USC Urban Trees Initiative Phase 2

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Introduction

USC's Urban Trees Initiative Phase 2 seeks to build upon the work begun last year in Phase 1, as the university continues on its goal to improve the environmental conditions of the surrounding communities and promote environmental justice. Urban tree canopy is an important tool to fight urban heat island effect and improve air quality, underscoring the importance to improve conditions as the climate warms. The study area for Phase 2 encompasses Boyle Heights, City Terrace, and the neighborhood surrounding the USC University Park Campus. Over the semester, our student team has conducted a baseline analysis of neighborhood conditions by studying data such as land use, overall green cover, and impervious surface for each area. We also created a tree inventory for the entire study area, mapping almost 50,000 private trees and incorporating city streets data.

These tasks will help identify priority areas for tree-planting, in addition to answering basic questions about the relationship between air quality, tree distribution, and community health and well-being. Throughout the semester, we have participated in a number of community engagement meetings to share our findings and receive feedback from residents and community leaders. After we produce a report of our findings, the City of Los Angeles will use it as a guide to improve the effectiveness of future tree plantings across the city.

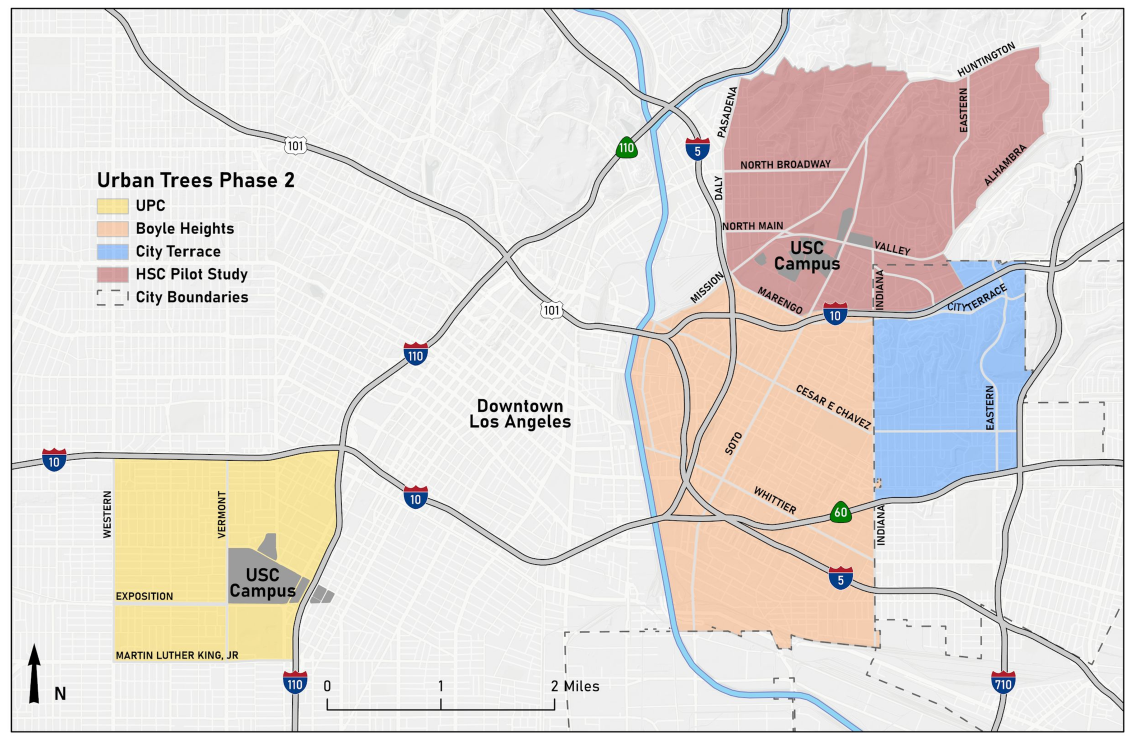
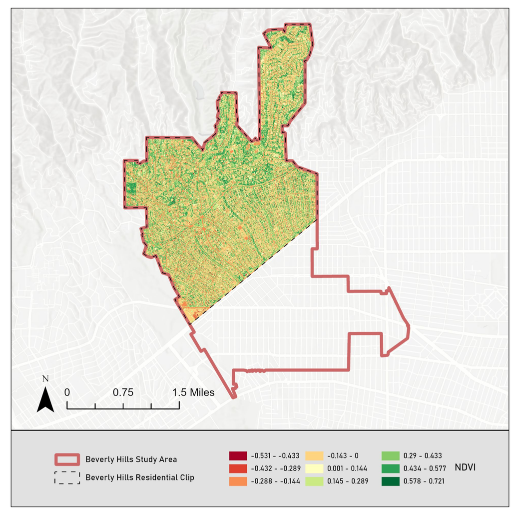
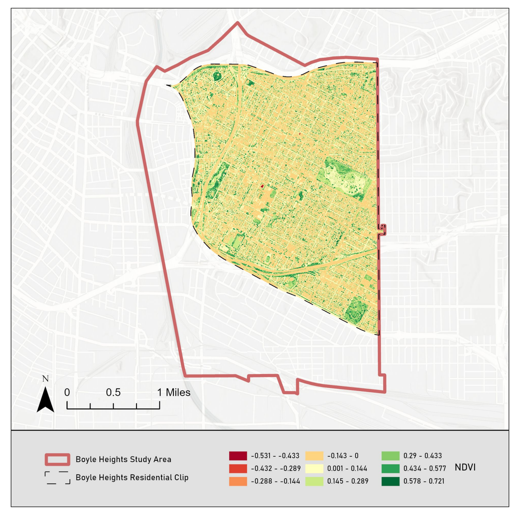


Figure 1: Study Area Map
This map depicts the study area of the project. The area in red was studied during Phase 1 in 2019-2020. Phase 2 adds the neighborhood around University Park Campus and the Boyle Heights and City Terrace Communities.

Equity and NDVI in Boyle Heights and Beverly Hills

Normalized difference vegetation index reads reflected light to estimate vegetation density in a given study area. By comparing the vegetation density of the residential neighborhood in Boyle Heights against that of the residential neighborhood in Beverly Hills, we are able to capture the disparity in vegetation equity between our study area and affluent neighborhoods in Los Angeles.





Figures 2 (left) and 3 (right): Beverly Hills and Boyle Heights NDVI Maps

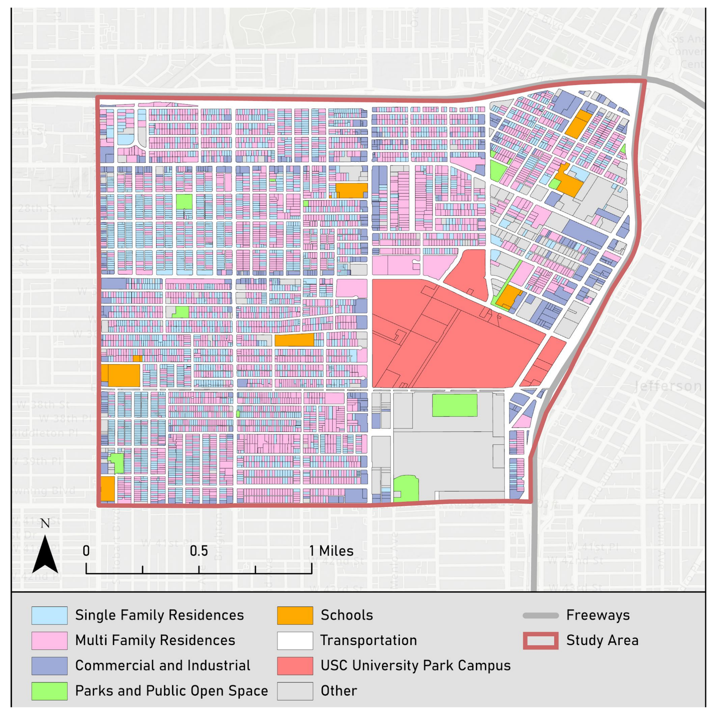
Methodology

This project can be split into three parts: the baseline conditions, the tree inventory, and analytical maps. Baseline conditions were generated to understand the unique features and demographics of each community. The tree inventory was a time-intensive data collection phase resulting in an understanding of current green conditions. Finally, the analytical maps (such as the Ideal Tree Planting Locations) use a combination of the previous two parts to target areas for increased canopy.

Results

Baseline Maps and Charts

These maps and charts were made using US Census data, LA County Parcel data, and satellite imagery. Each piece contributes to our understanding of the current conditions of each neighborhood.



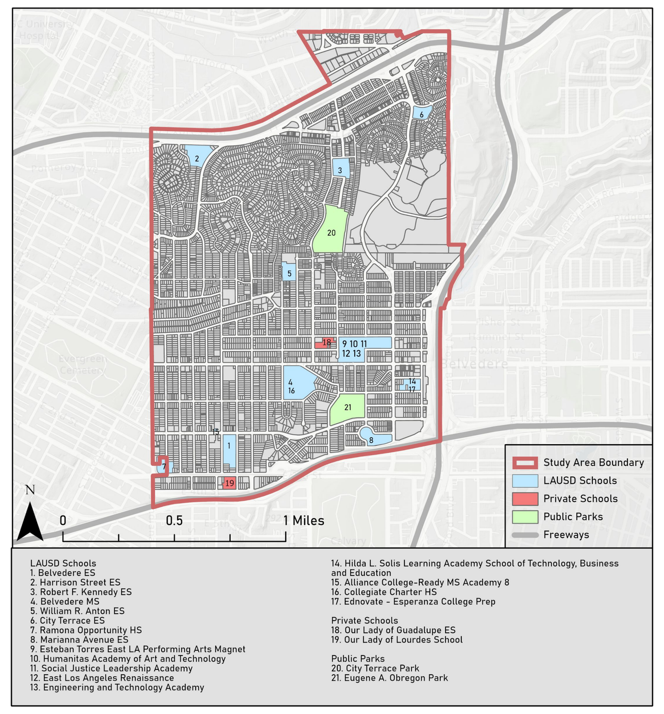


Figure 4 (Left): Land Usage in the UPC Neighborhood
This map shows how the neighborhood is divided for various uses. Within the study area, the majority of the land is residential, with both single family and multi-family homes. Large portions of the area are dedicated to USC, Exposition Park, and various roadways.

Figure 5 (Right): Schools and Parks in City Terrace
This map how schools and parks are configured across City Terrace. City Terrace is unique in that it is an unincorporated part of Los Angeles County, so it does not necessarily receive the same services as other parts of the city. Nevertheless, it contains a number of schools and parks. Our team was able to visit with community leaders in City Terrace and walk around the neighborhood to further understand conditions on the ground.

Demographic Charts for the Neighborhood around UPC

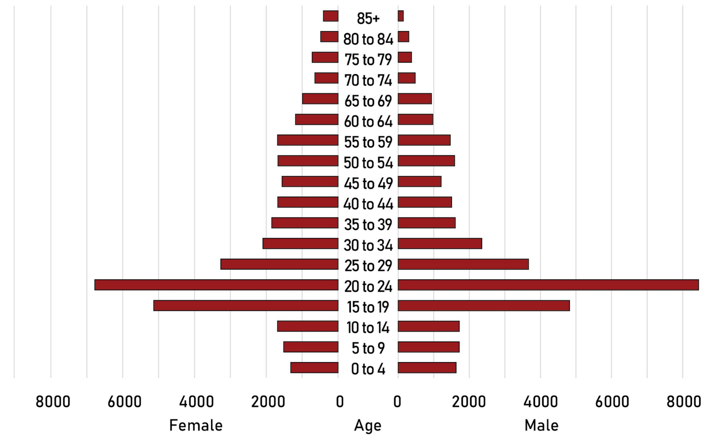


Table UPC3: Study site race and ethnicity as a percent of total population

Neighborhood	Hispanic	Non-Hispanic			
	All races	Black	Asian	White	Other
UPC	55.4	14.5	14.2	13.2	2.7

Table UPC4: Asian and Hispanic populations by origin as a percent of total population

Neighborhood	Hispanic origin				Asian origin			
	Mexican	Salvadoran	Guatemalan	Other	Chinese	Korean	Filipino	Other
UPC	32.0	12.0	7.0	4.4	5.9	2.6	1.1	4.6

Table UPC5: Demographic and socio-economic household profiles

Metrics	Homeowners	Renters	Totals
No. of households	3,352	14,958	18,310
Percent of households who moved in before 2010	78.8	36.0	43.8
Percent of households whose mortgage payment is ≥ 50% of total income	29.4	---	---
Percent of households whose rent is ≥ 50% of total income	---	35.5	---
Percent of households with no vehicle	3.2	28.2	23.6

Figures 6 (Left) and 7 (Right): Age and Race
These two charts explain the demographic data around the USC University Park Campus. Because of the density of college students living in this area, the age of residents peaks below the average ages in the other neighborhoods we studied. This area is majority of Hispanic origin, with sizeable minorities of each racial origin. Additionally, a large percentage of residents are renters.

Ideal Tree Planting Locations Using Existing Street Tree Counts and Pedestrian Routes

To determine street segments suitable for tree planting, we focused on the existing street tree count and walking routes from households to elementary schools. We normalized the street tree count by finding the mean number of trees per 200 feet of street segment. Breaking the study area into elementary school catchment boundaries and representing each household as one point, we used ArcGIS Network Analyst to create walking routes from households to their representative elementary school. By counting where routes overlap, we gain a rough proxy for pedestrian counts along street segments towards elementary schools. By comparing this data with the trees per 200 feet metric, we identified segments with a high pedestrian count and low tree count. These segments serve as a starting point for further determination of ideal planting locations, which will include parkway width and community input.

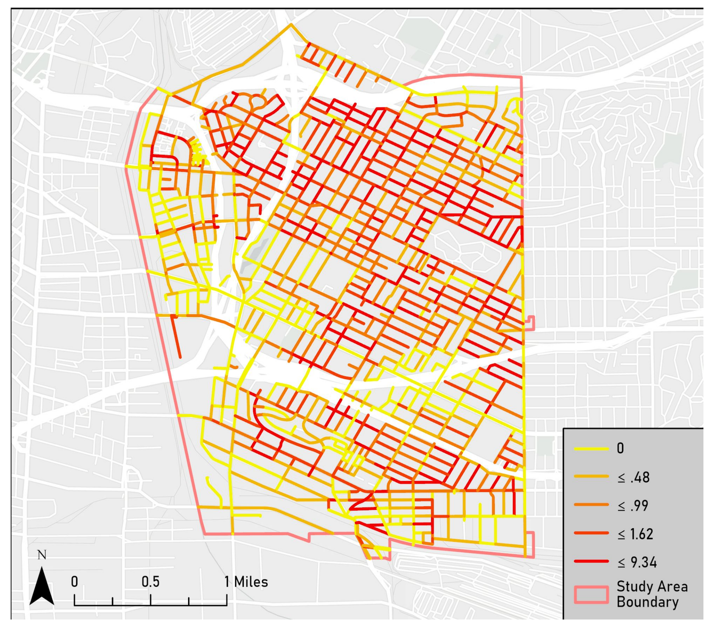


Figure 8: Boyle Heights Trees per 200 Feet
This map shows the trees per 200 feet metric for the entire Boyle Heights street network.

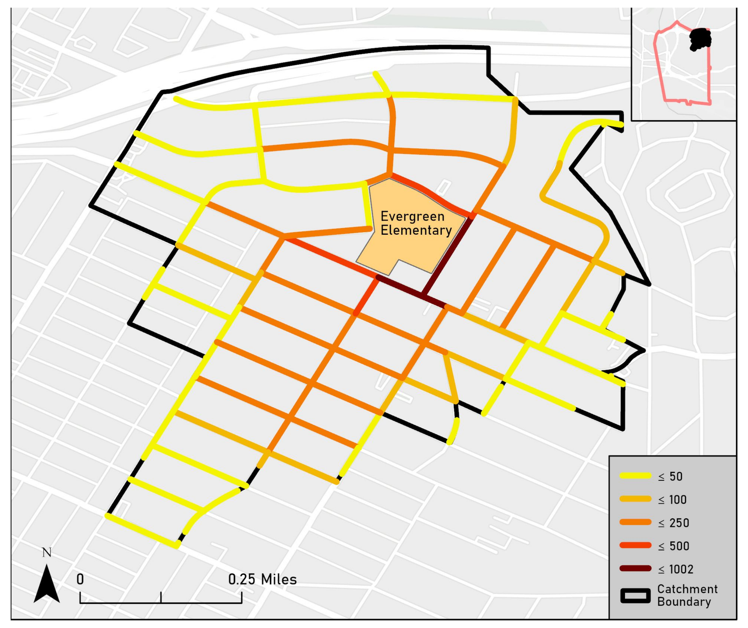


Figure 9: Evergreen Elementary Pedestrian Count
This map shows the pedestrian count towards Evergreen Elementary in Boyle Heights.

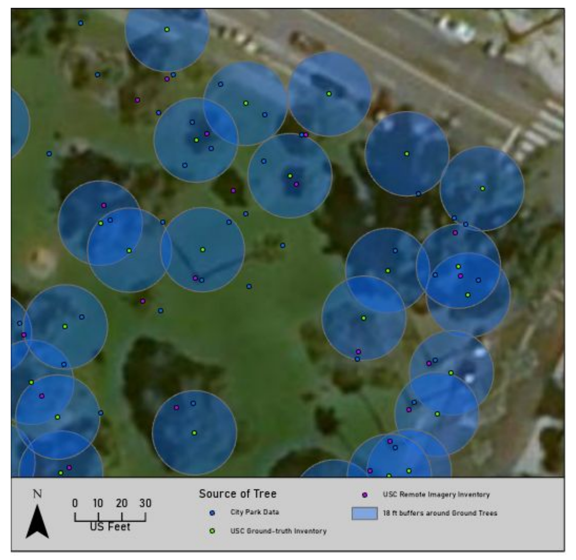
Figure 10: Ideal Planting Locations
This map shows the relationship between pedestrian and street tree counts, with streets in light green being of keen interest.

Tree Inventory

Figure 11: UPC Tree Inventory
To understand the current conditions of each neighborhood, it was important to study the existing tree canopy. Our team combined a number of data sets to create a full tree inventory within each neighborhood. For the area around UPC, we were able to combine City Street Tree data, City Park Tree data, USC FMS Tree data, and our own data created from satellite imagery.

Data Validation: Hollenbeck Park

Because our tree inventory is made up of various datasets, we were able to compare overlapping areas to understand the constraints of our various sources. In Hollenbeck Park (located in the Boyle Heights Neighborhood), we had two sources of data: our Remote Sensed inventory and the City's Park Tree data. We undertook a ground survey, using ArcGIS Collector to create a third inventory of ground-truthed trees. This process revealed that our remotely sensed imagery contained many fewer trees than the city and ground data due primarily to the difference between gathering canopy data versus trunk data. These issues arise due to small trees unable to be seen, trees hidden by the canopy of other trees, and difficulty in determining how many trees make up groups of canopy. The city park data is not without flaws either, including missing or outdated trees. Unfortunately, our ground-truthed data was only accurate within about 18 ft so it is unclear how our data would have improved with increased spatial accuracy. This analysis, when applied to the rest of the study areas, can help the inventories reflect a more accurate count of trees.



	Overlap with USC Ground	Extra, not in USC Ground	Missing from USC Ground
City Trees	388	220	131
USC Remote	164	80	355
USC Ground	519	0	0

Figures 12 (left) and 13 (right): Hollenbeck Park Ground Truth
The map above shows 18 ft buffers around each ground-truthed tree. Trees within these buffers are considered to be the same tree.

Conclusion

The immense amount of data collected and analyzed for this project will further the overall study of canopy conditions in Los Angeles and inform future decisions on how to most effectively target areas for canopy improvement. The final goals for this phase will be to use our tree inventory data to model the impacts of shade on the urban heat island and to use air quality sensors to determine how specific tree species impact air pollution. Both of these pieces will aid with investigating the benefits trees can have on a community and hopefully act as a scientific basis for increased attention to urban greening projects.

Acknowledgements

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