Students and Green Space Accessibility: Los Angeles Public Schools &

Green Space Access Across Different Demographic Student Groups

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ABSTRACT

Increased access to green space has been linked with many physical and mental health benefits. This project looked at the correlation between green space access in Los Angeles with Los Angeles Unified School District high schools and their student demographic data. I analyzed datasets using ArcGIS. The mapping analysis showed schools within areas of lower income and more BIPOC populations had less green spaces. This study showed that white and higher income school communities in Los Angeles have more nearby green spaces in the form of neighborhood, community, city, and school parks. Green space access inequity can cause unfair barriers. The distributional outcome of green space in the city of Los Angeles must be addressed by city planners and policy makers.

KEYWORDS

INTRODUCTION

Inequality in public school systems in the United States represents a larger issue with wealth and poverty, systematic and structural racism, and equal access to resources. As of 2021, the gap between the wealthy and the impoverished in the United States is higher than it has been in fifty years (Inequality.org). This socioeconomic divide creates inequality which keeps our society unequal and hinders progress. In the US, a history of racism such as redlining as well as structural racism have kept minority groups marginalized, prevented chances for equal opportunities, and prevented the closing of the socioeconomic divide. Public schools in the US represent one of the biggest discrepancies in opportunity and education access. Redlining and structural racism in city planning has deeply affected our school district makeup, intrinsically linking education opportunities with a student's socioeconomic background (heritage.org). Additionally, systemic racism and implicit biases also create obstacles for minorities and perpetuate white privilege. The socioeconomic gap and racist structures that plague our school system create a complex issue in US society. There are many methods to tackle this complex issue. One important method to combat the widening socioeconomic gap is through equal education opportunities.

Equal education is an important way to support growth and opportunities for lower income and minority communities. Currently the gap between academic achievement in the US is highly associated with a student's economic status and background (Reardon 2011). This is largely due to the fact that marginalized groups and minorities are largely clumped together in the same areas, because of factors like redlining. Regardless of this phenomena, the United States public schools get a large portion of their funding from real estate taxes from their surrounding area (Murphy et al. 2021). Affluent, privileged, and generally white communities, therefore, have well funded schools for their children to attend because they have the ability to live in the nicer and more expensive neighborhoods, pushing disadvantaged people into the less desirable and cheaper areas of a city (Rich et al. 2016). This compartmentalization of the community's public education system has caused a large problem in education equality between different demographics (Rich et al. 2016). In order to have equal education across all demographic and socioeconomic groups, the United States must work on providing equal education and academic opportunity in all public schools, regardless of location and student backgrounds.

To have equal education experiences and opportunities, students of all backgrounds must be given learning environments that are conducive to growth as well as physical and mental health. Public schools set up their students for success when they remove barriers to learning and growth for every student no matter their income or background or income. To remove barriers to learning and growth, schools must give their students a learning environment that supports their mental and physical health. A significant and widely overlooked part of a healthy and successful learning environment is access to green spaces. Past studies such as Nutsford et al. (2013) and Maas et al. (2009) have shown a positive correlation between mental health and an increased proximity to green spaces. Ensuring green space access from public schools could help level the playing field with privileged students by helping improve a school's learning environment for students.

In this study, I analyzed the relationship in Los Angeles between a public highschool's demographics and its surrounding area and environment. To accomplish this, I focused on two sub questions: For each public highschool I compared and analyzed data on (1) the student minority populations with the school's location in proximity to green spaces and surrounding environment and (2) the student average family income with the school's location in proximity to green spaces and surrounding environment. I expected that the schools with larger minority populations and lower average income communities would be located in the less compatible areas and environments for their students' learning, health, and growth; meaning less access to green spaces.

BACKGROUND

Green space access is one of the most overlooked factors for a person's health. A previous study in Auckland City, New Zealand showed the connection between green space and positive trends in mental health (Nutsford et al. 2013). The article analyzes mental health and green spaces. Using GIS, they compared green space data with area-level anxiety and mental health disorders data. They found that increased proximity and area of green spaces was correlated with a decrease in anxiety and mental health disorders. Other than having proven mental health benefits to people in close proximity, green spaces also decrease morbidity rates of nearby inhabitants. A Dutch study showed the connection between disease concentrations and

amount of green space (Maas et al. 2009). This article aimed to determine the cost of the increasing urbanization and decreasing living environments in the form of human health. This study specifically looked into the relationship between physician assessed morbidity and the presence of green space in people's environments. They performed multilevel logistic regressions for demographic and socioeconomic characteristics of households with morbidity data from Dutch medical records. They found that disease clusters were lower in areas with more green spaces. The most effect they found associated with an increase in green space was a decrease of anxiety and mental health disorders. Green spaces also have specific quantifiable effects on climate in their nearby area. For example, a study found that urban green spaces reduce the urban island heat effect by cooling nearby areas, though the effect intensity varied for different types of green space (Aram et al. 2019). These green spaces sequestered carbon emissions from vehicular traffic and helped air movements and increased shade to help cool the nearby urban environment. These phenomena are especially important to consider in the urban landscape where air quality is most affected. Overall green spaces are key factors in improving nearby inhabitants mental and physical health.

Location is often a factor not prioritized enough when deciding where to build a new school. Green spaces have been proven to help mental and physical health. Because of this benefit, schools that have access to green space therefore have the ability to benefit students' health. A previous study showed that a student's mental and physical health is correlated with their ability to grow and learn (Shaw et al. 2015). Their research discovered that unhealthy children had a higher chance for problems in school. Hence, schools with increased green space access are schools that set their students up to learn, grow, and ultimately succeed academically. Green spaces also have been shown to increase academic opportunities for students. A study in Amsterdam found that having green space in close proximity and accessible to a school is shown to lead to an increase in the amount of field-based education opportunities teachers give their students (Wolsink 2015). This occurred because green space close to schools affect teachers' perspectives on field trips. Teachers with access to green space for outdoor school-related activities were more likely to have outdoor learning activities for students and were even found more likely to take their students on field trips to green space areas farther away from the school. Ultimately, green spaces have undeniable potential for increasing a student population's academic success and academic opportunities.

METHODOLOGY

Using geospatial analysis as my main analysis tool, I can more accurately look at which schools have the best green space access. GIS allows use of more specific information on the level of proximity to green space and which student populations use each green space. A study done in Leicester, England also used a GIS-based network analysis similar to my study (Comber et al. 2008). This study used network analysis to look at green space distribution in the English city of Leicester with respect to different ethnic and religious groups. Their study demonstrated that a network analysis alongside an analysis of socioeconomic-type data is a great way to show how access to resources such as green space are distributed. Based on the ability of this study to successfully analyze green spaces in relation to socioeconomic factors in a city, similar methods will also be valuable for my study when I analyze the correlation between green space access in Los Angeles with LA Unified School District high school student demographic data. GIS allowed me to compare multiple factors across a city in relation to each other geospatially which works perfectly for answering my research question. These maps can help highlight school populations that lack access to any green space and also school populations that have access to multiple green spaces. GIS is a very useful geospatial analysis program for this project because it can create different maps that can show more holistic and interesting results.

METHODS

Data Collection

I obtained data from a variety of locations. On the County of Los Angeles Open Data website I downloaded a shapefile polygon data of the city boundaries in Los Angeles County. I collected demographic data from the US Census Bureau website as CVC tables along with census tract polygons as shapefiles. Next, I obtained a polygon data layer through the Los Angeles Parks and Recreation Department that showed city green space data for city parks, neighborhood green spaces, school fields, and other designated park recreation sites. Lastly from ArcGIS Online I downloaded point data for Los Angeles Unified School District (LA USD) school locations. I made the assumption that students tend to enroll at the nearest public school. This allowed me to make the leap in logic that public schools in census tracts with higher

household incomes held a student population from higher income families and so on.

By itself, the census tract layer only showed the census tract boundaries for the city. To add the demographic census data to this layer I conducted a table join to the CVC table for the census demographic data (United Census Bureau). Once the demographic data was connected to the census tract shapefiles, I selected for race in one map and household income in a second map for this layer. The layer then showed lighter polygons as having increased white households or increased income per household.

Geospatial Analysis

Using my data layers I created maps on ArcGIS with the Los Angeles city boundary, demographic data layer, green space data layer, and school location data layer. The first map, Population and Green space, shows the relationship between green space and population density in Los Angeles with school locations overlaid. The second map, Race and Green space, shows the relationship between green space and BIPOC, Black, Indigenous, and people of color, distribution in Los Angeles with school locations overlaid. The third map, Income and Green space, shows the relationship between green space and household income distribution in Los Angeles with schools overlaid. After creating all the maps I visually examined the maps for patterns and irregularities.

RESULTS

Geospatial Analysis

One of the first spatially significant findings was that green space in Los Angeles was not evenly distributed throughout the city, as seen in the first map Population and Green Space (Figure 1). As expected, because of historical drivers, lower income and BIPOC populations were concentrated in certain areas of the city and the wealthier and more white groups were concentrated in different areas. The pattern of green space distribution closely followed the uneven distribution between marginalized versus privileged communities in Los Angeles.
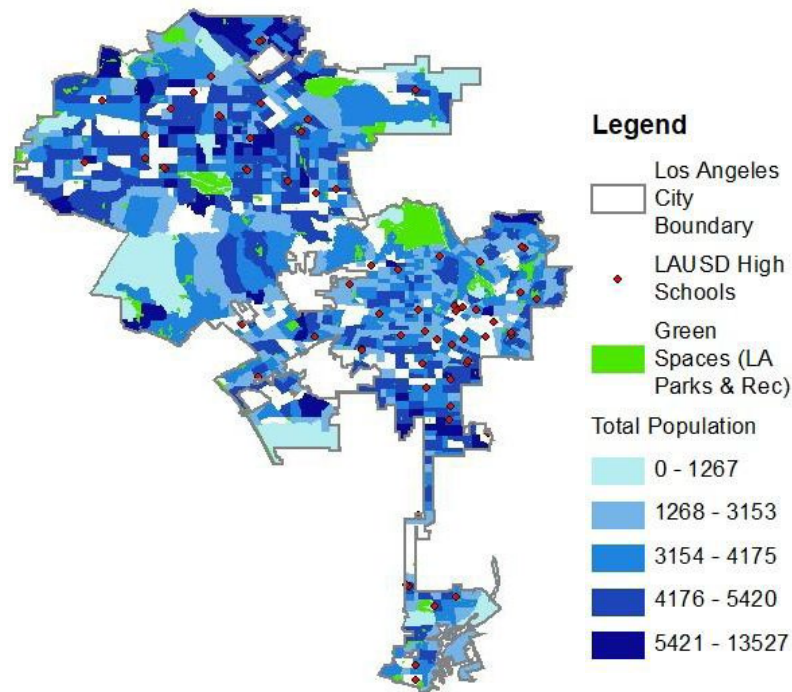
Figure 1. Population Density and Green Space. The map below acts as a control and shows the location of green spaces and high schools in relation to Los Angeles' total population density by census tract.

The second map, Race and Green Space, showed a distinct relationship between race and green space in Los Angeles (Figure 2). Large green spaces are disproportionately located in the predominantly white areas of Los Angeles (Figure 2). The southern areas of Los Angeles that have high numbers of BIPOC populations, seem to have little to no green spaces allocated to them. However there are green spaces in the southern and higher BIPOC concentrated areas but only as very small neighborhood parks (Figure 3). There is still a greater area of green space in the more white populated areas of Los Angeles.
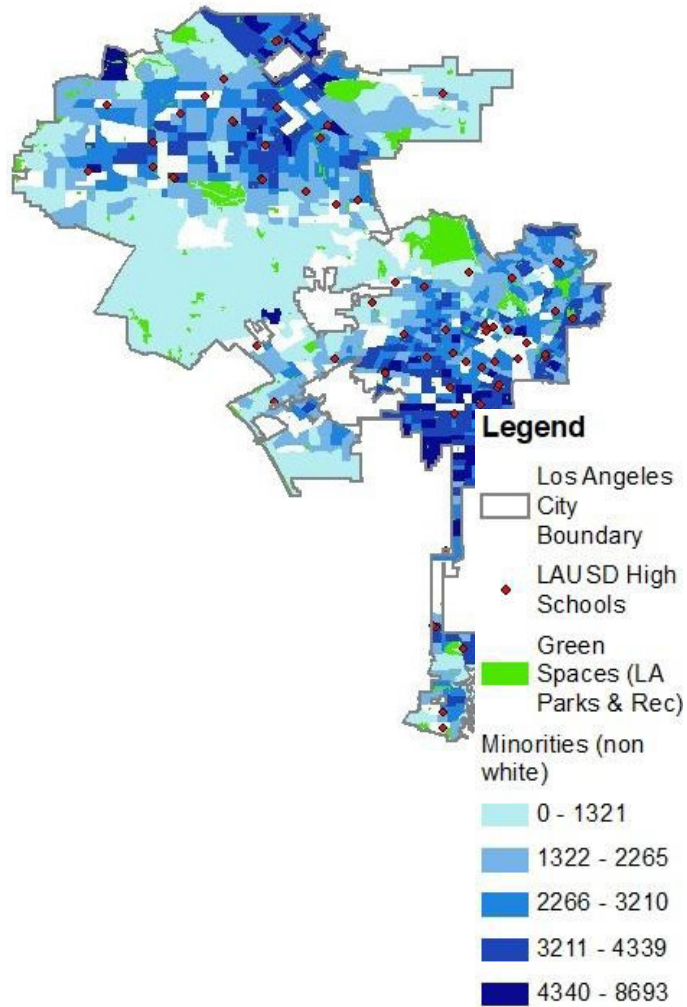
Figure 2. Race and Green Space. The map below shows the location of green spaces and high schools in relation to Los Angeles' Black, Indigenous, and People Of Color, BIPOC, population density. The map shows where the most densely BIPOC communities are located in LA with darker blue census tract polygons. It shows high schools as red dots and the park green spaces in green.
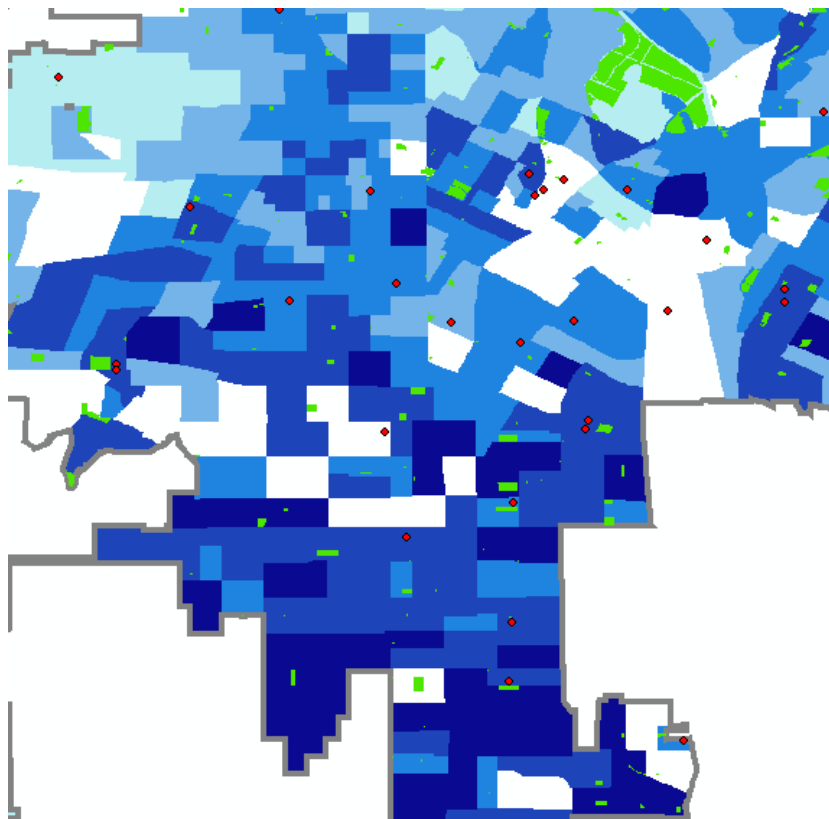
Figure 3. Race and Green Space in Southern Los Angeles. The map below shows a zoomed in look at one of the areas in Los Angeles with high BIPOC of Los Angeles from Figure 2. The location of green spaces and high schools are shown in relation to Los Angeles' Black, Indigenous, and People Of Color, BIPOC, population density.

The third map, Income and Green Space, showed a clear relationship between income and green space in Los Angeles (Figure 4). Areas with more green spaces are unevenly distributed to favor areas of Los Angeles with more concentrated white populations and also higher income populations (Figure 4). Areas of Los Angeles with whiter and higher income populations have larger areas of green space. Areas of Los Angeles with higher non-white and lower income populations have a greater number of green space but their green spaces are much smaller in area than green spaces in the whiter and higher income population area (Figure 3). Overall the data showed a relationship between a school community's student makeup and the school's level of green space access.
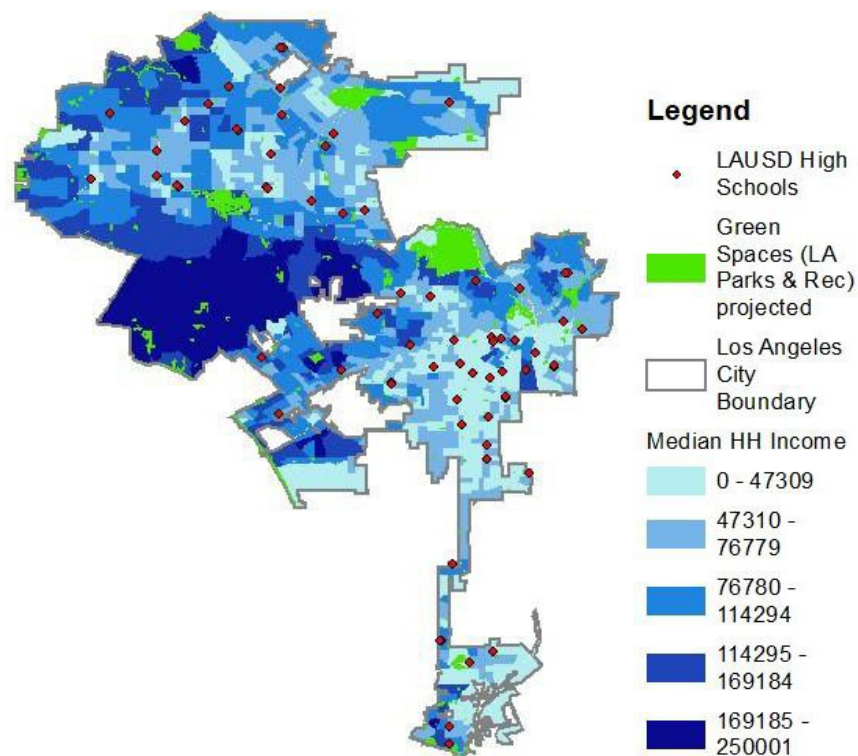
Figure 4. Income and Green Space. The map below shows the location of green spaces and high schools in relation to Los Angeles' median household incomes. This map shows the census tracts with the highest household incomes as darker blue and lower household incomes as lighter blue.

DISCUSSION

As expected, because of historical drivers, I found that lower income and minority populations were concentrated in certain areas of the city and the wealthier and more white groups were concentrated in different areas. The pattern of green space distribution closely followed the uneven distribution between marginalized versus privileged communities in Los Angeles. The maps created in this study show that a trend between racial and income data and green space distribution in Los Angeles does exist and favors predominately white and higher income census tracts. To answer the research questions I wanted to show that there is a connection between demographic data and green space access in school communities.

The map "Race and Green Space" showed a relationship between racial distribution and green space in Los Angeles (Figure 2). The most likely cause of this trend is the large history of

redlining in Los Angeles which has caused widespread city stratification. Factors such as structural and institutional racism in city planning have continued this stratification today by continuing the inequalities between historically "white" and "nonwhite" neighborhoods.

The map "Income and Green Space" showed a relationship between income and green space in Los Angeles (Figure 4). Income distribution in comparison to green space distribution across Los Angeles follows a very similar trend as racial distribution and green space. One reason for green spaces being more accessible in not only majority white areas but also in higher income areas is because BIPOC or "nonwhite" populations make up more of the lower income bracket than white populations. For example, the wage gap between white and Black Americans is as large as it was in 1950 (Bayer et al. 2018). Factors such as historical redlining and continued racism in our society through policies and institutions have kept the income gap between white and BIPOC large and continues to marginalize nonwhite communities in many ways, one being green space access.

The figures from my short study show that green spaces are disproportionately located in predominantly white and more privileged areas of Los Angeles. The pattern of green space access specifically favoring certain groups of people is very concerning for many social and environmental justice reasons. Because of this urban planning and systemic failure, the city is giving certain children unfair advantages over others. A systematic failure of this scale must be addressed in future city policy and planning. Without increased access to green space for lower income and non-white school communities, our city planning and education systems are placing an unfair advantage on some student groups over others.

Limitations

One limitation in my study was data resources. In the future it would be interesting to contact the school district for more accurate data. Ideally, I would use specific data on income and race information for each school's student body. Instead I used the leap in logic that students living in the areas surrounding a school would be attending that school. In a future project it would be useful to do survey work or contact Los Angeles Unified School District (LAUSD) public schools to get more accurate student population data.

Future Directions

In a future study I think it would be valuable to create a more holistic and detailed green space dataset for Los Angeles. For example, a future study could create a new data set that would include green space areas of all types, not just parks. Trees, open land, landscaped medians, public planter boxes, and community gardens are other green space types that are usually smaller and overlooked in data sources; however they could be a significant source of green space when looked at all together. A geospatial study focused on different types of green spaces would also be useful in showing how the quality of a green space relates to schools and communities distributively. Another useful approach in a future study would be to take a survey based approach to the research. Working directly with communities to conduct an experience and local knowledge driven study would add greatly to this study by giving better insight on how the effects of this environmental justice issue are actually felt by different school communities.

Broader Implications

My study found that urban green spaces are distributed unevenly. Privileged white and higher income school communities of Los Angeles have more green space access. My study draws attention to an alarming pattern of city planning perpetuating environmental justice issues. More studies should be done to fully assess the effects of unequal distribution of green spaces in urban cities and student green space access. City planners must acknowledge and mitigate this issue by using green space and park funding to help improve and create parks in the areas that need them the most.

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REFERENCES

Aram, Farshid, et al. "Urban Green Space Cooling Effect in Cities." Heliyon, vol. 5, no. 4, 2019, https://doi.org/10.1016/j.heliyon.2019.e01339.

Bayer, Patrick, et al. "Divergent Paths: A New Perspective on Earnings Differences Between Black and White Men Since 1940." The Quarterly Journal of Economics, Volume 133, Issue 3, August 2018, Pages 1459–1501, https://doi.org/10.1093/qje/qjy003.

Burke, Lindsey. "Housing Redlining and Its Lingering Effects on Education Opportunity." The Heritage Foundation,

https://www.heritage.org/education/report/housing-redlining-and-its-lingering-effects-education-opportunity.

Comber, Alexis, et al. "Using a GIS-Based Network Analysis to Determine Urban Greenspace Accessibility for Different Ethnic and Religious Groups." Landscape and Urban Planning, vol. 86, no. 1, 2008, pp. 103–114., https://doi.org/10.1016/j.landurbplan.2008.01.002.

"Income Inequality." Inequality.org, 30 Aug. 2021,

https://inequality.org/facts/income-inequality/#:~:text=Income%20disparities%20are%20so%20pronounced,UC%20Berkeley%20economist%20Emmanuel%20Saez.&text=They%20average%20over%2039%20times%20 more%20 income%20than%20the%20bottom%2090%20percent.

Maas, J, et al. "Morbidity Is Related to a Green Living Environment." Journal of Epidemiology & Community Health, vol. 63, no. 12, 15 Oct. 2009, pp. 967–973., https://doi.org/10.1136/jech.2008.079038.

Nutsford, D., et al. "An Ecological Study Investigating the Association between Access to Urban Green Space and Mental Health." Public Health, vol. 127, no. 11, Nov. 2013, pp.

1005–1011., https://doi.org/10.1016/j.puhe.2013.08.016.

Murphy, P., et al. "Financing California's Public Schools." Public Policy Institute of California, Public Policy Institute of California, 19 Oct. 2021, https://www.ppic.org/publication/financing-californias-public-schools/#:~:text=In%2020 18%E2%80%9319%2C%20California%20public,shares%20vary%20across%20school%20districts.

Porter, Eduardo. "Education Gap between Rich and Poor Is Growing Wider." The New York
        Times, The New York Times, 22 Sept. 2015,
        https://www.nytimes.com/2015/09/23/business/economy/education-gap-between-rich-and-
        poor-is-growing-wider.html.

Reardon, Sean F. "The Widening Academic Achievement Gap between the Rich and the
        Poor." Inequality in the 21st Century, 2018, pp. 177–189.,
        https://doi.org/10.4324/9780429499821-33.

Rich, Motoko, et al. "Money, Race and Success: How Your School District Compares." The New
        York Times, The New York Times, 29 Apr. 2016,
        https://www.nytimes.com/interactive/2016/04/29/upshot/money-race-and-success-how-y
        our-school-district-compares.html.

Shaw, Steven R., et al. "The Relationship between Student Health and Academic Performance:
        Implications for School Psychologists." School Psychology International, vol. 36, no. 2,
        2015, pp. 115–134., https://doi.org/10.1177/0143034314565425.

Wolsink, Maarten. "Environmental Education Excursions and Proximity to Urban Green Space –
        Densification in a 'Compact City.'" Environmental Education Research, vol. 22, no. 7,
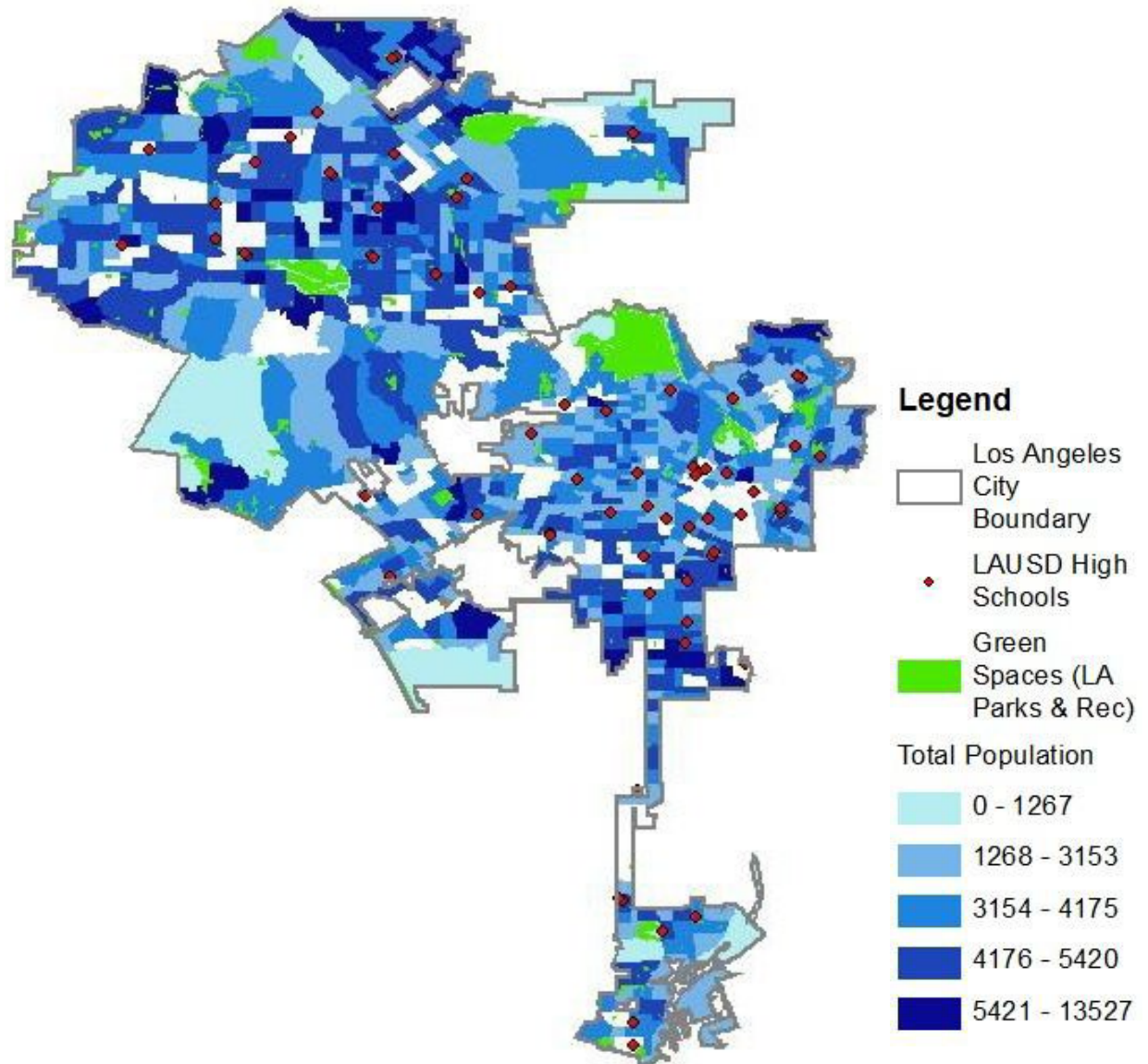   2015, pp. 1049–1071., https://doi.org/10.1080/13504622.2015.1077504.

APPENDIX

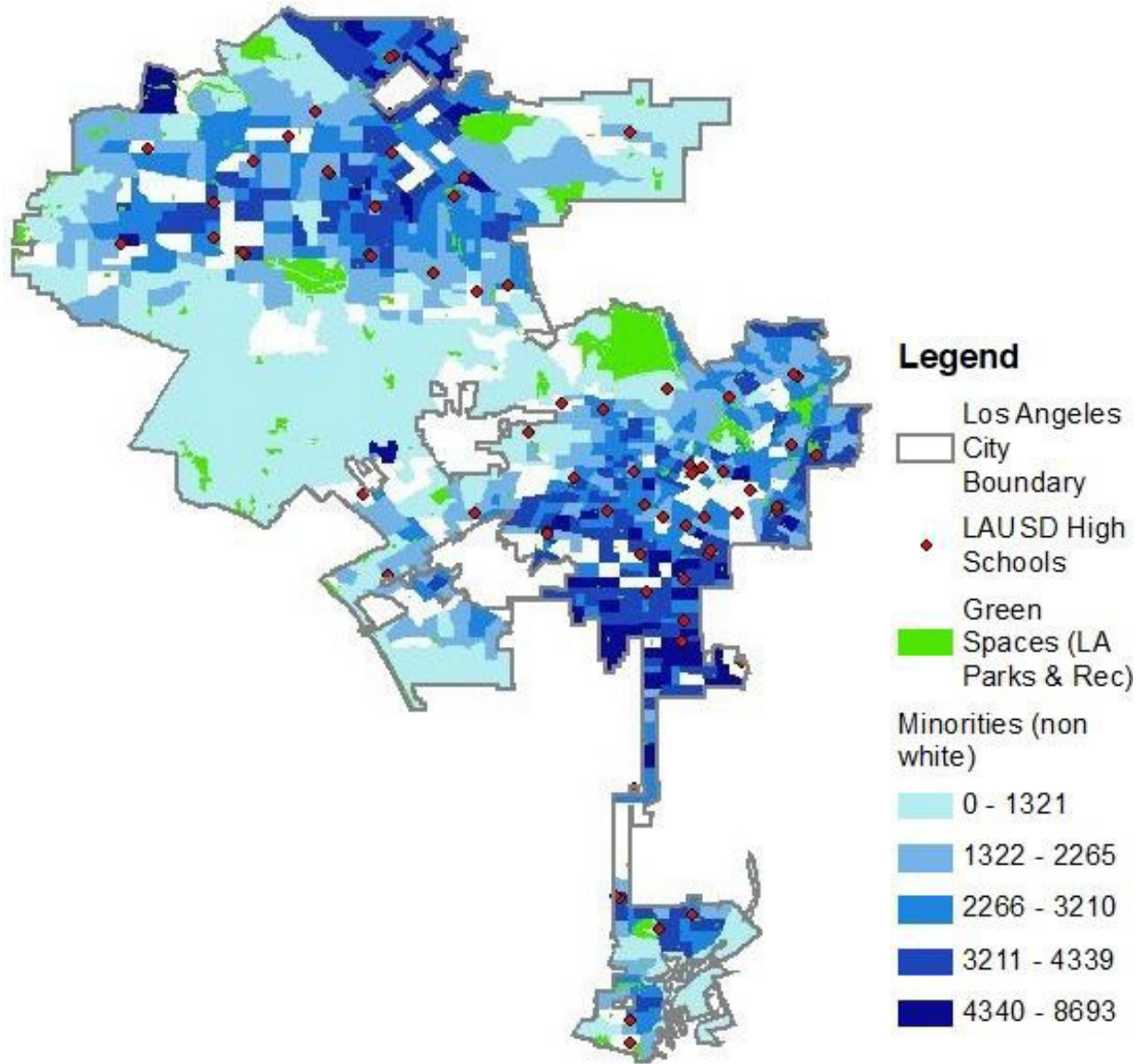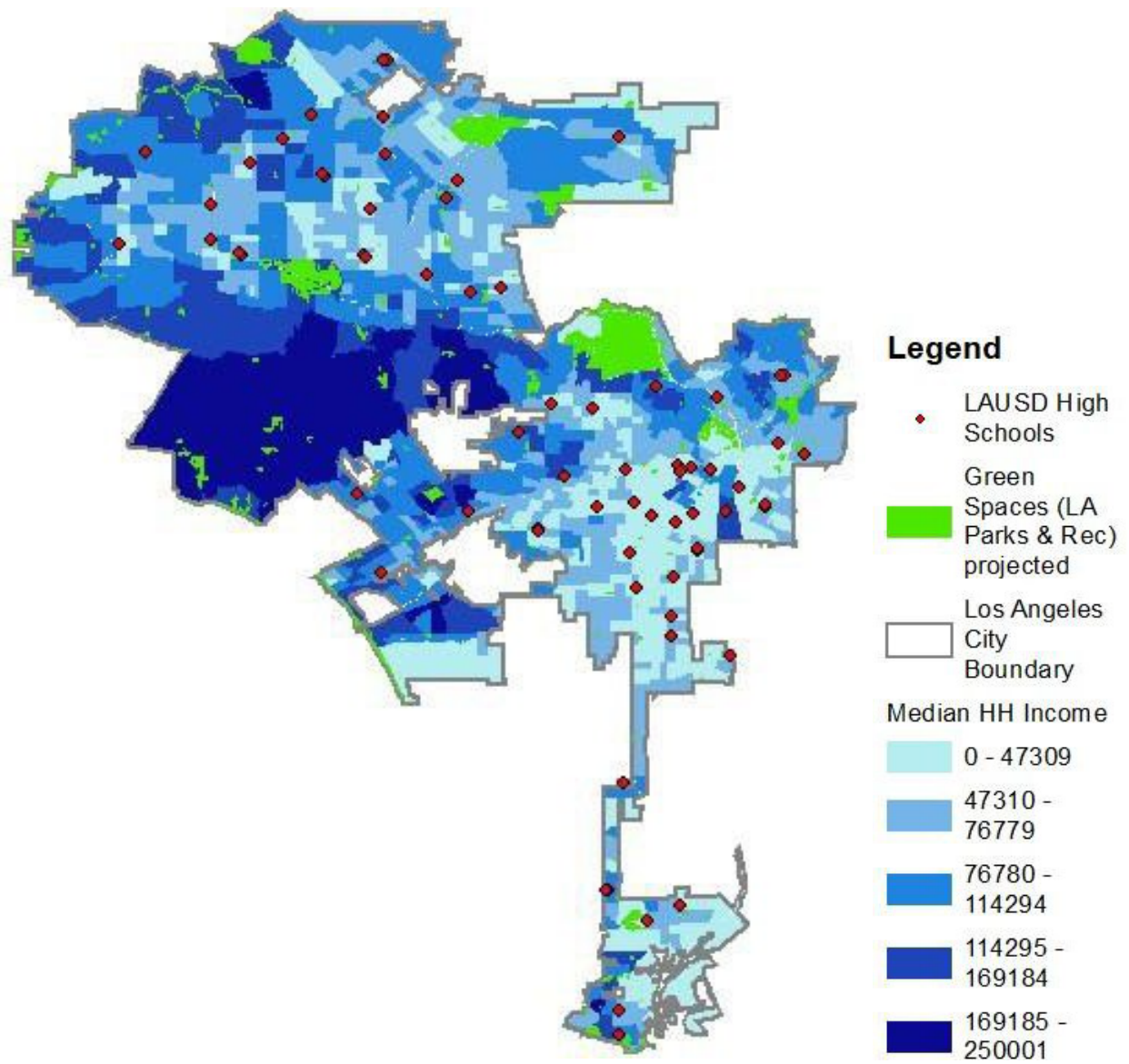
Figure 1: Population Density & Green Space.

Figure 2: Race & Green Space.

Figure 3: Income & Green Space.