



# ANALYZING THE METRO'S STATION AREA DENSITIES

Washington, DC

## Introduction

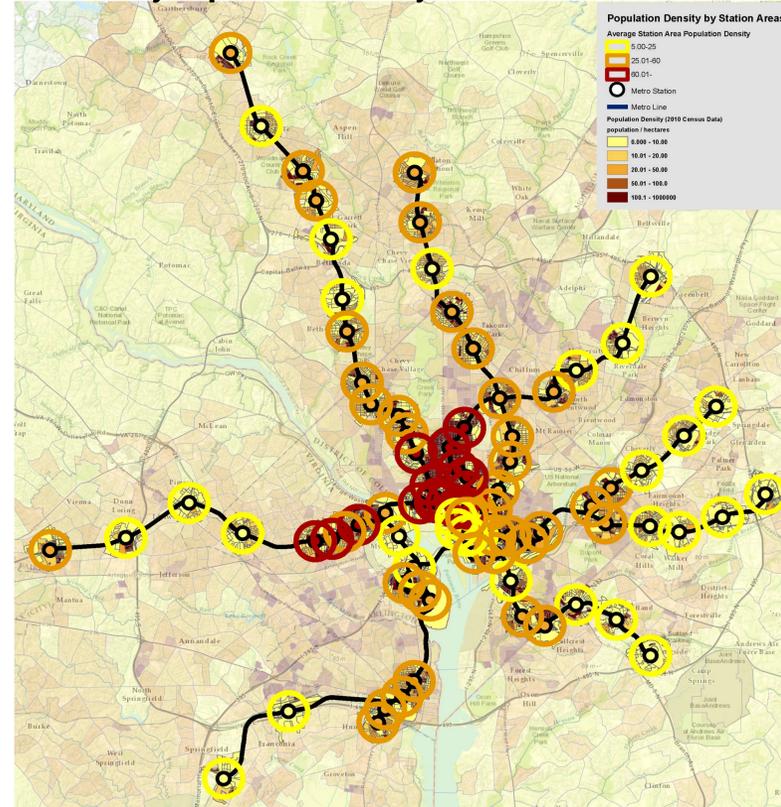
This study analyzes the Washington, DC Metro system, and the types of development and levels of density that exist around its stations. In order to do so, and to analyze the way in which stations relate to their surroundings in different ways, I look at levels of both population and employment density within a defined radius of each station. There are a number of different types of Metro stations, and these stations can be roughly categorized by the way they relate to their surroundings. Some stations are located in compact, urban settings, serving as both a resource for local residents and a destination for employees of the area. Some stations exist exclusively as employment hubs, while others are primarily origins of commuting trips. By looking at levels of population and employment density, we may come to a better understanding of the different ways in which the Metro is used, and even begin to categorize these stations by the densities that surround it. In this project I place stations into three different levels of average population density and employment density within a certain radius. Then, to further our understanding of the way the Metro is used at different stations, I look at the combined level of population and employment density, as well as the levels of ridership at each station. This study of density relative to transit could lead to conclusions about the role of transit on development patterns, and the role of transit within the larger transportation landscape.

## Procedure

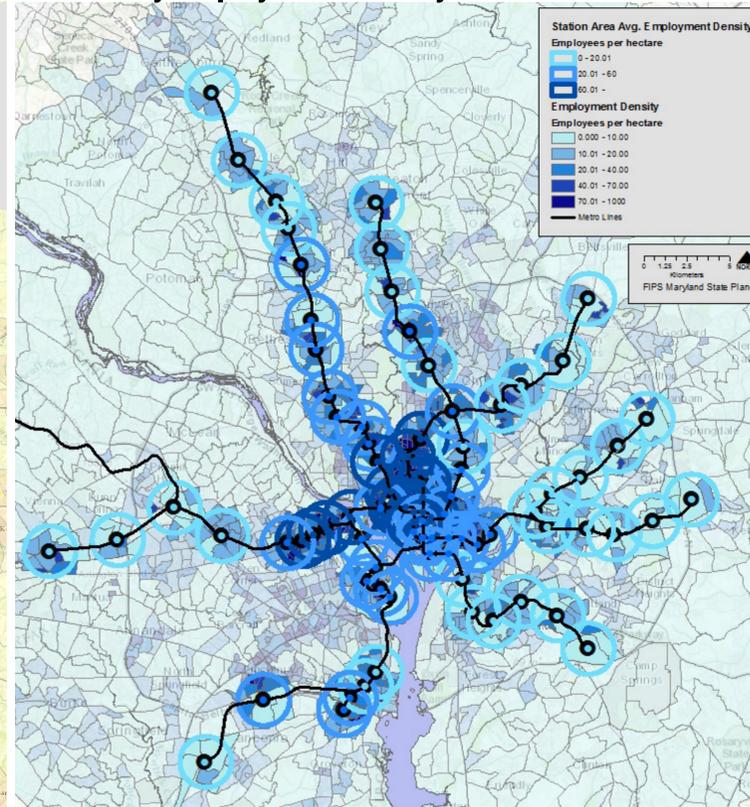
I use a simple geoprocessing procedure to answer my primary question about the relationship between transit and density. For the case of population density, for which I was able to obtain census block level data, I create a buffer of 1km around all Metro stations, use the "Select by location" tool to create an output of census blocks with their center within 1km of a Metro stop, and create a feature layer from those blocks for which we find summary statistics. For the case of employment density, I used census block group data, and repeated the same process with a radius of 1.5km rather than 1km.

After identifying the census areas that are proximate to the Metro, I then added a classification of Metro stations and their surrounding areas, to get a clearer view of the levels of density and development that exist around stations. By categorizing stations, we can now begin to see the difference between stations' uses, whether they be surrounded by transit-oriented development or stations that are designed for "park-and-ride" commuters. In order to model the station areas in this way, I had to change the "dissolve" operation in my buffer from "ALL" to "NONE", in order to distinguish between the different buffers. After that, I used a spatial join between the nearby census blocks and the buffer zones, and was able to find the average population and employment density per hectare of the census areas defined as proximate to each station. I then used these values of each station's aver-

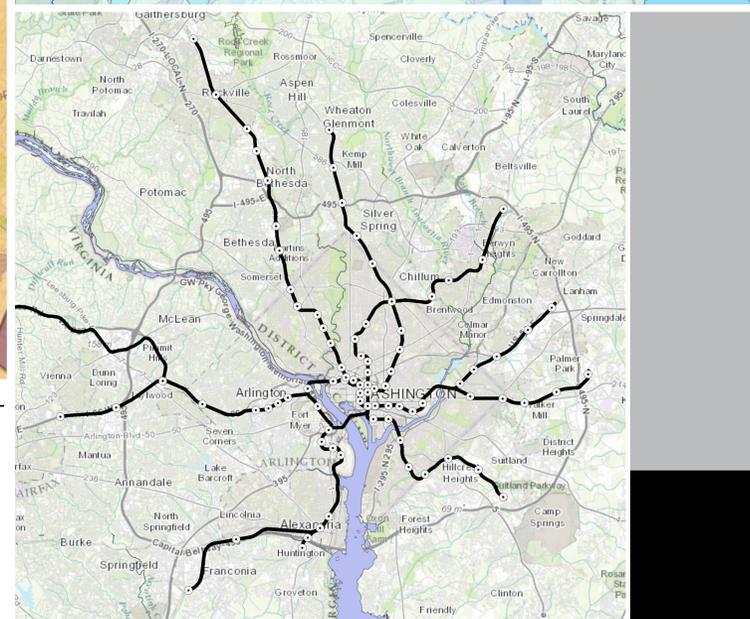
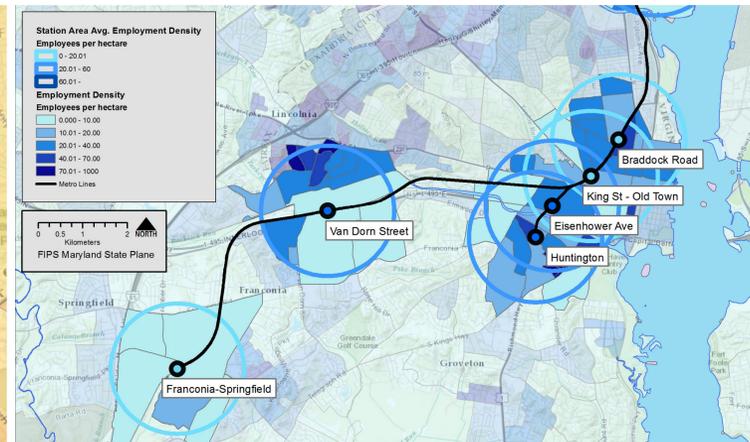
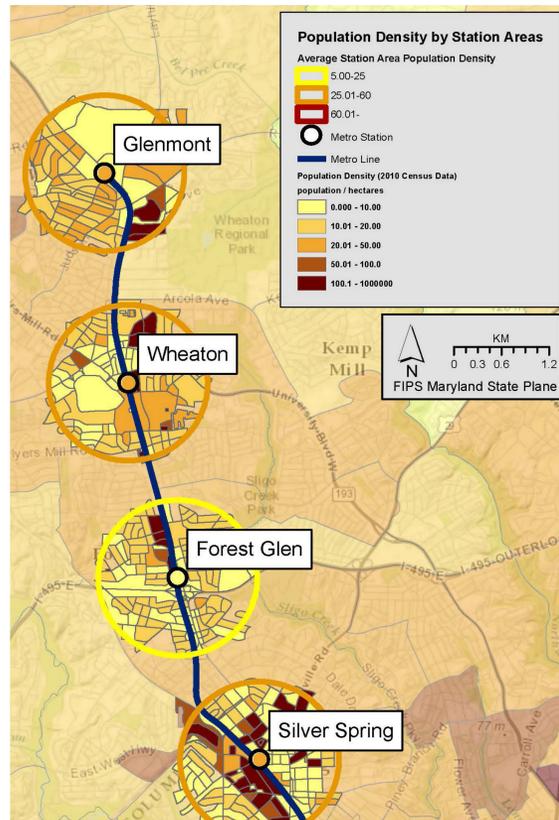
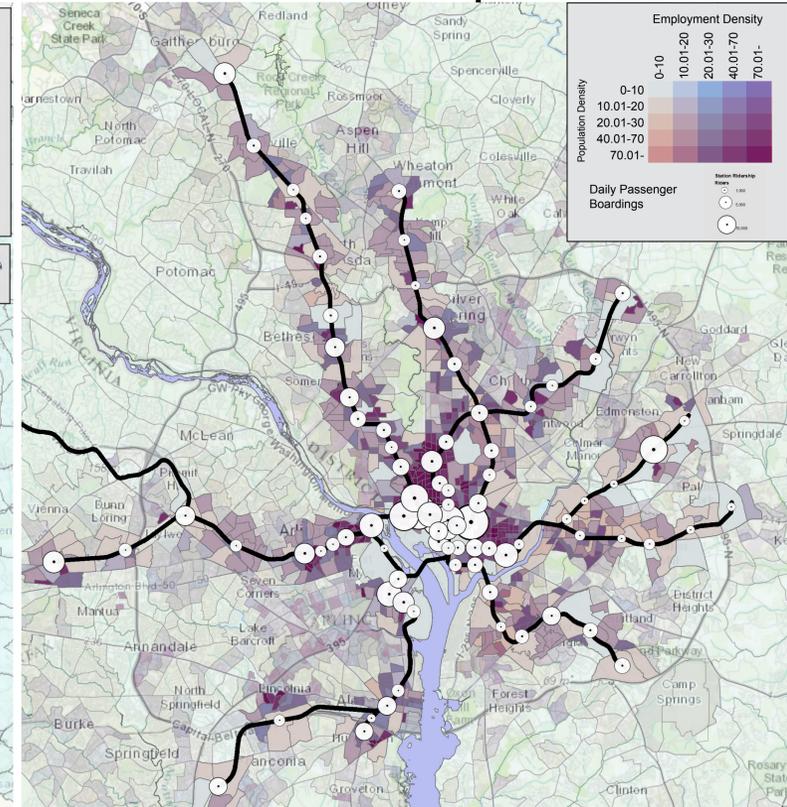
## Stations by Population Density



## Stations by Employment Density



## Combined Densities and Ridership



## Critical Aspects and Limitations

The most critical aspect of my model is that the buffer accurately represents the station area, and creates clusters of census areas that serve their purpose of representing the development around stops. Ideal data would be able to take many more factors into account, such as land use zoning, green space, and other outside factors. In addition, our data is not always as fine-grained as we would like it to be, especially when we are forced to use block group data rather than block data. This chunkier data set creates problems for the way that station areas are selected, as it is more difficult to have block groups that fit neatly within the defined distance of the station. We also experience the modifiable area unit problem for this block group data.

The idea of this study is to learn about the way people cluster around and utilize transit, but perhaps we may only be able to find an interesting statistic, rather than a significant conclusion. In the real world, populations cluster in a variety of ways for a variety of reasons, and, even with far more expansive data than provided here, it is impossible to account for all of these different reasons. With transit, there is also the problem of reverse-causation, as often times transit stops are located where there are already dense populations of people. Nonetheless, this compilation of maps serves as a useful visualization of the types and levels of density and development that exist around Metro stations, and the number of potential transit users that surround each station. By looking at these patterns of station area density, and comparing them to each station's daily ridership, we may better understand levels of transit usage and different ways the Metro relates to the areas around its stations.

age surrounding population and employment density to categorize the station areas.

For the last of my maps, employment density by block group is overlaid on top of population density by block group, using primary colors and transparency to create a visualization of the volume of potential transit users (i.e. those who either live or work within 1.5km of the Metro) for each station.