Adam Dodds

GEOG: 3050

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Trail Accessibility

Research Question & Goal

For my project I wanted to look at trail accessibility in the form of trail access points. By creating an access point feature layer it allows me to use those points in the service area analysis tool, creating walk time distances from the access points. With the walking boundaries determined I can look at other socioeconomic or demographic data of the population within those distances. This can be useful to understand how access is disturbed as well as seeing if access is equitable.

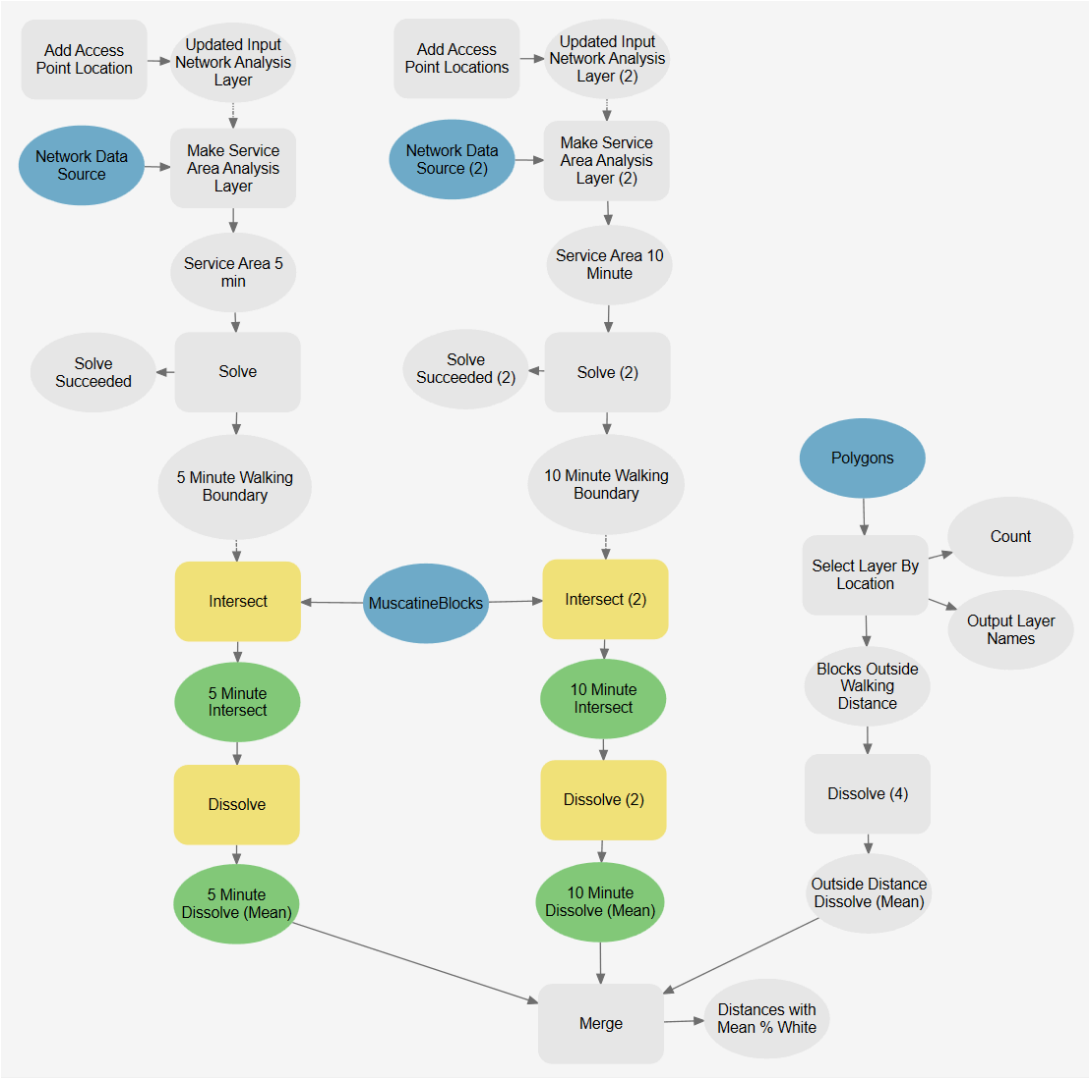
Data Collection

The most important piece of data needed for my project is the access point layer. This was not something that was already available so I manually placed the points. I did this by using the Muscatine trail map as well as referencing google street view and satellite imagery to make sure I was accurately placing points where the trails are. I used Iowa Census data from 2020 at the block level for the demographic data. This file contains data from the U.S. Census Bureau, joined to the 2020 TIGER boundaries. In addition to the raw counts, it also has the percentages within each block which made it more convenient for my analysis. This originally included all of Iowa but I clipped it down to the City of Muscatine. Finally I used residential parcel data for the City of Muscatine. I got this directly from the city's GIS team, but it contains the data on their website, beacon (MAGIC), where all parcel values are available to view but you can't directly

download from, this also means the data is current (2024). In total this included 9,500 parcel records.

Methodology and Workflow Model

Below is my generic workflow model of the way the code runs.



To start, it is mostly broken up into three sections which merge together at the end. At the top it creates a service area analysis layer, to that layer I add the access points, these become the facilities in the service area layer. There are two of these, one for the 5 minute walking distance and one for the 10 minute walking distance. Solve will run the tool to create the boundaries. For

each respected distance they get intersected with the Muscatine Blocks layer and dissolved into one polygon, in the dissolve I use the statistics field of my desired variable to get the mean of the entire intersection. The block on the right uses the selection by location tool to select the blocks that fall outside the 10 minute walking distance and again dissolve those blocks into a single polygon with the single value variable average. Finally the three dissolved layers get merged together to allow for simpler analysis such as creating charts and having all of the information on a single layer.

While this is a pretty specific project it could be utilized by any city or community given they had the resources to create their own access point layer. With the access point layer the use cases become much larger, for my project I chose to look at only a few variables but another community might have goals in mind as they are looking to create new trails and want to get a better understanding of how they can best serve their population, making sure access is distributed equally.

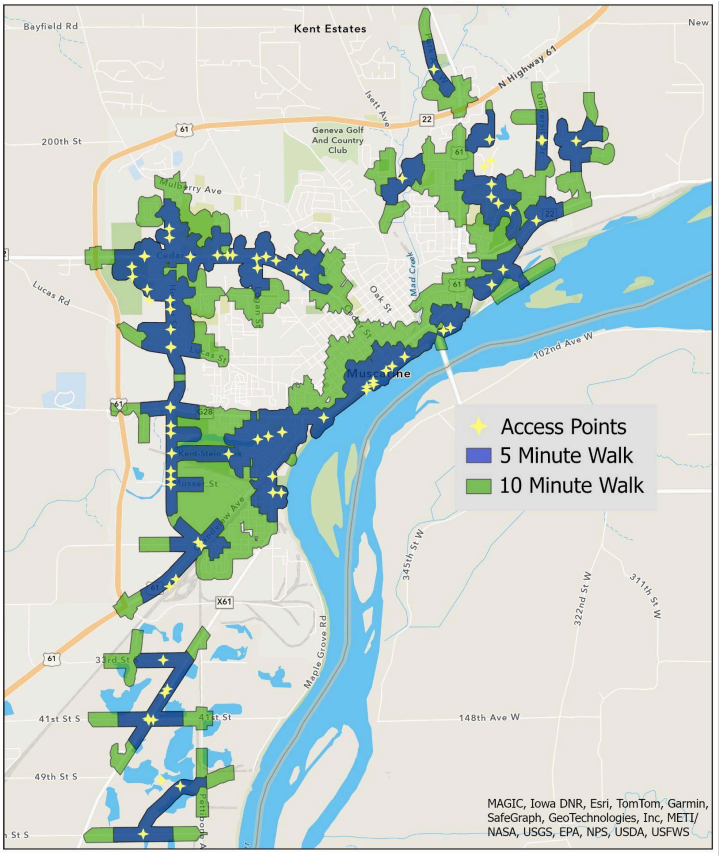
Results

For my project specifically I chose to look at my hometown of Muscatine, Iowa. I wanted to look at a demographic variable (percent white) and a socioeconomic variable (parcel value). This allows me to see if there is any correlation between someone's access to trails and my chosen variables.

Using the code below, this creates and runs the 5 minute walking distance. The same code is used to create the 10 minute walking distance.

```
# Define inputs for the service area analysis
network ="https://www.arcgis.com/"
points_layer = "AccessPoints"
output_folder = "C:/Users/Adam/Desktop/3050_project/3050_Project/3050_Project.gdb"

# Create a feature layer from the access points
arcpy.MakeFeatureLayer_management(points_layer, "points_lyr")

# Create a service area layer for 5 minute walking distance
output_5min = output_folder + "/5min_Walk.shp"
arcpy.na.MakeServiceAreaAnalysisLayer(network, "ServiceArea_5min", "Walking Time", "FROM_FACILITIES", [5], None,

# Add the points layer to the service area layer
arcpy.na.AddLocations("ServiceArea_5min", "Facilities", "points_lyr", "Name OBJECTID #;CurbApproach # 0;Attr_Min

# Solve the service area layer for 5 minute distance
arcpy.na.Solve("ServiceArea_5min")
```

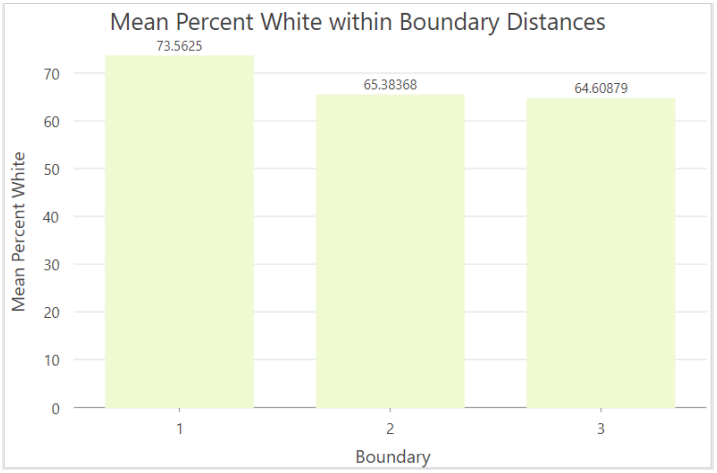
Just by creating these service areas is a good way to visually understand areas of access and to see where trails could be most impactful throughout the city.

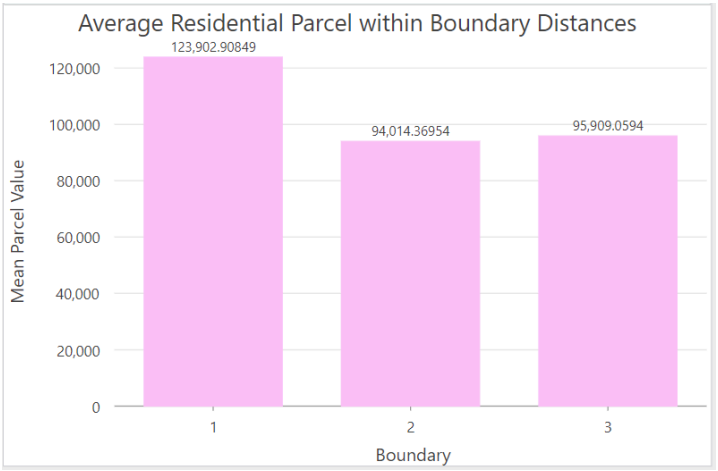


Using the layer with the three merged layers I created a chart using the code below to look at the difference in percent white at the three different intervals, the same code used to generate a chart for average residential parcel values.

```
#creates a bar chart for percent white at the 3 different boundaries
aprx = arcpy.mp.ArcGISProject("current")
map = aprx.listMaps()[0]
censusLayer = map.listLayers('Layers_Merge')[0]
chart = arcpy.Chart('MyChart')

chart.type = 'bar'
chart.title = 'Mean Percent White within Boundary Distances'
chart.description = ''
chart.xAxis.field = 'OBJECTID'
chart.yAxis.field = 'MEAN_PCT_P0020005'
chart.xAxis.title = 'Boundary'
chart.yAxis.title = 'Mean Percent White'
chart.addToLayer(censusLayer)
```

Below are the two final charts, the x axis is locked to the object id which can not be edited so 1 is outside walking distance, 2 is 10 minute walking distance and 3 is 5 minute walking distance.





Discussion and Conclusion

The results of this project did surprise me, while I did expect a correlation to be present I would have expected somewhat of the opposite of what was found. By looking at the mean percent white chart we can see that the largest percent white is the group that is not within a walking distance and drops by 8% going to the 10 minute boundary with 5 minutes just a percent below the 10 minute, meaning the lowest percent white on average has the closest access to the trial network. Parcel value shows a similar trend, with the highest average at $123,900 not being

within walking distance, while the 5 and 10 minute boundaries have an average value $28,000 less and are within walking distance to an access point.

I think this can be a useful start to developing a more equitable trail network in a city, for me growing up and knowing Muscatine this does make sense as some of the most expensive residential properties are in neighborhoods just outside the city limits where the trails don't connect, these areas are also blocks with some of the higher percent white within the whole study area.

The main limitation to my project is the need for the access point layer, most cities with trails usually have some kind of trail map so it could be created pretty quickly. Another use case for this could be to look at drive times to access points outside of a walking distance. For Muscatine a large portion of the population can only access the trails by driving. It would be important to make sure there is parking available.

Overall I learned a lot more about writing code throughout this project, getting a better understanding of what could be a practical use case for creating a program that could be easily utilized in multiple ways as well as in other areas. I think my code could still be greatly improved.