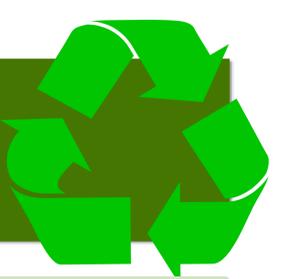


Greenfield Goes Green: The Use of GIS Network Analysis to Evaluate Proposed Recycling Facility Access in Greenfield, MA



Introduction

The town of Greenfield, MA currently serves as the epicenter of Franklin County's waste disposal services. As the state leans into policies supporting recycling, the burden of transfer stations to collect and move recycling to the larger city of Springfield will begin to encumber the city and county's waste management facilities. With the rush of momentum around recycling, there is also a new possibility that the city can invest in its own recycling facility.

There are currently two landfill sites within or near the city limits, but these sites only serve as transfer facilities for the community's recyclable goods. This pilot study looks at possible sites of a local recycling station based on ease of access by road for local residents and/or commercial trucks. Sumathi, Natesan, and Sarkar designed a multi-criteria analysis of waste-disposal sites in 2008 in which one of their primary criteria was access. I assess the number of residents that can access, via roads, a recycling facility at the two existing waste-processing sites as well as two proposed sites on unused land.

Population of Greenfield by Acre

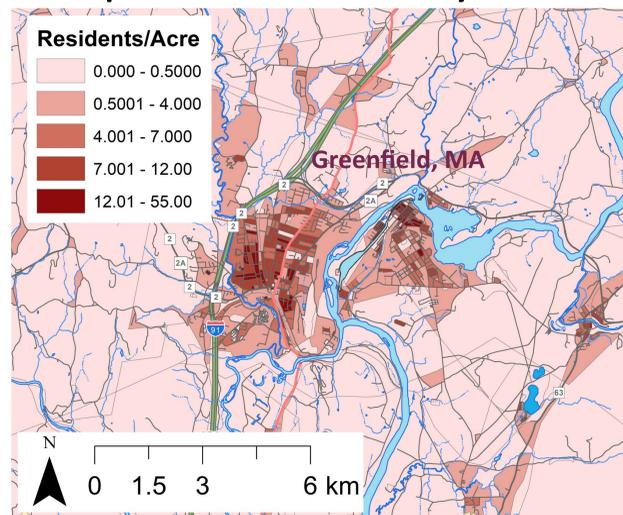
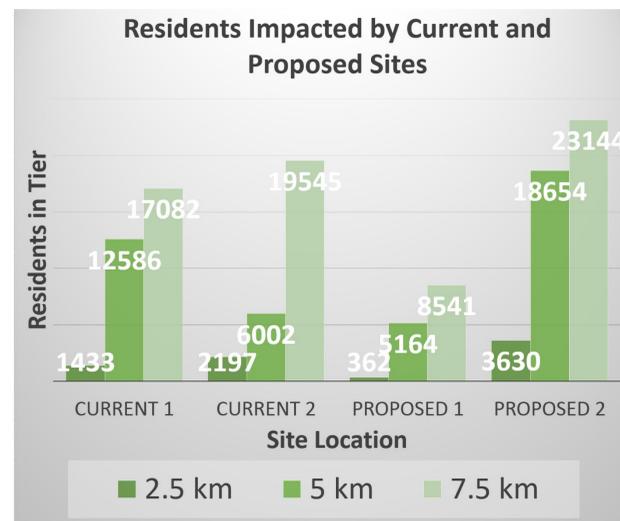
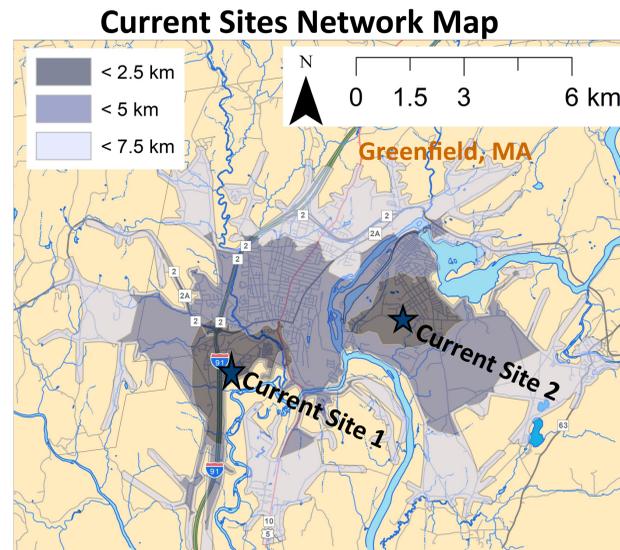


Figure 1: 2010 Census Population for Greenfield, MA and Turner Falls, MA, normalized by area. In Block Units.



Methodology

To assess the accessibility of the sites, a network analysis was conducted of the local road systems (Figures 2 and 3). A Mass Department of Transportation road layer (updated July 2018) which includes all public and private roadways was used as the basis for the network. Distance categories were designated as within 2.5 kilometers, 5 kilometers, and 7.5 kilometers based on relative site distance to population centers. Analysis did not expand far beyond roadways (no accounting for walking distance) due to the assumption that heavy recycling will not be manually carried significant distances.

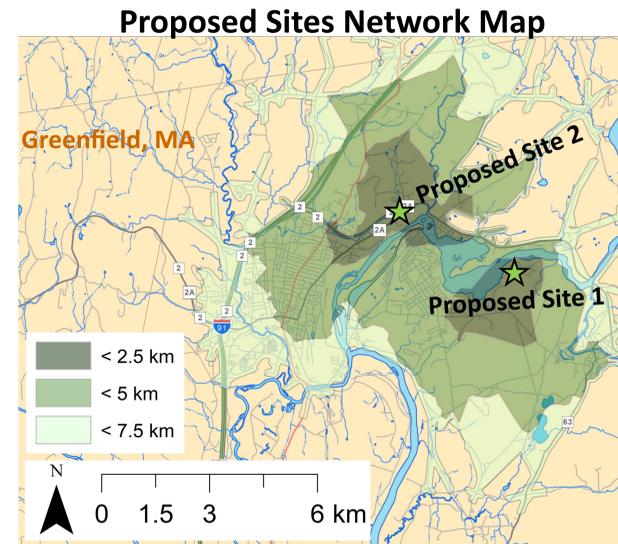


Figure 2 (Above left): Network Analysis at 2.5 km, 5 km, and 7.5 km based on 2018 MassDOT Roads from the two current solid-waste processing sites.

Figure 3 (Above): Network analysis at 2.5 km, 5 km, and 7.5 km based on 2018 MassDOT Roads from the two proposed recycling facility sites.

Figure 4 (Left): Residents impacted within each network distance

The second step in examining accessibility is to evaluate the number of residents within each tier of network distance. To do so, I used 2010 census population data (Figure 1), but census data is only precise down to block level to protect individual's privacy. Block level census data does not have the granularity we need to adequately examine impact in such a small area. To account for this, the population data was normalized by area and subsequently rasterized so that the population was divided among cells at the block level. This does not change the granularity of the data, but it does help to more accurately assess how many people are impacted by the sites, especially in the larger blocks.

The final step of the assessment is to use zonal statistics to take the summation of residents within each of the network tier polygons for every site. The value (# of 2010 residents) of all cells whose centroid is within the network polygons is summed up, providing the total residents impacted in each distance tier.

Results

This pilot model finds that proposed site #2 would be the most accessible recycling facility to local residents and the 1st proposed site the least accessible. I believe this model is a good tool for comparing the locations, but I am not confident in the actual number of residents that it predicts at each distance level. The 2010 Census data is not granular enough to assess precise resident impact at this scale, even when increasing precision by calculating residents per raster cell.

The model itself is only representing one small facet of the many considerations that must be examined before the city can choose a facility location. These data completely ignore environmental concerns, economic and political constraints, location-based stigma, etc. Before any decision could be made, a multi-criteria analysis incorporating this model and these other considerations will need to be developed.

Sources

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Created By: Nick Pipkin

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Coordinate Projection: Massachusetts State Plane