Is High Home Sale Price Come Along With High Building Density?

The Relationship Between Home Sale Price and Building Density in Investment Zones

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LARP 743 Geography Software Design
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Introduction

Opportunity Zones

With over $6 trillion in unrealized capital gains in United States, the potential market for reinvestment in real estate is absolutely massive. In trying to take advantage of this incredibly large sum of unrealized capital, the U.S. Congress introduced the Opportunity Zones program in the Tax Cuts and Jobs Act of 2017. Opportunity Zones (OZs) are part of a developmental program that promotes the long-term investment in and development of low-income urban and rural real estate across the United States. The program incentivizes reinvestment in distressed communities by giving investors substantial tax breaks on their capital gains. It can be found in every state in the nation. Each OZ is a selected census tract which requires it have a poverty rate of 20%. (The poverty rate is the ratio ofthe number of people whose income falls below the poverty line; taken as half the median household income of the total population.)

Investment Zones

Inspired by the concept of opportunity zone, in this project, I'm going to build the similar zone called Investment Zone which selected by median household income, percentage of bachelor and unemployment rate in Philadelphia. In these investment zones, I will doing the household value and household density spatial analysis to analyze these relationships and help people find the ideal opportunity of investing real estate.

Data Source

2010 Philadelphia Census Tract Shapefile
2010 Philadelphia Home Sale Price Shapefile

Method

Select Investment Zones
Firstly, I will calculate mean median household income by using the census tract in Philadelphia and select the regions which the median household income higher than the mean.
Then I will choose percentage of bachelor and unemployment rate to select the following regions. According to the above two steps, these selected regions will be built to display the investment zones in Philadelphia.

Spatial Join Home Sale Price
Third, I will use the home sale price point shapefile to spatial join these selected investment zones. It will display the home value level of these investment zones.
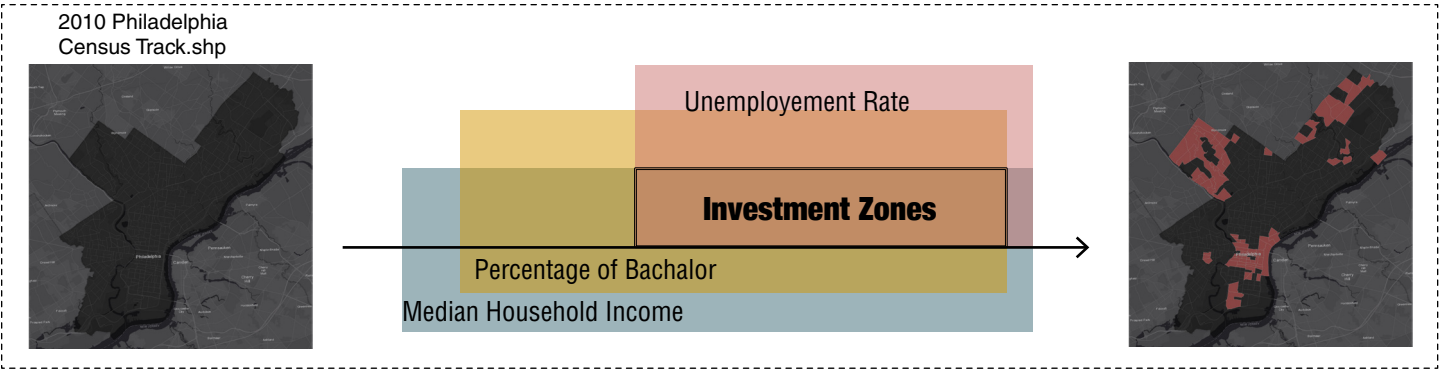
Kernel Density
Finally, using these home sale price points to display the building density in these investment zones.

Comparison
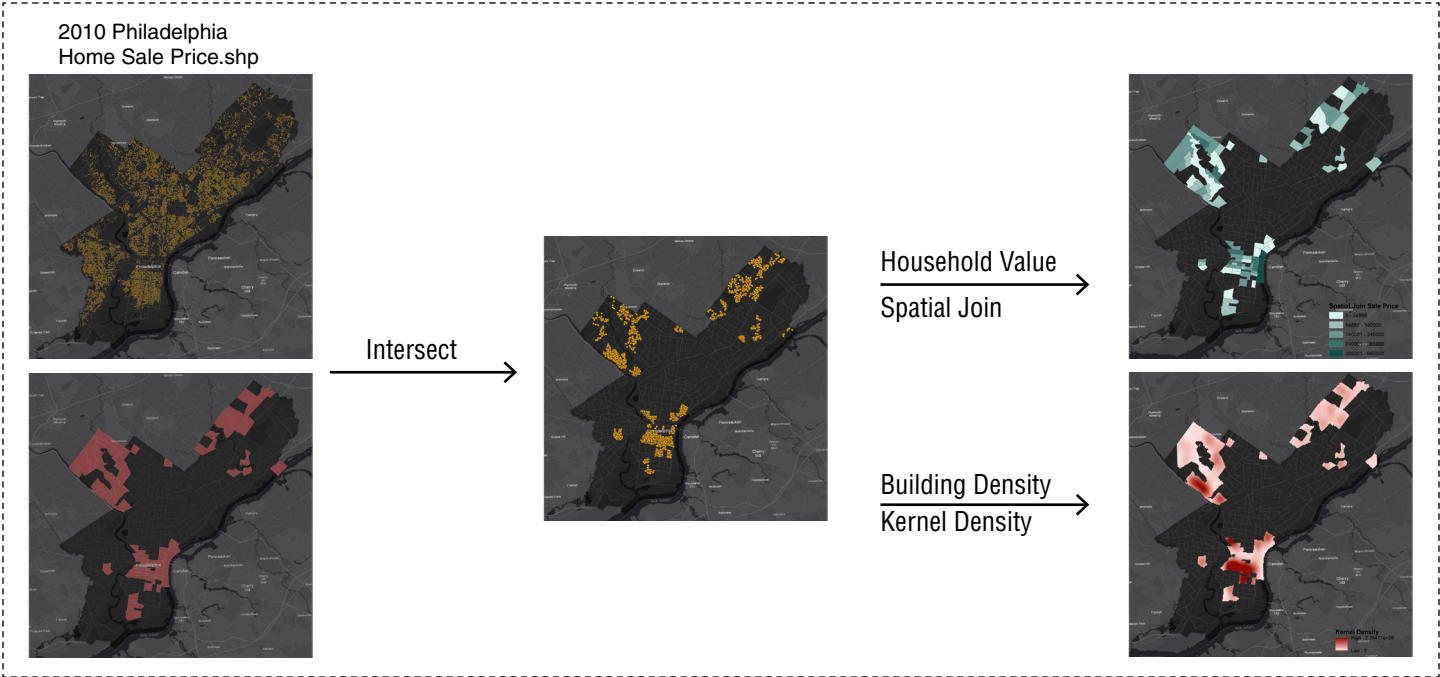In ArcScene , I will overlay the household value and household desity layers to see their relationship.
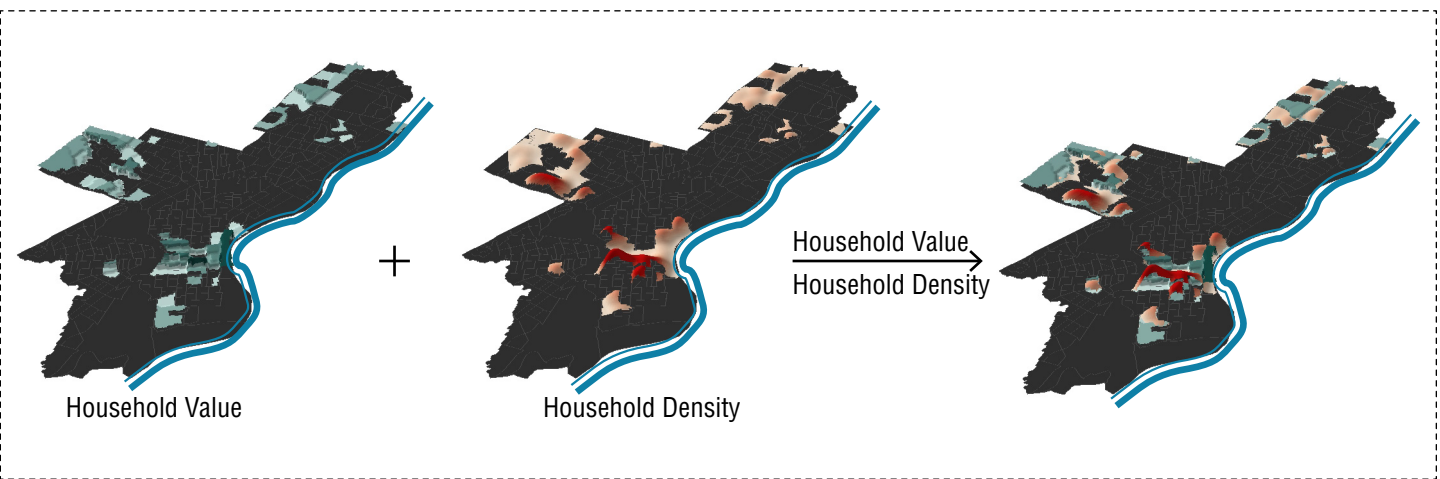
Road Map

Part I: Find Investment Zone

Part II: Exploration and Analysis
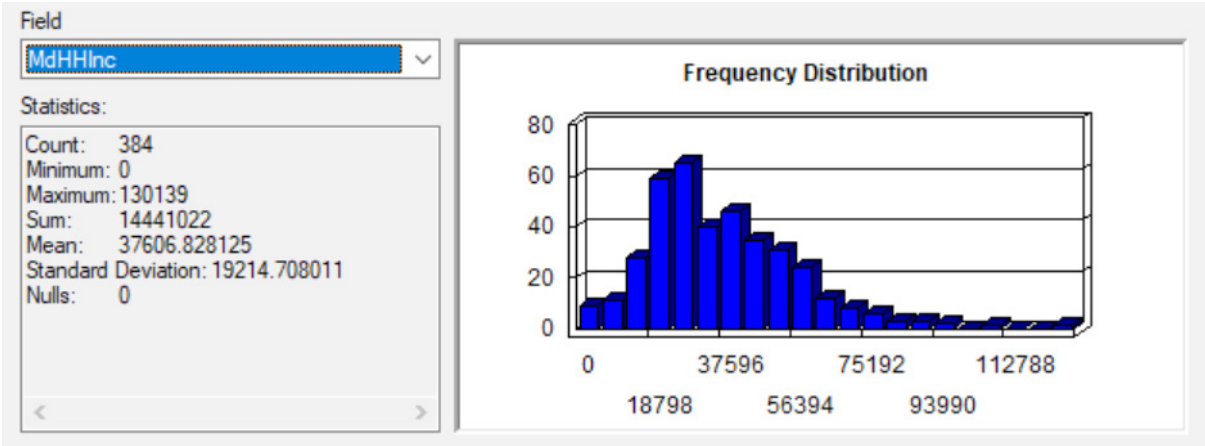

Part III: Visualization

Part I: Find Investment Zone

MEDIAN HOUSEHOLD INCOME > MEAN

Statistics of Median Household Income

The mean median household income is $37606, I will choose this number as the first select condition.


PERCENTAGE OF BACHALOR > 23%

Portrait of Philadelphia

After check the "Philadelphia City Data Population Demographicf" document, the percent of residents who graduated from college is 23%. I will choose this number as the second select condition.
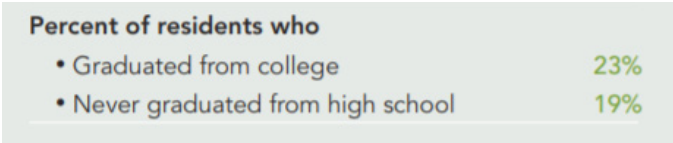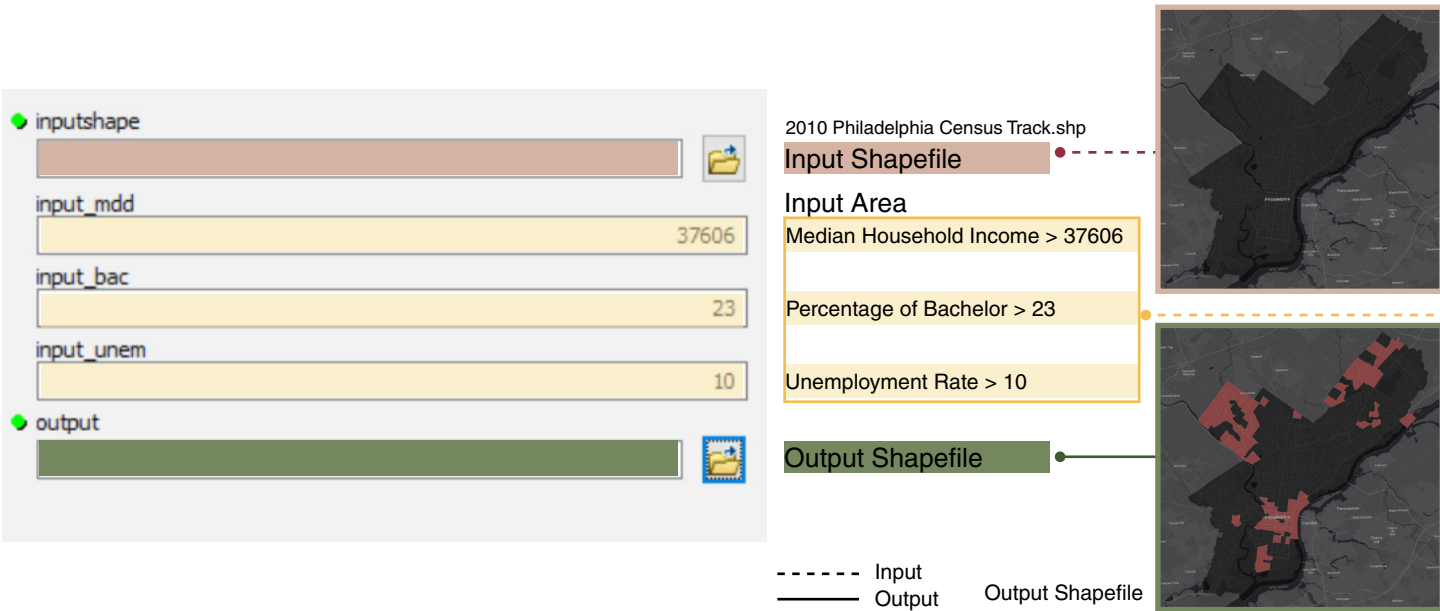

UNEMPLOYMENT RATE > 10%

Because I used the 2010 Philadelphia census tract data, so I check the unemployment rate in 2010. The average unemployment rate in 2010 is 10%. I will choose this number as the third select condition.
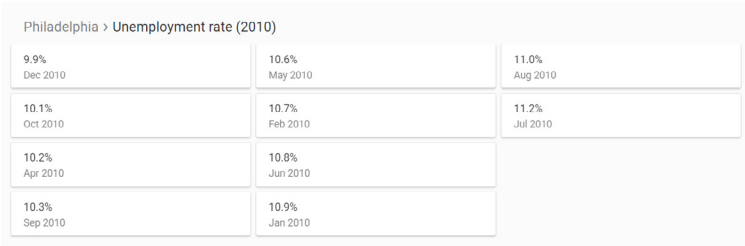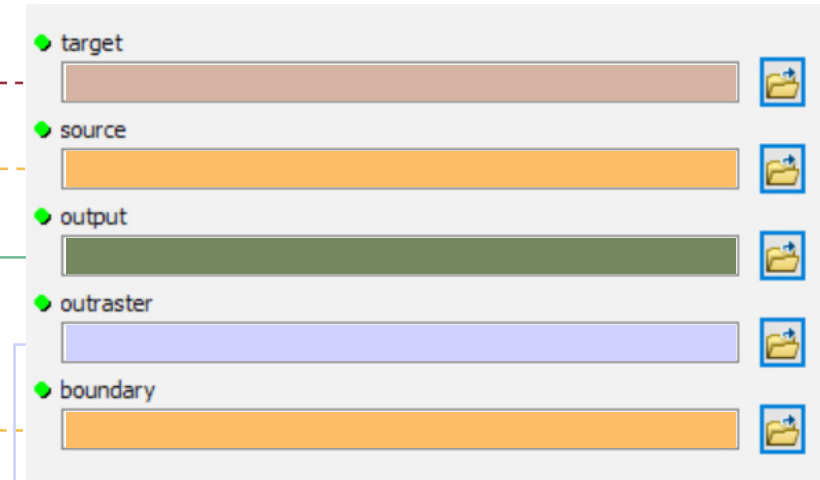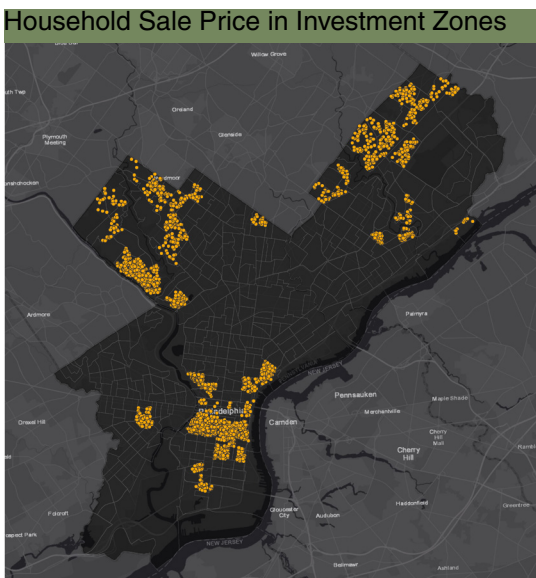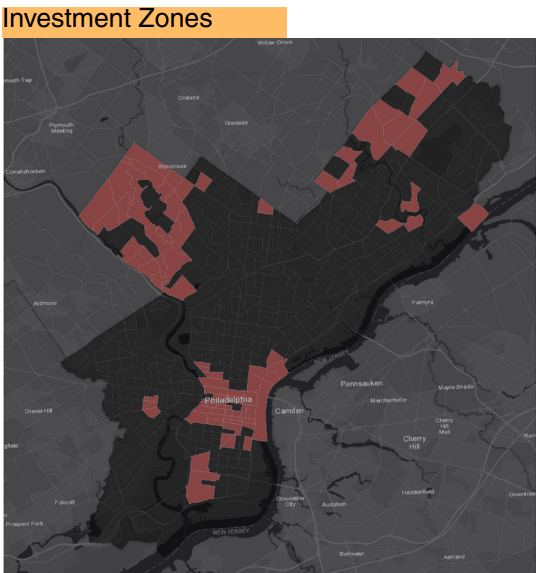

ARCPY: FIND INVESTMENT ZONES

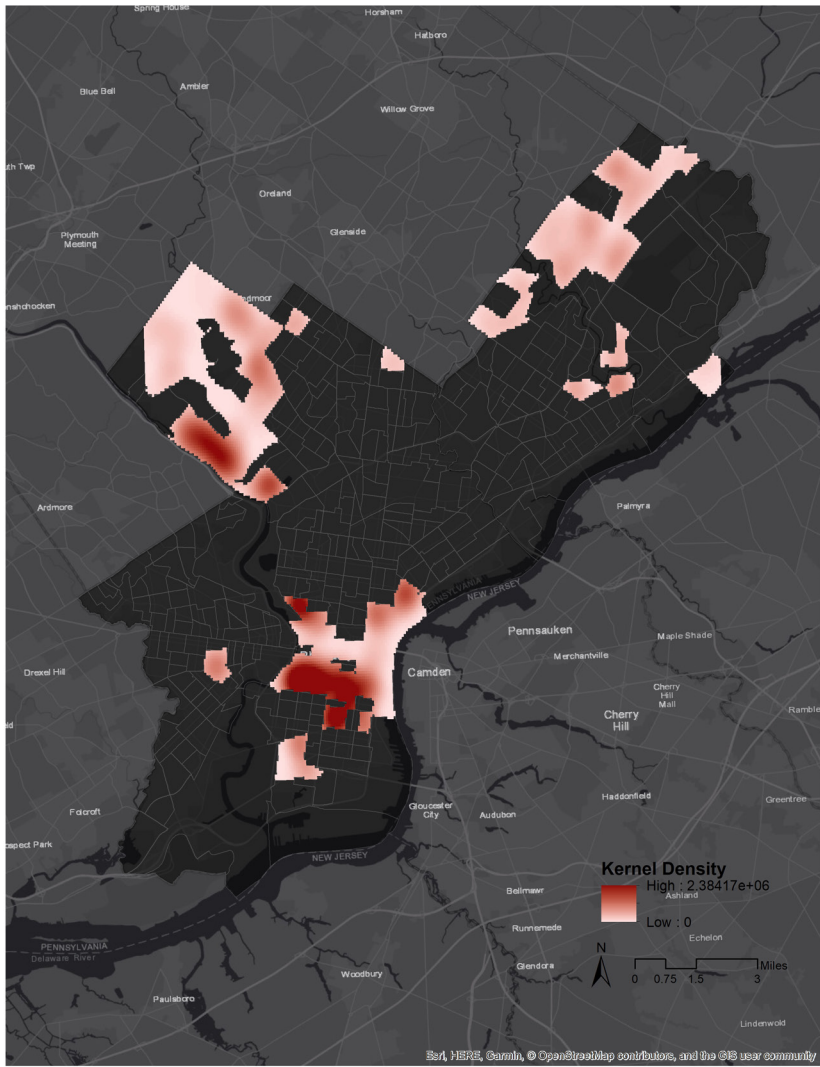# Appendix: ArcPy Script

Find Investment Zones

```python
1.  """
2.
3.  This script deals with basic attribute selection on feature layers.
4.  It takes the area as its selection creteria.
5.  Parameters:
6.      |Displayed Name      |      Data Type      |
7.      |Input Shapefile      |      Shapefile      |
8.      |Input Area           |      Double         |
9.      |Output Shapefile     |      Shapefile      |
10. """
11.
12. import sys, os, string, math, arcpy, traceback, csv
13. from arcpy.sa import *
14.
15. arcpy.env.overwriteOutput = True
16.
17. try:
18. #.........................................................Start
19.     # GetParas & SetEnv
20.     nameOfInputShapefile        = arcpy.GetParameterAsText(0)
21.     nameOfInputIncome           = arcpy.GetParameterAsText(1)
22.     nameOfInputPctBacherl       = arcpy.GetParameterAsText(2)
23.     nameOfInputPctUnemplo       = arcpy.GetParameterAsText(3)
24.     nameOfOutputShapefile       = arcpy.GetParameterAsText(4)
25.
26.
27.     # Create Layers
28.     arcpy.AddMessage('\n' + "Input shapefile: \t" + nameOfInputShapefile)
29.     arcpy.AddMessage("Input Cutting Area: \t" + nameOfInputIncome + "\n")
30.     arcpy.AddMessage("Output shapefile: \t" + nameOfOutputShapefile + "\n")
31.
32.     # Select Input Area
33.     arcpy.MakeFeatureLayer_management ( nameOfInputShapefile, "selected_layer_MdHHInc",
    """ "MdHHInc"> """+str(nameOfInputIncome))
34.     arcpy.MakeFeatureLayer_management ( "selected_layer_MdHHInc", "selected_layer_PctBa
    cherl",""" "PctBacherl"> """+str(nameOfInputPctBacherl))
35.     arcpy.MakeFeatureLayer_management ( "selected_layer_PctBacherl", "selected_layer_Pc
    tUnemplo",""" "PctUnemplo"< """+str(nameOfInputPctUnemplo))
36.     arcpy.CopyFeatures_management("selected_layer_PctUnemplo", nameOfOutputShapefile)
37.
38.
39. except Exception as e:
40.     # If unsuccessful, end gracefully by indicating why
41.     arcpy.AddError('\n' + "Script failed because: \t\t" + e.message )
42.     # ... and where
43.     exceptionreport = sys.exc_info()[2]
44.     fullermessage   = traceback.format_tb(exceptionreport)[0]
45.     arcpy.AddError("at this location: \n\n" + fullermessage + "\n")
```

Part II: Exploration and Analysis

Kernel Density: Building Density

Home Sale Price

Investment Zones

Household Sale Price in Investment Zones

target

source

output

outraster

boundary

Input Shapefile

Output

Output Raster
Kernel Density

Input

- - - - - Input
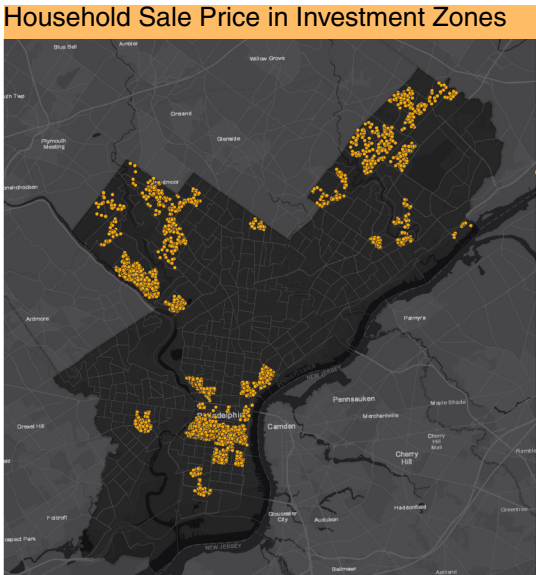———— Output

Kernel Density: Building Density

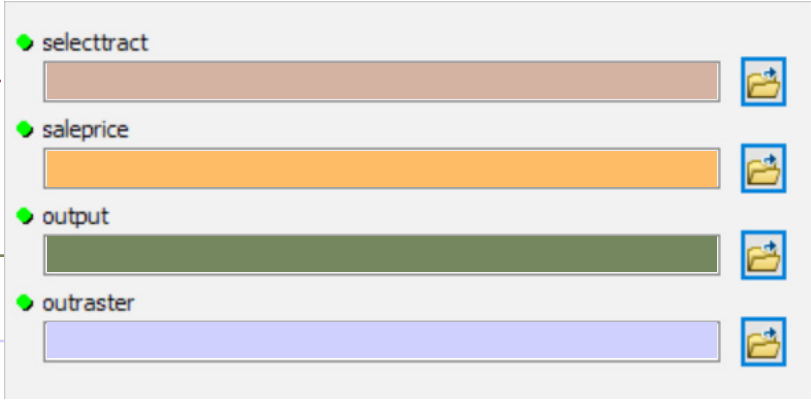Kernel Density
High : 2.38417e+06

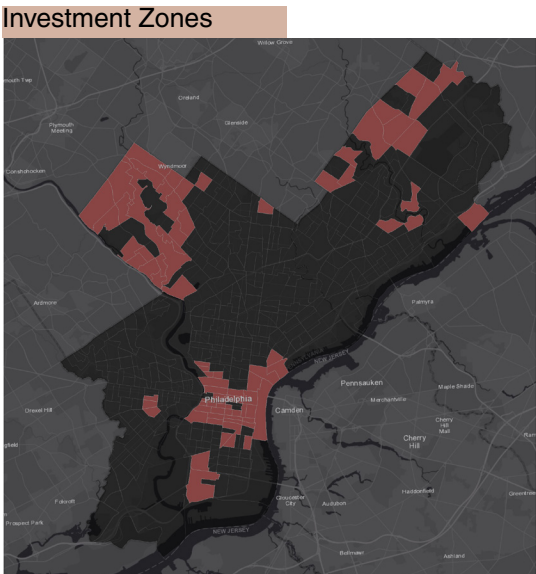Low : 0

Appendix: ArcPy Script

Kernel Density

```
1.  """
1.  """
2.  Parameters:
3.      |Displayed Name    |    Data Type    |
4.      |Input Shapefile   |    Shapefile    |
5.      |Input Shapefile   |    Shapefile    |
6.      |Output Raster     |      Raster     |
7.  """
8.
9.  import sys, os, string, math, arcpy, traceback, csv
10. from arcpy.sa import *
11.
12. arcpy.env.overwriteOutput = True
13.
14. try:
15. #..............................................................
16.     saleprice       = arcpy.GetParameterAsText(0)
17.     selected_tract  = arcpy.GetParameterAsText(1)
18.     out_feature_class   = arcpy.GetParameterAsText(2)
19.     output_raster = arcpy.GetParameterAsText(3)
20.     boundarylayer = arcpy.GetParameterAsText(4)
21. Create Input target and source Layers
22.     arcpy.MakeFeatureLayer_management(saleprice, 'saleprice_layer')
23.     arcpy.SelectLayerByLocation_management('saleprice_layer','intersect',selected_tract
    )
24. Create BoundaryLayer
25.     arcpy.CopyFeatures_management('saleprice_layer', out_feature_class)
26.     inMaskData= boundarylayer
27. Create Kernel Density and Output Layers
28.     outKDens = KernelDensity("saleprice_layer","NONE")
29.     rasteroutput = ExtractByMask(outKDens, inMaskData)
30.     rasteroutput.save(output_raster)
31.
32. except Exception as e:
33.     # If unsuccessful, end gracefully by indicating why
34.     arcpy.AddError('\n' + "Script failed because: \t\t" + e.message )
35.     # ... and where
36.     exceptionreport = sys.exc_info()[2]
37.     fullermessage   = traceback.format_tb(exceptionreport)[0]
38.     arcpy.AddError("at this location: \n\n" + fullermessage + "\n")
```
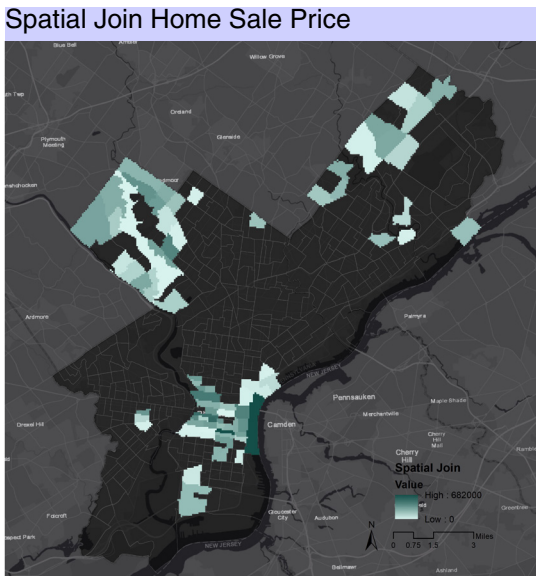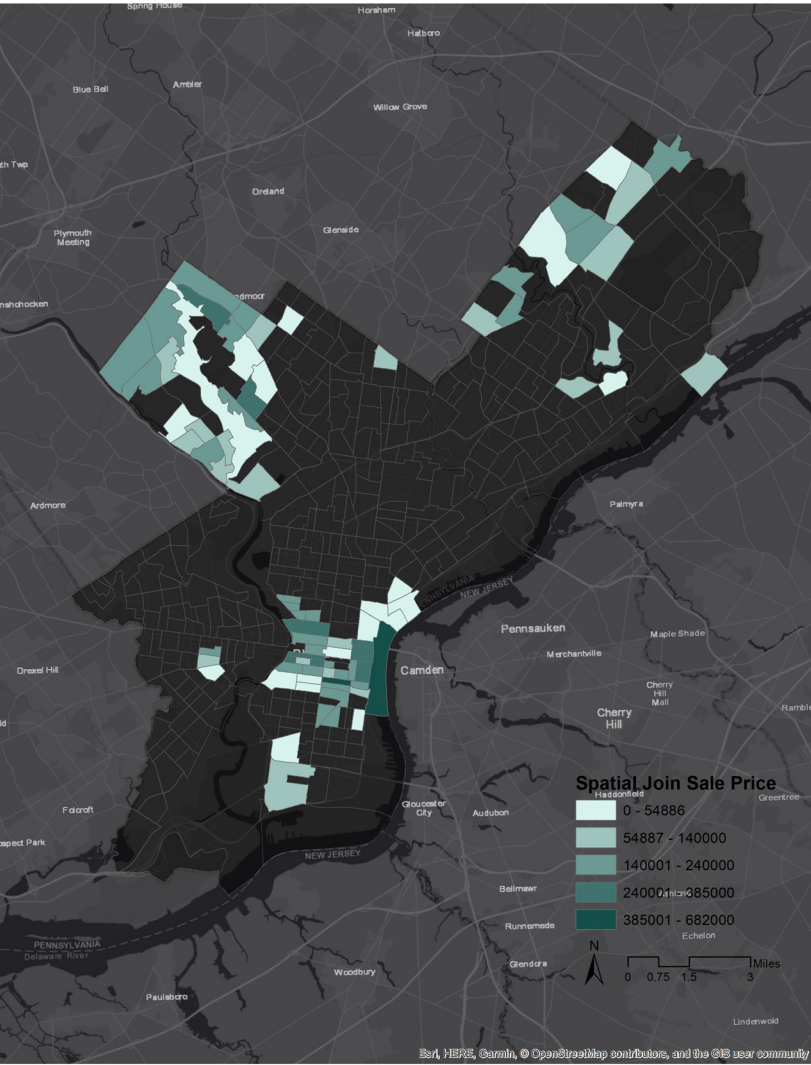
Part II: Exploration and Analysis

Spatial Join Household Value

Investment Zones

Household Sale Price in Investment Zones

Spatial Join Home Sale Price

selecttract

Input Shapefile

saleprice

Input Shapefile

output

Output
Spatial Join

outraster

Spatial Join Home Sale Price

- - - - - Input
———— Output

Spatial Join Sale Price
- 0 - 54886
- 54887 - 140000
- 140001 - 240000
- 240001 - 385000
- 385001 - 682000

Appendix: ArcPy Script

Spatial Household Value

```
1.  """
2.
3.  This script deals with basic attribute selection on feature layers.
4.  It takes the area as its selection creteria.
5.  Parameters:
6.      |Displayed Name    |    Data Type    |
7.      |Input Shapefile   |    Shapefile    |
8.      |Input Shapefile   |    Shapefile    |
9.      |Output Shapefile  |    Shapefile    |
10. """
11.
12. import sys, os, string, math, arcpy, traceback, csv
13. from arcpy.sa import *
14.
15. arcpy.env.overwriteOutput = True
16.
17. try:
18.     #...............................................Start
19.     # GetParas & SetEnv
20.     target_select_features    = arcpy.GetParameterAsText(0)
21.     join_saleprice_features        = arcpy.GetParameterAsText(1)
22.     out_feature_class        = arcpy.GetParameterAsText(2)
23.     out_raster        = arcpy.GetParameterAsText(3)
24.         arcpy.SpatialJoin_analysis(target_select_features, join_saleprice_features, out_feature_class)
25.         arcpy.FeatureToRaster_conversion(out_feature_class, "sale_price", out_raster)
26.
27.
28.
29. except Exception as e:
30.     # If unsuccessful, end gracefully by indicating why
31.     arcpy.AddError('\n' + "Script failed because: \t\t" + e.message )
32.     # ... and where
33.     exceptionreport = sys.exc_info()[2]
34.     fullermessage   = traceback.format_tb(exceptionreport)[0]
35.     arcpy.AddError("at this location: \n\n" + fullermessage + "\n")
```
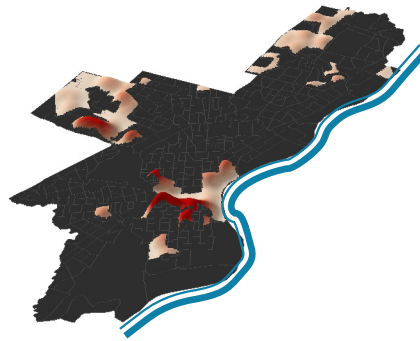
Part III: Visualization

ARCScene

Household Value

The household in the downtown and near the river has a higher value compared to the north and northwest regions. Especially near the river, the household value majored the highest value.

Building Density

In the downtown especially at south of Chestnut street, there has a high building density. And also, there has a high building density at northwest near the street.

Overlay the household value and building density layers, we can see that, in the high household value region, there may not has a high building density. For example, in the downtown, located at the south of chestnut street, there has a high building density, however the household value is not very high. Near the river, there has a high household value, however the building density is very low. Maybe the view of beautyful river sence made the value high. So choose a ideal opportunity should combined consider household value, building density and other factors.
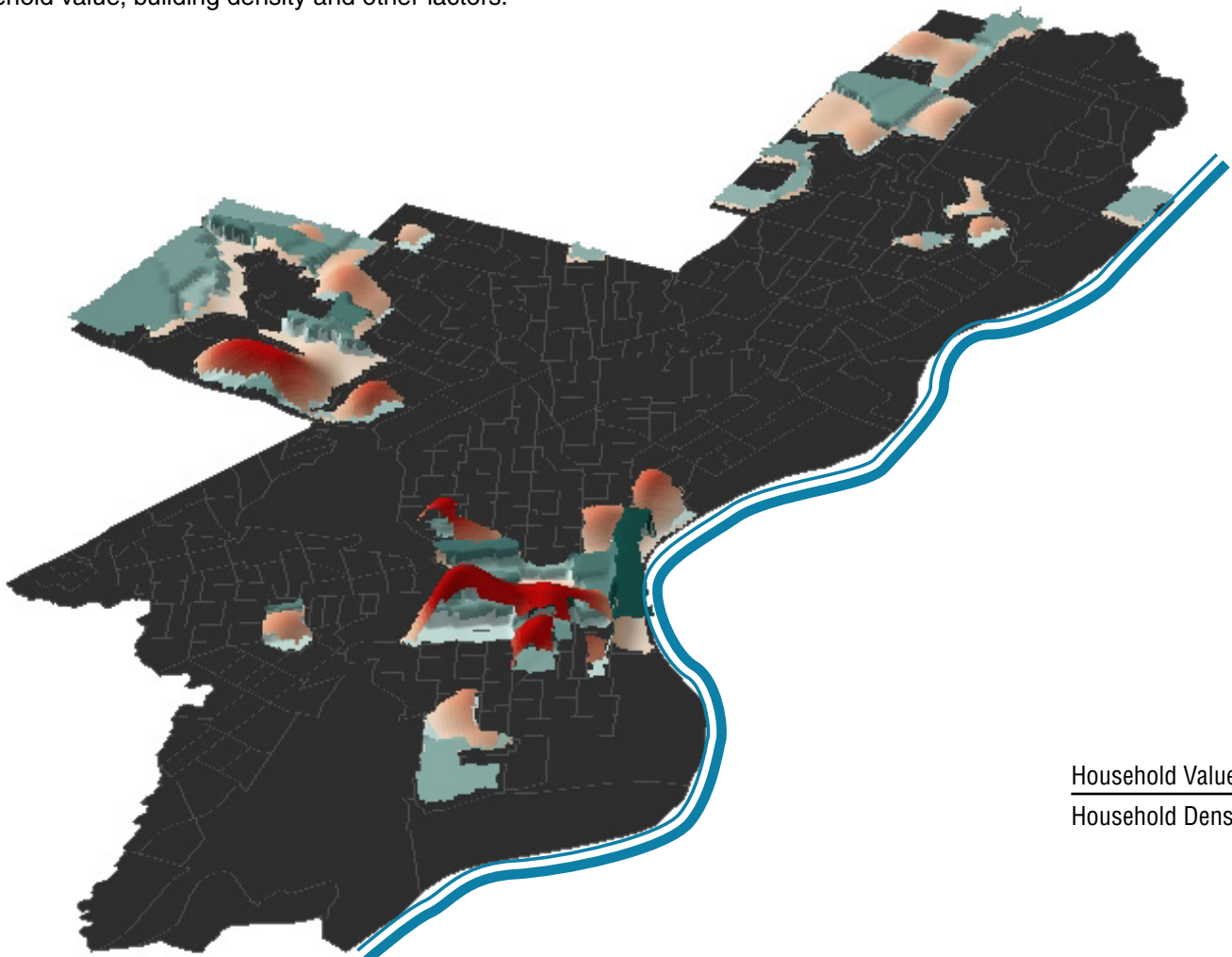
Household Value
Household Density