

Tree Canopy Equity in Chicago: Integrating Drone Imagery, Spatial Data, and Community  
Stories

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Lincoln Park & Citywide Tree Equity

GEO 442: GIS for Sustainable Urban Development

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## **Abstract**

The goal of our project was to take a citywide look at tree canopy equity in Chicago by combining spatial data, drone imagery, and the work done by all seven neighborhood-based groups in our class. Our team served as the integration group, rather than focusing on a single community area, we pulled together every group's data into one final Story Map. To do this, we have used the ChiVes tree canopy dataset, our drone footage from Lincoln Park, and all of the drone imagery and maps created by our classmates.

Our methods included comparing canopy percentages across community areas, examining neighborhood-level drone visuals, and layering in variables like air quality, heat, traffic, and flooding. The results display a very clear pattern: the neighborhoods with the lowest canopy levels such as Little Village, Gage Park, Pilsen, Pullman, Roseland, Chatham, and parts of Englewood are the same places facing the highest environmental burdens. Lincoln Park, which we captured ourselves, showed noticeably higher canopy by comparison.

These findings support the work of our community partners by highlighting where tree planting and green infrastructure can make the biggest impact and where in the city community areas are underserved in terms of equitable tree canopy coverage.

## **Introduction**

Cities across the United States are starting to recognize tree canopy as a critical part of sustainable urban development due to their various benefits. Trees reduce extreme heat, help mitigate flooding, filter air pollutants, improve mental health, and create more walkable and livable streets. In Chicago, historic redlining, disinvestment and industrial land use have shaped which neighborhoods have full, mature tree canopy and which remain severely underserved.

Our project asks: How equitably is Chicago's tree canopy distributed and how do neighborhood conditions and environmental factors relate to canopy levels?

Our group was focused on consolidation and integrating various features for the entire class. Rather than focusing on one neighborhood, we created a citywide Story Map that pulls together:

- Drone footage collected across Lincoln Park and the 7 community areas
- The ChiVes tree canopy data
- Environmental and health variables
- Community partner stories
- Maps and analyses from all student groups

We were tasked with presenting this data in a digestible format that can be shared with our specific community partner of the City of Chicago's Department of the Environment, and the various other community partners working with the other groups in class.

Tree canopy cover is an aspect of urban planning that has always been a topic of conversation. The percentage of tree canopy cover has been hotly debated within the world of urban forestry, a field developed out of the very concept of implementing and understanding the effect of trees on a city environment and the people who reside in it. Previously, it was understood that a blanket 40% value was what cities should aim to have an effective 'green' city. However, recent research and understanding about the variability of urbanized landscapes has led to groups like American Forests to suggest a more nuanced approach when assessing the development of sustainable urban forest.

With our modern understandings about invasive species, climatic and regional differences, as well as the issues that have a comprehensive urban tree canopy can impact; American Forests suggest a range of percentages that a city should aim for depending on its location and climate. Obviously, desert cities like Phoenix, Los Angles, and Las Vegas would have issues supporting a healthy 40% tree coverage, so a value closer to 15% has been ascribed as more reasonable and achievable. Conversely, cities in forested states, like Seattle, Portland, and Charlston, a tree canopy cover percentage from 40%-60% has been deemed achievable and effective. For cities like Chicago that are in more 'grassland' type areas, a tree canopy cover of 20% and above was determined to be an optimal goal.

Even with this new figure of 20% for a region like Chicago, by looking at the data it is obvious that many places in the city fall far below that prosed 20% baseline. Consistent higher levels of tree canopy coverage is known to help reduce issues like the urban heat island effect, storm runoff/flooding, noise pollution, and is known to be linked with a physically and mentally healthier population. Given these factors, it should be the goal of any municipalities to have consistent and equitable coverage throughout their cities, to benefit all the residents that call their cities home. And this is exactly what the AQ25 GEO 442 class looked at in regard to various neighborhoods in Chicago, with all eight groups focusing on specific community-based issues that some of the areas are facing and how that is linked with an equitable, or lack thereof, tree canopy cover. Our group, partnered with the city of Chicago's Department of the Environment, looked specifically at tree canopy cover on our own while also incorporating the data from other groups and their community partners.

### Importance to the Community

Tree canopy is directly tied to environmental justice. Numerous studies have shown that lower-income and majority-Black or Latinx neighborhoods have systematically seen lower tree canopy and higher exposure to environmental hazards (Locke et al., 2021; Nowak et al., 2022). Because trees cool streets, reduce asthma triggers, absorb noise and buffer stormwater, increasing the canopy in historically disinvested areas can help improve public health and quality of life.

Chicago's Department of the Environment (DOE) along with our community partner the Tree Equity Working Group are actively seeking methods to prioritize where trees should be planted first and our Story Map supports this mission by providing visual evidence, community context and baseline metrics across the city.

### Previous Research

Prior research consistently confirms this trend that tree canopy distribution across the United States is inconsistent.

- Historic redlining continues to predict modern canopy patterns (Locke et al., 2021).

- Socioeconomic factors strongly influence canopy loss or growth (Lyall & Darling, 2025).
- Lower-income areas experience hotter temperatures due to poor canopy (McDonald et al., 2021).
- Urban tree cover correlates with better environmental health and reduced pollution (Riley & Gardiner, 2020).
- Tree inequity follows income and racial lines, reinforcing environmental injustice (Schwarz et al., 2015).

These findings mirror the trends observed in our city Chicago with canopy being the highest on the North Side of the city and lowest in the South/South-West communities that are facing pollution, heat vulnerability, industrial land use and health burdens.

## **Methodology**

### Datasets used:

1. ChiVes Tree Canopy Data (2017) - LiDAR derived canopy percent at the block-group level.
2. Lincoln Park Drone Imagery.
3. Drone imagery from seven other groups that are Englewood, Gage Park, Pilsen, Little Village, Pullman, Chatham, and Roseland along with multispectral drone footage stitched into Ortho mosaics.
4. City of Chicago boundary & community area shapefiles.
5. Supplemental data provided by each group
  - o Flooding (Greater Chatham Initiative)
  - o Air quality & PM2.5 (Gage Park)
  - o Urban heat (Pilsen)
  - o Traffic (Little Village)
  - o Health outcomes (Imani Village)
  - o Noise (Red Line Extension Corridor)

## Analysis Techniques

### 1. Raster Interpretation & Layer Integration

We used the ChiVes tree canopy data and connected it to Chicago's community areas so we could see how much canopy each neighborhood has.

### 2. Comparative Drone Image Analysis

We compared the drone images from each neighborhood to the canopy data of each neighborhood, to see whether what we saw on the ground matched the LiDAR-based canopy percentages.

### 3. Layer Overlay Analysis

We compared canopy data with:

- Surface temperature
- Air quality/PM2.5
- Flood susceptibility
- Traffic density
- Health indicators
- Noise

This has helped us to identify relationships between low canopy and various environmental stressors.

### 4. Citywide Visualization & Mapping

We produced maps showing:

- Percent canopy
- Standard deviation from citywide canopy mean
- Drone visuals from each neighborhood
- Side-by-side comparisons

## Results

Figure 1. Citywide Tree Canopy Coverage Map  
(ChiVes dataset)

This map shows the canopy percentages across all of Chicago community areas and reveals that:

- North Side & lakefront areas (Lincoln Park, Edgewater, Rogers Park) show higher canopy (25–40%).
- South and West Side neighborhoods (Gage Park, Little Village, Englewood) consistently fall below 15%.

These patterns closely match the historic investment and land-use patterns.

Figure 2. Comparing Tree Canopy Examples from Other Neighborhoods

Drone footage captured by our classmates from other neighborhoods reveals that:

- Gage Park, with 15% tree canopy coverage, sparse, young trees and exposed streets. Even from these ground shots of the streets near Senka Park you can see more of these smaller trees providing considerably less canopy coverage to the community area.
- Pilsen with a 16% tree canopy coverage had low canopy levels, possibly due to the proximity to a robust industrial corridor.
- Little Village had very low vegetation in heavy-traffic zones such as Pulaski and I-55.
- Pullman/Chatham when compared to the Pilsen and Gage Park imagery, has a higher reported tree canopy coverage. With the specific census tract observed having a canopy coverage of about 25%.
- Roseland, specifically Fernwood Park, sat at 24% and had a strong canopy inside the park with this trend not being reflected within the drone footage of the surrounding residential blocks.
- Englewood (34% in some tracts) had surprisingly high canopy levels in pockets, though it was unevenly distributed.

Figure 3. Drone Imagery of Lincoln Park, Gage Park, Pilsen, and Chatham

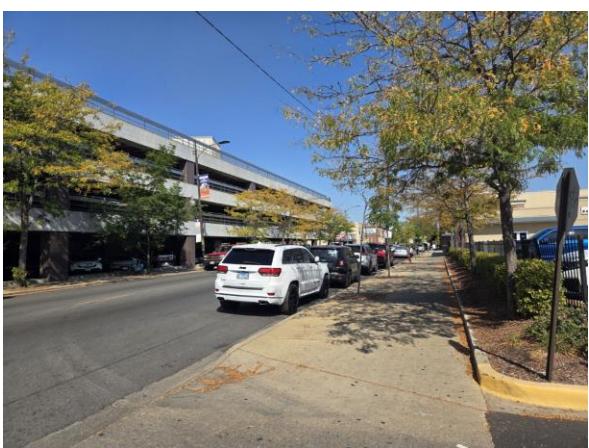


Figure 4. Chicago Tree Canopy Histogram

The histogram confirms the visual pattern: Chicago's tree canopy skews toward the lower end, with most community areas clustered around the 20% mark. Only a handful of neighborhoods exceed 30%, while many fall well below 16-18%.

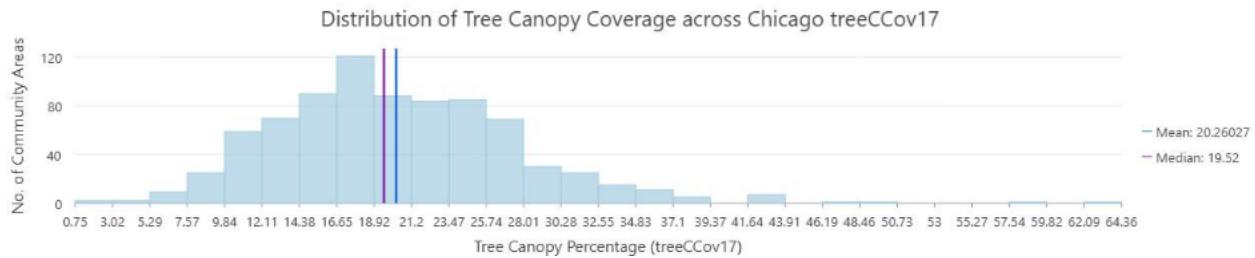


Figure 5. Tree Canopy Coverage Map – Chicago (ChiVes)

Tree Canopy Coverage across Chicago (Highlight : Lincoln Park)

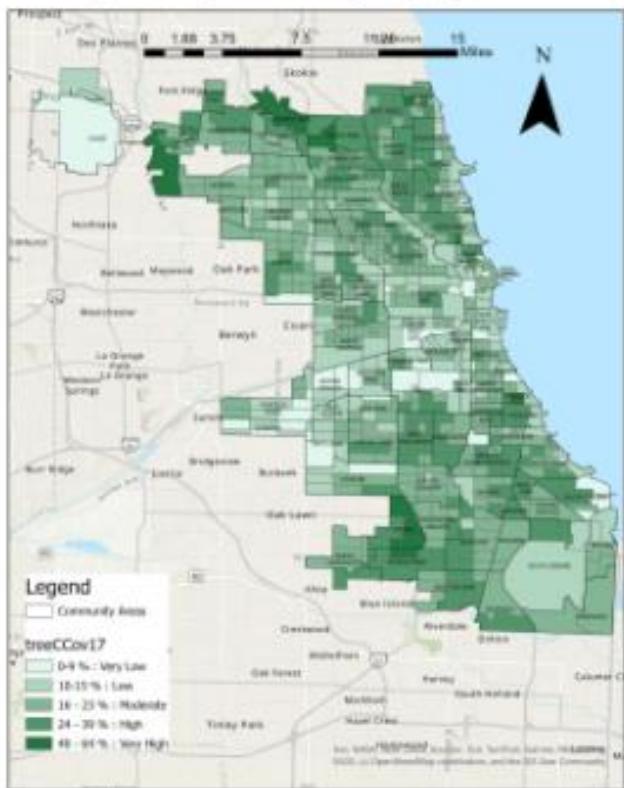
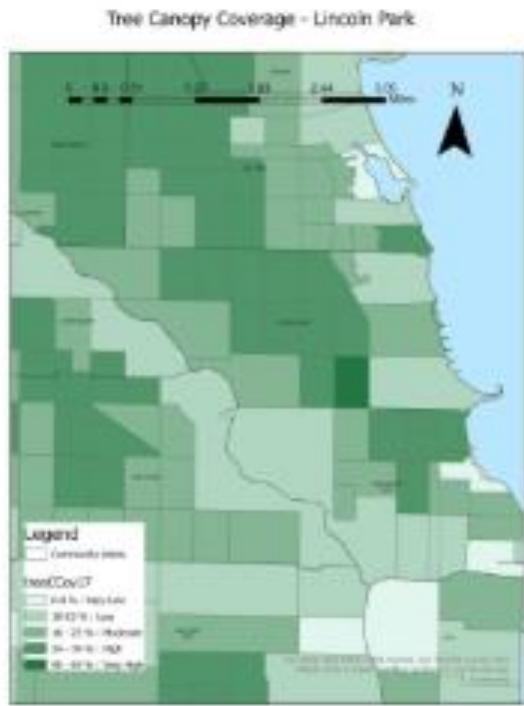


Figure 6. Tree Canopy Coverage Map – Lincoln Park (ChiVes)



## Discussion & Conclusion

Across the datasets, one conclusion is unavoidable that Chicago's tree canopy is not distributed equally and that neighborhoods with lower canopy have consistently:

- Higher urban heat
- Poorer air quality & PM2.5
- Higher traffic exposure
- Higher asthma and chronic disease rates
- More impervious surface
- Less walkable and safe environments

This mirrors national research showing that environmental burdens fall on neighborhoods with fewer trees. Lincoln Park demonstrates what 26–30% canopy looks like with shaded sidewalks, cooler streets, and higher comfort levels. Meanwhile communities such as Gage Park, Little Village, and Pilsen illustrate what 15% or lower canopy looks like with hotter, more polluted and more vulnerable areas.

Our Story Map gives partners:

- Visual evidence to advocate for more trees
- Neighborhood-by-neighborhood comparisons of tree canopy
- Contextual environmental data to justify the urgency
- A tool to guide planting priorities in each area
- A unified narrative that connects all groups' findings

DOE, CDPH, Grow Greater Englewood, Mi Villita Neighbors, Imani Village, and the Red Line Extension Coalition can all use this work to pursue funding, target planting sites, communicate with their residents, support grant applications and shape policy recommendations.

Ultimately the expanding canopy in underserved areas would help reduce heavy environmental burdens and make Chicago more resilient to various climate factors.

Expanding tree canopy in underserved areas is not merely about adding greenery, it is a strategy to reduce pollution exposure, lower temperatures, address health inequities, and improve quality of life across Chicago. These findings match the citywide pattern shown in our ChiVes standard deviation map, the neighborhoods with the fewest trees are often the same neighborhoods with the highest need.

## References

American Forests. (n.d.). Tree Equity Score: Methods & Data. <https://treeequityscore.org/>

City of Chicago. (2023). Urban Forest Management Plan.

Locke, D. H., et al. (2021). Residential housing segregation and urban tree canopy in 37 U.S. cities. *NPJ Urban Sustainability*, 1(1), 15. <https://doi.org/10.1038/s42949-021-00022-0>

Lyall, J. D., & Darling, L. E. (2025). Turning a new leaf: Social and land use drivers of urban tree canopy change in the Chicago metropolitan area. *Urban Forestry & Urban Greening*, 113, 128999.

McDonald, R. I., Beatley, T., & Elmqvist, T. (2021). The tree cover and temperature disparity in U.S. urbanized areas. *PLOS ONE*, 16(4).

Morton Arboretum. (2020). 2020 Chicago Region Tree Census.

Riley, C. B., & Gardiner, M. M. (2020). Examining the distributional equity of urban tree canopy cover and ecosystem services across U.S. cities. *PLOS ONE*.

Schwarz, K., et al. (2015). Trees grow on money: Urban tree canopy cover and environmental justice. *PLOS ONE*, 10(4).

Why We No Longer Recommend a 40 Percent Urban Tree Canopy Goal. (n.d.). American Forests. <https://www.americanforests.org/article/why-we-no-longer-recommend-a-40-percent-urban-tree-canopy-goal/>