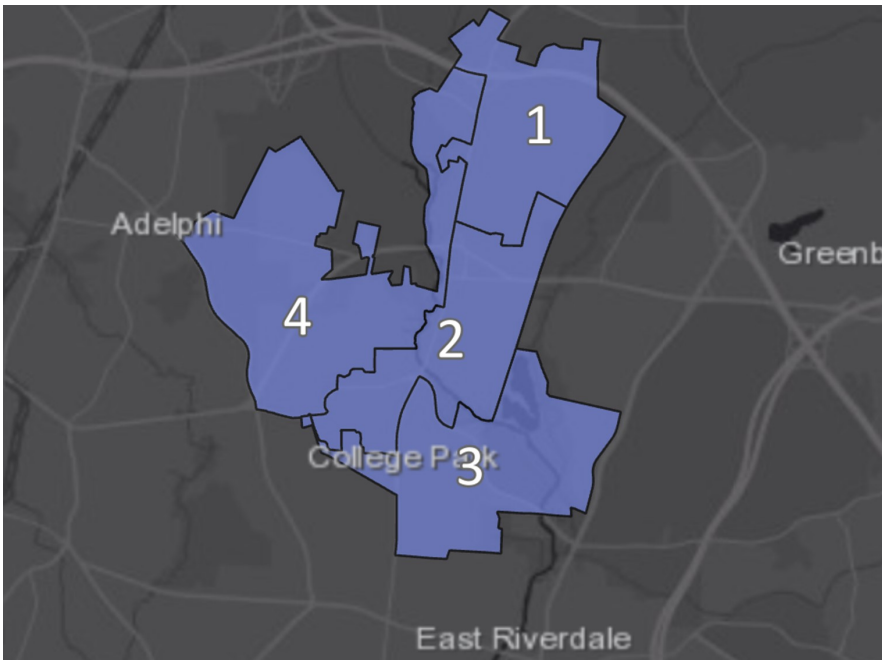

Figure 13: Districts

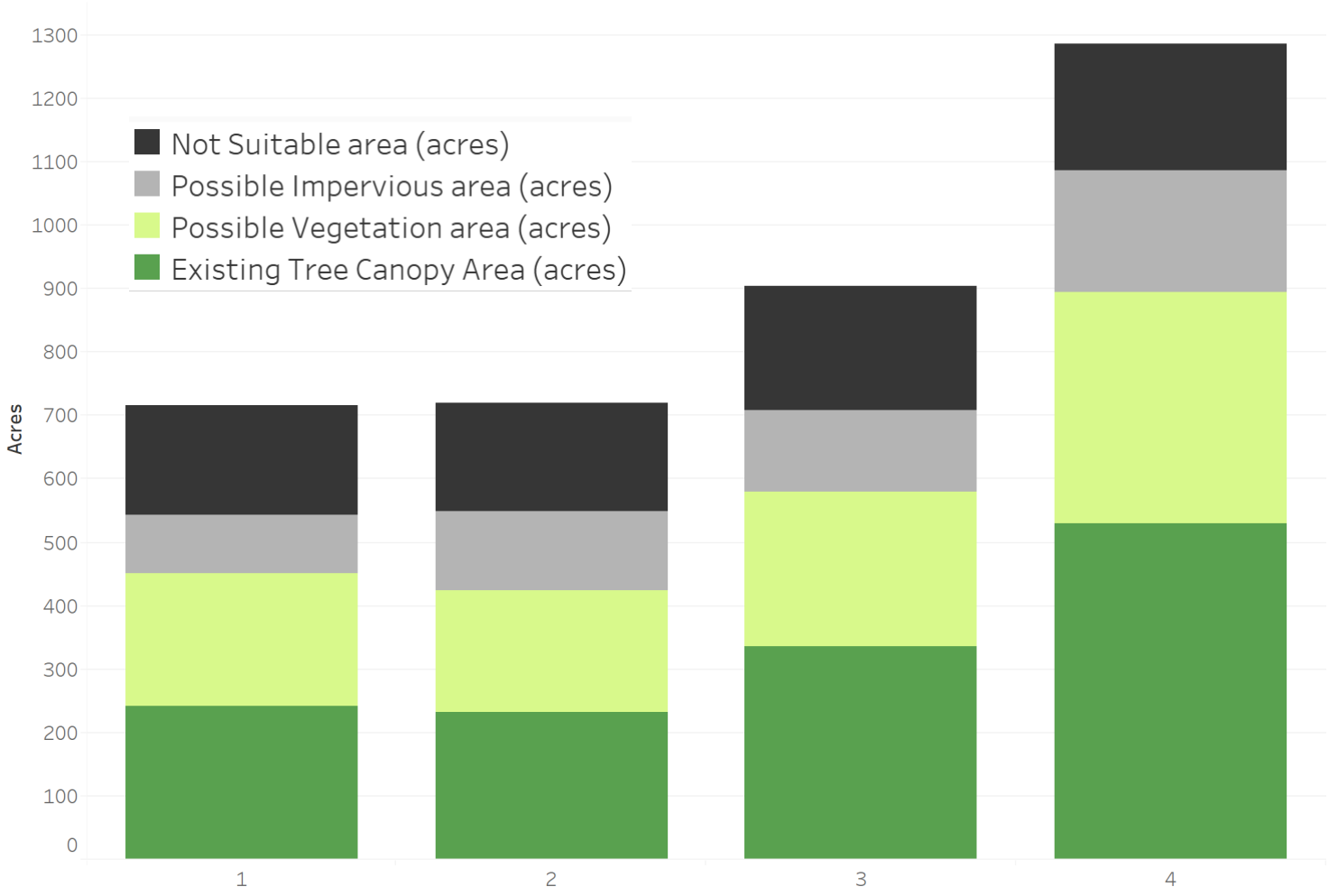

Figure 14: Tree canopy metrics summarized by district.

Urban Heat Island

One of the important ecosystem services that trees provide is reducing the urban heat island effect. Trees not only provide shade, through transpiration they actively remove heat. Impervious surfaces absorb heat, making developed areas of the landscape warmer than natural areas. To explore the roll trees play in reducing the city's urban heat island this study obtained thermal data from the Landsat satellite acquired in July of 2018. This thermal imagery records the amount of heat being emitted by a surface providing an indication of the surface temperature. There is a clear inverse relationship between tree canopy and surface temperature. (Figure 16). Areas with higher amounts of tree canopy have lower surface temperatures.

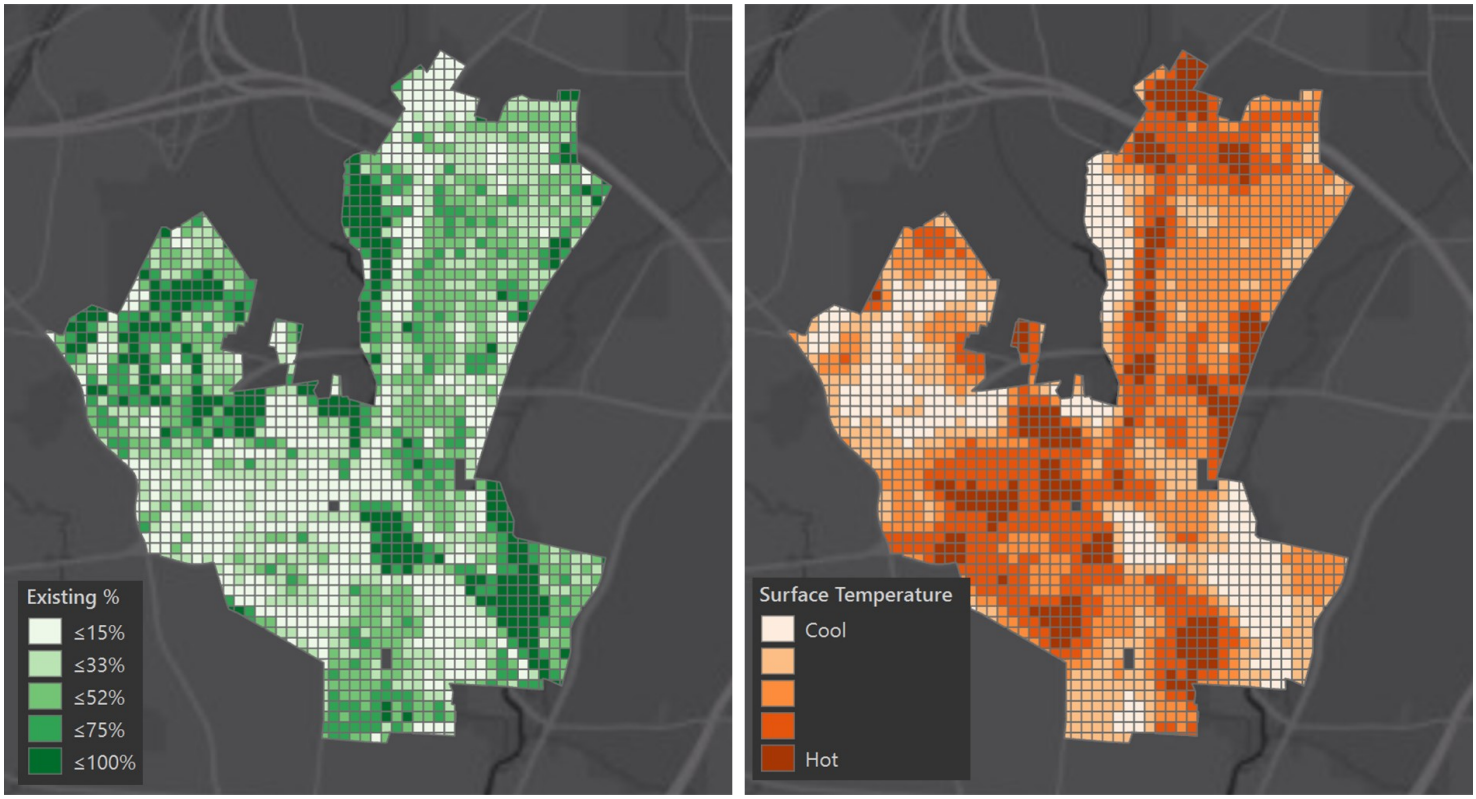

Figure 15: 300-foot grid cells summarizing tree canopy (left) and emitted thermal energy (right).

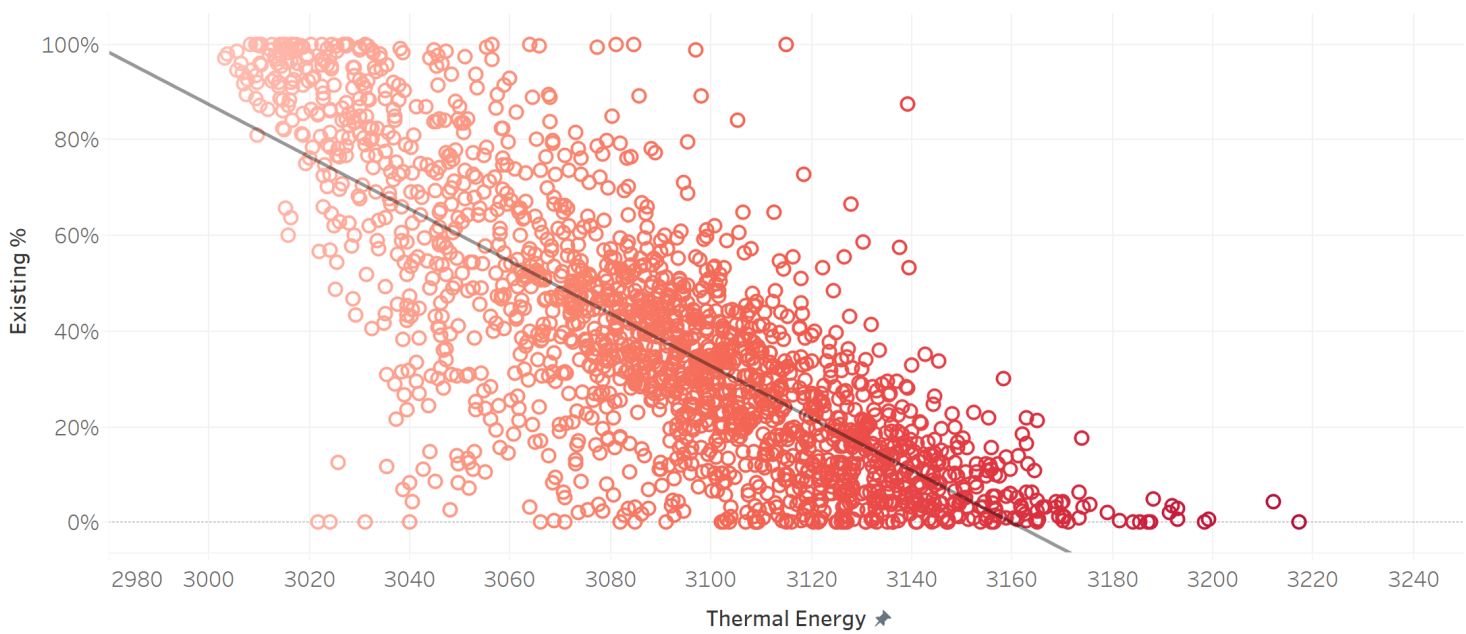

Figure 16: Emitted thermal energy (radiance) received by the Landsat satellite thermal sensor. Higher values correspond to hotter surface temperatures.

Tree Canopy Change

Data suitable for mapping the city's tree canopy exists for three separate time periods: 2009, 2014, and 2018. This study mapped tree canopy change over these years with an emphasis on a detailed accounting of the changes that have occurred within the 2014-2018 time period to better understand the immediate threats to the city's tree canopy. Canopy was classified into three categories: no change, loss, and gain. No change indicates that the tree canopy remained unchanged from 2014-2018. Gain indicates an increase over the four years. Loss refers to the removal of tree canopy. Accurately accounting for changes in tree canopy is challenging due to differences inherent in the data. As source data quality improves so does the ability to map tree canopy. This study found that the tree canopy has declined over the past nine years from 44% in 2009 to 40% in 2014 to 38% in 2018. These losses appear largely due to construction, in which land was cleared, and individual tree removal. The latter could be due to landowner preferences, pests, disease, utility line work, or other events.

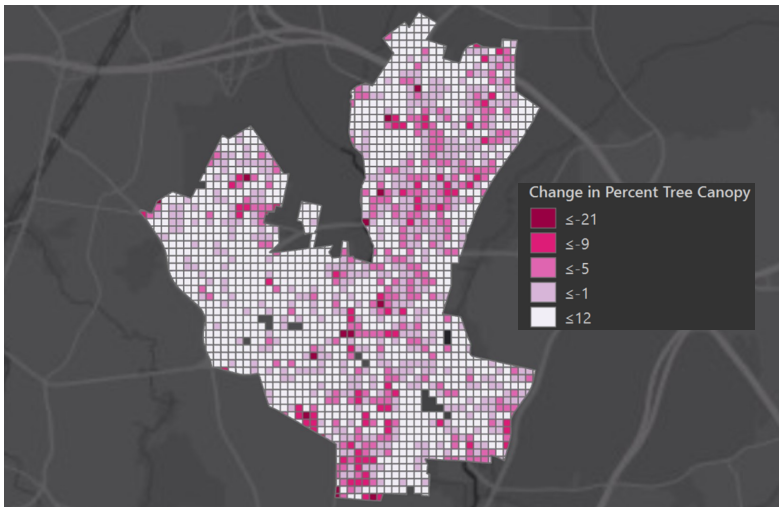

Figure 17: % absolute tree canopy change between 2014-2018. Darker areas indicate progressively greater amounts of tree loss.

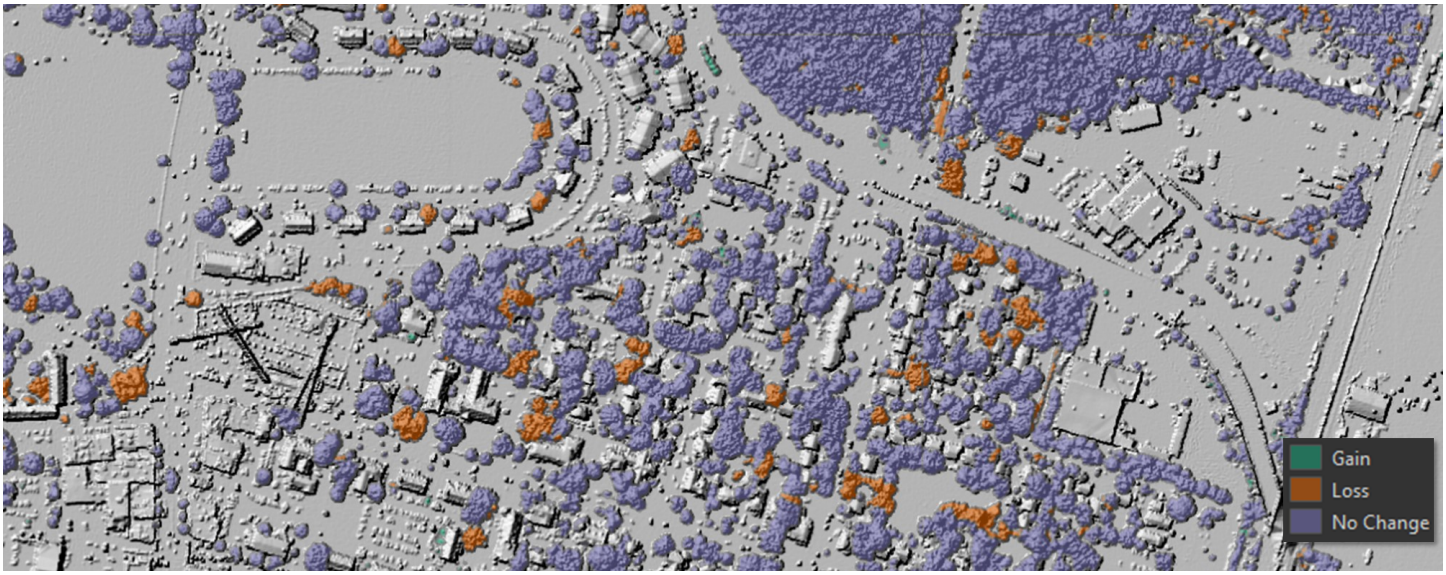

Figure 18: Tree canopy change for the 2014-2018 time period overlaid on 2014 LiDAR.

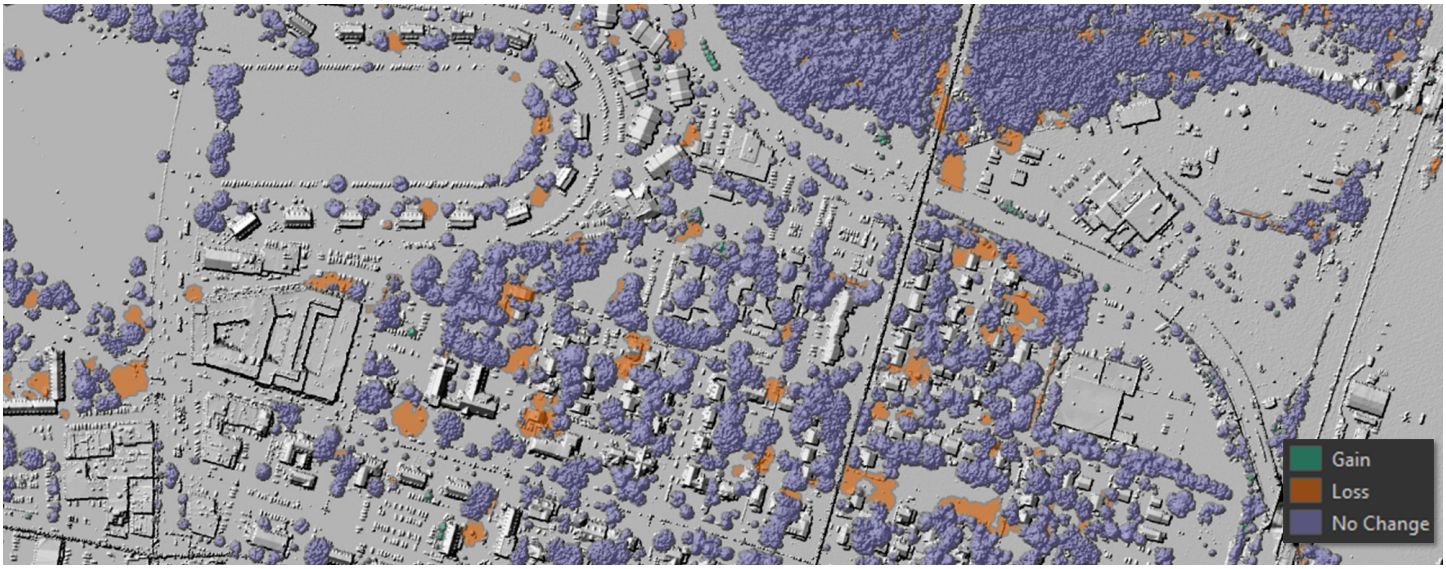

Figure 19: Tree canopy change for the 2014-2018 time period overlaid on 2018 LiDAR.

Conclusions

The urban forest is under threat. Due to new construction and individual tree removal the city's tree canopy has been steadily declining since 2009. Tree loss tends to be an event, while growth is a process. The city faces challenges in preserving its tree canopy as some of the largest collective losses have been on land that are outside of the control of the city.

Preserving existing tree canopy is critical. The most efficient and effective way to sustain and increase tree canopy is to preserve the city's existing tree canopy. Recent losses of tree canopy, particularly on private land, highlight some of the threats to the city's overall tree canopy. While ordinances can help to prevent tree removal, it is difficult to legislate tree care and tree planning on private land, necessitating other approaches.

Residents hold the key. A clear majority of the city's tree canopy is on residential land or on rights-of-way in residential areas. How residents value the trees in and around their property may very well be the determining factor in how the city's tree canopy changes over the coming decade. If residents fail to care for their trees and plant new ones to replace those that have been lost the city's urban tree canopy will continue to decline.

Continue mapping, monitoring, and inventorying. This project was able to provide insights into changes to the city's tree canopy over the past decade thanks to the investments made in imagery and LiDAR from MNCPPC. Without these data, this assessment would not have been possible. The city should continue to carry out tree canopy assessments every 2-6 years. The "top-down" approach used in this study is not a replacement for field work. Ground-based inventories are essential for assessing factors such as species, size, and health, which cannot be done effectively from above.

Figure 20: Tree canopy overlaid on the 2018 LiDAR data.

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Additional Information

For more info on the Urban Tree Canopy Assessment please visit **http://nrs.fs.fed.us/urban/UTC/**

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