Proposed Locations for New Recycling Facilities in Chatham County, NC

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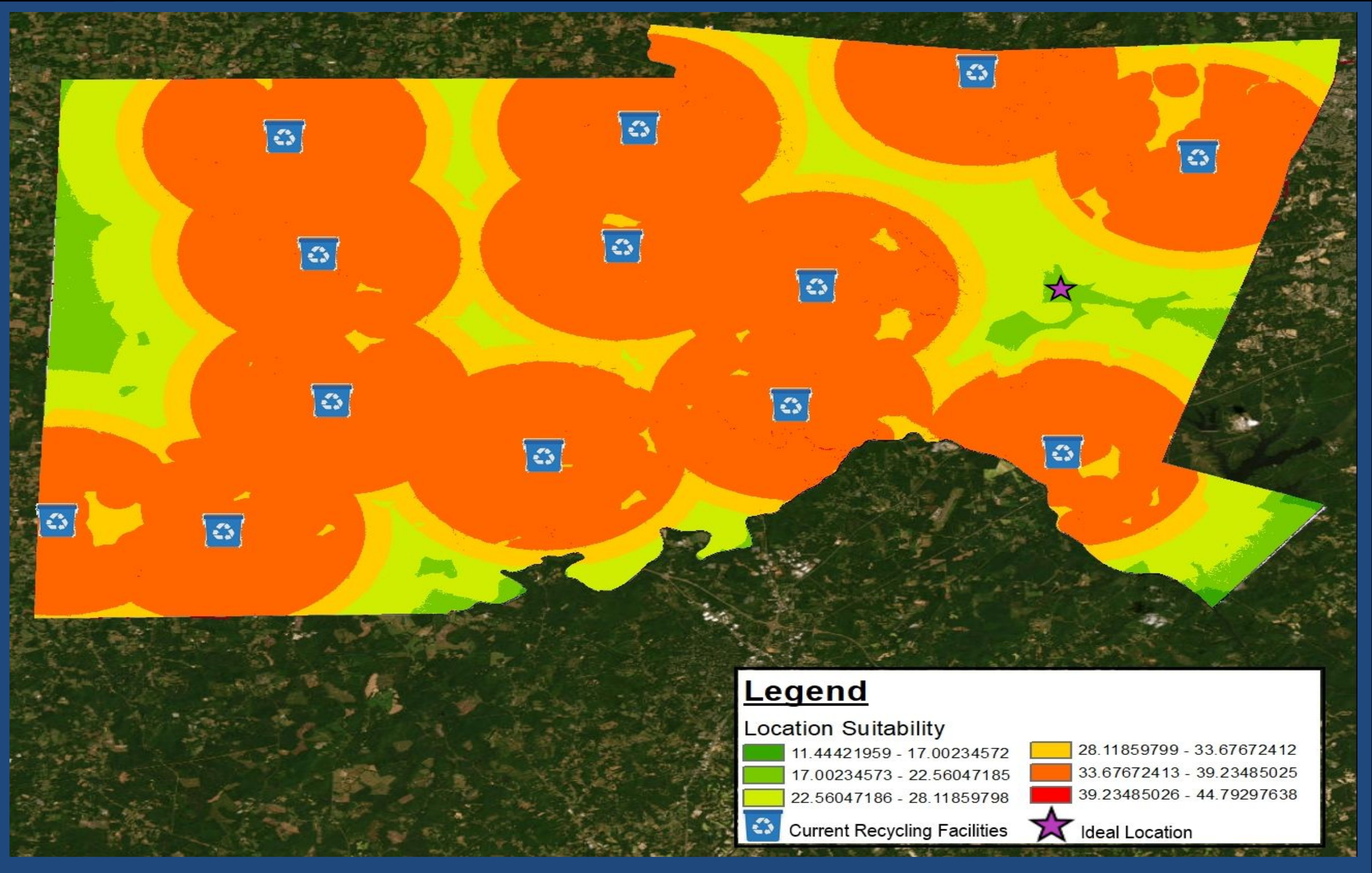### December 5th, 2023

Introduction

According to the U.S. Census Bureau, from 2010 to 2020 the State of North Carolina saw a 9.48% increase in their population from 9,535,483 to 10,439,388 residents. Comparatively, Chatham County saw a 20.12% increase from 63,505 to 76,285 in their population between 2010 and 2020. As a result of Chatham County's growing population, additional recycling facilities will likely be needed in the future. The question our analysis serves to answer is where should a new waste recycling facility be located in Chatham County, North Carolina in order to minimize transportation costs and environmental impact, while considering existing transportation infrastructure, landscape elevation, and the locations of preexisting recycling facilities.
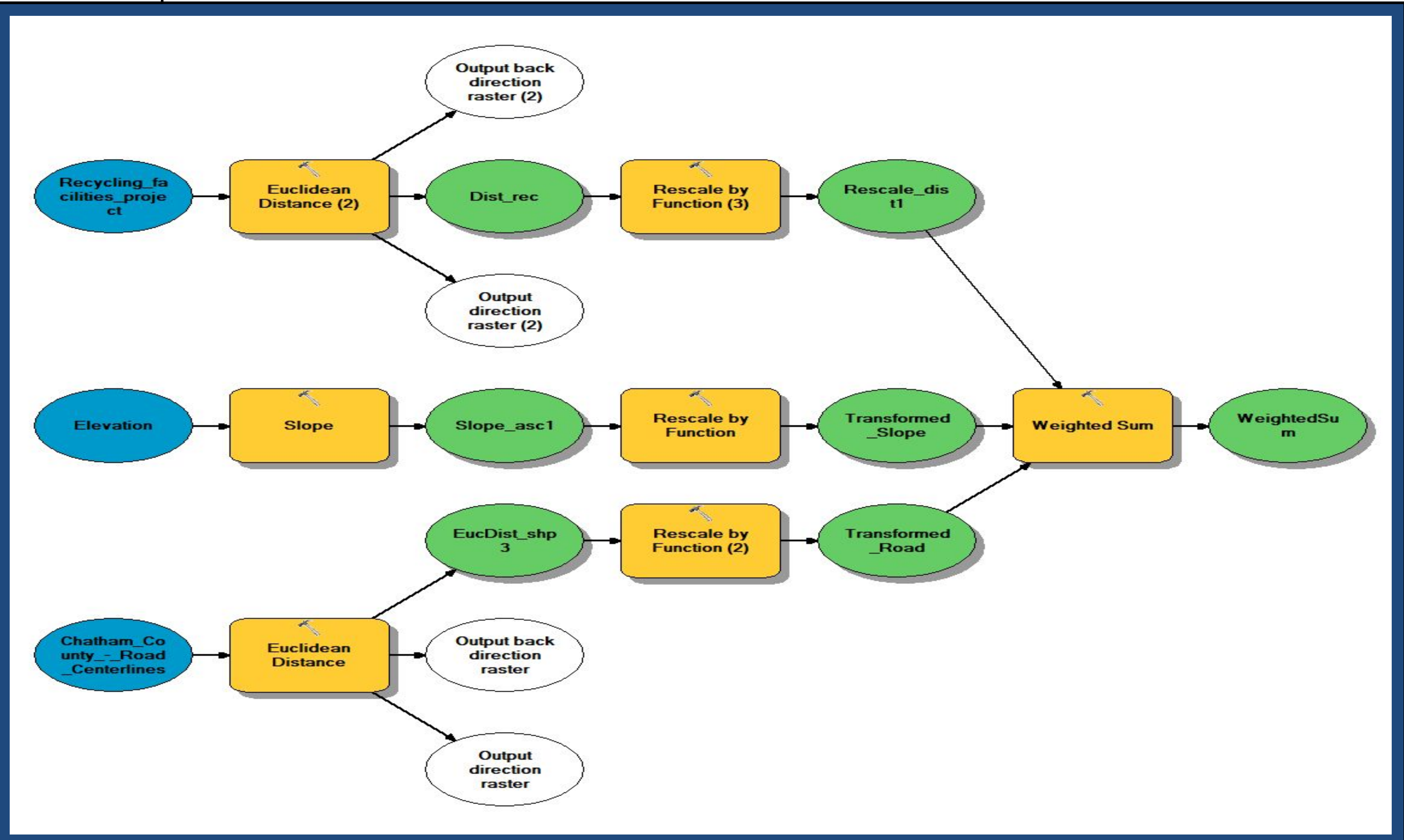
Methods

To streamline the spatial analysis process, we combined our different datasets into a Spatial Modelbuilder model in ArcMap. We included the Chatham County current recycling facilities point layer, the road centerlines line layer, and the elevation DEM raster layer within our model. First, we used the Buffer layer to calculate a distance of 3 miles around each current recycling facility. We then used the Euclidean Distance tool on both the recycling facilities buffer layer we created, as well as the roads line layer in order to calculate the spatial distance from the current recycling facilities and existing roads. Next, we used the Slope tool on the elevation DEM raster layer to identify the steepness at each cell of the raster layer. Following that, we put the newly calculated euclidean distance recycling facility and road layers as well as the elevation slope layer through the Rescale by Function tool to apply a transformation function to each layer and transform the results onto a continuous evaluation scale. For the recycling facilities buffer and current roads distance layers, we used the MS Small transformation function, while for the elevation slope layer we used the Logistic Growth function. We wanted gradual slopes (flatter areas) to be weighted higher than steeper slopes, and less distance from roads to be weighted higher than more distance from roads, with the opposite applied to the recycling facilities. At the end, areas of high priority were flat, close to roads, and far from other recycling facilities. Finally, we used the Weighted Sum tool on all of our new layers to assign different weights to each of our criteria based on their importance. The slope elevation layer would be weighted a 1, our road distance layer would be weighted a 1.5, and our facilities distance layer would be weighted a 2. Modern construction technology allows slope to be of little concern, which is why it is weighted as a 1. The distance to roads is weighted at 1.5 because although it is not favorable, a new road can be built to access the facility if necessary. The distance to other facilities is most important because we want our new facility to service as many new people as possible, so we weighted it the highest as a 2.

Map

Legend
Location Suitability
- 11.44421959 - 17.00234572
- 17.00234573 - 22.56047185
- 22.56047186 - 28.11859798
- 28.11859799 - 33.67672412
- 33.67672413 - 39.23485025
- 39.23485026 - 44.79297638

♻ Current Recycling Facilities   ★ Ideal Location

Model

Results

Presented in Figure 1 is a location suitability map for a new recycling facility in Chatham County, North Carolina. Suitability of a new facility was based on proximity to existing recycling facilities, existing roads, and elevation. In order to avoid close proximity to an existing site, ideal locations would be 3 miles or greater from current facilities. In an effort to minimize environmental impacts, it was recommended that existing roads be nearby to decrease required construction. Concerning elevation, it was desired that proposed sites be relatively flat to make construction and future transportation more straightforward. As the legend of figure 1 depicts, areas represented by shades of green were considered to be more desirable than those that are yellow or orange.

Discussion

We designated the location of the proposed new recycling facility as the area represented by the star as shown in Figure 1. The areas in the darker green color are the most suitable for the facility based on having the closest proximity to existing roads, farthest distance from the other facilities, and flattest slopes. Though there are multiple darker green areas, the one we chose is more localized within the county boundary, rather than intersecting with neighboring counties. Our selection allows for the most residents to be serviced in the county, and can improve recycling measures in Chatham County.

Data Sources

- Chatham County Government, *Chatham County - 2010 Census Block Groups* (05/25/2018): This source was used to depict the tract boundaries within the county.
- Chatham County Government, *Chatham County - Recycling Facilities* (10/31/2016): Provided layer of existing recycling facilities in the county..
- Chatham County Government, *Chatham County - Road Centerlines* (10/27/2016): Depicts all current roads within the county.
- North Carolina State University (NCSU), *Chatham County Elevation* (07/13/2013): Raster layer of the elevation levels of the county.