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Los Angeles County Tree Canopy Assessment

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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. Understanding the tree canopy is an essential 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 Los Angeles Have?

An analysis of Los Angeles based on land cover data (Figure 1) derived from circa 2016 data found that 18% of the County's and 25% of the City's land are covered by tree canopy (Figure 2). The metrics derived from the land cover data can be used not only to compute the Existing Tree Canopy but also the Possible Tree Canopy. Existing is the land currently occupied by tree canopy whereas Possible indicates merely that there is land available to establish new tree canopy. In many areas, ecological, social, and financial factors may make it impractical to increase the tree canopy. The City- and County-level metrics mask the range of tree canopy values that occur at finer scales, such as Census block groups, subwatersheds, and individual properties. This report provides examples of how the tree canopy assessment data can be used to derive insights at multiple scales and how the data can be integrated with other information to prioritize tree canopy plantings.

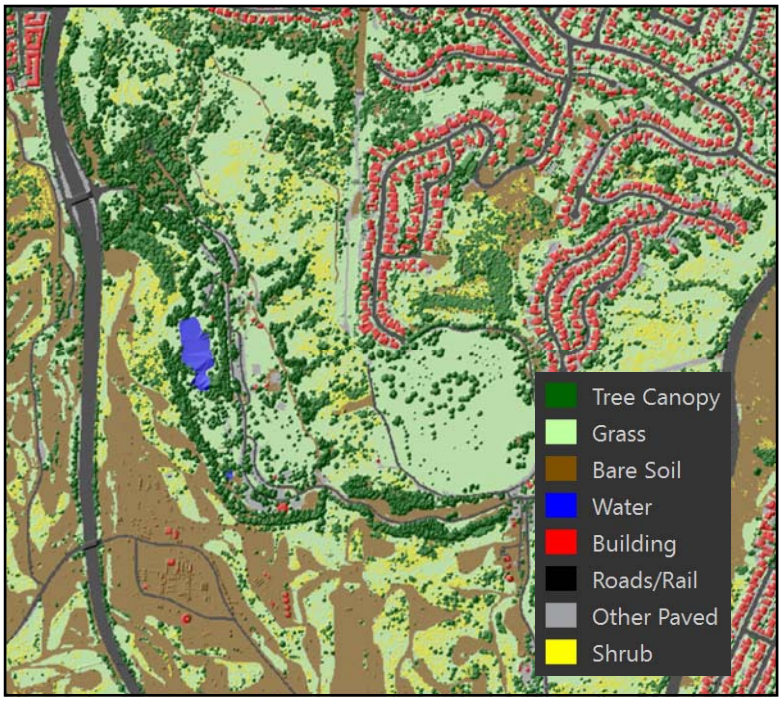


Figure 1: Study area and example of the land cover derived from high-resolution imagery for this project.

About the Project

This project applied the USDA Forest Service's Tree Canopy Assessment protocols to the City of Los Angeles. The analysis was conducted using imagery and LiDAR acquired in 2016 provided through the Los Angeles Region Imagery Acquisition Consortium program.

The assessment was funded by a grant to TreePeople and carried out by SavATree in collaboration with the Center for Urban Resilience at Loyola Marymount University, the Spatial Analysis Laboratory at the University of Vermont's Rubenstein School of the Environment and Natural Resources, and Dr. Dexter Locke.

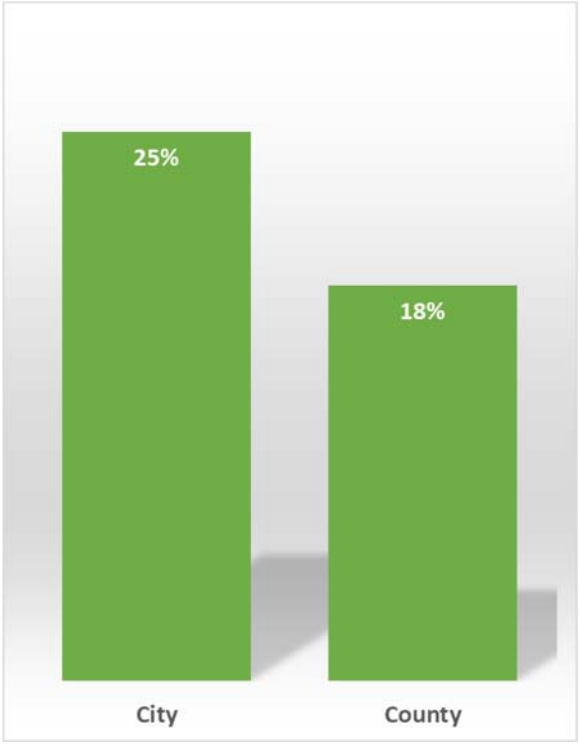


Figure 2: Tree Canopy metrics showing the percent of city and county land covered by tree canopy.

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).

A Range of Tree Canopy

Los Angeles is ecologically and socially diverse. Factors such as rainfall, soil type, elevation, population density, land use history, and local policies all influence the amount of tree canopy in a given area. Using Census block groups as the unit of analysis, this assessment found Existing Tree Canopy ranges from less than 1% to over 80% across the County.

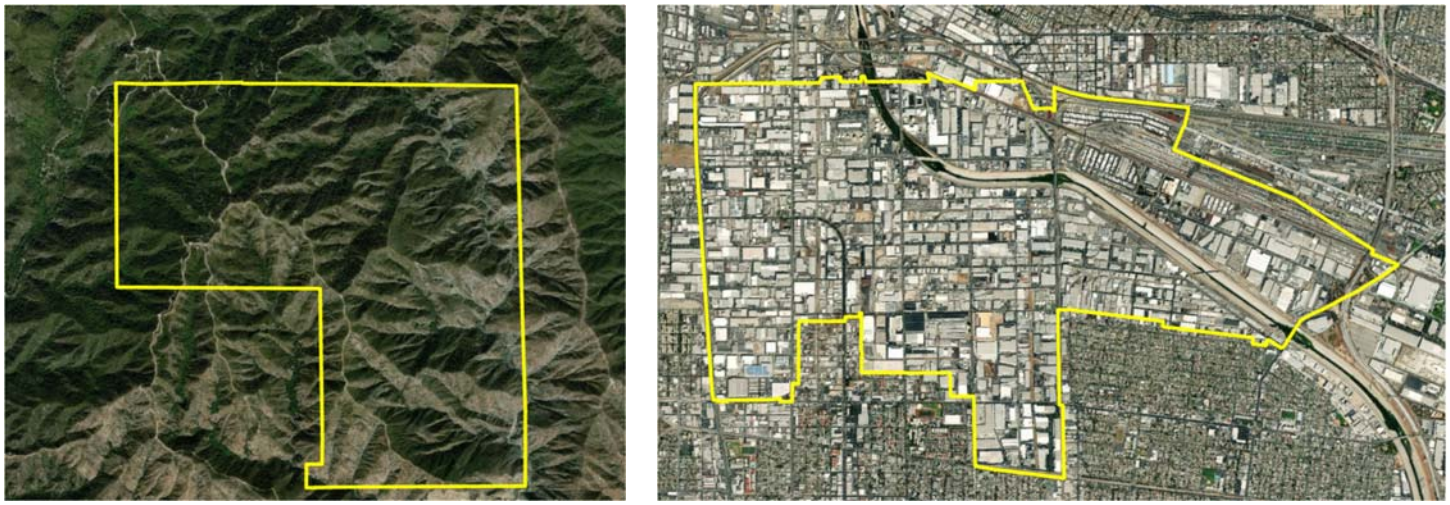


Figure 3: Examples of Census block groups that illustrate the range of Existing Tree Canopy within the County. The Census block group on the left is within Duarte and contains 84% tree canopy. The Census block group on the right, in Vernon, contains less than 1% tree canopy.

Tree Canopy Metrics

Tree canopy metrics were computed at a wide range of geographical units to provide actionable information on the amount of Existing and Possible Tree Canopy. Stakeholders may operate at a single scale or multiple scales, and environmental issues cross jurisdictional boundaries. This assessment computed tree canopy metrics at geographies to fulfill a range of needs and use cases. The units of analysis ranged from property parcels (Figure 4) up to much larger areas such as watersheds and city boundaries. The metrics, which tie directly into the county's Geographic Information Systems (GIS), make it easy to to find the percent tree canopy for a single parcel, examine the relationship between tree canopy and income, or find the subwatersheds in a city that have the most room for establishing new tree canopy. This report provides some examples of the types of analytics that can be done using this data.

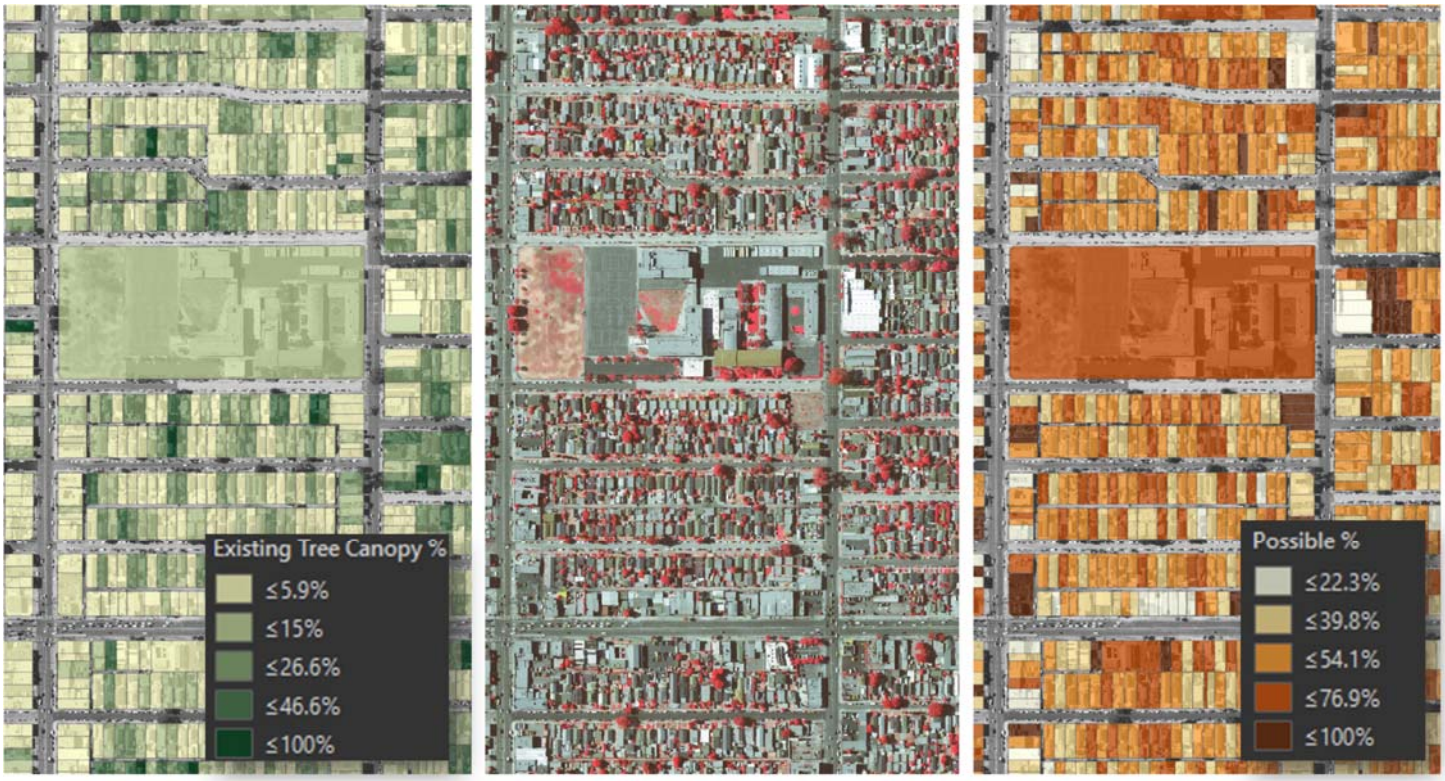


Figure 4: An example of tree canopy metrics computed at the property parcel level.

County Land Use

Understanding the relationship between land use 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. This study consolidated the land uses within Los Angeles County into twelve general land use types (Figure 5). The majority of the County's tree canopy falls within three land use types: recreational, residential, and right-of-way (ROW) (Figure 6). This is not surprising given the vast amounts of recreational land in the hill/mountain areas where trees are naturally occurring and are offered a greater sense of protection. Another way to examine the Existing Tree Canopy is to look at the percent of land covered by tree canopy for each land use type. Recreational land also maintains the highest percent Existing Tree Canopy. Although agricultural land occupies a small amount of the total land in the County and thus does not contain much of the County's tree canopy in aggregate, agricultural land use has far above average tree canopy with nearly 30% coverage. ROW and recreational land use types round out the top four with respect to percent coverage. Collectively, this information provides some useful insights into what strategies are required to preserve tree canopy is Los Angeles. Recreational and ROW lands are largely controlled by the government. Although there are numerous governmental agencies within the County, the process is far more straightforward than preserving tree canopy on residential lands, which consists of hundreds of thousands of individual landowners all making decisions. Preserving tree canopy on government-controlled land will likely be accomplished through funding and policies. Doing so on private land will require outreach, education, and regulations.

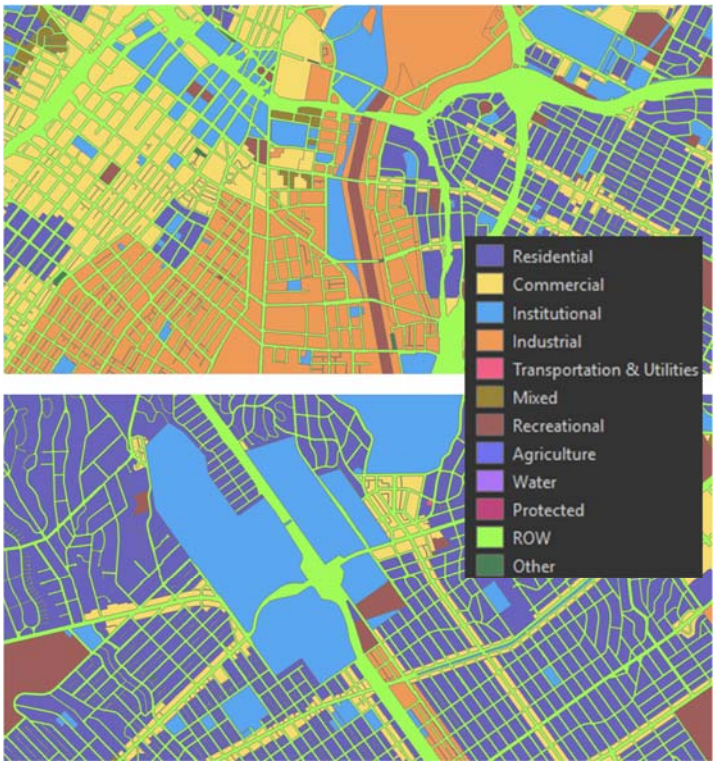


Figure 5: Examples of land use for the City's downtown area (top) and West Los Angeles (bottom).

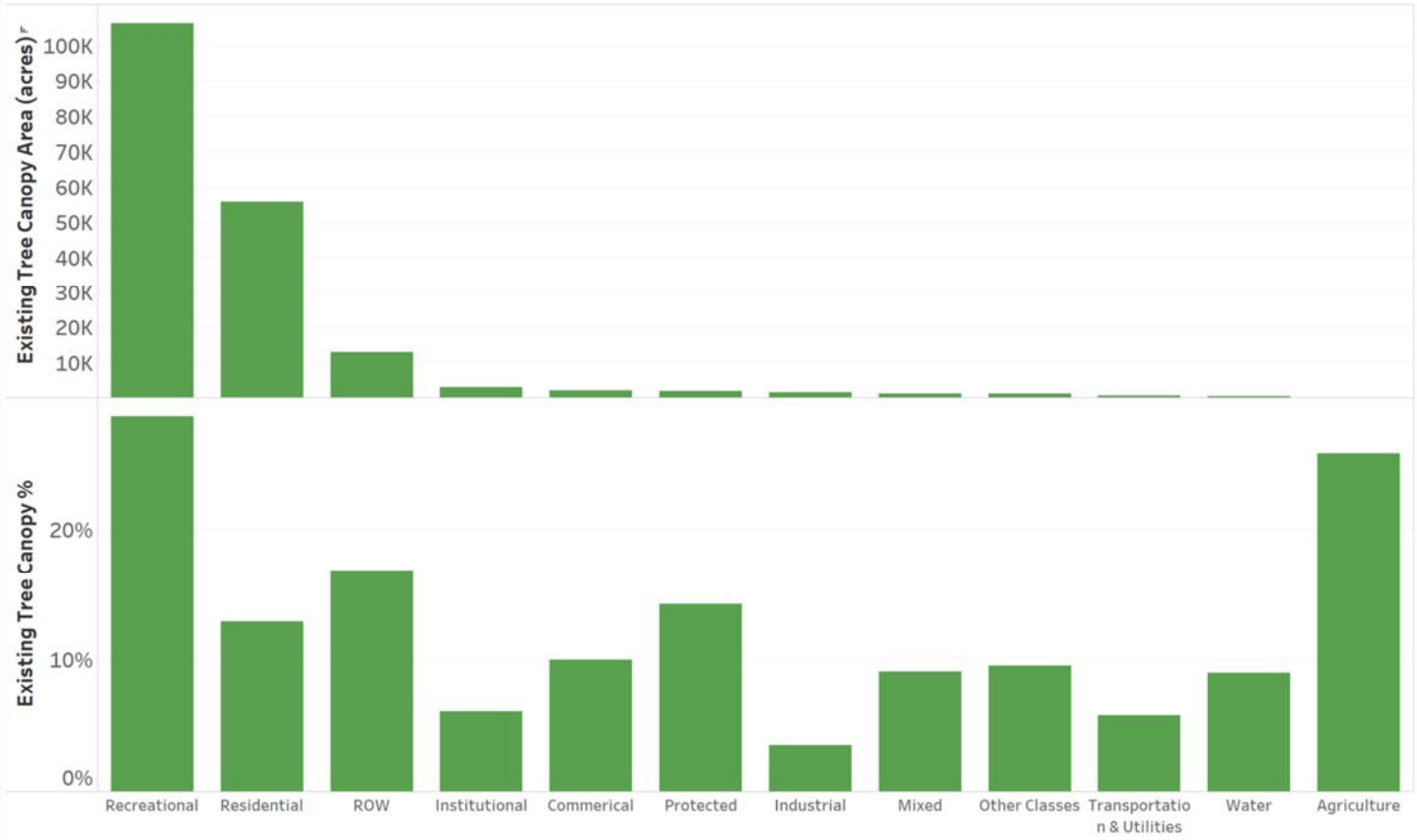


Figure 6: Existing Tree canopy metrics for LA County summarized by land use. The top graph shows the total acreage of tree canopy in each land use class. The bottom graph shows the percent of land in each land use class covered by tree canopy.

City Land Use

When the land use analysis is repeated for only the City of Los Angeles the story changes and residential land is the dominant class for both Existing and Possible Tree Canopy. Recreational and ROW still play important roles, but residential lands hold the key for preserving and increasing tree canopy within the City.

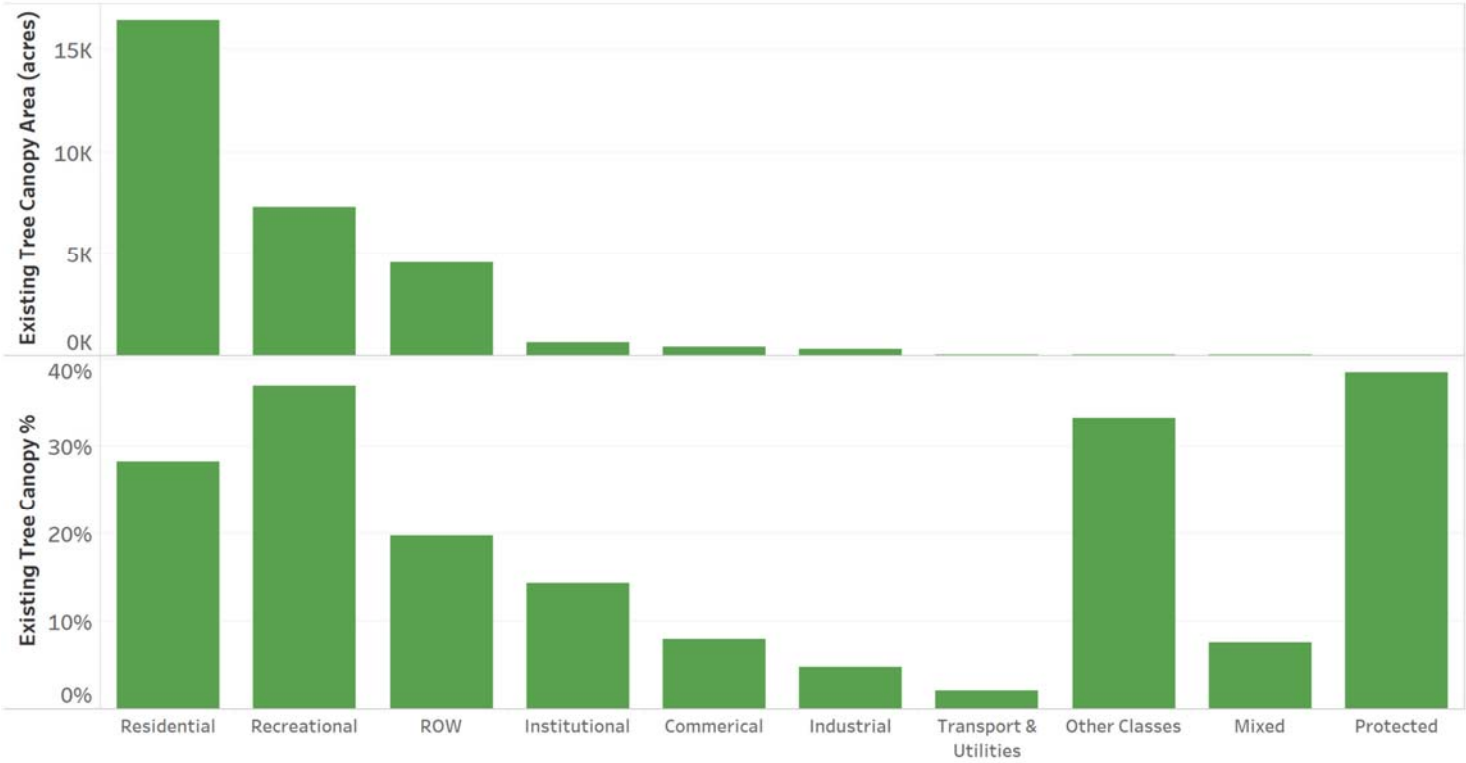


Figure 7. Existing Tree canopy metrics summarized by land use for the City of Los Angeles. The top graph shows the total acreage of tree canopy in each land use class. The bottom graph shows the percent of land in each land use class covered by tree canopy.

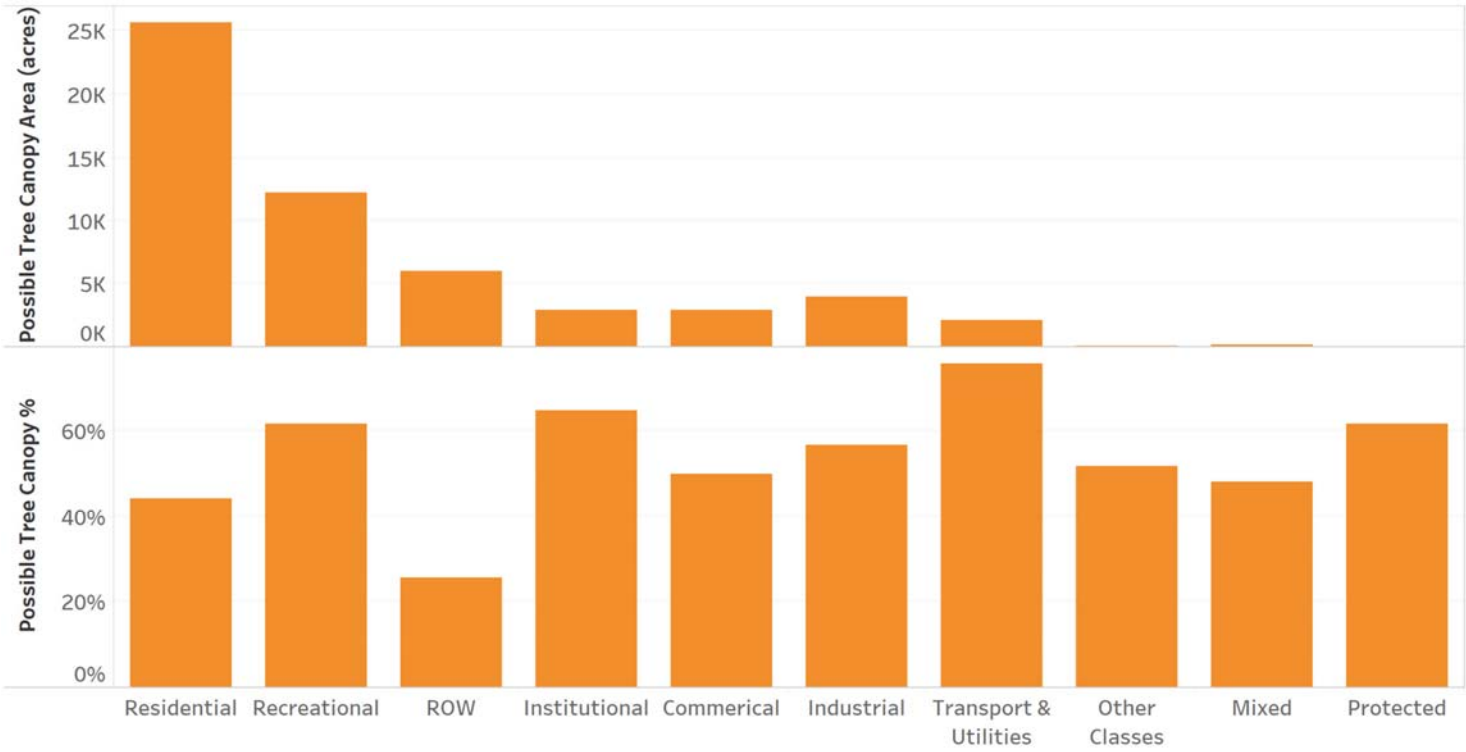


Figure 8. Possible Tree canopy metrics summarized by land use for the City of Los Angeles. The top graph shows the total acreage of Possible in each land use class. The bottom graph shows the percent Possible in each land use class.

Demographics

Trees have essential benefits to society. Analyzing the relationships between socio-demographic information and tree canopy can provide insights into issues of environmental justice as well as the marketing approaches that may help tree programs succeed in communities. This study employed Esri Tapestry data, a market segmentation database that integrates Census and expenditure information. Census block groups are assigned to one of sixteen LifeMode categories that reflect populations that share a collective experience (e.g., new immigrants) or a particular trait (e.g., affluence). This study found that the vast majority of the City of Los Angeles' tree canopy resides in its wealthiest Census block groups (Figure 10). These affluent block groups tend to also have a higher percentage of their land covered by tree canopy.

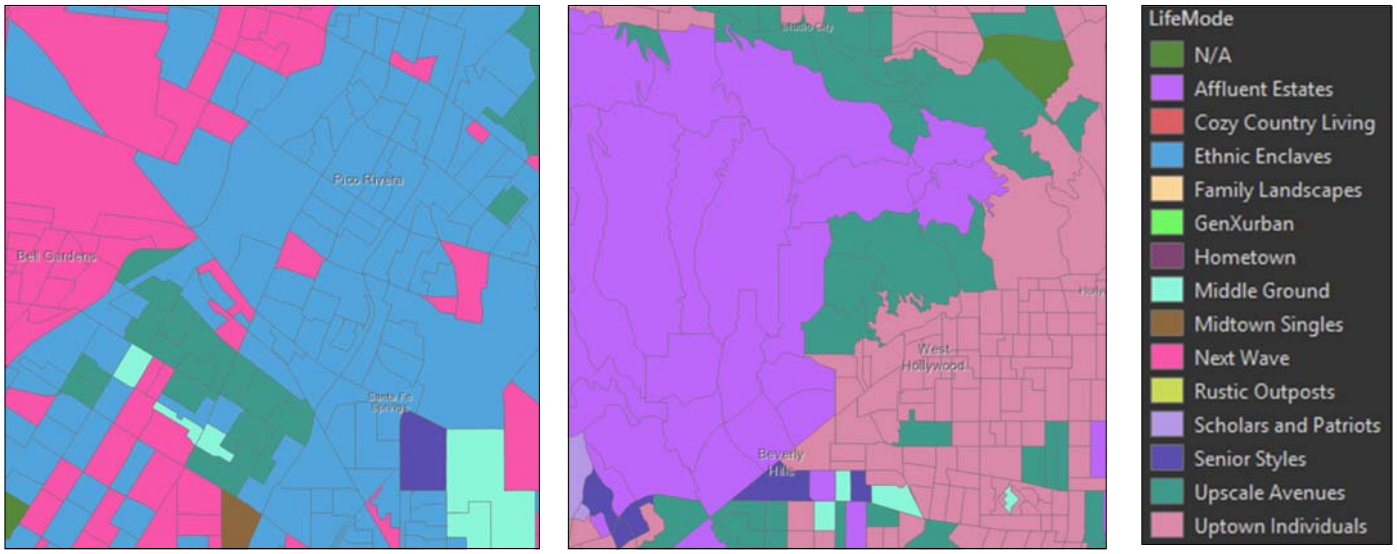


Figure 9: LifeMode block group characterizations for two very different parts of Los Angeles. Next Wave and Ethnic Enclaves, both are which are immigrant communities, dominate the Pico Rivera and Bel Gardens areas. In West Hollywood and Beverly Hills the wealthy Affluent Estates and Uptown Individuals LifeModes are in the majority.

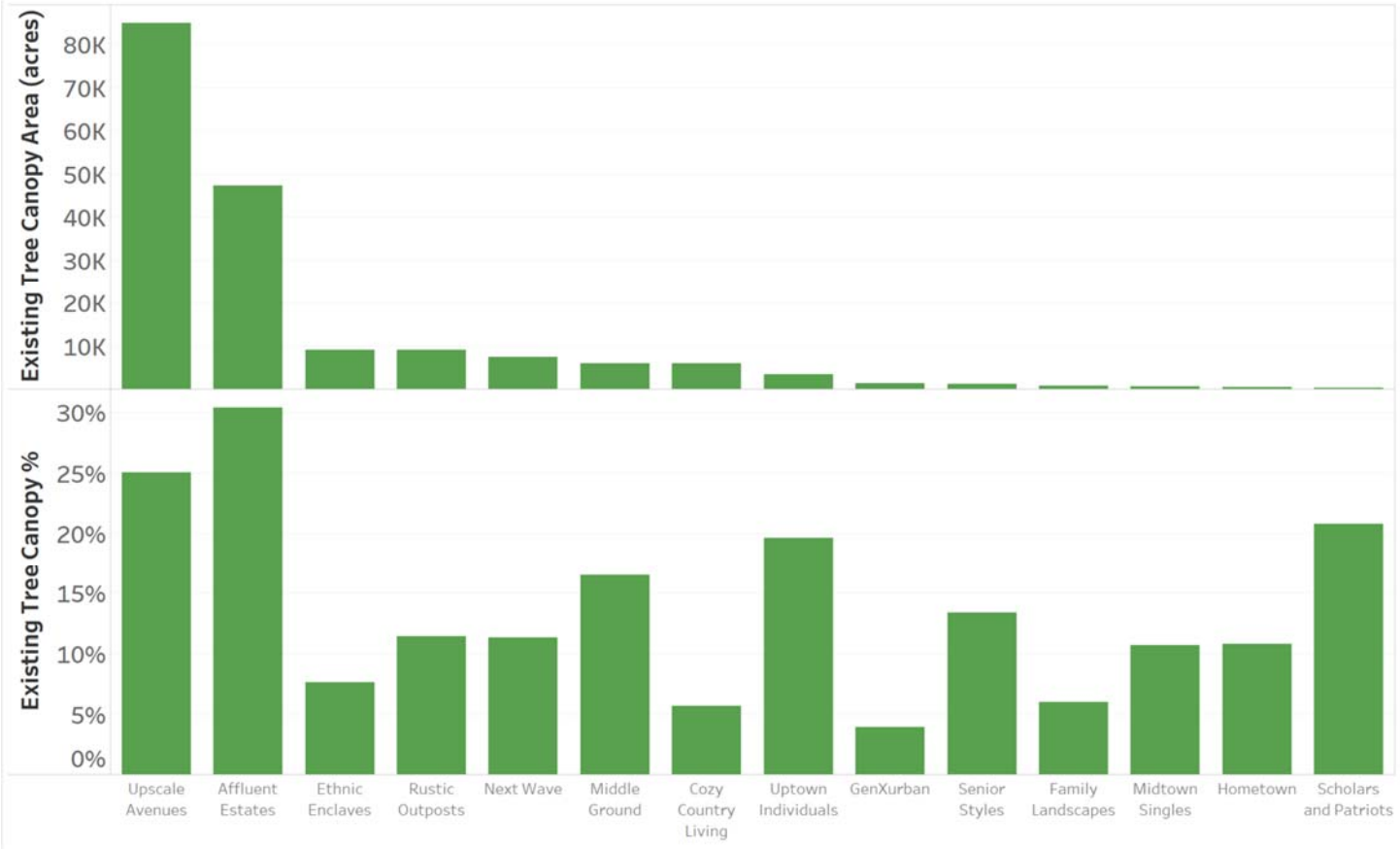


Figure 10: Existing Tree canopy metrics summarized by LifeMode for the City of Los Angeles. The top graph shows the total acreage of tree canopy in each LifeMode class. The bottom graph shows the percent of land in each LifeMode covered by tree canopy.

Is Tree Canopy Equally Distributed?

With 25% of its land area covered by tree canopy, the City of Los Angeles appears to have a robust urban forest. Further inspection reveals a much more nuanced story. Using Census block groups as the unit of analysis this assessment looked at the proportion of the City's tree canopy that fell within each block group. Five block groups, one in Pacific Palisades, one in Los Feliz, two in Brentwood, and one in Shadow Hills, contain 18% of the City's total tree canopy. Less than 1% of the City's population resides in these areas making it clear that much of the City's tree canopy is not where the people are. There are a multitude of factors that contribute to this disparity. For one, more affluent residents can afford to live in the hill areas, which are more ecologically suited for tree canopy and have lower development density. Wealthy residents also have the financial means to plant trees along with the time and connections to advocate for more trees in their neighborhoods. It will certainly not be possible for the City to achieve a perfectly balanced canopy over such a varied landscape, but this type of analysis can help to guide future initiatives centered on ensuring that more of the City's residents benefit from the tree canopy. When integrated with the LifeMode market segmentation analysis from the previous page, outreach plans can be tailored to match the communities they are targeting.

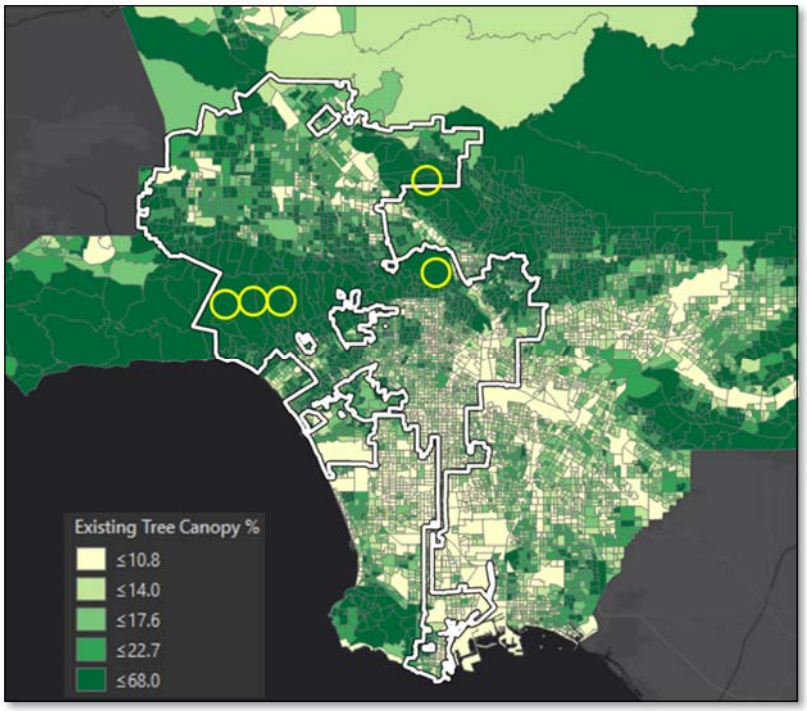


Figure 11: Existing tree canopy as a percent of land area by Census block group. The yellow circles indicate the location of the five block groups in Figure 12 that control 18% of the City of Los Angeles' tree canopy.

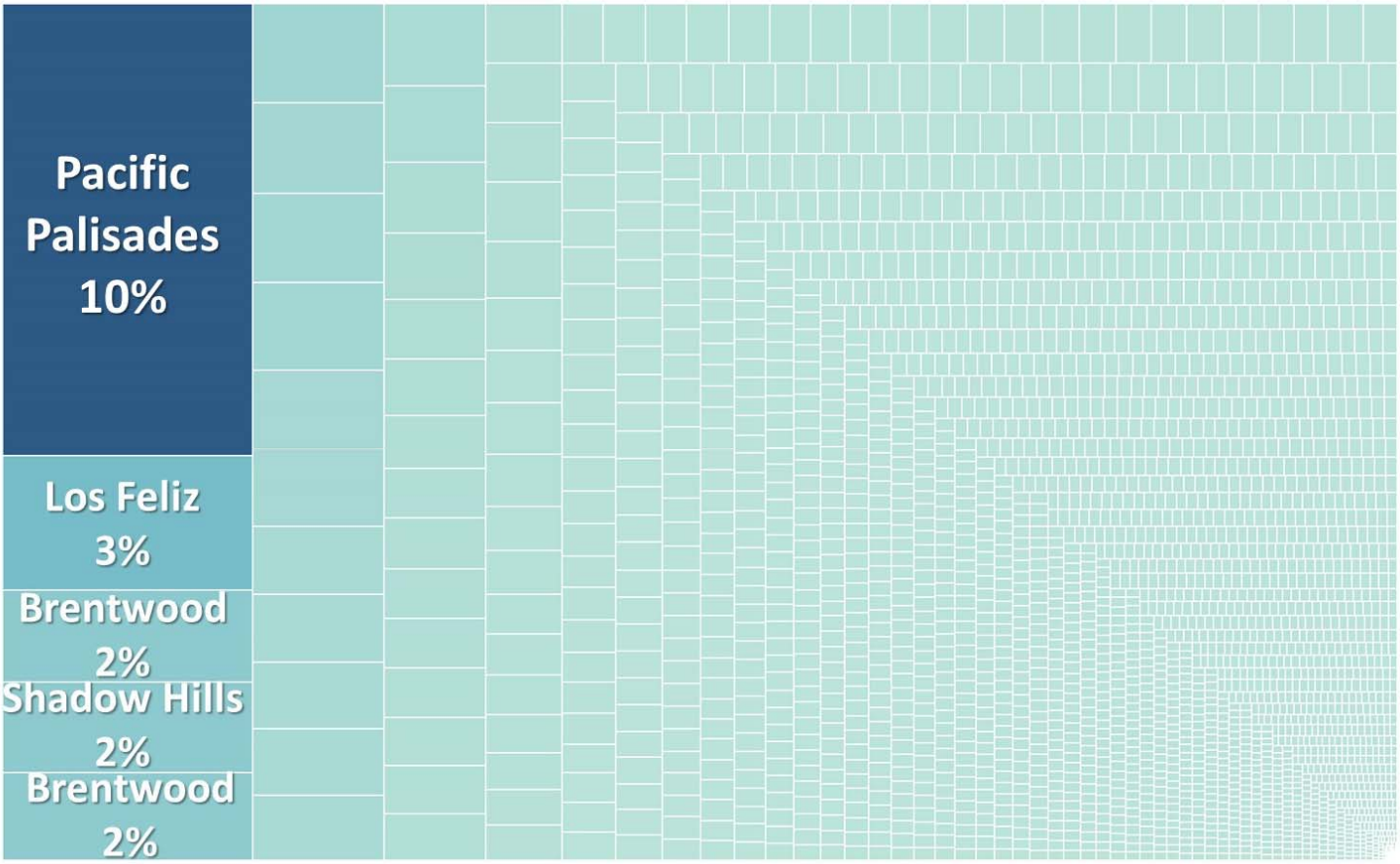


Figure 12: Relative percentage of tree canopy within each Census block group for the City of Los Angeles. Each rectangle represents a single block group. The size and color gradient are proportional to the amount of the City's total tree canopy within each block group.

Year Built & Sale Price

The County's parcel database offers a rich source of information for exploring relationships between property characteristics and tree canopy. Development patterns can influence tree canopy just as tree canopy can influence how desirable a property is. The examples below present the results of two analyses for single-family residential homes in the County. The first focused on the relationship between year built and percent tree canopy on each property parcel. Trees and construction do not mix. During home construction trees are typically removed when the lot is cleared and graded then planted around the time the first homeowner moves in. This "founders effect" results in a robust tree canopy many decades after the home is built. This analysis found a statistically significant inverse relationship between tree canopy and year built, with a noticeable drop-off in the percent tree canopy on homes built after 2000. This study also found that home prices and percent tree canopy are correlated (Figure 12), indicating that homeowners may prefer properties with more tree canopy.

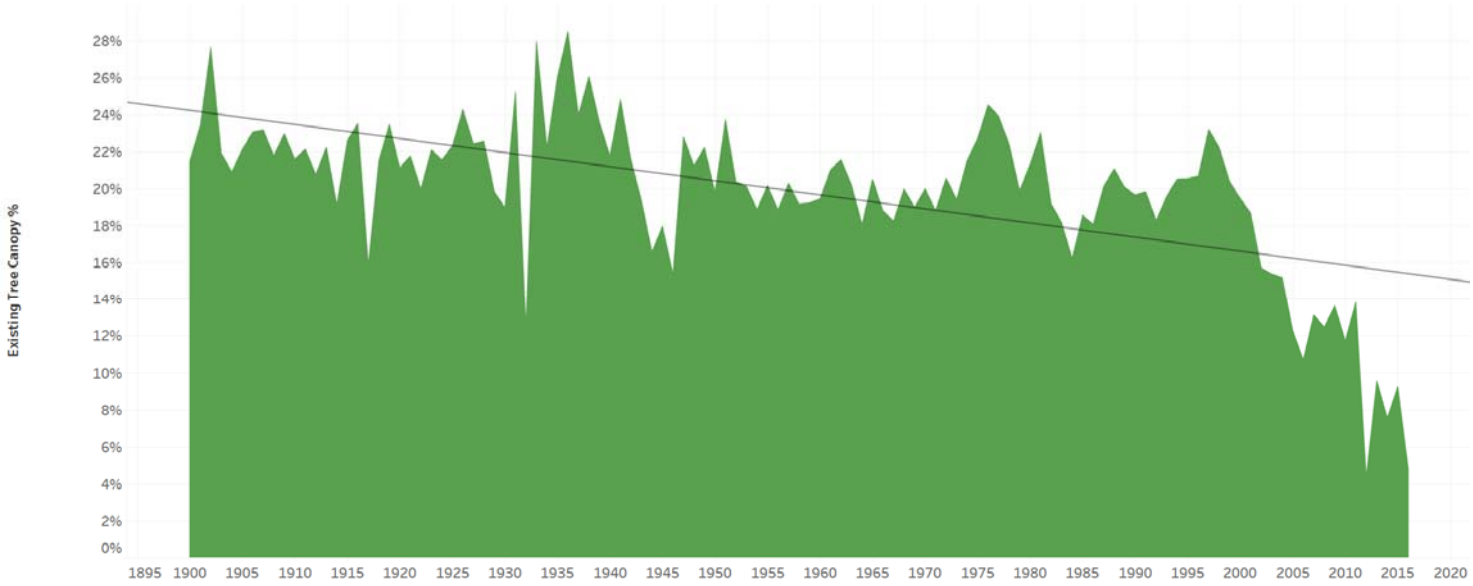


Figure 13: Year built in relation to percent tree canopy for single-family residential homes in Los Angeles County.

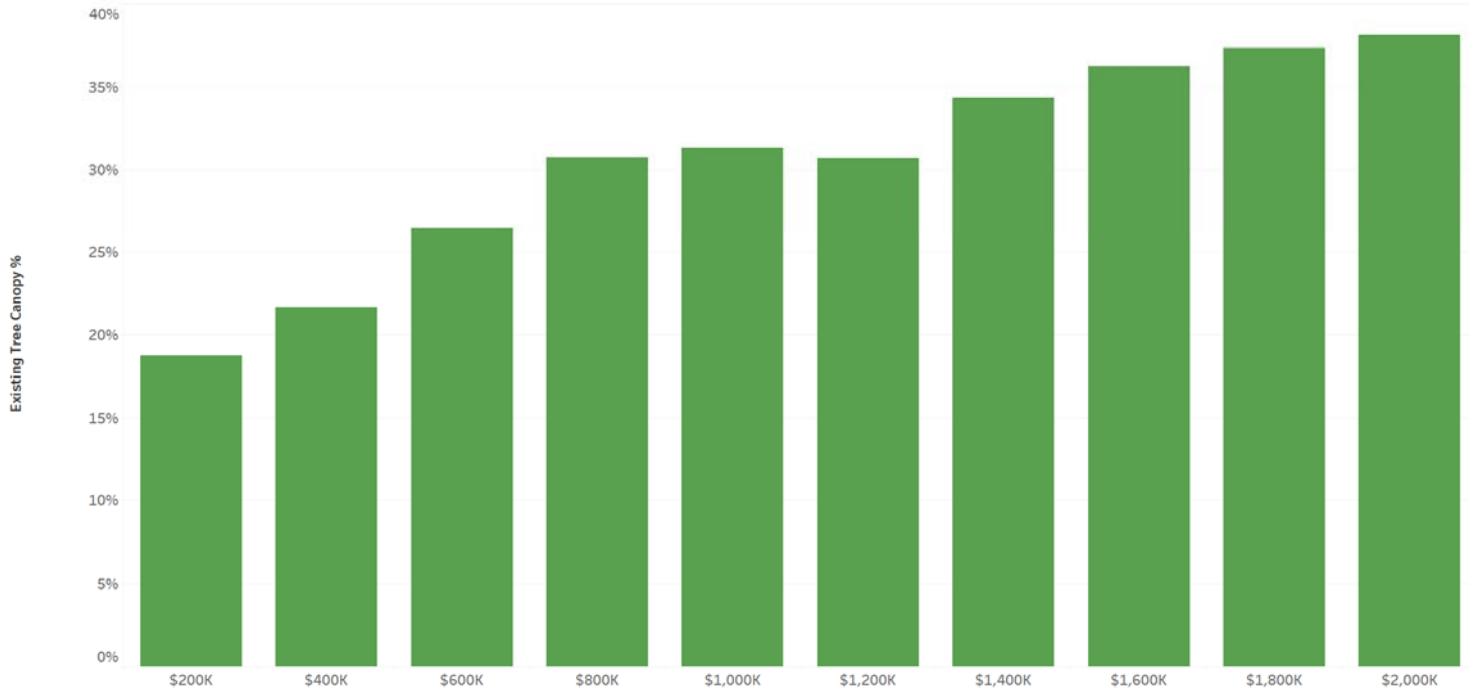
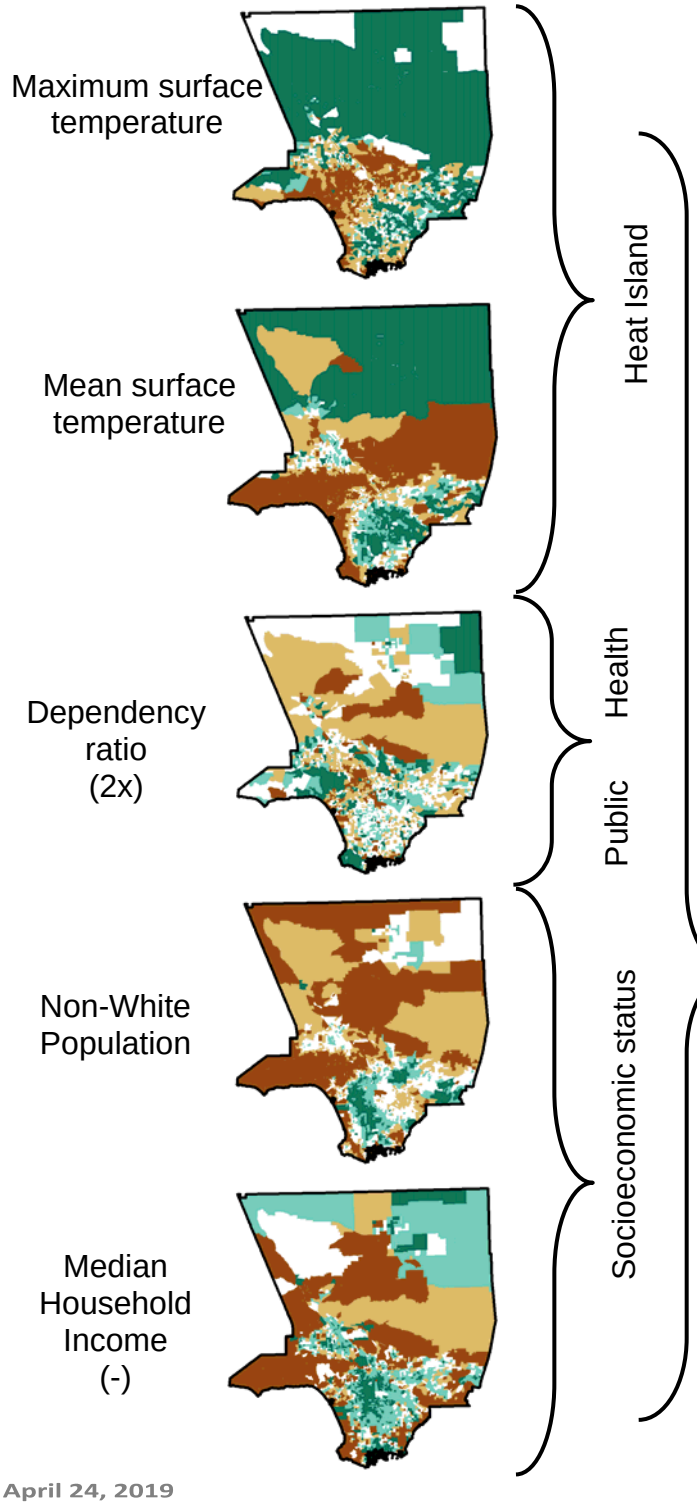


Figure 14: Home sale price in relation to percent tree canopy for single-family residential homes in Los Angeles County.

Tree Planting Prioritization

Experts at TreePeople wanted to identify areas with chronic and severe heat stress, public health vulnerabilities, and low socioeconomic status that could potentially benefit from tree planting. Maximum and mean surface temperature on August 25, 2016 were used jointly to create a urban heat island indicator. The dependency ratio (the portion of the population 15 and younger and 65 and older, divided by the remainder) , was used as a public health vulnerability measure. Finally, the percentage of the non-White population and median household income (weighted negatively) formed a socioeconomic status measure. A final UTC Prioritization map was created by standardizing and combining the weighted maps.

Prioritization Criteria



- NASA's Landsat data was obtained for a hot (August 25) day and used to calculate surface temperature. Maximum and mean temperature per Census tract were calculated. Both types of heat are important for mapping and mitigating urban heat island.
- The Dependency Ratio is the portion of young (<15 years old) and old (>+65 years old) population divided by everyone else. It is commonly used to assess who is 'dependent' relative to those who can provide care. Note that because the units of analyses match the CalEnviroScreen V3.0 boundaries, these data can readily by linked to sources of public health risks, such as noxious exposures.
- The percentage of the non-White population was calculated as one of the socioeconomic status sub-indicators.
- Median household income is the other socioeconomic status sub-indicator. Values are made negative so that lower income areas are higher planting priorities.

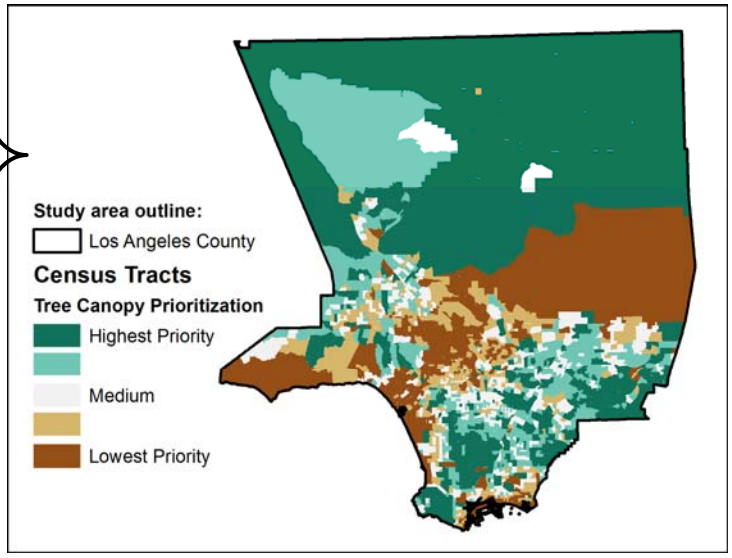


Figure 15: Prioritization analysis

Conclusions

Los Angeles has a robust urban forest but the benefits are not evenly distributed. Some residents live virtually in a forest while many others live in virtually treeless environments. These extreme differences in conditions will create great variation in how residents access and benefit from the various social, environmental, and human health benefits provided by tree canopy.

Preserving existing tree canopy is critical. The ecosystem services provided by trees are directly related to the amount of canopy they provide. When trees are removed and replaced, there is not only a size difference in the canopy provided by the new tree compared with the mature tree; there is also a time lag of reduced benefits until the new tree can grow to the size of the mature tree. Keeping the trees you have is more efficient than removing and replacing them. Harmonizing tree preservation efforts between the City, County, and the many municipalities in the County may help achieve regional tree canopy goals.

Residents hold the key. Residential lands hold the majority of Existing and Potential Tree Canopy in the City and are the second biggest land use for Existing Tree Canopy in the County. Different markets need different messages carried by different messengers. Those with Existing Tree Canopy may benefit most from outreach on tree care and maintenance. Those in canopy deficit areas may benefit most from technical and resource assistance with tree planting and establishment.

Continue mapping, monitoring, and inventorying. This assessment provides a very useful baseline dataset. Over time, partners will initiate efforts to preserve and expand canopy, while storms, fires, drought, pests, and development will threaten it. Canopy loss is generally an event while canopy gain is a process of growth and planting. Measuring progress over time and developing countermeasures as needed will you be responsive to the ever changing landscape of LA City and County and keep the region's tree canopy growing.

This project was funded by US Forest Service and CAL FIRE through the Urban and Community Forestry Program.
The methods, findings, and recommendations contained in this report are those of the project team and not of the funding agencies.

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Additional Information

For more info on SavATree Consulting Group, see **https://www.savatree.com**

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

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