Access to Critical Services in Mecklenburg County

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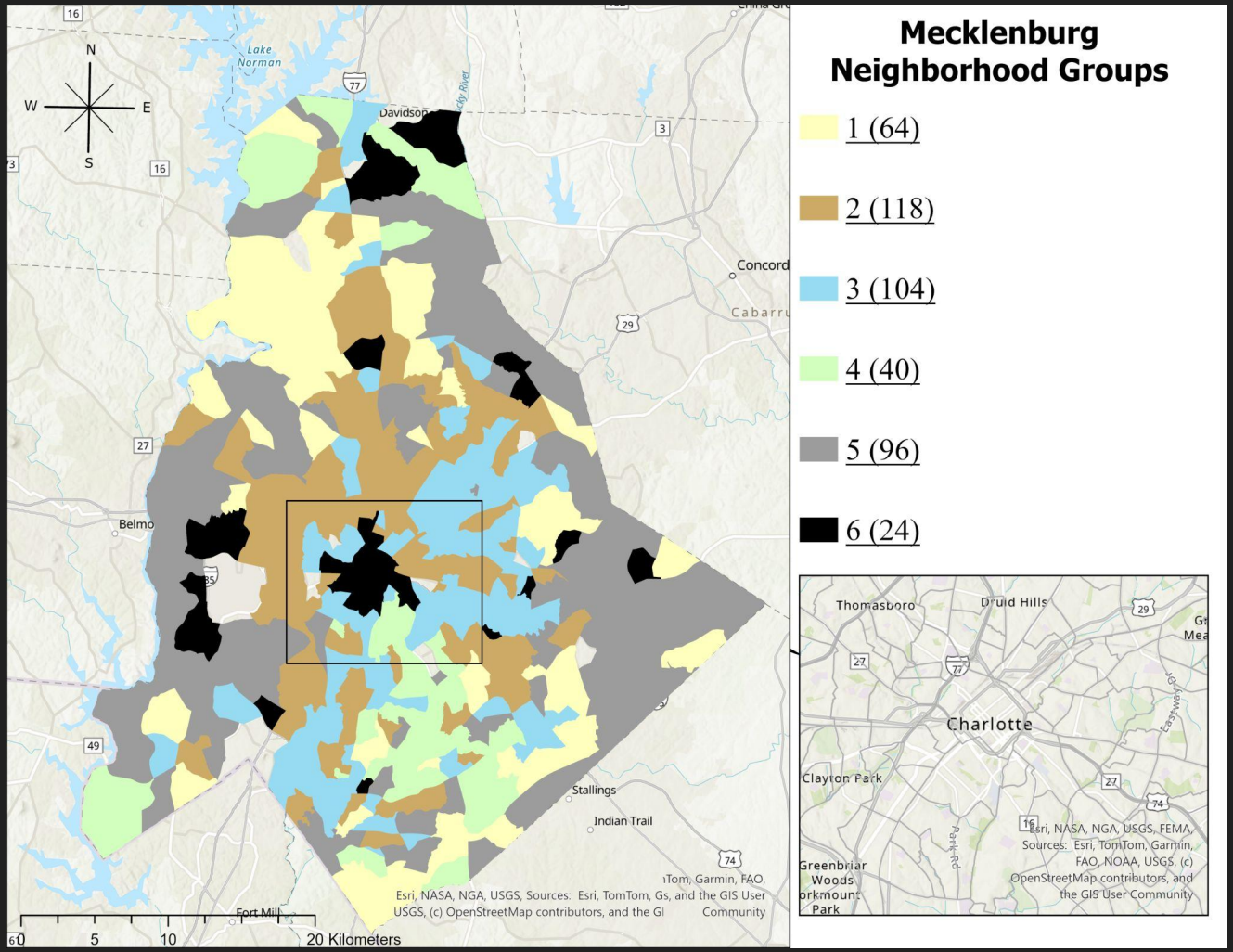
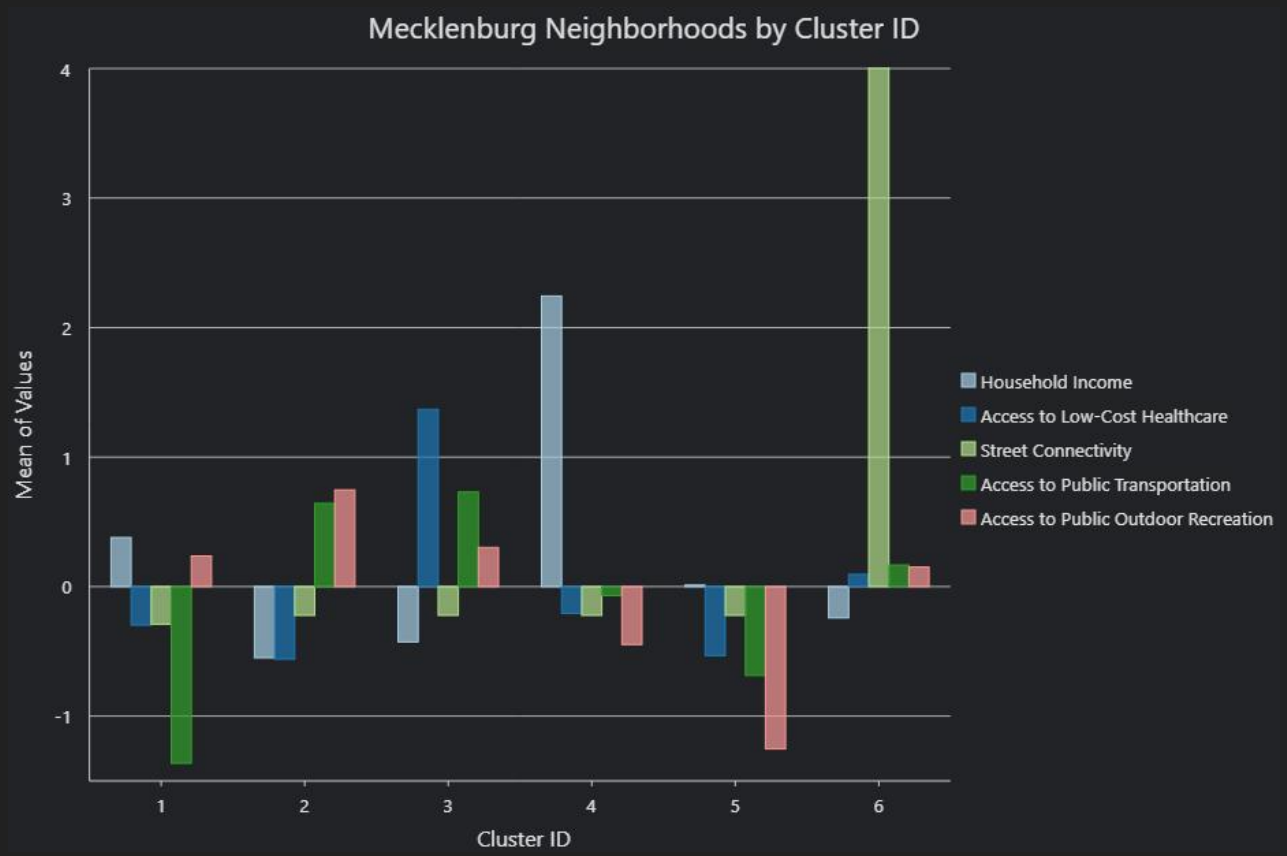


Let's start our analysis of Mecklenburg County accessibility by grouping people based on shared levels of certain measures of access to critical services

The next slide will show exactly what each group has in common



This graphic shows how many standard deviations above or below the mean each variable is for each neighborhood group. A larger bar indicates a greater deviation from the average for that variable. In a normal distribution, approximately 68%, 95%, and 99.7% of values fall within 1, 2, and 3 standard deviations from the mean, respectively — a pattern known as the empirical rule.

Cluster 1: Suburbanites (64 neighborhoods)

This group is characterized by higher than average household income and access to outdoor recreation, while having lower than average access to public transportation, street connectivity, and affordable healthcare. These are your classic suburban, middle class families. Having a personal vehicle is essential in these areas, as there is very little public transportation or walkability, and essential services are generally not close by.

Cluster 2: Resourceful Locals (118 neighborhoods)

This group is characterized by lower than average household income and proximity to affordable healthcare, but with higher than average close proximity to public transportation and outdoor recreation. Consider these your average charlotte residents, who are not affluent enough to live in the wedge, but still have resources that promote health and quality living. Perhaps they work in the city center and take public transportation to work. Perhaps they spend their free time outdoors, taking advantage of the numerous health benefits that come from green spaces.

Cluster 3: Mobile Dependents

This group is characterized by high access to critical services, but lower than average household income. This cluster includes UNC Charlotte, Queens, and Johnson C Smith University. Many of these residents are students living on or slightly off college campuses with high access to public transportation, healthcare, and green spaces. However, these residents are limited by lower income and may still be dependent on their parents while funding their education. For the most part, these neighborhoods are similar to cluster 2, but with more resources available due to the social capital of their school.

Cluster 4: Affluent Enclaves

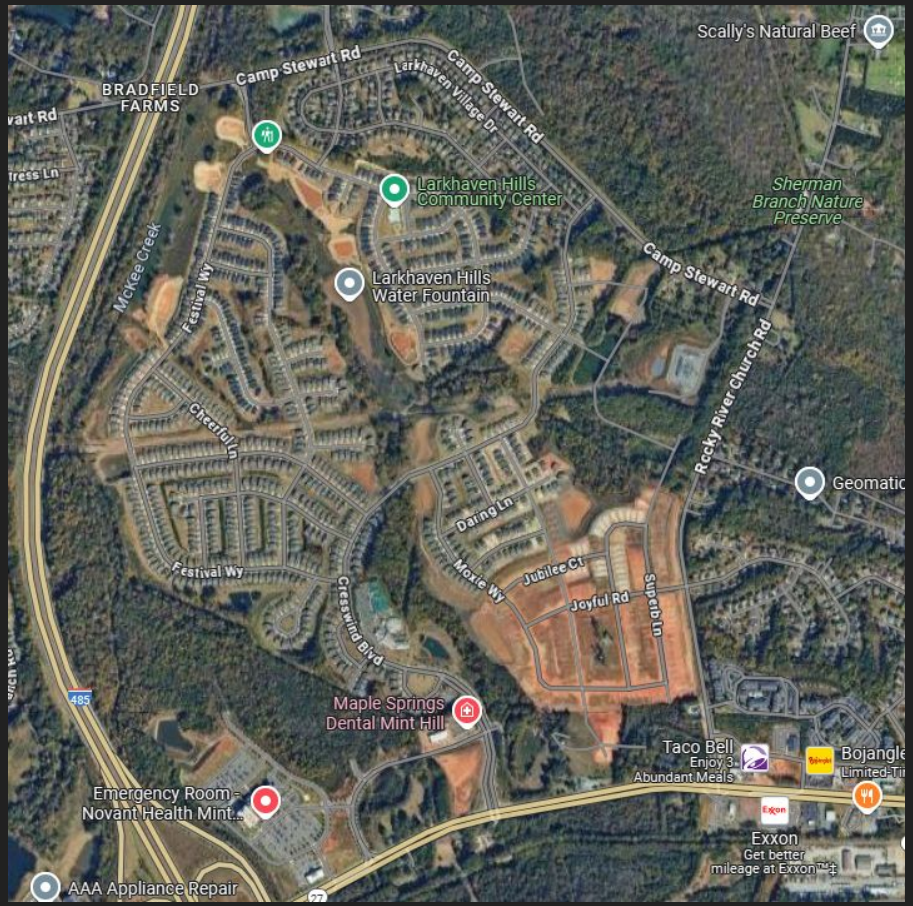
This group is characterized by significantly higher than average household income, while having lower than average access to critical services and poor walkability. On the map, this group represents the “wedge” portion of Charlotte’s arc and wedge spatial distribution. The residents of these neighborhoods likely do not have as great a need for close proximity to affordable critical services. Most of them will have money for personal vehicles and will be willing to drive a little farther for services if it means being more succeduled and living a quiet lifestyle.

Cluster 5: Underserved Exurban Dwellers (no image)

These neighborhoods are lacking in access to all of the measured critical services. While they do have average income, a personal vehicle is essential while living in these areas. Very few of these residents live near parks, public transit, or affordable healthcare. An advantage to living in this area is that is is more rural, which means less congestion and pollution. Some may prefer this lifestyle, but will need weigh the trade off of worse access to critical services.

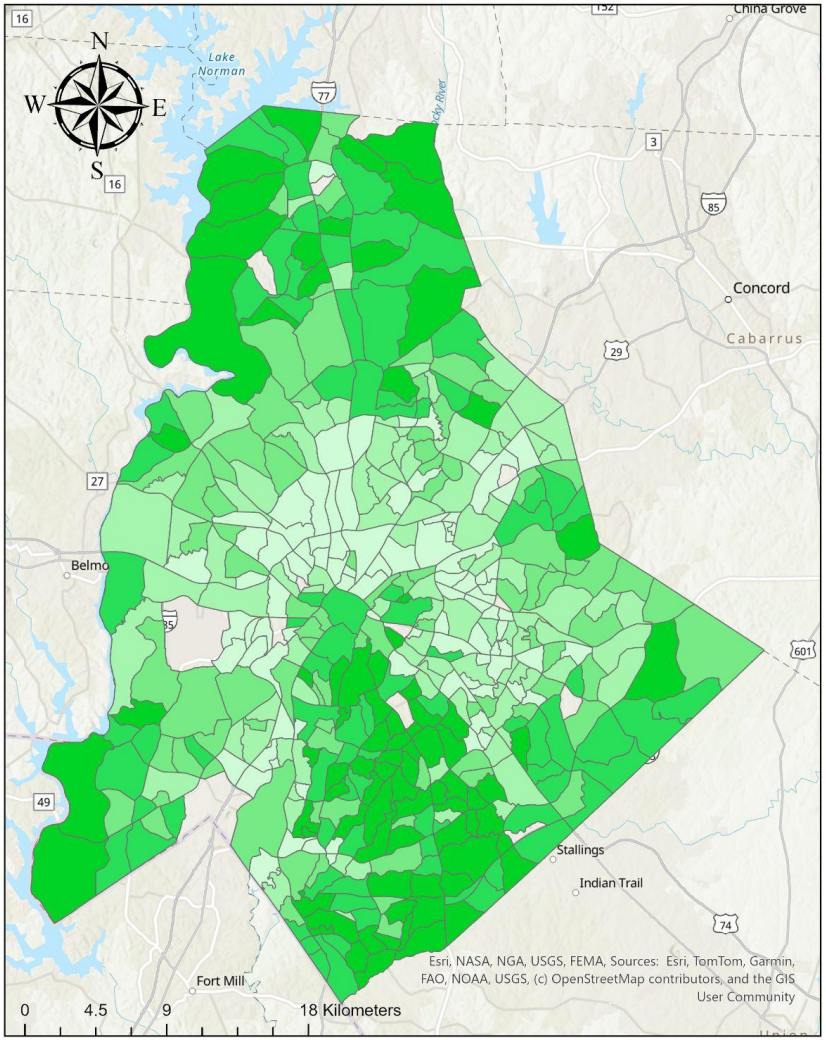
Cluster 6: The Connected Few

This is perhaps one of the most interesting clusters. These neighborhoods have essentially average measures of access in every regard except street connectivity, which is significantly higher than average. Most of these neighborhoods are located in the city center, likely due to grid design which increases availability of multiple routes. Some neighborhoods in this category are located in less obvious places, such as surrounding the airport and adjacent to to cluster 5 neighborhoods. These neighborhoods with high street connectivity that are not in the city center are very similar to cluster 1, but typically wedged between two major highways, so they are suburban areas that are somewhat self sufficient with schools and grocery stores, but they are disconnected from other neighborhoods.



Explanation of Terms

When we map these types of neighborhood characteristics, we want to know whether areas with similar characteristics are located near each other or spread out randomly. This is known as **spatial autocorrelation**, and it's what **Moran's I** helps us figure out. It's a number that tells us whether there's a pattern in how values are distributed across space. A value close to +1 means similar neighborhoods are clustered together, while a value near -1 means opposite types (like high-income next to low-income) are next to each other. A value near 0 means there's no pattern, it's random. To interpret Moran's I, we compare it to something called the **expected index**, which tells us what the Moran's I would be if everything was completely random. The **z-score** then shows how far the observed pattern is from that random expectation, measured in standard deviations. A high z-score (positive or negative) means we're seeing a strong pattern, while a z-score near zero means there's likely no meaningful clustering or dispersion. Finally, the **p-value** helps us judge how confident we can be in these results. It tells us the likelihood that the pattern we're seeing is just due to chance. A low p-value (typically under 0.05) means there's a low chance we're wrong to think a real pattern exists—in other words, we can trust the result.



Mecklenburg Standardized Income Distribution

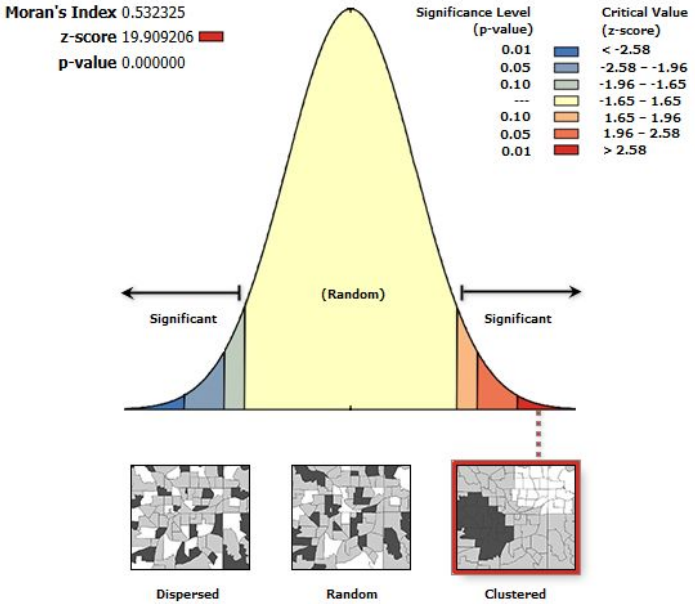
legend

Income Z Score

- -1.7 - -0.84
- -0.83 - -0.41
- -0.40 - 0.058
- 0.059 - 0.72
- 0.73 - 4.0

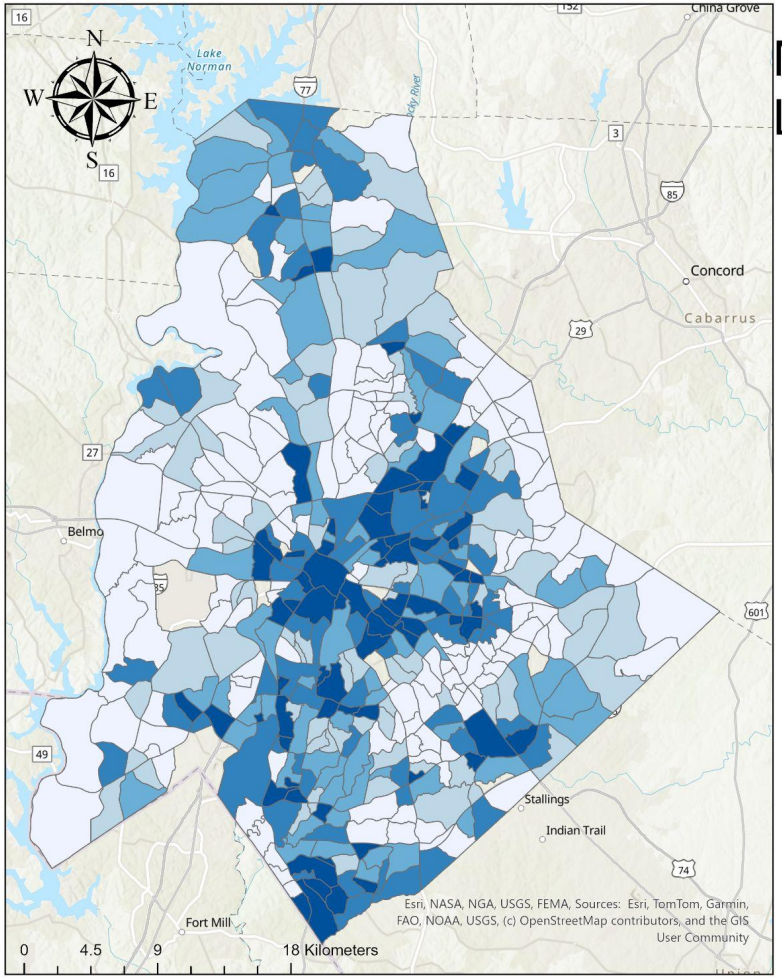
Z-score = standard deviations above/below the mean. Higher = more

Spatial Autocorrelation Report



Given the z-score of 19.909206, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Mecklenburg Proximity to Low-Cost Healthcare



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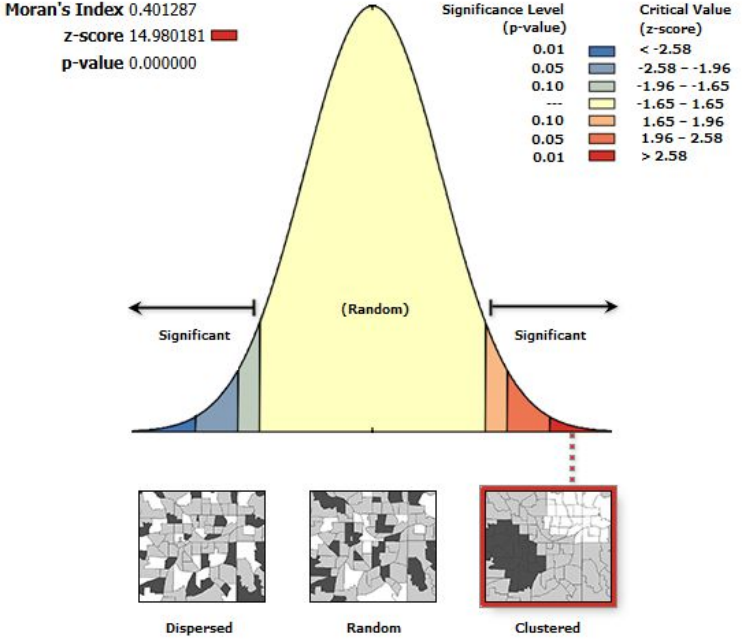
z_health

- -0.902050
- -0.902049 - -0.382836
- -0.382835 - 0.390085
- 0.390086 - 1.210208
- 1.210209 - 2.048031

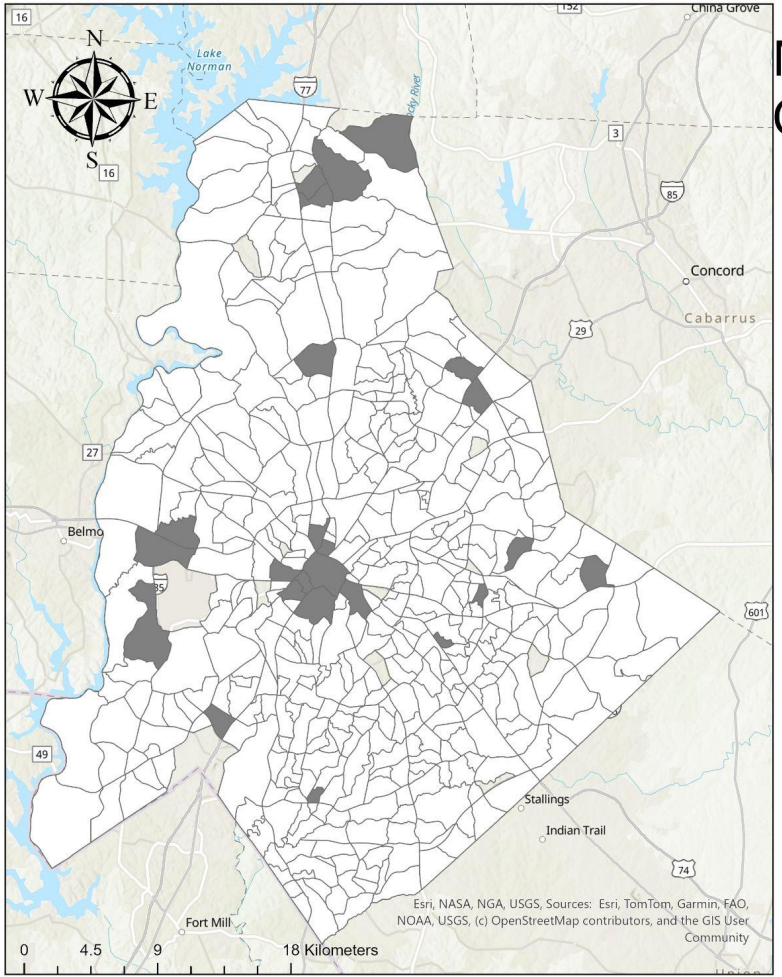
Z-score = standard deviations above/below the mean. Higher = more



Given the z-score of 14.980181, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Mecklenburg Street Connectivity

Z-score = standard deviations above/below the mean. Higher = more



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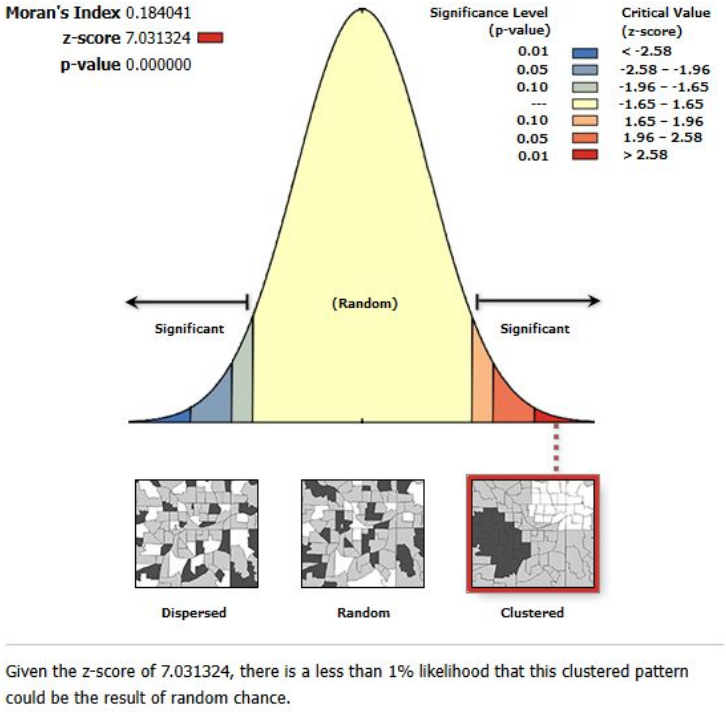
Street Connectivity Z-Score

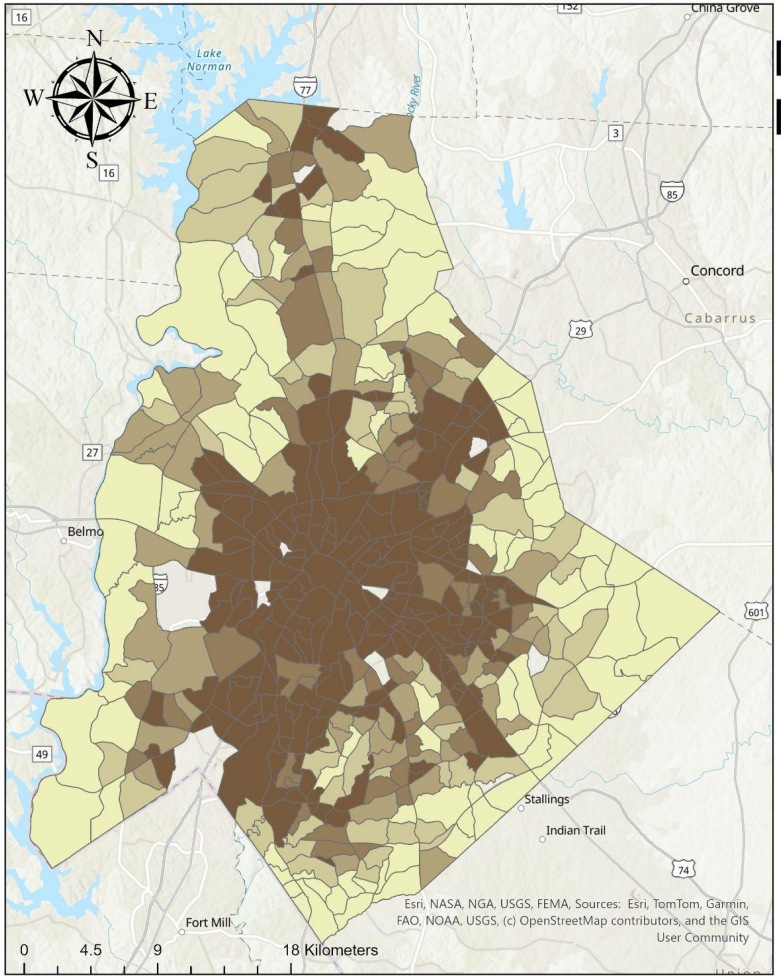
-0.222926

-0.222925 - 4.099865



Given the z-score of 7.031324, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Mecklenburg Proximity to Public Transportation

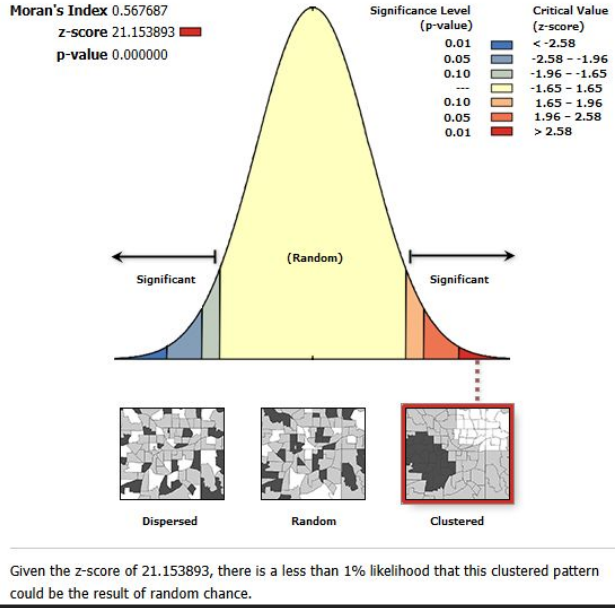


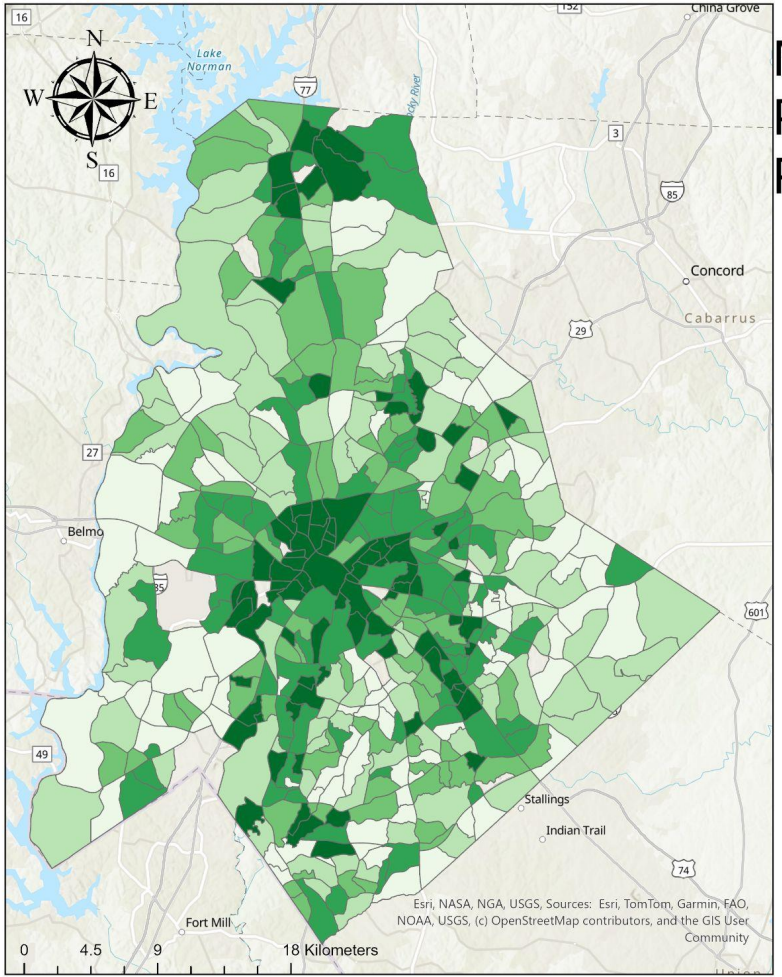
legend

Proximity to Public Transportation Z-Score

- -1.778294 - -1.300198
- -1.300197 - -0.396544
- -0.396543 - 0.218151
- 0.218152 - 0.641082
- 0.641083 - 0.848607

Z-score = standard deviations above/below the mean. Higher = more





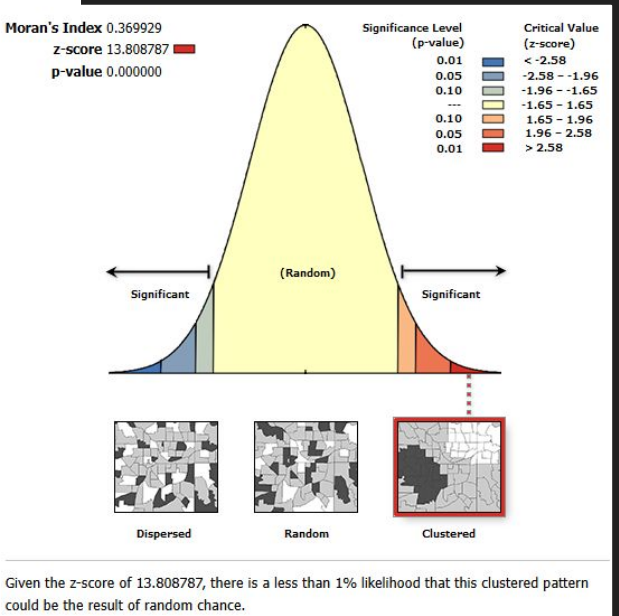
Mecklenburg Proximity to Public Outdoor Recreation

legend

Proximity to Public Outdoor Recreation Z-Score

- -1.690323 - -1.148461
- -1.148460 - -0.171426
- -0.171425 - 0.513622
- 0.513623 - 1.103213
- 1.103214 - 1.117250

Z-score = standard deviations above/below the mean. Higher = more



Given the z-score of 13.808787, there is a less than 1% likelihood that this clustered pattern could be the result of random chance.

Comparing Spatial Autocorrelation Statistics

	Household Income	Healthcare Proximity	Street Connectivity	Public Transit Proximity	Outdoor Recreation Proximity
Expected Index	-0.002252	-0.002252	-0.002252	-0.002252	-0.002252
Moran's Index	0.532325	0.401287	0.184041	0.567687	0.369929
Z-Score	19.909206	14.980181	7.031324	21.153893	13.808787
P Value	0.000000	0.000000	0.000000	0.000000	0.000000
Spatial Autocorrelation	clustered	clustered	clustered	clustered	clustered

Comparing Spatial Autocorrelation Statistics

Each of the five variables we analyzed—Household Income, Healthcare Proximity, Street Connectivity, Public Transit Proximity, and Outdoor Recreation Proximity—show statistically significant spatial clustering across the study area.

The Moran's I values are all positive, ranging from about 0.18 (for street connectivity) to over 0.56 (for public transit), indicating that neighborhoods with similar values tend to be located near each other, rather than being randomly distributed. This suggests that, for example, low-income areas tend to be near other low-income areas, and neighborhoods with good transit or park access are grouped geographically, not scattered randomly.

The expected index for a random pattern is around -0.002, so the actual values are much higher, reinforcing that a clear pattern exists.

The z-scores for each variable are also very high (all well above 2), with some over 21, meaning these patterns are many standard deviations away from what we'd expect by chance—a strong indicator that the clustering is real.

Finally, all the p-values are 0.000000, which in statistical terms means the chance that these patterns are random is less than 0.000001%. Put simply: we can be **extremely** confident that each variable is spatially clustered.

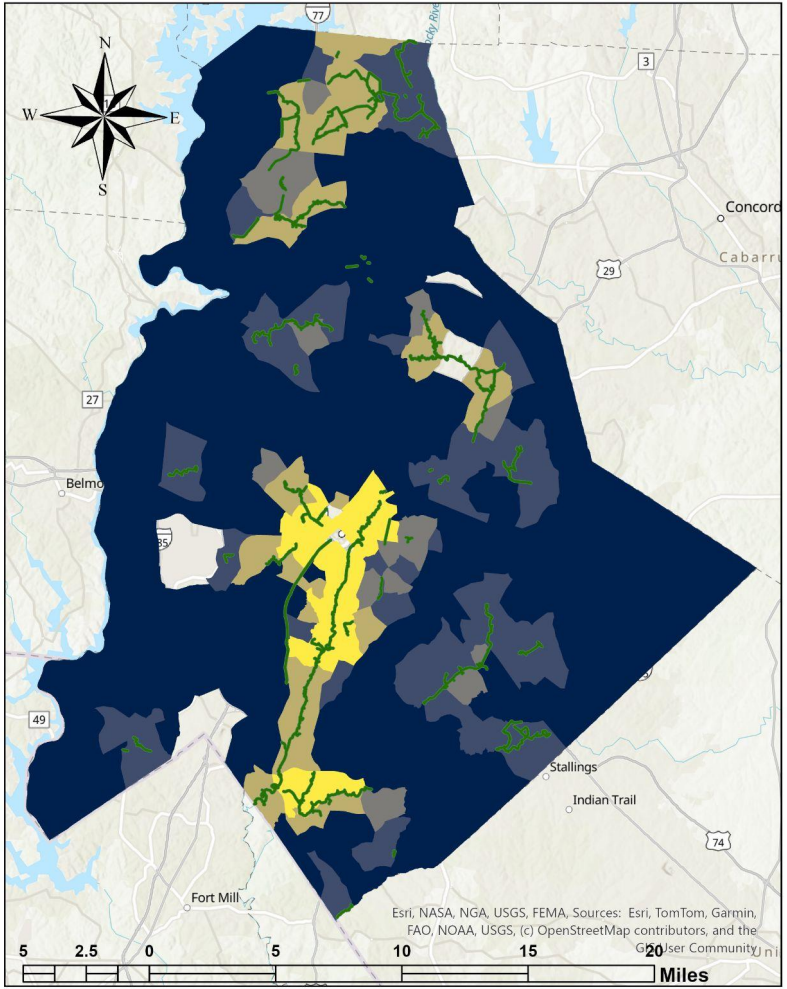
Note that sidewalk connectivity only appears as slightly below the mean, or significantly above the mean. This is because sidewalk connectivity is measured on a scale of 1-3, and data used for this analysis is rounded to the nearest whole number. A score of 2 is well above the mean, which is around 1.05. No neighborhood in Mecklenburg county scored higher than 2.

Accessibility analysis

The following map shows the availability of greenway entrances per person within a 1-mile radius of each census tract. It uses the a spatial model known as the 2SFCA method to account for both proximity to entrances, the population competing for access, and the size of the greenway being accessed.

I chose a 1-mile catchment area because it represents a typical walking or biking distance for most people to access a greenway entrance. This distance is commonly used in transportation planning to capture realistic, everyday access to recreational areas in urban and suburban environments.

Population-Weighted Greenway Access Using 2SFCA (1-Mile Threshold)

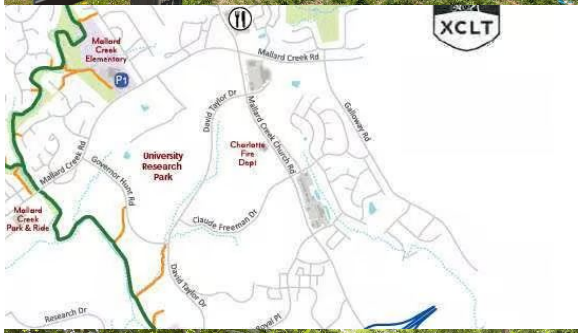


2SFCA Accessibility Score (Higher = More Access)

Greenways (17)

finalratio

- 0 (161)
- 0 - 0.02 (53)
- 0.02 - 0.037 (16)
- 0.037- 0.17 (33)
- 0.17 - 1.24 (35)



d Creek Church Rd.

Greenway Accessibility Application

The greenway 2SFCA map is a valuable tool for understanding how accessible greenways are to different communities, particularly in terms of their proximity to critical services such as healthcare, education, and employment centers. By assessing greenway access within a 1-mile radius, it helps identify areas where residents may face barriers to active transportation, which could impact their ability to reach essential services efficiently, especially if they are already underserved. The map also highlights the interconnectedness of the city's greenway network, showing how well various neighborhoods are linked to green spaces and recreational areas. This can inform urban planning decisions, ensuring that greenways are strategically placed to promote equitable access, reduce transportation inequality, and encourage healthier, more sustainable mobility options for all residents.

Final Comments

There are many new greenways being built right now, because this is one of the most cost effective ways to increase the equitable access to essential services in a mixed (urban/rural) environment. Our maps of access to critical services will look very different in the near future, and projects focused on not just proximity to services, but access to walkable infrastructure connected to those services will be necessary to evaluate the transportation equity of our county.