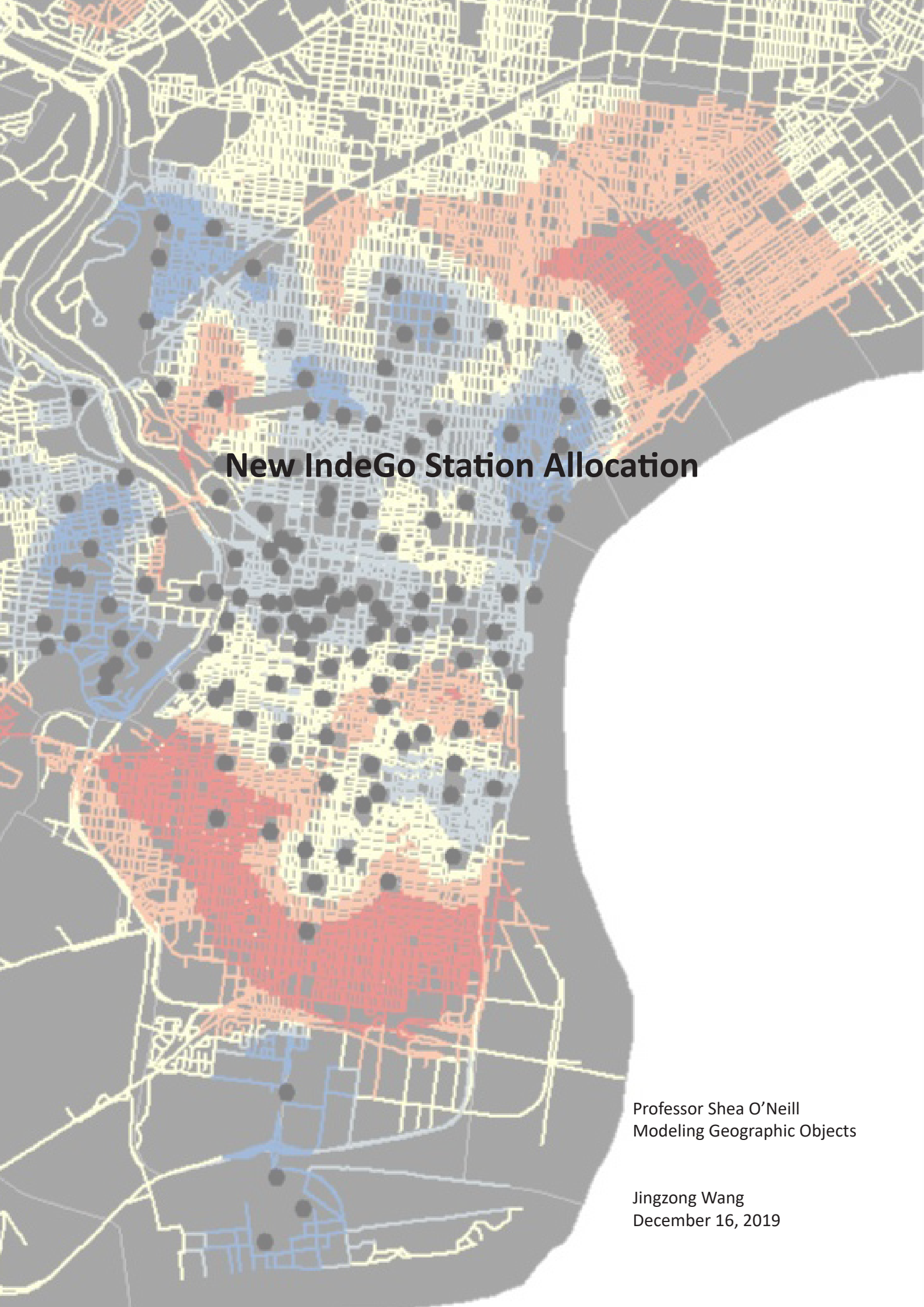


New IndeGo Station Allocation

Professor Shea O'Neill
Modeling Geographic Objects

Jingzong Wang
December 16, 2019

ABSTRACT

The purpose of this research is allocating new IndeGo bike stations in Philadelphia in the next two years by using GIS. Demand/Supply gap analysis is used in this study in order to find sweet locations. In terms of supply, based on the station data, this study measures the accessibilty of IndeGo bike for a given location. True demand includes existing demand and potential demand. In this study, existing demand is measured by summing trip data in 2019. Potential demand is estimated by two ways. The first one is based on the increasing demand from 2018 to 2019. Another way is figuring out the density of population who usually ride bike or walk to wotk. By integrating these spatial elements on the street level and taking existing stations into consideration, this research finally identified 40 locations for new bike stations in Philadelphia.

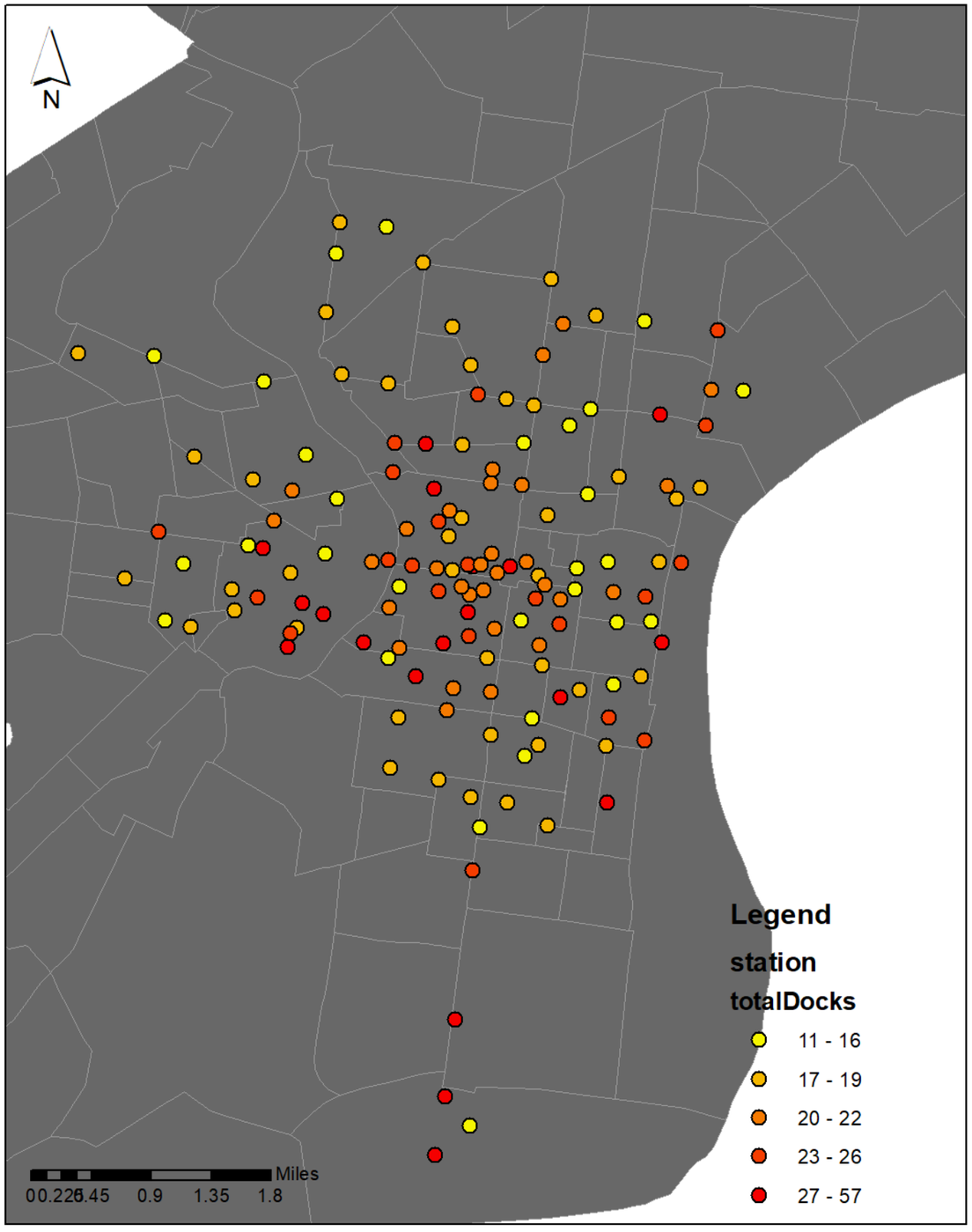
Demand/Supply gap = Existing Demand + Potential Demand - Supply

DATA SOURCE:

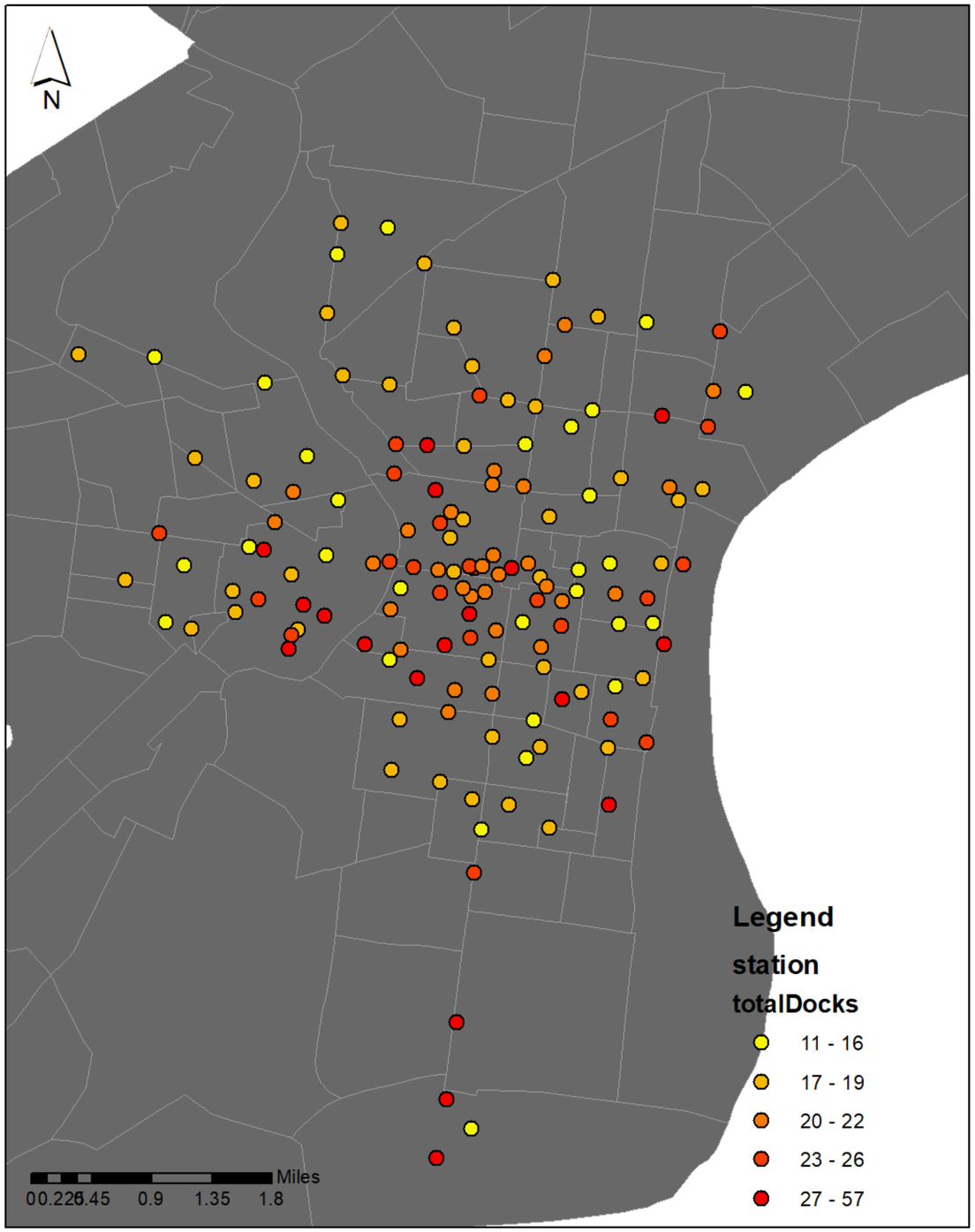
IndeGo Data:
https://www.rideindego.com/about/data/

American Fact Finder
https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

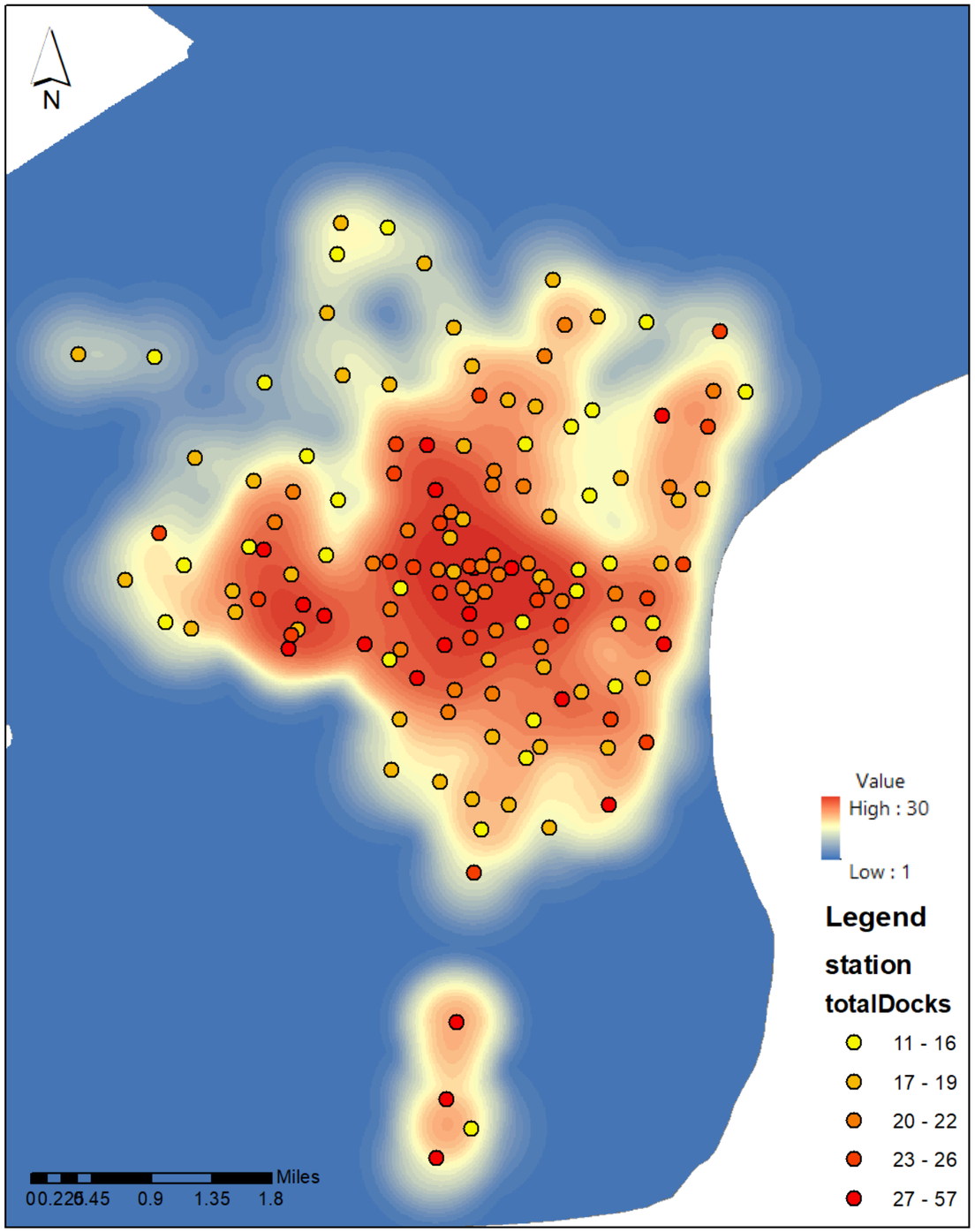
2018 IndeGo Station



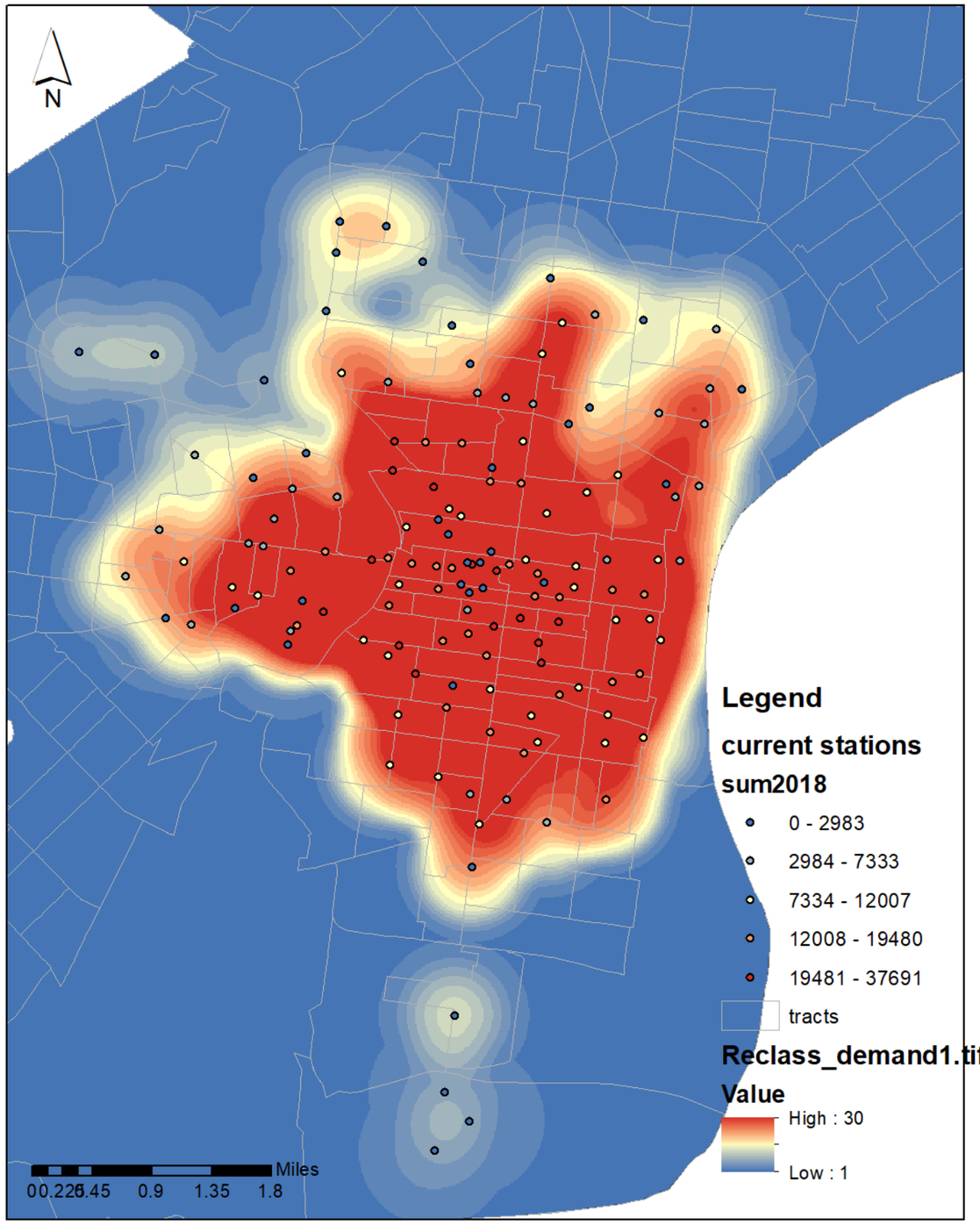
THE NUMBER OF DOCKS FOR INDEGO STATION



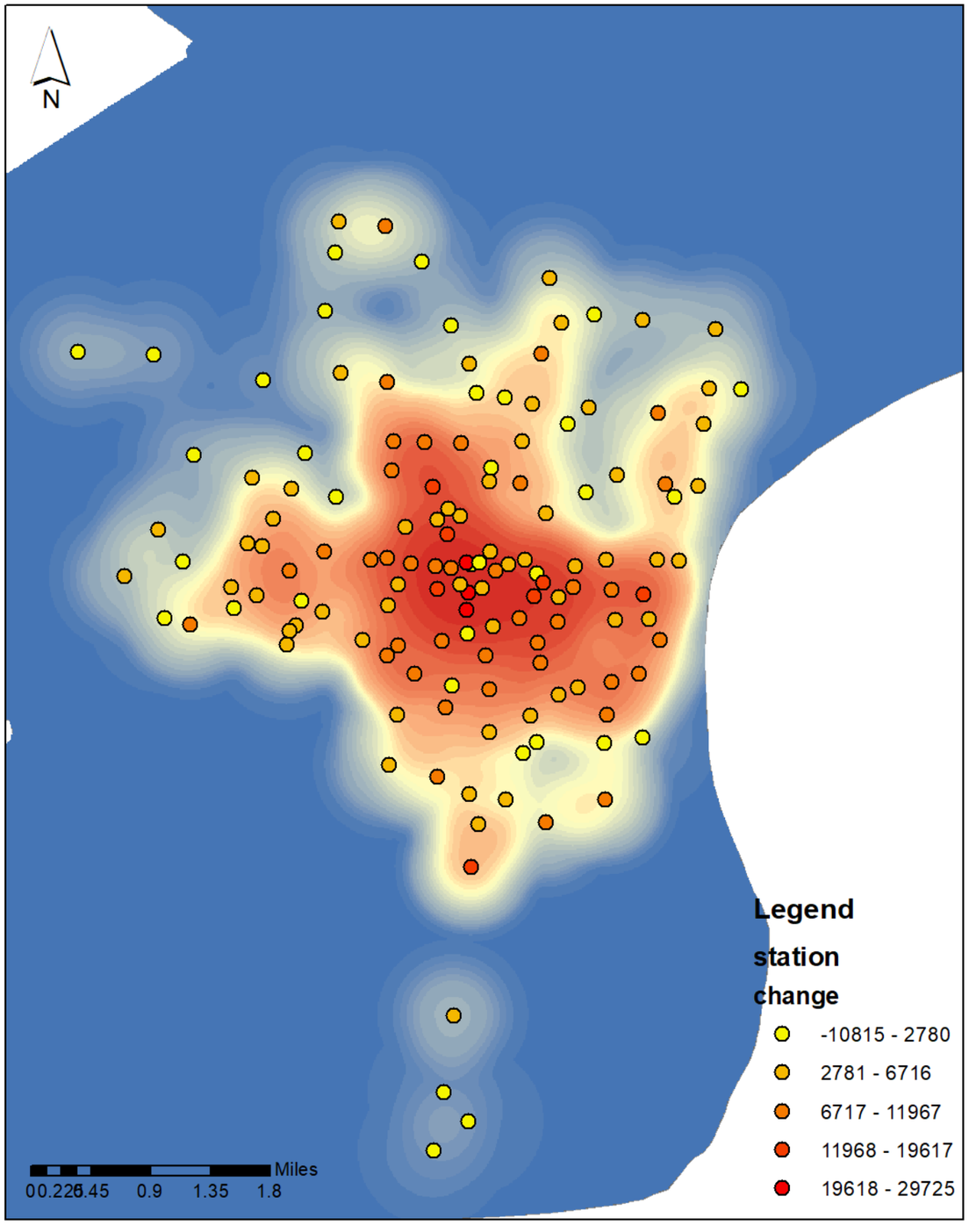
SHARE BIKE SUPPLY



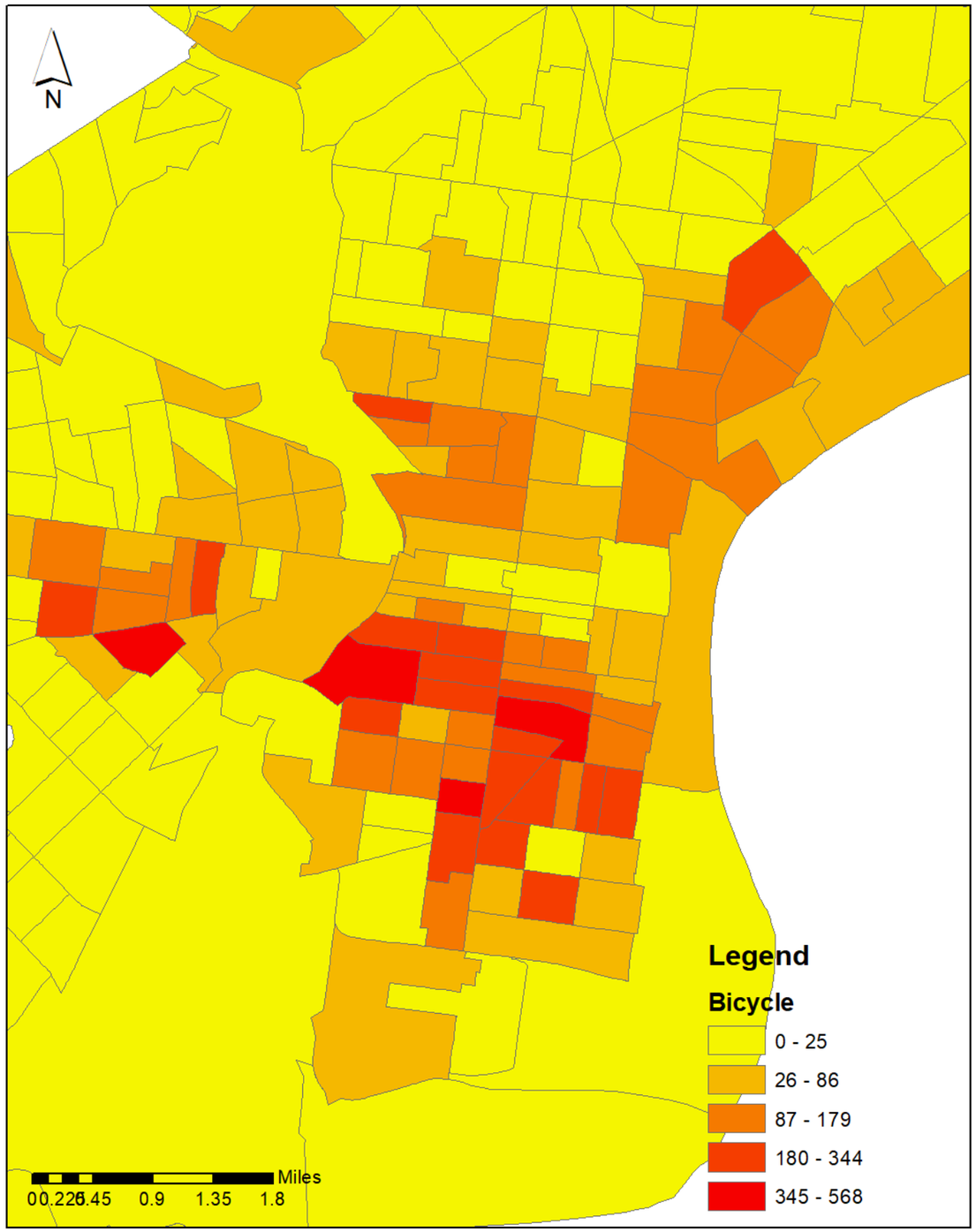
EXISTING DEMAND 2019



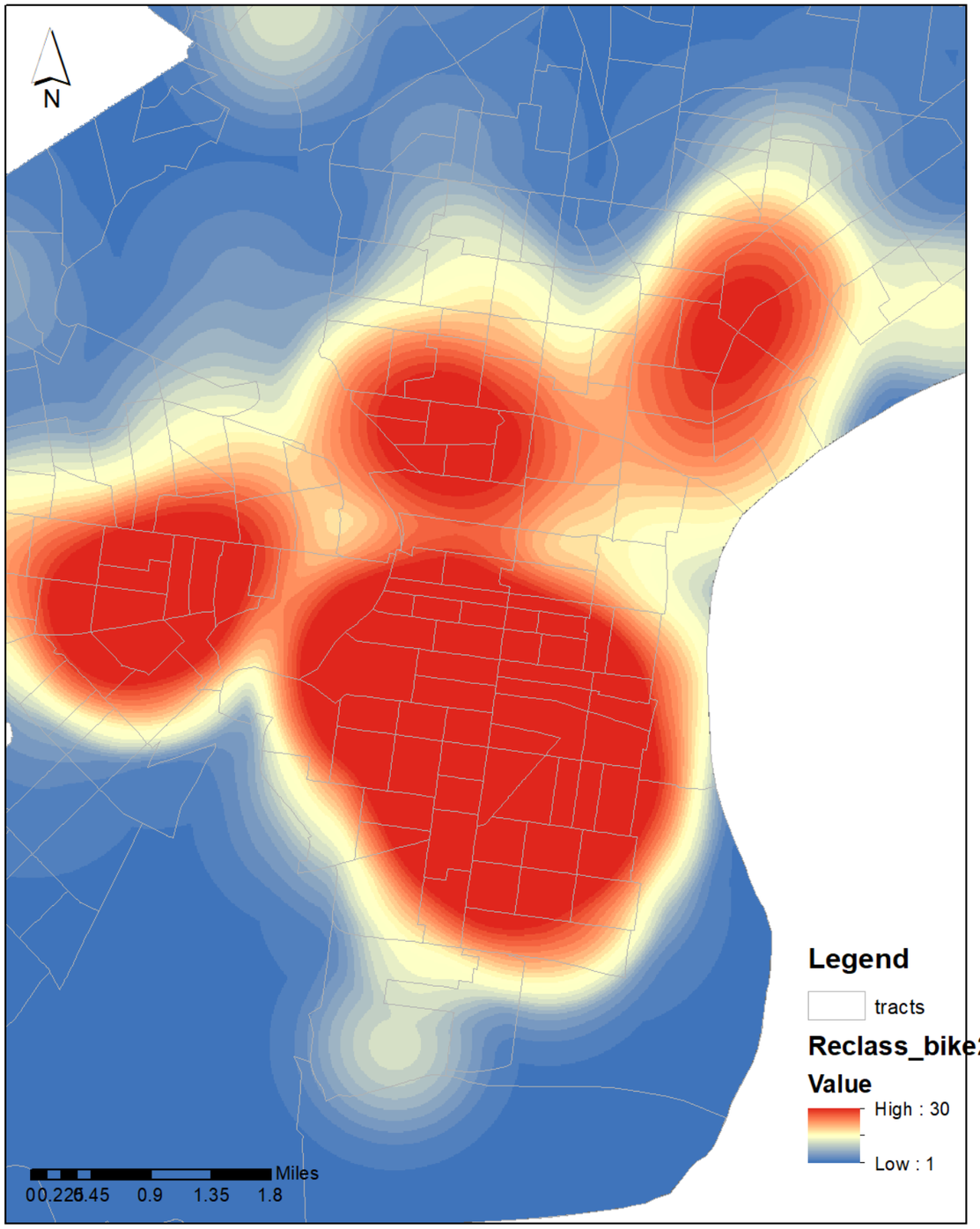
POTENTIAL DEMAND: INCREASING TRIPS FROM 2018 TO 2019



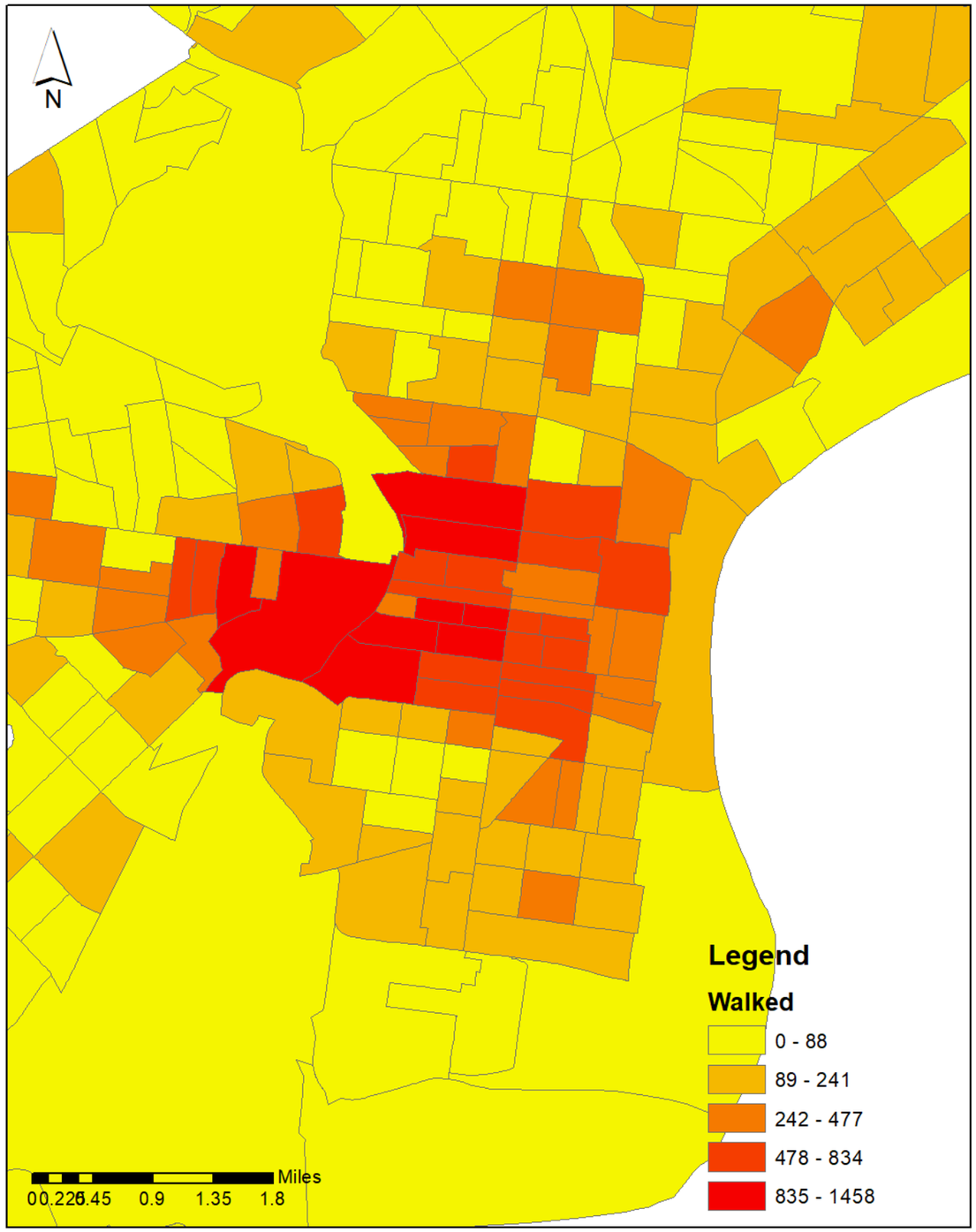
NUMBER OF PEOPLE WHO GO TO WORK BY BIKE



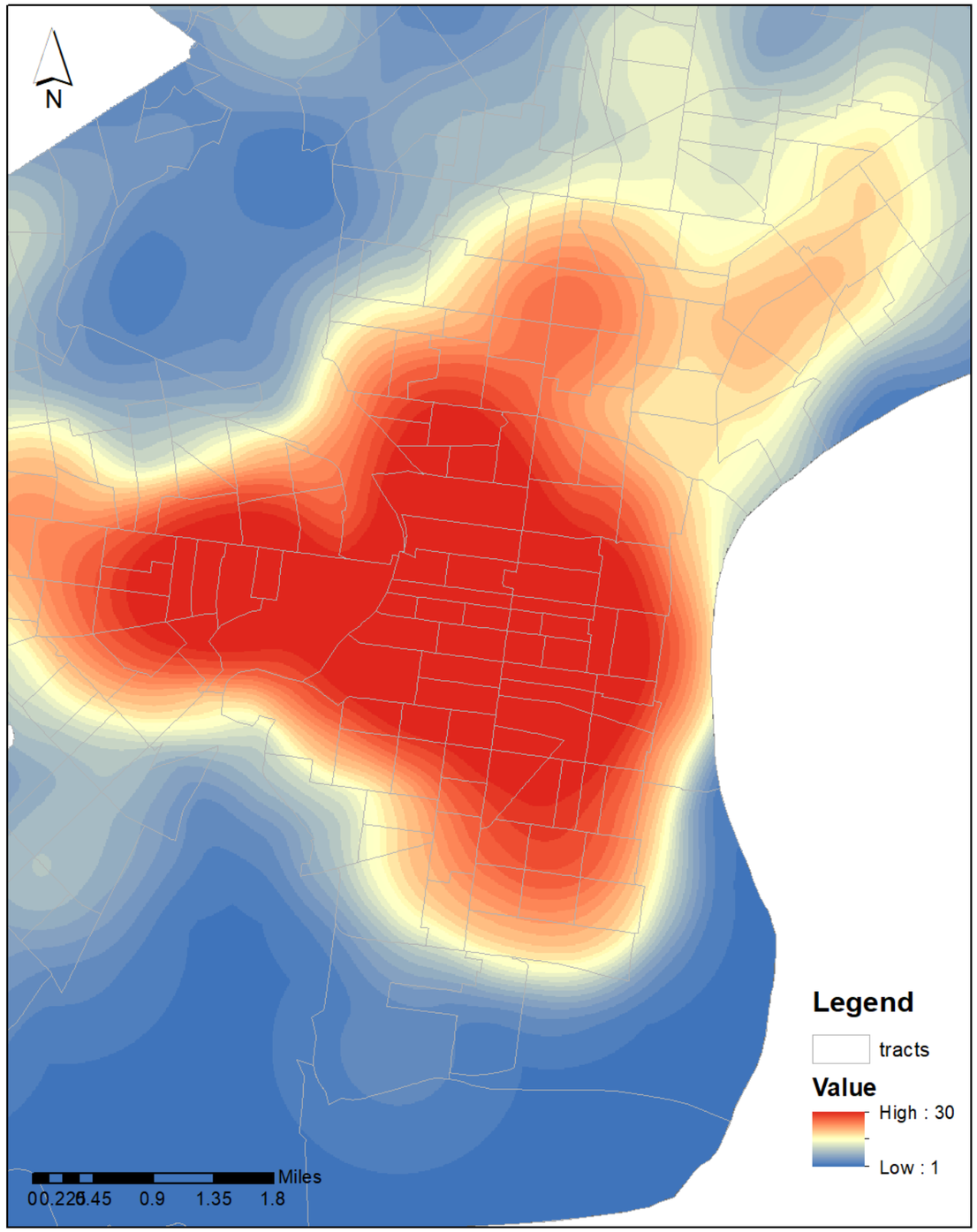
POTENTIAL DEMAND: DENSITY OF CYCLIST



NUMBER OF PEOPLE WHO GO TO WORK BY WALKING

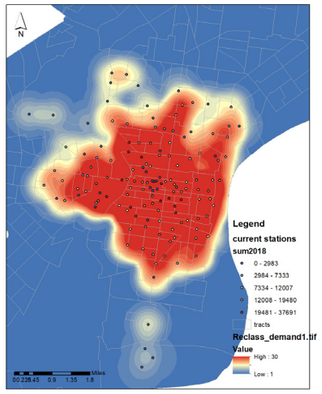


POTENTIAL DEMAND: DENSITY OF WALKER



TRUE DEMAND

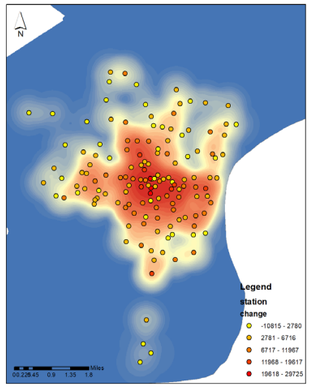
EXISTING DEMAND 2019



X 5

+

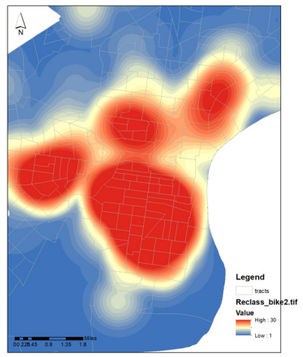
POTENTIAL DEMAND:
INCREASING TRIPS



X 3

+

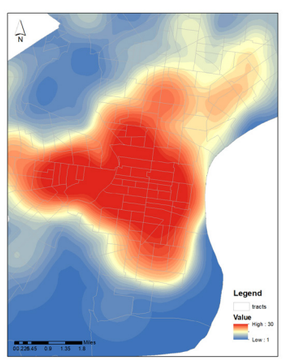
POTENTIAL DEMAND:
DENSITY OF CYCLIST



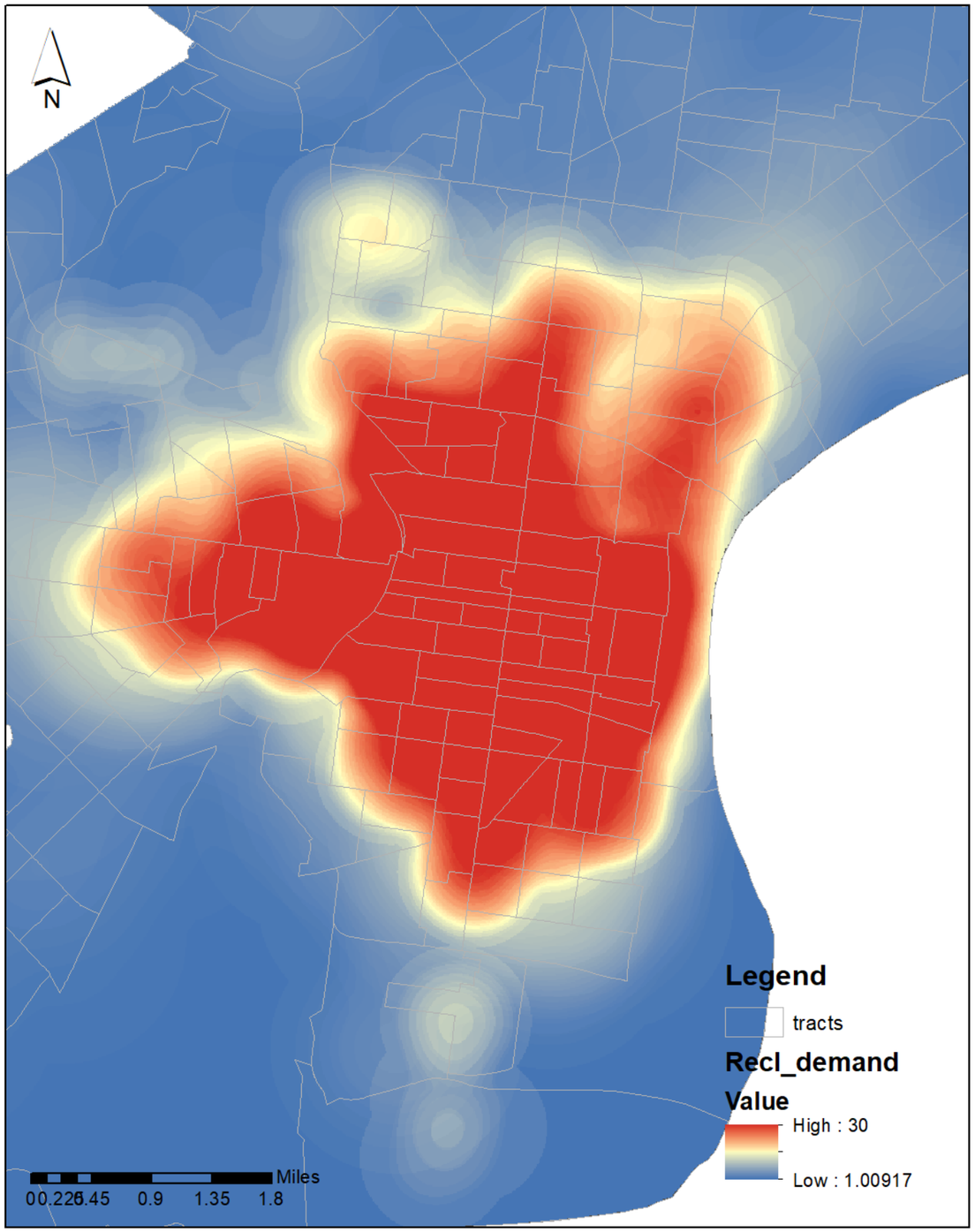
X 1.5

+

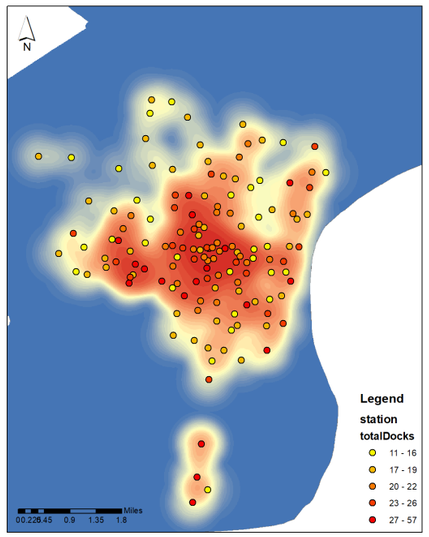
POTENTIAL DEMAND:
DENSITY OF WALKER

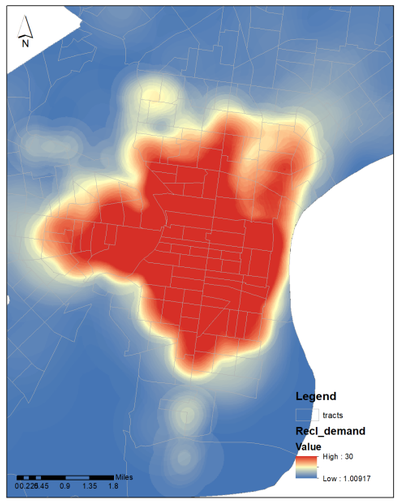


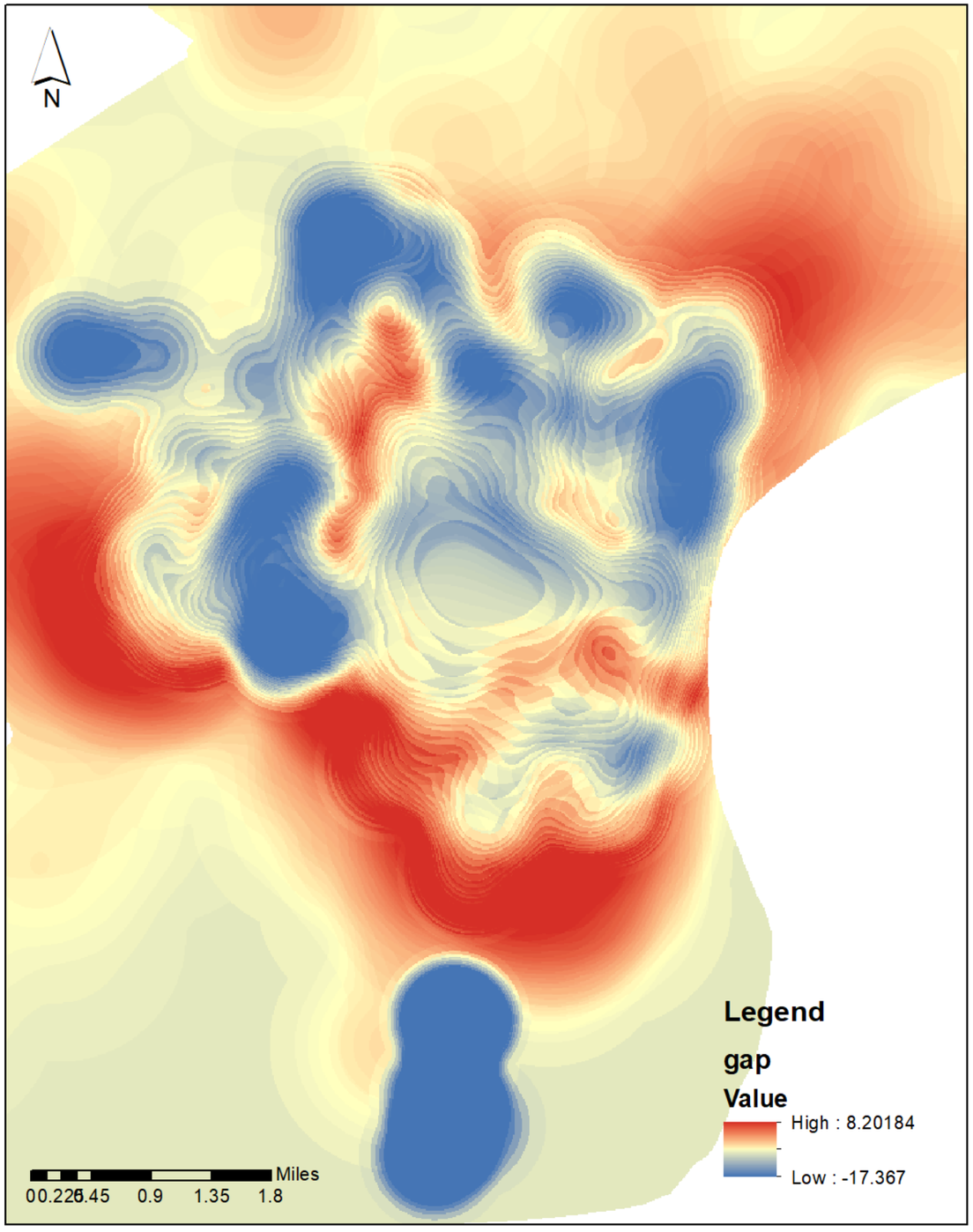
X 1.5



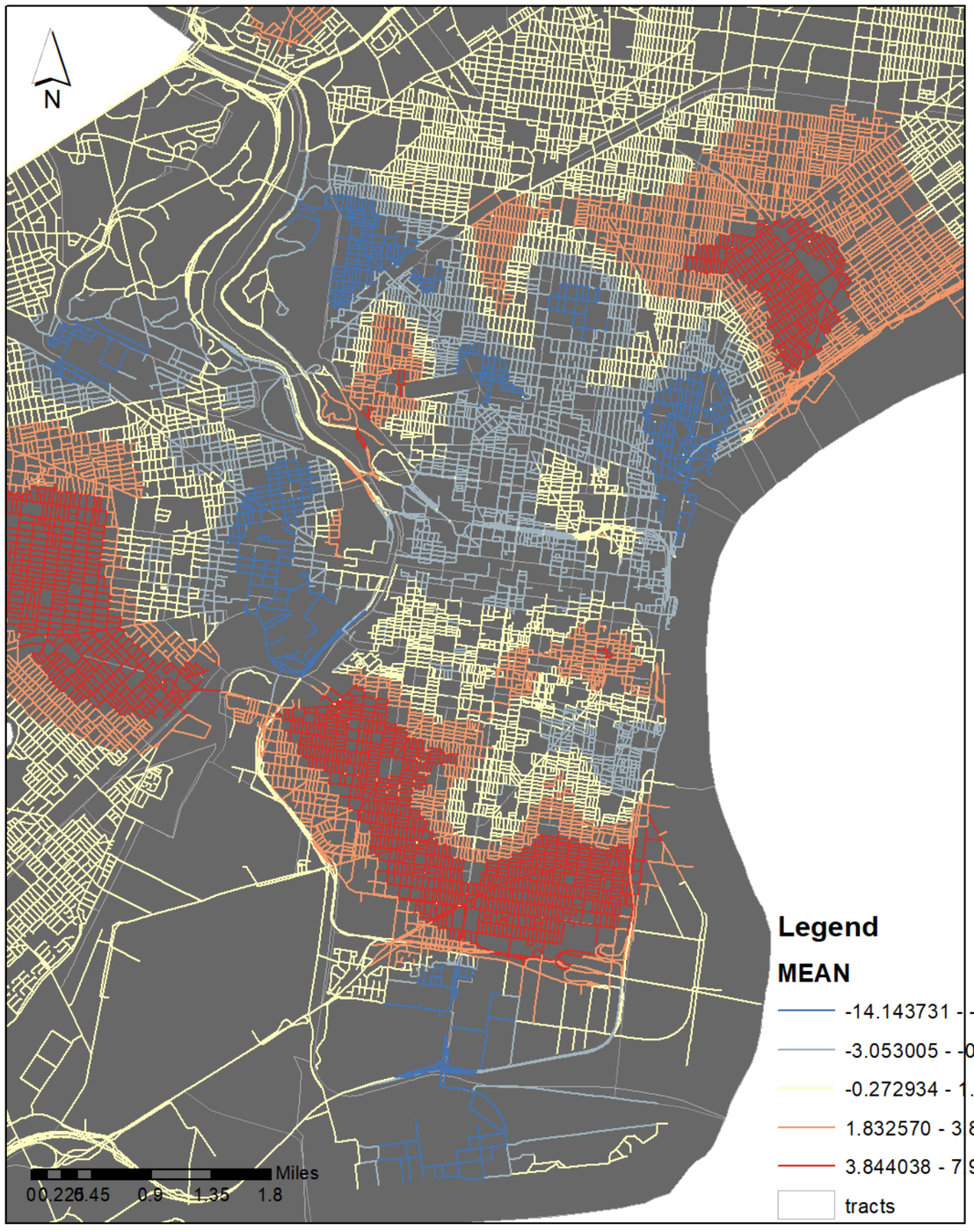
DEMAND/SUPPLY GAP



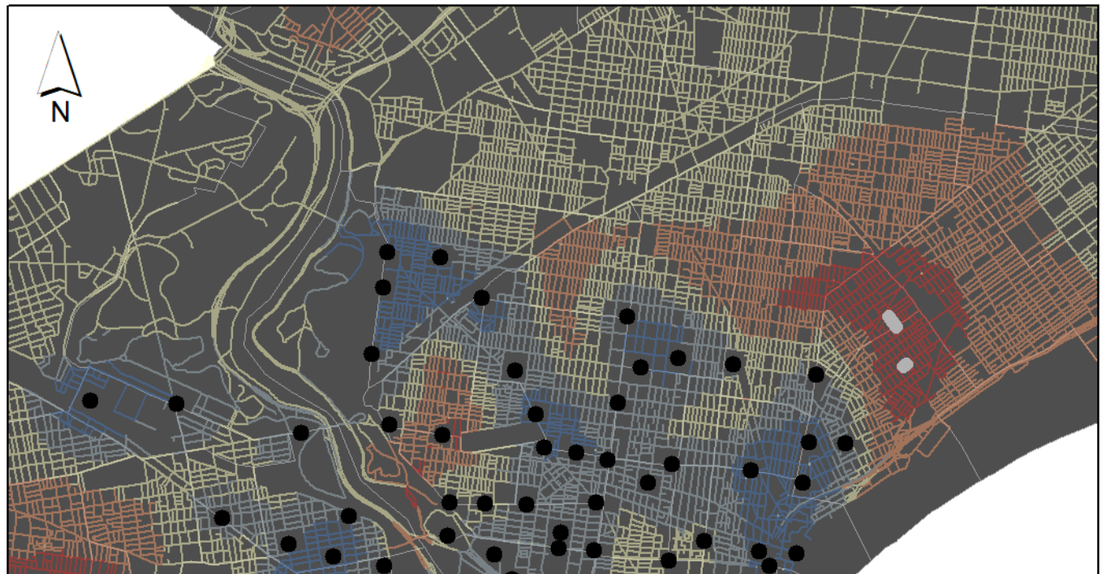




DEMAND/SUPPLY GAP AT STREET LEVEL



LOCATIONS FOR NEW BIKE STATIONS IN 2020 AND 2021



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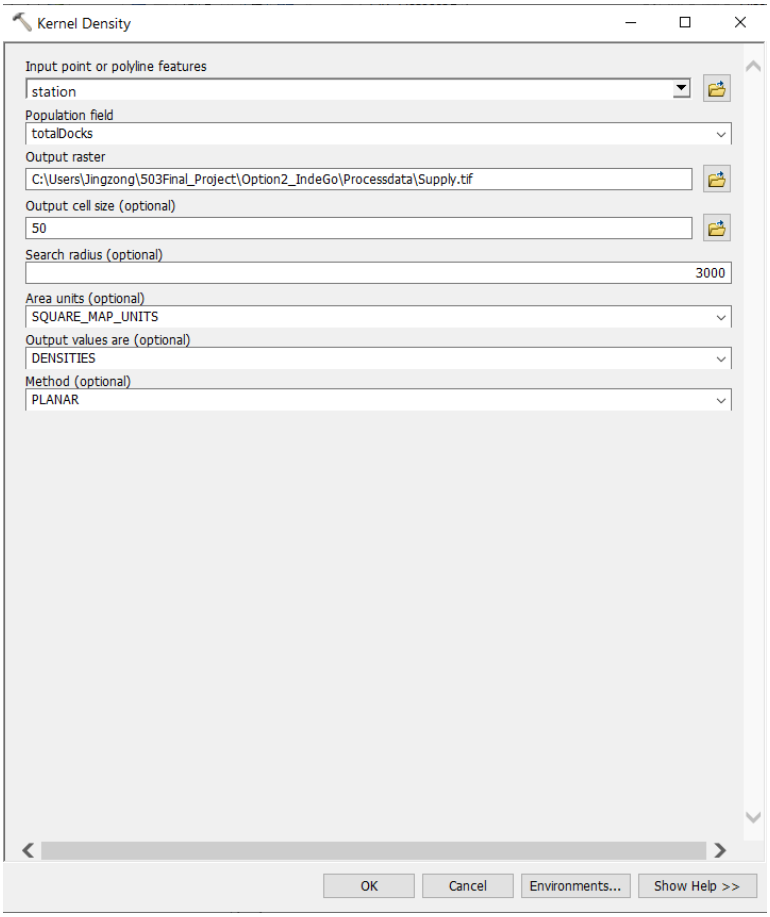
Appendix

Supply

I used **Kernel Density** with the number of total docks as population to create a raster of the accessibility of IndeGo bike and then reclassified it into 30 levels.

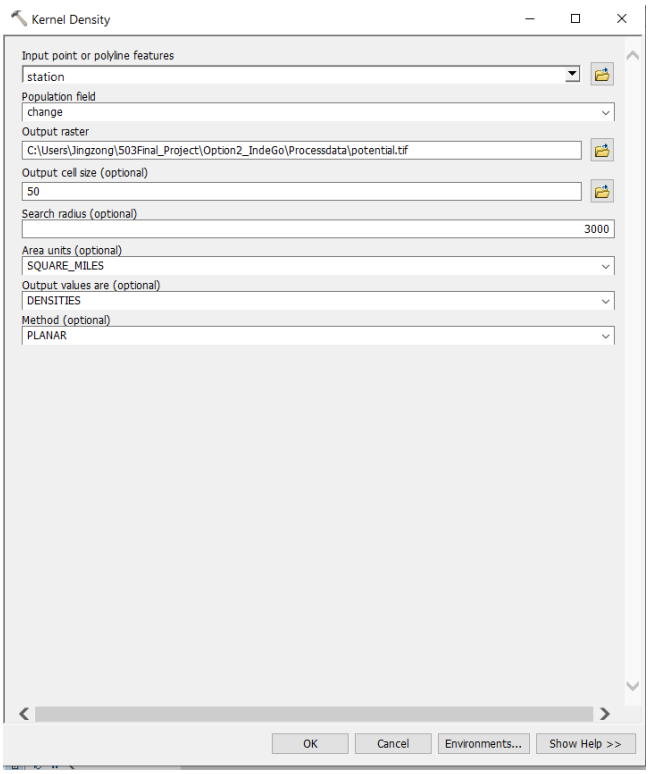


Existing Demand

For existing demand, I firstly download the trip data for the third quarter of 2019. Because there are some new stations were built in 2019 and only in the third quarter of 2019 trip data of these new stations was created. After cleaned the data, I joined it to stations and counted the number of trips for each station like I did in Prompt1 and 2. Then, like what I did in supply part, I used **Kernel Density** and **reclassify** to create existing demand raster.

Potential Demand: Increasing Trips

Now, I've already had the number of trips in 2018 and 2019(multiply the number in quarter three by 4) for each station. So, I added a new field and calculated the change by using **field calculator.** Then I repeated the same process above and created increasing trips raster.



Potential Demand: density of cyclist and walker

I firstly collected MEANS OF TRANSPORTATION TO WORK data for each tract. After joined the data to tracts shapefile, I used **feature to points** to transform tracts to points class so that I can use the kernel density. Raster of the density of cyclist and walker finally were created.

True Demand

Then, **raster calculator** was used to combine different kinds of demand. The weights for existing demand, increasing trips, density of cyclist, and density of walker were 5, 3, 1.5, and 1.5. Potential demand has more weight here because new stations are more expected to serve or impulse potential demand rather than existing demand. The value of new raster was scaled back to 1 to 30.

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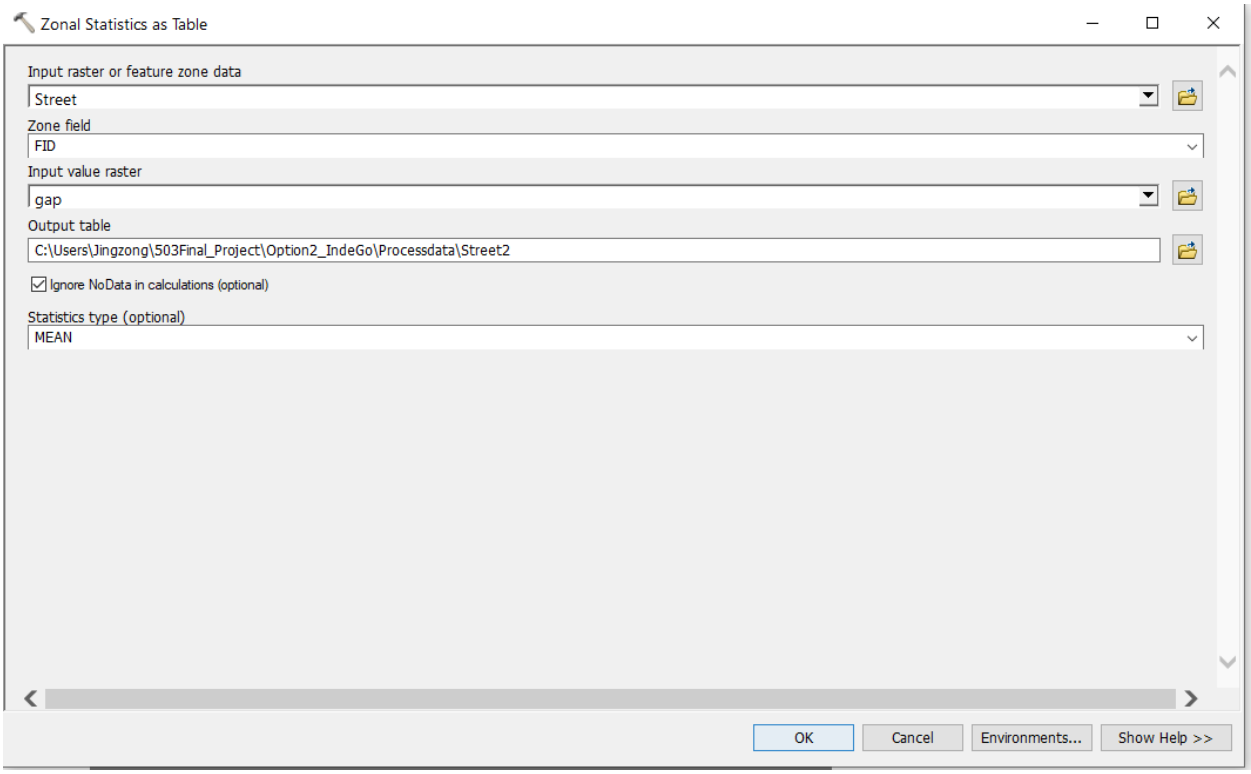
Demand/Supply Gap

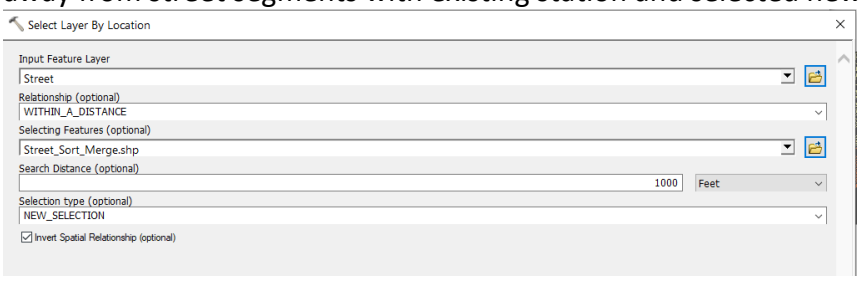
Finally, the raster of Demand/Supply Gap was created by using **raster calculator.**

Allocation

Raster is a good container for spatial information but not a good unit for allocating new bike stations. Since bike station must be installed along the street and usually at most only one station on one segment of street, street segment could be a better unit of allocation. Therefore, I found the Philadelphia street file given before and used **zonal statistic as table** to transform the value of demand/supply gap from raster to street.



After that, I decided to create a **model** to choose new locations. Firstly, I added a **For iterator** with 40 loops. Then I used **select layer by location** to choose those street at least 1000 feet away from street segments with existing station and selected new locations.



The next step is **sorting** the selected street segments condescending by the value of demand/supply gap. Then the top one with the highest demand/supply gap was selected by using **make feature layer.** The new selected location then was **merged** with those were selected before. And the merged location was used to narrow candidates for the next round until 40 locations were selected. 20 locations with higher demand/supply gap were chosen for new stations in 2020, and others in 2021.

Additional stations in 2020 do have impact the allocation for 2021. New trips data will generate new demand and supply and hence change the demand/supply gap I measured now. Thus, the allocation for 2021 would be different.