COLUMBIA GSAPP FALL 2022 | FINAL SELF-DIRECTED RESEARCH STUDY

EVALUATING AMENITY ACCESS WITHIN A VEHICLE-LESS NYC

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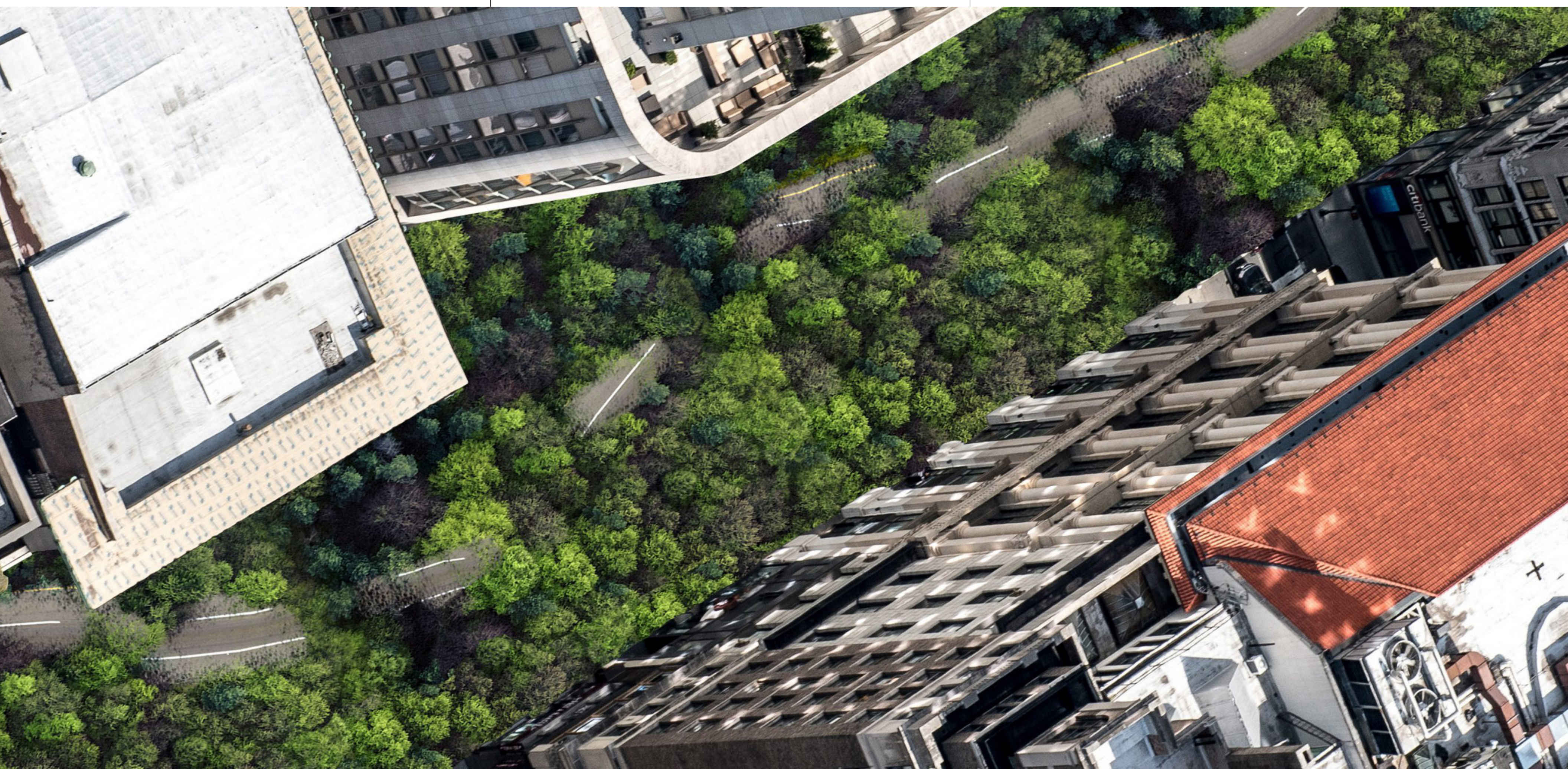

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_BACKGROUND

WHY CONSIDER A CITY WITHOUT CARS?

Despite what you may have heard, a future vehicle-less New York City is not outside the realm of possibility. The city has dipped its toes into this potential future already, restricting all of 14th Street in Manhattan to buses in 2019. Now, there are even talks to revamp Grand Army Plaza in Brooklyn by eliminating cars from the Prospect Park gateway, another potentially landmark change to another major transit hub within the city.

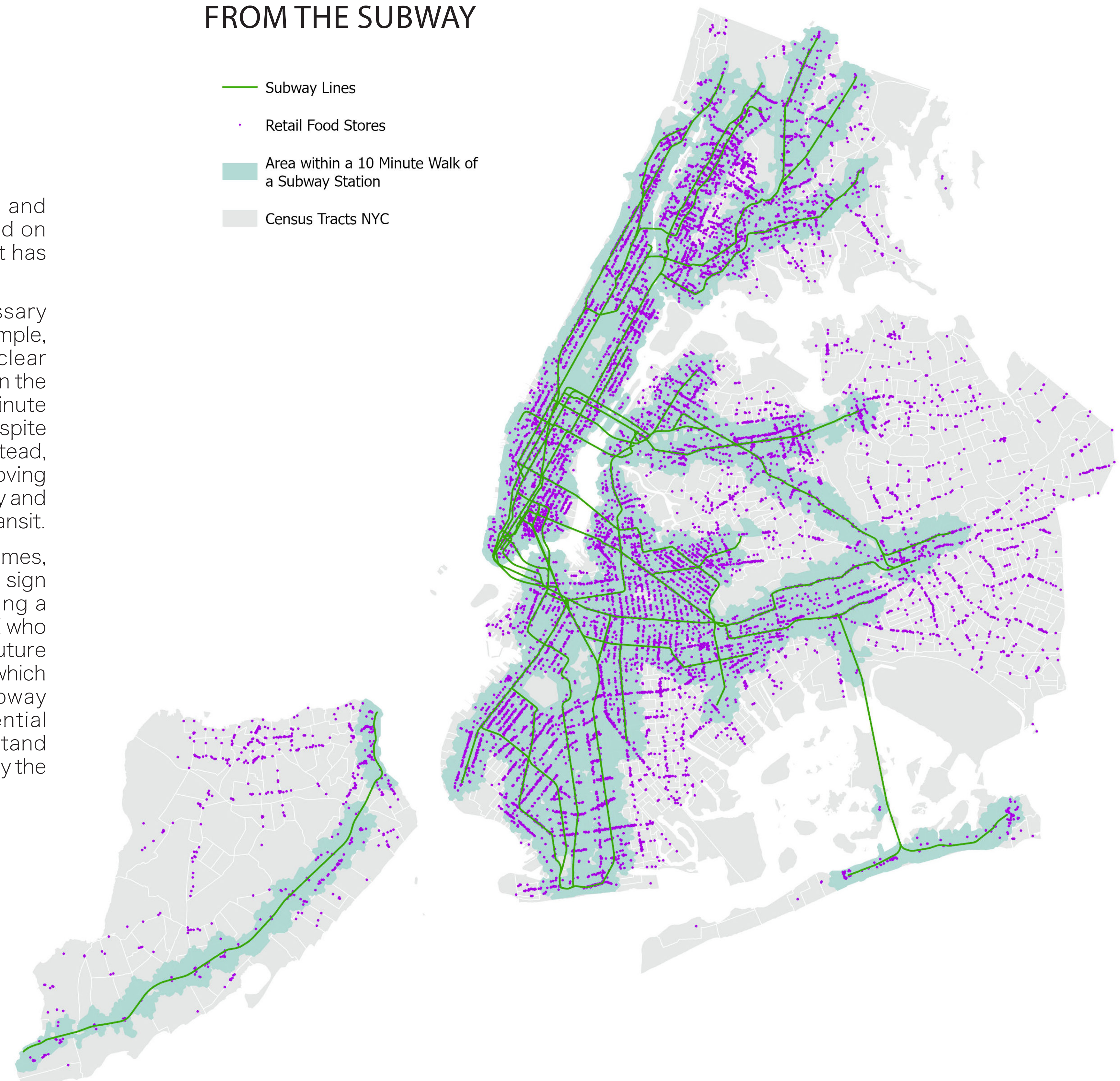
But perhaps the city is simply listening to its residents? Maybe there is a better use for NYC streets? These questions are underscored by the immense popularity of Open Streets, the NYC program brought about during the COVID-19 outbreak in 2020 to help give individuals more access to open space amidst lockdowns and community health concerns surrounding densely populated areas. Not only was this program popular, but reports show that it supported the economic success of those streets as well, with Open Streets seeing a 10% increase in new businesses during the pandemic while nearby control corridors saw a 20% contraction.

Not to mention, is it even worth having a car in the city anymore? In 2021, one measure of car ownership in the city surged 224%, and residents across the boroughs remarked on just how difficult–borderline impossible–it has become to find street parking in NYC.

This is not to say that cars are unnecessary within the five boroughs however. For example, from a simple preliminary analysis it is clear that the majority of food retail stores within the city (82.1% to be exact) are within a 10 minute walking distance from a subway station, despite the city's existing robust bus network. Instead, this may suggest that the city is already moving towards a system centered around subway and pedestrian transit rather than vehicular transit.

Whether these changes are a sign of the times, which are admittedly unprecedented, or a sign of what is to come, it is worth considering a New York City without cars and buses, and who would be most affected by that potential future reality. What this report seeks to uncover is which neighborhoods without convenient subway access are best prepared for this potential future. And through that we can understand which of those neighborhoods are currently the most under and over served.

LOCATION OF RETAIL FOOD STORES & AREA WITHIN 10 MINUTES FROM THE SUBWAY



_RESEARCH QUESTIONS, SCOPE & LIMITATIONS

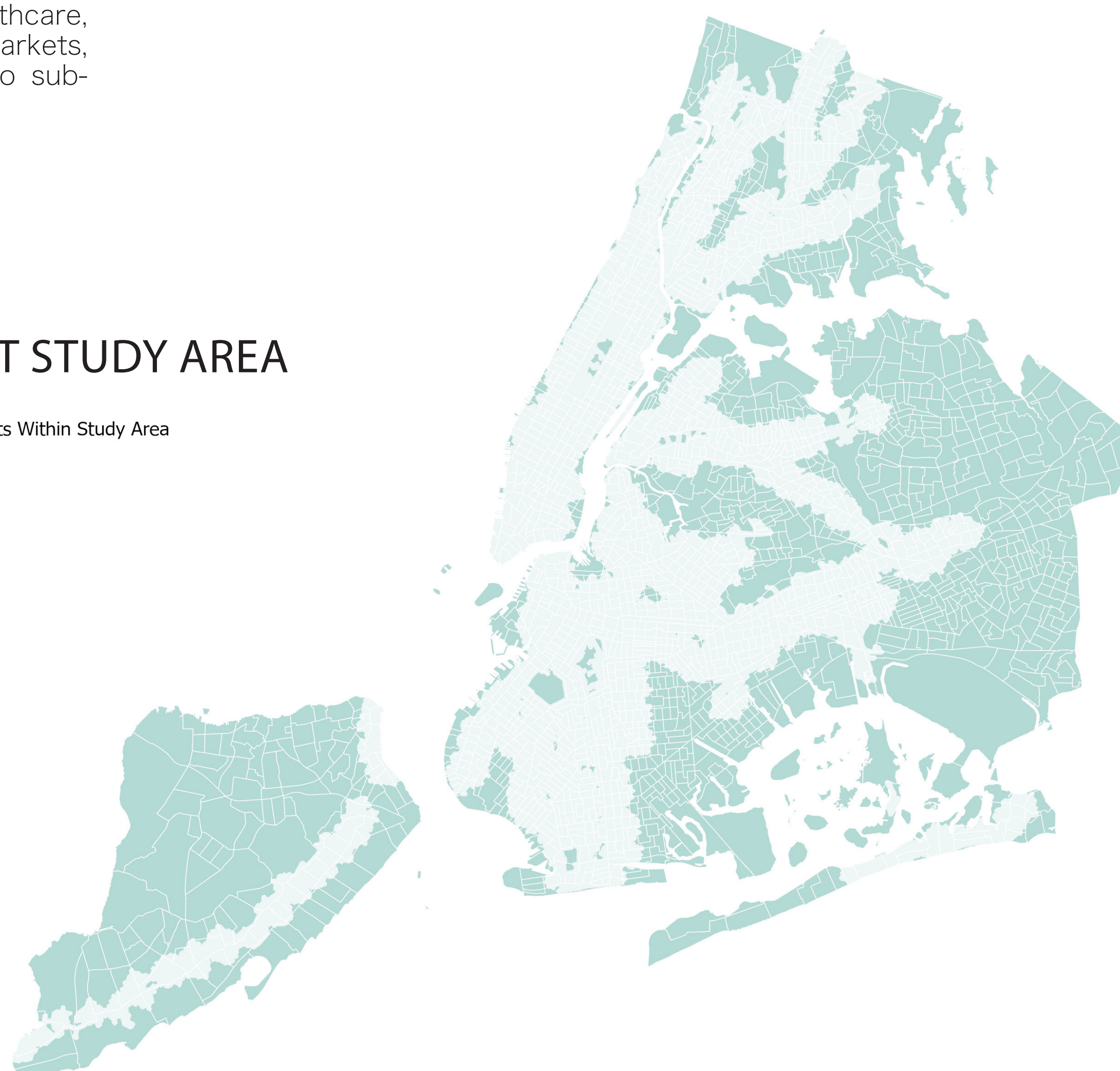
THERE ARE THREE MAIN QUESTIONS THIS PROJECT AIMS TO ANSWER:

1) Should vehicles become restricted within NYC in the future, which neighborhoods will be most "livable"? Which neighborhoods are the most amenity-dense—considering healthcare, education, food markets, parks, and access to subways?

2) Of these neighborhoods, which are the most underserved? Which are the least supportive of individuals with ambulatory disabilities?

3) Are there any demographic patterns among the most and least "livable" neighborhoods? If so, what are they?

PROJECT STUDY AREA



SCOPE

To best answer these questions, we chose to limit our analysis to all locations within the five boroughs of New York City that are outside of a 10-minute walking distance from a subway station. These areas are of particular interest to our research questions because, should vehicles be banned within the city, they would be the most affected by this change. Regardless, they currently represent the most underserved areas when also considering subway access within NYC. It is important to note that, as a result of this, unsurprisingly most of Manhattan is excluded from our analysis.

While we could have conducted the same analysis without removing the areas within 10 minute walking distances to the subway, removing these was important in order to reduce the overall amenity density in our analysis area. This allowed us to best illustrate the variations between amenities in similarly accessible neighborhoods, rather than having those be unclear due to the extreme density of amenities located within 10 minutes of subway stations.

To standardize our analysis area, we then organized these inaccessible locations into hexagonal bins based on walking distance diameter. For this, we utilized an average walking speed of 3.5 miles-per-hour, which is considered to be an average brisk walking pace. Hexagons were specifically chosen for this tessellation because it is the shape closest to a circle, therefore it most closely simulates an area with uniform walking radius without introducing potential gaps between bins.

The size of each hexagon layer was determined on a case-by-case basis per the amenity being analyzed. Schools and healthcare facilities were an-alyzed on a 15 minute walking distance hexagon layer, because we believe that 15 minutes is a rea-sonable distance to walk for those services. Similarly, parks and food retail stores were analyzed on 10 minute and 5 minute walking distance hexagon layers, respectively.

When analyzing the densities of amenities, we utilized manual breaks informed by quantile breakdowns for each density map. This was in order to maintain readable numbers with clear conclusions while also maintaining statistical relevance. For our Getis Ord Gi* analysis, we utilized a fixed-distance band of three-times the hex bin distance used for each amenity. This was chosen in order to standardize our hot spot analyses while allowing them to be dynamic for each amenity, similarly to our hex bin assignments.

LIMITATIONS

As a result, these decisions introduced some important limitations. In our initial network analysis to form the study area, we utilized LION street centerlines in order to form the network. Therefore, our network layer does not include paths that could be formed across alternate pedestrian routes such as parks and open lots.

Additionally, when assigning the size of the hex bins, we decided to choose the size based on the amenity and our assessment of what a reasonable walking distance would be to that amenity. First and foremost, in assuming this average walking speed we are limiting our ability to dynamically consider those who walk either faster or slower than that speed, and who as a result may have a different perspective of what is convenient or not convenient. Because of this, we acknowledge that our bias influences our results, however there is simply no way to evaluate accessibility to amenities without introducing some form of personal bias.

Finally, when joining census data to these hex bins, we determined each attribute based on the percentage of each census block located within a hex bin. Because of this, there are cases where we see a decimal number for population and other similar clearly inaccurate values. However, since we determined that it was most important for us to standardize our analyses by walking distance, these minor data errors were unavoidable.

Overall, we acknowledge these limitations and the fact that there is always the opportunity to alter this analysis in order to answer the same–or different–questions. For this report we chose the methodology that we believe best fits our understanding of community amenity needs and how to best analyze them.

_METHODOLOGY

CLEANING & LOADING RAW DATA

- Clean tabular data
- Add vector and tabular data to ArcGIS
- Convert tabular data to points
- Table join census data to census tracts

CREATING SPATIAL UNITS

- Perform network analysis on streets using subway stations as facilities to determine study area
- Create hexagonal tesselation grid layers for analysis spatial unit
- Spatial join amenities to respective tesselation layers

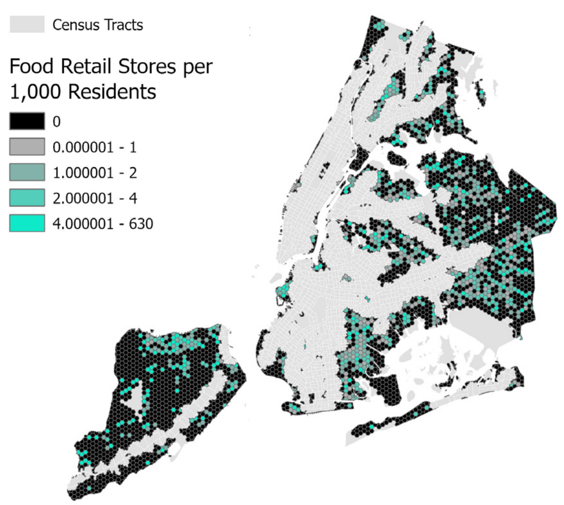
CONDUCTING DENSITY AND CLUSTER ANALYSIS

- Conduct a proportional split & spatial join census tracts to tessellation layers
- Normalize amenity counts using population density
- Conduct hot spot analysis for each amenity type
- Rasterize tesselation layers and conduct map algebra
- Visualize demographic in chosen areas of interest

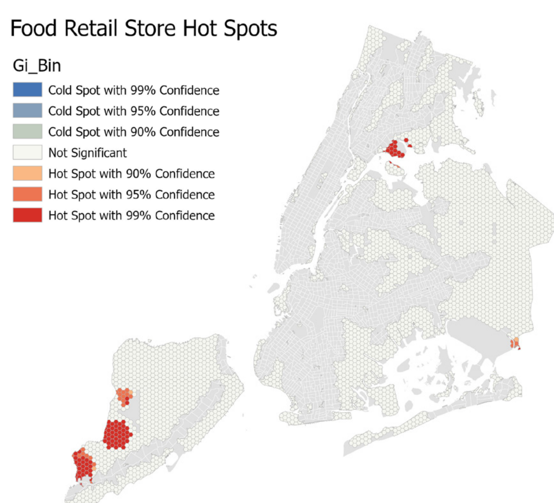
_PART I: EVALUATING AMENITIES WITHIN WALKING DISTANCE

To evaluate the amenities within each area, we normalized them per 1,000 residents. This had the benefit of both standardizing our results for better comparisons, as well as removing any hexagon bins without any population, further narrowing our analysis area.

I: FOOD RETAIL STORES IN 5 MINUTE HEX BINS

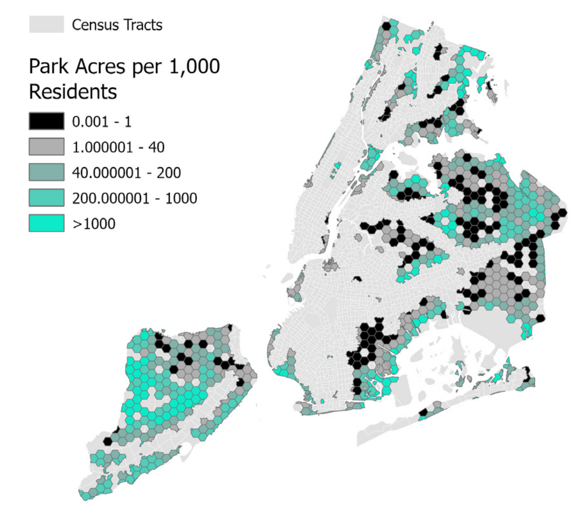


From this analysis, it is clear that there are several areas within New York City where residents will need to walk more than five minutes in order to reach a food retail store. While this may not sound like much, when carrying heavy bags filled with groceries it will feel a lot longer than 5 minutes. Especially because this is a necessary weekly task for all individuals, we can conclude that, within these areas, individuals are underserved.

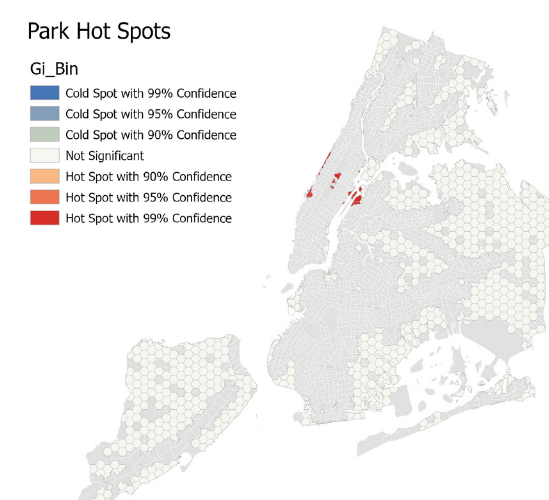


It is particularly interesting to see that not only are there no cold spots for food retail stores within our analysis area, but that the most hotspots are located in West Staten Island. This isn't surprising, as Staten Island is more suburban and thus more organized into residential and commercial areas, however it is interesting to see just how insignificant the rest of the five boroughs are. It is also important to note that the hot spots that are seen in the Bronx and Brooklyn are located in Hunts Point (home of the immense Hunts Point Distribution Center and Hunts Point Produce Market) as well as outside of John F. Kennedy International Airport.

II: PARKS IN 10 MINUTE HEX BINS

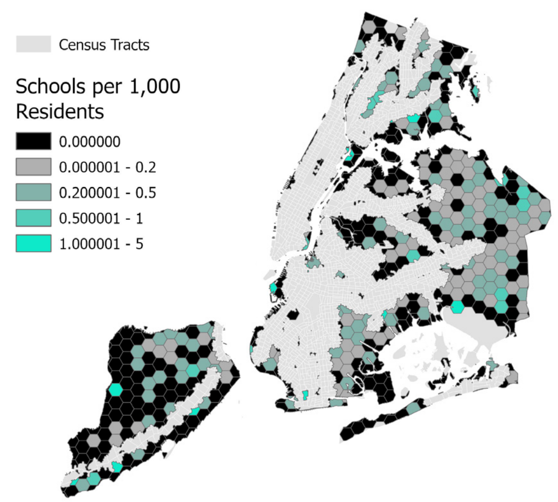


For parks we performed our analysis a bit differently: instead of identifying how many parks there were per 1,000 residents, we identified how many acres of parks there were per 1,000 residents. Under this analysis, we can see that there are a few distinct areas wherein park access isn't absent, but is instead limited. Furthermore, the grouping of these areas suggests that these are distinct areas in need of green space.

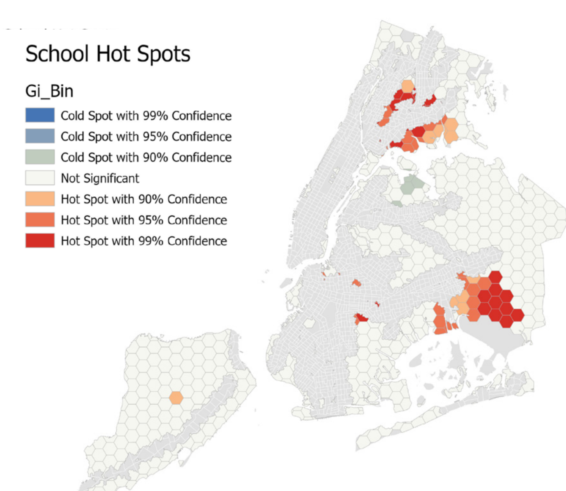


For our park analysis, we did perform a Getis-Ord Gi* analysis, however the only areas with hot spots were small and limited to the areas surrounding Central Park. This did not feel significant for our findings, and thus we can conclude that there is no clustering significance of park areas within New York City.

III: SCHOOLS IN 15 MINUTE HEX BINS

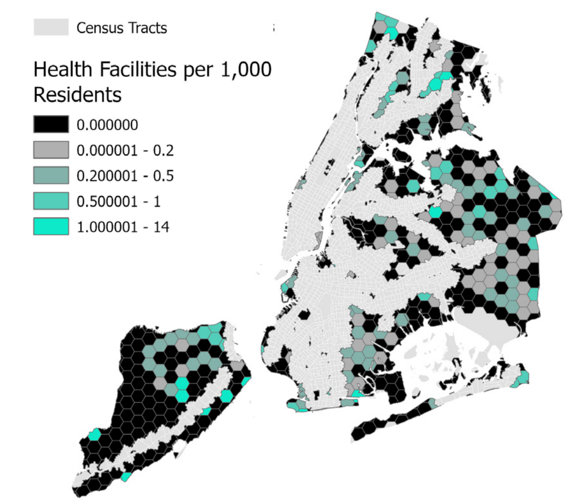


For the majority of the city, there is some access to a public school within 15 minute walk, though it is clear that a single school is shared with a large population for many areas. This can point to inequitable distribution of resources. While not many, a few areas do not have a school within a 15 minute radius, particularly around Staten Island.

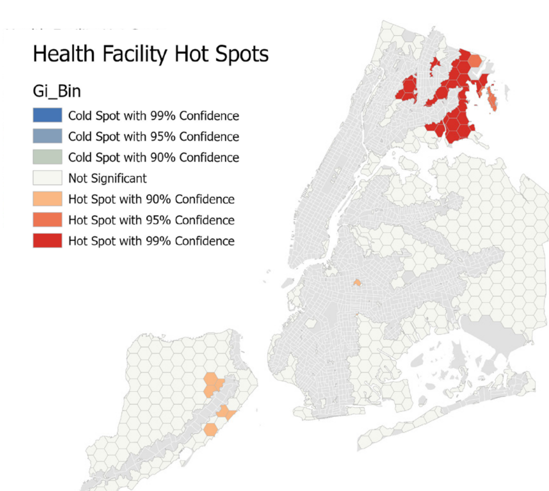


When a Getis-Ord Gi* analysis was conducted, it identified South Jamaica as a hot spot, which was particularly surprising. The reason behind this is unclear, perhaps a ghost of the past segregated school system in a particularly black neighborhood, or perhaps it is an effect of CUNY York College being located nearby. It also highlights Astoria Heights as a cold spot, which is unsurprising given that LaGuardia is located adjacent to it.

IV: HEALTHCARE IN 15 MINUTE HEX BINS



Compared to public schools, health facilities are more clustered. This means many people in New York City will need to walk more than fifteen minutes in order to reach a health facility. This is particularly the case near Oakland Gardens, Queens. We also looked at health facilities indiscriminately; it is not guaranteed that they provide the particular service one may need. A more detailed investigation into whether healthcare needs are being met should be conducted in the future.



Our Getis-Ord Gi* analysis identified in and around Throgsneck to be a hotspot. It is a largely middle class neighborhood, which may be resulting in greater accessibility.

_PART II: CASE STUDIES

MAP ALGEBRA

In order to evaluate the overall amenity density within our analysis area, we rasterized each density map according to a binary:

- 1 or more amenities (or more than 1 acre of park) per 1,000 residents = 1
- Less than 1 amenity (or less than 1 acre of park) per 1,000 residents = 0

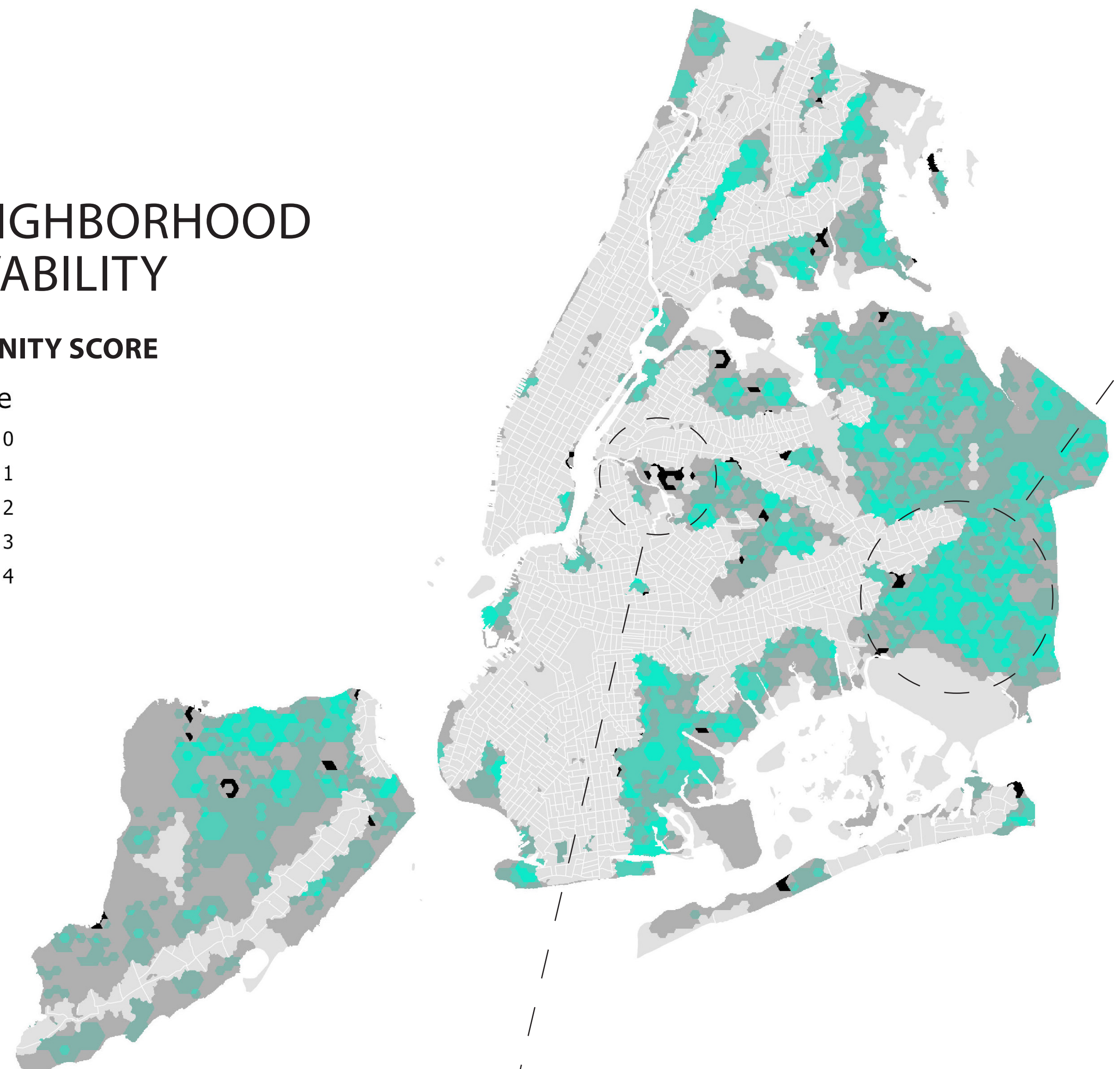
Using raster calculations, these individual amenity rasters were then added together to create our overall amenity density map.

NEIGHBORHOOD LIVABILITY

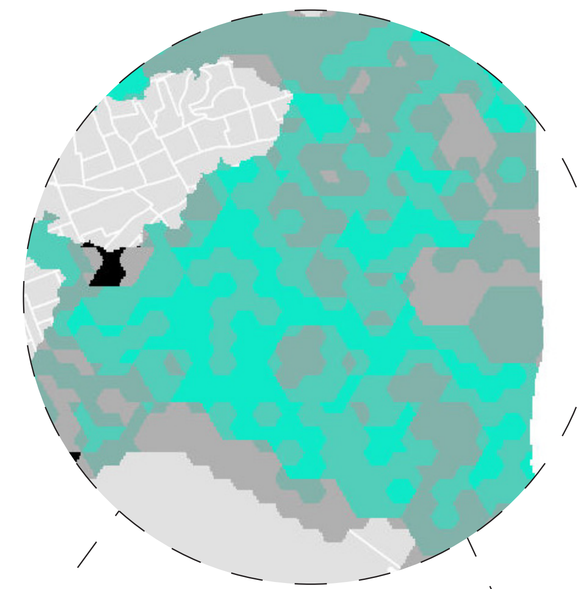
AMENITY SCORE

Value

- 0
- 1
- 2
- 3
- 4



I: MOST "LIVABLE" NEIGHBORHOOD: JAMAICA, QUEENS

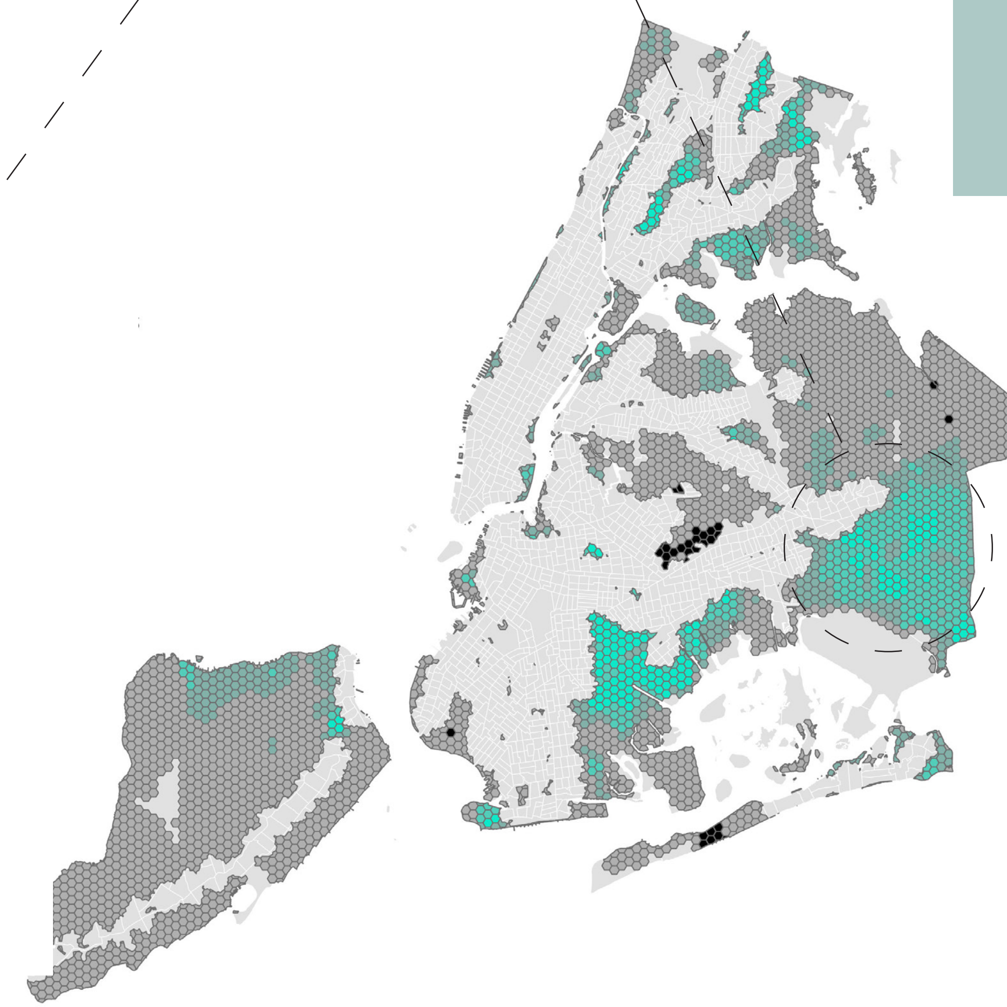


Surprisingly, there are several areas wherein all four amenities are available. For this report, we are specifically looking at the Jamaica, Queens area. When consulting our original density maps, we can see that in this area:

- The number of food retail stores ranges from 0-4 per 1,000 residents;
- The number of park acres per 1,000 residents ranges from <1 to 40;
- The number of schools is less than 0.2 per 1,000 residents, but never zero; and
- The number of health facilities ranges from 0 to 0.2 per 1,000 residents.

Furthermore, when analyzing this area demographically, we can see that the majority of the population is not white, and majority Black. Additionally, there are a high number of individuals with ambulatory disabilities. The total population density is one of the highest in our analysis areas, and the average household income ranges from $65,000 to $90,000 per year.

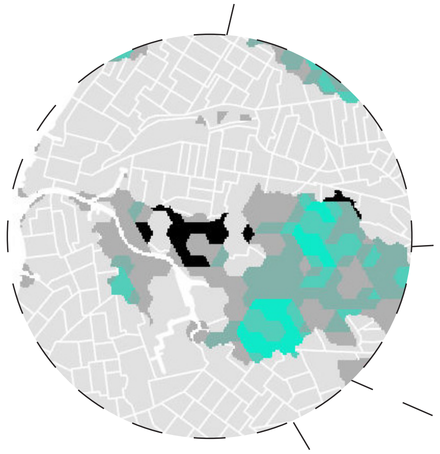
The overall amenity density of this area allows us to conclude that Jamaica is particularly well served, which is somewhat surprising considering the overall population density within that area. As a result, this is a particularly exciting finding of this report.



DISTRIBUTION OF POPULATION OF DEMOGRAPHIC IDENTIFYING AS BLACK

- 0.000000
- 0.000001 - 100.000000
- 100.000001 - 500.000000
- 500.000001 - 1000.000000
- 1000.000001 - 3994.374715

II: LEAST “LIVABLE” NEIGHBORHOOD

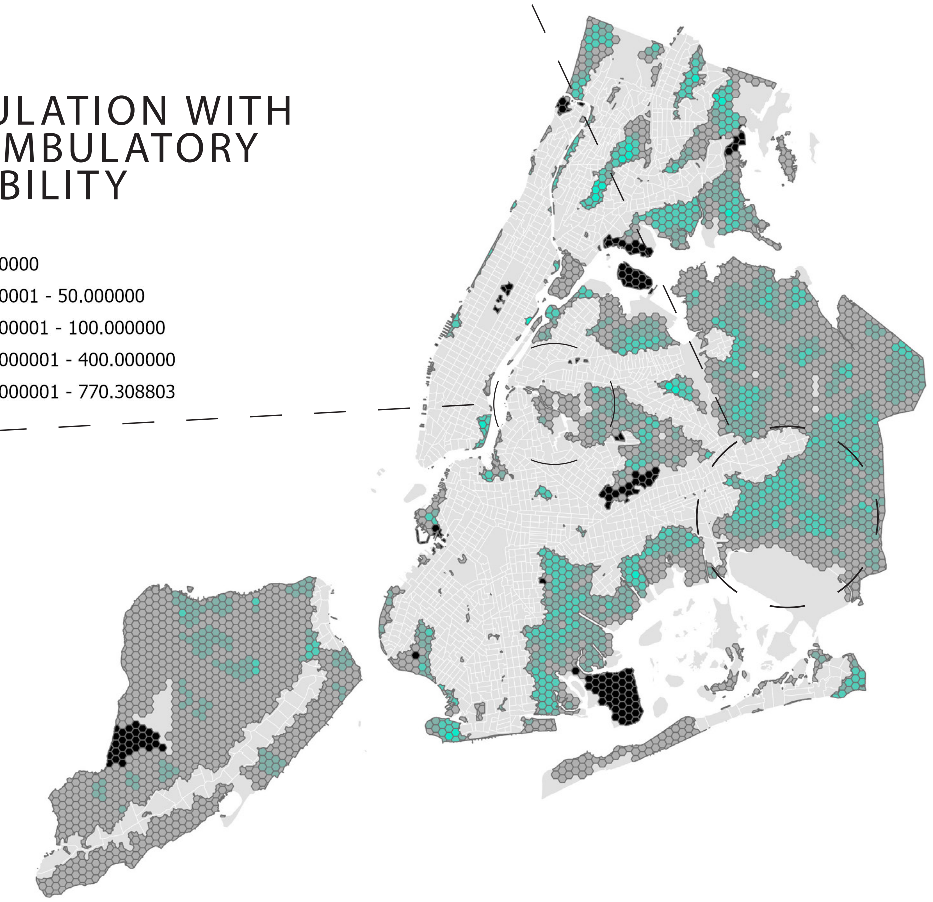


After performing our raster analysis, it is clear that there is only one distinct area that appears to be severely underserved in terms of amenities: the area just south of Sunnyside, Queens. While this is a small area, here, the density of amenities ranges from 0 to 1, with the only existing amenities being food retail stores.

Demographically, this area has a population of 503 to 5300 residents, which means it is underserved. This population is majority Hispanic, and the average household income is less than $65,000 per year. The number of individuals with ambulatory disabilities ranges from 8 to 400. While this area is a 25 minute walk from central Sunnyside, which boasts subway access and thus higher amenity density overall, given its population demographics and density, in conjunction with the overall lack of amenities, we can conclude that it is a severely underserved community.

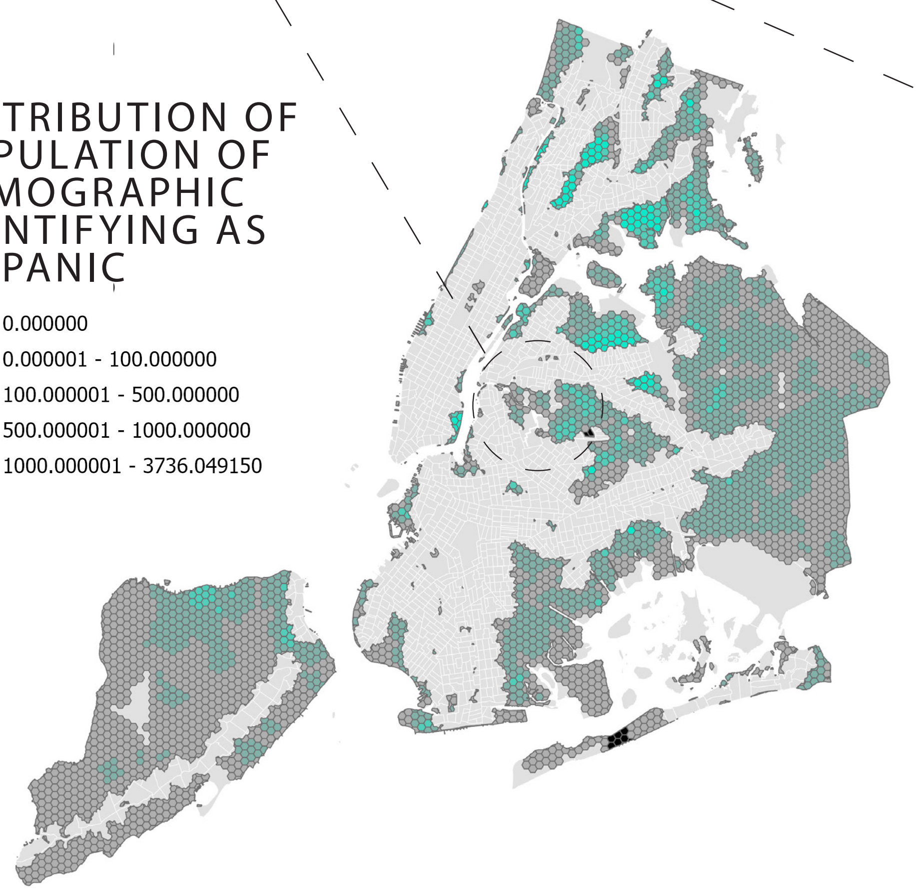
POPULATION WITH AN AMBULATORY DISABILITY

- 0.000000
- 0.000001 - 50.000000
- 50.000001 - 100.000000
- 100.000001 - 400.000000
- 400.000001 - 770.308803



DISTRIBUTION OF POPULATION OF DEMOGRAPHIC IDENTIFYING AS HISPANIC

- 0.000000
- 0.000001 - 100.000000
- 100.000001 - 500.000000
- 500.000001 - 1000.000000
- 1000.000001 - 3736.049150



MEDIAN HOUSEHOLD INCOME

- -2500.010326 - 35000.000000
- 35000.000001 - 65000.000000
- 65000.000001 - 90000.000000
- 90000.000001 - 100000.000000
- 100000.000001 - 250001.000003

III: LEAST SUPPORTIVE NEIGHBORHOOD FOR INDIVIDUALS WITH AMBULATORY DISABILITIES

Individuals with ambulatory disabilities are already underserved within NYC, and those individuals would be the most affected by changes affecting public transit. For that reason, we specifically wanted to locate the most underserved areas for individuals with ambulatory disabilities in an effort to call more resources to those areas.

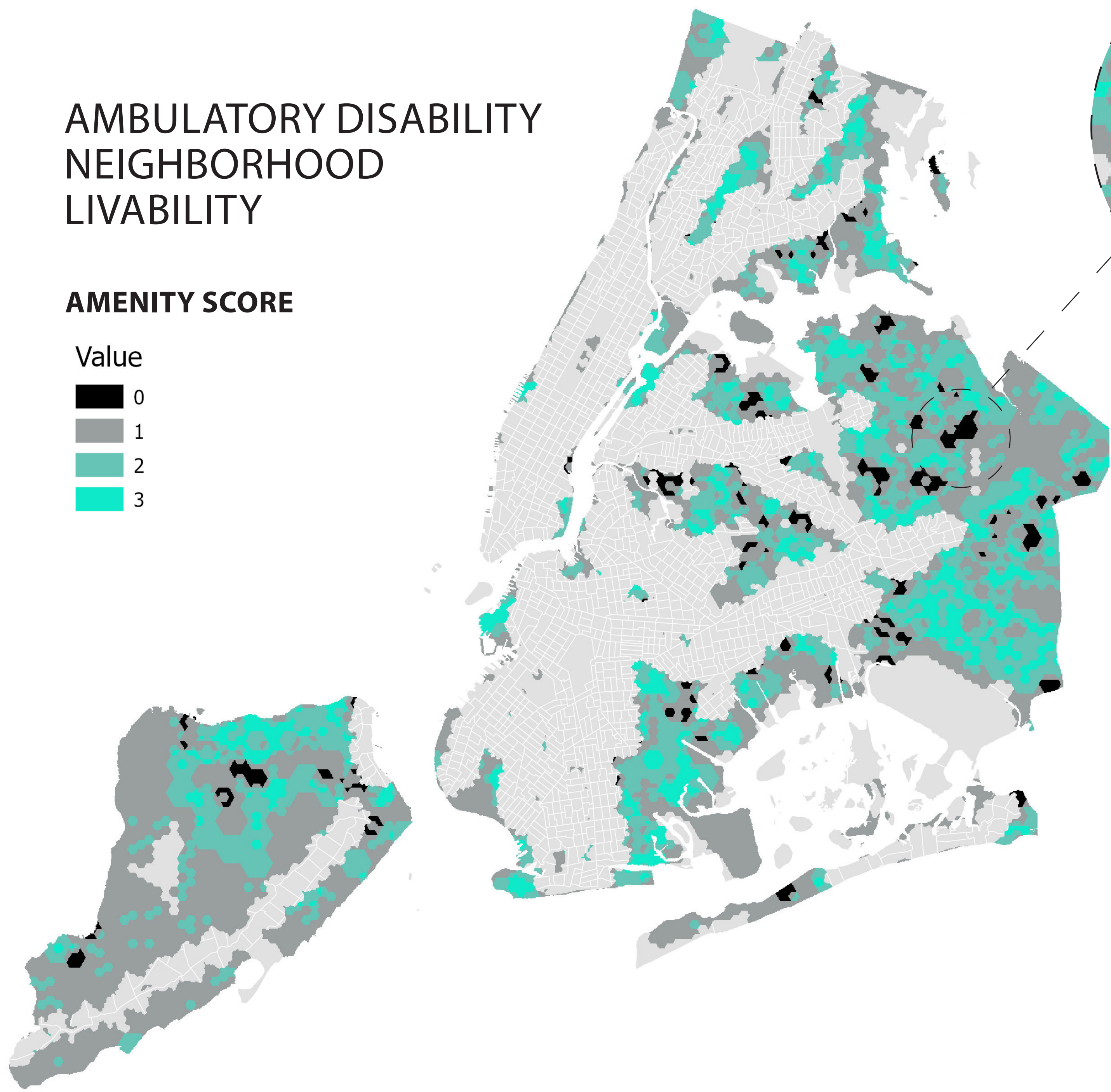
When conducting this analysis, we only focused on food retail stores, parks, and health care facilities. As is clear from our resulting map, there are several locations within our analysis area that are underserved under these conditions. For this report, we will focus specifically on the South Auburndale neighborhood of Queens.

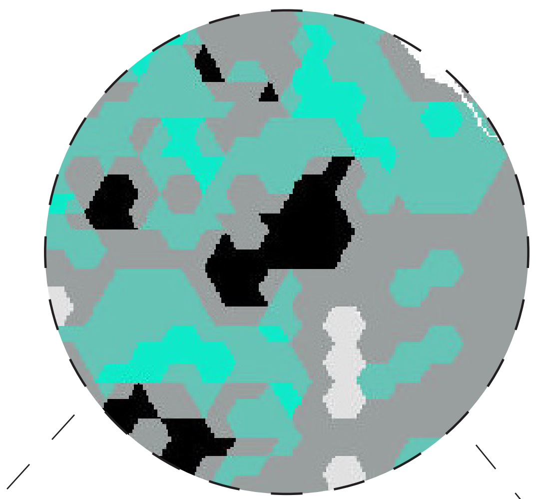
While this area is adjacent to an area with high amenity density, for individuals with ambulatory disabilities this distance makes those areas out of reach.

Demographically, this area is fairly evenly resided by White, Asian, and Hispanic populations. The average household income ranges from $65,000 to $100,000. Surprisingly, there is a high number of individuals with ambulatory disabilities within this area, with that number ranging between 550 and 1700 of the total population of between 5200 and 14500 residents. For this reason, this area's population is particularly underserved and the most in need of added amenities.

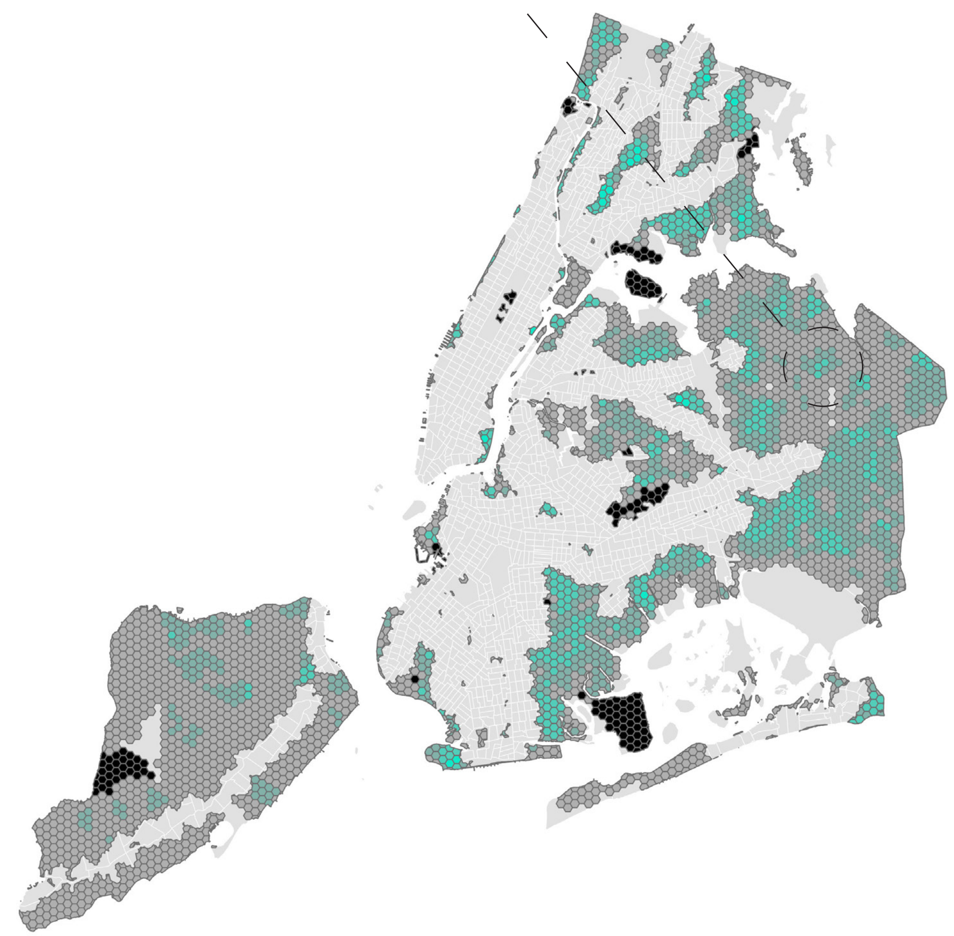
AMBULATORY DISABILITY NEIGHBORHOOD LIVABILITY

AMENITY SCORE

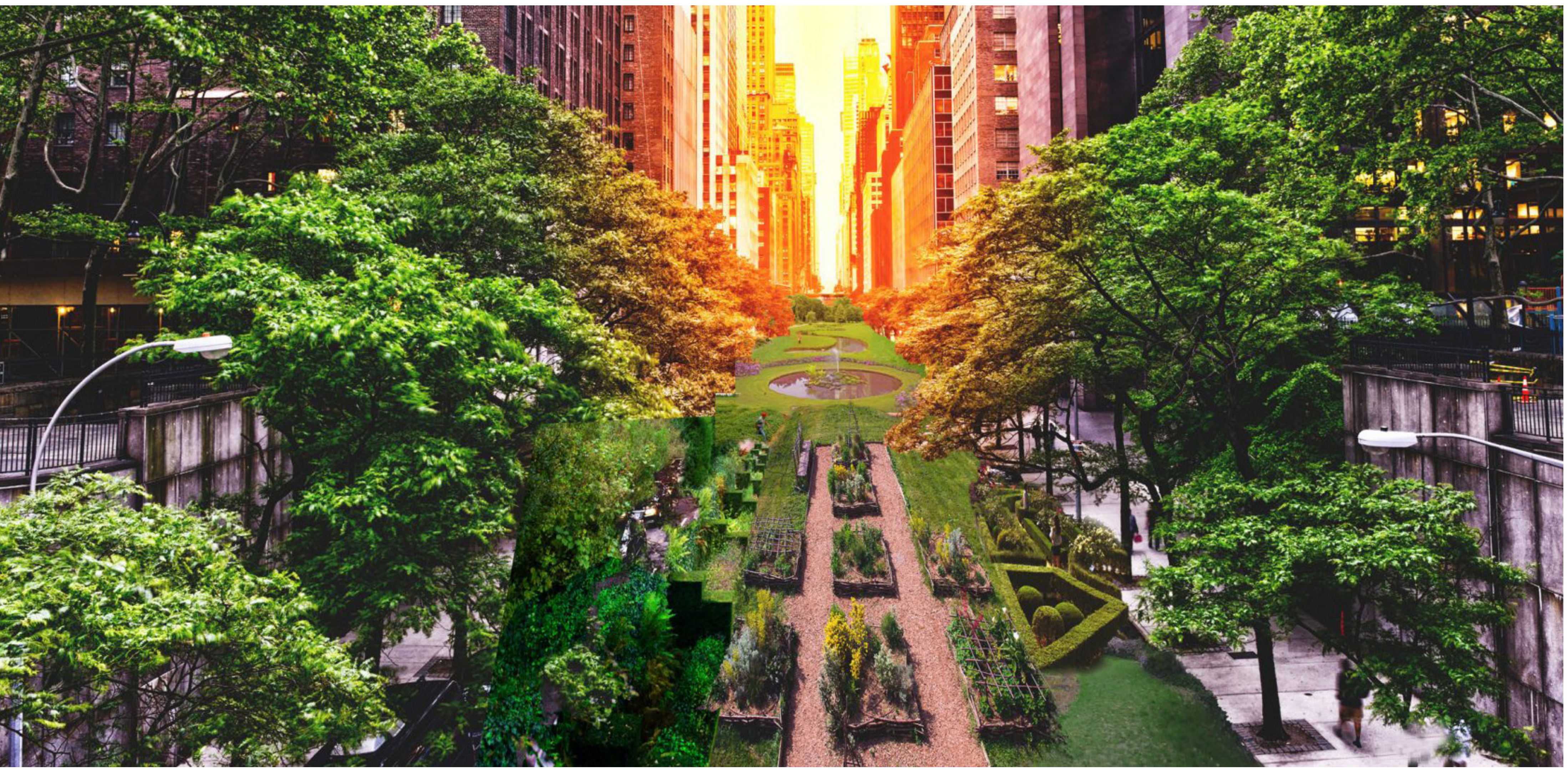




POPULATION WITH AN AMBULATORY DISABILITY



_CONCLUSIONS & RECOMMENDATIONS



In conclusion, we found that most of the areas within our study area are well-served in terms of amenity density, and very few are severely underserved. The lack of overall cold spots supports this conclusion, given that most of our analysis areas were areas of no significance. Additionally, there were several areas with high amenity density, and thus these areas can be used as a guide for individuals looking for the best areas to live within NYC outside of major subway transit lines.

Despite this however, this report did successfully identify two specific areas that are underserved based on their current population, and it is our recommendation that these areas receive expanded amenity access in order to best support their residents, especially those who have ambulatory disabilities.

Overall, the results of our analysis were surprising, and we are pleased to discover that for the most part, New York City is a very livable city, even outside of subway transit lines. These results make the possibility of a vehicle-less NYC less worrisome, and as a result this potential future feels even more possible.

_APPENDICES

DATA SOURCES

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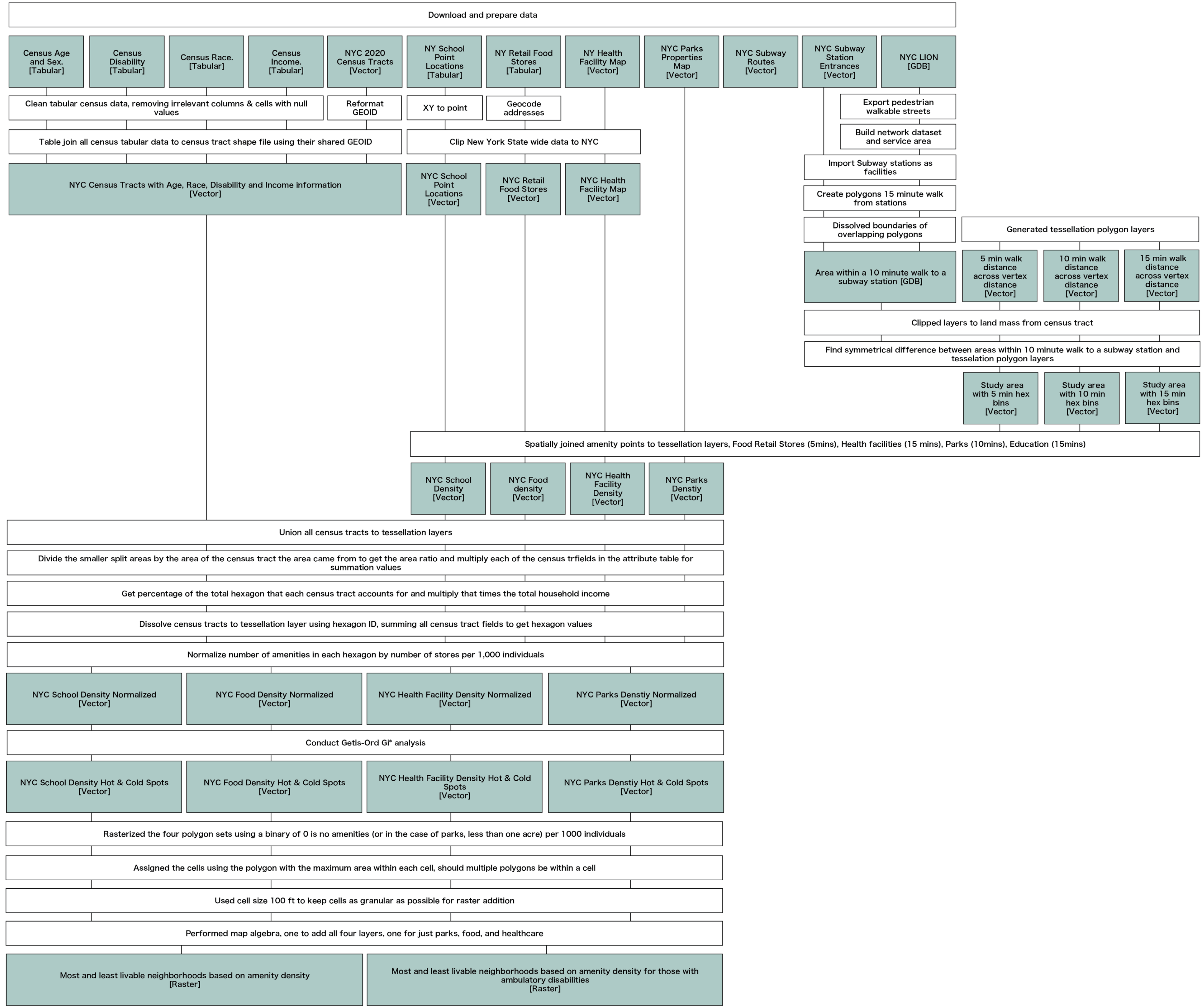
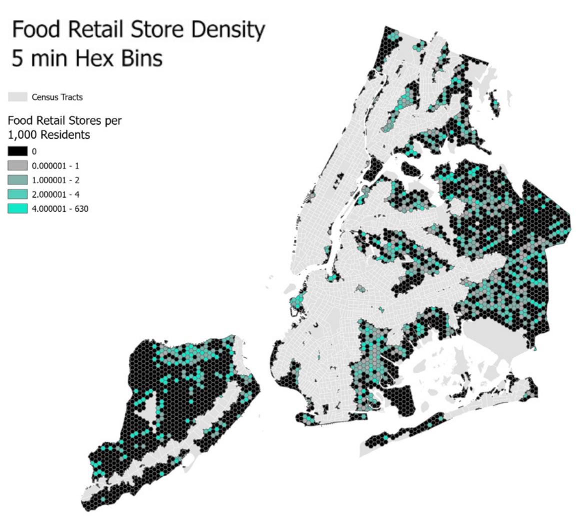
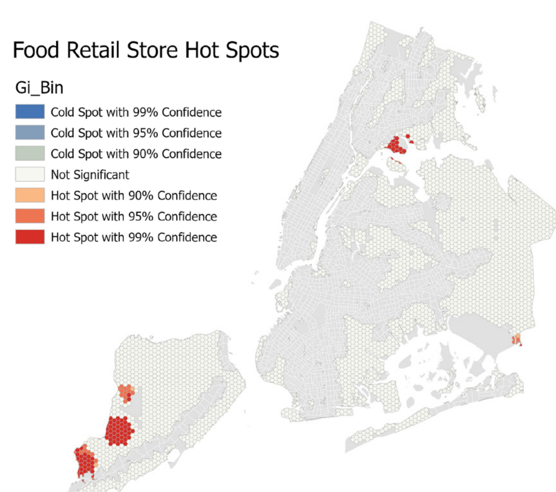
DETAILED METHODOLOGY



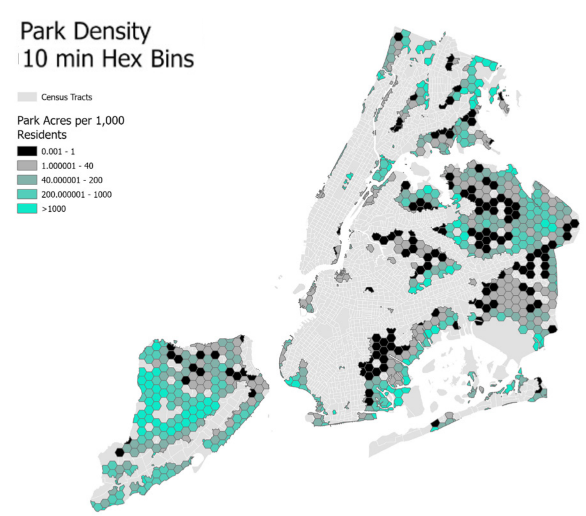
_PART I: EVALUATING AMENITIES WITHIN WALKING DISTANCE SIDE BY SIDE COMPARISON

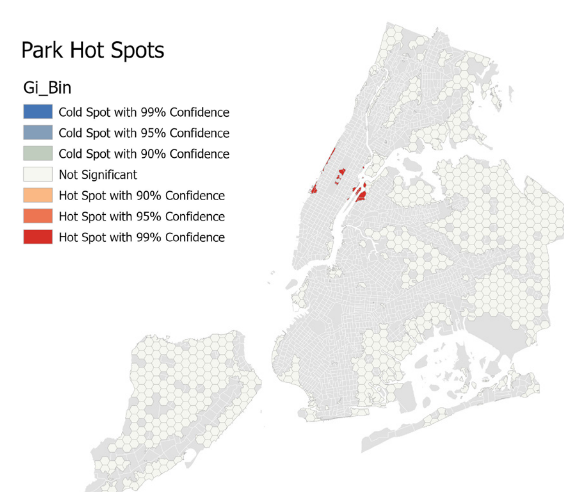
I: FOOD RETAIL STORES



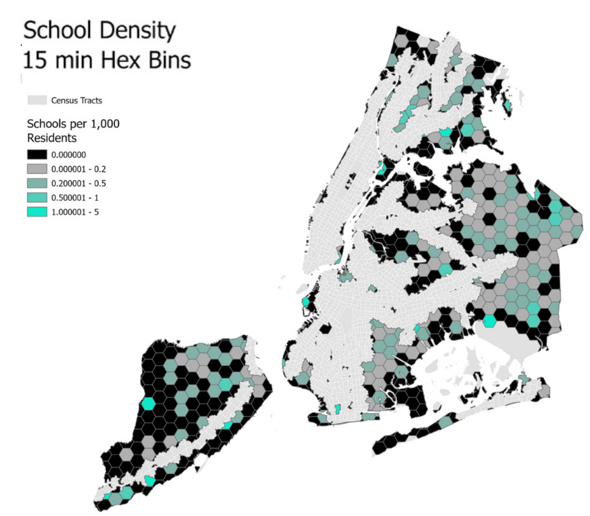


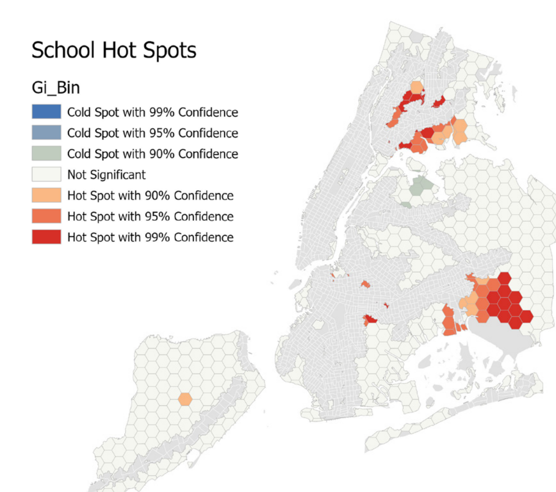
II: PARKS





III: EDUCATION





IV: HEALTHCARE