Cartographer: Morgan Griffiths
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Projection: Lambert Conformal Conic
Coordinate System: NAD 1983 2011 Massachusetts State Plane (US Feet)

A Place to Farm:
Locating Medford's Next Community Garden

Tufts

Introduction

Community gardens can benefit urban communities in several ways: not only do they yield fresh fruits and vegetables and thus contribute to the physical health of community members (Blair, Giesecke, and Sherman), they can also help bridge ethnic, income, and age gaps by getting neighbors to work together to produce food (Armstrong, Tieg et al.). This interdependence can result in feelings of reciprocity and mutual trust amongst city dwellers, which can build community cohesion and can motivate residents (especially in lower-income areas) to work together to address other problems facing their neighborhoods (Ibid). At the same time, however, the presence of community gardens can make neighborhoods more attractive to developers and home-buyers, thus contributing to the gentrification of previously low-income areas and the displacement of its residents (Markham).

The City of Medford, Massachusetts currently has four community gardens. Given the size of the city and the community-building potential of urban farms, more gardens could feasibly be constructed in the city to positive effect. However, given the connection between urban farms and gentrification, care must be taken in the selection and creation of sites in order to prevent gardens from contributing to the displacement of current residents. **In this project, then, I ask the following questions: what areas of Medford are suitable for the creation of a new community garden? Do demographics in these areas indicate susceptibility to gentrification?**

Methodology

Criteria for Suitable Garden Location

1. Far from existing community gardens (at least 1/2 mile away)
2. Near MBTA bus Stops (ideally 1/4 mile or closer)
3. Near MBTA T stops (ideally 1/4 mile or closer)
4. Far from large roads that could cause soil and air pollution (at least 1/3 mile away)
5. Located within low income block groups (ideally below $57,617, the median income for the United States in 2016)
6. Located on suitable land type (Open land, high density residential, low density residential, multifamily residential, urban/public land, and/or commercial land)
7. Located on land parcels with 0% built area
8. Located on areas with appropriate slope (15% or less)

Steps for Weighted Raster Overlay

I collected vector data for all 8 criteria, converted each layer into either a regular raster or a Euclidean Distance raster, and then reclassified each to reflect the various scales shown in the table below (here, higher numbers reflect more suitable conditions and lower numbers reflect less suitable conditions). I then combined each raster to create a weighted overlay, using the weights shown in the table below.

Data Layer	Reclass Scale	Weight
Community Garden Euclidean Distance	1-6	2%
Roads Euclidean Distance	1-6	3%
MBTA T Stops Euclidean Distance	1-8	8%
MBTA Bus Stops Euclidean Distance	1-8	8%
Block Groups symbolized by Income	1-5	8%
Slope Raster	1-7	15%
% Built Area Raster	1 or 10	22%
Land Use Raster	0, 9, 0r 10	34%

Steps for Fuzzy Raster Overlay and Vector Suitability (to mitigate spatial errors caused by the arbitrary classifications in the Weighted Overlay)

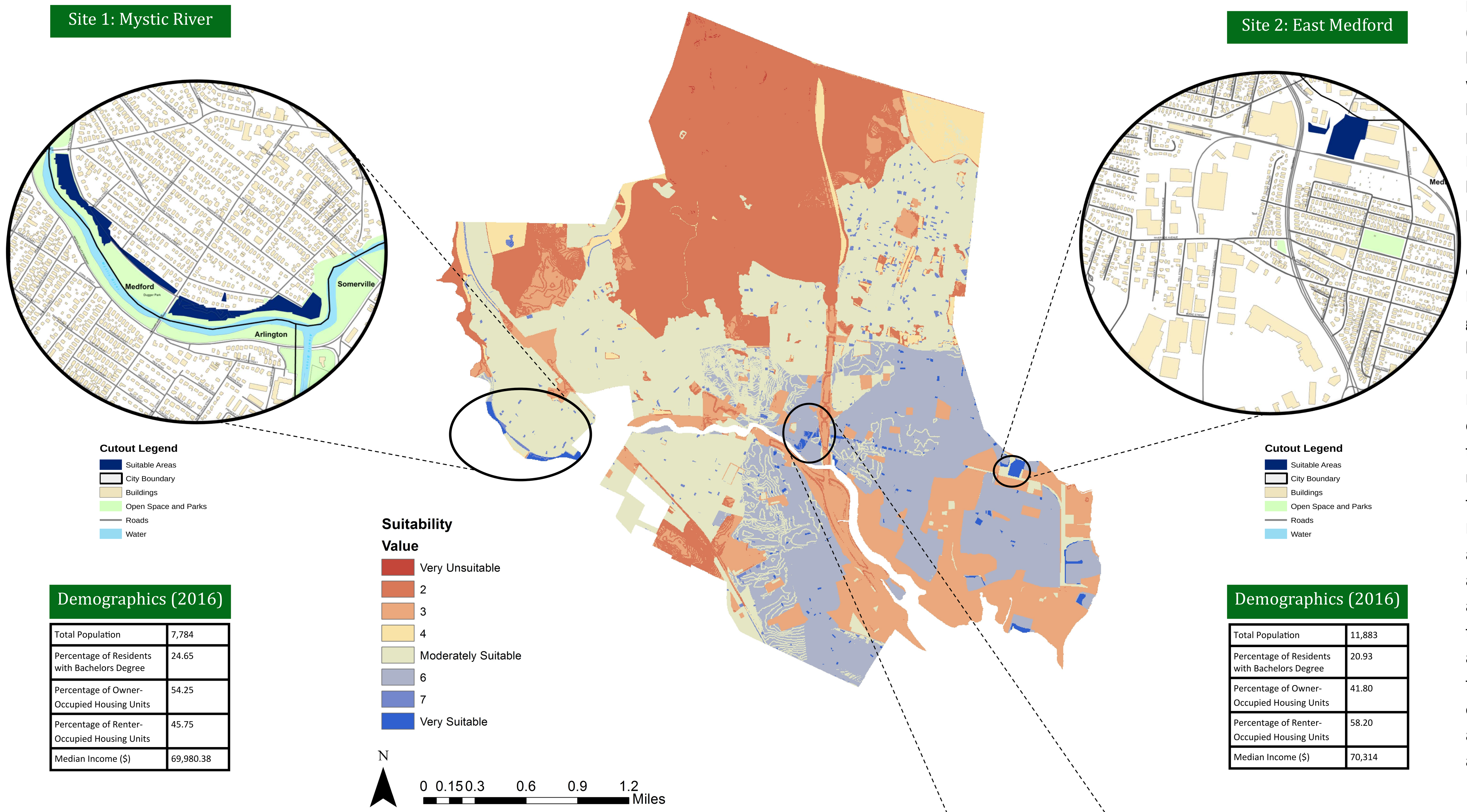
1. Converted each pre-reclass Euclidean Distance raster and the slope raster to Fuzzy members
2. Used the Fuzzy Overlay tool to combine each fuzzy member into a common overlay
3. Selected lower income block groups, appropriate land use polygons, and parcels with 0% built area from original vector layers and found where all three intersected
4. Placed vector polygon layer on top of the fuzzy overlay to see common areas

Steps for Finding Demographics of each area

1. Identified 4 of the largest and most suitable areas on both overlays
2. Converted weighted suitability raster to polygons
3. Selected every block group located within 1/4 mile of each suitable polygon area
4. For each set of block groups, recorded total population, mean percentage of residents with a bachelors degree, mean percentage of owner and renter occupied housing units, and mean median income

Results

Weighted Raster Suitability



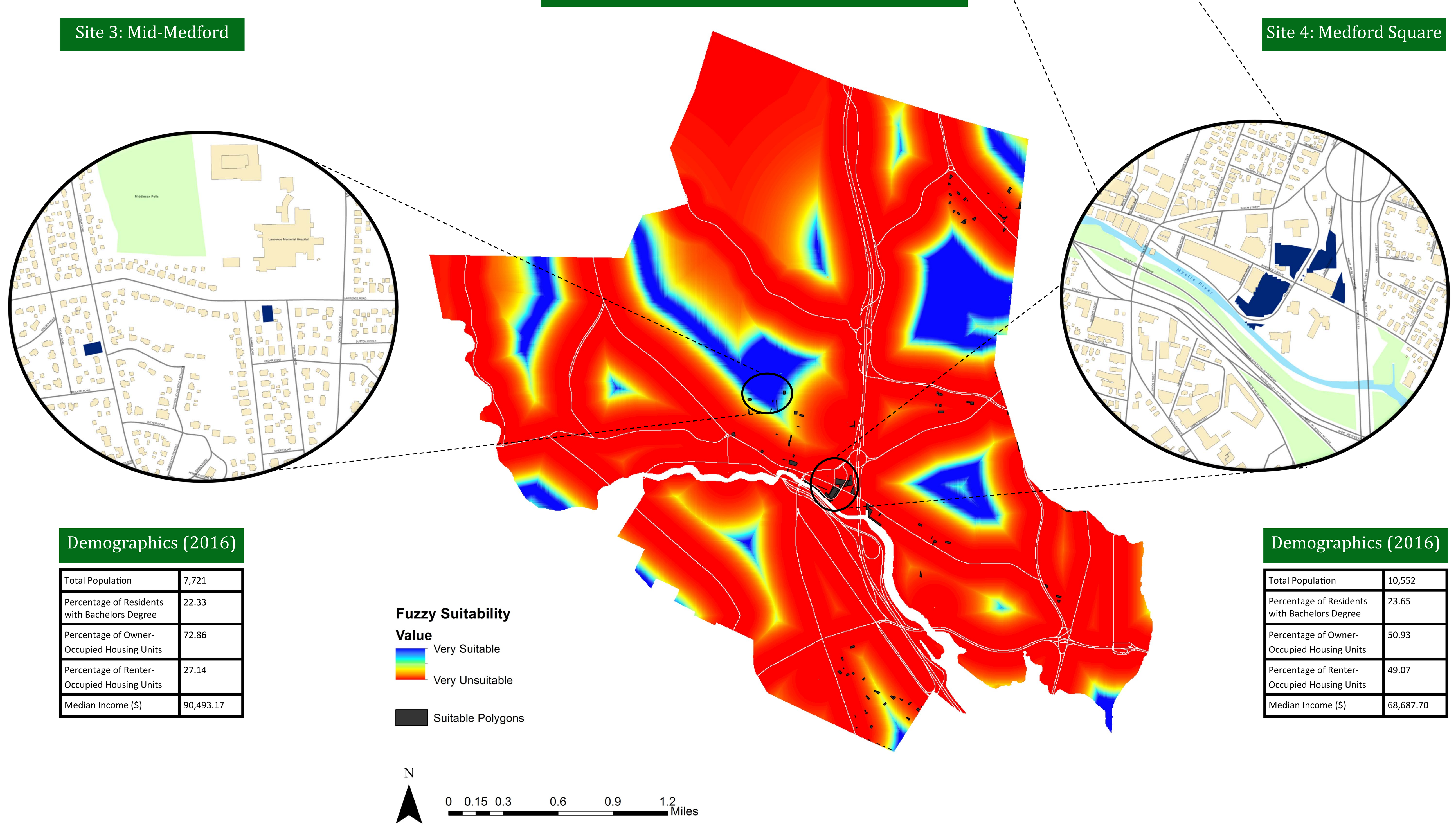
Site 1: Mystic River — Demographics (2016)

Total Population	7,784
Percentage of Residents with Bachelors Degree	24.65
Percentage of Owner-Occupied Housing Units	54.25
Percentage of Renter-Occupied Housing Units	45.75
Median Income ($)	69,980.38

Site 2: East Medford — Demographics (2016)

Total Population	11,883
Percentage of Residents with Bachelors Degree	20.93
Percentage of Owner-Occupied Housing Units	41.80
Percentage of Renter-Occupied Housing Units	58.20
Median Income ($)	70,314

Fuzzy Raster and Polygon Suitability



Site 3: Mid-Medford — Demographics (2016)

Total Population	7,721
Percentage of Residents with Bachelors Degree	22.33
Percentage of Owner-Occupied Housing Units	72.86
Percentage of Renter-Occupied Housing Units	27.14
Median Income ($)	90,493.17

Site 4: Medford Square — Demographics (2016)

Total Population	10,552
Percentage of Residents with Bachelors Degree	23.65
Percentage of Owner-Occupied Housing Units	50.93
Percentage of Renter-Occupied Housing Units	49.07
Median Income ($)	68,687.70

Conclusion

When deciding which sites to highlight, I looked for ones that were the most suitable and also the largest (which allows for a larger garden and more flexibility in placement). Here, I have decided to highlight 4 key areas. I chose Site 1 (the Mystic River) and Site 2 (East Medford) because they are relatively large sites that have been given the highest level of suitability on the weighted raster overlay. The combined fuzzy/polygon overlay was more difficult to assess because areas of high fuzzy suitability rarely matched up with large suitable polygons. So, I decided to highlight Site 3 (Mid-Medford) which is comprised of two smaller suitable polygons that are found in an area of high fuzzy suitability. Finally, I decided to highlight Site 4 (Medford Square) because it appeared as both a highly suitable area on the weighted raster and as a group of suitable polygons on the fuzzy/polygon overlay (though there it also lies on top of an area of low fuzzy suitability).

These four areas are thus strong contenders for possible community gardens because they have met all (or most) of the criteria that I had set. The East Medford and Medford Square Sites further stand out because over 10,000 people live in the block groups that are within a quarter mile of each (thus, they have the potential to be accessible to more people than the other 2). However, it is important to consider the demographics of each area in order to ascertain its vulnerability to gentrification. The City of Portland has identified areas with high concentrations of residents without a bachelors degree, high concentrations of renters, and low median income as particularly vulnerable to gentrification (City of Portland). In each of the block groups around all four sites, the mean percentage of people over 25 with bachelors degrees was less than 33.4% (the national average in 2016). The percentage of renter occupied units was over 50% around East Medford, and was close to 50% around Medford Square, while it was not as high around the Mystic River and Mid-Medford. The mean median income for each area was at least $10,000 above the national average in 2016 of $57, 617 though it was highest around Mid-Medford. So, while none of the selected areas satisfy all of the above criteria for vulnerability to gentrification, East Medford and Medford Square may be more vulnerable than the other two given their high percentage of renters and low percentage of educational attainment, and so care must be taken if they are selected for future gardens.


Fenway Community Garden in Nearby Boston. Photo courtesy of Wikimedia Commons

Finally, it is important to note that this is only the beginning of the garden selection process. I have identified four possible sites based on my criteria, but it would be useful to run further suitability analyses with other criteria such as access to water, shade level, soil type, and access to parking, among other things. That, however, is a task for another project.

Sources of Error

There could have been many possible sources of error in this project. First, the demographic data that I joined to the block group layer was missing income information for a few block groups in southwest Medford. Thus, these areas were not included in any subsequent income analysis, which could have prevented them from being as strongly considered in the weighted and fuzzy/polygon overlay processes. Second, the very process of reclassifying and weighting rasters is full of the potential for error. By making (more or less) arbitrary classification and weighting decisions, I grouped together and gave different levels of importance to data that might not naturally fall into such neatly-defined categories. The process of creating a fuzzy raster decreased this error somewhat, as it allowed for each set of data to be classified in a way that was more consistent with how it exists in the real world.

Sources

Data Sources: MassGIS, MAPC, IPUMS NHGIS, Google Maps, City of Medford, City of Somerville, City of Arlington. Special thanks to the Medford Community Garden Commission

Literature: Blair, Dorothy, Carol C. Giesecke, and Sandra Sherman "A dietary, social and economic evaluation of the Philadelphia urban gardening project. *Journal of Nutrition Education* 23, no. 4 (July-August 1991): 161-167; Armstrong, Donna. "A survey of community gardens in upstate New York: Implications for health promotion and community development"*Health and Place* 6, no. 4 (December 2000): 319-327; Teig, E., et al., Collective efficacy in Denver, Colorado: Strengthening neighborhoods and health through community gardens. *Health & Place* (2009): 1-8; Markham, Lauren. "Gentrification and the Urban Garden" *New Yorker,* May 21, 2014; City of Portland Bureau of Planning and Sustainability. "Gentrification and Displacement Study Overview." City of Portland (2013).