Examining connectivity and weather on bike share use

**INTRODUCTION**

In many cities and towns throughout the United States, municipalities are planning for the inevitability of climate change. Climate change threatens to disrupt transit systems in a myriad of ways—ranging from higher temperatures wiping out train tracks to extreme storms flooding other available routes. Building a diverse system is key to providing a resilient suite of transportation options for residents. However, if bike sharing is to be a part of this system, it is important for planners to understand how climate change may impact users’ willingness to ride. The literature shows that bike sharing usage is highly susceptible to weather, especially for casual riders. In addition to the damage caused by snow piles and the discomfort caused by rain, humidity and heat can both factors in most user preferences. In cities with more extreme climates, like Minneapolis, this can lead to significant changes in system use. As these changes prepare for the impacts climate change will have on extreme temperatures, understanding current heat events is critical to understanding future ride behavior.

In this study, we will examine Minneapolis bike sharing data to understand how extreme heat events impact usage patterns. We will focus on impacts of extreme heat events which we will define as over 90 degrees Fahrenheit, as this is the difference between “warmths” and “summer-like” terms of the Nice Ride program. We will also look at how the differences between “warmths” and “summer-like” terms change over time. In this study, we are interested in understanding where users are riding bikes.

**METHODS**

Data:
- Nice Ride trip history data, joined to station location data
- National Oceanic and Atmospheric Administration (NOAA) weather monitoring stations
- Hennepin County bike and road network shapefiles

Analysis:
- Build a network dataset from the bike network and road layer using, intersecting the two and adding an attribute table. In my experience, the bike share dataset from the National Oceanic and Atmospheric Administration (NOAA) is a useful dataset for urban planning. It’s not perfect, but it’s a good start. We can use this data to see what the impedance was if users were to ride single-digit bikes.

To perform the Origin-Destination (OD) Cost Matrix analysis, we first need to determine the average time it takes for an individual to ride from one station to another. This can be achieved by using a tool like the Network Analysis tool in ArcGIS. The tool takes into account the distance between two points and the time it takes to travel that distance.

**RESULTS**

Casual users accounted for a large share of rides, and their destinations were highly clustered in the three stations around U of M but not around Lake Harriet. However, the Chain of Lakes has been attractive to wealthier residents with their lake homes throughout the area. This neighborhood also attracts many tourists, and easily connects to the wealthy southwestern suburbs. However, these stations are not as well connected to the rest of the Nice Ride system. The areas of the city north of downtown are also the least connected to the rest of the Nice Ride system, making it vital to resiliency planning as climates change. Bike share organizations leverage resources more efficiently than other modes and are the most bike-centric on exceptionally hot days. It is also the least constrained to the rest of the Nice Ride system, improving the bike network to connect these stations to areas across these zones.

**CONCLUSIONS**

Understanding how different user types interact with a bike share system can help policy makers and the administrators of bike share organizations leverage resources more efficiently. Bike share is an important part of a resilient public transportation system, making it vital to resiliency planning as climate change continues.

For future analysis, I would recommend examining the connectivity of bike stations in particular neighborhoods. Minneapolis is highly segregated, with neighborhoods separated by non-continuous bike paths, education, income, etc. This city is also rapidly gentrifying and many casual residents are disappointed by the emphasis being placed on amenities for “creative class” residents. If bike share is to be an equitable system, it must ensure that all users are served equally.