More Housing, Less Greening?

Housing Developments and Vegetation Change in Massachusetts, 2013-2017

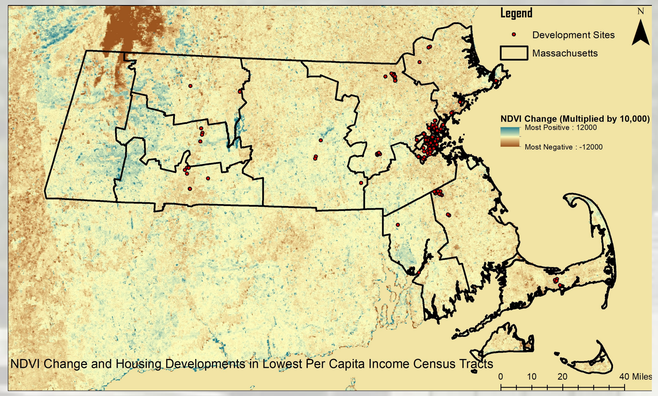
Introduction

In order to develop housing in Massachusetts, we absolutely need land. But where does the land come from? The assumption here is that greenery land has contributed a lot to it, which probably is not too surprising. Quite a few scholarly articles online suggest that housing development patterns in Massachusetts have some relationships with greenery variables. Some claim that a lot of farmland has lost in order for housing units to be built, especially in areas away from the centers of the cities in north central Massachusetts (Levia 1997). Some declare that forest land has been converted a lot as well in the Commonwealth and that has something to do with local economic influence (McDonald et al. 2006). Others have found that housing developments have a positive correlation with the number of invasive exotic plant species in New England (Gavier-Pizzaro et al. 2010). Therefore, it is natural to consider how the housing developments relate to the general greenery pattern, with additional considerations for economic factors.

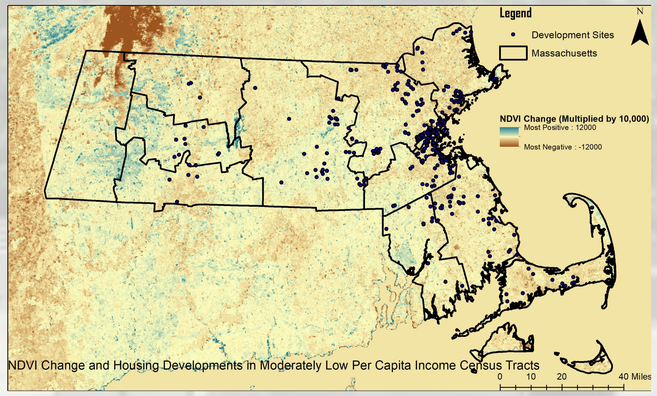
Here I choose NDVI (Normalized Difference Vegetation Index) to be an indicator of the general greenery condition, and I will explore the change for a five-year period, which is an appropriate length to see change. I will use per capita income as a measure of local economic situation.

Methods (Data Collection)

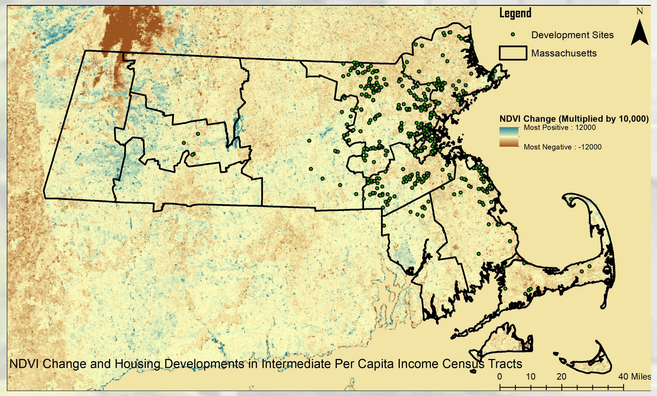
I obtained housing development unit data from Massbuilds under MAPC (Metropolitan Area Planning Council). It was a shapefile of vector points. The last time that all data were updated is in 2018, so I pick projects completed between 2013 and 2017 (inclusive). That means I can only select NDVI data early in 2018 and 2013, which is springtime, to see the change before and after they were built. I select April, because spring just begins and the change of NDVI is more conspicuous. I use data from the eMODIS NDVI V6 collection by USGS. I choose the time to be as close to each other as possible—for 2013 it's April 9 to 22 and for 2018 it's April 17 to 30—and the NDVI value is the average over these days. The data are in a raster layer, and I pick the smallest resolution 250m. The values are multiplied by 10,000 for the sake of storage convenience. As for per capita income I downloaded a csv file for 2013-2017 in smallest spatial unit available census tract from DataCommon which is also under MAPC.



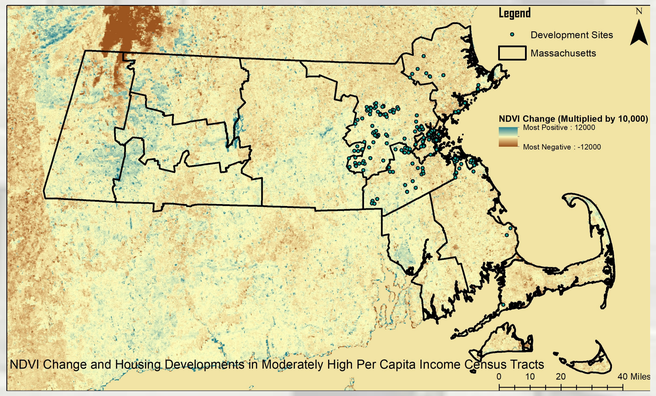
NDVI Change and Housing Developments in Lowest Per Capita Income Census Tracts



NDVI Change and Housing Developments in Moderately Low Per Capita Income Census Tracts



NDVI Change and Housing Developments in Intermediate Per Capita Income Census Tracts



NDVI Change and Housing Developments in Moderately High Per Capita Income Census Tracts

Cartographer: Yue Wang

Date: December 2019

Class: UEP 232 Introduction to GIS

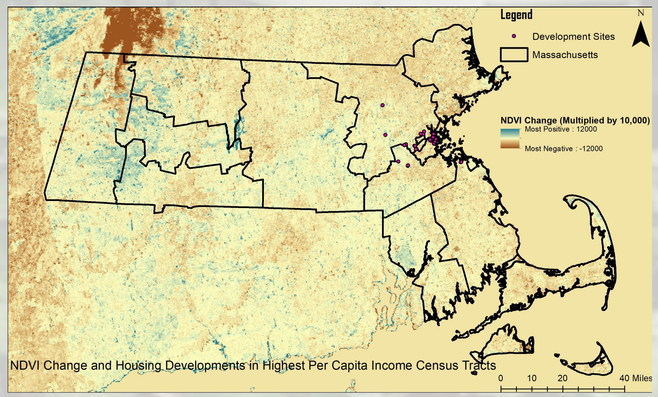
Projection: Lambert Conformal Conic

Sources:

Tufts M Drive

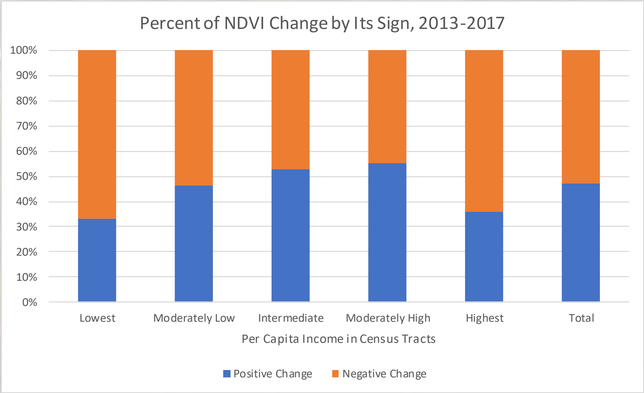
USGS eMODIS NDVI V6

Massbuilds



NDVI Change and Housing Developments in Highest Per Capita Income Census Tracts

	Development Units with Positive NDVI Change	Development Units with Negative NDVI Change	Total
Lowest Income Census Tracts	82 (33%)	166 (67%)	248
Moderately Low Income Census Tracts	187 (47%)	214 (53%)	400
Intermediate Income Census Tracts	275 (53%)	244 (47%)	519
Moderately High Income Census Tracts	146 (55%)	119 (45%)	265
Highest Income Census Tracts	42 (36%)	74 (64%)	116
Total	732 (47%)	816 (53%)	1548



Literatures:

Gavier-Pizzaro, Gregorio I. et al. (2010). "Housing is Positively Associated with Invasive Exotic Plant Species Richness in New England, USA."

Levia, D. F. (1997). "Farmland Conversion and Residential Development in North Central Massachusetts."

McDonald, Robert I. et al. (2006). "Forest Harvesting and Land-use Conversion over Two Decades in Massachusetts."

Background Image:

The Straights Times

https://www.straitstimes.com/business/more-greenery-space-in-cluster-housing-under-new-ura-guidelines

Methods (Operations)

I first use raster calculator to find the NDVI change. I then do an attribute query on the development site layer to find out units completed between 2013 and 2017. I extract raster values to points so that these units have information of raster values of the 250m grid they are in. I drag in 2010 census tract layer and do an attribute join to have income data joined to the layer. I do a spatial join (polygons to points) between census tract layer and development layer so that housing units have information of per capita income in their census tracts. Then I do select (analysis) to select on these units based on per capita income level. I extract raster values to points for these units at each income level so that these units at different income levels have raster values as well. Lastly I select by attribute to see how many units have positive/negative raster values.

Results & Discussions

As we can see from the table, overall 53% of the development units have negative NDVI changes. At per capita income levels, from low to high, the numbers are 67%, 53%, 47%, 45%, and 64%, respectively. So, it looks like housing developments generally have a negative impact on greenery in Massachusetts. The most negative impact happens at the lowest and the highest per capita income census tracts. Housing developments in the census tracts that have intermediate per capita income level and moderately high per capita income level actually have positive impact on greenery. Further research can be done to give more insight as to why we have such patterns. Is it because greenery land is taken mainly for the richest and the poorest people? Or could it be the richest and poorest people all do not care about vegetation or even like to destroy it, while people who live at and above the standard care more about it?

Limitations

For sure the study is still constrained in many regards. For example, we just select two individual years and something unusual might happen in either of those two years, which could affect our NDVI results. If I have more time, I could also examine multiple five-year periods and see how the results are similar or different to each other.