



Green Space in New York City

An analysis of inequality as shown by access to nature in NYC.

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What is Green Space?

Green space, as it's defined by the New York City Department of Parks and Recreation, is *“a citywide system of engineered landscapes that transform unused impervious areas into vibrant and pervious green space.”* One way to measure green space is by looking at an area's [Tree Equity Score](#), defined by the non-profit American Forests as:

Tree Equity Score is a nationwide, block group-level score ranging from 0-100 that highlights inequitable access to trees.

www.treeequityscore.org

Green space has a wide range of uses, from economic to cultural purposes. Within New York City, the NYC Mayor's Office of Climate and Environmental Justice has said that **green space and green infrastructure are critical for "ensuring access to nature, improving stormwater management, and combating extreme heat."** Beyond the environmental benefits of green space, the National Center for Biotechnology Information (NCBI) has linked green space access to positive mental health benefits, as well as overall physical health benefits. The NCBI has said that **green space in urban areas can act as therapeutic and rehabilitative ways to increase one's interaction with natural space.** This has been proven to have positive mental effects, such as alleviating stress and an overall improvement in mood. Additionally, easily accessible green spaces promote physical activity, which plays a role in a healthy lifestyle.

Data & Methodology

A majority of our data for analysis was taken from 4 sites: The U.S. Census Bureau, NYC Open Data, Open Data NY, and Tree Equity Score. The U.S. Census Data is from 2020 and is projected in NAD 1983 New York State Plane, with a unit of US feet. We ended up projecting all of our data to this projection for analysis, as State Plane is ideal for the scale we were working with, and all 5 of our counties of focus fall within the Long Island zone of the New York State Plane system. NYC Open Data was largely responsible for our green streets data; Open Data NY Provided us with overall green space data. Finally, the Tree Equity Score is a measure of how well various neighborhoods have access to the benefits of trees. The Tree Equity Data we used was at the scale of census blocks, and we combined it with the 2020 U.S. Census data. We focused on vector data in our analyses and didn't utilize raster data.

Further in our research, specifically delving into the historical redlining practices of NYC and how they affect current access to green space for people of color, we downloaded data from a study conducted through the University of Richmond called

"Mapping Inequality"; this study focused on original redlining maps from ca. 1930 when redlining first became standard practice in larger U.S. cities. A study by Okorom-Achuonye et al. examined the historical and present-day effects of redlining in NYC, focusing on how it continues to affect equal access to housing and overall housing security for people of color.

Green Space in NYC

The map below provides further context on the location of green space in NYC; such as parks, green streets, water-front spaces, recreational fields, etc. Data for this map was accessed through the NYC Department of Parks and Recreation (DPR) via NYC Open Data and is representative of all green space locations owned (wholly, or in part) by the NYC DPR.

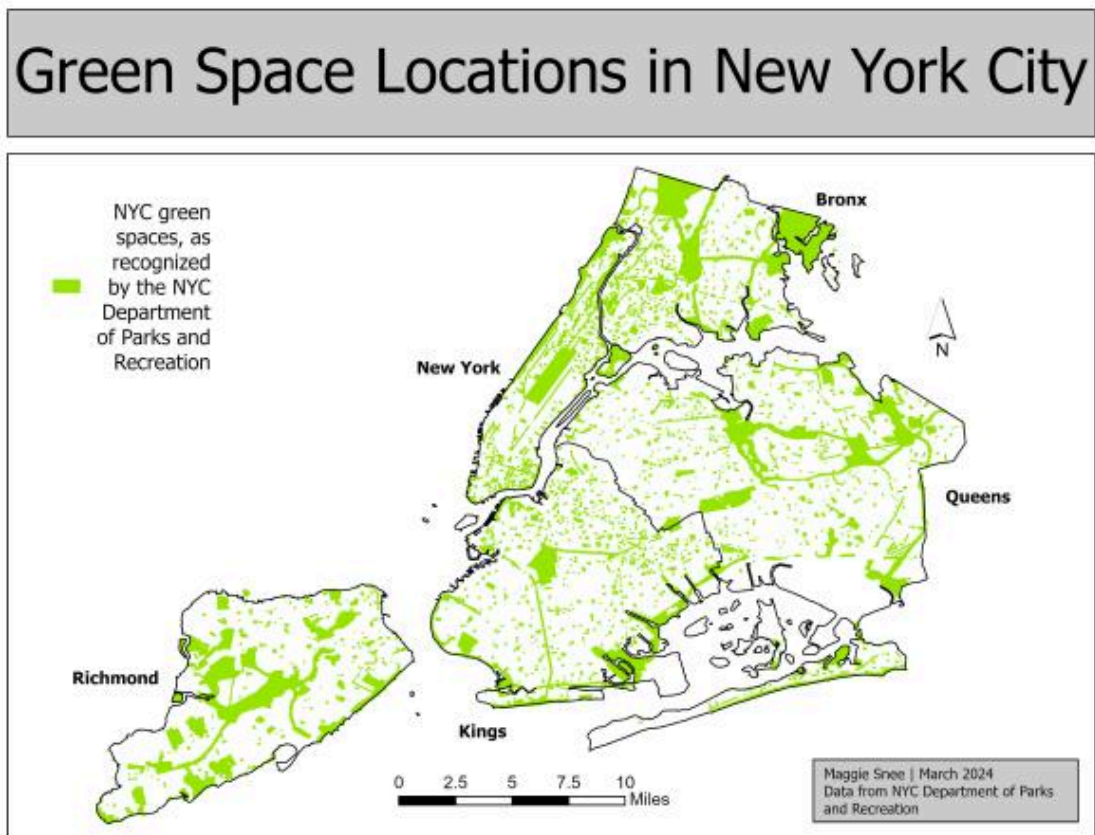


Figure 1

These locations are what we used to identify the overlap and relationships between access to nature and communities of

color.

Green Space & Racial Demographics

To analyze racial demographics in NYC as related to green space, we utilized the Tree Equity Score on a Census Block level. We focused mainly on two variables from this data; *pctpcnorm*, the normalized percent of people of color inside the block group, and *tes*, the Tree Equity Score of the block group, which ranges from 0 to 100, where 100 means a census block has high, consistent access to trees. We created bivariate maps for each of the five counties of NYC, which we later combined into one single map. The bivariate legend reflects the percentage of people of color in a block, ranging from 0-100%, and the Tree Equity Score in a block, which ranges from 44-100, as the lowest value across our five counties of interest was found to be 44.

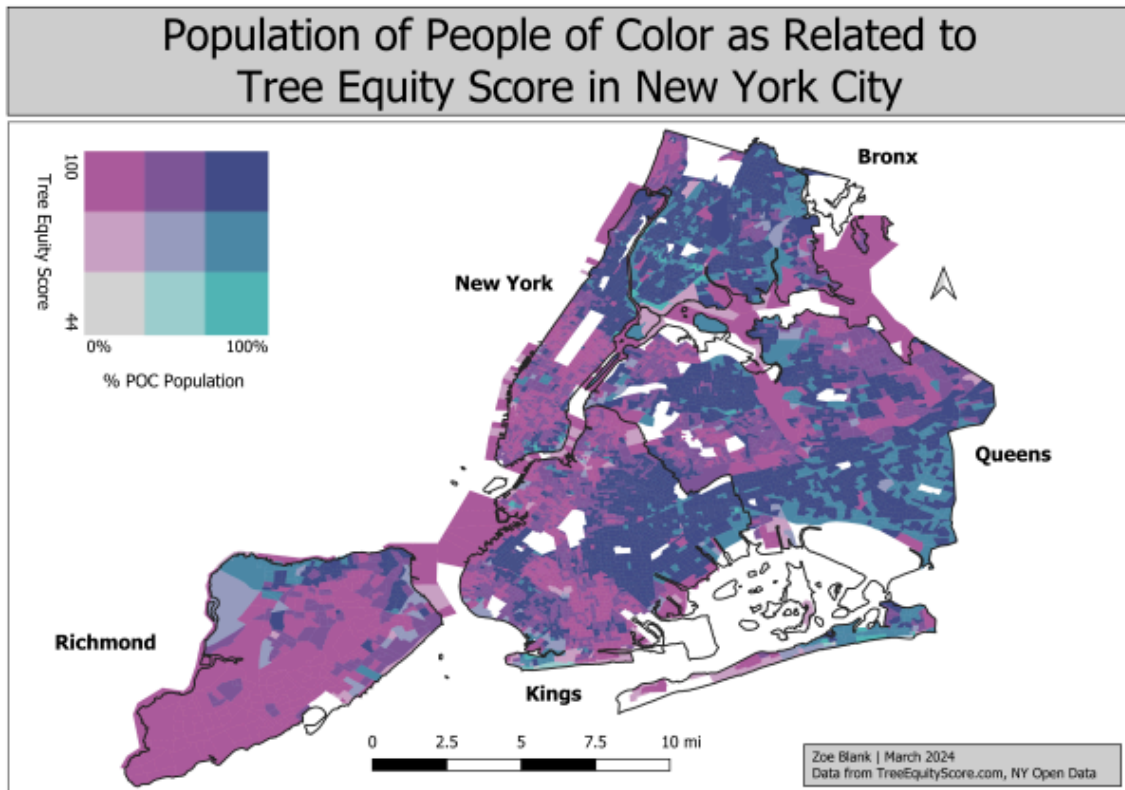


Figure 2

In this map, areas of dark pink indicate a low population of people of color (POC) and a high tree equity score; this is perhaps the most common color on this map. This color is

very frequent in Richmond County and a large part of Kings County. The second most common color, dark purple, indicates a high POC population and high tree equity score, which is ideal for a neighborhood - we see a lot of this in the Bronx, Queens, and Kings County.

The colors we want to look out for are light teal and blue, which indicate a high POC population but a low tree equity score. **This is highly common in both Queens and the Bronx, which has several occurrences of a very low tree equity score with a high POC population.** We also note a stretch of blocks in northern Richmond County which are blue in a sea of otherwise pink and purple blocks, indicating some neighborhoods with many people of color but little tree cover.

There are very few occurrences of light pink, which would indicate a block with a low POC population and a low tree equity score, showing that **the racial makeup of a neighborhood seems to come into play with access to green space and tree cover.**

New York City's History of Redlining

Redlining was the practice of categorically denying access to mortgages not just to individuals but to whole neighborhoods.

University of Richmond, "Mapping Inequality"

Between 1935 and 1940, the Home Owners' Loan Corporation (HOLC) applied grades of "residential security" to neighborhoods across the country to demonstrate to banks and lenders the viability of loaning to people in those neighborhoods. This ultimately culminated in discrimination towards minority communities, as areas with high amounts of African American, Jewish, or immigrant populations were given poor grades. Due to redlining, people of color living in

these areas were barred from taking out loans to renovate their homes, and people of color looking to move into these areas (as it was often the most they could afford) were denied mortgages.

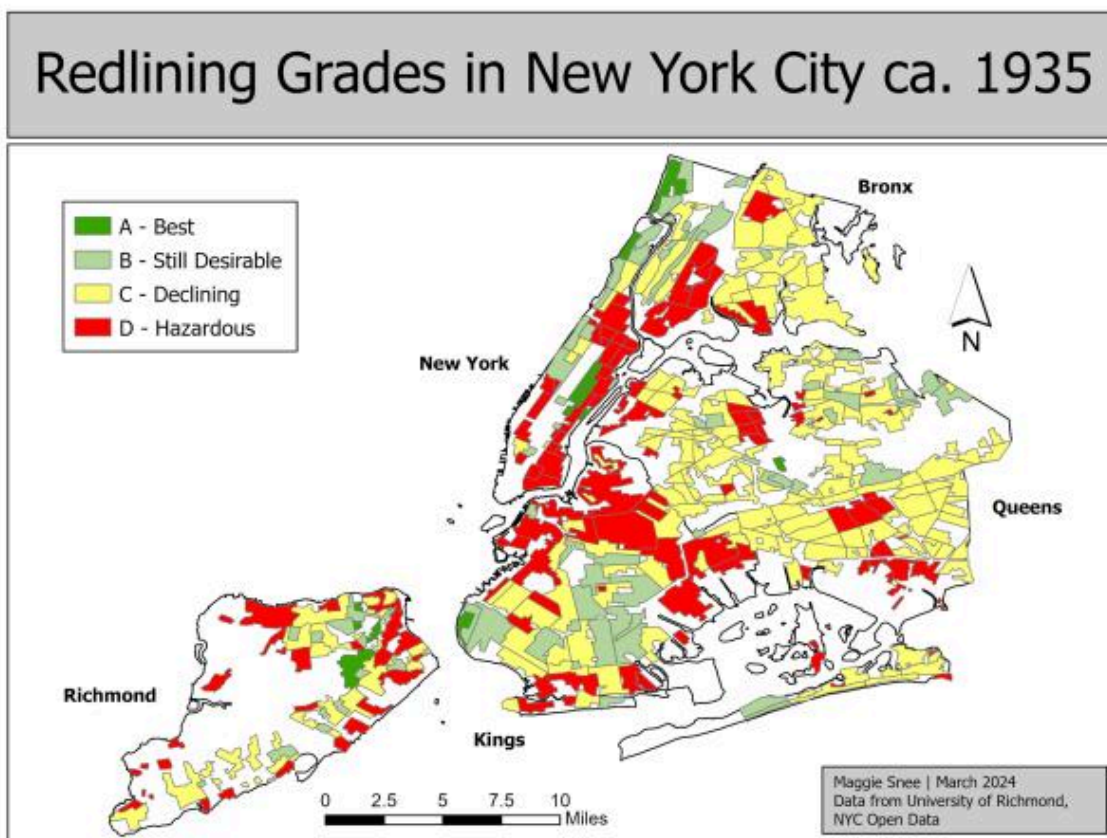


Figure 3

Though the HOLC stopped operations in 1951, redlining as a practice was still completely legal, and redlining grades were still used to deny mortgages and loans to people of color in "undesirable" areas of NYC. The Fair Housing Act, established in 1968, was the first law that made it illegal to discriminate against any given race, sex, national origin, and religion regarding real estate sales, rentals, and financing.

To evaluate historical redlining in New York City, we utilized data from the University of Richland, which collected information from city survey files at the National Archives. This data includes the grade assigned to neighborhoods as mentioned above. We also referenced a study performed at

Harvard by Okorom-Achuonye et al., which examined the historical and lasting effects of redlining in NYC.

Despite the Fair Housing Act and the end of redlining practices, NYC still sees various patterns across its neighborhoods than can be attributed back to the HOLC's ratings. For example, historically redlined communities in NYC experience more crime per square mile than their non-redlined counterparts (Haley et. al.). Further, an association has been found between poor redlining scores and adverse health outcomes, such as more severe asthma, increased preterm birth rates, and increased rates of infection and death for COVID-19 (Kraus et. al.).

Data downloaded from the University of Richmond included the assigned "grade" for each neighborhood established by the HOLC in the 1950s. A grade of "A" indicates that a neighborhood was deemed suitable by the HOLC; a grade of "D" means the area was considered to be unsafe or hazardous.

In order to study the lasting effects of redlining as related to green space access, we created a bivariate map using the same population data as Figure 1, the percentage of people of color in each census block. This was compared against the grade, A-D, assigned to the community.

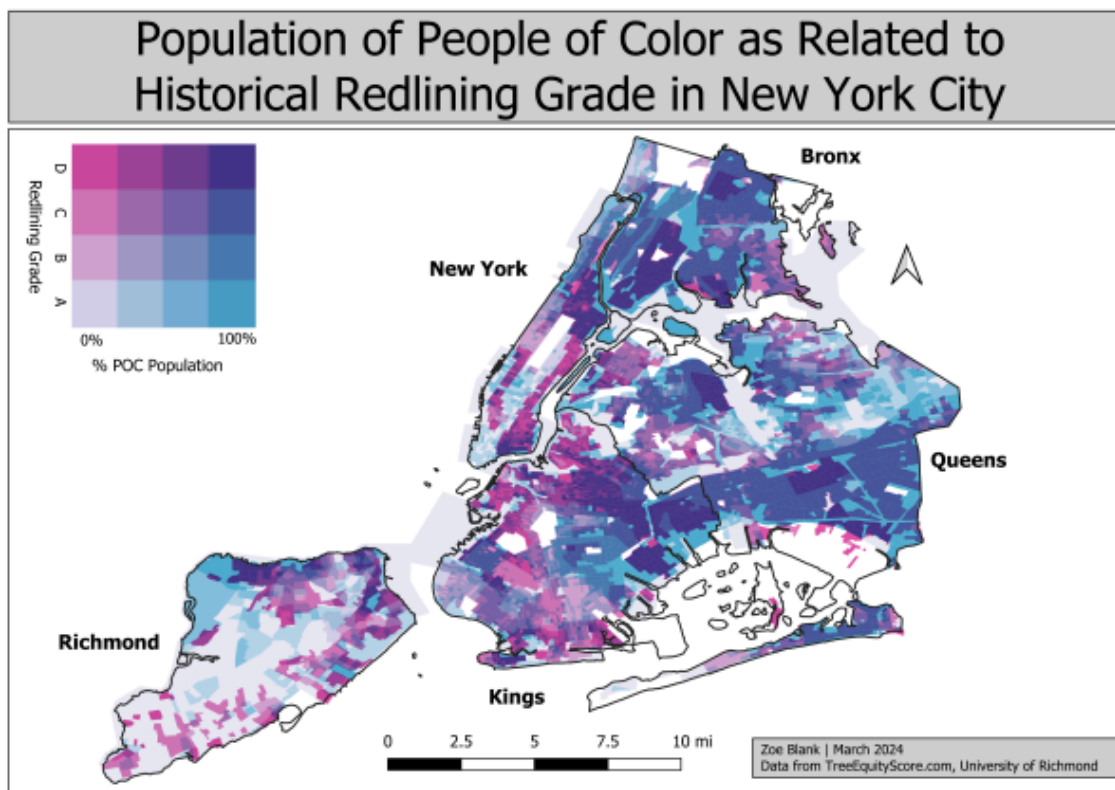


Figure 4

In the above map, areas of dark purple are of the most interest to our analysis, as they represent areas with large populations of color and a poor historic redlining grade. Areas throughout Bronx County, northern Kings County, and northeast New York County have a very large amount of these neighborhoods.

This is meaningful to our analysis, as these were also areas of concern in Figure 1, meaning that these areas have low tree equity score. Essentially, **these areas display the possibility for a link between historical redlining in communities of color and poor access to trees and green space.**

Conclusions

Our research has revealed various patterns in green space availability across the five boroughs of New York City; most notably, this research has identified a harmful lack of access to green space in communities of color. Though these problematic areas exist around the city, they are especially prominent in Queens and the Bronx, along with areas within

Brooklyn (Kings County) and Manhattan (New York County). The city should take advantage of measures like the Tree Equity Score for determining these areas of need; it is the responsibility of decision makers and leaders in the city to ensure equal access for all New Yorkers.

Further, our research identified lasting effects of harmful historical redlining practices, and we were able to note similarities between communities lacking in green space access and historically redlined communities. Though there is much room for further analysis on this topic, our visualizations help to identify these areas of need.

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Sources

American Forests. (2023). Methods & Data. Tree Equity Score. <https://www.treeequityscore.org/methodology>

Bureau, U. C. (2023, November 23). United States Census Bureau. Census.gov. <https://www.census.gov/en.html>

Bureau, U. S. C. (2022). New York City, New York. Explore census data. https://data.census.gov/profile/New_York_city,_New_York?g=160XX00US3651000

City of New York. (2023a). Categories. NYC Open Data. <https://data.cityofnewyork.us/browse?q=state+parks&sortBy=relevance>

City of New York. (2023). Categories. NYC Open Data. <https://data.cityofnewyork.us/browse?q=>

queens&sortBy=relevance

Department of City Planning. (2020). Census- Download and Metadata. NYC Department of City Planning.

<https://www.nyc.gov/site/planning/data-maps/open-data/census-download-metadata.page>

Department of City Planning. (2022, October 6). Political and Administrative Districts - Download and Metadata. NYC Planning. <https://www.nyc.gov/site/planning/data-maps/open-data/districts-download-metadata.page>

Department of Parks and Recreation (DPR). (2023, November 10). Parks properties: NYC open data. Parks Properties | NYC Open Data. <https://nycopendata.socrata.com/Recreation/Parks-Properties/enfh-gkve>

Green Infrastructure : NYC parks. New York City Department of Parks & Recreation. (n.d.). <https://www.nycgovparks.org/greening/green-infrastructure>

Greenspace. NYC Mayor's Office of Climate and Environmental Justice. (2022, October 25). <https://climate.cityofnewyork.us/subtopics/green-space/>

Haley, S. J., Jardine, S. J., Kelvin, E. A., Herrmann, C., & Maroko, A. R. (2023). Neighborhood Alcohol Outlet Density, Historical Redlining, and Violent Crime in NYC 2014–2018. *International Journal of Environmental Research & Public Health*, 20(4), 3212. <https://doi.org/10.3390/ijerph20043212>

Hur Pintor, B. (2019, September 15). Bivariate Choropleth Maps in QGIS. BNHR. <https://bnhr.xyz/2019/09/15/bivariate-choropleths-in-qgis.html>

Kraus, N. T., Connor, S., Shoda, K., Moore, S. E., & Irani, E. (2023, December 26). Historic redlining and health outcomes: A systematic review. *Public Health Nursing*. <https://onlinelibrary.wiley.com/doi/10.1111/phn.13276>

Le Gall, N. (2022, August 20). City Buildings Seen From Above. Pexels. <https://www.pexels.com/photo/city-buildings-seen-from-above-13473979/>

Lee, A. C. K., Jordan, H. C., & Horsley, J. (2015, August 27). Value of urban green spaces in promoting healthy living and wellbeing: Prospects for Planning. National Center for Biotechnology Information. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4556255/>

Nelson, R. K., Madron, J., Champine, R., Devers, C., Ayers, N., Evans, A., Winling, L., Tobias, R., Cogan, C., & Kimball, J. (2023). Mapping inequality. Digital Scholarship Lab. <https://dsl.richmond.edu/panorama/redlining/data>

New York State GIS. (n.d.). Civil boundaries. New York State GIS. <https://gis.ny.gov/civil-boundaries>

Okorom-Achuonye, B., Jackson, S., & Ortigas, R. (n.d.). Inequality in New York City: A Legacy of Redlining. Inequality in NYC. <https://rayortigas.github.io/cs171-inequality-in-nyc/>