Northampton, MA: Exploring the Relationship Between Home Age & Energy Efficiency

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Introduction

The City of Northampton, Massachusetts is seeking to reduce its carbon footprint by increasing the number of residents investing in home energy improvements. To accomplish this, Northampton is planning an outreach program to encourage residents to replace older oil and natural gas heating systems with renewable thermal energies. The City would like to target their outreach at likely adopters of these improvements. The process of identifying likely adopters can be greatly benefitted using GIS spatial analysis by mapping the energy efficiency ratings of homes throughout Northampton.
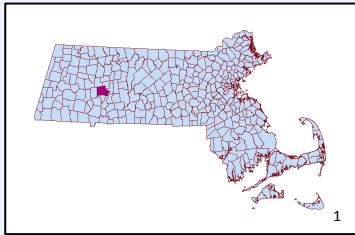


Figure 1: Study area: Northampton, Massachusetts

Source Data

- GIS layer that contains all municipal boundaries in MA. From Mass GIS.
- Shapefile that contains roof outlines of all buildings in MA larger than 150 square feet. From Mass GIS.
- Shapefile of all MA roads. From Mass GIS.
- Excel file that contains the addresses, age, and energy efficiency scores of each home in Northampton. From Northampton's Department of Planning and Sustainability.
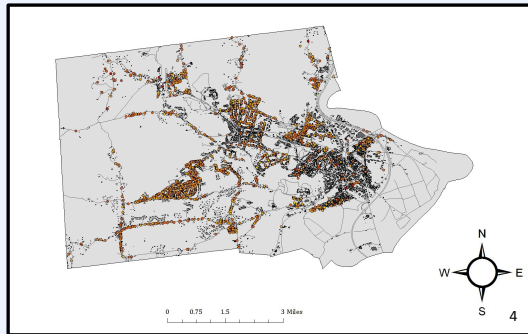

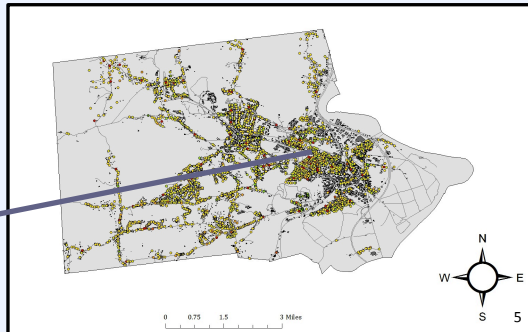Figure 2: Zoomed view of "Homes Built 1979 – Present"
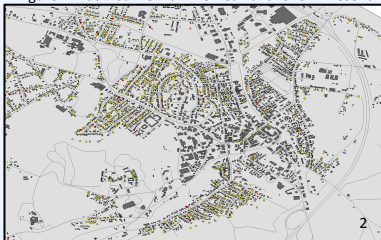
Homes Built Pre - 1943
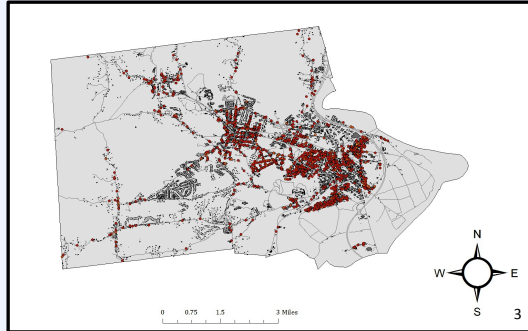
Homes Built 1943 - 1978

Homes Built 1979 - Present

Methods

- I geocoded all Northampton addresses and added the coordinates to an excel file that contains all addresses and energy efficiency information
- I imported the excel sheet and specified XY values and a coordinate system (GCS_North_American_1983)
- I created permanent shapefiles for these points by exporting the newly created data
- I applied green/red gradient symbology, where bright red points represent energy inefficient homes, and bright green points are zero net energy homes
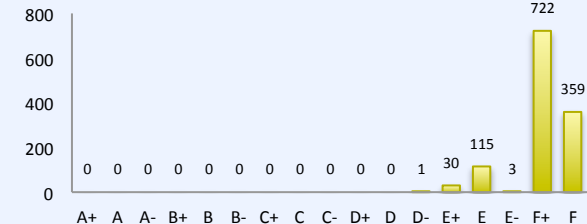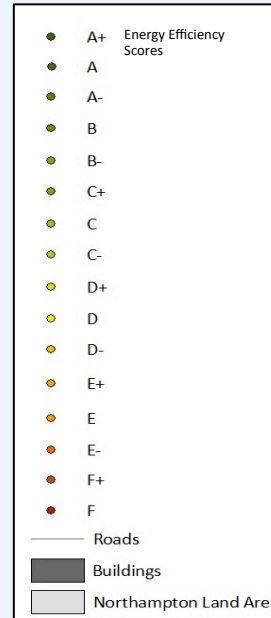
Legend

Energy Efficiency Scores

A+
A
A-
B
B-
C+
C
C-
D+
D
D-
E+
E
E-
F+
F

— Roads

▪ Buildings

▫ Northampton Land Area

Figure 6: Ratings of Homes Built Pre - 1943

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E+	E	E-	F+	F
0	0	0	0	0	0	0	0	0	0	0	1	30	115	3	722	359
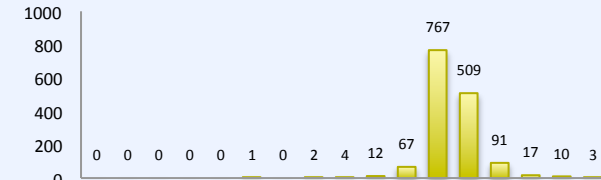
Figure 7: Ratings of Homes Built 1943 - 1978

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E+	E	E-	F+	F
0	0	0	0	0	1	0	2	4	12	67	767	509	91	17	10	3
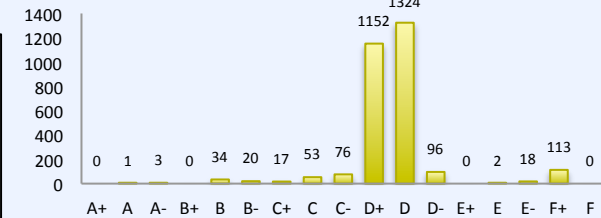
Figure 8: Ratings of Homes Built 1979 – Present

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E+	E	E-	F+	F
0	1	3	0	34	20	17	53	76	1152	1324	96	0	2	18	113	0

Results & Discussion

These maps suggest an important relationship between the year Northampton homes were built and their energy efficiencies, where older homes are less energy efficient on average. The energy efficiency grade distribution differed significantly among the three age groups (see Figures 6-8). The maps (Figures 3-5) show that homes built in similar time periods have similar energy efficiency scores. The older, less energy efficient homes tend to be found closer to the center of the city, while newer homes built further from downtown had overall higher efficiency scores.

With an improved understanding of where energy inefficient homes are located, Northampton can focus on other criteria of energy improvement likely adopters (age of heating system, boiler type, income level) in these select areas as they continue planning their outreach efforts.

Limitations to this project include geocoding mistakes. Zip codes were not available in the database, so the zip code 01060 (Northampton's primary zip code) was used for every address.