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Predicting Gentrification using Areas of Known Gentrification

Intro

Gentrification is a problem affecting cities and the cultural areas in them. It can be defined as the process in which poor urban area is changed due to more affluent people moving in leading to improved infrastructure and more businesses in the area. This is a problem because it tends to cause the displacement of current residents since the area becomes more expensive to live in. Not only this gentrification causes ethnic areas to diminish. Most ethnic areas are inhabited by poorer minorities and once these people are displaced from the area so is the culture. Gentrification is not all bad, though. As stated previously it leads to improved infrastructure and more businesses which is great for the area, however these benefits should not come at the cost of the individuals who currently live there.

Literature Review (5 old, 5 new)

There have been many ways people have tried to map and measure gentrification. Such ways include field surveys and investigations, evaluation of culture and history, statistical correlation models, transfer learning, machine learning imagery classification, and time-series deep learning. (Lin et al 2021) The indicators that are considered include race (percent white vs percent nonwhite), education level, household income, and proximity to public transportation among others (Preis et al 2021) There are advantages and limitations to each of these methods however there are still problems in trying to map and measure gentrification. One problem is that there is no consensus on how to measure gentrification. This can be seen in the paper

Gentrification and Displacement in the San Francisco Bay Area: A Comparison of Measurement Approaches by Mujahid et al. After using three different methods to measure gentrification in the

San Francisco Bay area, they found that two of the methods said that most of the census tracts were stable with a low number of tracts gentrifying whereas the third said almost half of the tracts were undergoing some form of gentrification. (Mujahid et al. 2019) Not only this there is a lack of evidence proving that the displacement is occurring due to gentrification as well as there is difficulty obtaining it. (Easton et al. 2020) This can be seen in *The Determinants of Gentrification* by Jed Kolko. In this paper it states that reasons an area becomes gentrified varies from place to place as well as over time. (Kolko 2007) This means it would be hard to find a singular to measure gentrification in all places due to these various problems.

Other problems than can come up when trying to map gentrification are the Modifiable Area Unit Problem (MAUP), the Uncertain Geographic Context Problem (UGCoP), ecological fallacy and contextual fallacy. The MAUP is an issue that comes up when data is aggregated which can lead to different results based on the aggregation level. (Openshaw 1979) This is a problem when it comes to gentrification because it would make it hard to see exact data in an area such as the true distribution. The contextual fallacy builds off this issue since it occurs “when correlations based on aggregate data do not apply to the individuals within the aggregating unit” (Fowler et al 2020) This means it is possible to find that gentrification is occurring based on the data when in it not occurring. As for the UGCoP it is “the problem that the findings about the effects of area-based attributes on individual behaviors or outcomes could be affected by how contextual units or neighborhoods are geographically delineated.” (Kwan) In other words it states that it is difficult to state that the effects of the attributes of a location on individuals is affected by how the spatial units are defined. Therefore, as it applies to gentrification since it would be hard to determined that an area changed due to gentrification or something else that may have been hidden due to the spatial scale used. Finally, there is the

ecological fallacy. This is a problem that arises due to certain countries use areal units rather than individual units. (Openshaw 1984) This can lead to problems in mapping gentrification because it would lead to estimates of the area rather than knowing the exacts and this can also lead to the problems previously stated.

Data

The data used is ACS 5 year estimates collected from the Census Bureau using cenpy at the census tract level. The major limitations of this data are that it only goes back to 2013 and cenpy does not contain values for every city. Gentrification existed earlier than 2013 so it is possible that an area could have been gentrified before 2013 but the data on the area after 2013 shows that it is not undergoing gentrification. As for cenpy having information on every city, this is a problem because some cities could show signs of gentrification but there would not be any data to perform analysis on. One example is Emeryville, California . This city is a part of an area currently being gentrified yet cenpy is unable to pull values for it. Cenpy, however, can pull some surrounding cities such as Oakland and Berkeley which are also a part of the area being gentrified however without Emeryville it would be hard to see the full picture of gentrification.

Methods

To look to see whether a location is undergoing or at risk of undergoing gentrification, certain indicators will have to be defined. The indicators that will be used are race, income status, and education status. These values will be looked at over the course of 2013 to 2019 at two-year intervals. The locations will be pulled using cenpy using the ACS 5 year estimate data from the census. Two cities at random will be chosen to see if gentrification can be predicted using these indicators. These cities are Cleveland, Ohio and Austin, Texas A third city will be used to see what should be expected with the trends. This city will be Oakland, California

because the North Oakland, Berkeley, Emeryville (NOBE) area is a known area that has undergone gentrification which can be used to compare to other areas to predict if they are either undergoing gentrification or not. In order to see what these trends are the segregation package will be used. The segregation package allows for certain population data to be visualized in such that certain trends can be seen overtime. (Knaap 2019) The analysis that will be used are composition, location quotient, local diversity, and local entropy These were picked because composition and location quotient help to see the concentration of a specific group within a certain area while local diversity and local entropy help to show how diverse has an area is. Once these values are found for each city it will then be compared to the values for Oakland to predict if an area is undergoing gentrification.

Results

Oakland, California

For this city, many different trends can be seen. To start with, based on the composition and location quotient for race, the White population is mainly concentrated in the northern region and disperse outwards overtime. As for the Black population, there is a large concentration in the northwest in which some parts decrease overtime. The Hispanic population is mainly concentrated in the south to southwest region with no real change. When it comes to income, there is a moderately low concentration of low income all over in 2013 which then decreases in 2015 and 2019 and increases again in 2019. Middle income is spread out with an overall increase however there is a slow decrease starting after 2015 especially in the north. As for high income there it seems as if they are dispersing themselves to the surrounding tracts so there is an overall increase through the years. As for education the small concentration of individuals with High

school or less in the north is decreasing throughout the years while the concentration of those with a bachelor's degree or greater is increasing within those areas.

Next, based on local diversity and local entropy, the diversity of race is increase within each year however one area should be taken note of. That area being the area with the one with the high concentration of the black population in the north which starts out with low diversity and slowly becomes more diverse over time. As for income it starts out very diverse all over the city, but the north slowly becomes less diverse. When it comes to education there is an overall increase in diversity with

Looking at these results it can be determined that gentrification causes an increase in the white population and displaces some minority groups but not all depending on the location. This can be seen in the areas with an increase in the composition of the white population and a decrease in the composition of the black population in the north. Even though this happened there was no real change in the locations of the Hispanic population. Gentrification also causes an increase in the population with higher education and high income with a decrease. Places also become more diverse due to gentrification however diversity must be compared with other indicators in order to get the full picture. For example, one could not say a specific area is undergoing gentrification because there is an increase in diversity of income. The reason for this is because other factors may be occurring such as an influx of high-income individuals of one race in an area of low income individuals of the same race. This would cause the income diversity to increase but the race diversity to stay the same meaning looking at only one form of diversity is not helpful in trying to predict gentrification. When it comes to this location low-income middle income, and the Hispanic population are not good indicators for gentrification.

Cleveland, Ohio

For this city there is a clear divide in the location of specific races. The black population is situated in most of the east, the white population is located in the center and most of the west and the Hispanic population is located primarily in the center. These positions do not really move between the years. The low-income population is located almost everywhere except the center and there is a decline in their population overtime. The middle-income population is similar to the low-income population however with a slight increase. As for the high-income population, they are heavily concentrated in the center and with no real change other than in 2019 where there is a slight increase outside of the center. Education is similar to income where those with higher education are located in the center while those without live elsewhere.

As for diversity, when it pertains to race, the east is not very diverse while the center and west are which does not change for most years except for 2017 in which the east experienced more diversity while the center and west experienced less. As for income, most of the city is diverse except for a portion in the center throughout every year. With education its area becomes increasing more diverse except for the same part identified in the income which stays a low diversity each year.

Based on these results it can be said that this city is not undergoing gentrification since there is not an increase of the white population with a decrease in a minority one, the high-income population and population with a bachelor's or higher did not move from their main location. There was an increase in diversity however the biggest increase was income diversity while the others did not increase all too much. This means that people are moving into the same areas as those with the same race as them but different income and education levels which is not a sign of gentrification

Austin, Texas

When it comes to race, the White population is located all over and increases overtime. One of these areas being an area with a high concentration of the Black population. As for the Black population, they are mainly located in a mid-eastern area on the edge and slowly decrease over time. When it comes to the Hispanic population, they are located mainly along the east of the city and are slowly increasing outward. Individuals with low income are located around the mid to southeast but there is a decrease in this group all over through the years. Middle income is located everywhere and steadily increases up until 2017 and slowly decrease in 2019. The high-income group is located in the east to northeast region but seem to disperse into the surrounding areas through the years. Those with high school education or less are mainly located along the east while those with higher education are located almost everywhere and increase a lot each year encompassing more area.

When it comes to race, diversity stays relatively the same through the years with the most diverse areas being along the east while the less diverse ones are along the west. As for income, most of the entire city is very diverse although a few areas have very little diversity and the areas surrounding them slowly become less diverse over time. When it comes to education there is more diversity along the east that gets push more eastward each year by the decreasing diversity happening westward spreading to the surrounding areas.

Based on these results it can be said that gentrification is possibly happening in this location, albeit slowly, but there needs to be more work done to confirm it. The reason for this is that the White population is seen to move into area with a high concentration of the Black population however these areas were diverse based on race income and education. This means that even though there is an increase in the White population there it is hard to know if this increase lead to more diversity in the area. What can be seen however is that there is an increase

in the higher educated and higher income groups with a decrease in the low income and high school or less groups which can be a sign of gentrification.

Discussion and Future Work

After looking at the result it can be said that the process chosen to predict gentrification could be worked upon. To begin with looking at only Oakland to serve as the standard limits all of the changes that could happen with gentrification. This however could be improved by looking into other areas where gentrification is happening to see the trends. The results also show how areas that might be undergoing gentrification would be hard to see. For example, with Austin, TX we could see that certain aspects of gentrification were happening, but it is hard to determine if it was gentrification causing the changes. Some limitations of this are that not all changes due to gentrification can be seen at census tract level. For example, we would be able to see race and income distribution but not how they are exact placed to see if they if a certain group is being pushed out. An example of this would be if an area were to expand and could accommodate more individuals without displacing the ones already living there. If there was a population of ten with five being White and five being Black and you slowly increased the White population without removing the existing population. The amount of Black people in that area will decrease based on composition of the area even though they have not moved. Due to this it could be hard to determine if this area changed due to gentrification. In order to improve on this, incorporating more indicators of gentrification such as the Asian population and age would be beneficial as well as figuring out why certain census tracts were not present in the data for certain cities and certain categories.

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Figures

For visualizations of Location Quotient and Local Entropy, refer to python files

Oakland California

- Race Composition

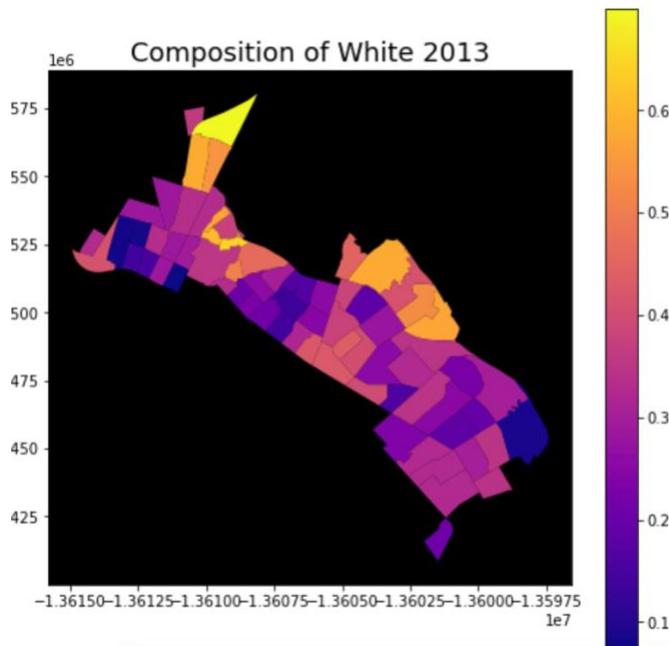


Figure 1 Composition of White 2013 Oakland

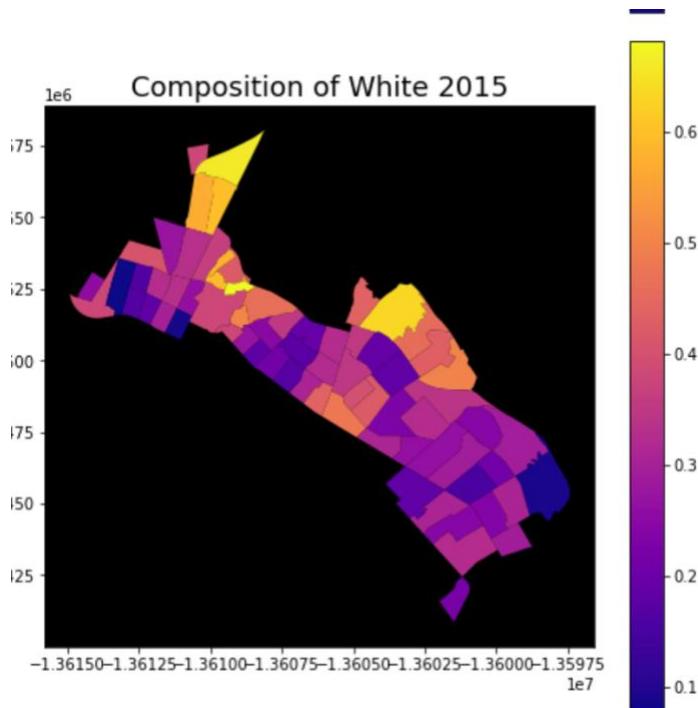
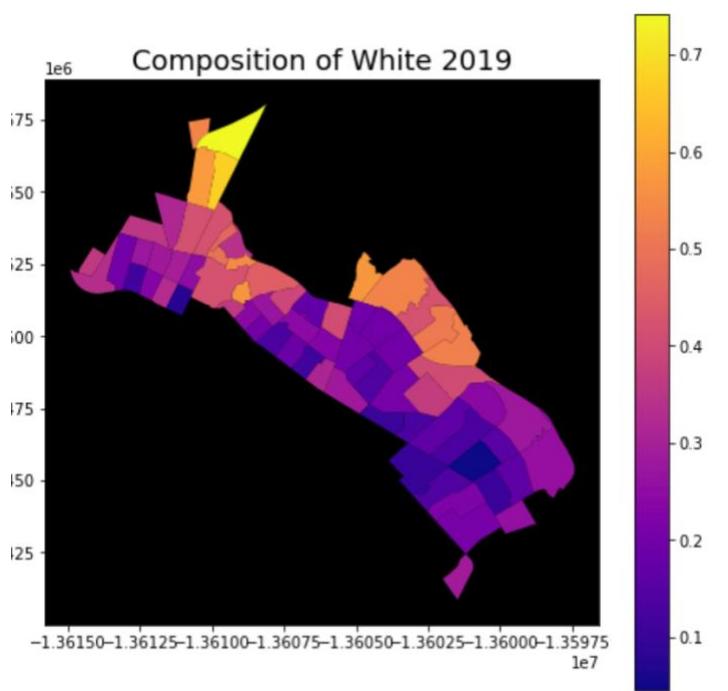
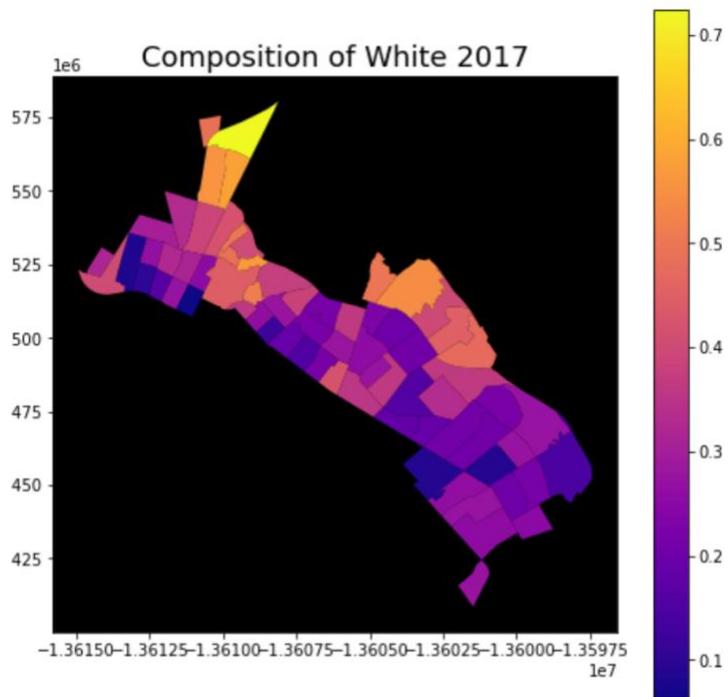
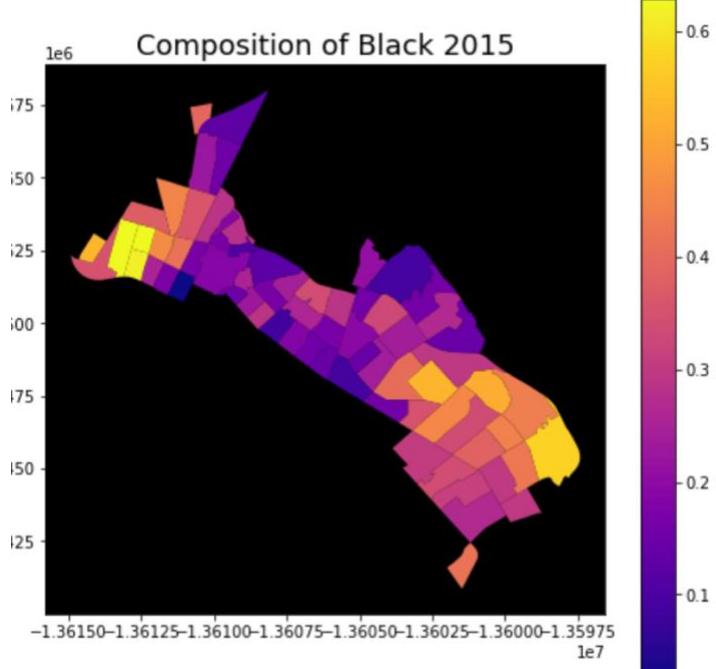
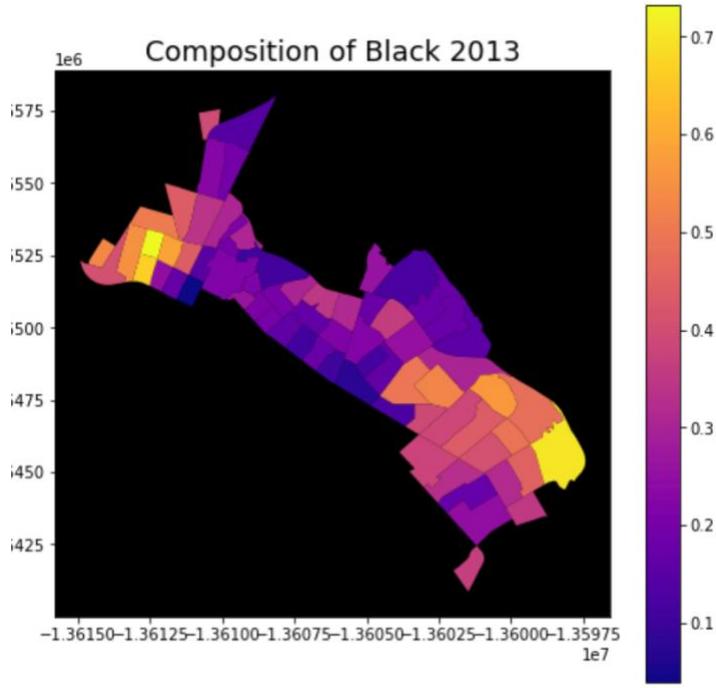
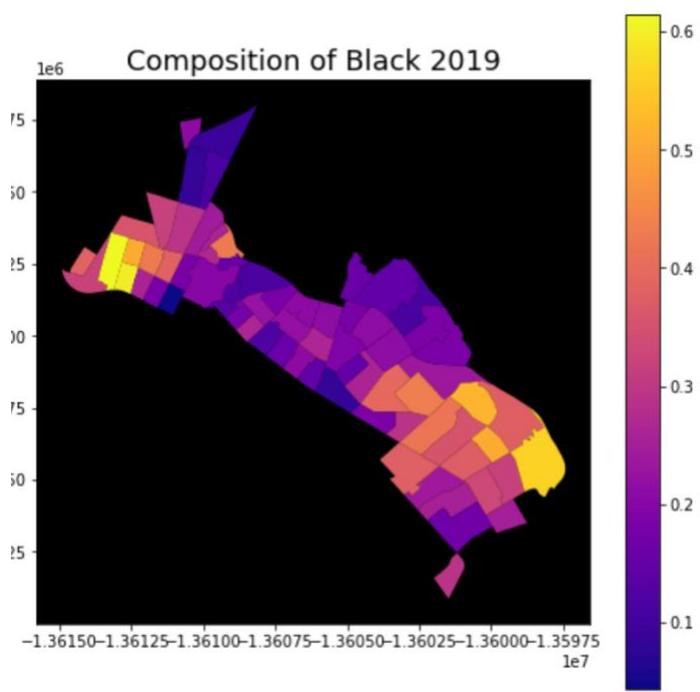
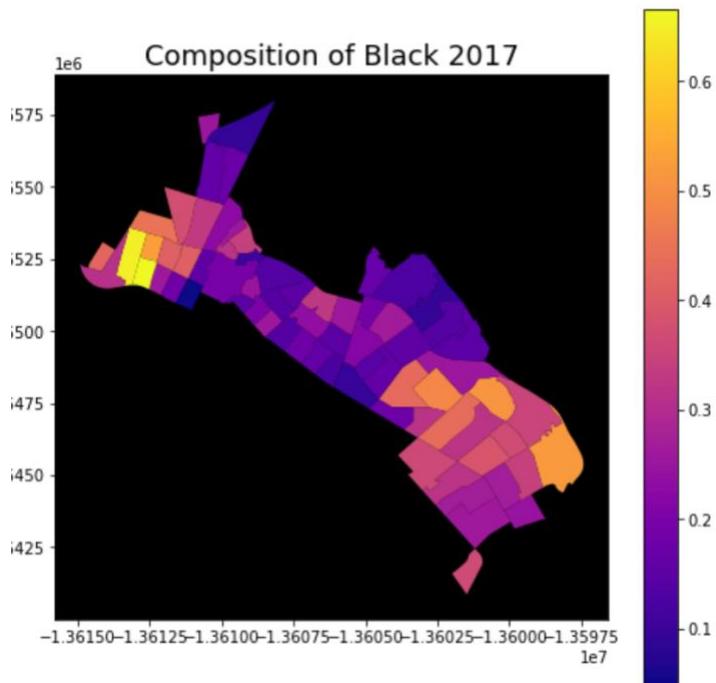
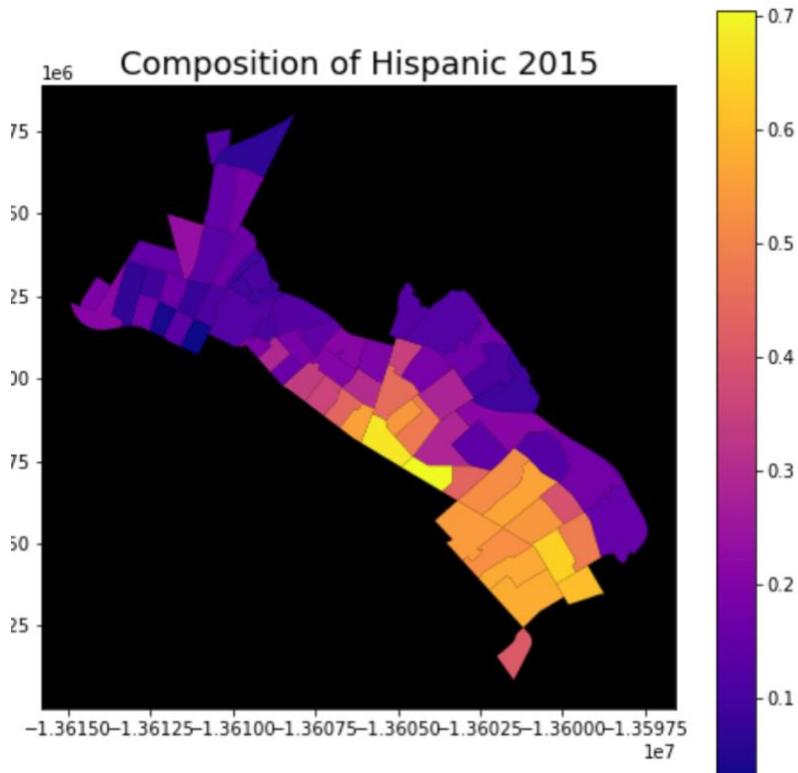
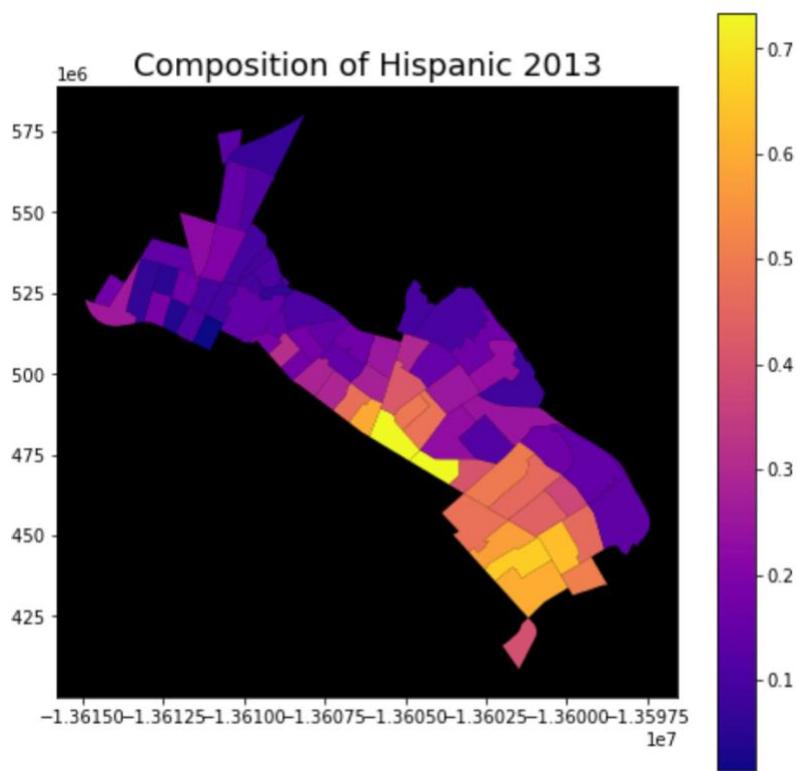


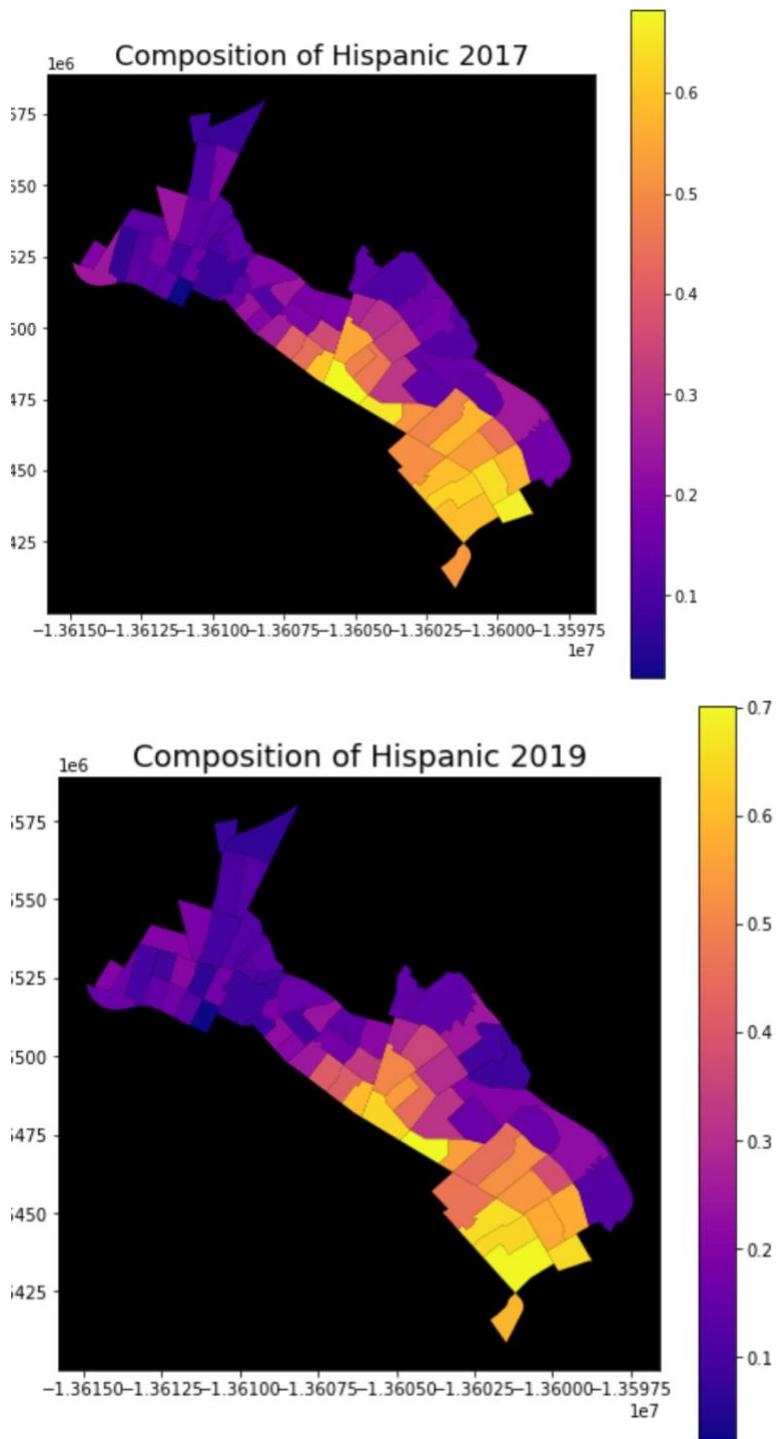
Figure 2 Composition of White 2015 Oakland



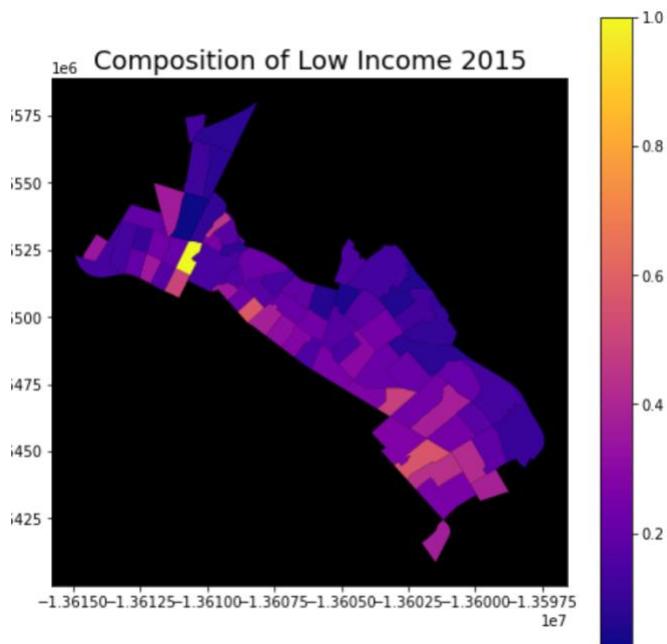
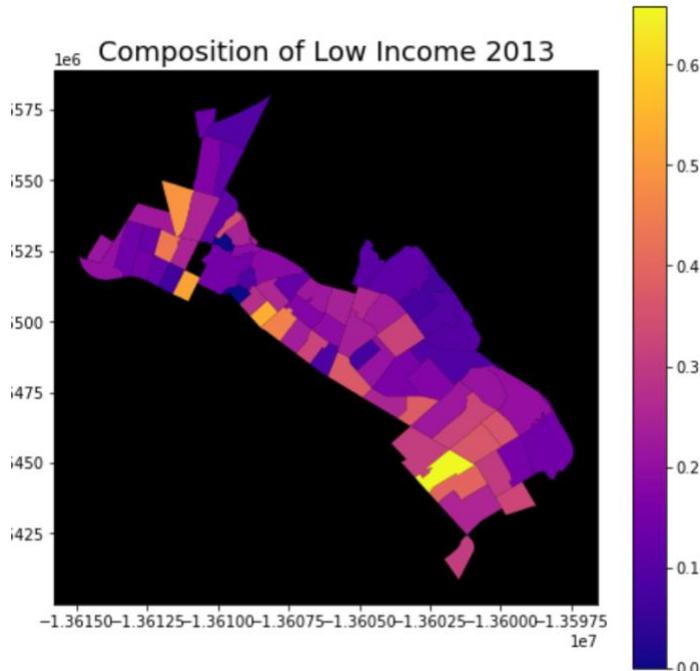


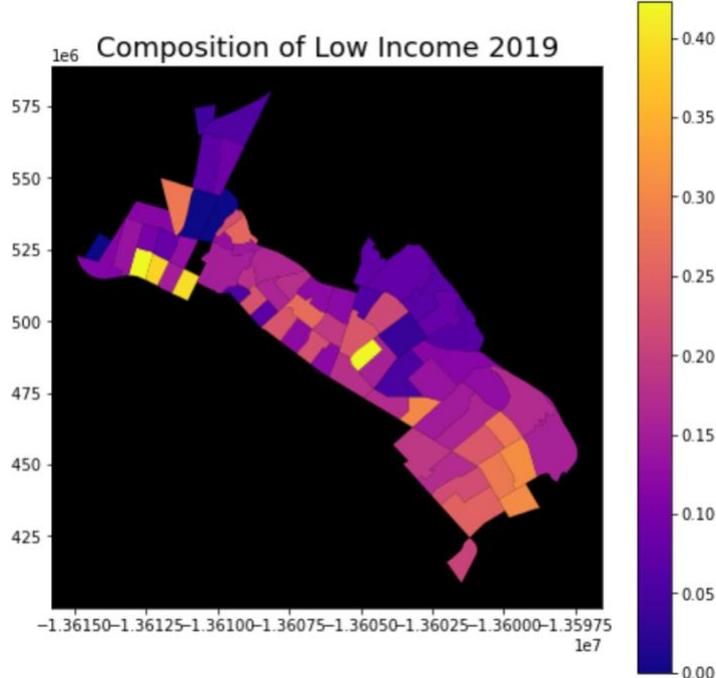
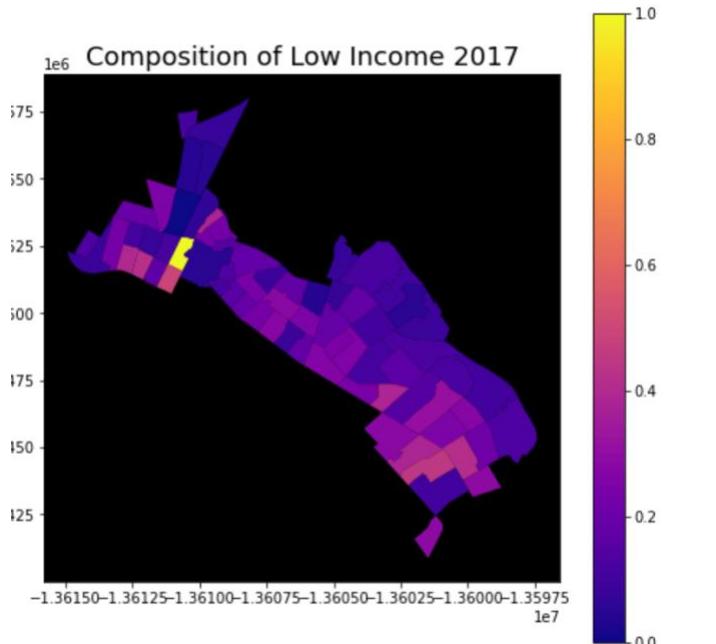


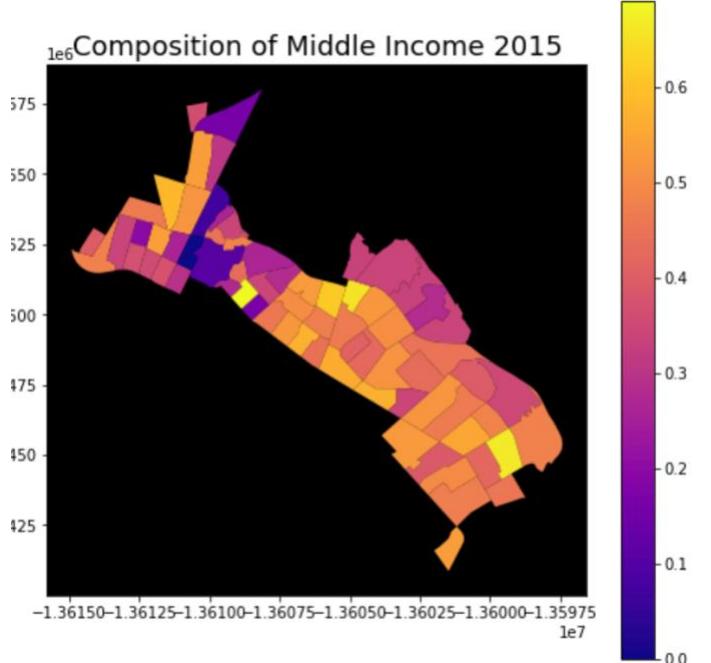
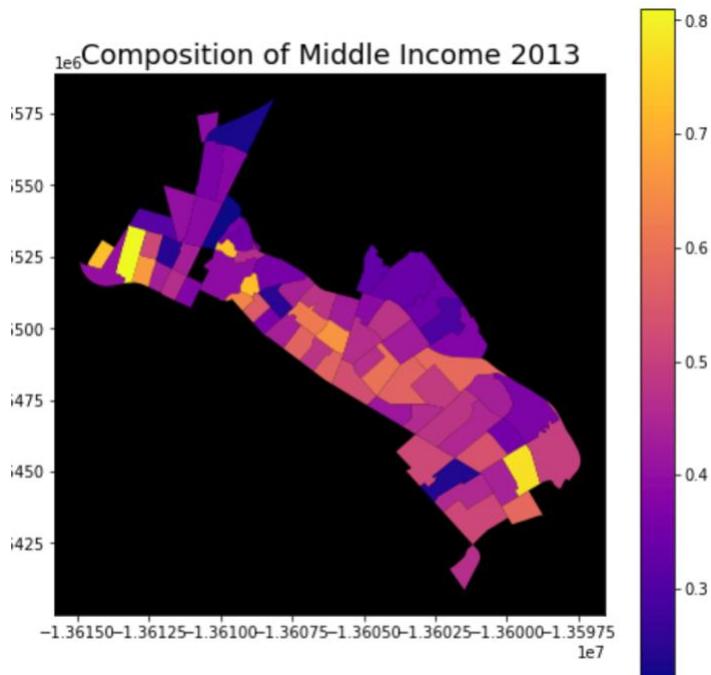


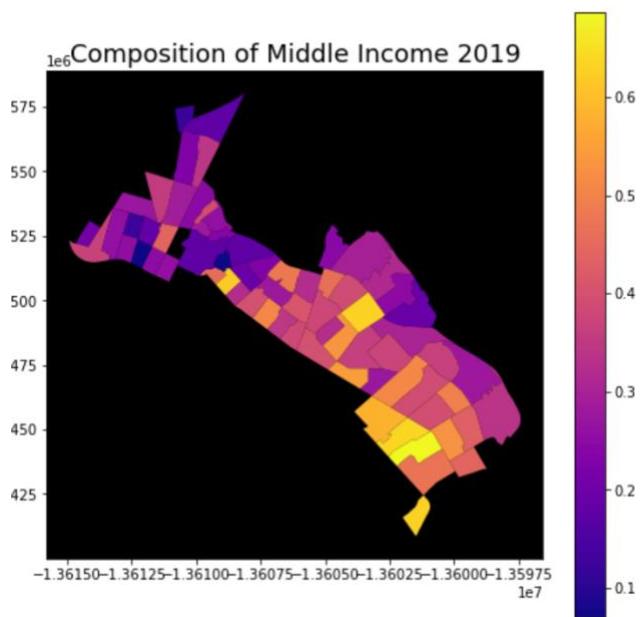
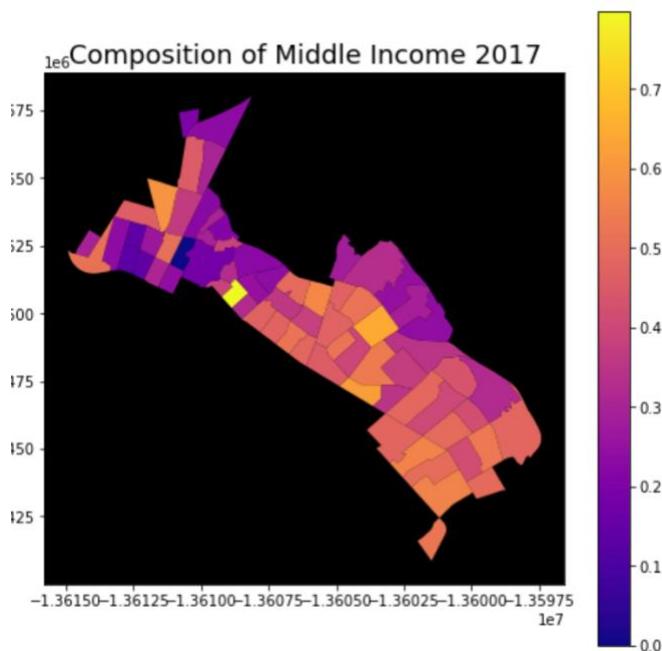


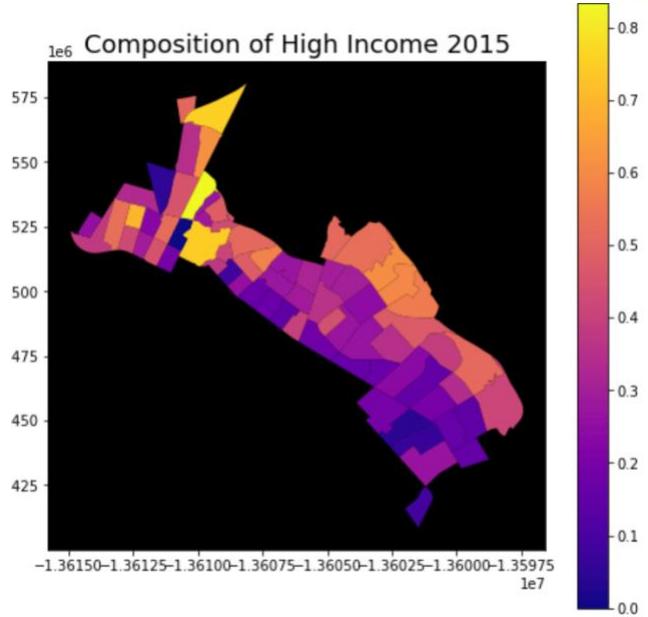
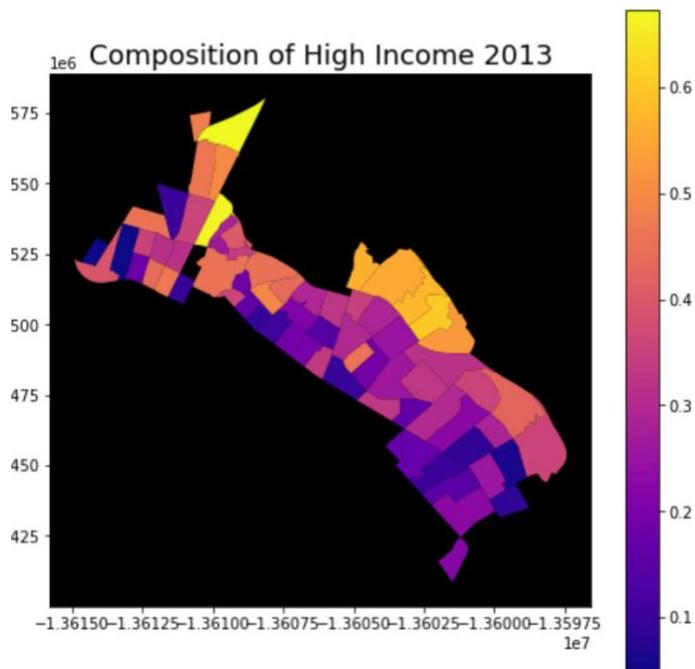
- Income Composition

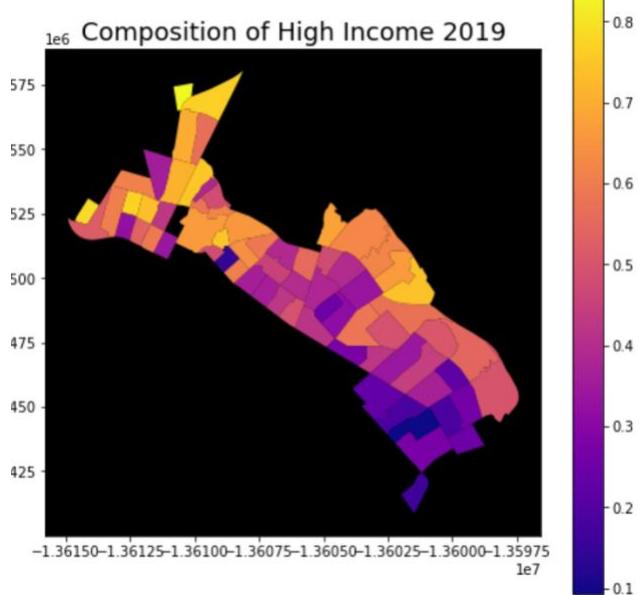
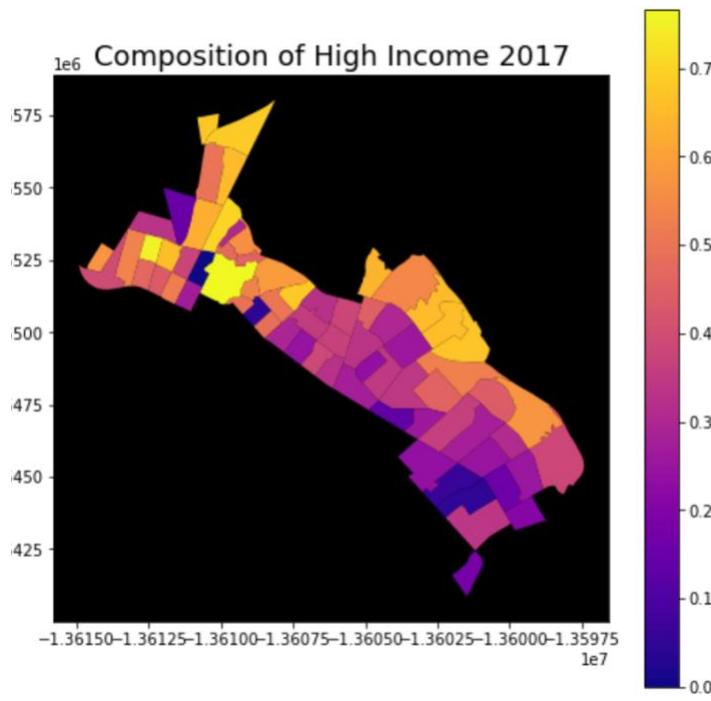






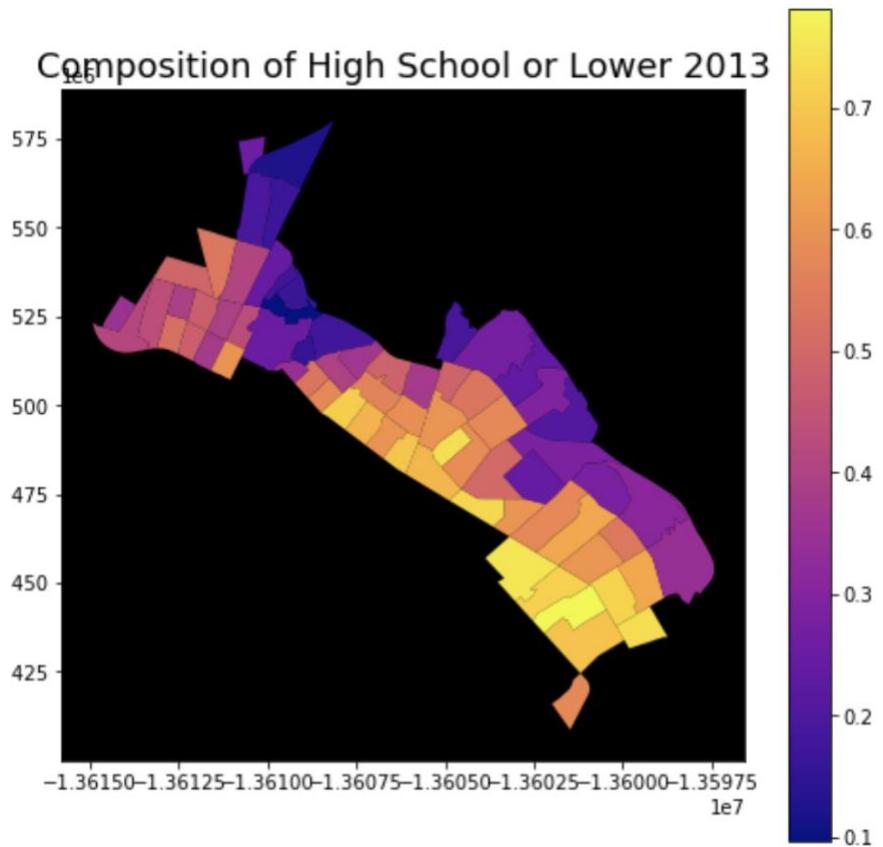




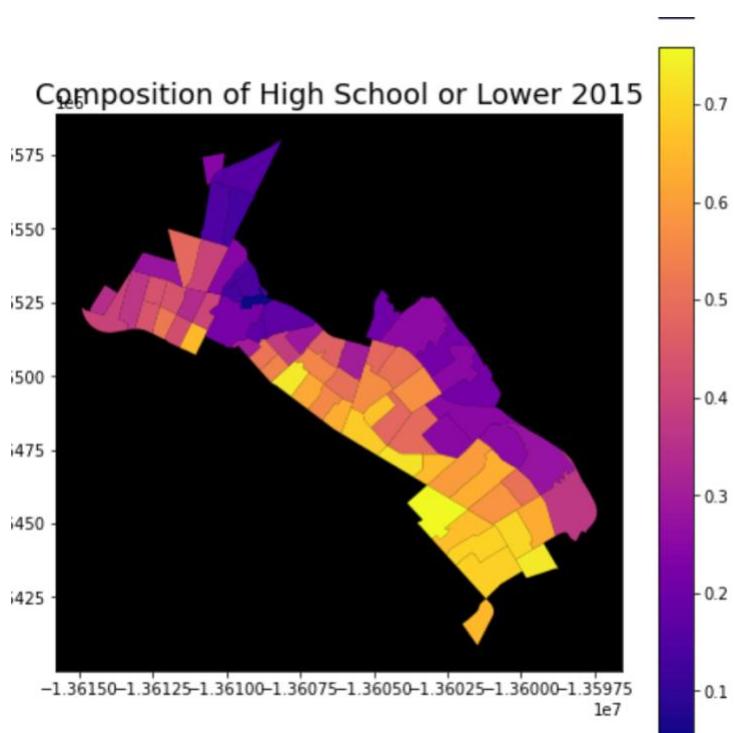


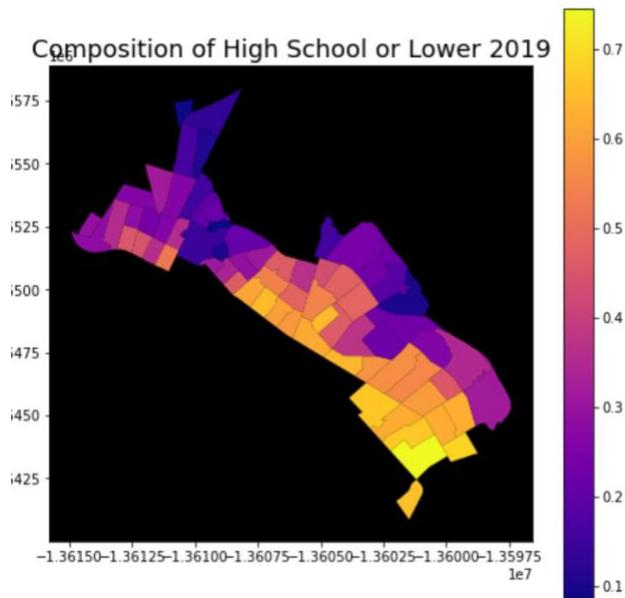
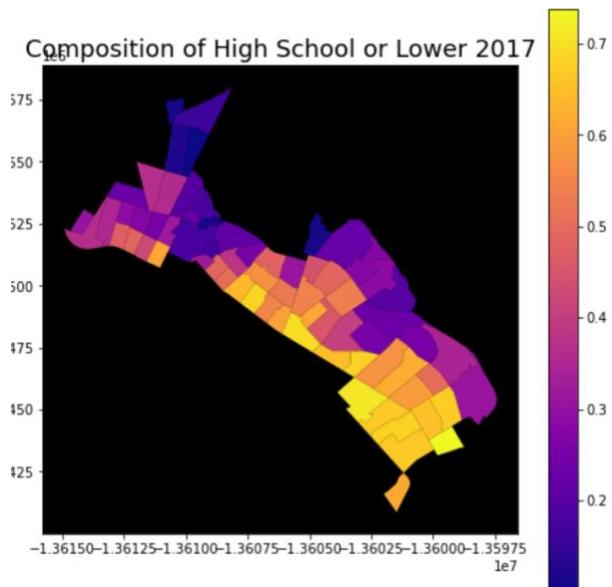
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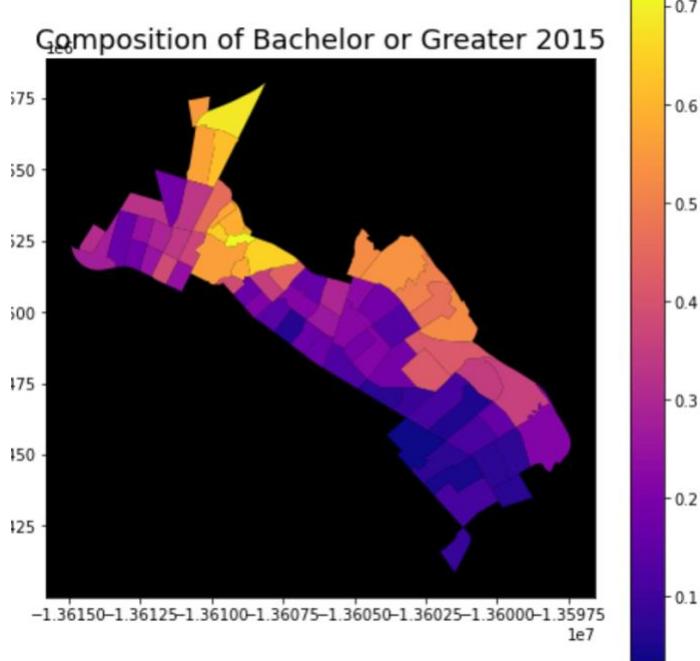
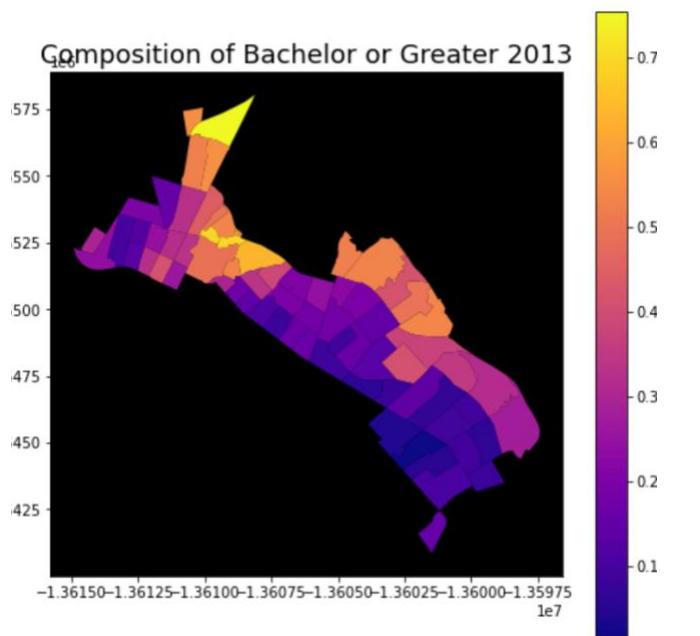
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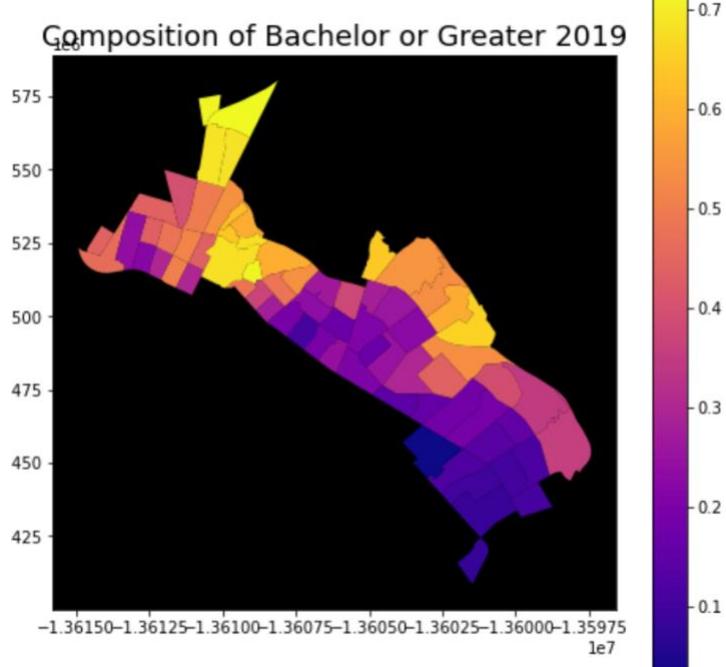
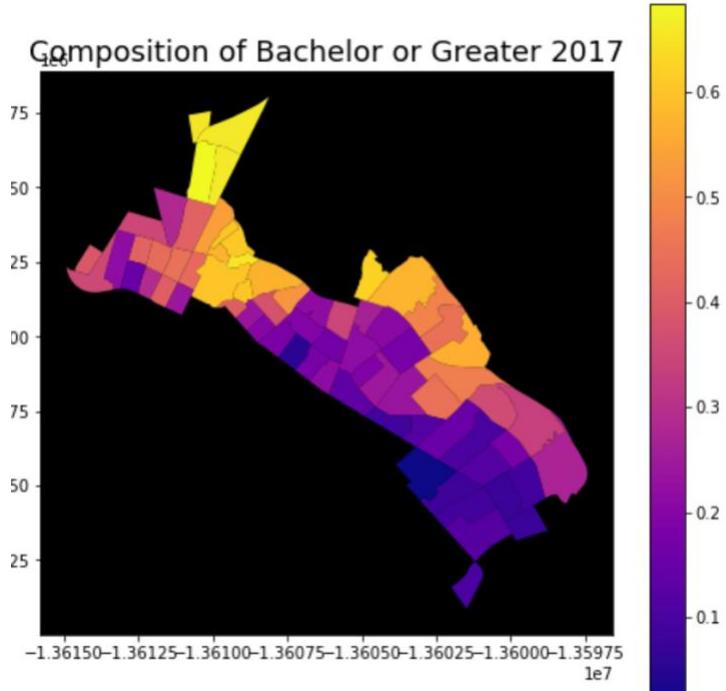


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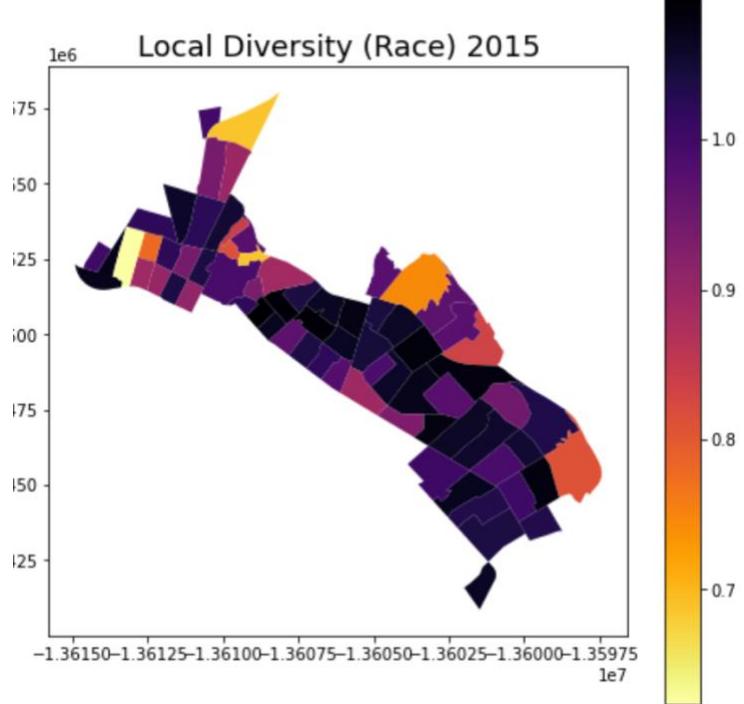
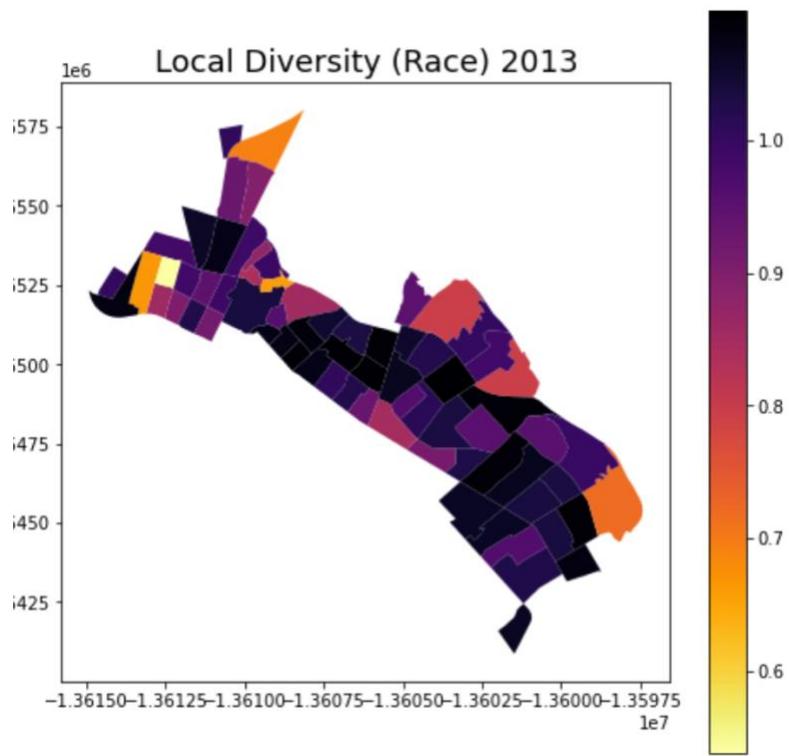


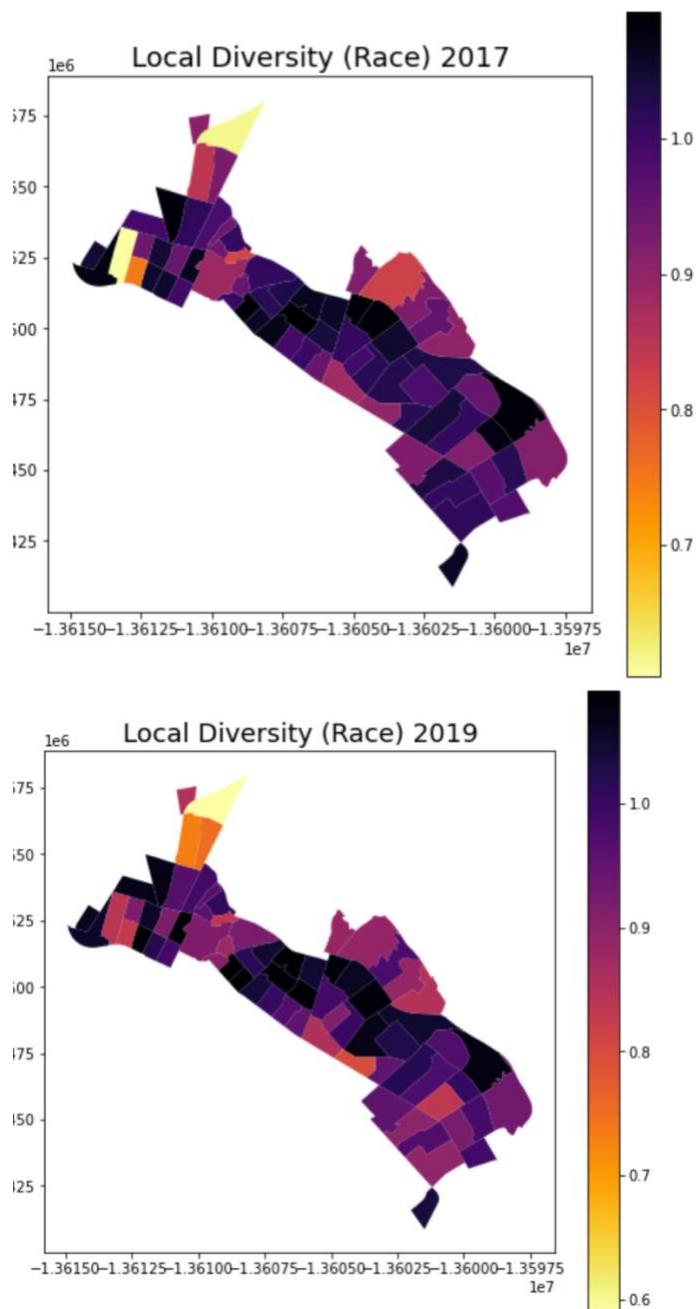




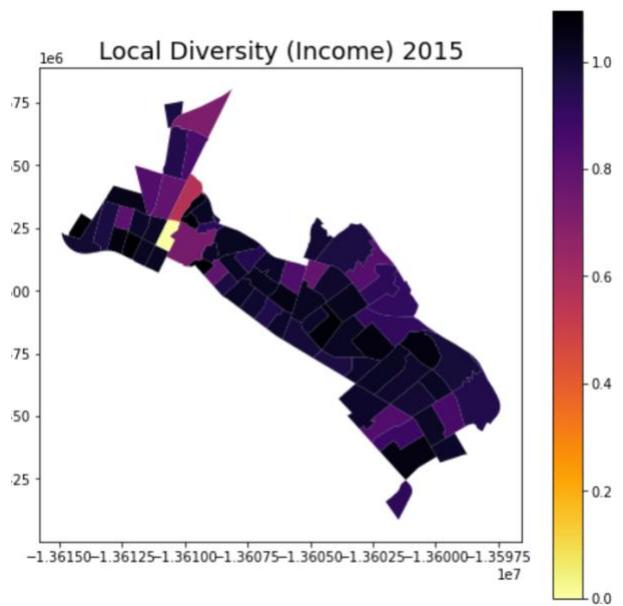
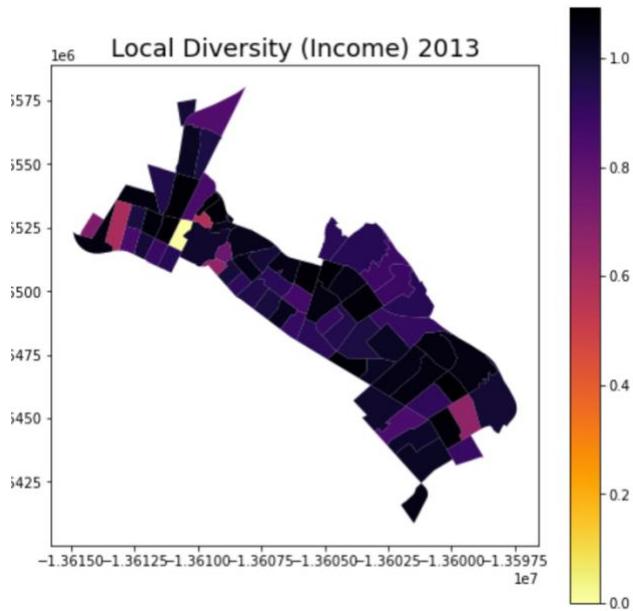


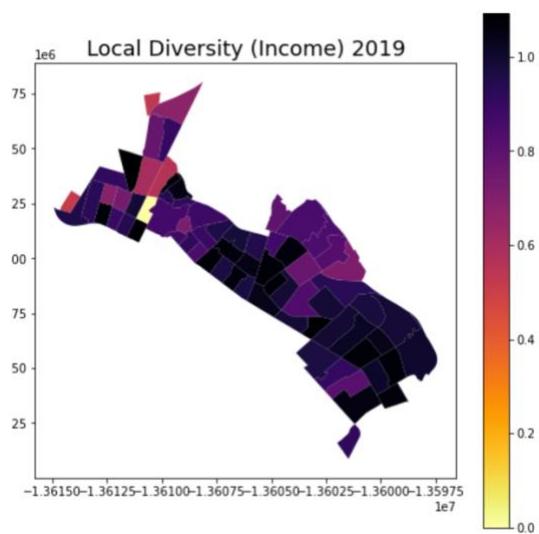
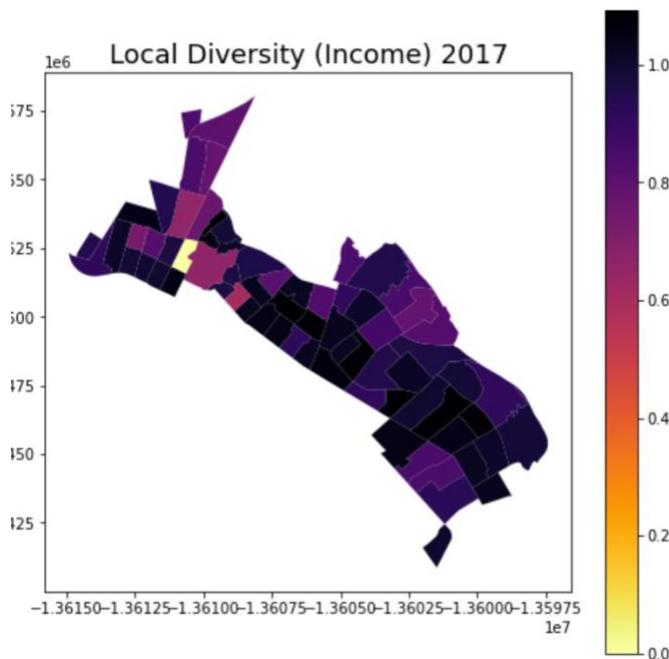
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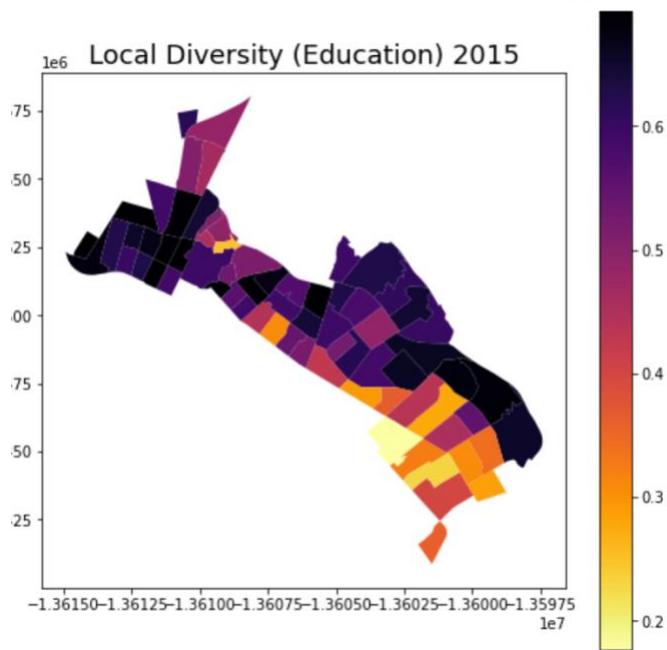
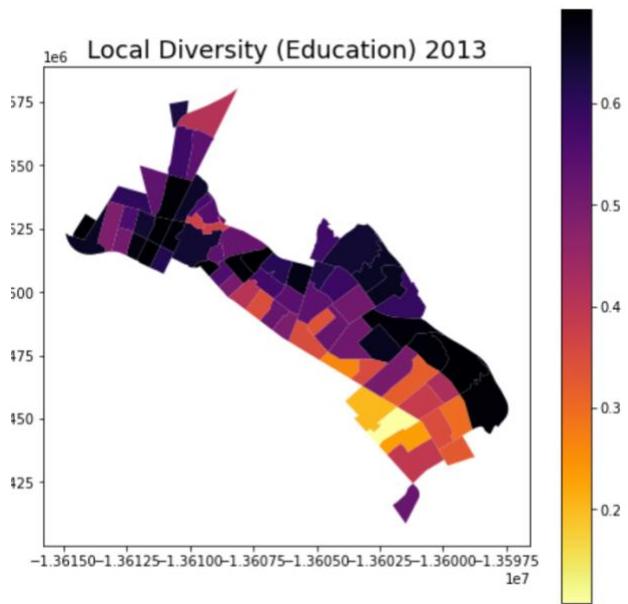


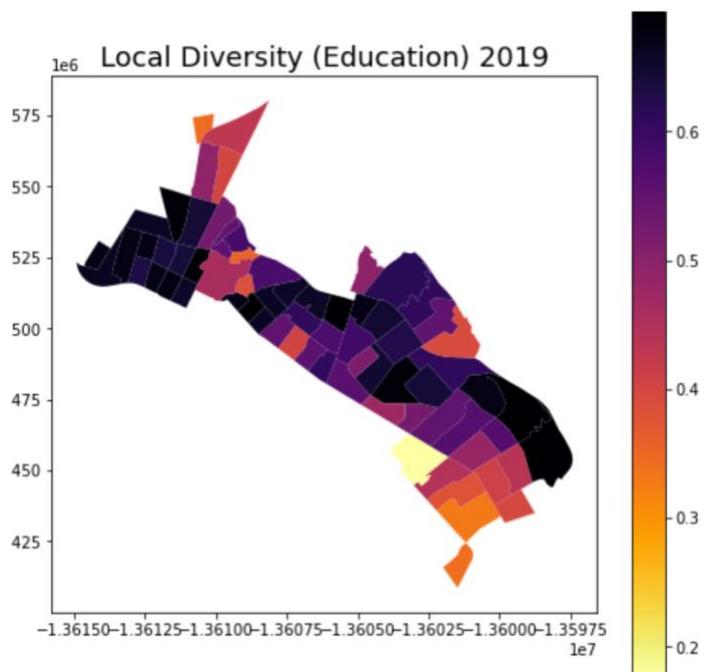
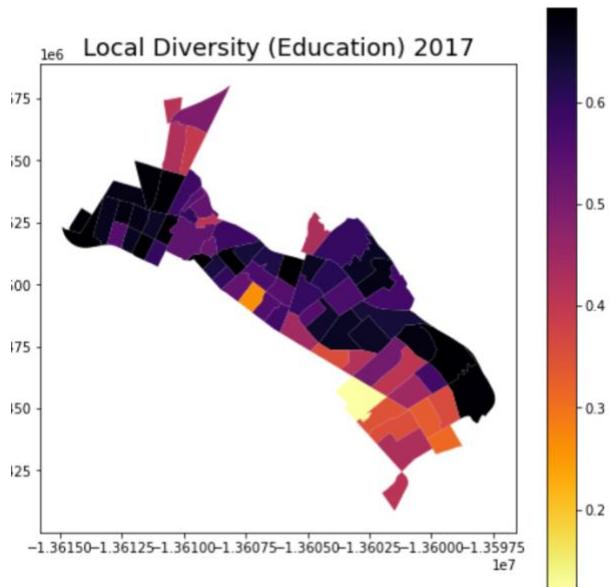
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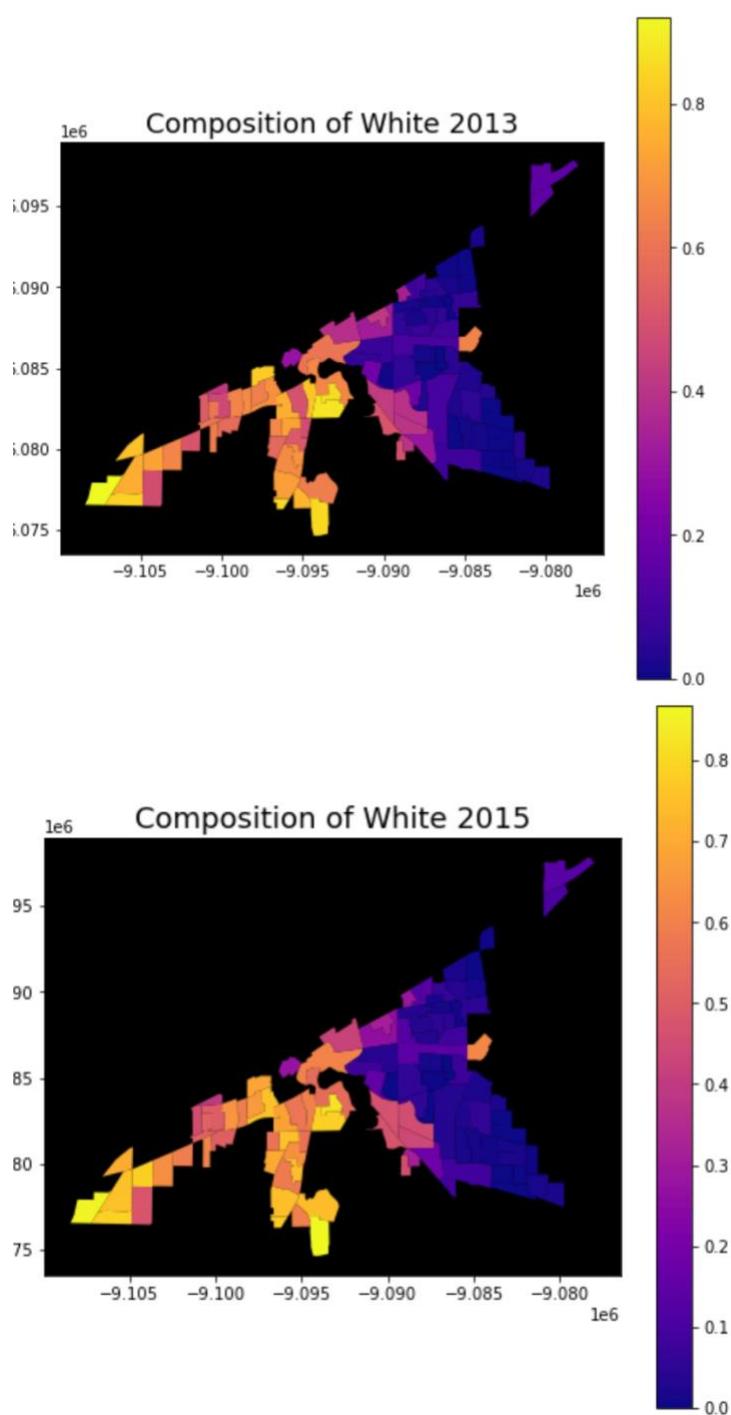
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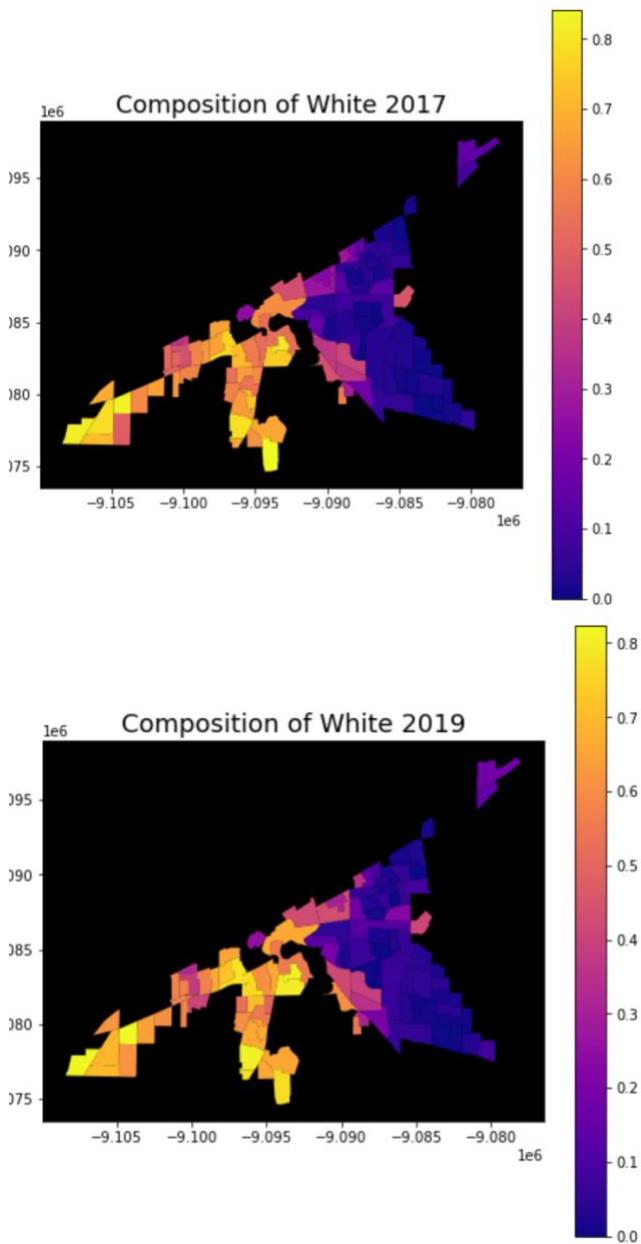


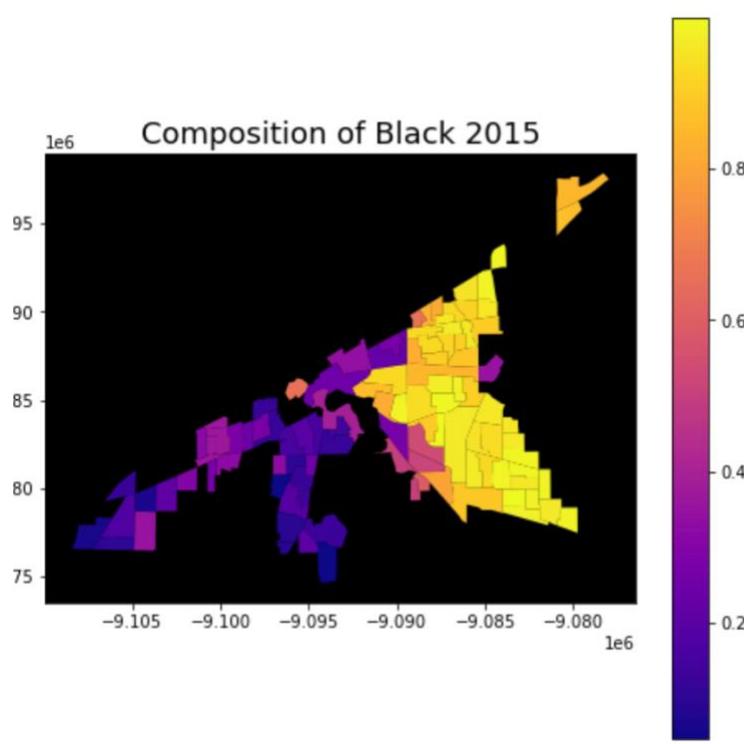
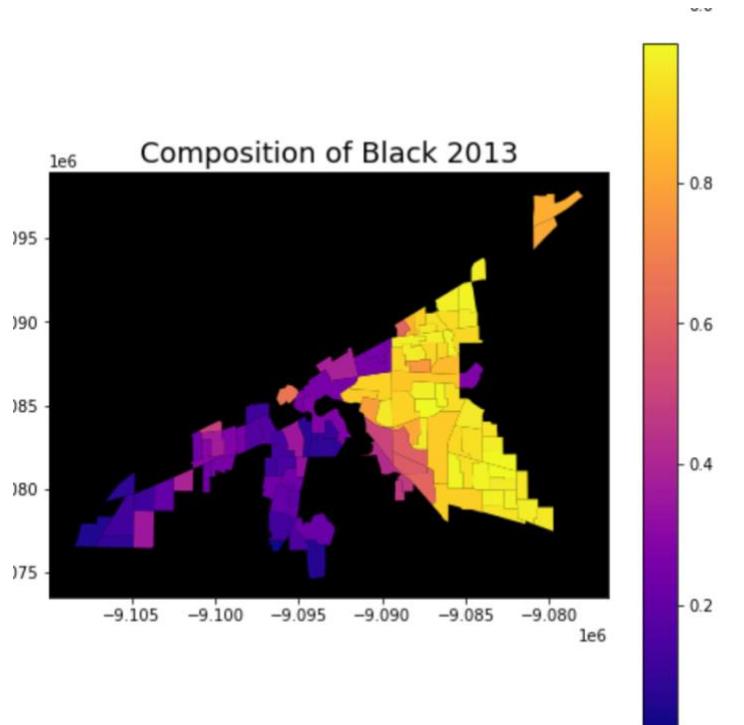


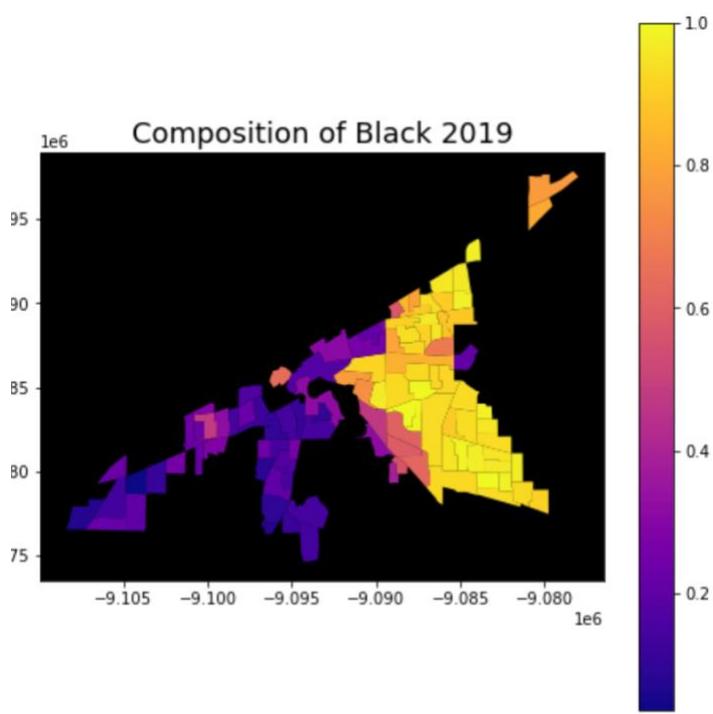
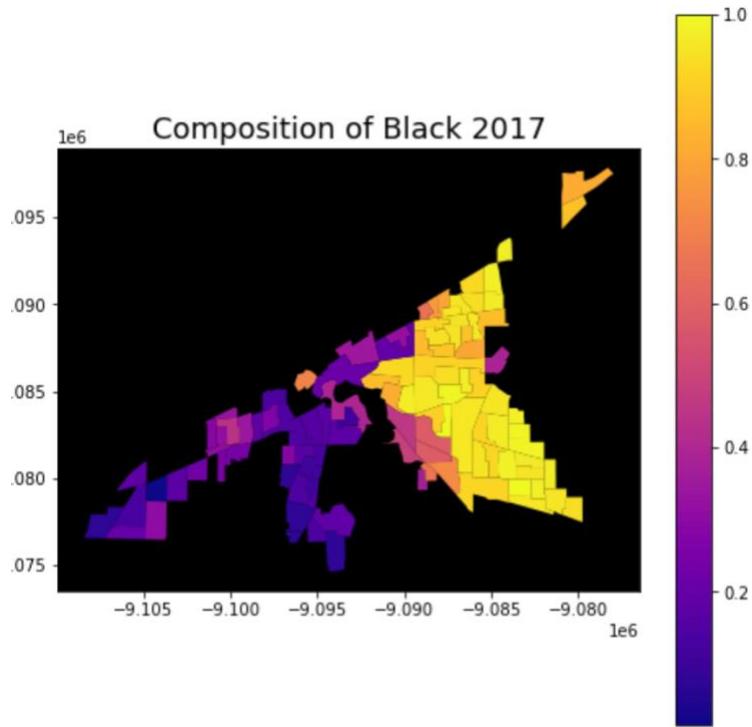
Cleveland, Ohio

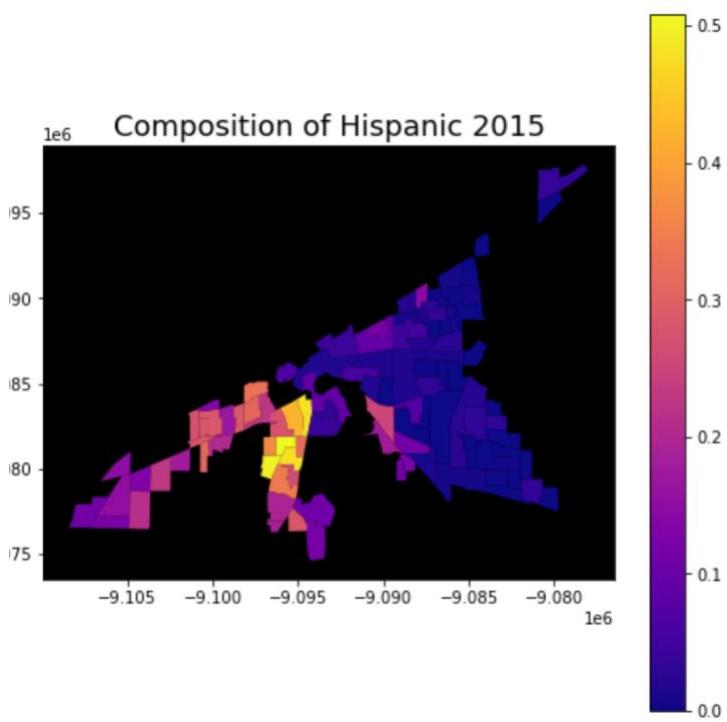
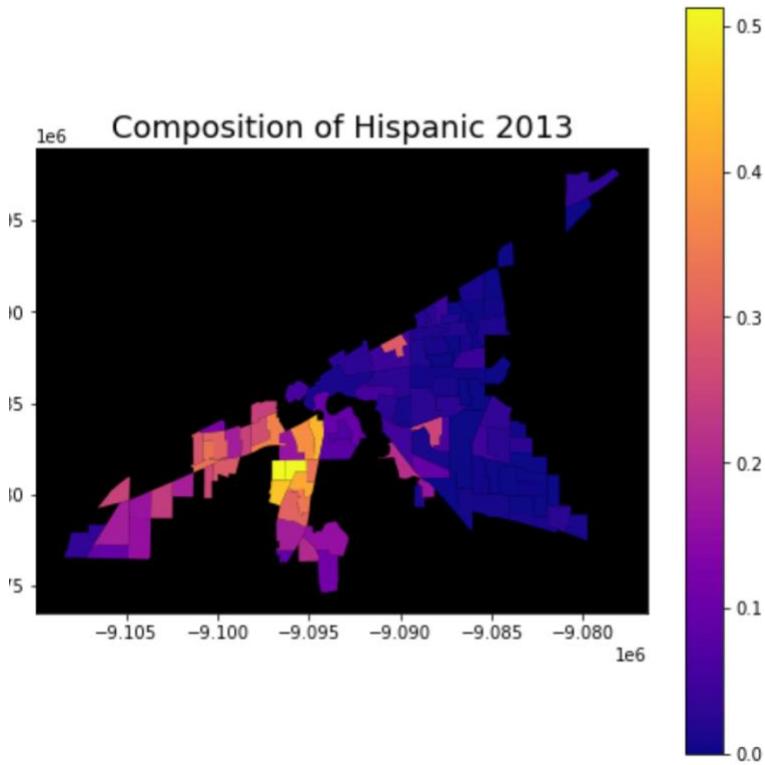
- Race Composition

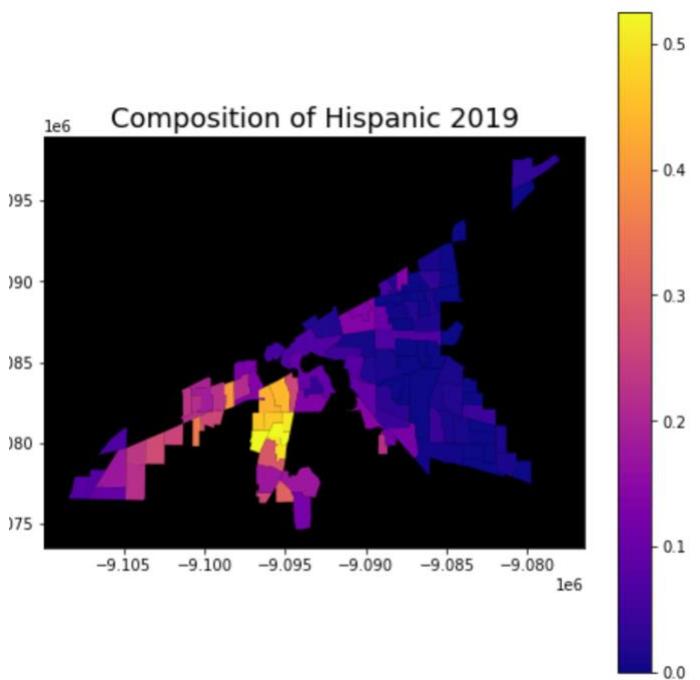
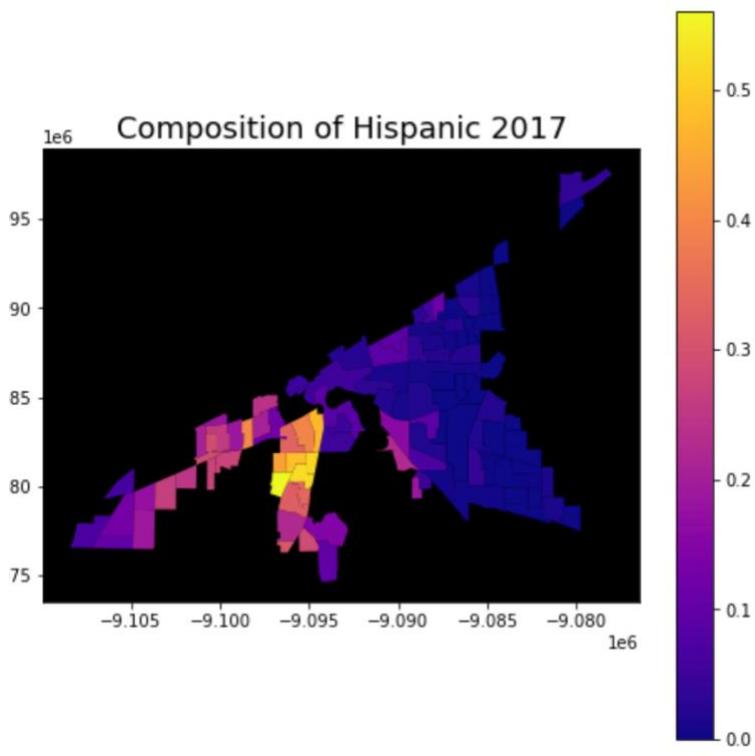




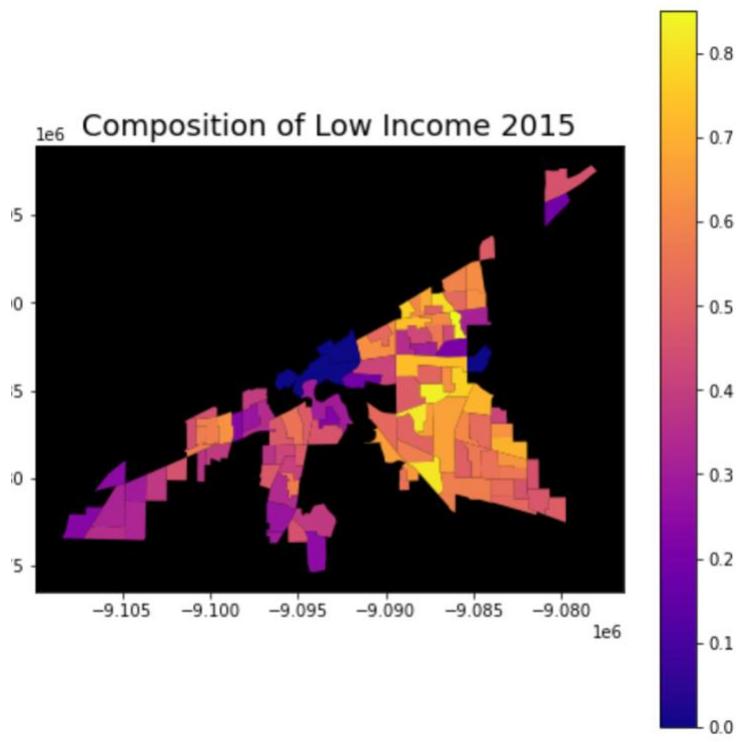
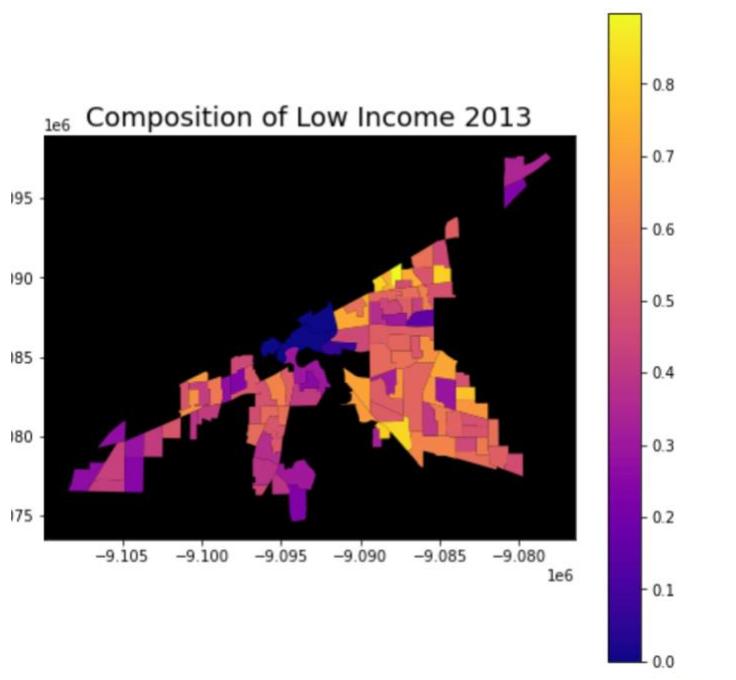


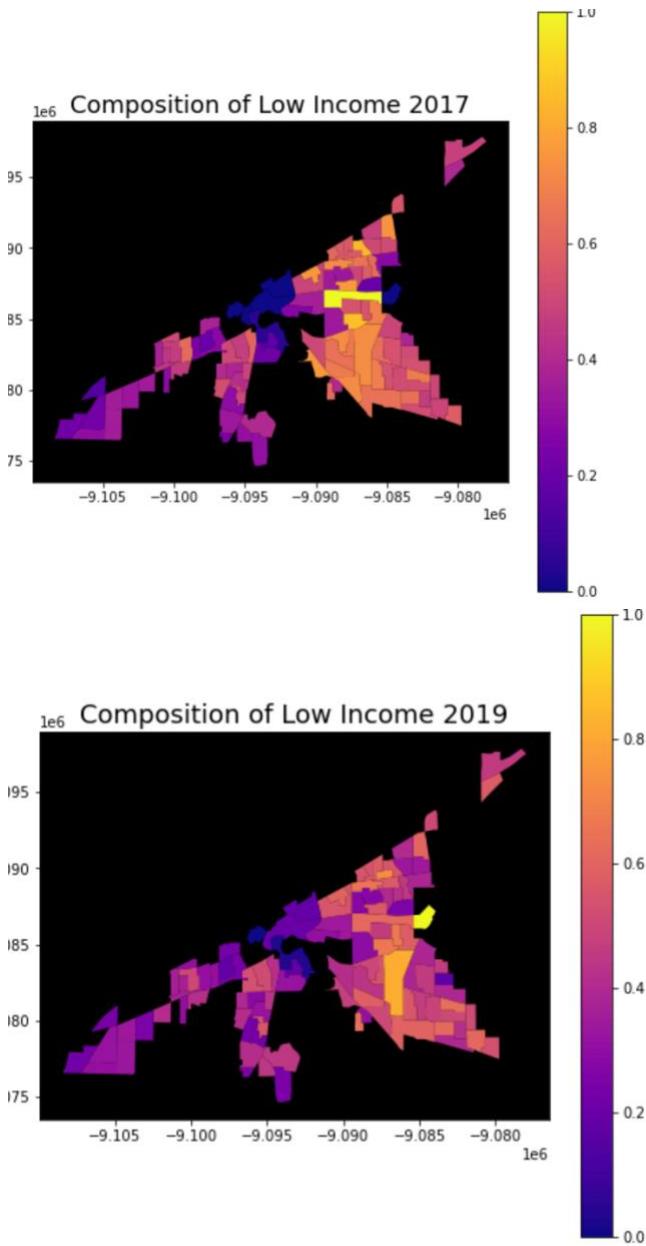


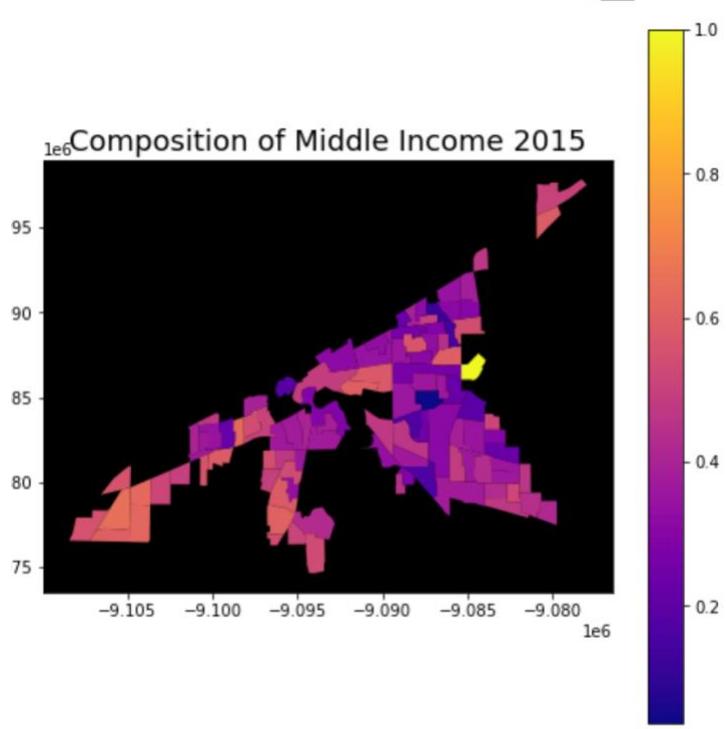
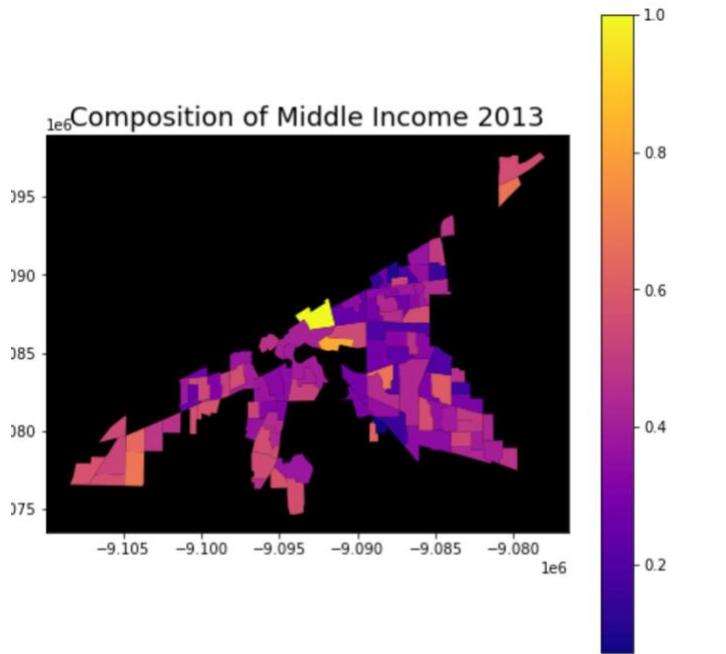


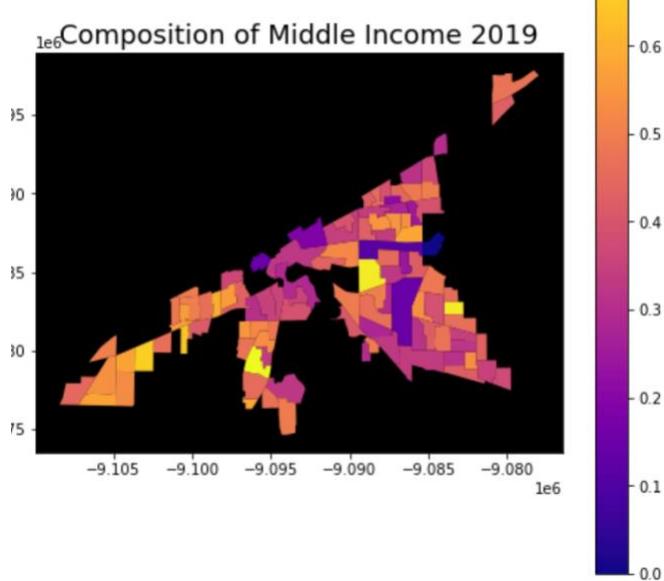
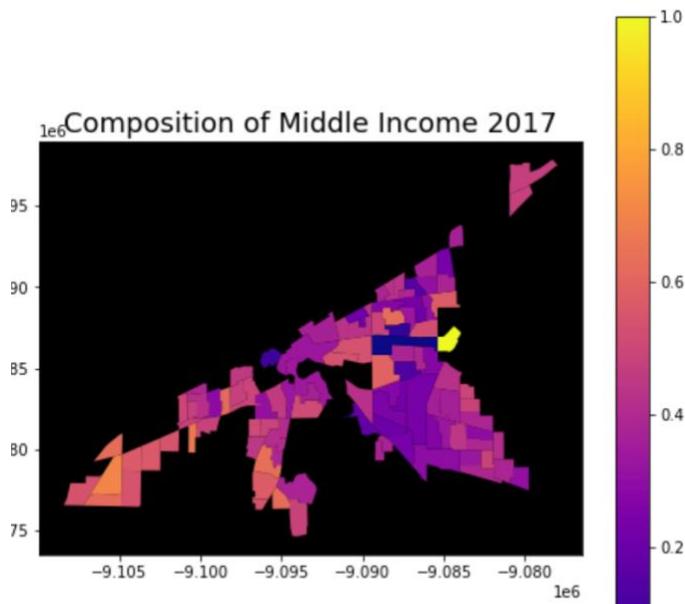


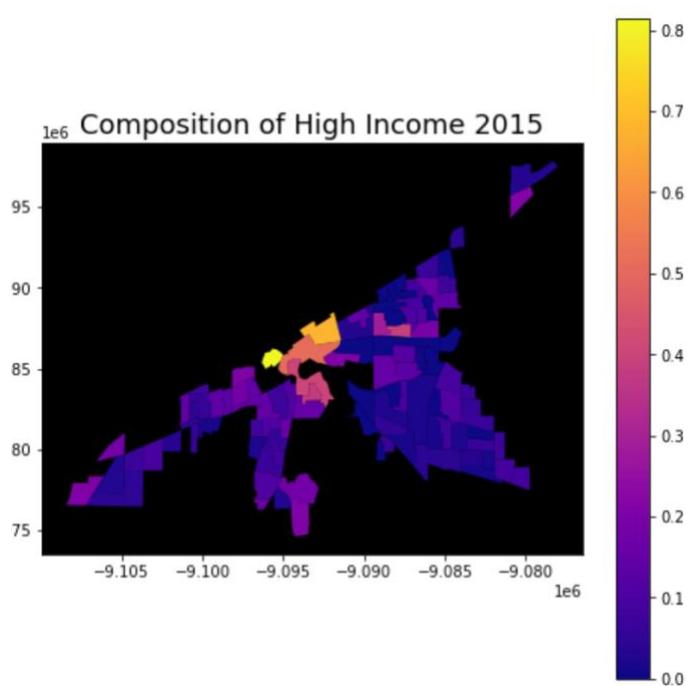
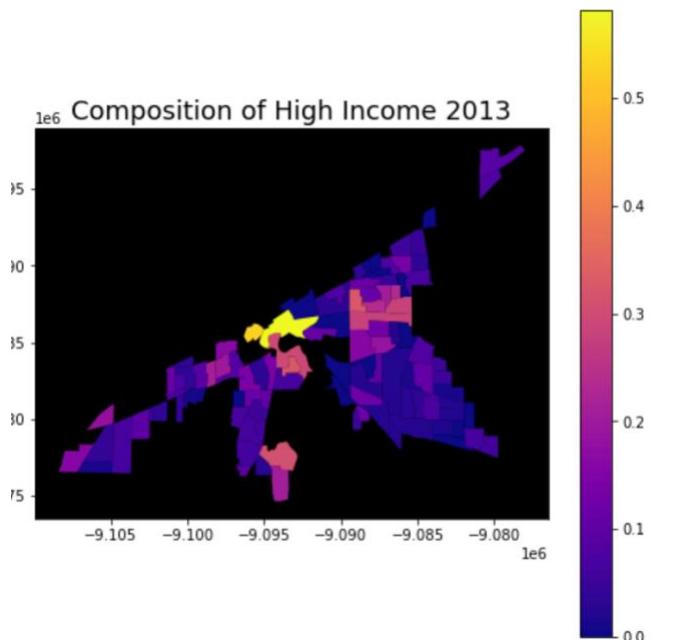
- Income Composition

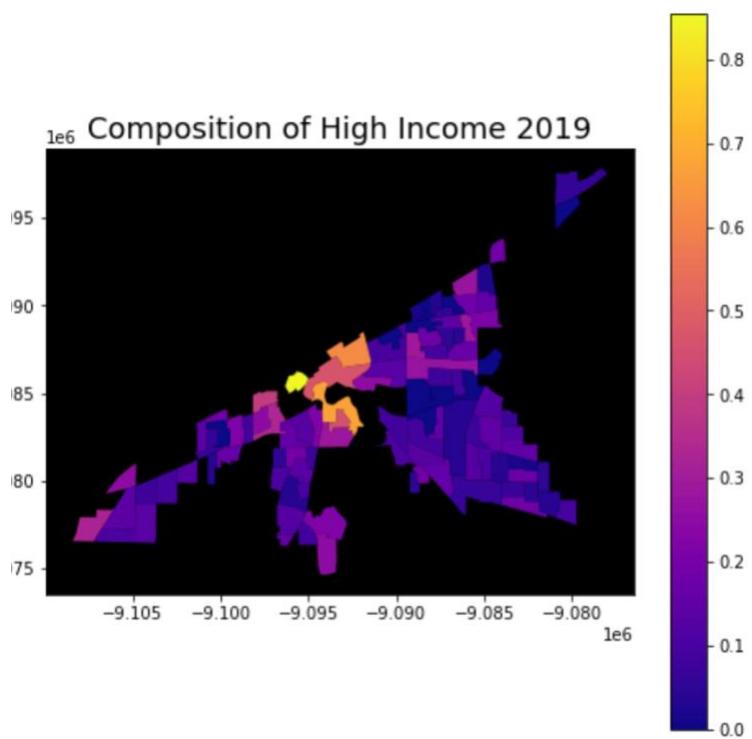
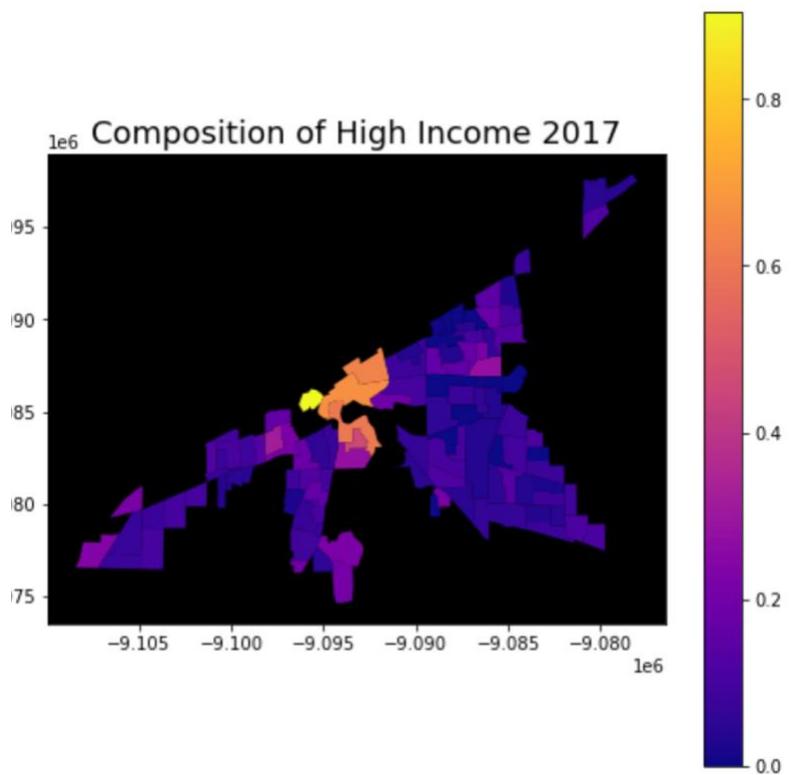




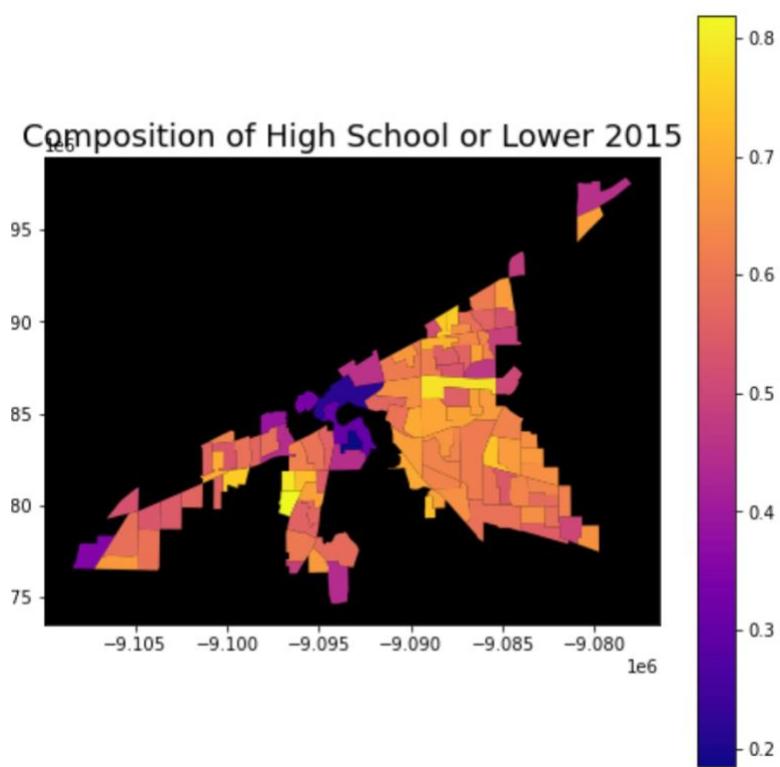
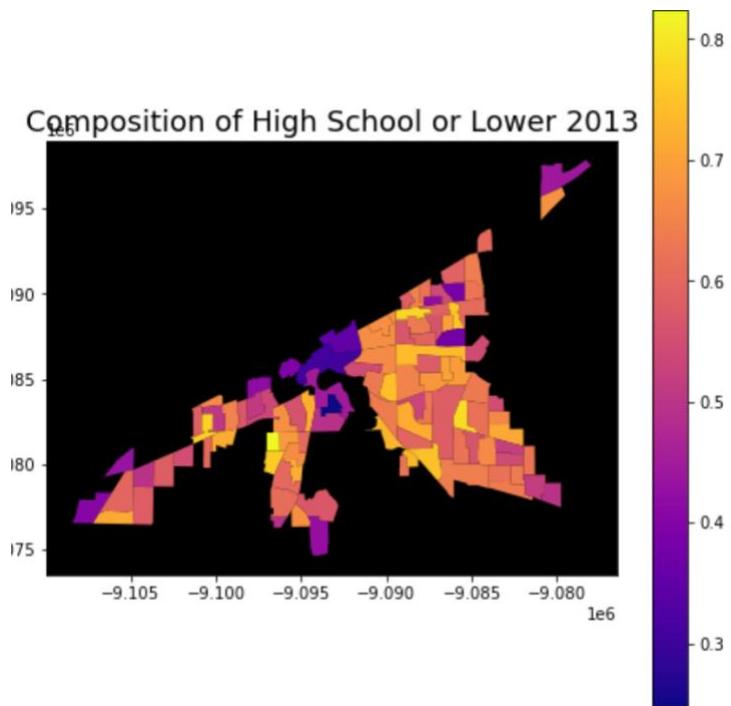


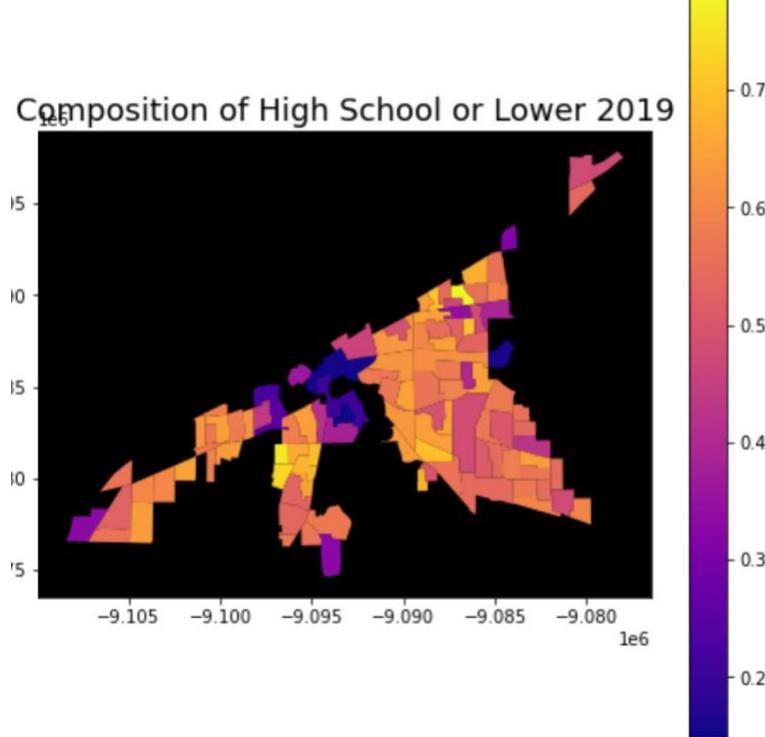
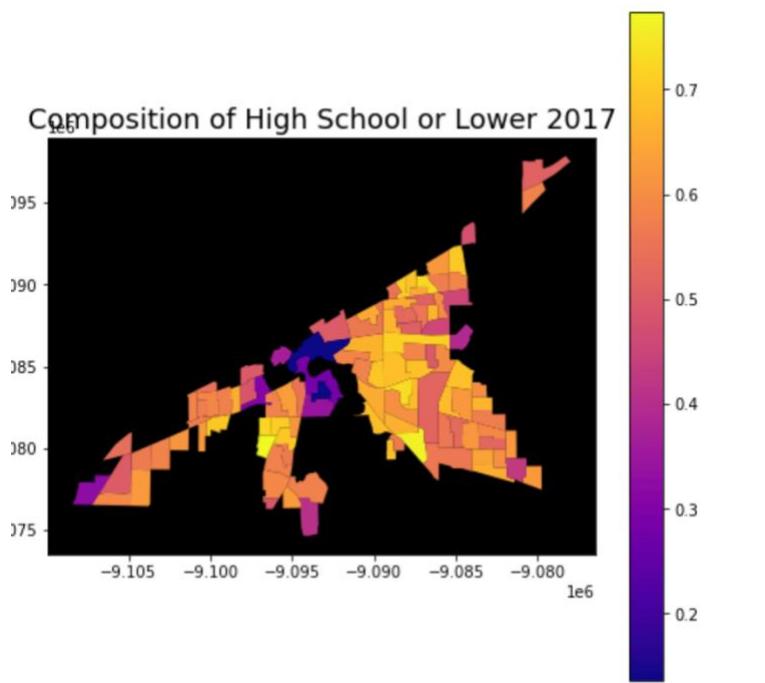


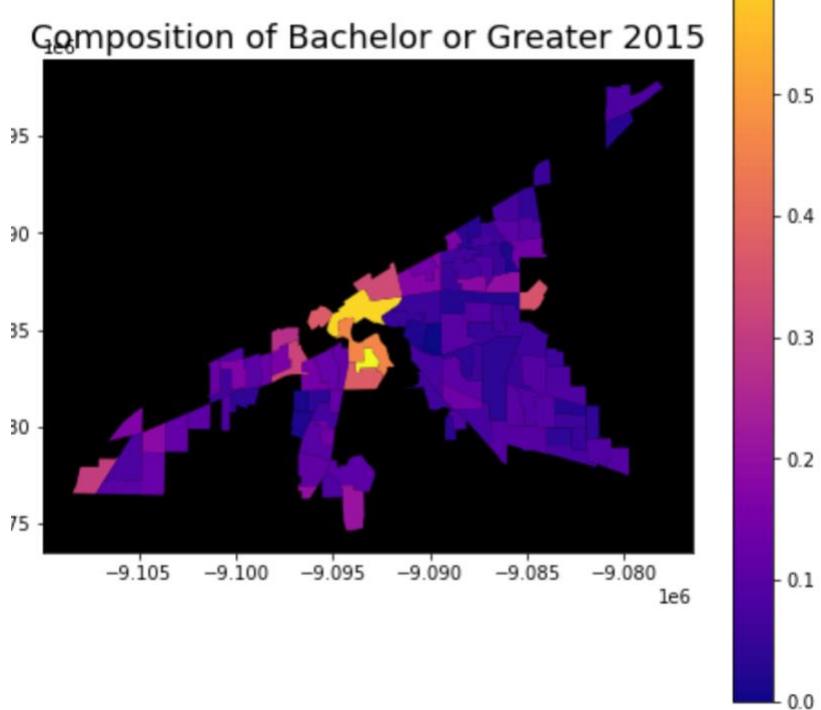
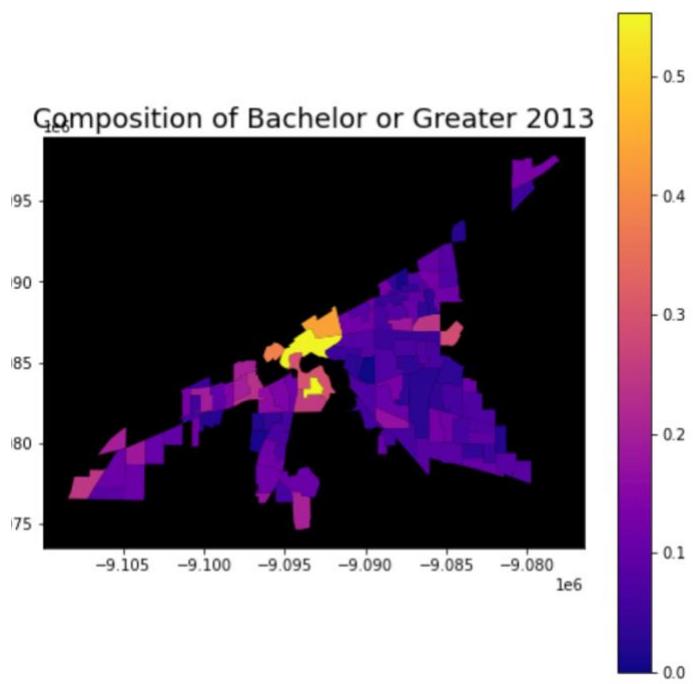


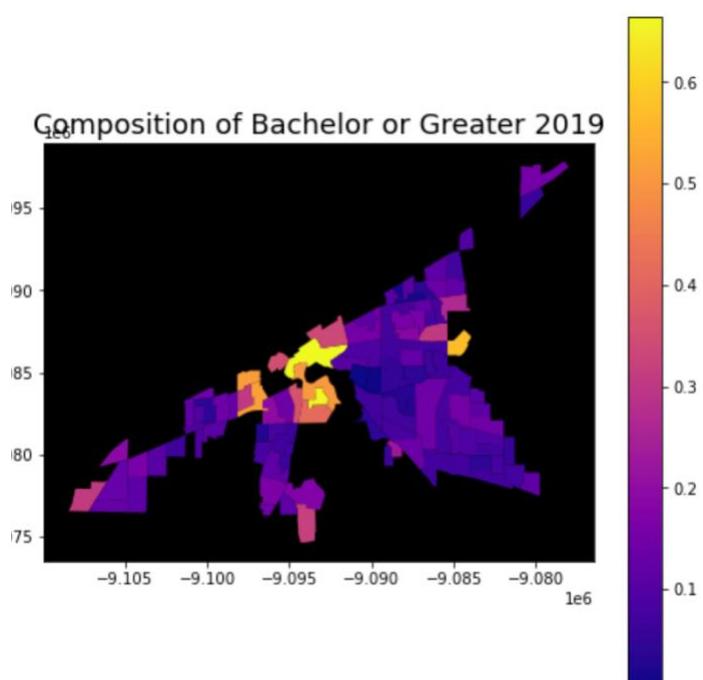
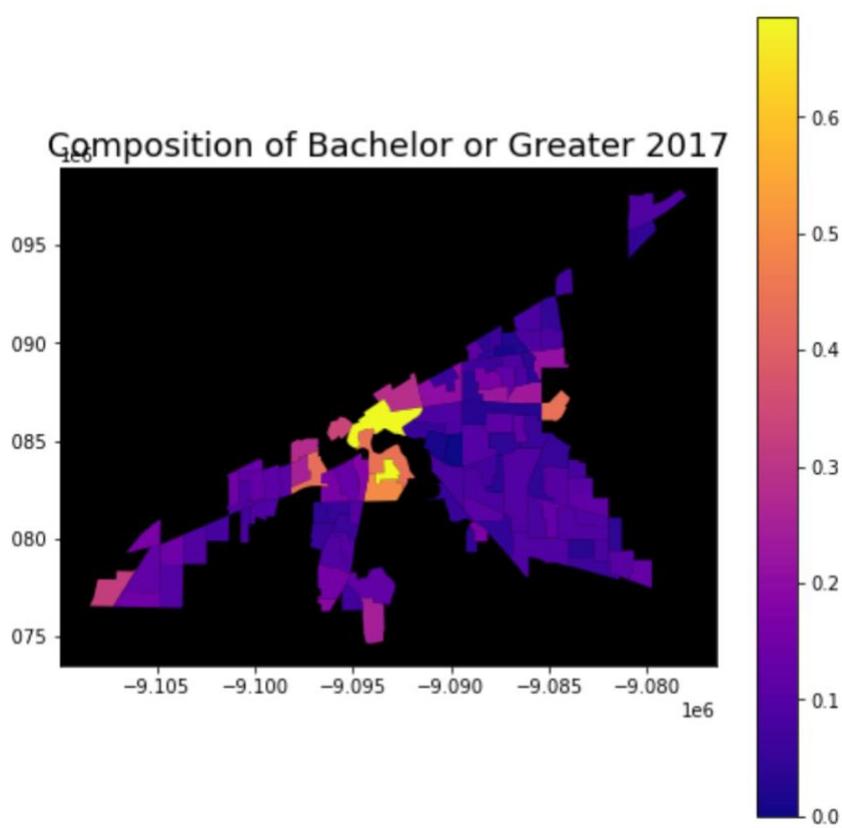


- Education Composition

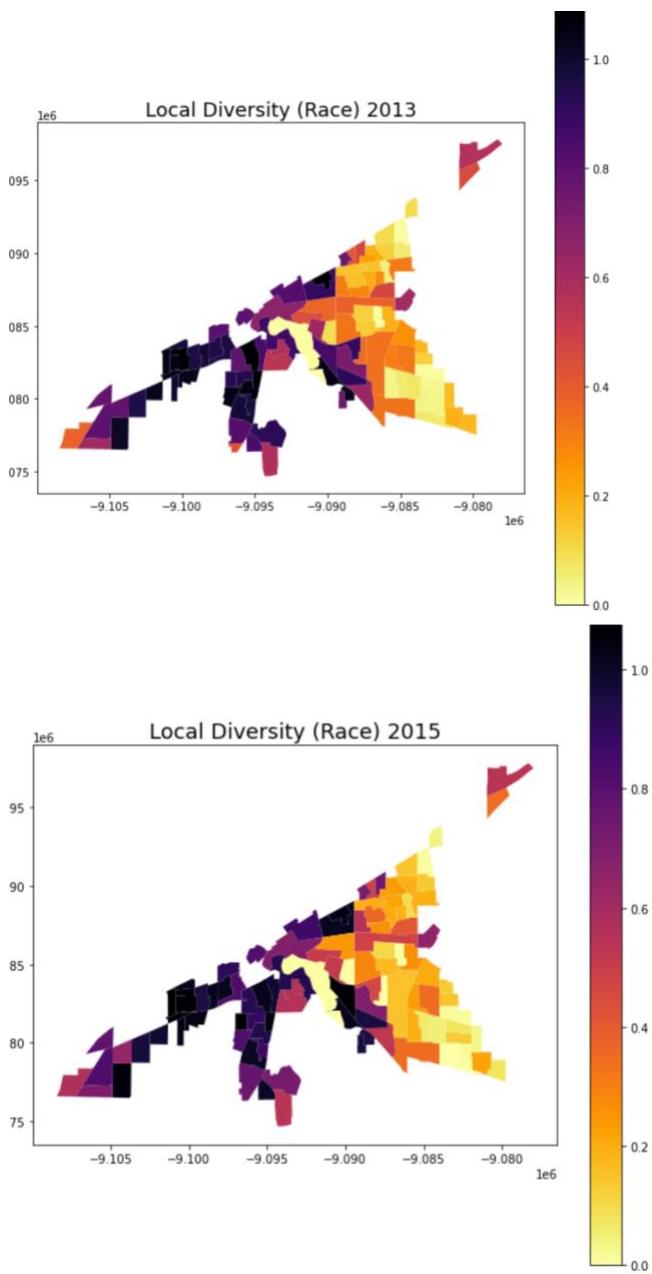


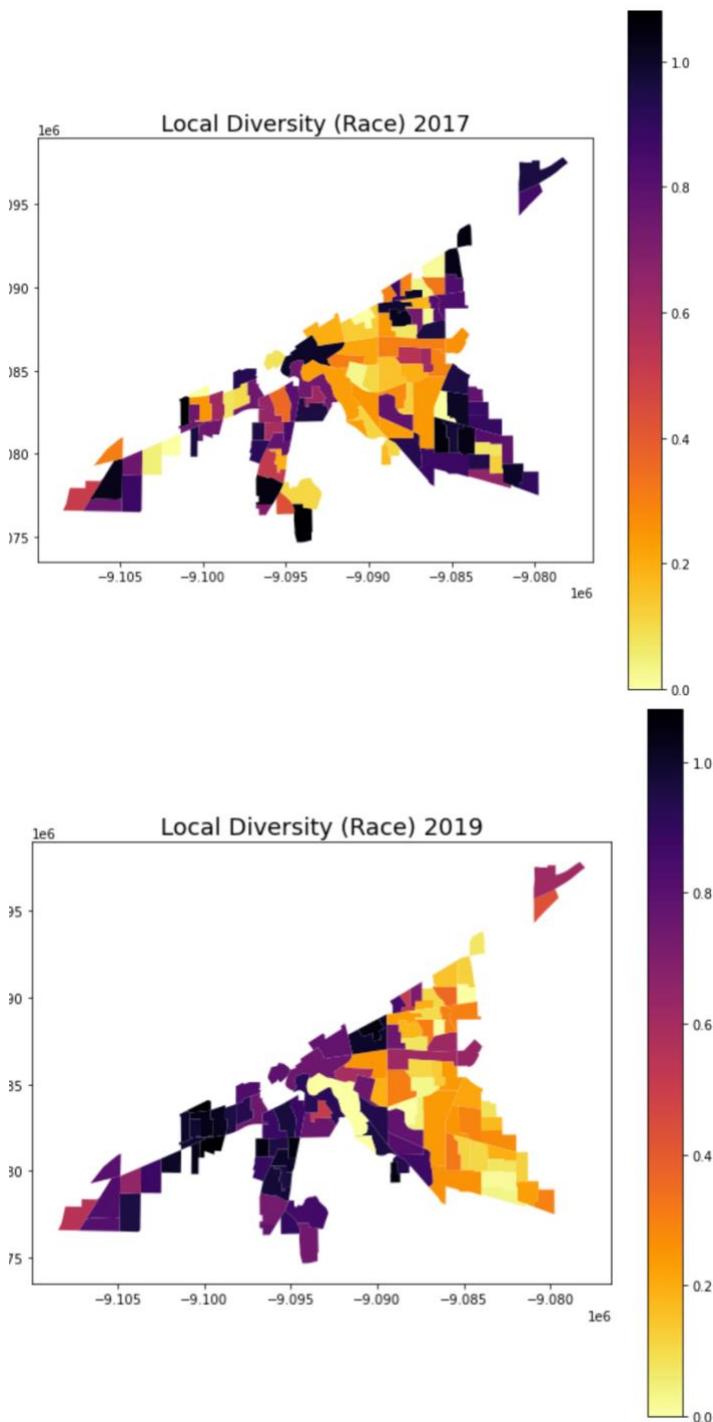




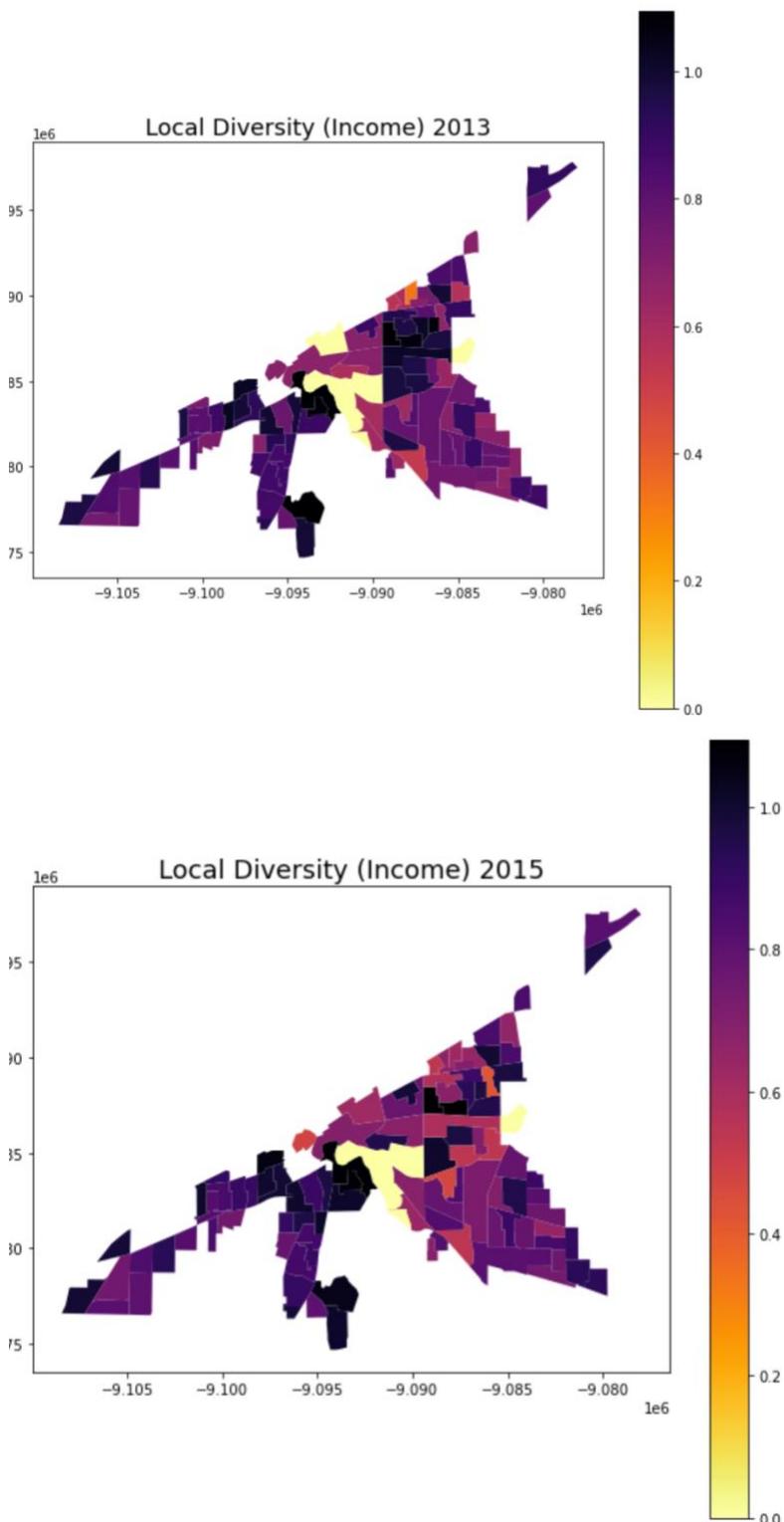


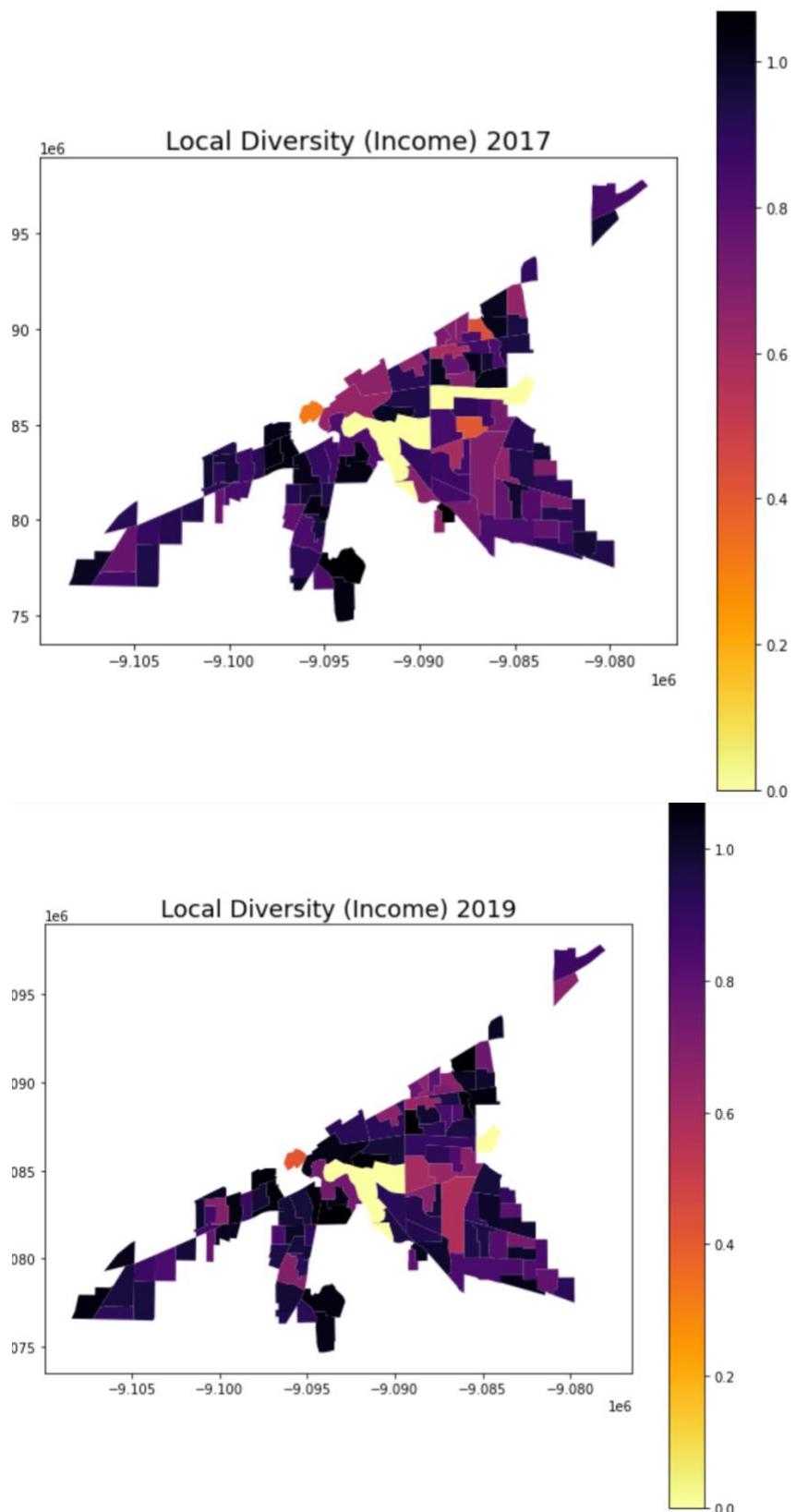
- Race Diversity



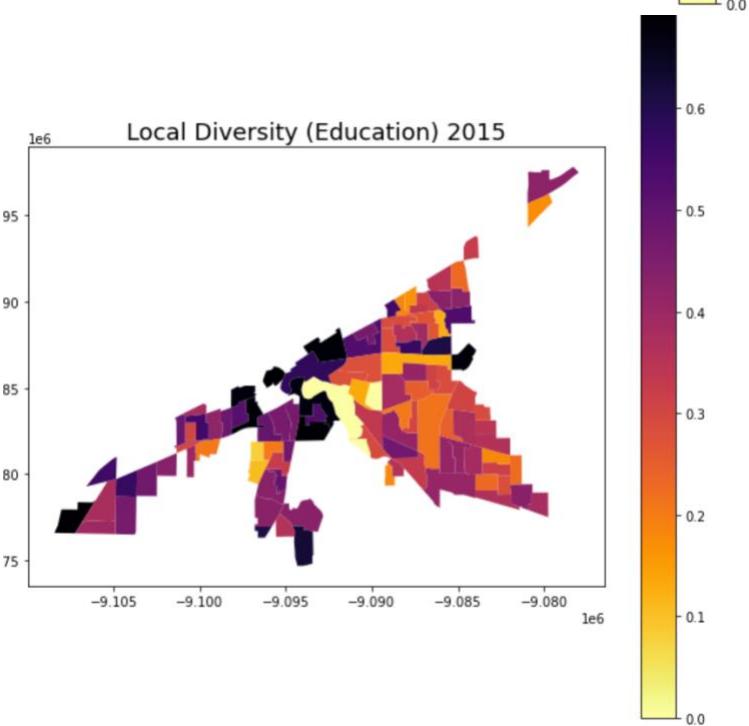
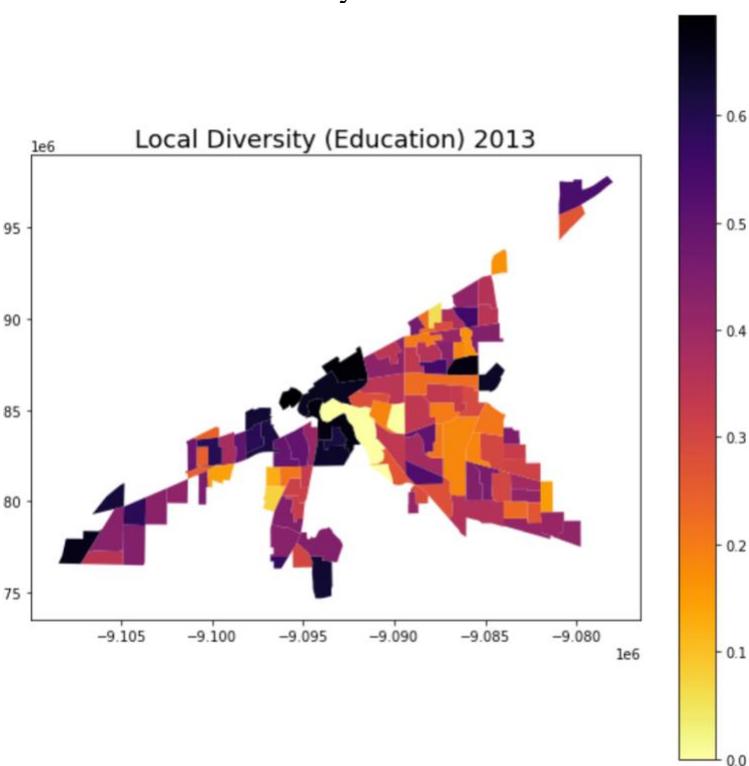


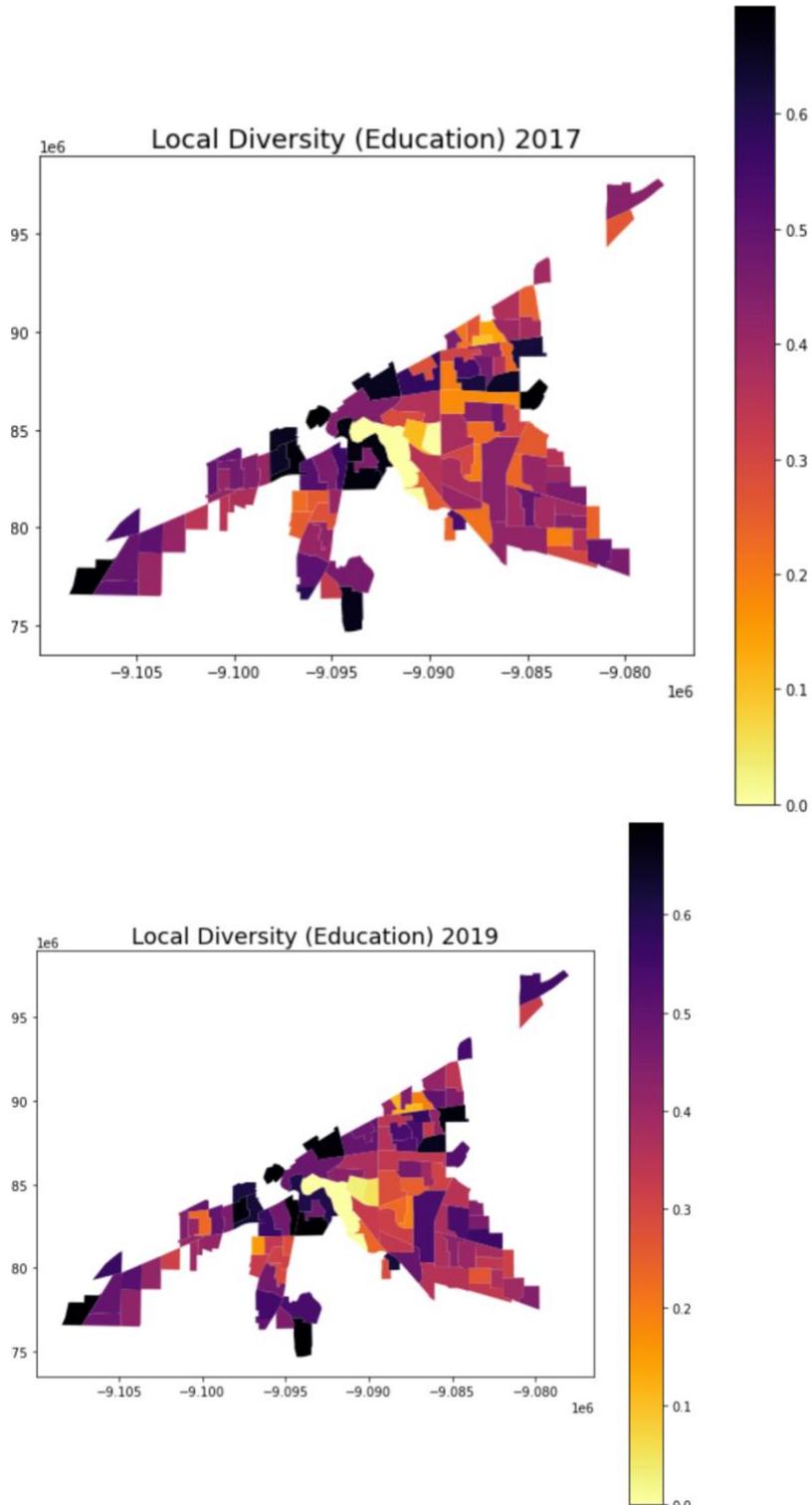
- Income Diversity





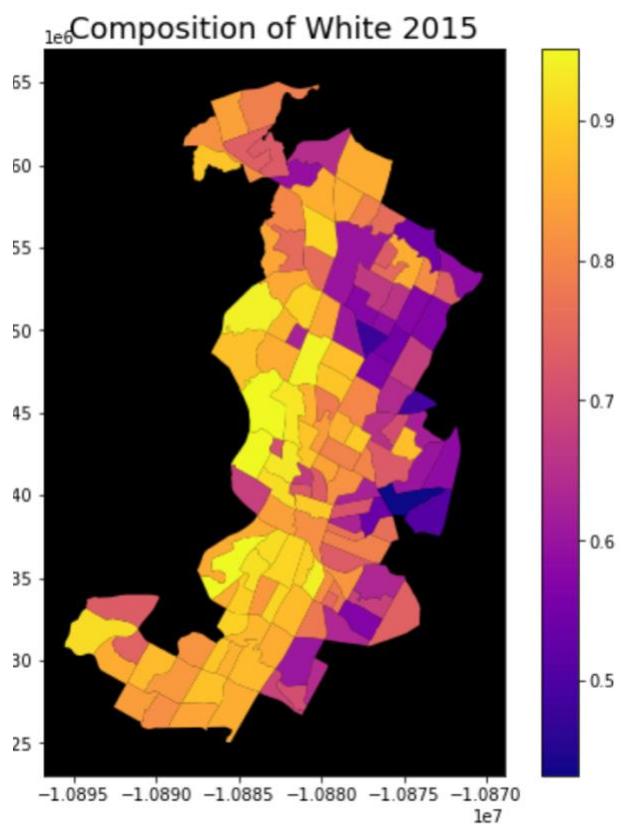
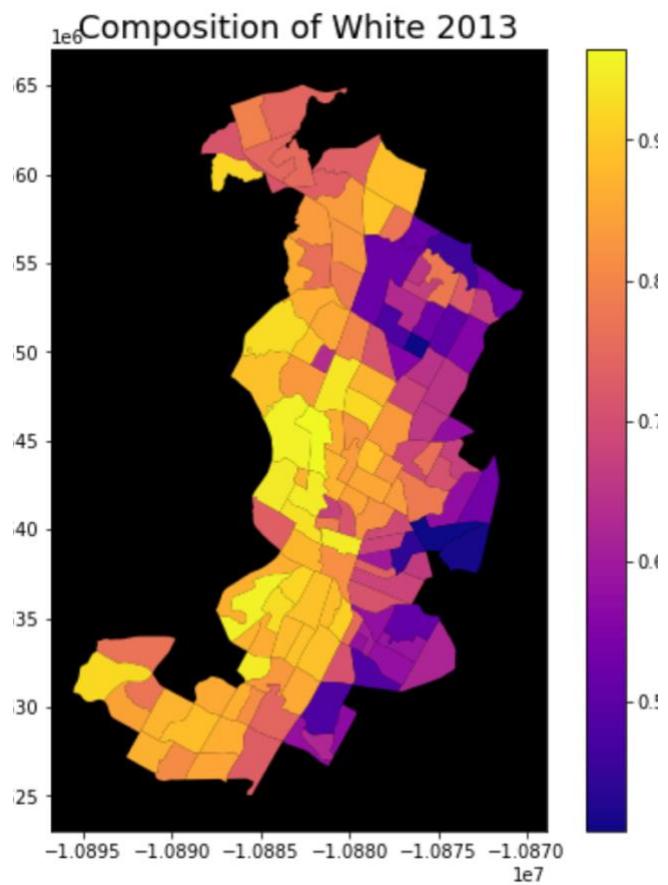
- Education Diversity

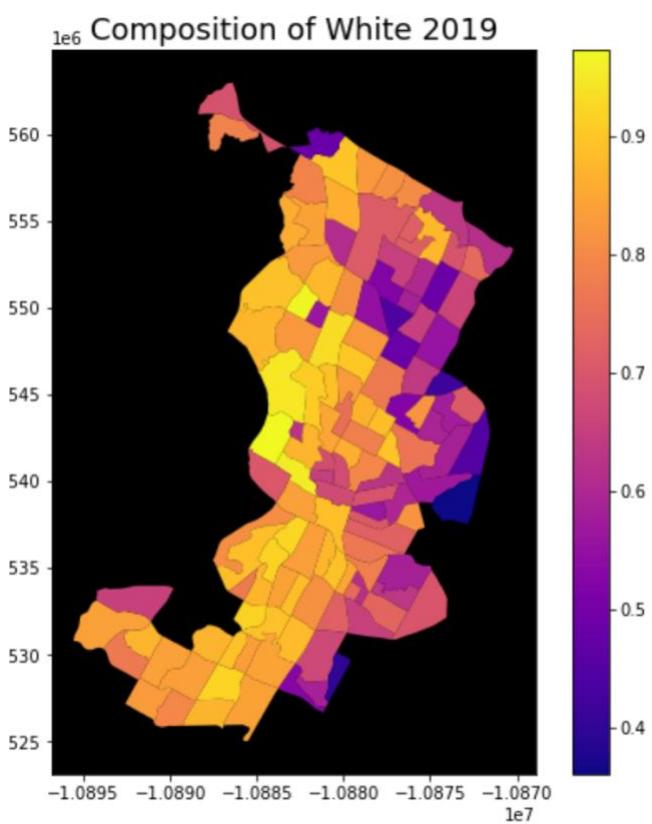
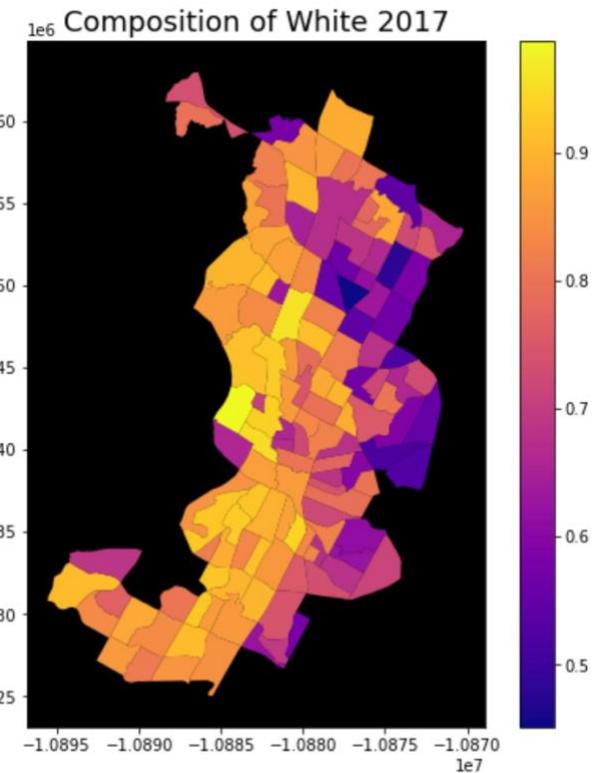


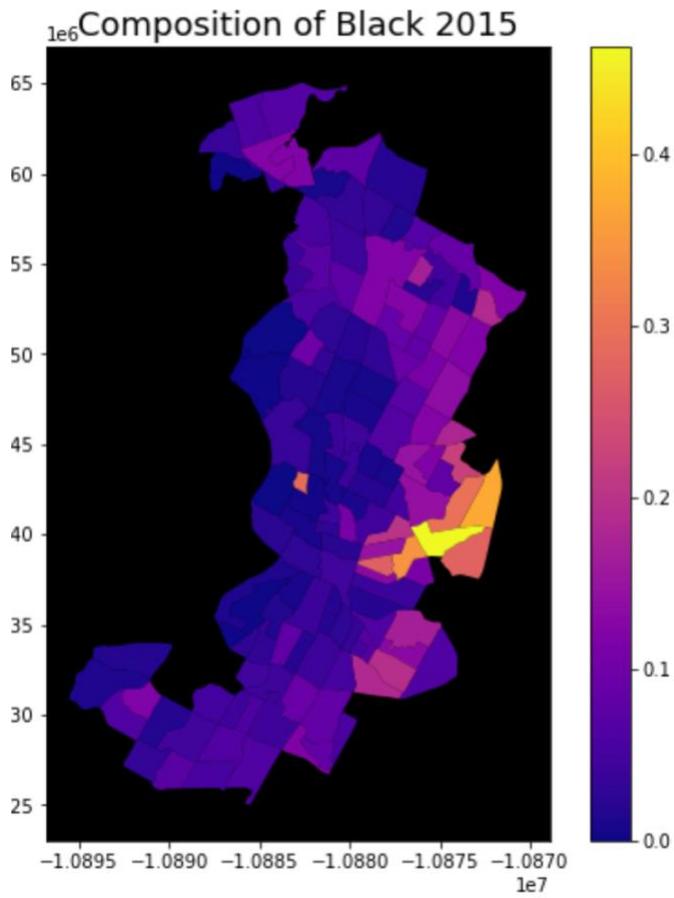
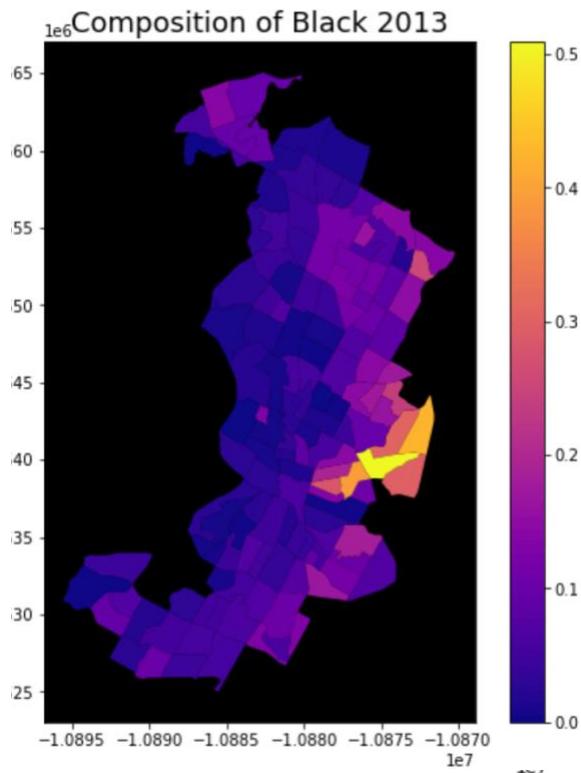


Austin, Texas

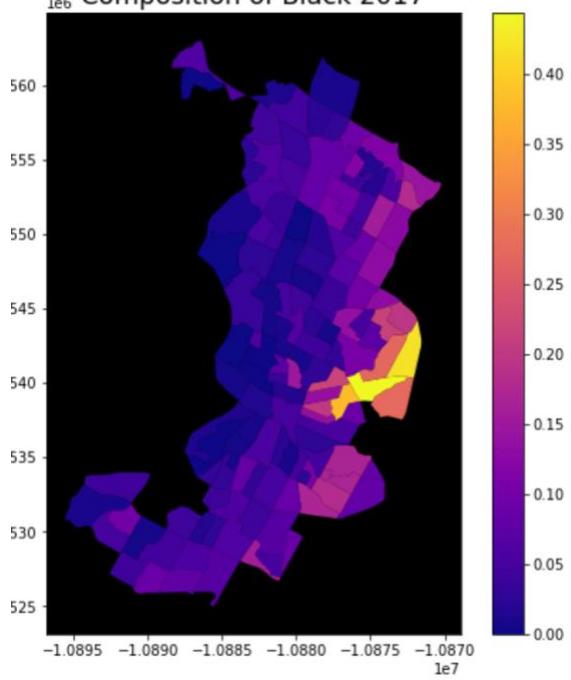
- Race Composition



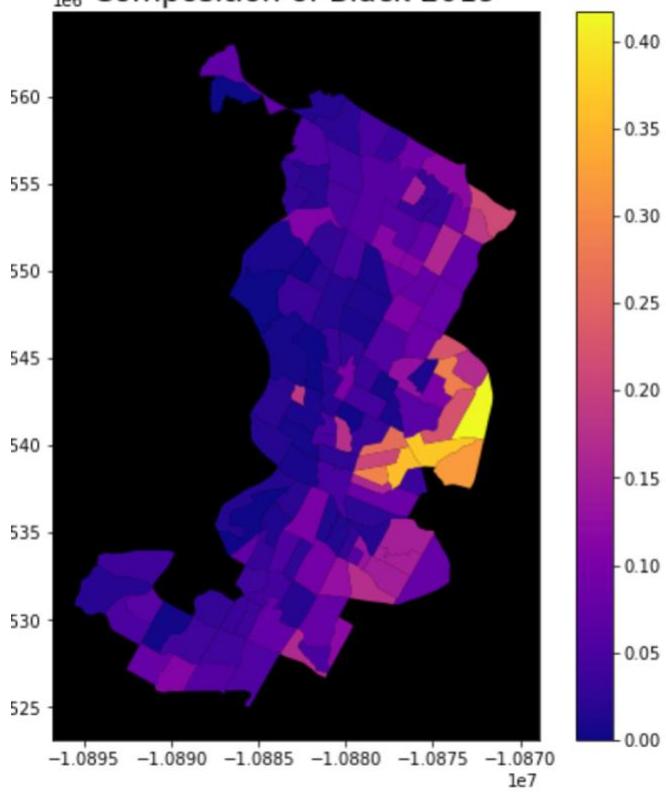


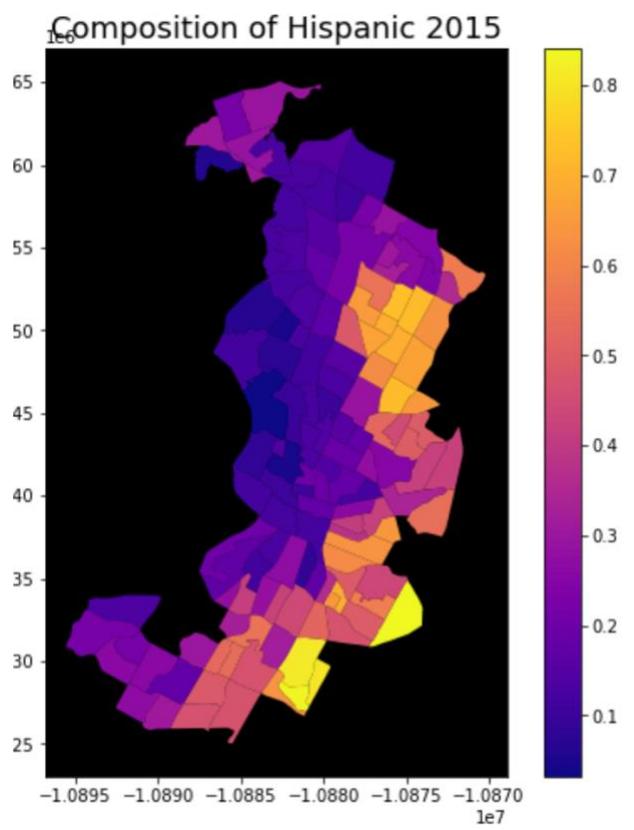
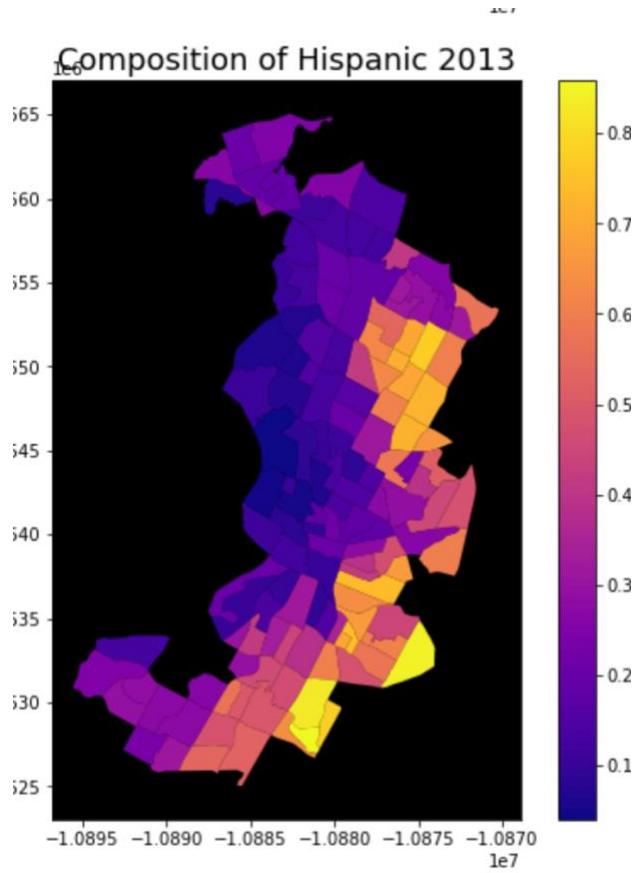


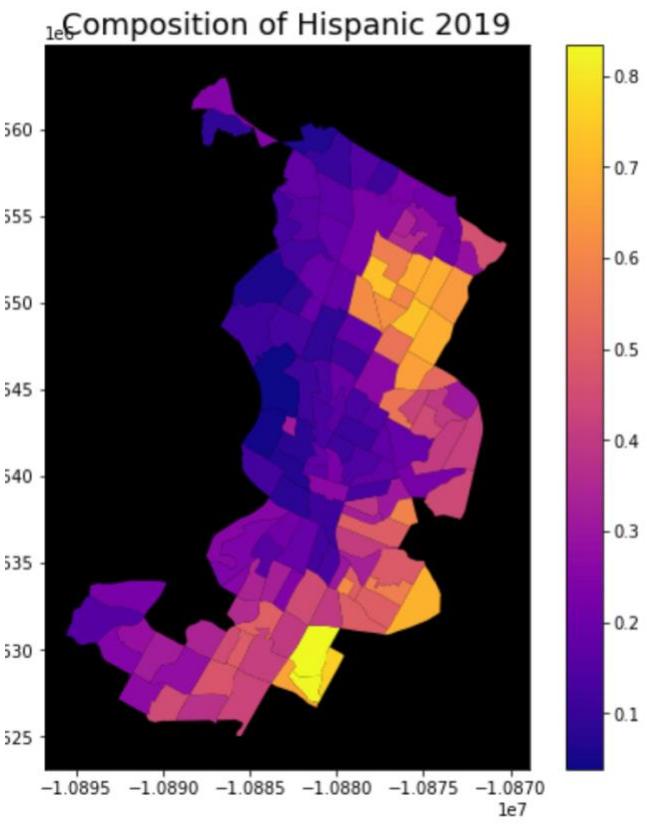
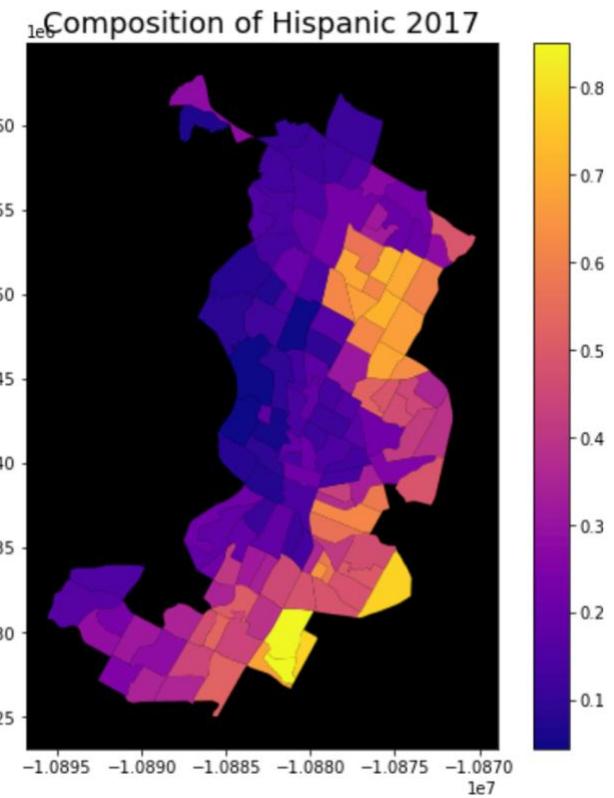
$1e6$ Composition of Black 2017



$1e6$ Composition of Black 2019

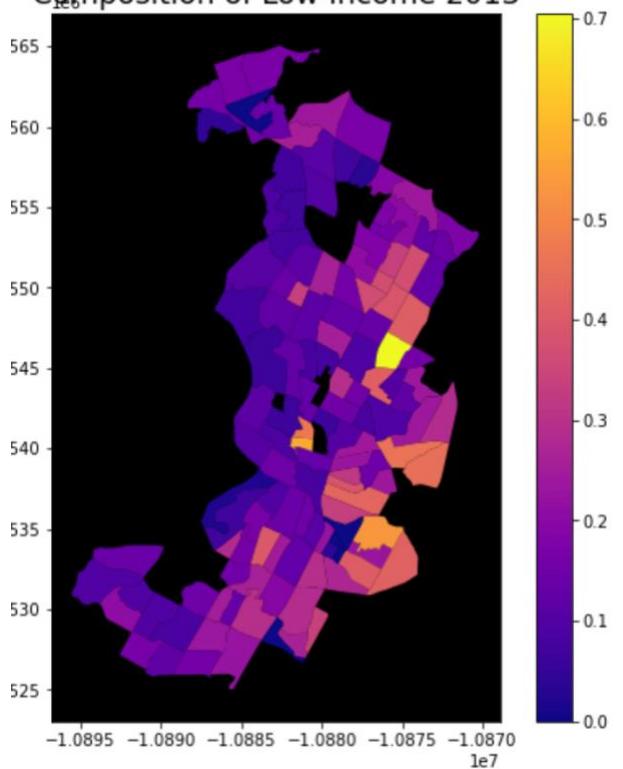




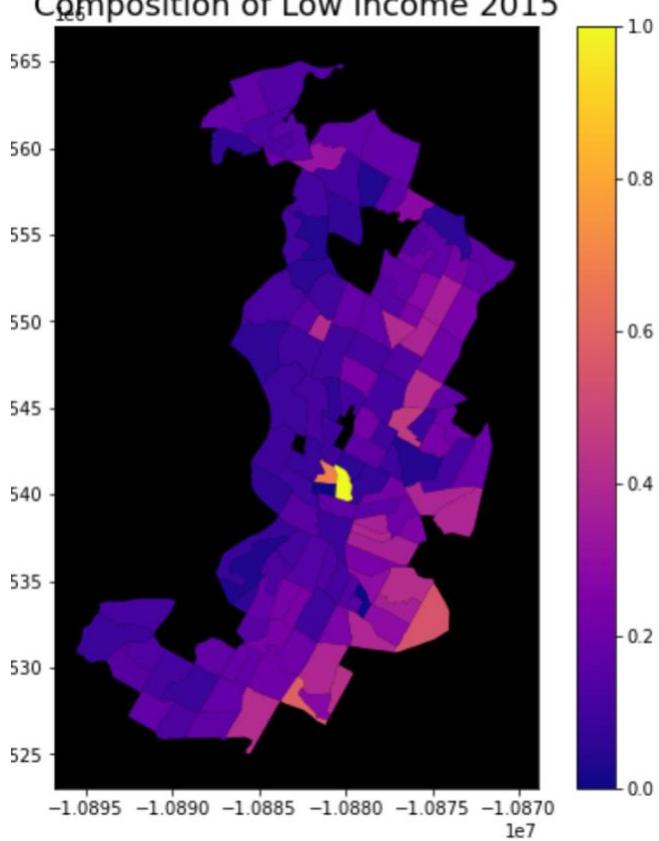


- Income Composition

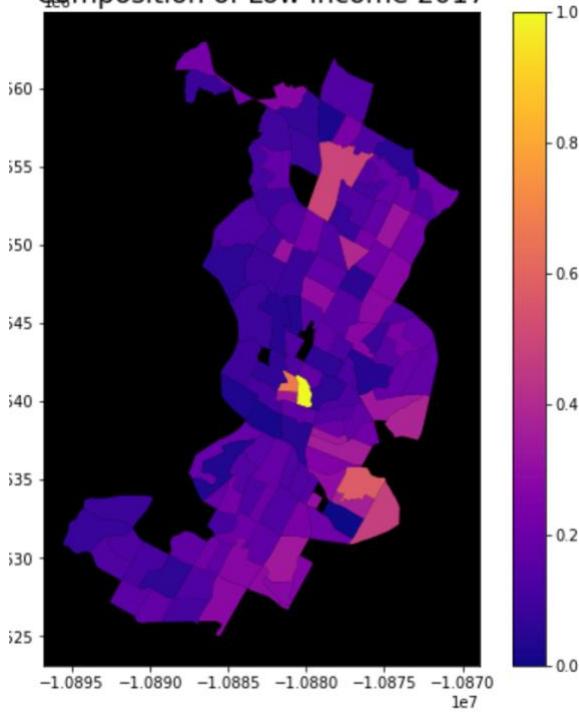
Composition of Low Income 2013



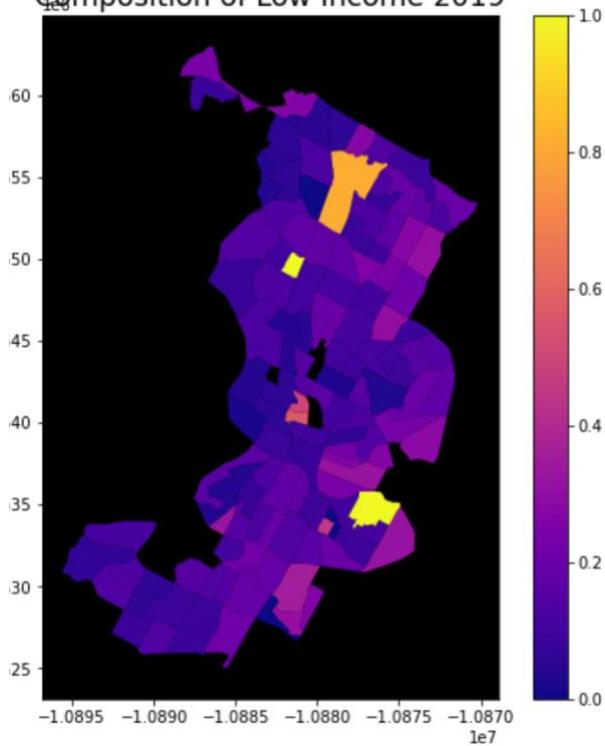
Composition of Low Income 2015



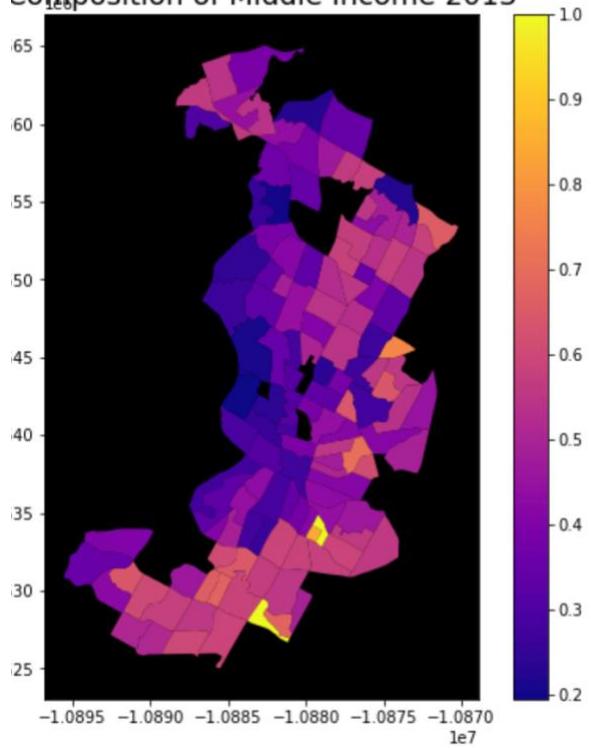
Composition of Low Income 2017



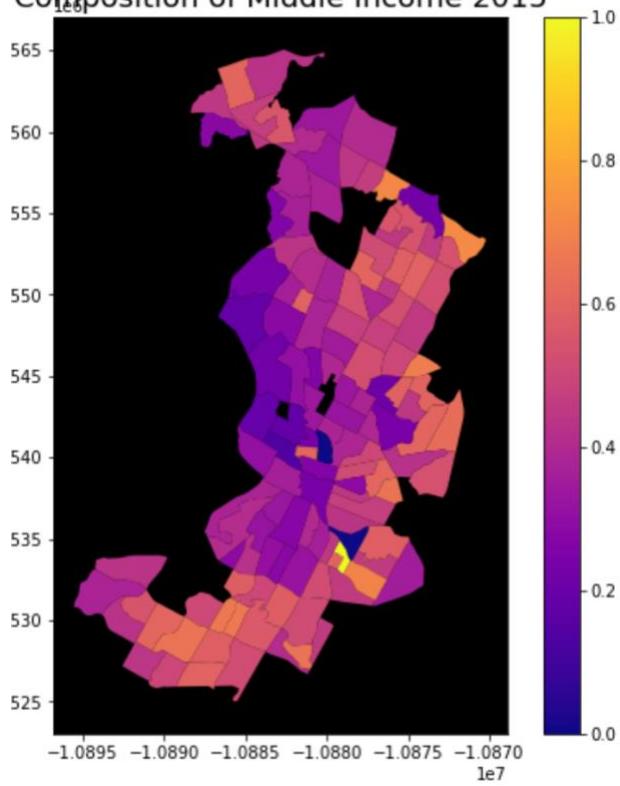
Composition of Low Income 2019



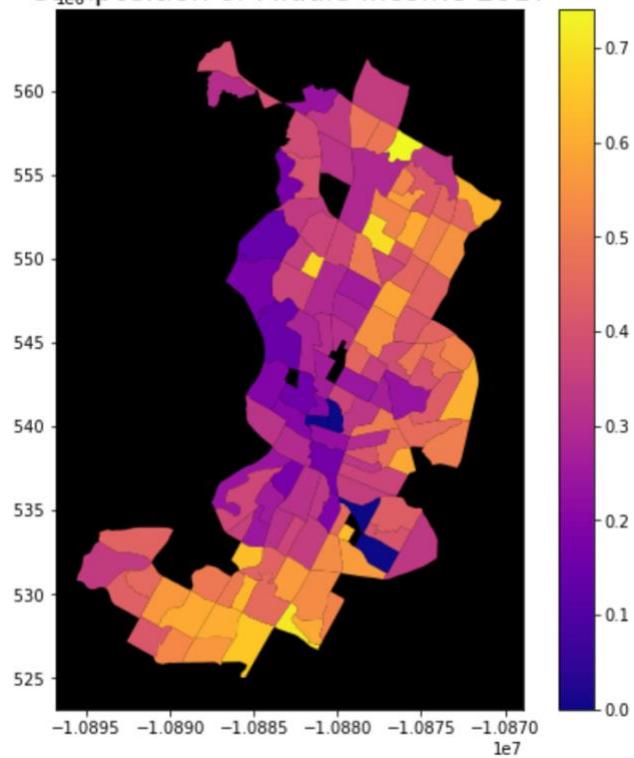
Composition of Middle Income 2013



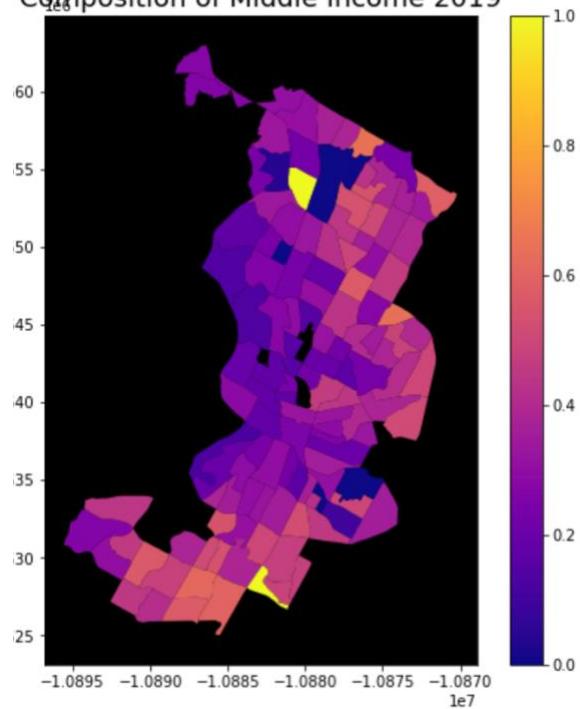
Composition of Middle Income 2015



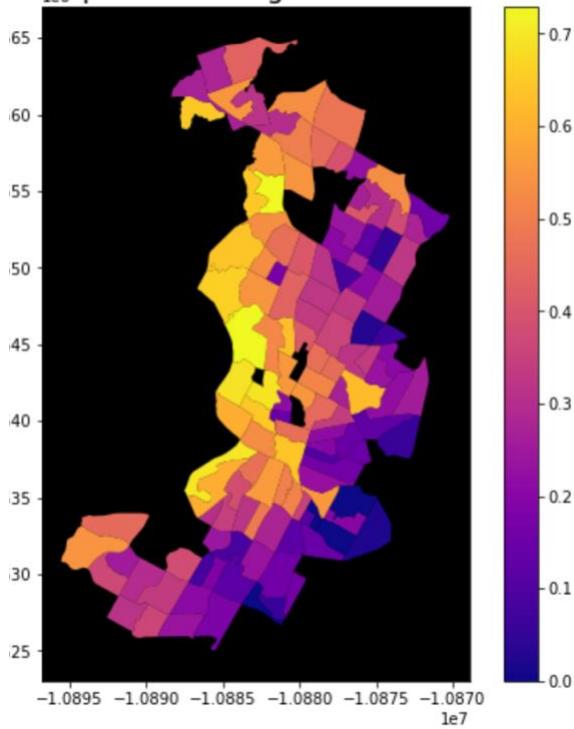
Composition of Middle Income 2017



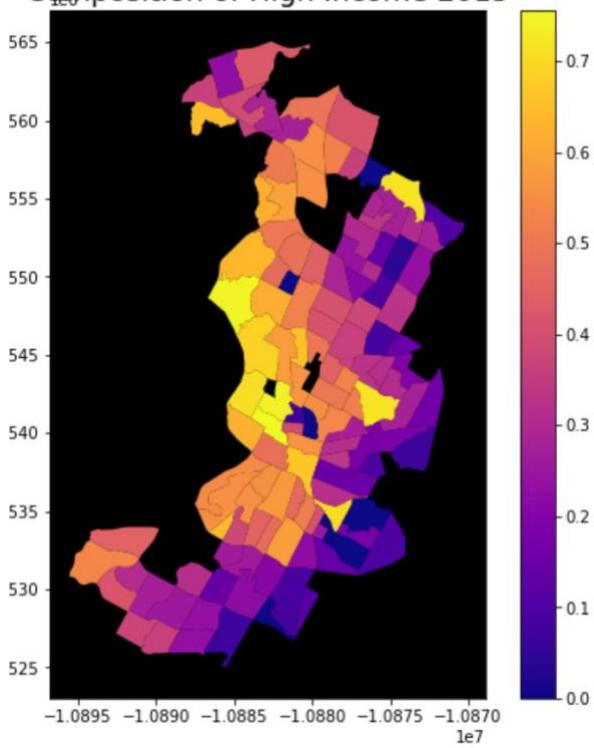
Composition of Middle Income 2019



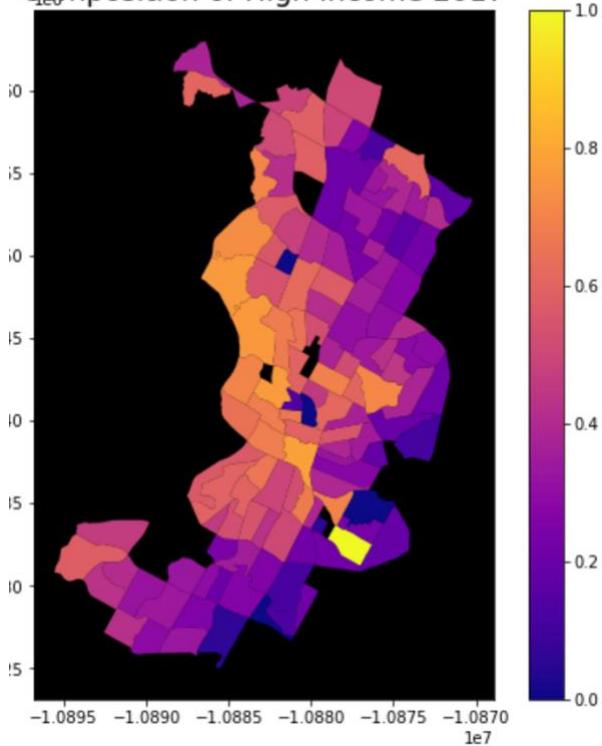
Composition of High Income 2013



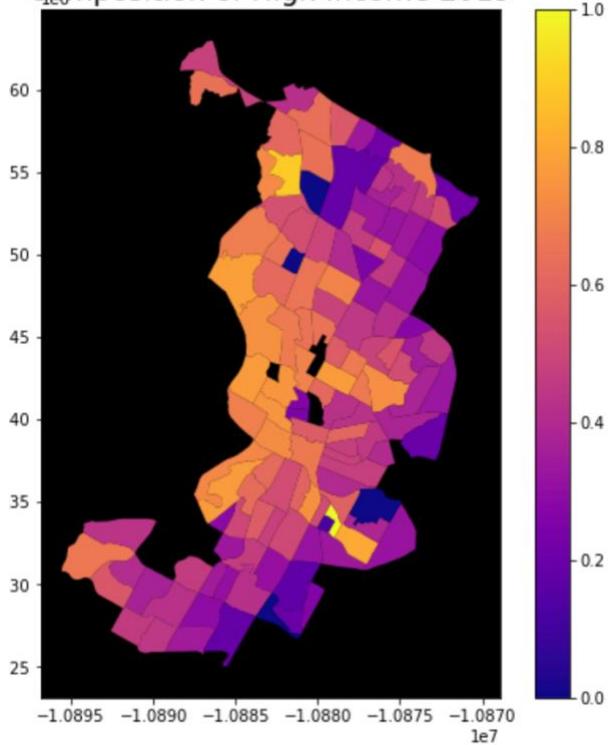
Composition of High Income 2015



Composition of High Income 2017

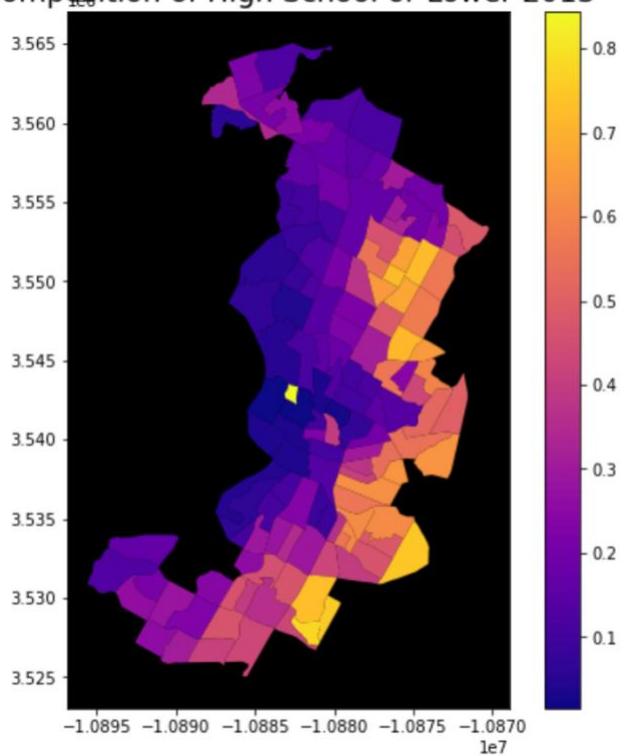


Composition of High Income 2019

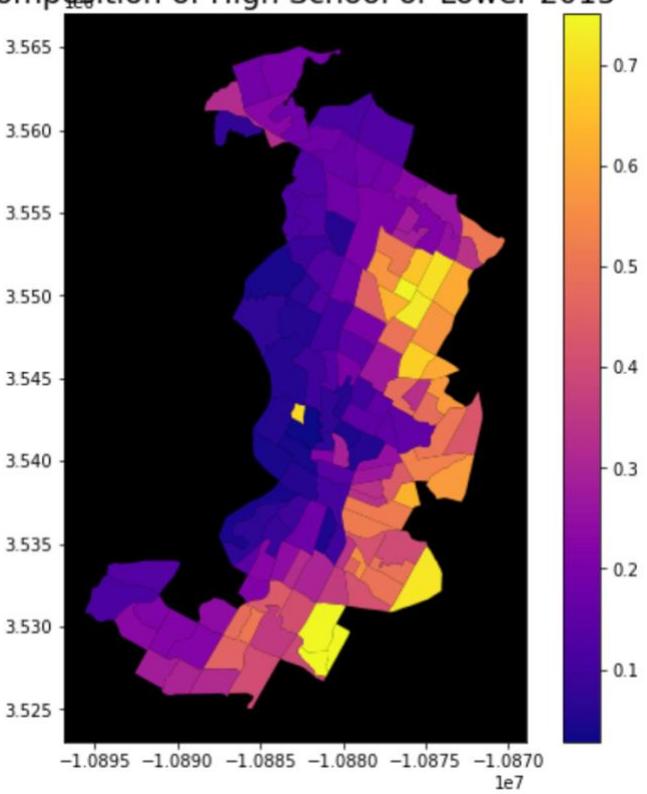


- Education Composition

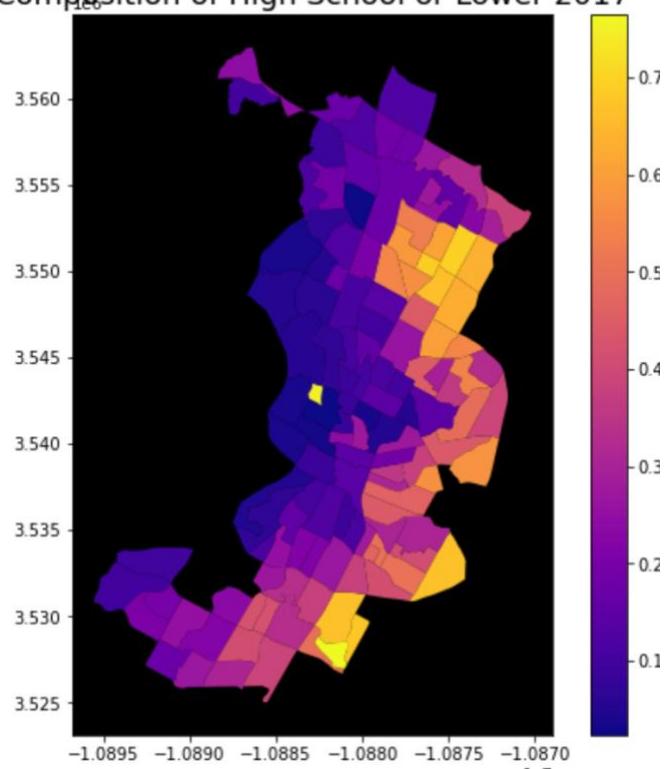
Composition of High School or Lower 2013



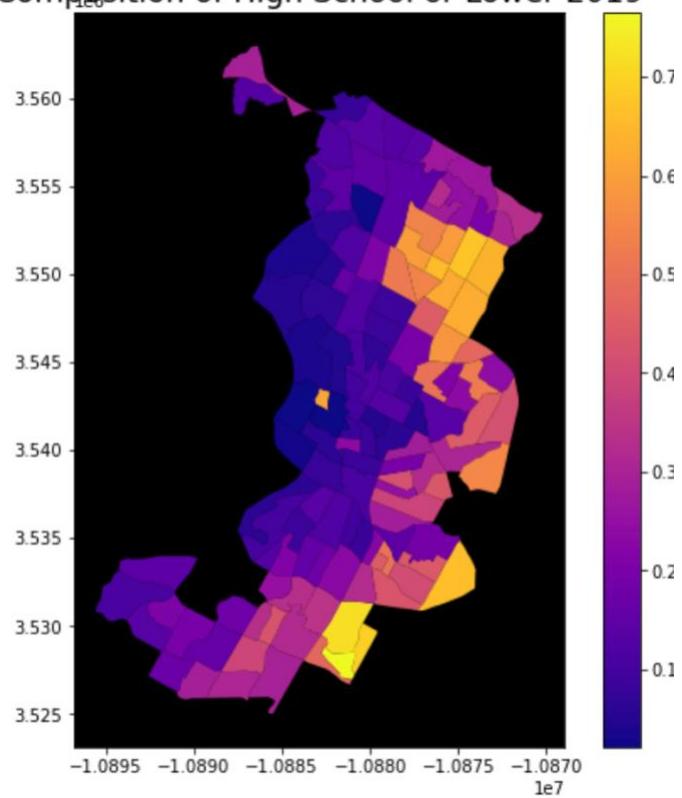
Composition of High School or Lower 2015



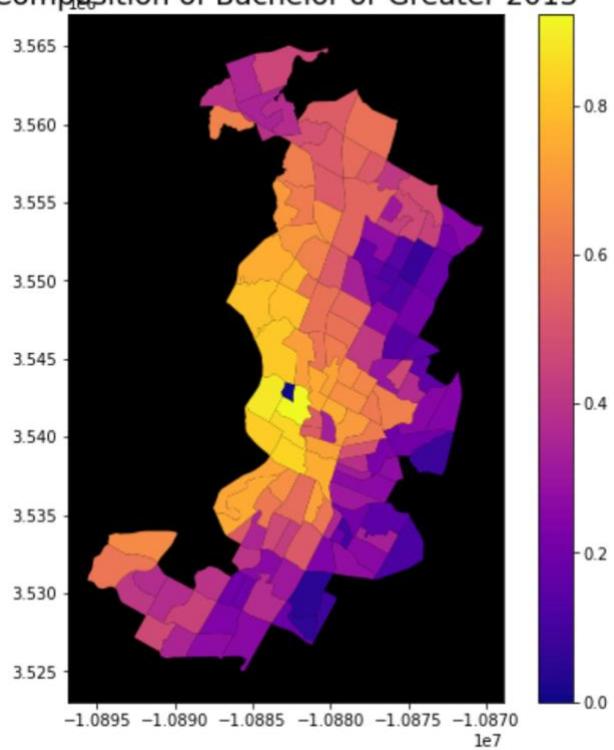
Composition of High School or Lower 2017



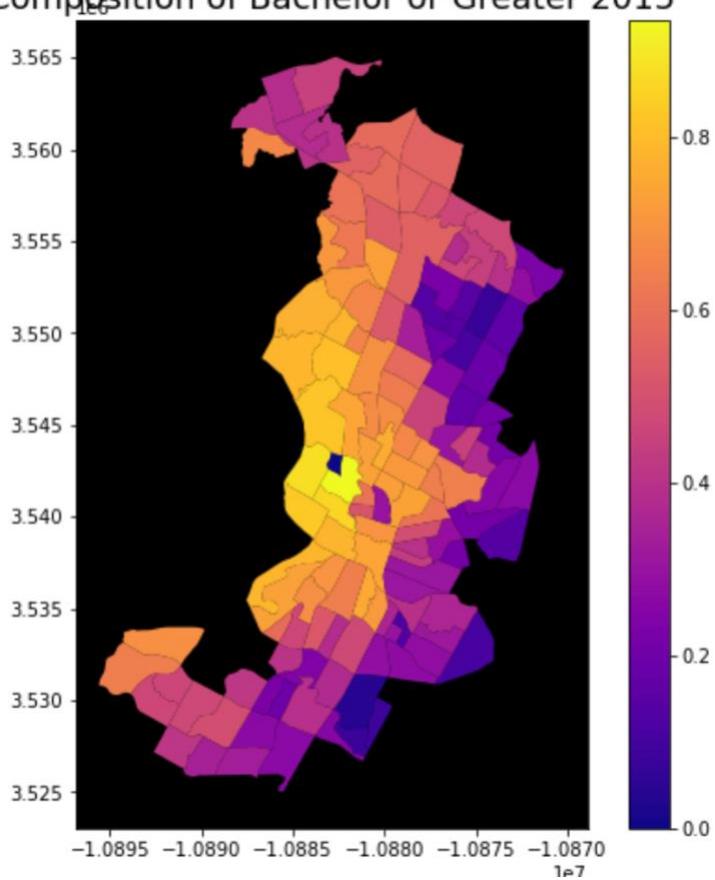
Composition of High School or Lower 2019



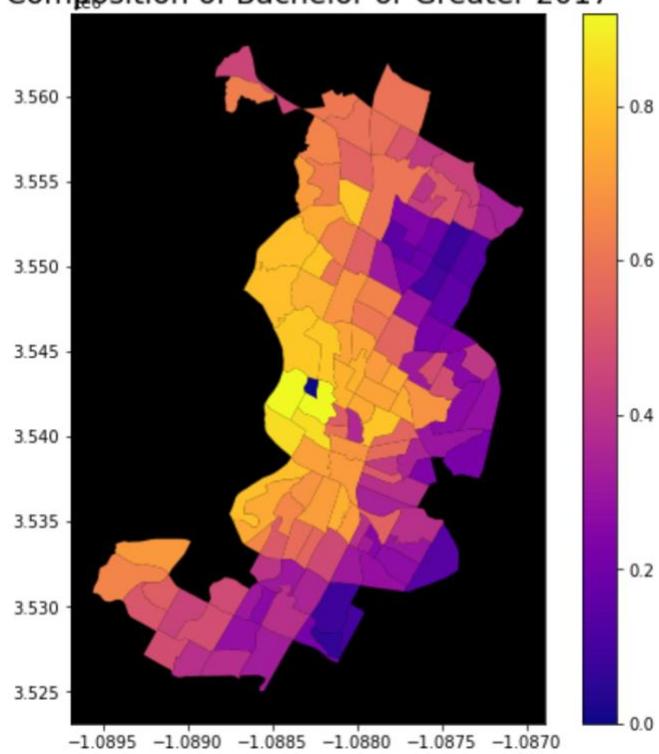
Composition of Bachelor or Greater 2013



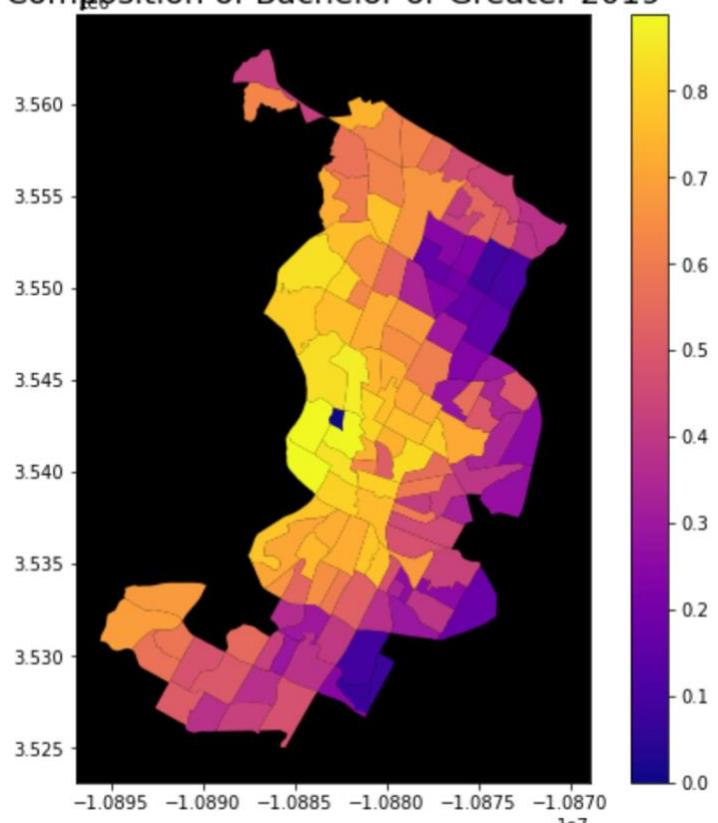
Composition of Bachelor or Greater 2015



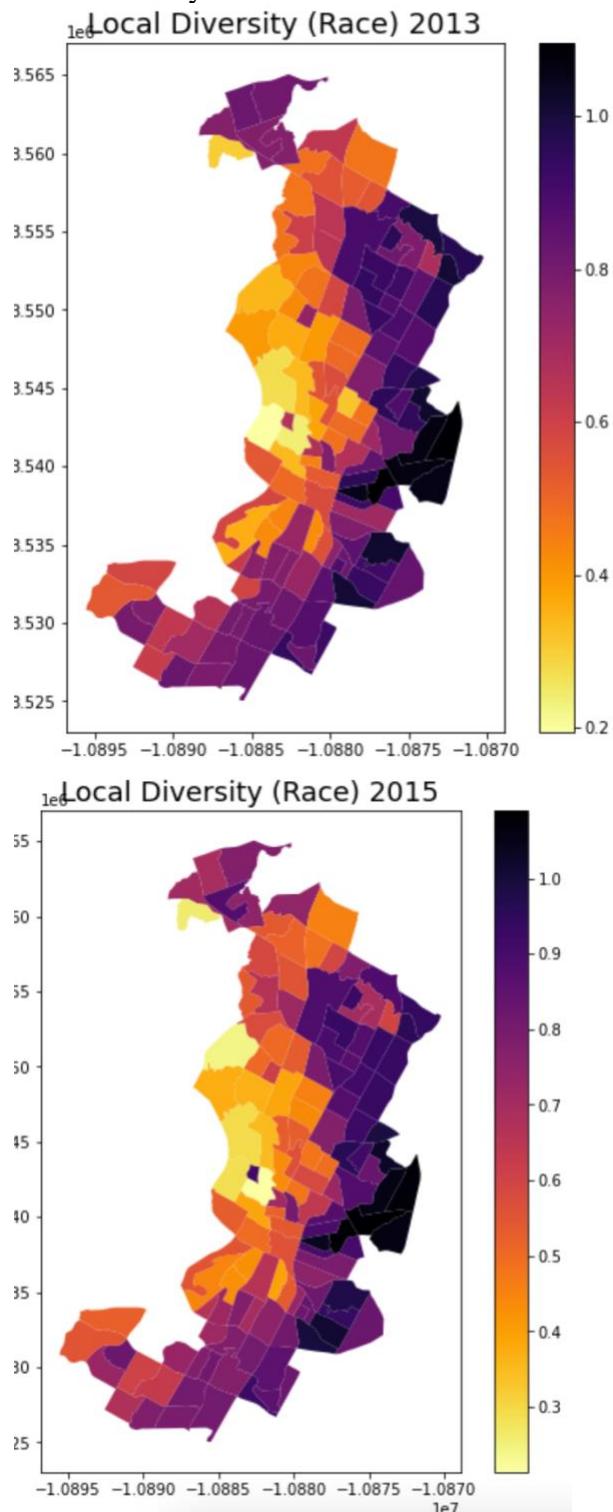
Composition of Bachelor or Greater 2017

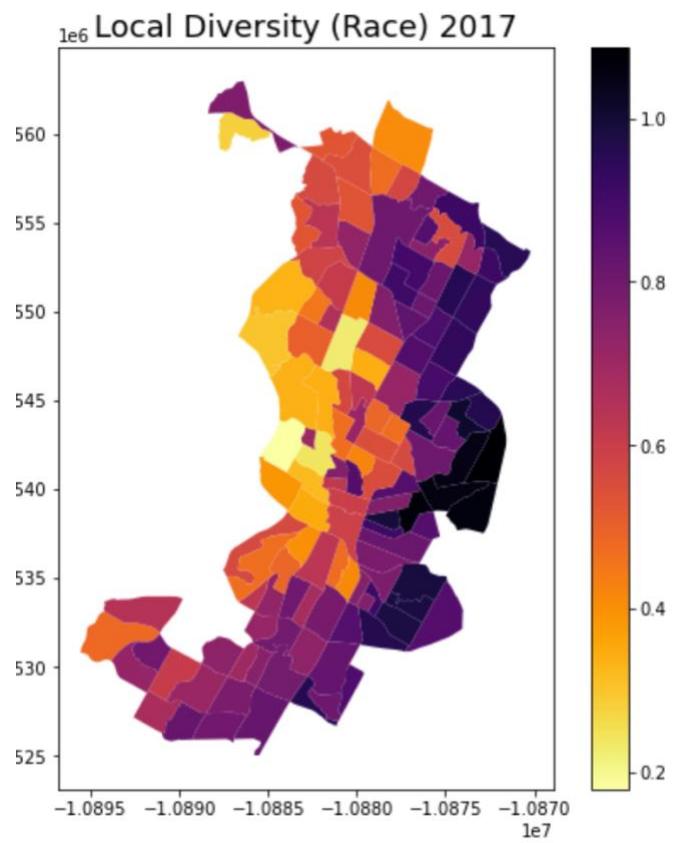


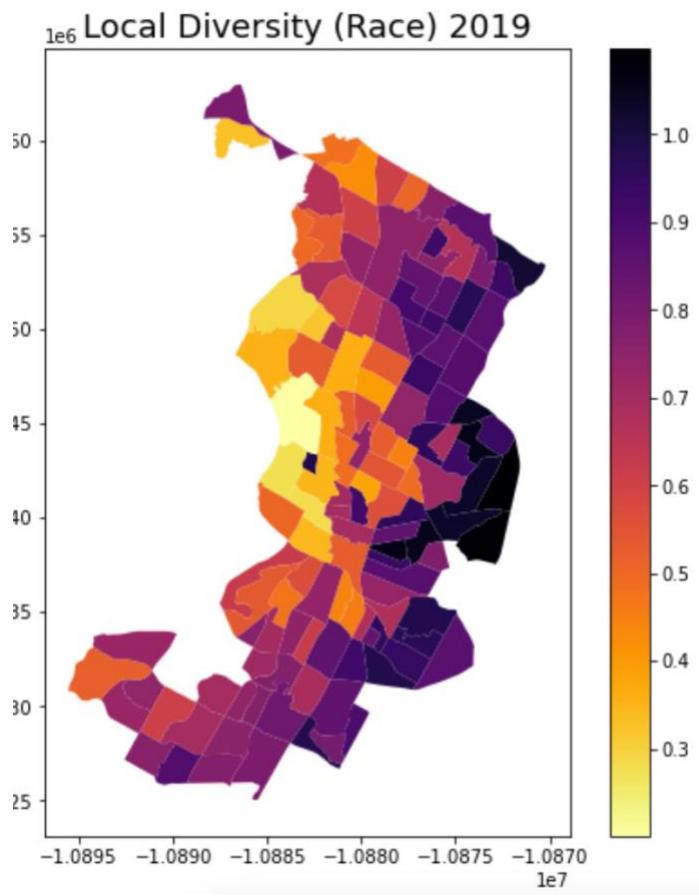
Composition of Bachelor or Greater 2019



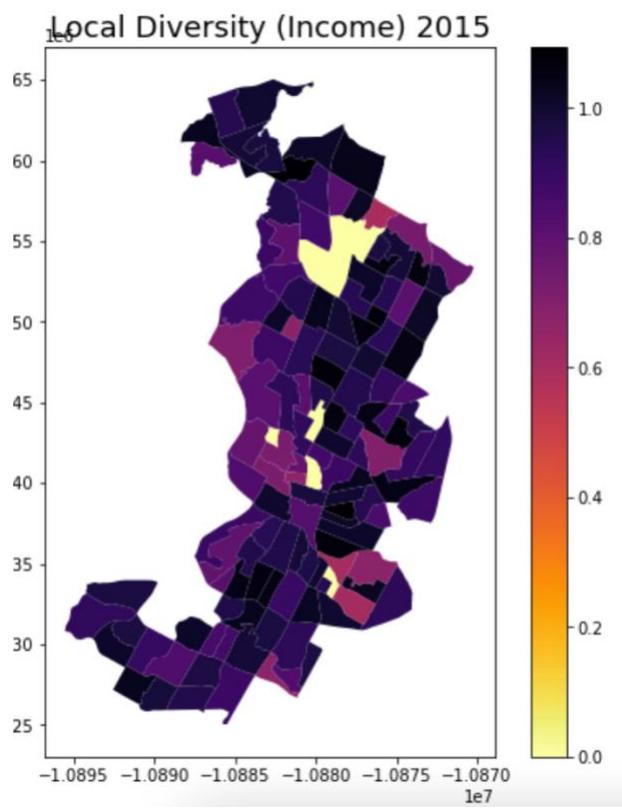
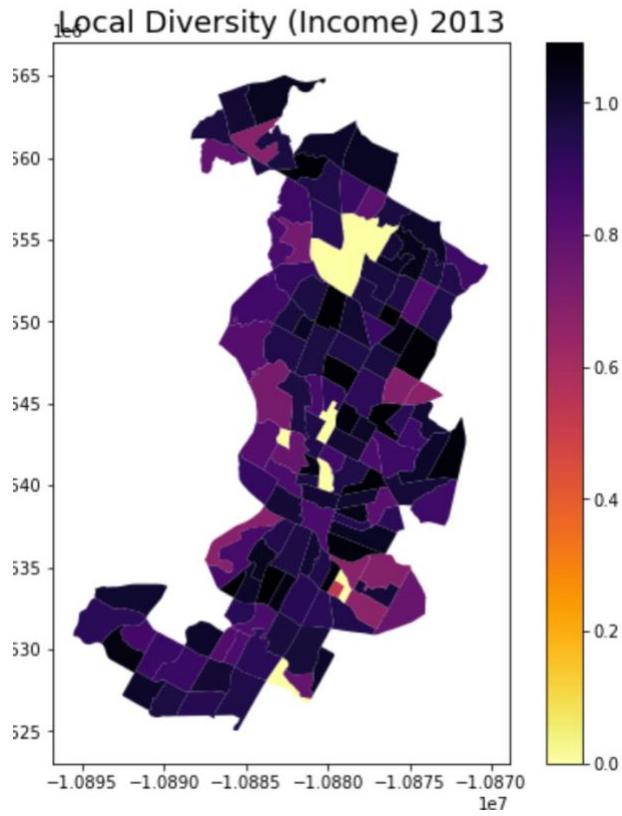
- Race Diversity

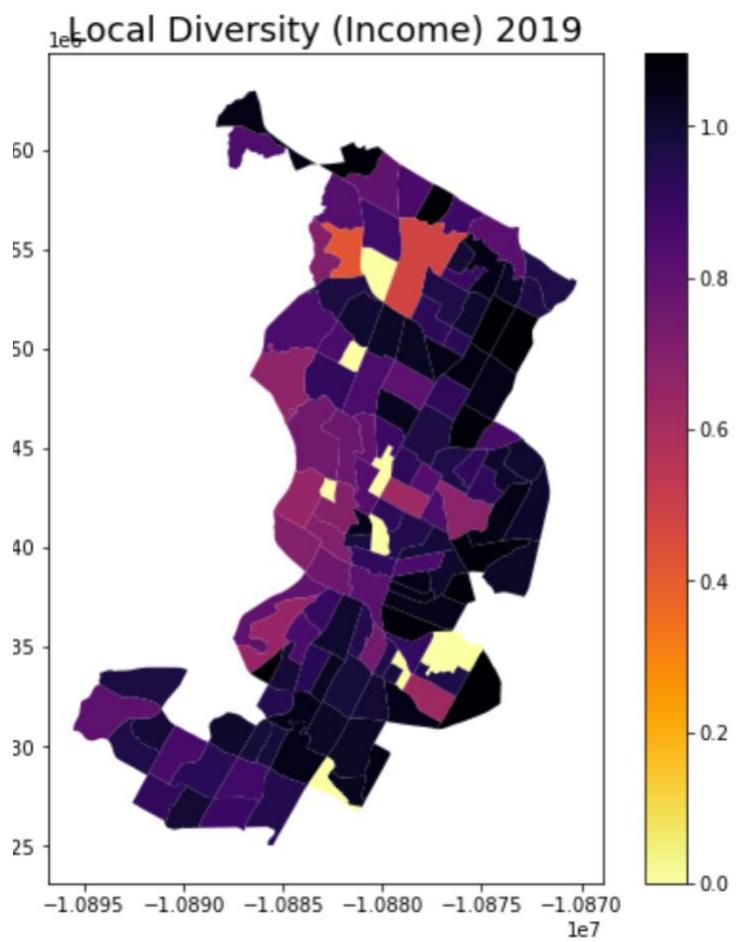
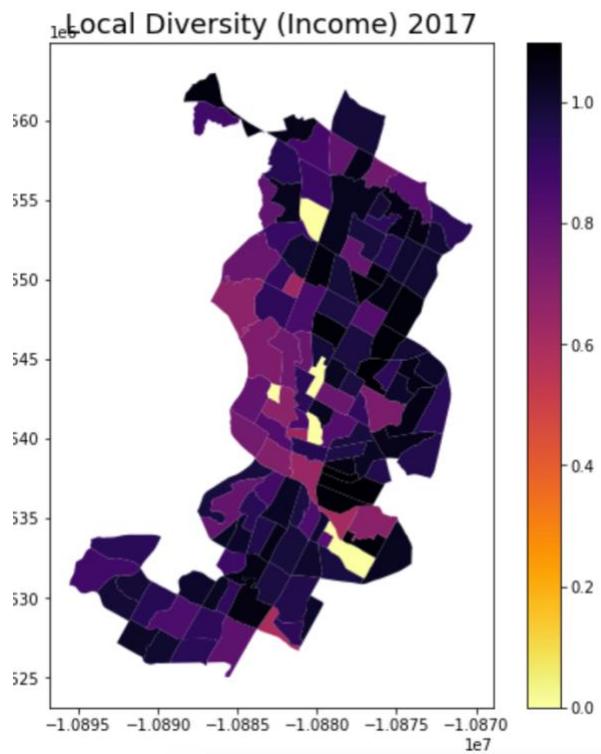






- Income Diversity





- Education Diversity

