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GEOG 482 – GIS II

Final Project

Initial Results

Goals & Rationale

There is a tremendous opportunity for the BikeShare program to positively impact underserved individuals and the community as a whole. BikeShare programs can open up employment and education opportunities outside a resident's immediate area, lessen their reliance on cars, increase their freedom, and connect them to their community. This analysis seeks to identify areas within the Eugene/Springfield Urban Growth Area (UGA) that are in a greater need for bikeshare hubs and the mobility and opportunity they offer.

The three overall goals of this analysis are as follows:

1. assess station placement for expanded BikeShare coverage
2. expand BikeShare access for underserved areas
3. expand BikeShare access for underserved populations

To accomplish these goals, this analysis considers five main factors: poverty, education, diversity, and commuter accessibility. These factors of evaluation, or "submodels", are often made up of multiple datasets and layers of analysis.

Currently the average user of the BikeShare system is wealthier than the average Lane County resident. The median salary of annual BikeShare members is tens-of-thousands of dollars higher than the median salary in the county as a whole (LDA Consulting). Lane Transit District should therefore endeavor to provide better access to its services among individuals below the median salary. According to data from the US Census, 18.5% of Lane County residents live below the poverty line, and 19.2% of households receive food stamps / SNAP. This submodel is broken down into two layers: the percentage of those below the poverty line, and the percentage of individuals receiving food stamps / SNAP. These layers correspond to ACS tables S1701 and S2201, respectively.

Access to education is one of the most important factors in economic stability and wellbeing. This submodel will be composed of two layers: the percentage of those with no college degree, and the percentage of those currently pursuing a college degree. Around 60% of Lane County residents have not attained a Bachelor's degree or higher (LDA Consulting). The first layer will analyze American Community Survey (ACS) data table S1501 (Educational Attainment). According to the US Census, roughly one in eleven are enrolled in some form of college or professional school. This layer will use ACS table B14007 (School Enrollment by Detailed Level of School Population 3 years or Older).

Overall, Lane County is relatively homogenous, but some diversity does exist. According to the US Census, of the estimated 379,611 residents in Lane County, 324,162, or about 85% are white. This submodel aims to highlight areas in which diversity is relatively high, by using ACs table B02001.

According to the US Census, 17.6% of commuters live within a 10-minute drive of their place of work, with another 21.5% within a 15-minute drive. Barring major geographic obstructions such as highways, these commutes could likely be accomplished by bicycle. This would have a number of positive impacts, including reduced emissions, decreased traffic, and improved health of the commuters. Interestingly, 4.1% more females live within a 10-minute commute than males. Prioritizing areas where a large ratio of residents live within a short commute is a realistic way of increasing BikeShare adoption. This analysis will correspond to the table B08134 (Means of Transportation to Work by Travel Time).

To ensure that BikeShare hubs are allocated in areas where they will actually be used, two additional submodels are included. The first, "General Demand", is composed of four layers: Residence Demand, Workplace Demand, Proximity to existing Hubs, and Proximity to Bus Stops. Information for thee layers comes from LaneCountyRAC_2017, LaneCountyWAC_2017 (both LODES datasets), BikeShare_Hub_Points, and LTD_Stops_Fall2019, respectively. The second submodel analyzes data mined from previous BikeShare rides. BikeShare_Hub_Points is used again in this submodel to ensure that new hubs are placed within a reasonable distance of existing hubs, while the General Demand submodel ensures that hubs are not placed too close. Additionally, the end-points of trips that lie outside the vicinity of both existing hubs and the BikeShare service area are analyzed to see where current users of the system might benefit from new hubs.

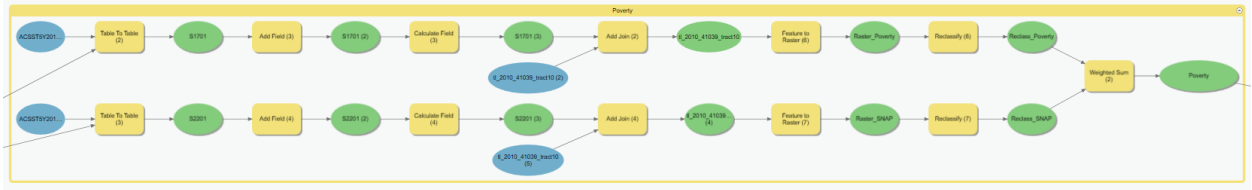
Methods

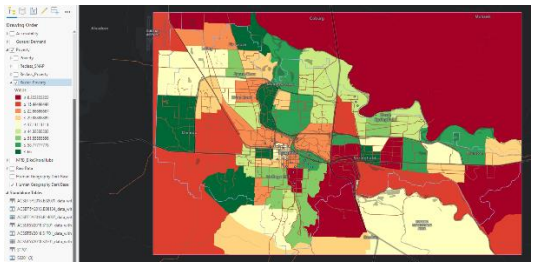
ACS / US Census tables with the prefix 'B' relate to data at the Block Group level, while tables with the prefix 'S' provide data by the census tract. The majority of the data used in this analysis comes in the form of vectors or tables. After the necessary steps are taken to add and calculate fields and join to other tables, these layers are converted to rasters using the Feature to Raster tool. Proximity-based layers are generated by created Multiple-Ring Buffers (MRB's) around the selected points. The output of each submodel is represented as a single raster, which are used as inputs for the Weighted Sum operation, which creates a cumulative output raster for analysis. This raster is used in combination with topographic information and BikeShare facility locations to produce a map for the visualization and interpretation of the results of the analysis. The following table describes how the submodels are weighted, and how their constituent layers are used.

Submodel	Points	Methodology		
Poverty	20	**Layer**	**Pts**	**Methodology**
		% Below Poverty Line	10	1 point assigned for every 2.5% of the population below the poverty line (Areas with >25% below poverty line receive 10 points)
		% Receiving Food Stamps / SNAP	10	1 point assigned for every 2.5% of the population receiving food stamps/SNAP (Areas with >25% on SNAP receive 10 points)
Education	10	% Education Attained < Bachelor	5	1 point assigned for every 20% of the population with no degree (Areas with >80% without a degree receive 5 points)
		% School Enrollment (Ages 18+)	5	1 point assigned for every 5% of the population enrolled in some form of college (Areas with >20% in college receive 5 points)
Diversity	20	5 points assigned for every 5% of the population with non-white ethnicity (Areas with >15% non-white residents receive 20 points)		
Commute Accessibility	20	% Within 10-minute Commute	10	1 point assigned for every 2% of the population within 10-min commute (Areas with >28% within 10-min commute receive 15 points)
		% Within 10-14-minute Commute	10	1 point assigned for every 10% of the population within a 10-min commute (Areas with >40% within 10-14-min commute receive 5 points)
General Demand	20	Residence Demand	10	Census Blocks assigned 2.5 points per quartile of population density (Areas in the top-quarter receive 10 points)
		Workplace Demand	10	Census Blocks assigned 2.5 points per quartile of employment density (Areas in the top-quarter receive 10 points)
		Proximity to Bus Stops	10	Locations within 1 mile of bus stops receive 5 points, locations within ½ mile receive 10
		Proximity to BikeShare Hubs	-10	Locations within ½ mile of BikeShare hubs **lose** 5 points, locations within ¼ mile **lose** 10
Bike Ride End Locations	10	Proximity to BikeShare Hubs Outside Zone	5	5 points awarded to locations within 1 mile of an existing hub AND outside the operating zone
		Bike Ride End Locations Outside Zone	5	5 points awarded to locations within 1/8 mile of a bike ride end location AND outside the operating zone

The above submodels are decomposed below, showing the process models used, notable input and output layers, and the final rasters.

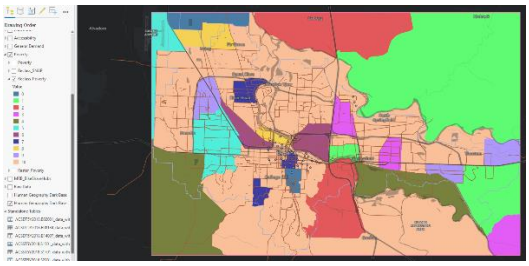
Poverty



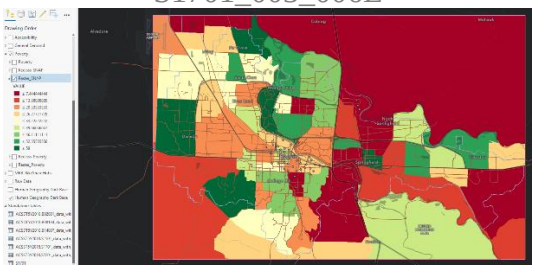


Raster_Poverty

S1701_003_006E

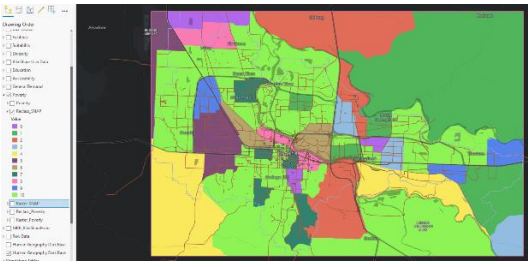


Reclass_Poverty

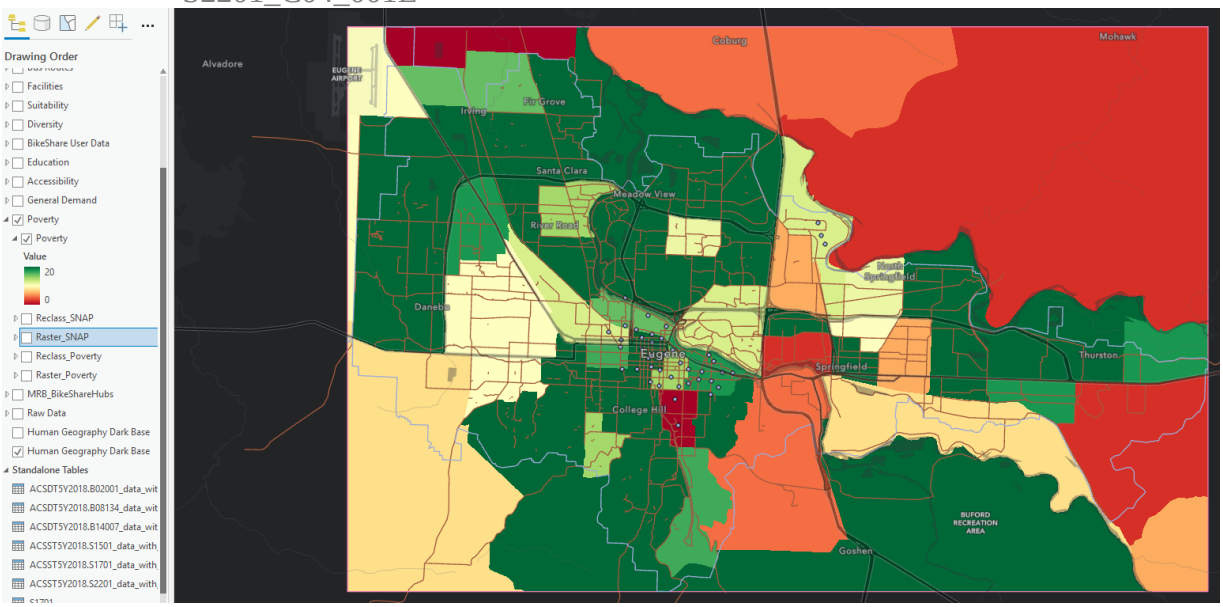


Raster_SNAP

S2201_C04_001E

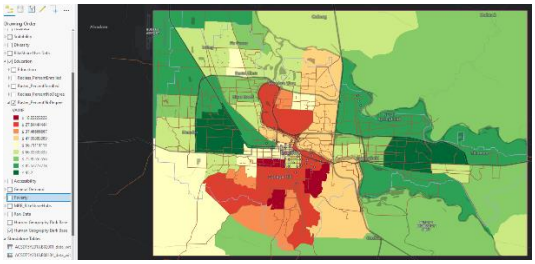


Reclass_SNAP



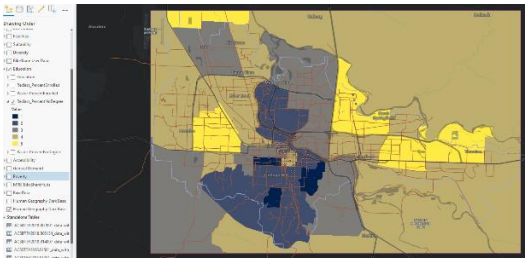
Poverty Output

Education

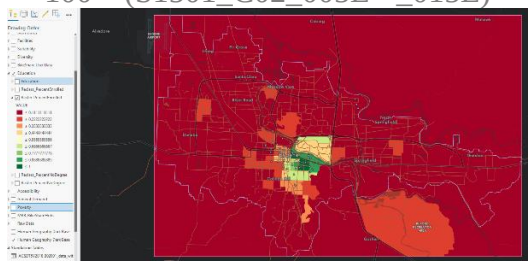


Raster_PercentNoDegree

100 – (S1501_C02_005E - _015E)

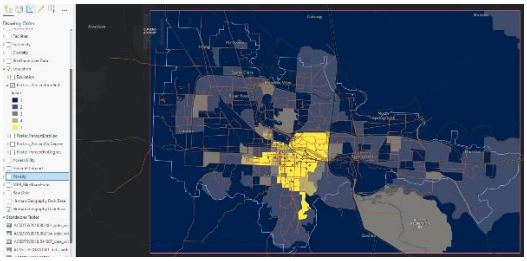


Reclass_PercentNoDegree

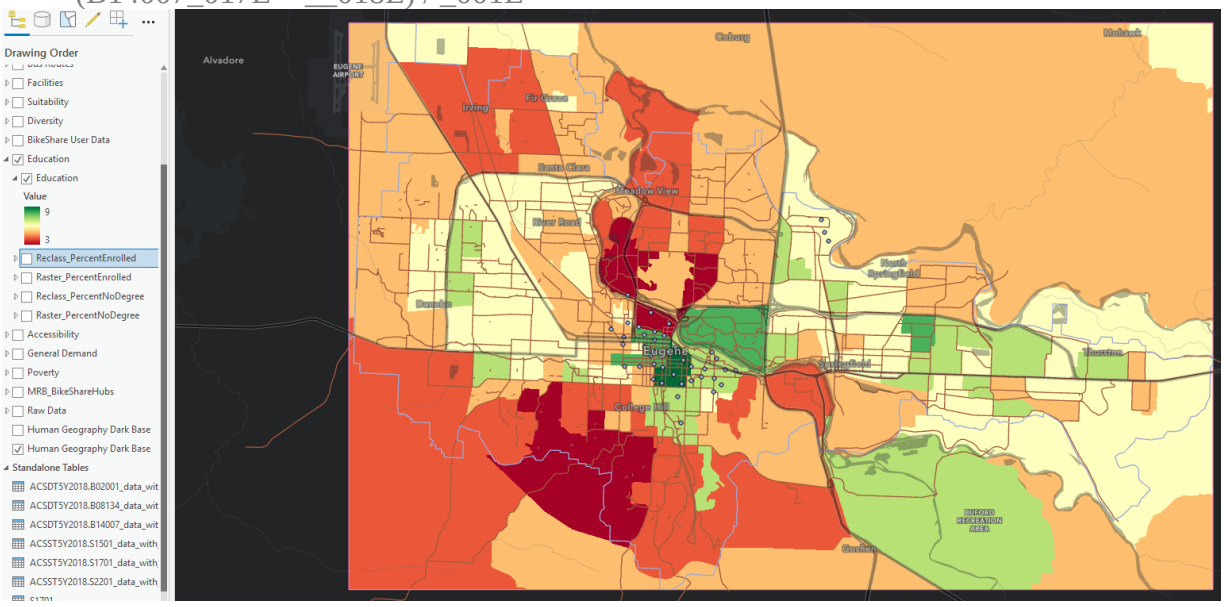


Raster_PercentEnrolled

(B14007_017E + __018E) / _001E

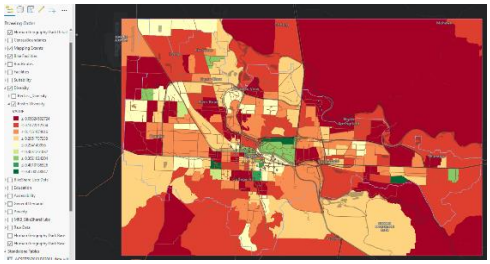


Reclass_PercentEnrolled



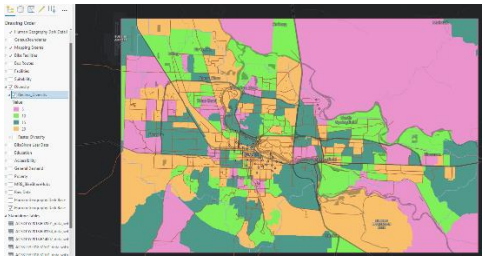
Education Output

Diversity



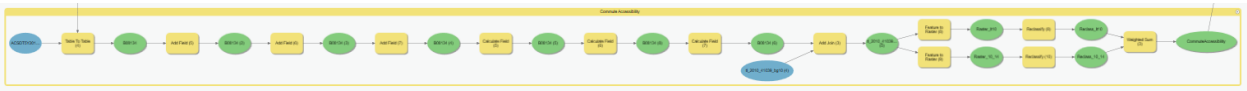
Raster_Diversity

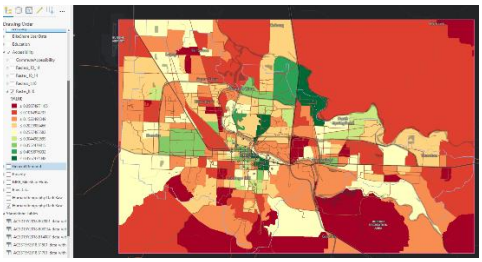
(B02001_001E - _002E) / _001E



Diversity Output

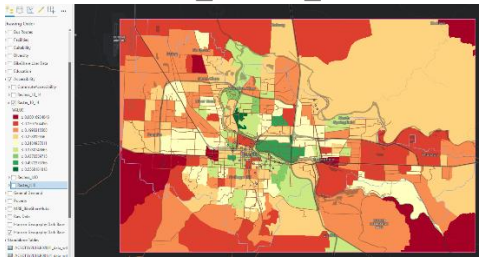
Commute Accessibility



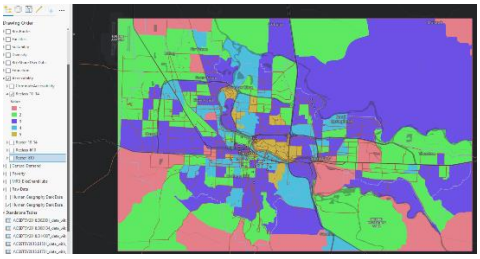


Raster_LessThan10Min
B08134_002E / _001E

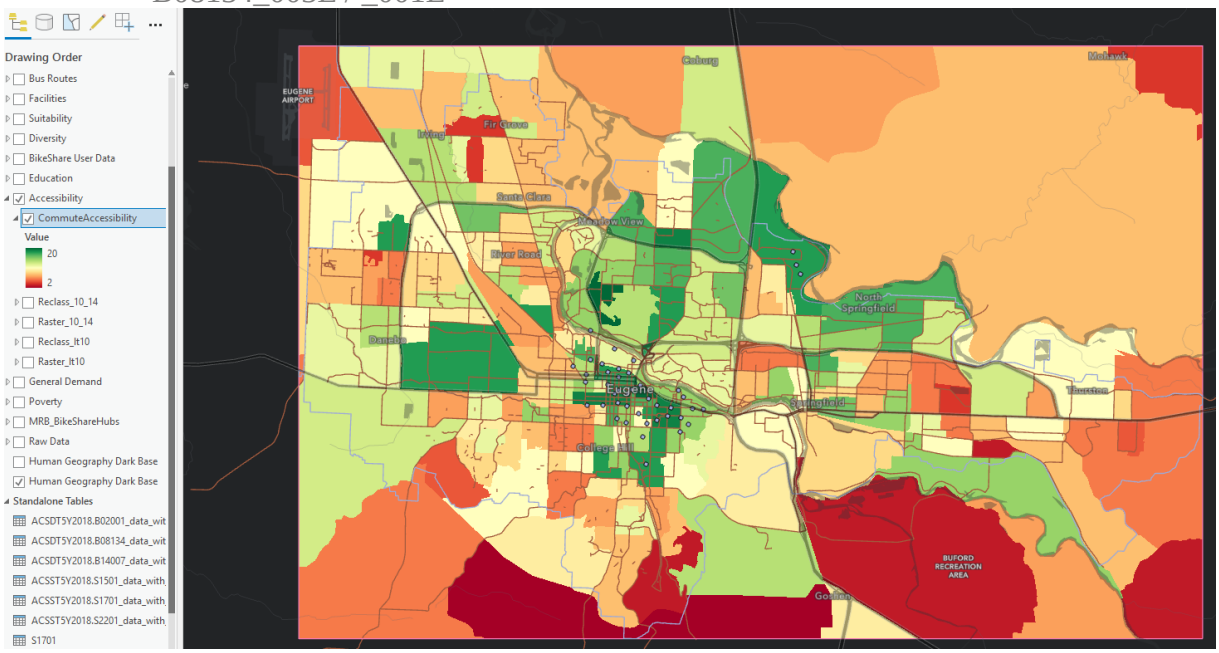
Reclass_LessThan10Min



Raster_10-14Min
B08134_003E / _001E

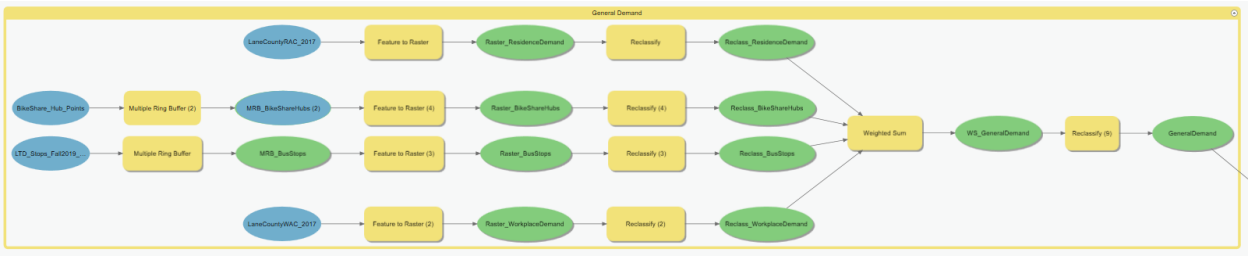


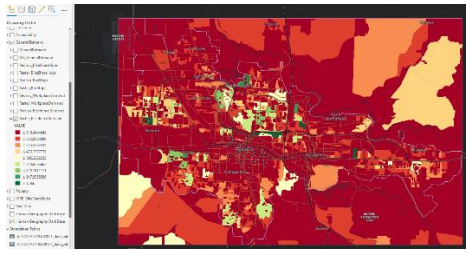
Reclass_10-14Min



Commute Accessibility Output

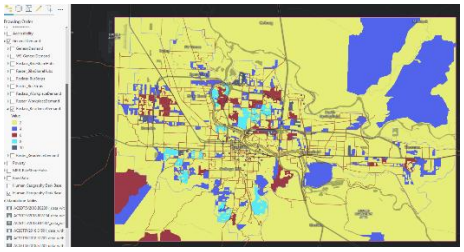
General Demand



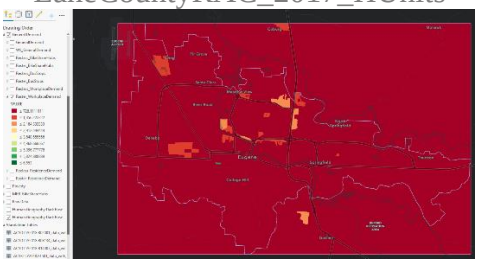


Raster_ResidenceDemand

LaneCountyRAC_2017_HUnits



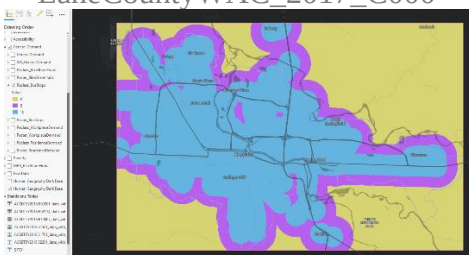
Reclass_ResidenceDemand



Raster_WorkplaceDemand

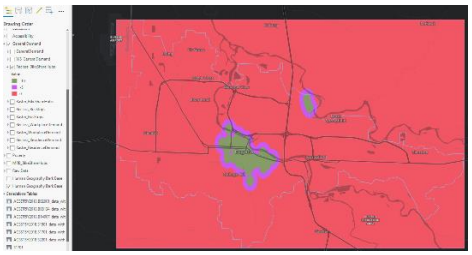
LaneCountyWAC_2017_C000

Reclass_WorkplaceDemand



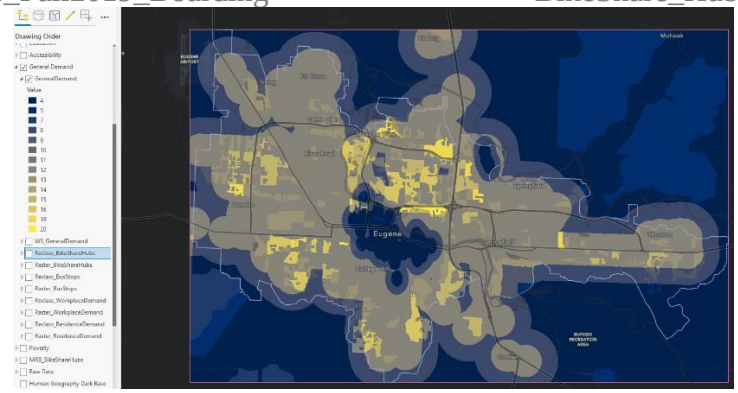
Reclass_BusStops

LTD_Stops_Fall2019_Boarding



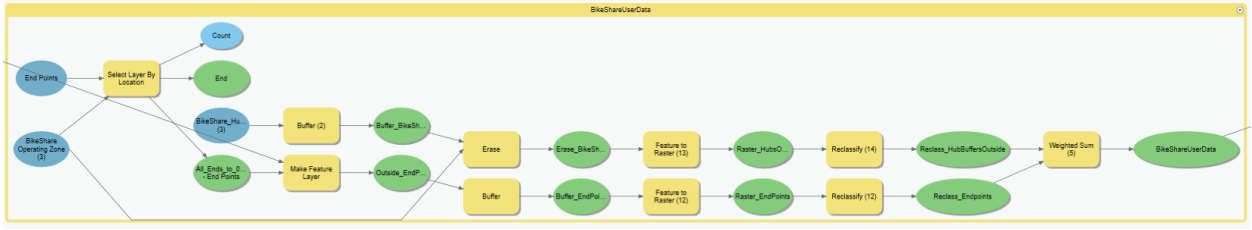
Reclass_BikeShareHubs

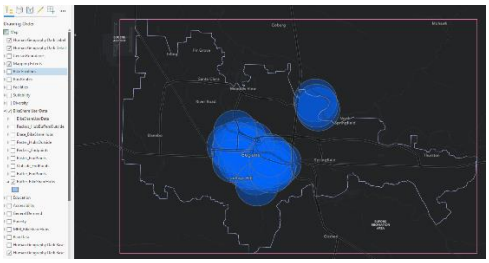
BikeShare_Hub_Points



General Demand Output

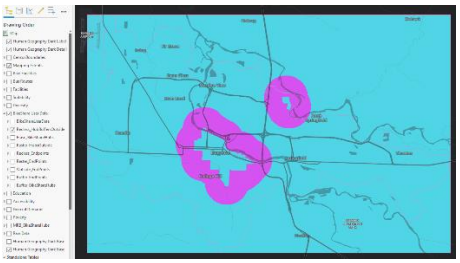
Bike Ride End Locations



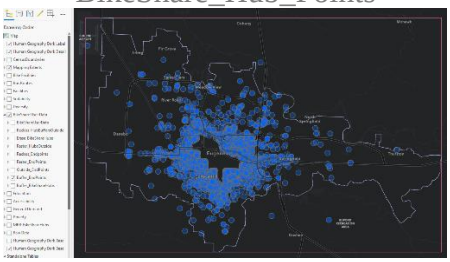


Buffer_BikeShareHubs

BikeShare_Hub_Points



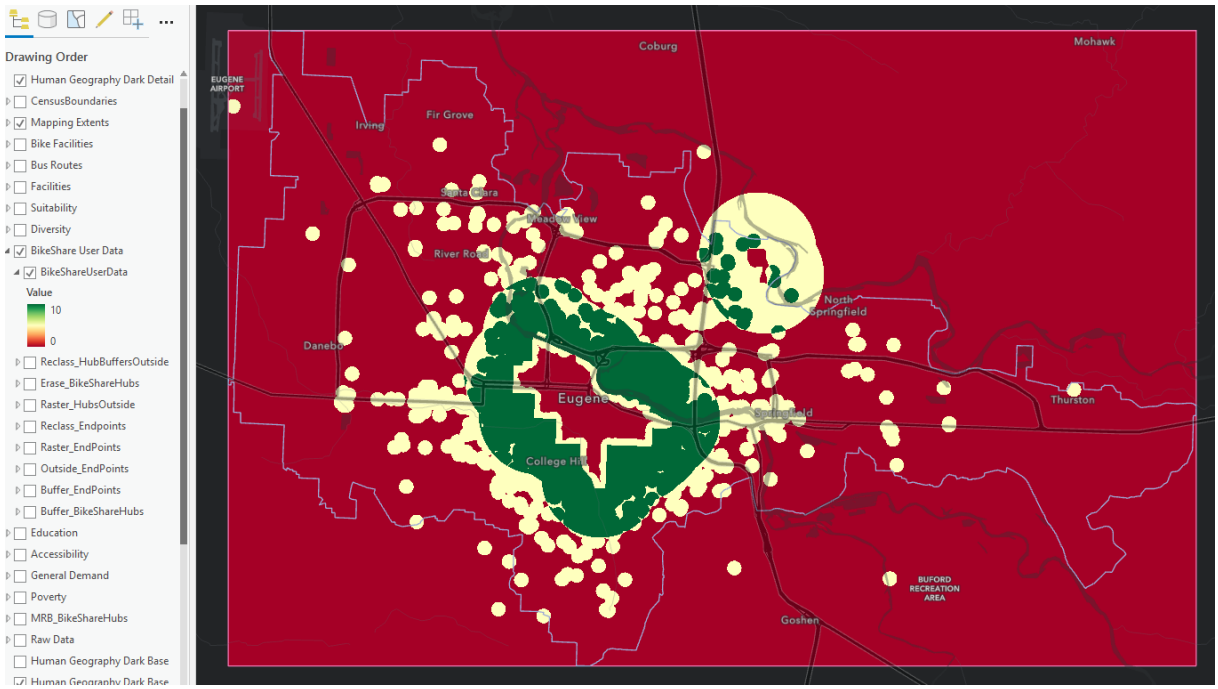
Reclass_HubBuffersOutsideZone



Buffer_RideEndPoints

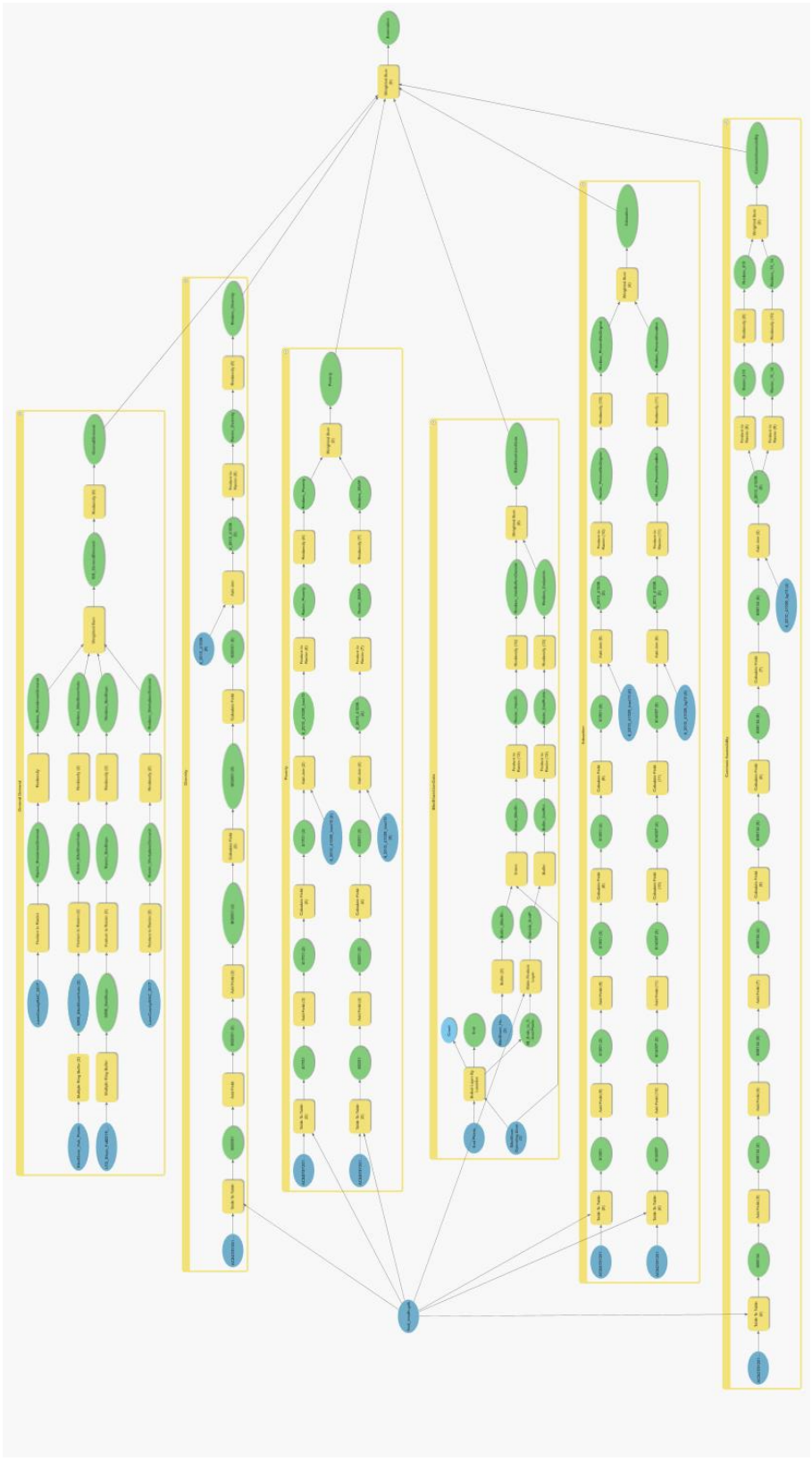
All_Ends_to_04_24_2020_ORSouth-EndPoints

Reclass_EndPointsOutsideZone

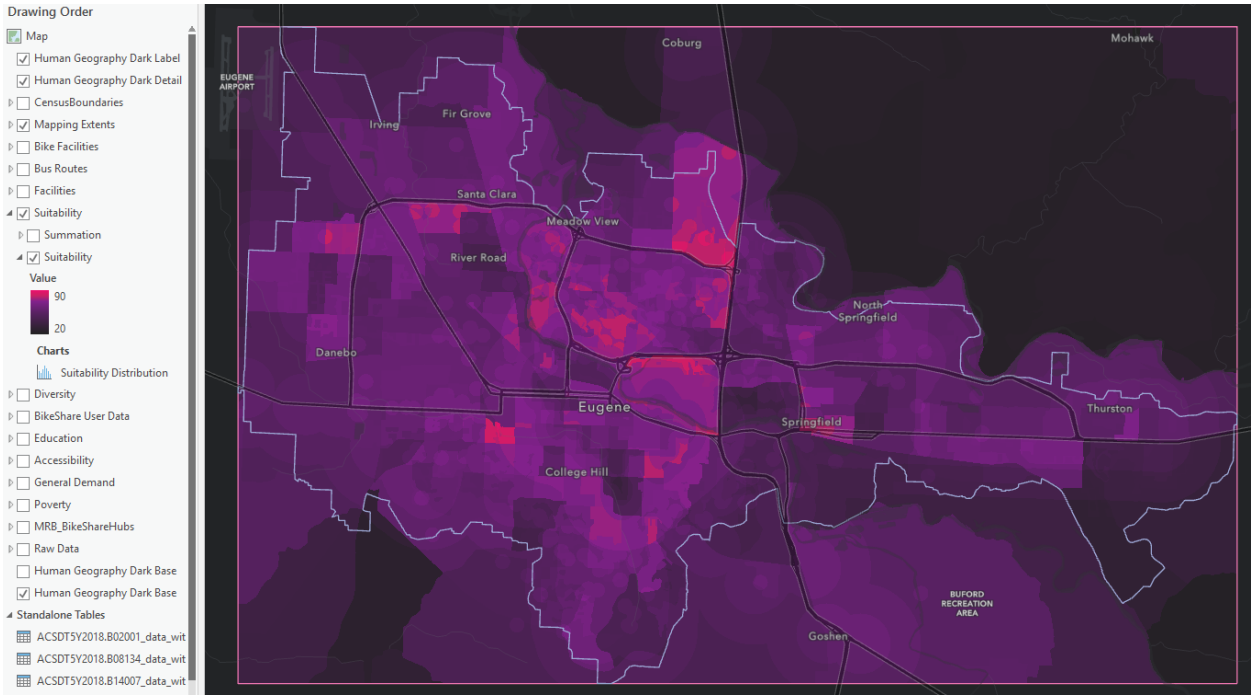


Bike Ride End Locations Output

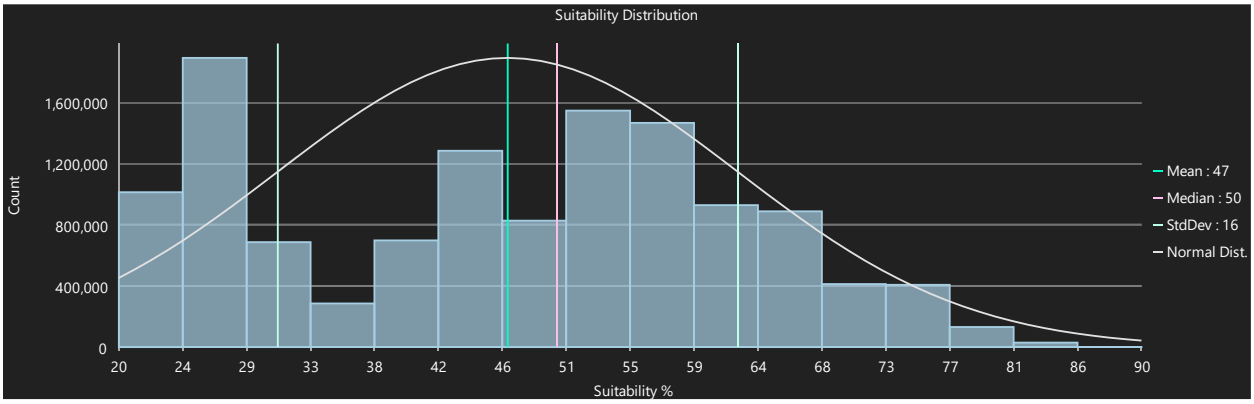
Overall Analysis



Discussion of Analysis Results



Suitability Output



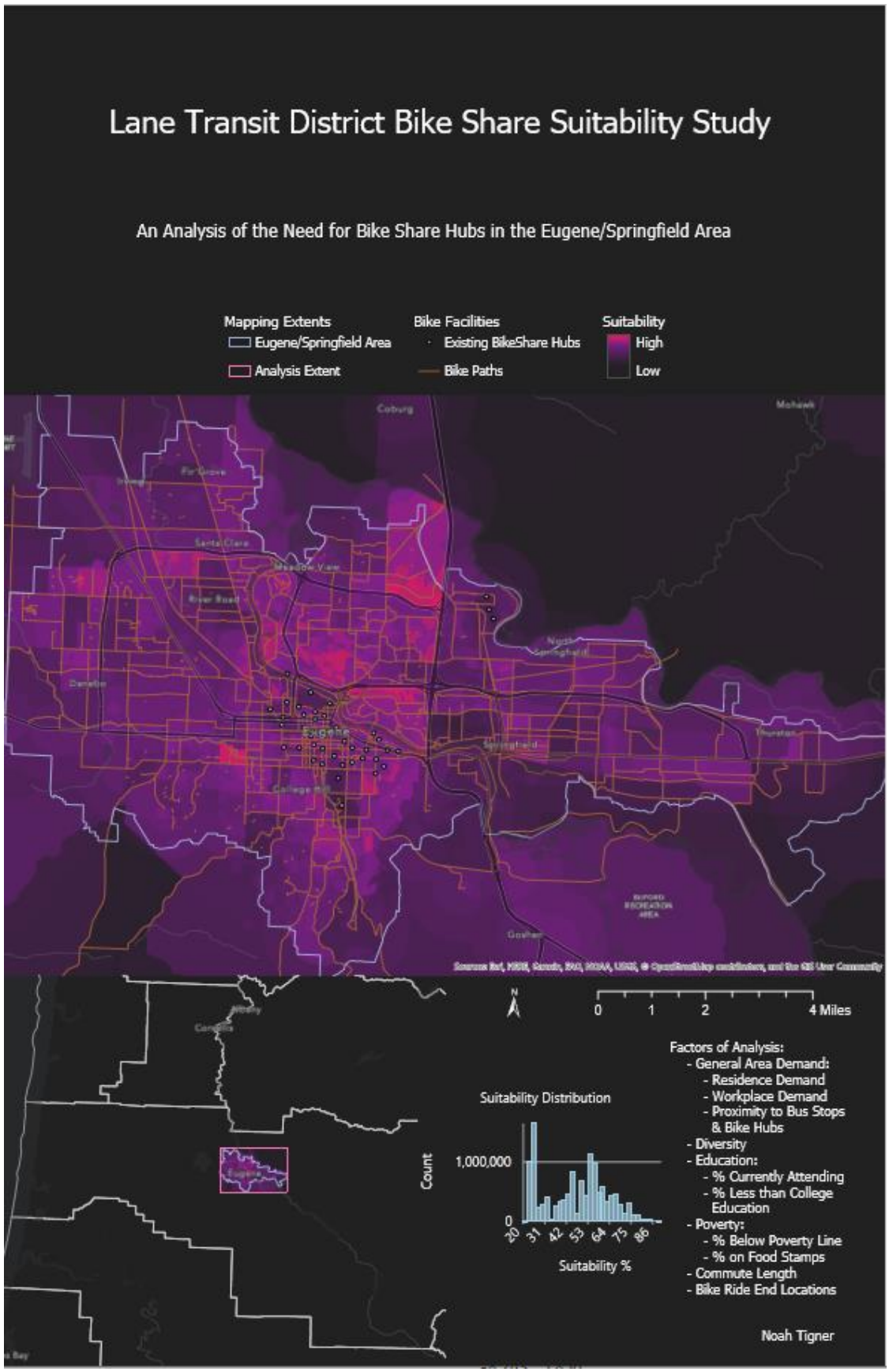
Suitability Distribution

The histogram above reflects the distribution of scores given to cells across the Eugene/Springfield UGA. As defined by the weights table on page 3, a cell's inputs can sum to a total of 100 points. The maximum value observed, however, is 90. The minimum is 20, meaning

that no area in the UGA is completely unsuitable. The median value is 50 and the mean is 47, which is slightly skewed by the high frequency of values around the first quartile. If not for the first quartile the distribution would nearly match the Normal Distribution. The most common range of values is between 24 and 29. We can isolate the most suitable locations by reclassifying the output raster. Reclassifying all values between 0 and 80 to 0, and all values between 80 to 90 to 1 allows us to easily locate the areas the analysis deemed most suitable. The results of the reclassification are shown below.

Most Suitable Locations for New BikeShare Hubs (in green)

The above map highlights a number of areas found to be the most suitable for BikeShare Hubs. Among these are Irwin Park in the Northwest, Garfield Park, a triangular parcel of land off Cal Young Road, the land between MLK Jr. BLVD. and OR-126 (North of Autzen Stadium), land across from Alton Baker park on Franklin Avenue, and a number of locations between N Coburg Road, the Randy Pape Beltline, and the Pacific Highway.


Lane Transit District Bike Share Suitability Study
An Analysis of the Need for Bike Share Hubs in the Eugene/Springfield Area
Mapping Extents
Eugene/Springfield Area
Analysis Extent
Bike Facilities
Existing BikeShare Hubs
Bike Paths
Suitability
High
Low
Coburg
Mohawk
Fox Grove
Santa Clara
Meadow View
River Road
Danebo
Eugene
Springfield
Thurston
College Hill
Goshen
N
0
1
2
4 Miles
Factors of Analysis:
- General Area Demand:
- Residence Demand
- Workplace Demand
- Proximity to Bus Stops & Bike Hubs
- Diversity
- Education:
- % Currently Attending
- % Less than College Education
- Poverty:
- % Below Poverty Line
- % on Food Stamps
- Commute Length
- Bike Ride End Locations
Suitability Distribution
Count
1,000,000
0
20
31
42
53
64
75
86
Suitability %
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Works Cited

LDA Consulting (2013). 2013 Capital Bikeshare Member Survey Report. Accessed online at http://capitalbikeshare.com/asets/pdf/CABI-2013SurveyReport.pdf on May 20, 2020.

US Census. US Census Data. https://data.census.gov