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WHO NEEDS TREES?

A Case Study of Downtown Johnson City, NY

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Produced in collaboration with the Johnson City Redevelopment Project and Binghamton University's Department of Geography.

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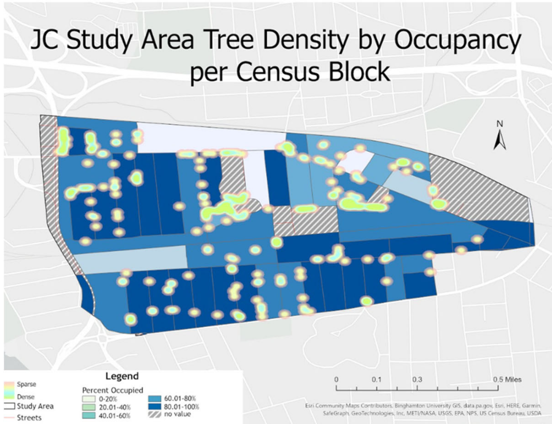

Figure 1: A map comparing tree density to occupancy rates per census block in the Johnson City Study Area

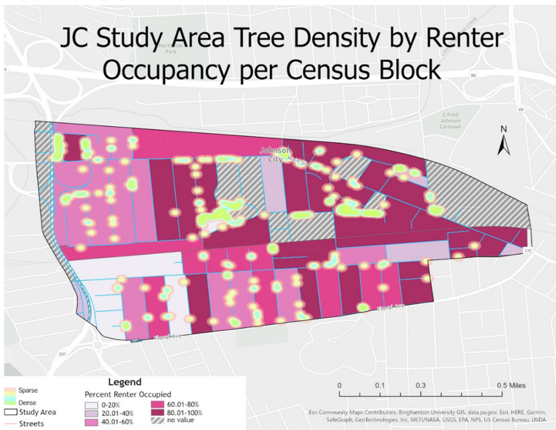

Figure 2: A map comparing tree density to renter occupancy rates per census block in the Johnson City Study Area

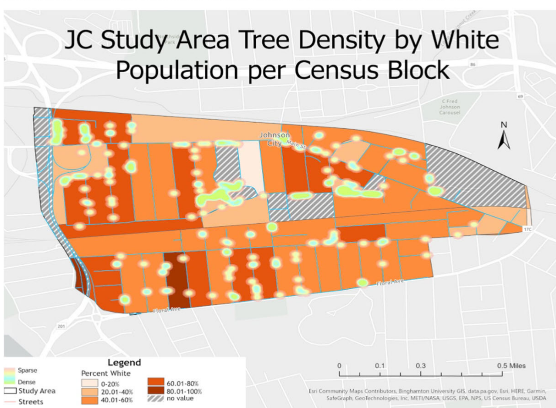

Figure 3: A map comparing tree density to white population per census block in the Johnson City Study Area

INTRODUCTION

The Village of Johnson City, NY has a rich industrial history, and is renowned for being the home base of the former Endicott-Johnson Shoe Company. Its industrial legacy is cemented into the fabric and landscape of the local community, with many of the old factories being repurposed for health, residential, and educational purposes. Its long established residential neighborhoods still exist today, and continue to be characterized by relatively high levels of both ethnic and racial diversity.

Amid downtown revitalization efforts, fueled by local investments from Binghamton University, UHS, and the NYS DRI, the sleepy village has undergone transformational change. An important component of revitalization in post-industrial regions is the effort to increase urban vegetation. The planting of trees, shrubs, and other vegetation help beautify decaying areas and create a sense of connection between the community and nature. Additionally, they reduce the urban heat island effect, create a more pleasant and resilient environment, and provide numerous health benefits to the surrounding population.

Inspired by a recent tree collection done in adjacent Binghamton, NY, our team decided to complete a similar survey in the Johnson City Redevelopment Study Area. Trees which were accessible via sidewalk were measured by various attributes, including circumference, species, health, and location. These data were collected and then analyzed and visualized using ArcGIS Pro to determine density of public trees in the village, and to observe correlations between tree density and other community characteristics.

LITERATURE REVIEW

- Tree canopy cover reduces the overall temperature of urban environments (Ziter et al., 2019)
- Tree circumference is a scientifically sound way to estimate the age of trees (Moller, 2018)
- Urban trees improve the appearance of streets, increase air quality, reduce stormwater, store carbon, limit the heat island effect, and increase property values (Mullaney and Trueman, 2015).
- Previous studies have found that low income blocks and majority non-white blocks have, on average, 15.2% less tree cover. After controlling for population density, this is an estimated 68 million fewer trees, equating to a difference of $56 billion (McDonald et al., 2021).
- Renters skew towards the lower end of the economic scale in terms of income and wealth. In 2019, 88% of people with net worths below the 25th percentile rented their homes (Federal Reserve Bulletin).

METHODOLOGY

- Over the course of two months, the study area was walked block by block to collect data on the location, size, and health of trees that were accessible by pedestrians from the sidewalk.
- The Mobile ArcGIS App, Survey123, was used to capture tree attribute data and precise location. Tree circumference was measured using a surveying tape measure and recorded in inches. Tree height was recorded in three categories: small, medium, and large. Pictures were taken of each tree and its individual leaves to determine the general health of the tree and identify the species.
- We based our analysis on existing literature that established a relationship between tree cover and temperature of urban environments; as well as the disparity of tree density in low income and minority neighborhoods.
- Census blocks and demographic data were retrieved from the US Census. We compared the density of trees to levels of housing occupation, renter occupation, and White population. Using ArcGIS Pro, we were able to visualize this relationship.
- Parcel data was accessed from the Broome County GIS Portal. Zoning by parcel was then compared to tree circumference in ArcGIS Pro.
- We created a heat vulnerability index by census blocks using mean Landsat 8 surface temperatures during summer months (June, July, August) from 2013 to 2023, population density, and lack of tree canopy calculations from the European Space Agency WorldCover 2020 Land Cover imagery service.
- Using the Summarize Nearby tool in ArcGIS Pro, a 5 meter buffer was assigned to each tree point to assign the zoning district that it was part of. Since the trees were only recorded on publicly accessible streets, not all tree points were close enough to a zoning district to be included. This tool created Figure 8, which depicts the tree distribution for each parcel zoning classification.The parcels that contain Binghamton University campuses were not included in this chart because it is only for visualization purposes.

RESULTS

- Urban trees are highly concentrated within two main census blocks with the highest renter occupancy rates (Figure 2).
- More densely populated census blocks tend to have a higher density of trees. However, the most densely populated census blocks do not have the highest density of trees (Figure 1).
- The northwest portion of our study area which has the lowest renter occupancy rates also depicts a disproportionate density of trees.
- Urban multi-family home parcels tend to have trees with a greater circumference (Figure 7)
- Maples are the most common type of tree species, followed by Bradford Pear and Basswood (Figure 6).
- Most tree circumferences fall within the 1-50 inch range (Figure 5).
- Though there are a high concentration of trees in census blocks that score between 60-80% White, no such relationship can be shown in census blocks that are 80-100% White. Furthermore, the highest density of trees in the study area is shown to in an area that is 20-40% White. (Figure 3).
- Areas with a higher density of trees usually have a lower heat risk index (Figure 4).
- New developments around UHS and Binghamton University campuses have many recent plantings, though are currently in a higher heat risk index area. Tree canopy improvements may take 20+ years to be noticeable (Figure 7).
- The spatial distribution of tree point data is visualized in Figure 8: The "Other" category represents tree points which covered two or more districts, which include Urban Single Family (2.9% (8), Urban Multi and Office Overlay (1.8%, (5)), Urban Single Family & Office Overlay District (1.4% (4), Neighborhood Commercial and Urban Multi Family 1.1%/(3), or Other (1.4% / (4). The highest density can be found in Urban Multi Family zoning.

CONCLUSION

Trees take time to grow, so planting more trees now in the red areas (Figure 4) will likely improve the heat risk index values for the downtown area of Johnson City as global temperatures are expected to increase over time. Priority areas should include the neighborhoods west of Baldwin Street, between Floral Park Cemetery and the inoperable southern rail line. Most trees surveyed were a maple variety (red, silver, sugar, or other), with second being Bradford Pears and Basswood and Honey Locust being close third. Contrary to previous research, our analysis did not reveal a significant correlation between tree density and census blocks that had a majority White population (Figure 3).

As shown in Figure 2, tree density is at its highest in within two census blocks that have the highest renter occupancy rates. However, the distribution of trees in other census blocks surrounding that area varies enormously, with some streets not having any trees at all despite having a high occupancy and renter occupancy rate (Figure 1). Our findings show that tree density is greatest in the census blocks containing and adjacent to the Pharmacy and Nursing Campus, as well as the UHS Campus. These trees also have a smaller tree circumference (Figure 7), suggesting that they were planted more recently than the more mature trees in residential sections. Residential streets do not have nearly the same tree density levels as the streets around the school and hospital. As shown in Figure 8, Urban Multi Family zoning does have the highest number of trees. However, by looking at the map in Figure 7, we can see that Urban Multi Family zoning makes up the majority of the parcels. In this case, having 36.2% of the trees recorded does not reflect an equal or sufficient distribution of trees to Urban Multi Family residences. It can be concluded that areas with a high residential density have been neglected by the city, with fewer new trees being planted and old trees not being preserved. Consequently, these are the same areas that suffer from the greatest heat vulnerability.

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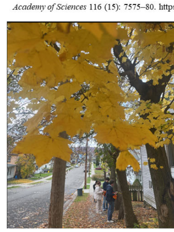

Heat Vulnerability Index per Census Block

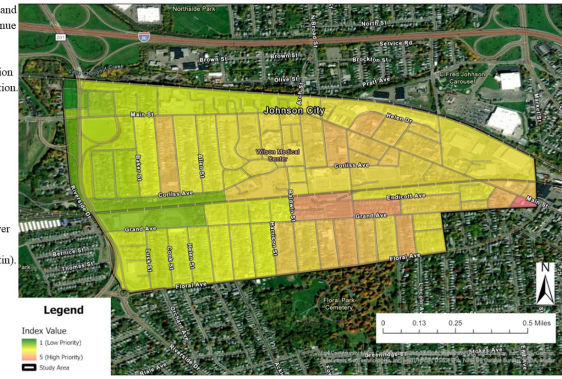

Figure 4: A map visualizing the heat vulnerability index (HVI) per census block in the Johnson City Study Area. Areas which are shaded in red should be tree planting priorities by location. The HVI combines tree cover data, surface temperature averages, and population density.

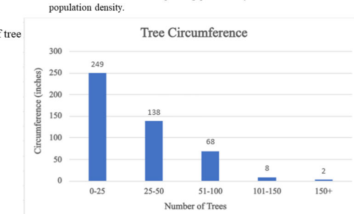

Figure 5: A histogram depicting the frequency of tree circumferences measured. Tree circumference can be used to determine the relative age of a tree (Moller, 2019). This figure shows that most trees surveyed are 25" or narrower, about 40 years old or younger. A tree which is 150" in circumference is likely 150 years or older!

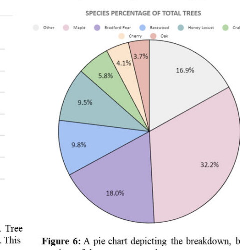

Figure 6: A pie chart depicting the breakdown, by species, of the trees surveyed

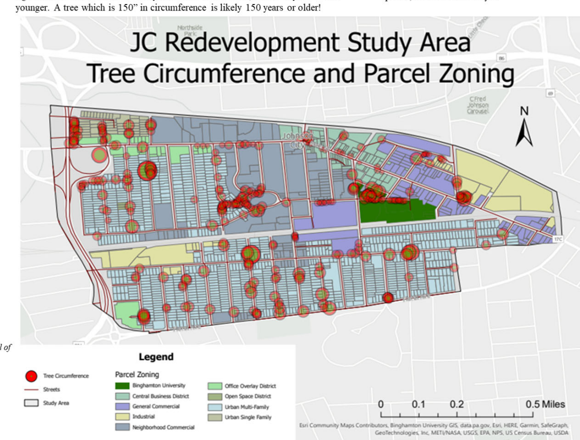

Figure 7: A map comparing tree circumference to parcel zoning in the Johnson City Study Area

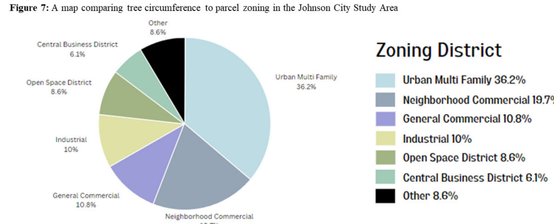

Figure 8: A pie chart showing the distribution of trees for each parcel zoning classification