Tree Canopy Assessment

Southern Connecticut Region

June 27, 2019

THE NEED FOR GREEN

Communities are facing a host of environmental challenges, from stormwater runoff to the urban heat island effect. At the same time, communities are seeking to become more livable and sustainable to attract companies 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 shows that they can even improve social cohesion and reduce crime. A healthy and robust tree canopy is crucial to the sustainability and livability of our communities

TREE CANOPY ASSESSMENT

For decades governments have mapped and monitored their infrastructure to support effective management. That mapping has primarily focused on gray 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 in the Southern Connecticut Region.

THE TREE CANOPY ASSESSMENT PROCESS

Remotely sensed data forms the This project employed the USDA Forest Service's Urban Tree Canopy assessment protocols and made use of hundreds of thousands of dollars of data provided by community partners.

Remotely sensed data forms the foundation of the tree canopy assessment. We use high-resolution aerial imagery and LiDAR to map tree canopy and other land cover features.

The land cover data consist of tree canopy, grass/shrub, bare soil, water, buildings, roads/railroads, and other impervious features.

The land cover data are summarized by various geographical units, ranging from the property parcel to the watershed to the municipal boundary.

These summaries, in the form of tree canopy metrics, are an exhaustive geospatial database that enables the Existing and Possible Tree Canopy to be analyzed.

The tree canopy metrics data analytics provide basic summary statistics in addition to inferences on the relationship between tree canopy and other variables.

The report (this document) summarizes the project methods, results, and findings.

The presentation, given to partners and stakeholders in the region, provides the opportunity to ask questions about the assessment.

Existing Tree Canopy

The tree canopy that you currently have, consisting of the leaves, branches, and stems when viewed from above.

Possible Tree Canopy

Land where it is biophysically feasible to establish new tree canopy (excludes buildings and roads). It is easier to establish tree canopy on vegetated areas as opposed to impervious surfaces.

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 datasets, which have been acquired by various governmental agencies in the region, are the foundational information for tree canopy mapping. Imagery provides information that enables features to be distinguished by their spectral (color) properties. As trees and shrubs can appear spectrally similar, or obscured by shadow, LiDAR, which consists of 3D 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 region's tree canopy to be mapped in detail over 1000-times higher than ever before. From the street tree in downtown New Haven to a core forest patch on conserved land, every tree in the region was accounted for.

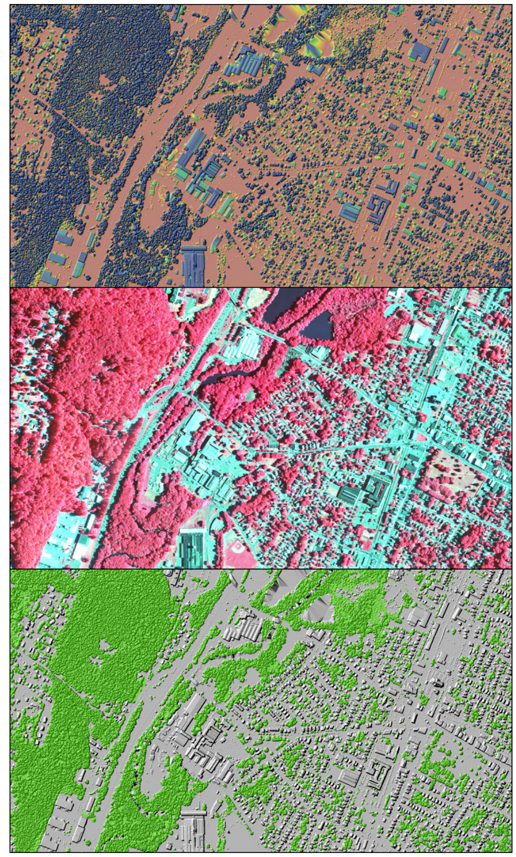


Figure 1: Imagery (top), LiDAR surface model (middle), and high-resolution tree canopy (bottom).

1+ Billion

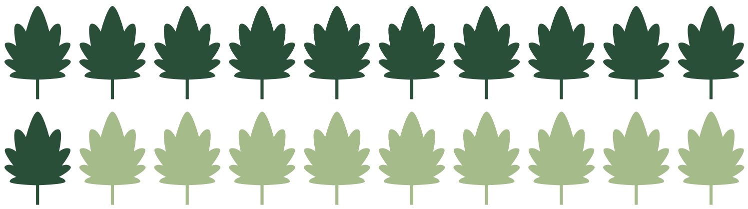
Billions of data points were processed to generate the tree canopy map

The high-resolution land cover that forms the foundation of this project was generated from the most recent LiDAR and imagery, both of which were acquired in 2016. Compared to national tree canopy datasets, which map at a resolution of 30-meters, this project generated sub-meter maps that better account for all of the region's tree canopy.

Figure 2: High-resolution land cover developed for this project.

TREE CANOPY METRICS

56% *Tree canopy cover 56% of all land within Southern Connecticut Region*



Using Geographic Information Sytems (GIS) tree canopy was summarized at various geographical units of analysis, ranging from the property parcel to watersheds. These tree canopy metrics provide information on the area of Existing and Possible Tree Canopy for each geographical unit.

Region

To analyze the distribution of tree canopy within the region, metrics were generated for grid cells that are 2000 feet on a side. Figure 3 shows the distribution of Existing Tree Canopy as a percentage of land area (water is excluded). Not surprisingly, Existing is highest in the less developed areas o the region and lower in the urbanized and coastal ecosystems that are less conducive to tree canopy. Figure 4 shows the Possible Tree Canopy (vegetation) for the same 2000-foot grid cells. The Possible vegetated consists of grass and shrub areas that do not currently contain tree canopy but where it may be feasible to establish new tree canopy. It is low in those areas that either contains high amounts of tree canopy or little green open space. Establishing new tree canopy relies on a host of land use, social, and financial considerations, and thus the Possible should serve as a guide for further analysis, not a prescription of where to plant trees.

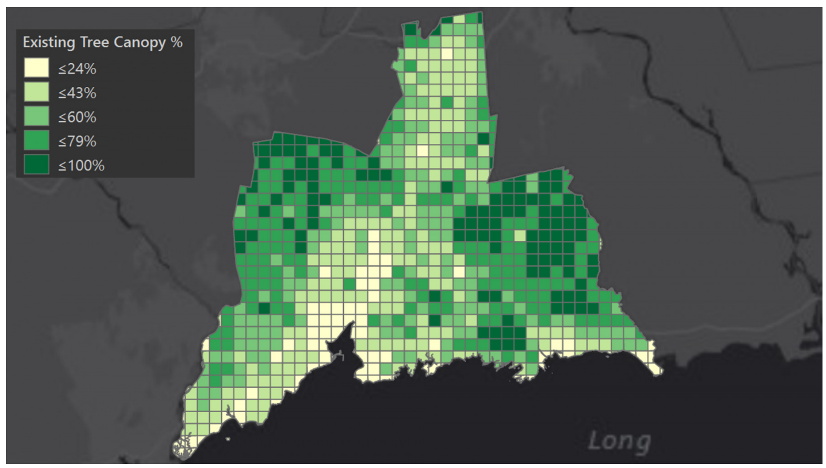


Figure 3: Existing tree canopy summarized by 2000-foot grid cells for the region.

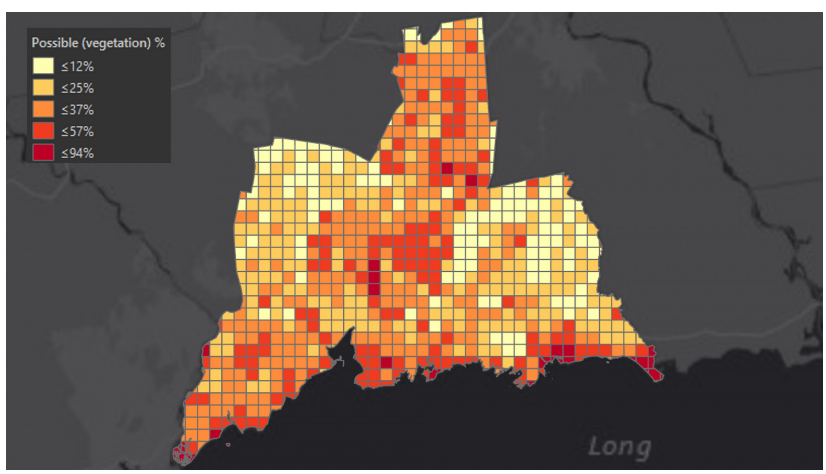


Figure 4: Possible vegetation summarized by 2000-foot grid cells for the region.

Municipalities

The amount of land currently covered by tree canopy and the amount of land available to plant new trees differs by municipality. These differences are due to several factors ranging from land use history to current land use to the degree of urbanization. With over 80% Existing tree canopy, Bethany has more of its land covered by trees than any other municipality. Milford, at just over 40% Existing tree canopy, has the lowest. Milford and New Haven lead in the Possible category, with considerably more vegetated land to establish tree canopy than other municipalities. The heavily canopied areas of Bethany and Milford have very low Possible percentages. Having land available to establish new tree canopy does not always mean that adding tree canopy on those lands is either desirable or feasible. Residents generally prefer to have some lawn, recreational fields provide societal benefits, and open green space has aesthetic value.

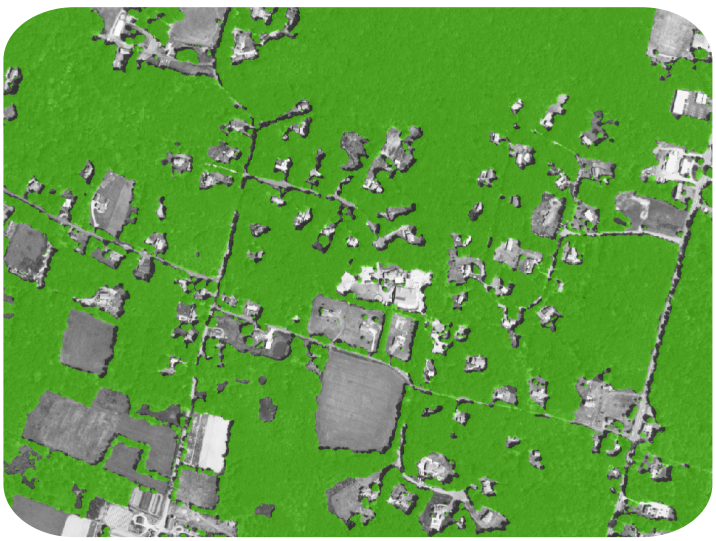


Figure 5: Tree canopy for an area in Bethany, which has the highest percent of land covered by tree canopy.

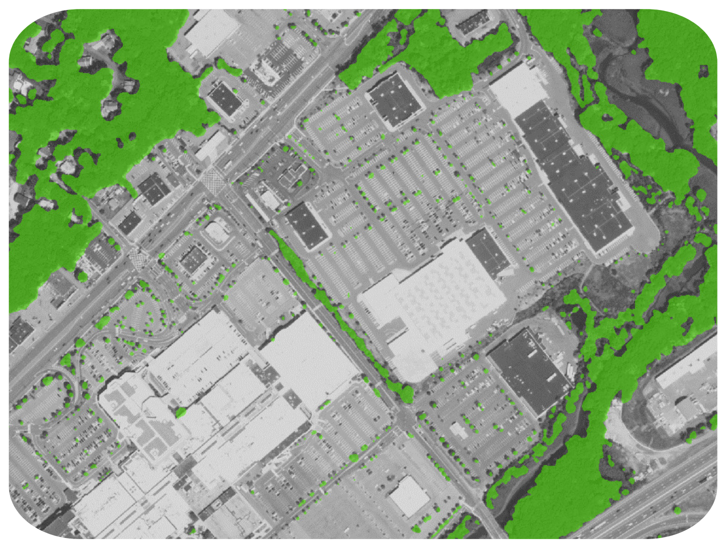


Figure 6: Tree canopy for an area in Milford, which has the loest percent of land covered by tree canopy.

Figure 7: Existing tree canopy metrics summarized by municipality.

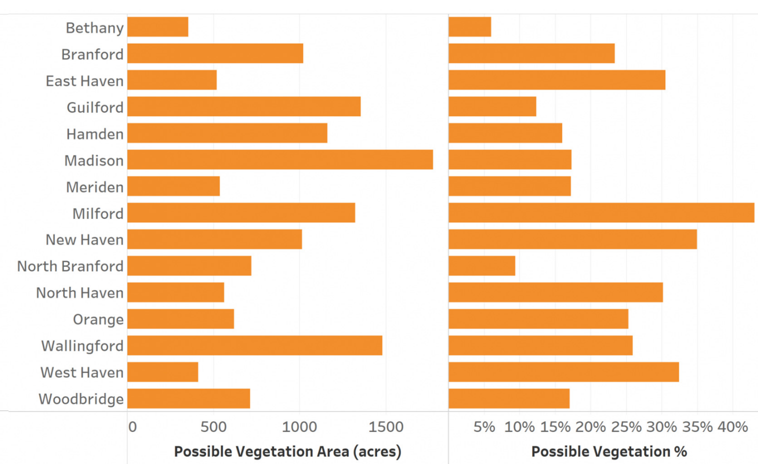


Figure 8: Possible-vegetated tree canopy metrics summarized by municipality.

Land Use

Land use is different from land cover. Land cover refers to the features, such as the trees, buildings, and other classes mapped as part of this study. Land use is how we, as humans, make use of the land. Residential land use can contain tree, building, impervious, grass, and other land cover features. Land use can significantly influence the amount of tree canopy and the room available to establish new tree canopy. Industrial and commercial land uses typically have substantially less tree canopy cover than conserved regions. Planners within the region assign land to one of nine land use categories. The vast majority of the land is under residential use, and not surprisingly, residential land holds total tree canopy than any other land use type. Open space is not too far behind, but other land use types constitute only a small fraction of the region's total tree canopy. Open space, which is mostly undeveloped, has the highest percentage of its land covered by tree canopy. Most of the room to establish new tree canopy is on residential land. The distribution of tree canopy by land use differs by municipality. While all have high proportions of tree canopy in residential and open space, trees within the rights-of-way (ROW) provide a are more prominent in Milford, New Haven, North Haven, and Orange.

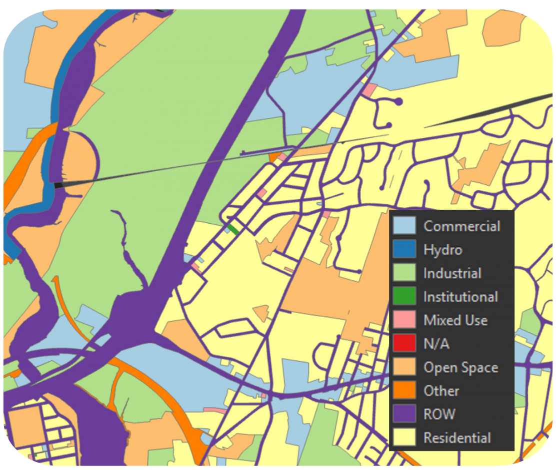


Figure 9: SCRCOG land use categories.

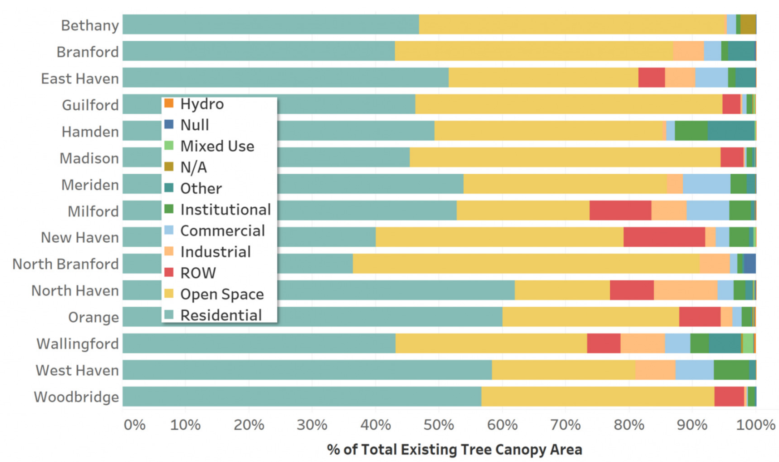


Figure 10: Proportion of tree canopy in each land use category by municipality.

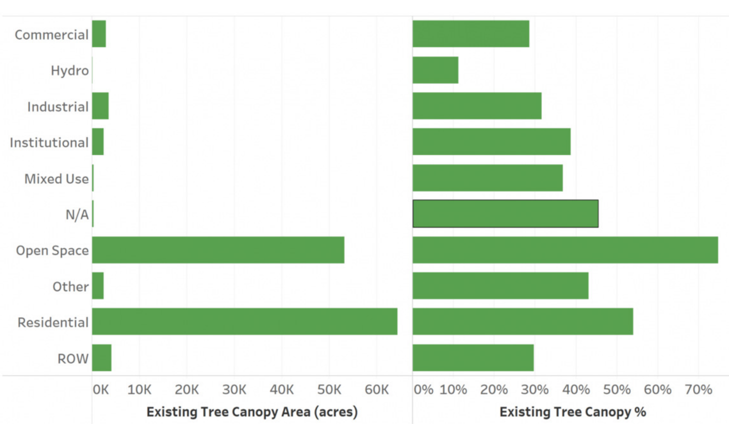


Figure 11: Existing tree canopy metrics summarized by land use.

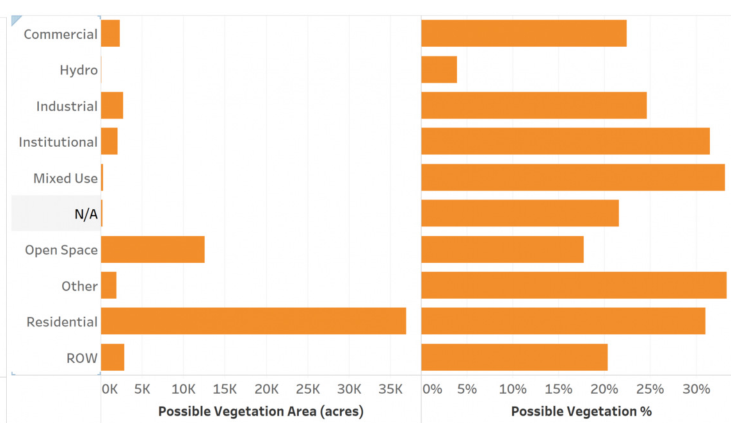
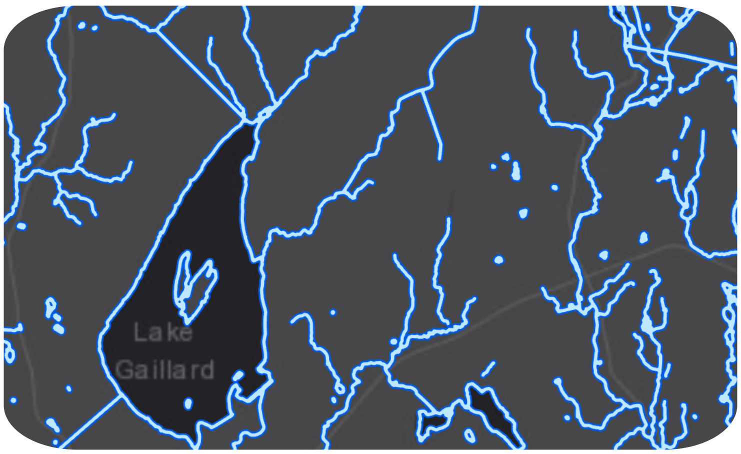
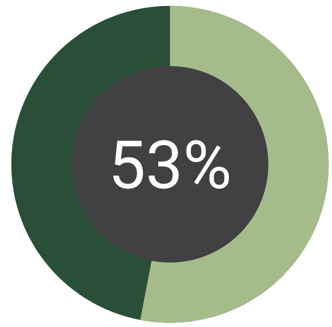


Figure 12: Possible-vegetated tree canopy metrics summarized by land use.

Water Buffer

Trees in the riparian buffer next to hydrologic features such as streams, rivers, lakes, and ponds serve many important functions. The shade they provide reduces water temperatures to levels that are needed for native fish populations to thrive. They filter a variety of nonpoint source pollutants while also reducing runoff. Stream banks are stabilized by the presence of trees in the riparian zone, and they can also reduce the severity of floods. Tree canopy was summarized within a 100-foot buffer (Figure 5) around all hydrologic features. Tree canopy covers 53% of all land within the buffer, slightly less than the regional average of 56%.





53% of the 100-foot hydrologic buffer is covered by tree canopy.

Figure 13: 100-foot hydrologic buffer.

Open Space

The region's open space includes parks and conserved lands that provide valuable places for people to recreate while preserving the natural resources that are crucial for long-term sustainability. Open space tree canopy metrics were computed for the function and owner of the open space areas. Presented in this report are the owner metrics. Although the owners for most open space areas are unknown, we see that not all open spaces have similar amounts of tree canopy. Those owned by the water authority have the highest percent tree canopy coverage. A positive sign given the importance of trees in protecting water quality. Rights-of-Way (ROW) and roads have lower coverage due to the high percentage of impervious surfaces.

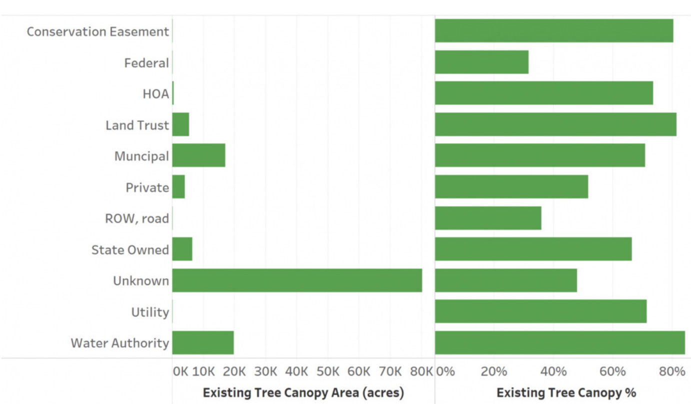


Figure 14: Existing tree canopy metrics summarized by open space ownership.

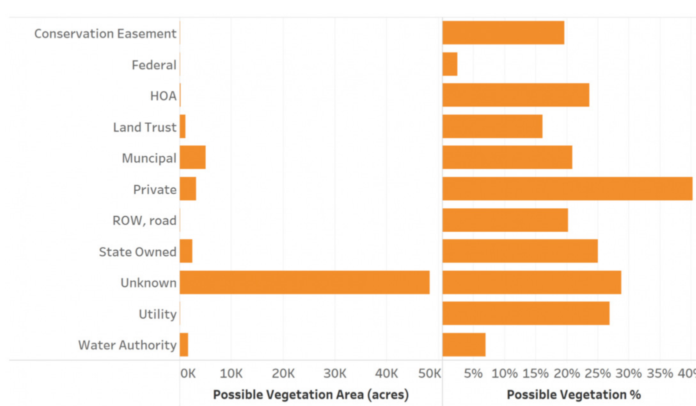
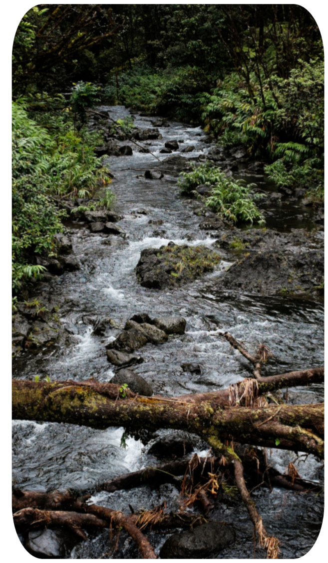


Figure 15: Possible-vegetated tree canopy metrics summarized by open space ownership.

Watersheds

In urbanized areas impervious surfaces short circuit traditional pathways, rapidly routing water and the nonpoint source pollutants it contains, directly into streams and rivers. Having a robust, consistent, and comprehensive tree canopy throughout the watershed can help to improve water quality. Many of the region's watersheds have greater than 50% tree canopy, but those in the more urbanized areas and along the Interstate 91 corridor have lower amounts. Fortunately, these watersheds also have a considerable amount of land available to establish new tree canopy. Improving tree canopy within these watersheds will have a positive impact on water quality. Increasing tree canopy will require an "all lands" approach and depend on local conditions. Residents and open space lands offer the most space to increase tree canopy in all watersheds. In the more urbanized watersheds, street tree plantings initiatives will be necessary.



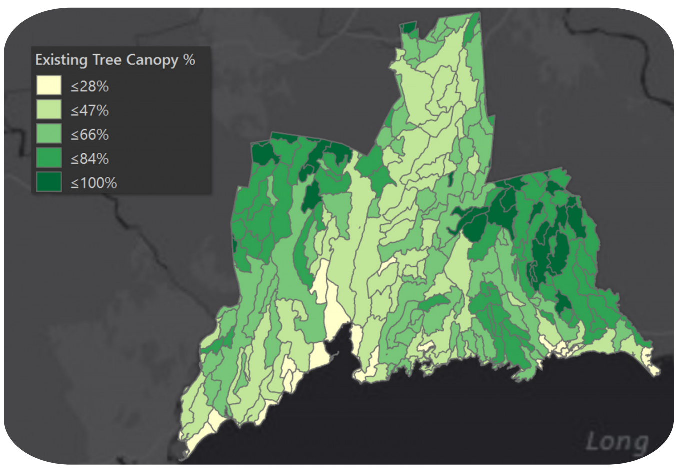


Figure 16: Existing tree canopy metrics summarized by sub-watershed.

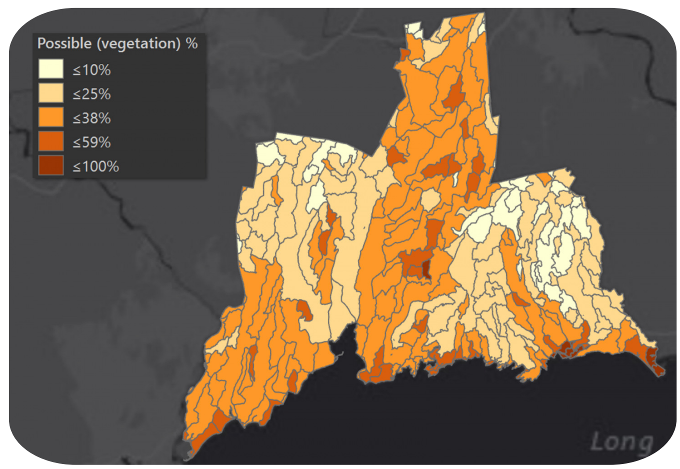


Figure 17: Possible-vegetated tree canopy metrics summarized by sub-watershed.

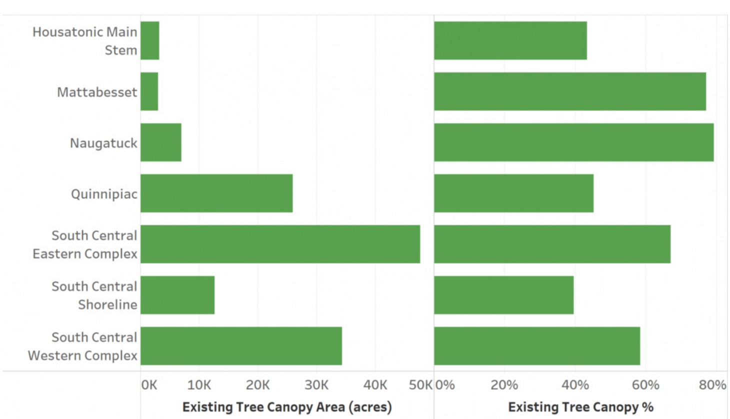


Figure 18: Existing tree canopy metrics summarized by major watershed.

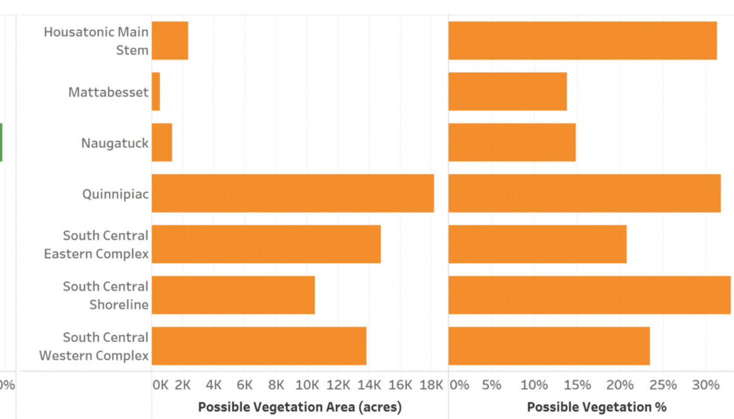


Figure 19: Possible-vegetated tree canopy metrics summarized by major watershed.

Urbanization

More densely urbanized areas generally have less room for trees due to the presence of built features. Measures of urbanization are developed for the US Census block group, a unit of analysis for aggregating socio-demographic information. Within the region there exist the full range of the six urbanization classes, which range from the dense principal urban centers to the rural. Most of the land in the region and the overwhelming amount of tree canopy resides in the suburban periphery areas. These areas are low density and predominantly residential. Even though the tree canopy in these areas appears to be a connected forest when viewed from above, from an ownership perspective, it is highly fragmented, with tens of thousands of individuals making management decisions.

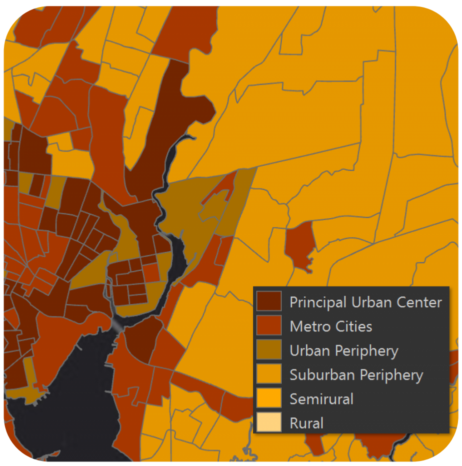


Figure 21: Example of the six urbanization categories.

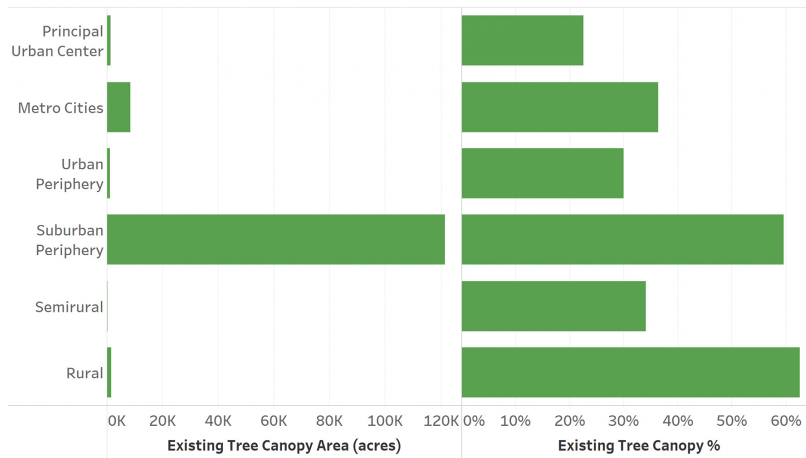


Figure 22: Existing tree canopy metrics summarized by urbanization class.

Year built

Tree canopy and new home construction rarely coexist, with trees are most likely to be removed when homes are built then planted immediately after construction. Establishing a robust tree canopy in suburban areas takes decades, and then once those trees reach life expectancy and die, canopy declines. The region experienced a housing boom in the 1950s through the 1980s, with those homes having the highest percentage of tree canopy.

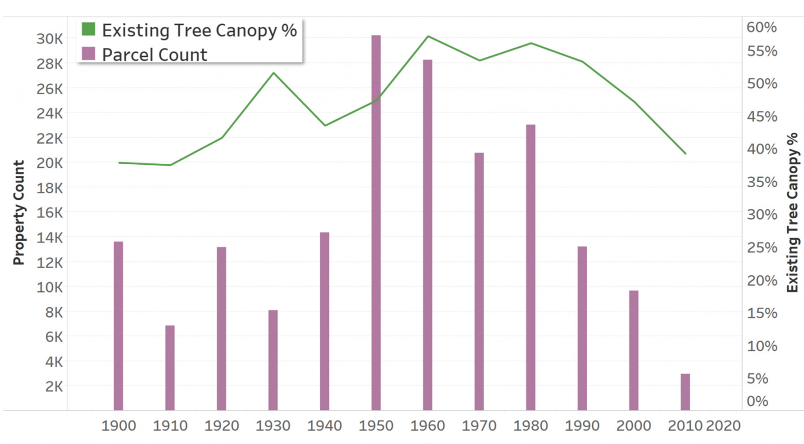


Figure 23: Year built in relation to Existing tree canopy.

FINDINGS

Overall, the region has a robust amount of tree canopy. The tree canopy provides important ecosystem services to the Region's residents.

Tree canopy is not evenly distributed, with highly urbanized areas many having less than the regional average.

Residents own most of the region's tree canopy and a crucial to sustaining it in the years to come.

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

RECOMMENDATIONS

The tree canopy assessment data should be integrated into planning decisions at all levels of government.

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

Preserving existing tree canopy is most effect means for securing future tree canopy as loss is an event but gain is a process.

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

The Southern Connecticut Region tree canopy assessment was a collaborative partnership between the Southern Connecticut Regional Council of Governments and the University of Vermont Spatial Analysis Laboratory.