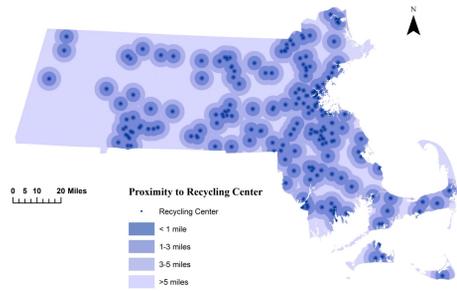
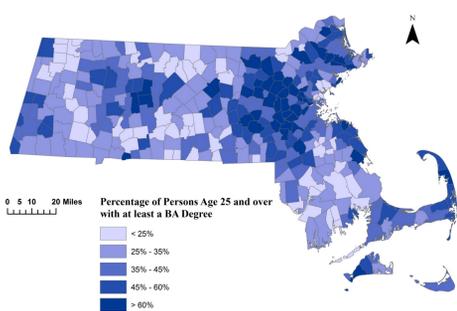


Effectiveness Analysis of Pay-as-you-through Program in Massachusetts

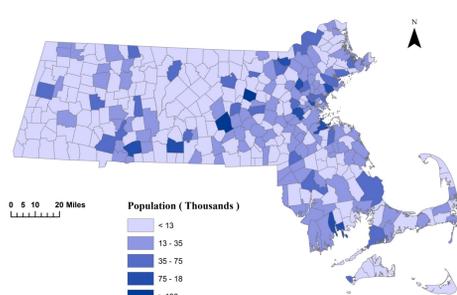
Distance to Recycling Center by Massachusetts Municipalities, 2008



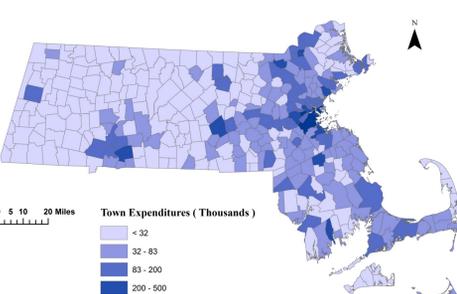
Education Level by Massachusetts Municipalities, 2008



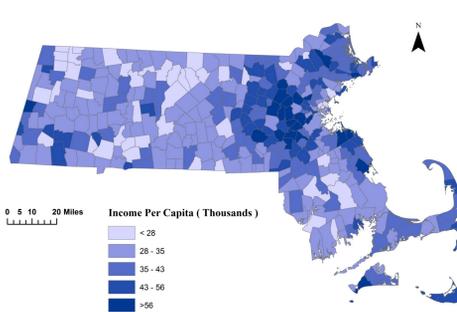
Population Distribution by Massachusetts Municipalities, 2008



Town Expenditures by Massachusetts Municipalities, 2008



Per Capita Income by Massachusetts Municipalities, 2008



Regression Analysis for the Effect of PAYT Program on Massachusetts Municipalities' Recycling Rates from 2003 to 2008

VARIABLES	OLS	Random Effect
PAYT Program	0.3774	0.3165
(Dummy Variable)	(0.0228)***	(0.0376)***
Income per capita	3.4386	12.4324
	(1.9036)*	(2.0971)***
Percent 25 and over with at least a BA degree	0.7198	
	(0.1275)***	
Town Expenditures	0.0012	
	(0.0004)***	
Population	-0.0056	
	(0.0016)***	
_cons	-1.7679	-1.8786
	(0.0463)***	(0.0836)***
R-Squared	0.2389	
N	1,834	1,836
SER	0.4500	0.2654

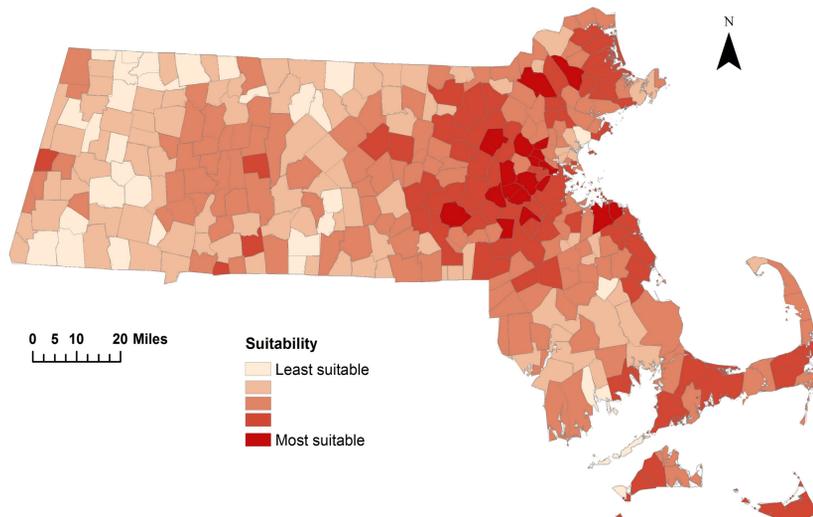
* p<0.1; ** p<0.05; *** p<0.01. Standard errors in parentheses

Introduction

Pay-as-you-throw (PAYT) program has become popular in Massachusetts in recent years. It is defined as a usage-pricing trash collection and recycling program for disposing of municipal solid waste. The effectiveness of a PAYT programs is usually measured by its ability to increase recycling rate. The objective of the project is to understand what factors might influence the effectiveness of a PAYT program.

This project intends to answer two questions. The first is if a PAYT program is effective in increasing recycling rate on municipality level. The second question is based on the results of the first question. If PAYT programs do not do well in all municipalities, what factors might explain this kind of ineffectiveness in particular areas? Answering these questions will provide some insights on how to improve the effectiveness of PAYT programs in Massachusetts.

Suitability to implement a PAYT Program by Municipalities, MA



Methods

The main variable of interest of the project is PAYT program. To explore if implementing a PAYT program leads to an increase of recycling rate, both static and dynamic analyses are conducted. Two maps are created to depict the changes of recycling rate and PAYT program status within each municipality from year 2003 to 2008. A bar graph is used to compare the differences of recycling rates among municipalities with and without a PAYT program.

To answer the second question, a suitability model was constructed to identify municipalities where implementing a PAYT program will be effective in increasing recycling rate. I capture five key factors that may influence the effectiveness of PAYT programs: per capita income, population, town expenditures, education level and distance to recycling centers. The buffer tool is used to depict proximity to recycling centers and the near tool is applied to calculate distance between each municipality and the closest recycling center. By converting polygons to raster, and reclassifying raster, it is possible to rank municipalities for each of the dimensions. Using raster calculator and giving different weight to each factor, a suitability map combining all these factors is created and it can be compared with actual PAYT program status in 2008.

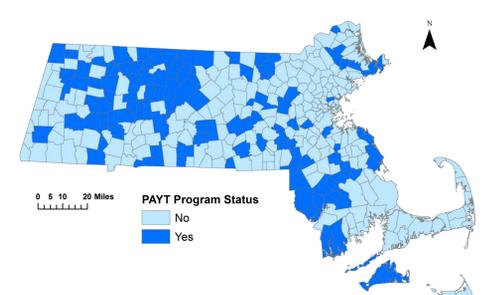
In order to see if the spatial relationship depicted is consistent with statistical analyses, both OLS and random effect model are run for the panel data from year 2003 to 2008. In the OLS model, demographic factors are used as control variables. The random effect model assists in controlling for unobserved heterogeneity that might

be time invariant and correlated with recycling rate. We can foresee that implementing a PAYT program can contribute to higher recycling rate in both models. However, a more robust statistical analysis is required before we draw further conclusions on the effect of PAYT program.

Findings

From the dynamic analysis of the change in PAYT program status and recycling rate, we see that implementing a PAYT program does not necessarily lead to increase in recycling rate for all municipalities. The reason is that the effectiveness of PAYT program is affected by demographic factors and distance to recycling centers. Econometric analysis proves this kind of spatial relationship. In general, income, education level and town expenditures have positive effects on recycling rate while population has a negative effect. The closer an area is to a recycling center, the more effective a PAYT program would be. The suitability map combines all these five factors, and identifies areas that are most suitable for implementing a PAYT program. Comparing with PAYT program status in 2008, we find that most municipalities with high suitability have already implemented a PAYT program. However, some of the western suburbs in Middlesex county such as Newton and Weston are highly suitable for implementing a PAYT program but do not have one.

PAYT Program Status by Massachusetts Municipalities, 2008



Conclusions

This project combines economic analysis with GIS technology and provides a detailed analysis of current PAYT program in Massachusetts. It provides valuable information for suggesting how to increase the effectiveness of municipal recycling program in the future. People need to be educated of the necessity of recycling and government should provide economic incentives to those poor areas which have a PAYT program. This can be done through advertising, and awareness raised as part of the curriculum in the schools located in poorer neighborhoods. Further research is needed before we reach a final conclusion on this issue.

Data Sources: MassDEP, MassGIS, City-Data.com

Coordinate System:

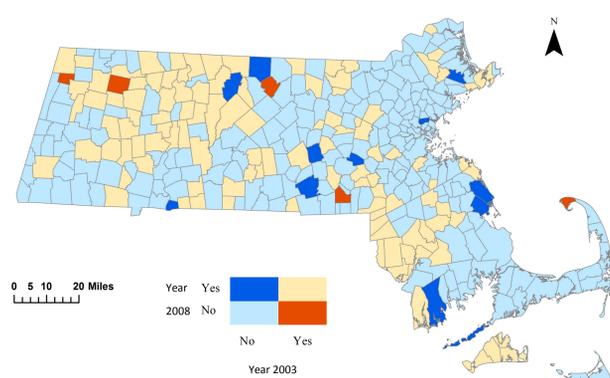
NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001

Cartographer: Jun Gao, Dec. 2015, UEP-232-01

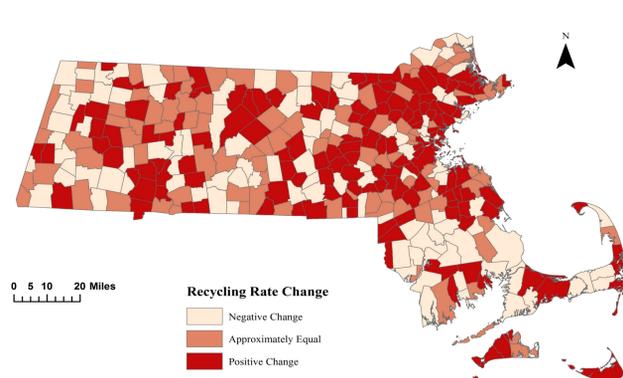


The Effect of PAYT Program on Recycling Rate : Static and Dynamic Analysis

Change in PAYT Program Status by Massachusetts Municipalities 2003 - 2008



Change in Recycling Rate by Massachusetts Municipalities 2003 - 2008



Average Recycling Rates in Municipalities with and without PAYT Program 2008

