Vulnerability Assessment: Flooding in Miami-Dade County, FL

Background

Miami-Dade County is located on the Southeastern tip of Florida. The county has a population of about 2.7 million. It's demographics are 68% Hispanic or Latino, followed by 15% Black, with the White-Only population being at 12%. And 52% of the population is foreign-born. (Data USA, 2017). Miami-Dade County while being a diverse county with people where there is a minority-majority, still struggles with large amounts of segregation.

Gini-Coefficients Map by Census Tract

Gini Coefficient Levels
- 0.15 - 0.37
- 0.38 - 0.42
- 0.43 - 0.48
- 0.49 - 0.55
- 0.56 - 0.69
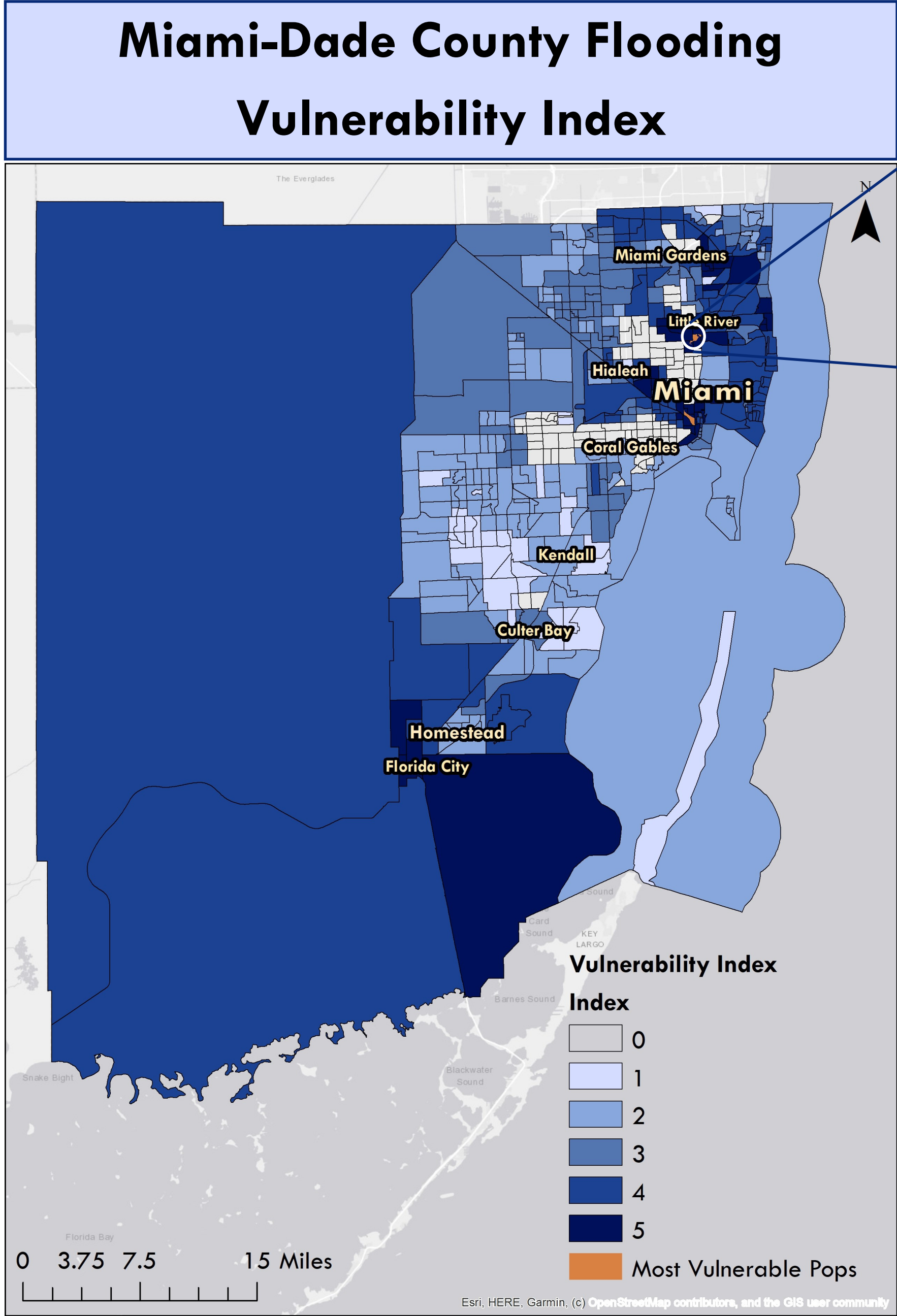- Most Vulnerable Pops

0 3.75 7.5   15 Miles
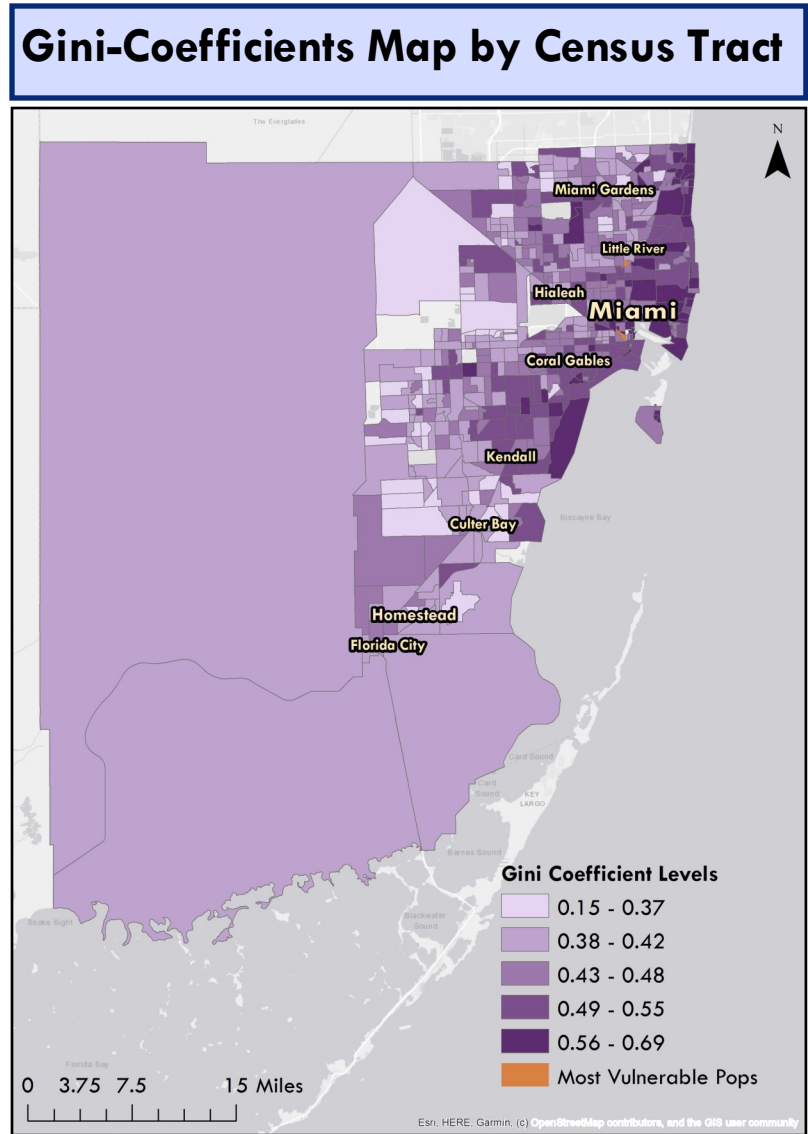
Urban planning and policies have isolated vulnerable populations historically (Mohl, 2001). The inequality across the county has shows patterns of high-highs and low-lows. The county-wide Gini-coefficient mean is .44, lower than the national average, yet there are 118 (out of 518, 2017) tracts that have a Gini-coefficient of more than 2 standard deviations away from the mean. One interesting analysis is comparing the areas of highest inequality to the areas classified with a vulnerability index score of 5 in the Miami-Dade County Flooding Vulnerability Index Map.
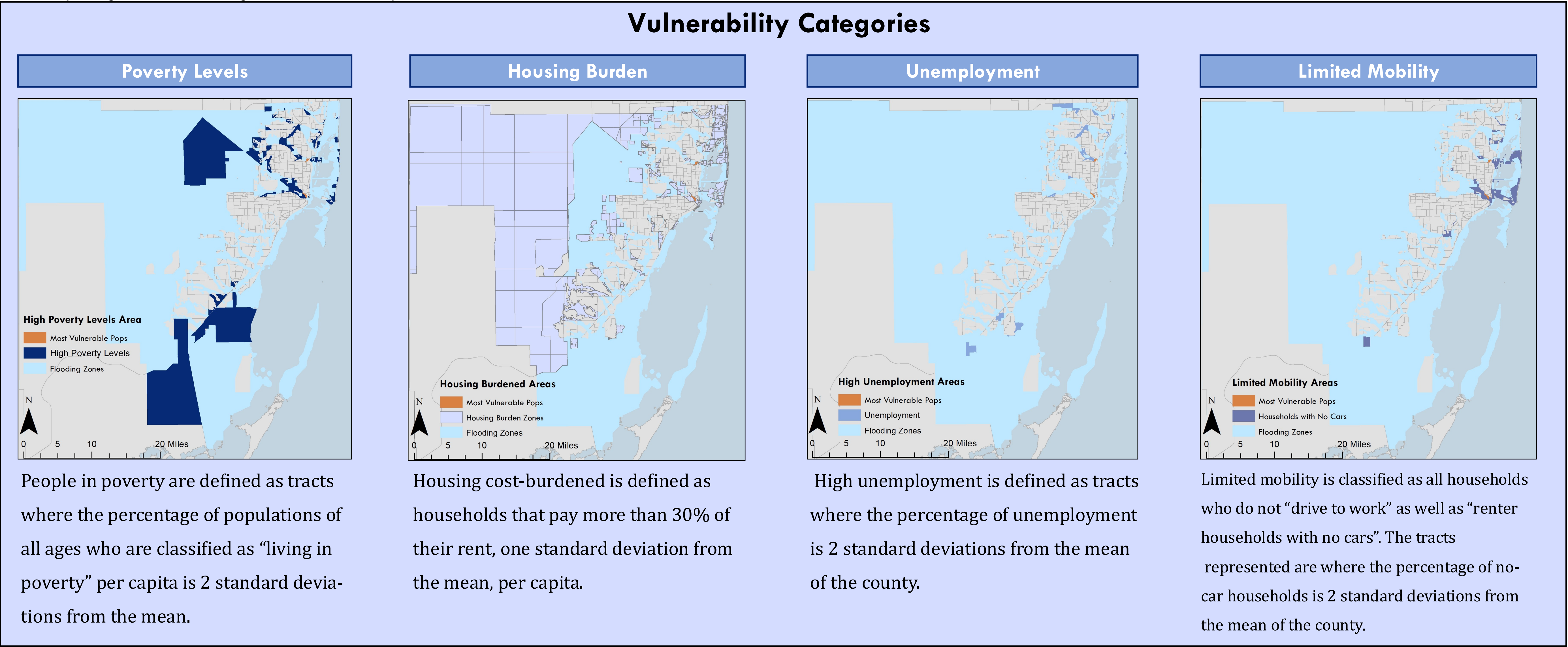
Methods

This research looked at data from two main sources the FEMA 1996 Flooding Index, which is used in insurance rates for the county of Miami-Dade, and US Census Tract data from Social Explorer. The FEMA Flood Index specified which areas of Miami-Dade were considered potential "Hazardous Flood Zones" in the event of water level increase. The data downloaded from the Social Explorer included information within four vulnerability categories: People in Poverty, Unemployment, Housing Cost Burdened, and Limit Mobility. This data from Social Explorer was then joined to Miami-Dade County Census Tract tiger files from the US Census website. Once this join was created, and intersect was done between the flooding zones and the Miami-Dade County tract data. Once these flooding tracts were identified, then indicators for the above-mentioned categories were defined and selections by attributes allowed for the identification of these tracts.

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Results & Conclusion

For the Flooding Vulnerability Index Map each tract had combinations of the 5 vulnerability categories. The categories were selected based on the financial and mobility limitations that might affect someone from evacuating during a flood. From the 4 categories outlined below, hazardous flooding zones as the 5th category, each tract received a score of 1 to 5 depending on how many categories it met. The Vulnerability Index Map shows high levels of vulnerability across neighborhoods of Miami, Hialeah, Miami Gardens, and Florida City. While the categories represent a set of issues that impact the mobility of residents of the city, there were only two tracts where all 5 categories overlapped perfectly: One neighborhood around downtown Miami and the other tract was within the neighborhood of Little River. It is interesting to note, what sections of the county struggle with which issues, noticeably the southern and western areas of the county suffer the most from being housing cost-burdened and in high levels of poverty. While it is important to understand how different issues affect different neighborhoods, focusing one neighborhood that represents all vulnerability categories can show key insights to addressing these issues county-wide.

Miami-Dade County Flooding Vulnerability Index

Miami Gardens
Little River
Hialeah
Miami
Coral Gables
Kendall
Cutler Bay
Homestead
Florida City

Vulnerability Index

Index
- 0
- 1
- 2
- 3
- 4
- 5
- Most Vulnerable Pops

0 3.75 7.5   15 Miles

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Case Study: Little River

The neighborhood of Little River, Miami, Fl is one where there are all 5 indexes overlap and make this community extremely vulnerable to future environmental changes. This community is 48.2% Black or African American Alone, 46.2% Hispanic or Latino, and 4.02% White Alone (US Census Data, 2017). Making it one of the largest concentrated populations of Black people in the county. It is clear that being next to a river as well as receiving little infrastructure support from the city has created a space for growing vulnerability.

As the county prepares for incoming climate change impacts and creates plans for a more sustainable future, it is impervious that the county starts here in Little River. Plans to help this community will have resounding impacts across the county, and creating solutions here will create solutions for other communities struggling with similar problems. A vision for a more equitable and safe county for all starts with putting our vulnerable communities first.

Vulnerability Categories

Poverty Levels

High Poverty Levels Area
- Most Vulnerable Pops
- High Poverty Levels
- Flooding Zones

0 5 10   20 Miles

People in poverty are defined as tracts where the percentage of populations of all ages who are classified as "living in poverty" per capita is 2 standard deviations from the mean.

Housing Burden

Housing Burdened Areas
- Most Vulnerable Pops
- Housing Burden Zones
- Flooding Zones

0 5 10   20 Miles

Housing cost-burdened is defined as households that pay more than 30% of their rent, one standard deviation from the mean, per capita.

Unemployment

High Unemployment Areas
- Most Vulnerable Pops
- Unemployment
- Flooding Zones

0 5 10   20 Miles

High unemployment is defined as tracts where the percentage of unemployment is 2 standard deviations from the mean of the county.

Limited Mobility

Limited Mobility Areas
- Most Vulnerable Pops
- Households with No Cars
- Flooding Zones

0 5 10   20 Miles

Limited mobility is classified as all households who do not "drive to work" as well as "renter households with no cars". The tracts represented are where the percentage of no-car households is 2 standard deviations from the mean of the county.