

# New England's Changing Forests: Mapping Land Cover Change



Joshua Plisinski – Harvard Forest – 8/23/2018

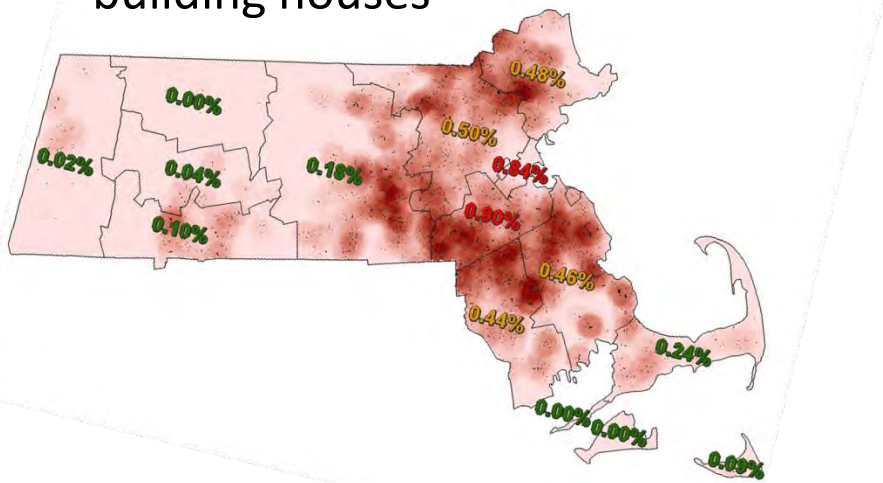
# Hi, my name is Josh



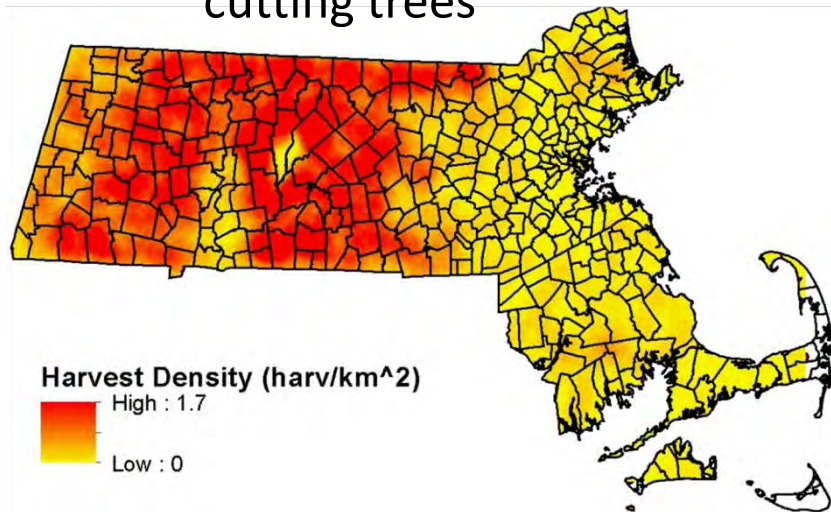
Can you guess what I do here at Harvard Forest?

# I make maps!

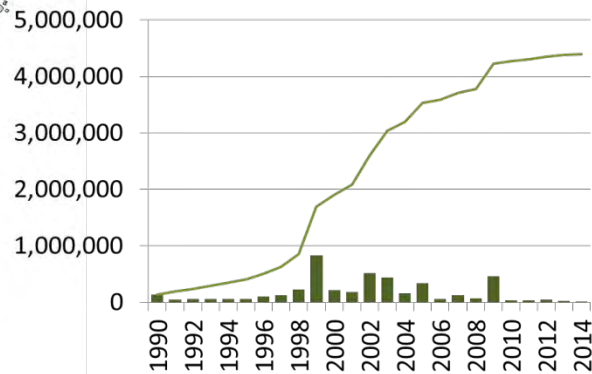
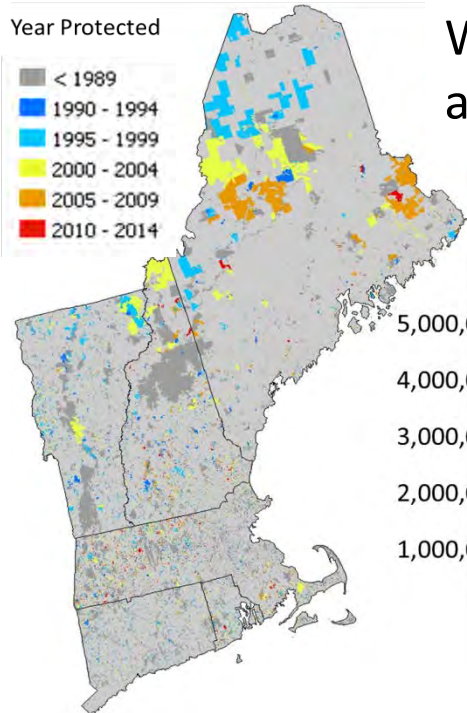
Where people are building houses



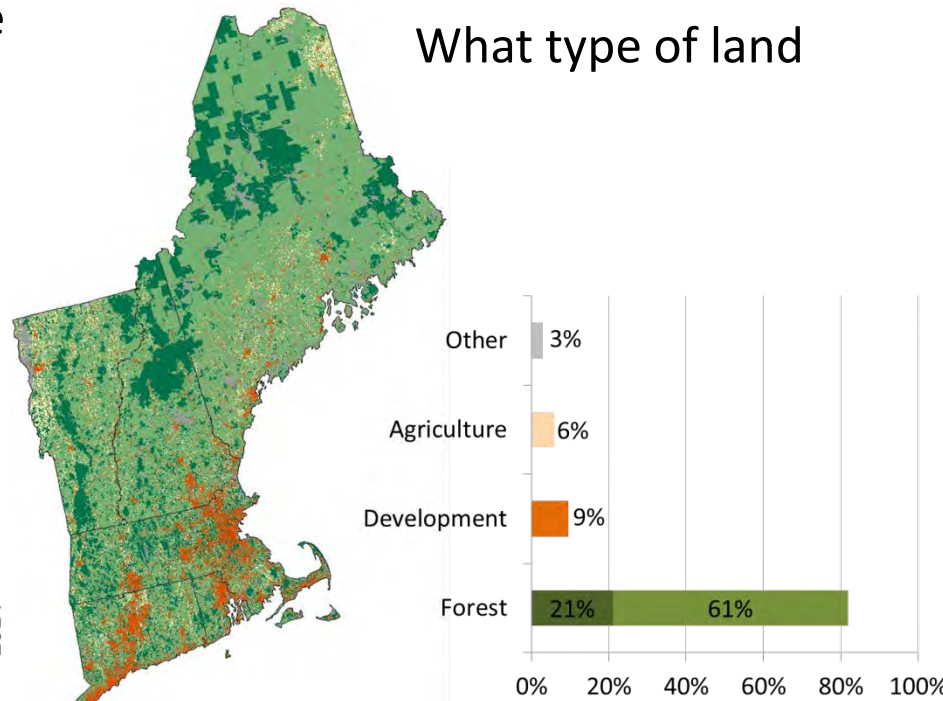
Where people are cutting trees



Where and when people are protecting land










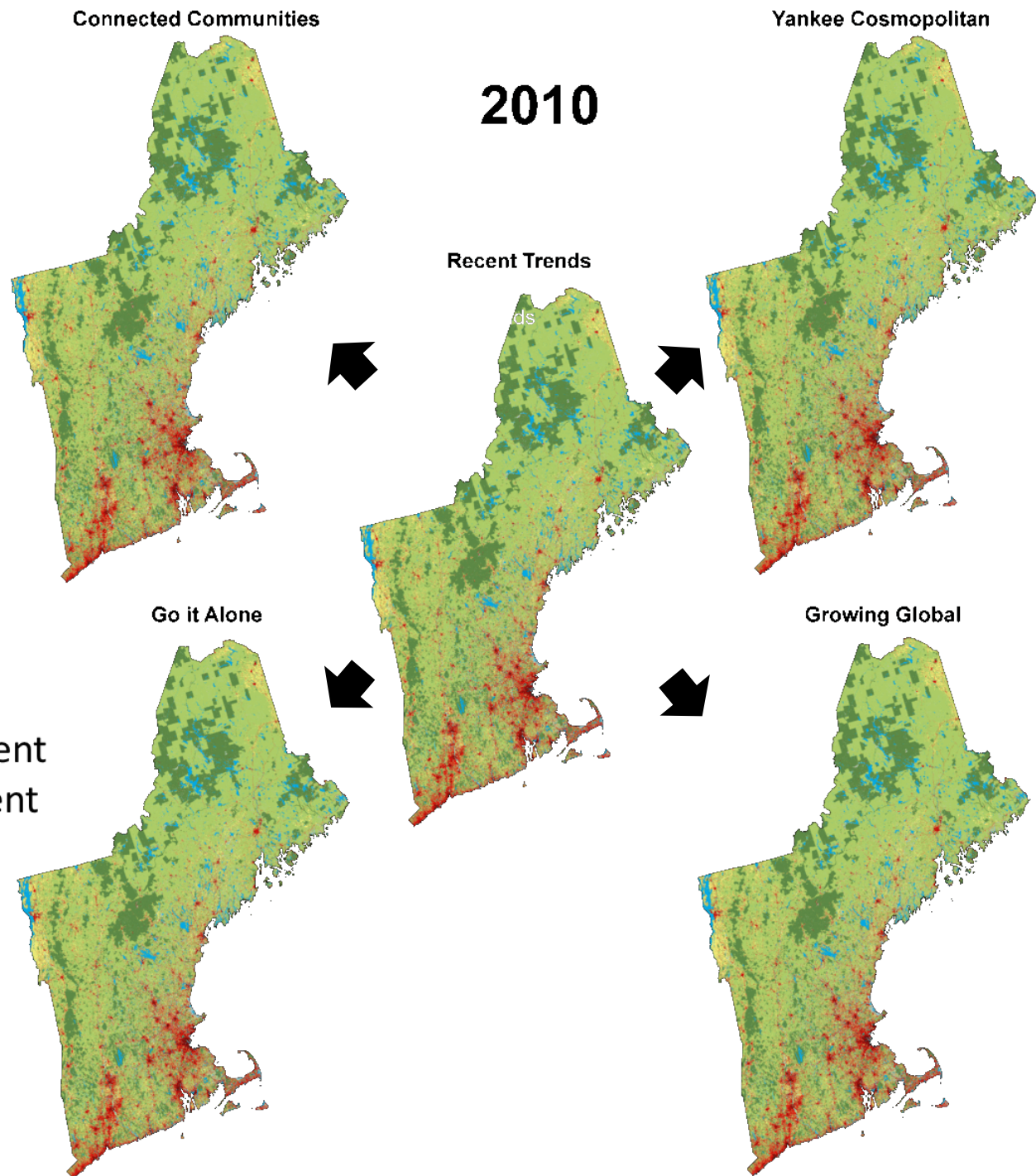
What type of land



# What will the future look like?



-  High Density Development
-  Low Density Development
-  Unprotected Forest
-  Conserved Forest
-  Agriculture
-  Other
-  Water



What do you think my job title is?

GIS and Research Assistant

Geographic Information Systems

Where is it?



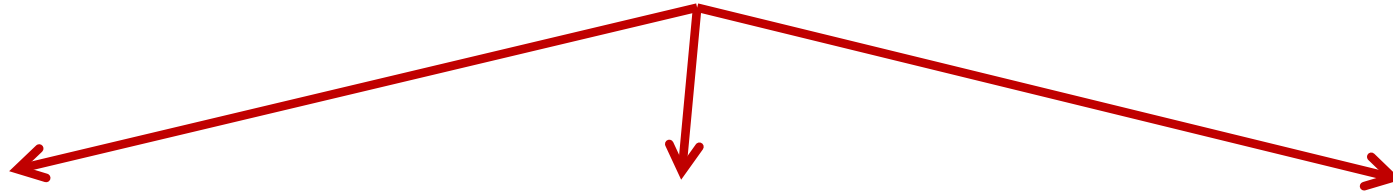
What is it?



How do we organize it?



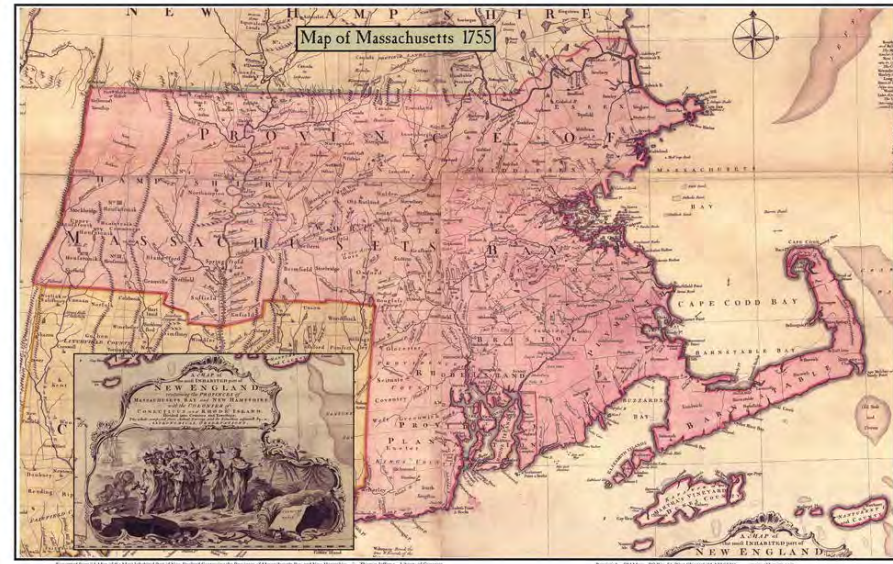
# GIS and Research Assistant



What is our question?

Has someone already answered it?

Should we use the information?



# GIS and Research Assistant

A team of helpers!



We assist the  Senior Ecologist

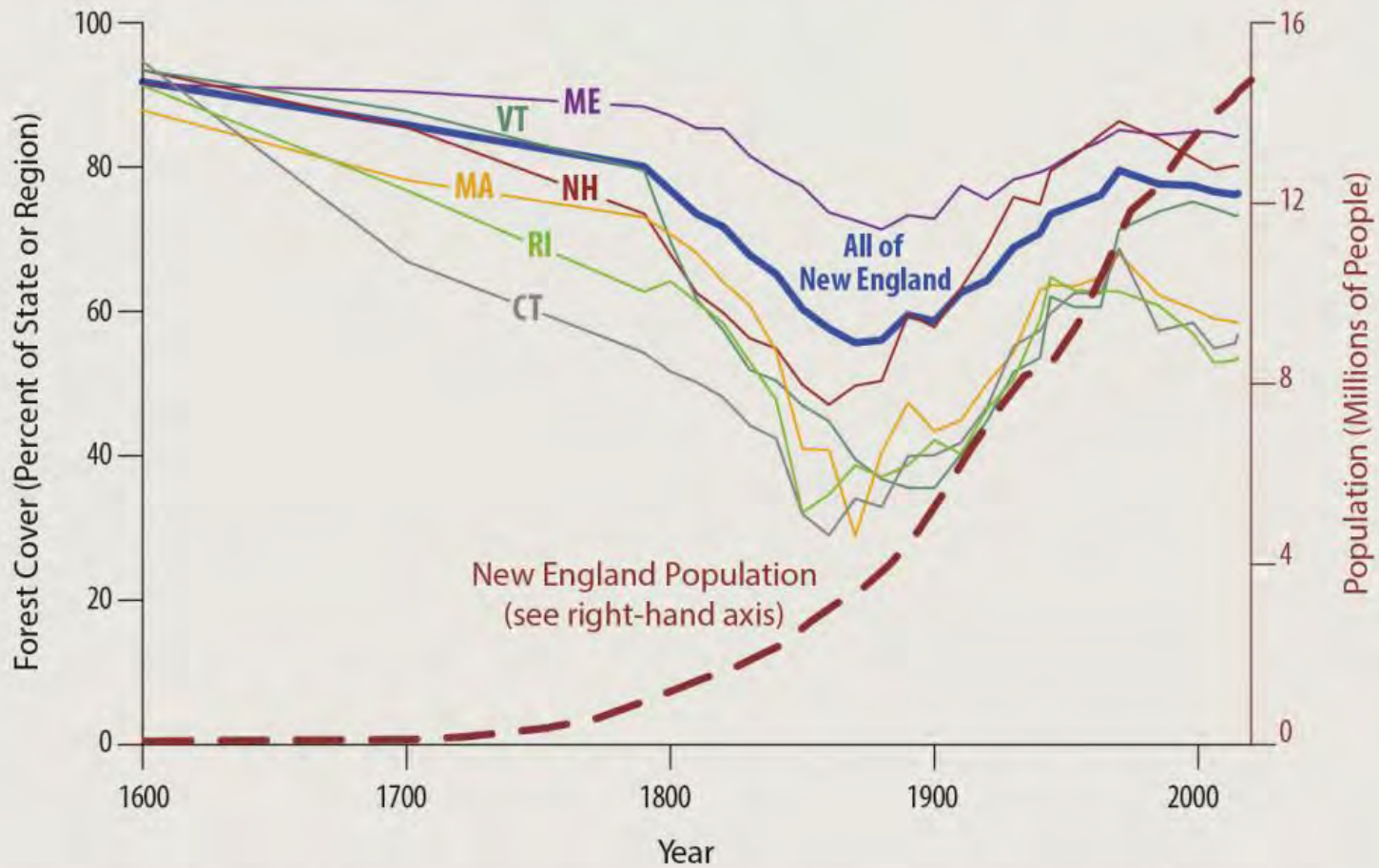
# New England's Changing Forests: Mapping Land Cover Change



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# New England Forest Cover and Human Population



*The second wave of forest loss now under way in New England jeopardizes the region's environmental success story, which has been characterized by the return of forests following the decline in agriculture in the East.*



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Contour lines are shown at 20-foot intervals.  
 Quilts are shown where a quilt line is indicated.  
 County boundaries are shown with a thick red line.  
 Town & City boundaries when not County boundaries are shown with a thin red line.

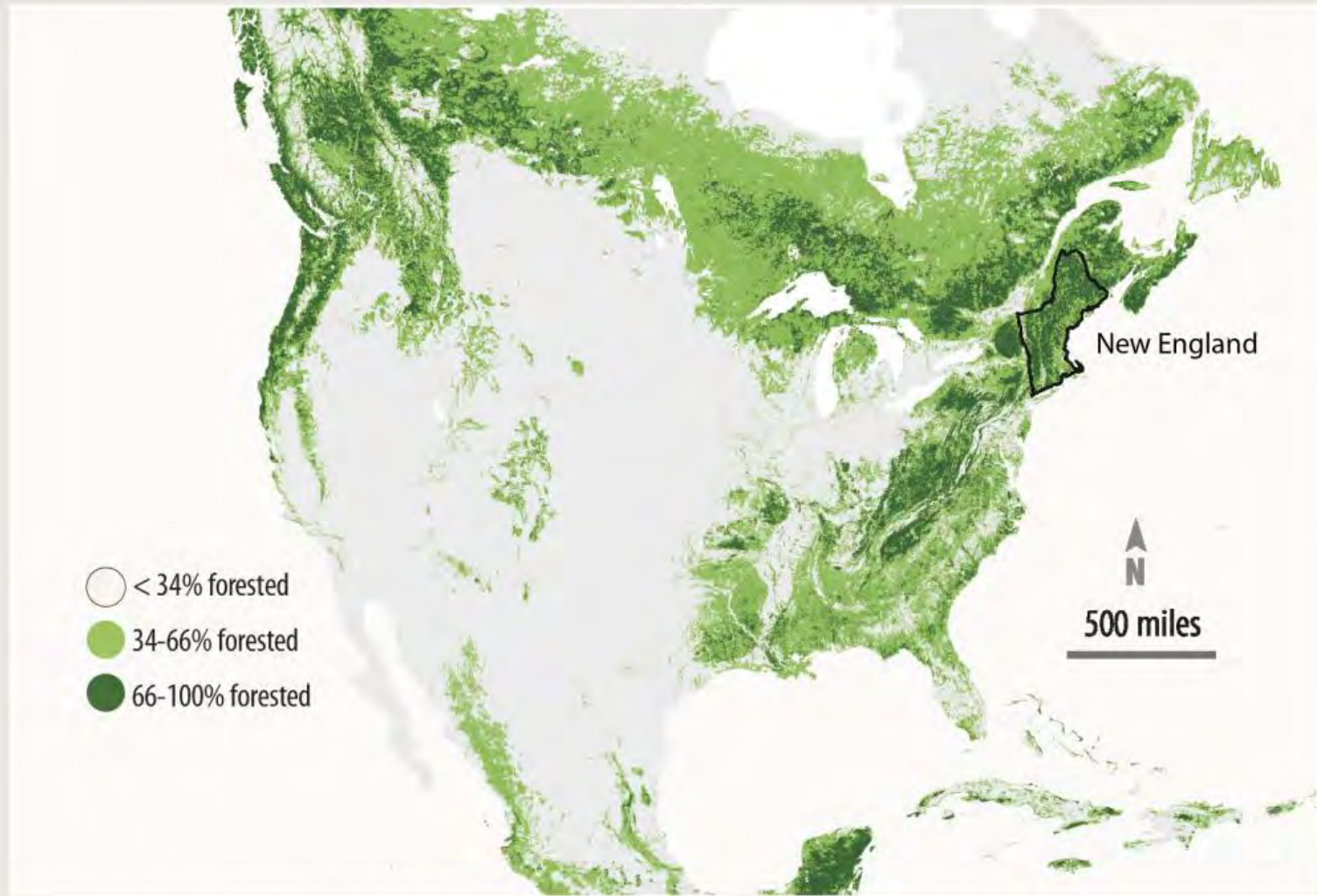
Railroads & Streets are shown with a black line.  
 Dead Crossings are shown with a black line.  
 If the Road Goes over the Railroad it is shown with a black line.  
 If the Road Goes under the Railroad it is shown with a thin red line.

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The color of the water is shown by a blue line.  
 Other Roads are shown with a thin red line.  
 The names of all places that have a Post Office have P.O. after them.  
 County names are shown by bold lines.  
 Thick figures show heights in feet above sea level.

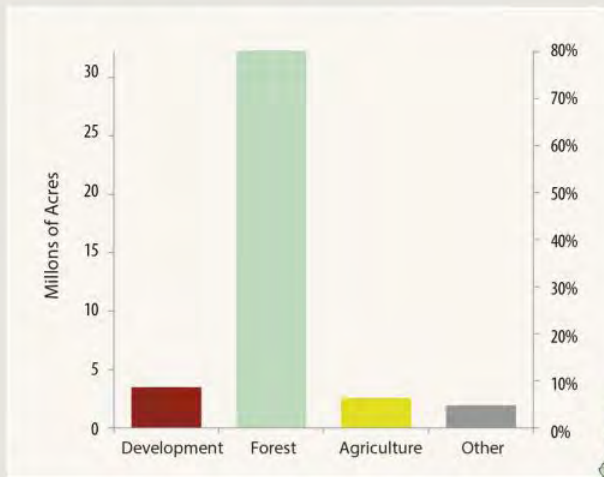
Scale of Miles

## New England Forests: A Globally Important Resource

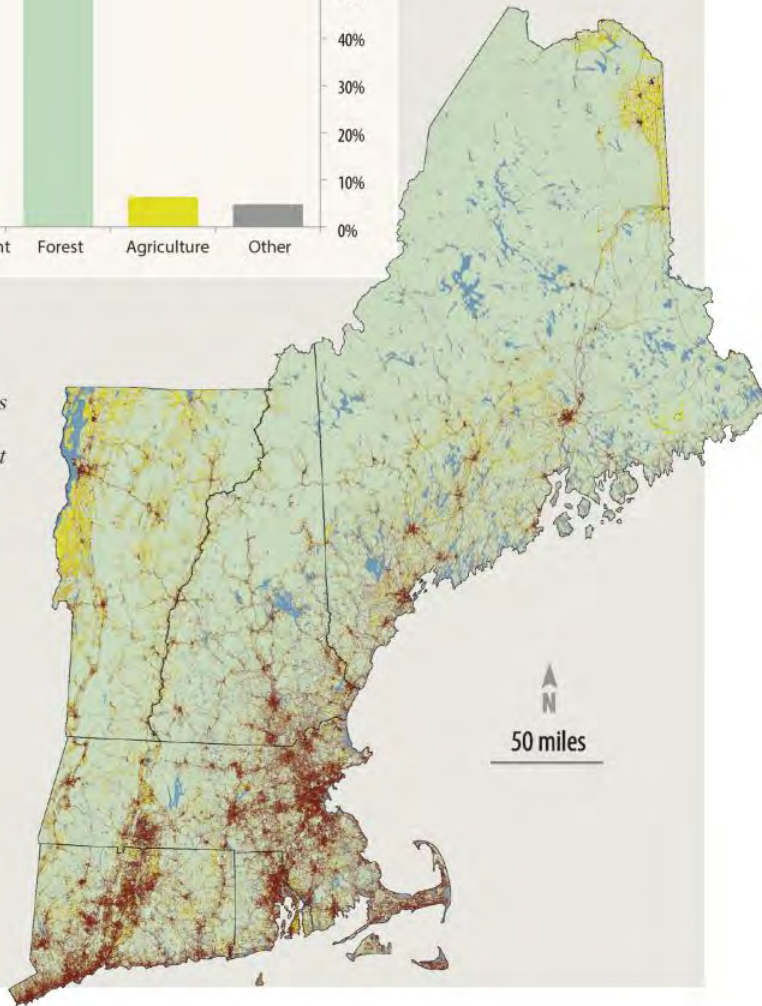


*New England is one of the most heavily forested parts of the United States. Forested areas provide critical benefits to its population and an essential corridor for plant and animal movement between the southern Appalachians and the boreal forests of Canada in a time of climate change.*

## New England Today: A Peopled and Forested Landscape

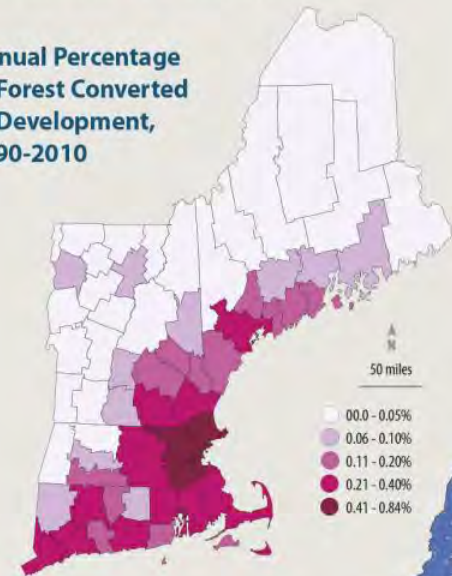


*As one of the most densely populated regions in the U.S., New England supports expansive forests across over 80 percent of its land base and farmland on an additional 7 percent.*

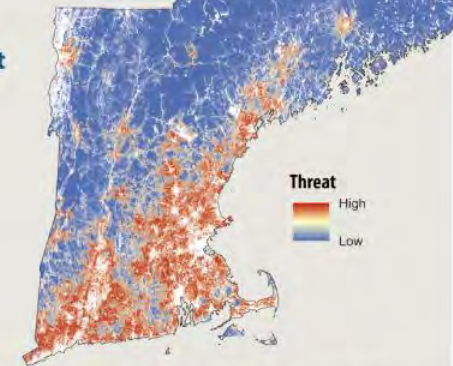


## Forest Loss to Development

Annual Percentage of Forest Converted to Development, 1990-2010



Future Development Threat



*Trends in forest conversion to development from 1990 to 2010 (above) show the fastest rates of loss in southern and eastern counties. While northern New England experiences a much lower overall rate of development, it is characterized by a more dispersed pattern of land perforation and fragmentation. Model projections (below) show that if current trends continue, 1.2 million acres of forest and farmland will be lost from 2015 to 2060.*

Based on an analysis of recent trends from 1990-2010, New England is losing approximately 10,000 hectares of forest to development every year.



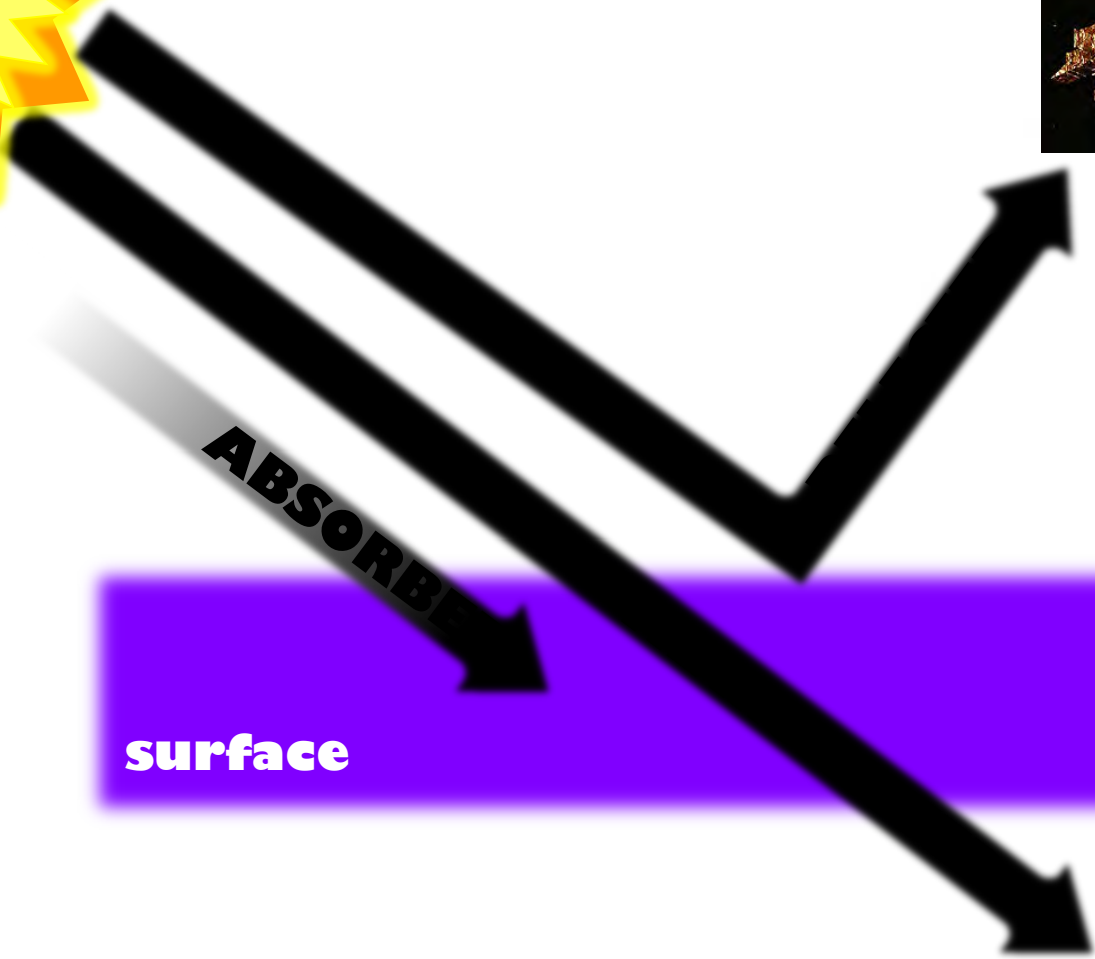


# remote sensing

"the acquiring of data about an object without touching it"

(Jensen 2007)

"the noncontact recording of information from the ultraviolet, visible, infrared, and microwave regions of the electromagnetic spectrum by means of instruments such as cameras, scanners, lasers, linear arrays, and/or area arrays located on platforms such as aircraft or spacecraft and the analysis of acquired information by means of visual or digital image processing"



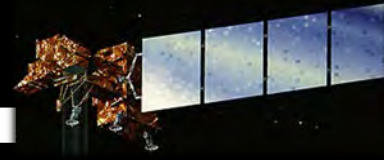
**surface**

**ABSORB**



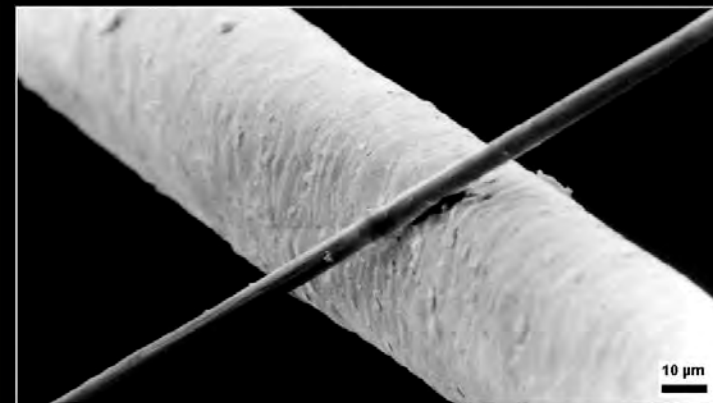
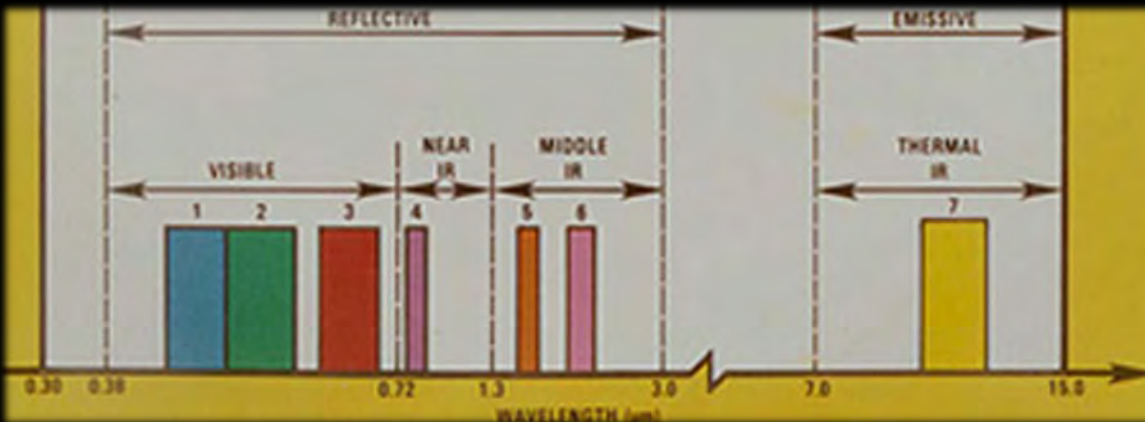


# LANDSAT

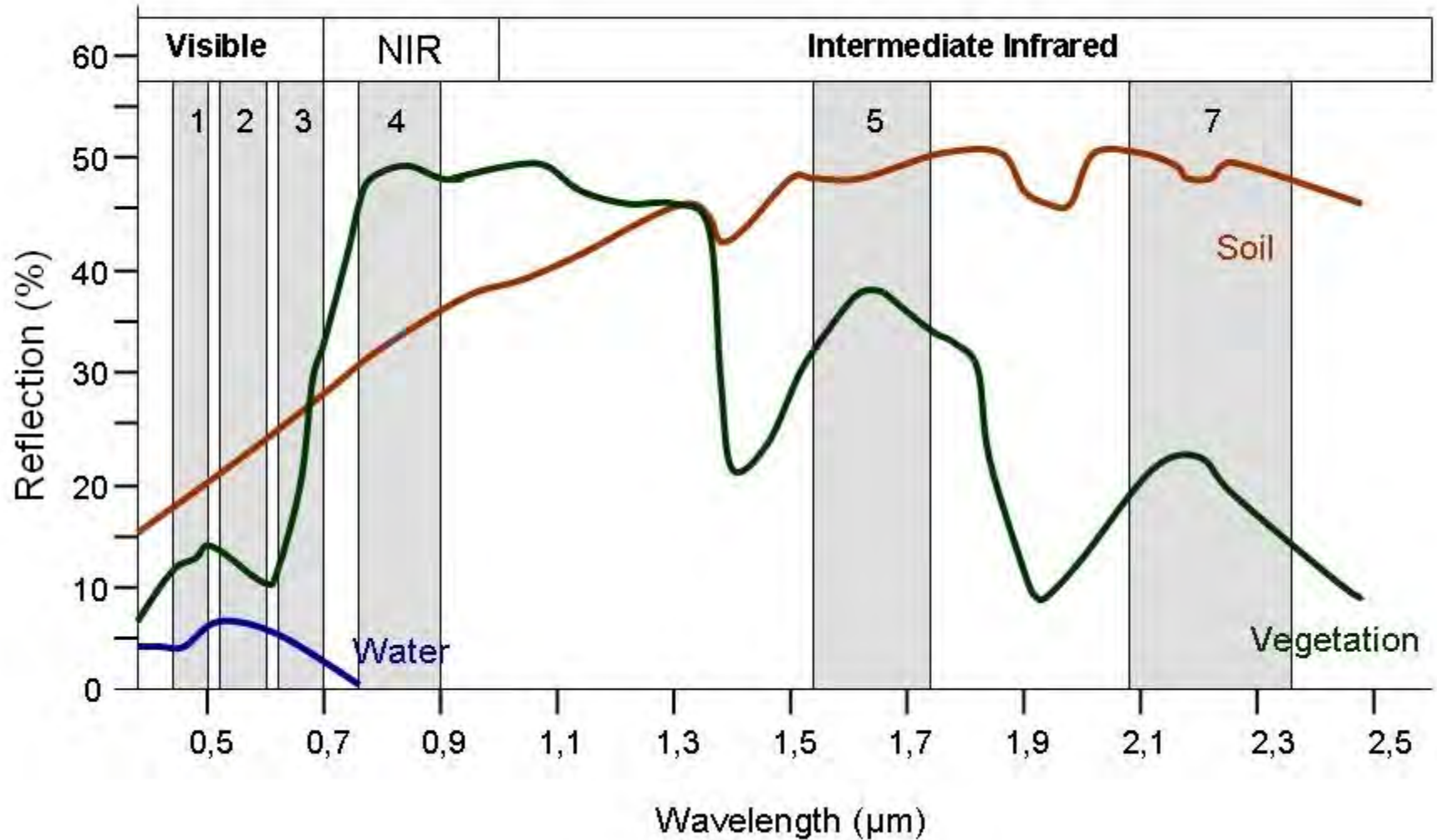


TM Band Wavelength ( $\mu\text{m}$ )

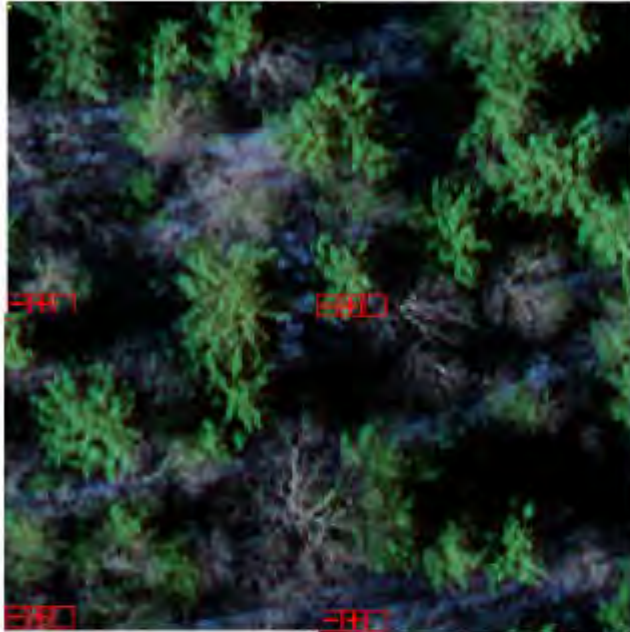
6	10.4 - 12.5		Thermal Infrared
7	2.08 - 2.35		Shortwave Infrared
5	1.55 - 1.75		Shortwave Infrared
4	0.76 - 0.90		Near Infrared
3	0.63 - 0.69		Red
2	0.52 - 0.60		Green
1	0.45 - 0.52		Blue



# Spectral Resolution



# Spatial Resolution:



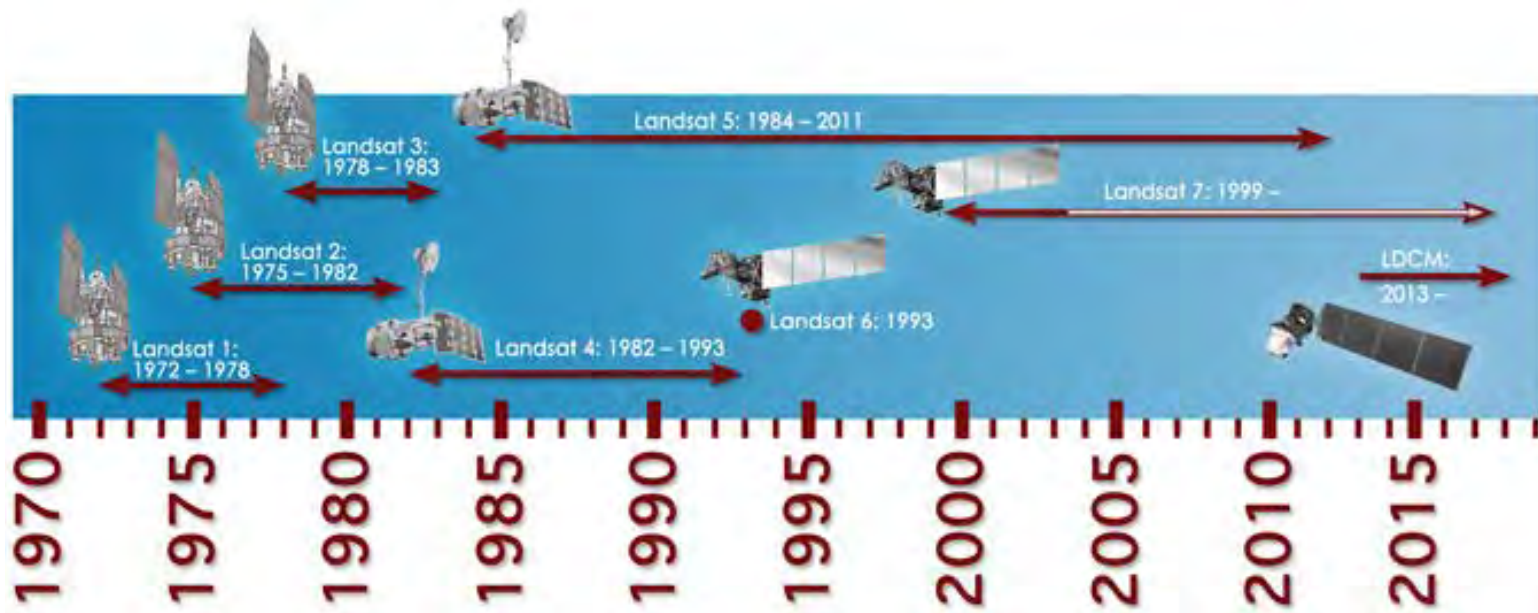
**30 cm pixels**  
(Aerial photo)



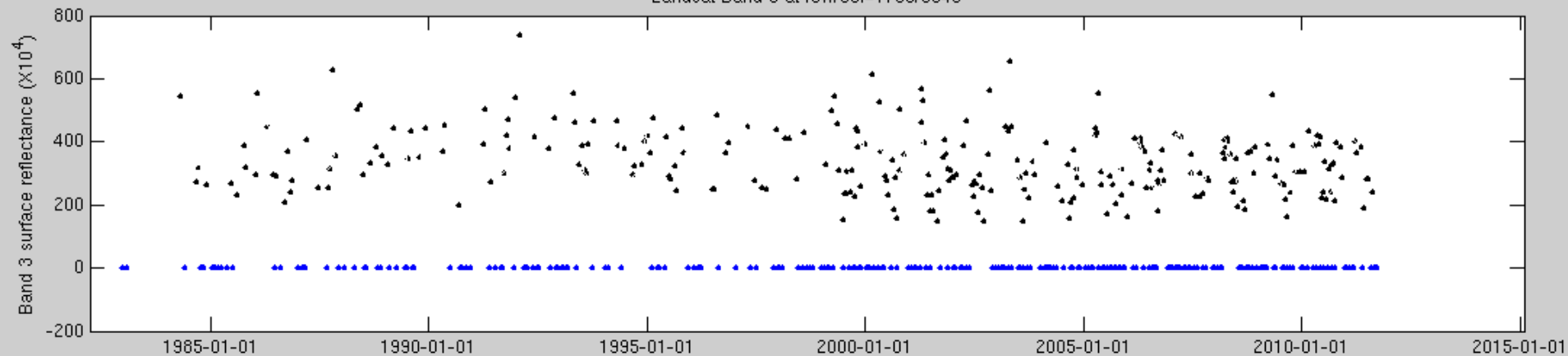
**30 m pixels**  
(Landsat)



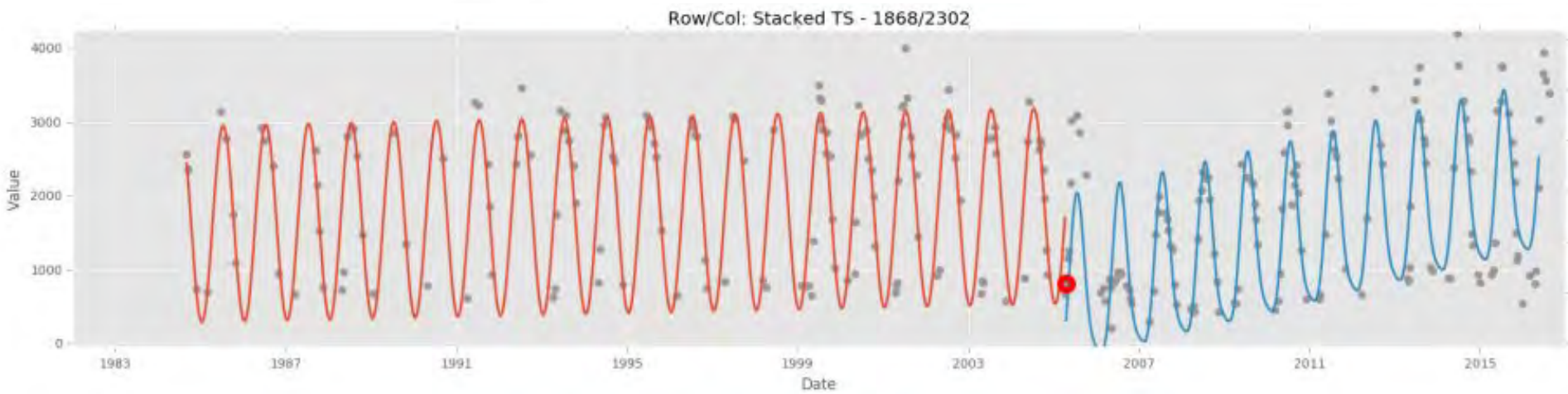
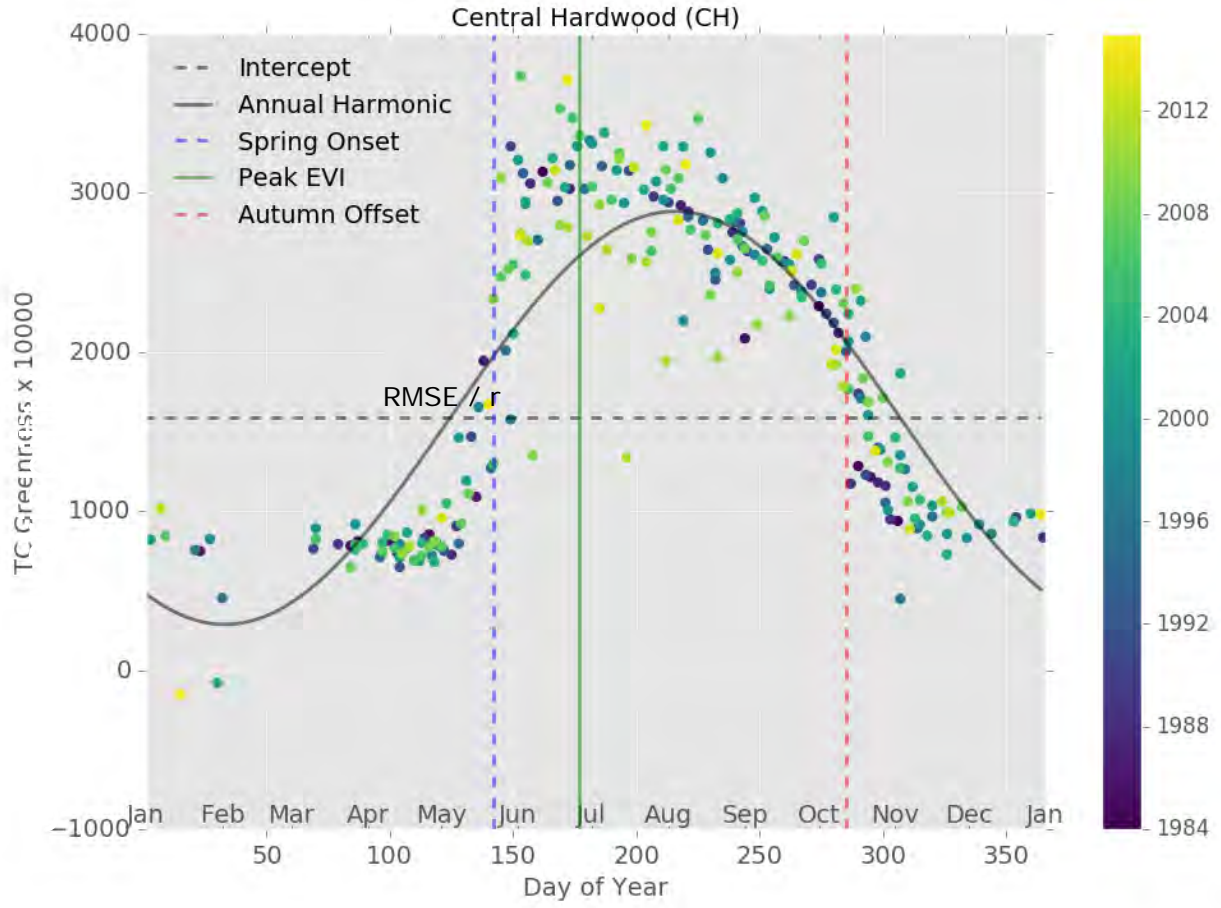
# Temporal Resolution



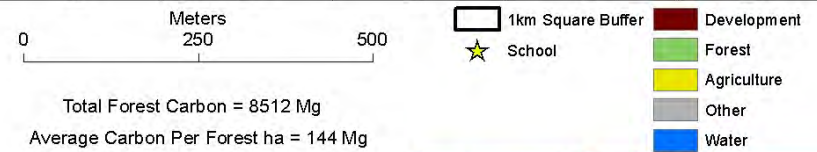
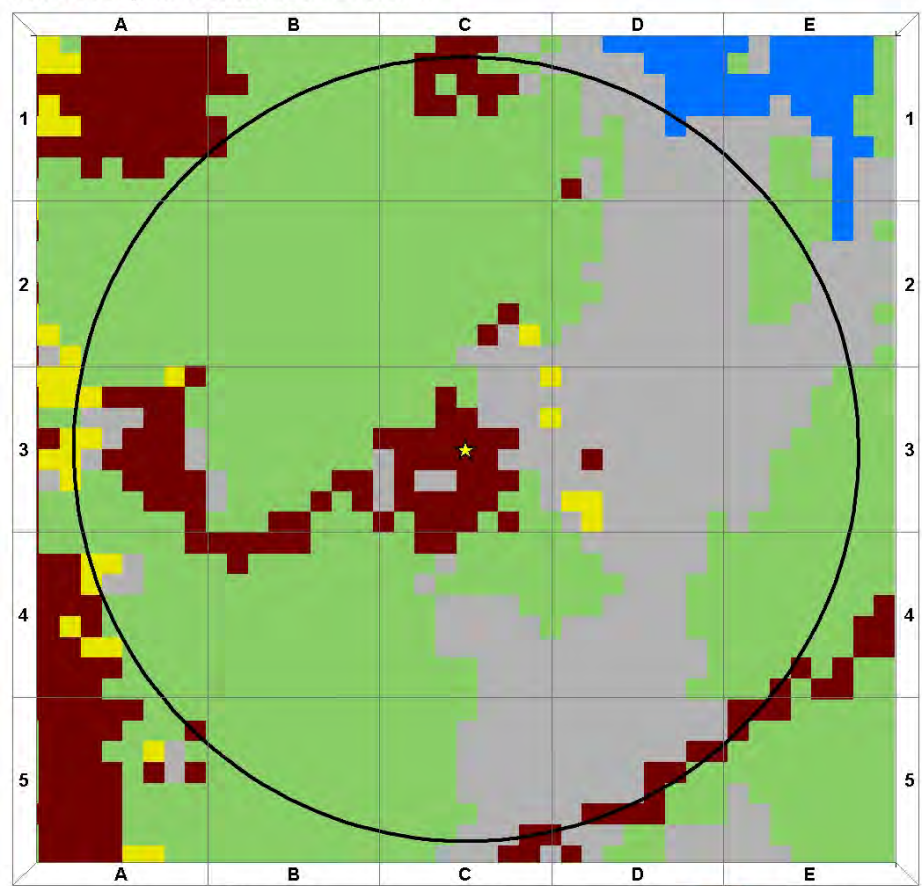
Landsat Band 3 at row/col=1735/3849



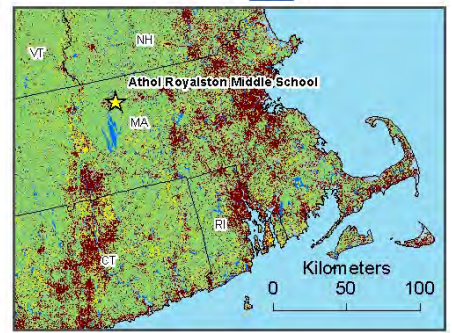
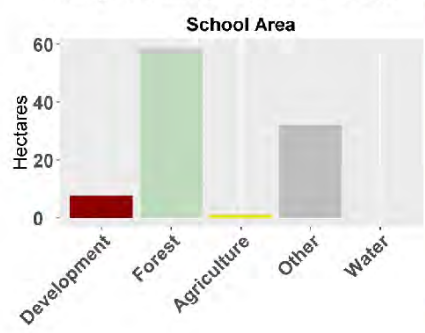
# Spectral-Temporal Features



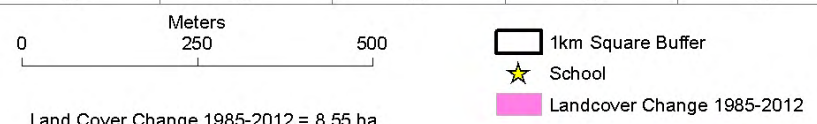
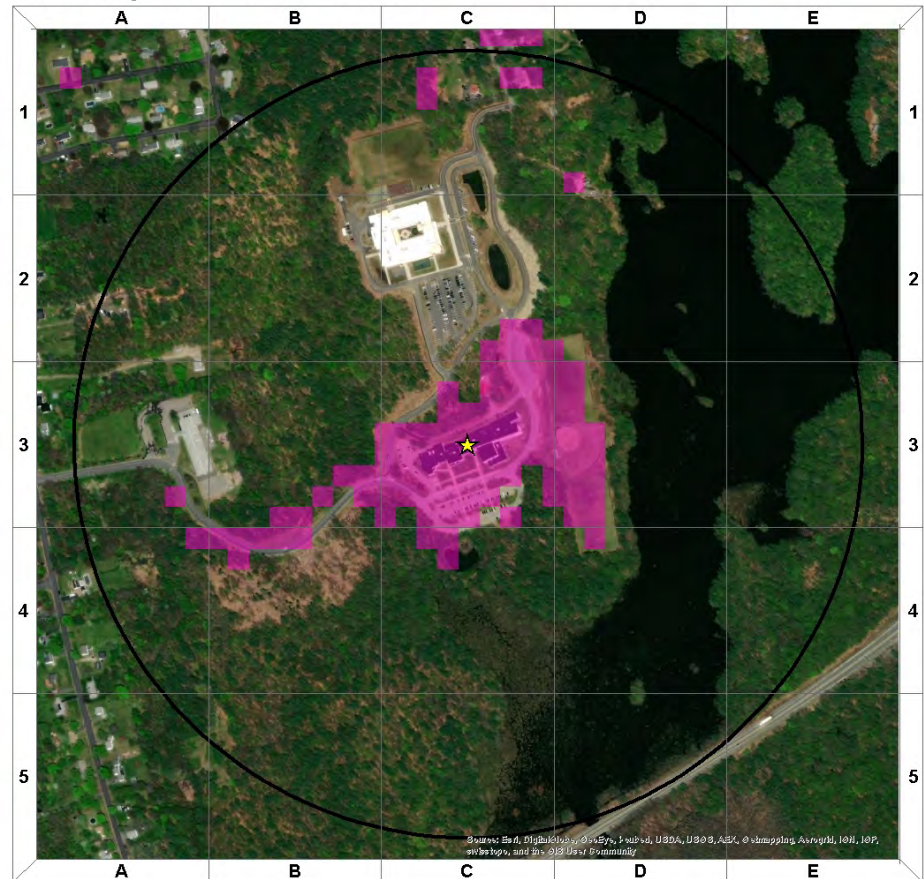
# Athol Royalston Middle School



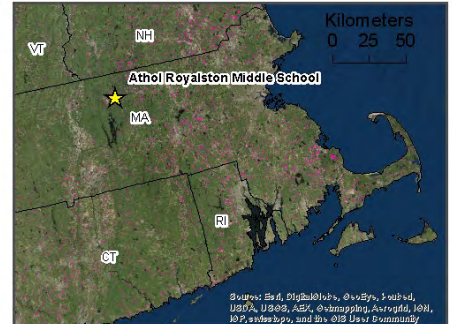
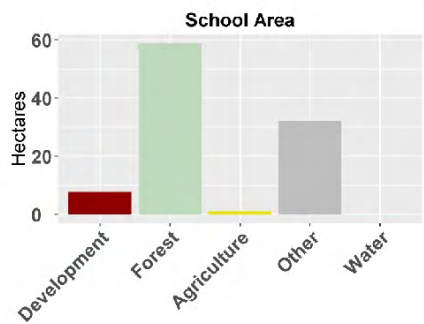
Total Forest Carbon = 8512 Mg  
 Average Carbon Per Forest ha = 144 Mg



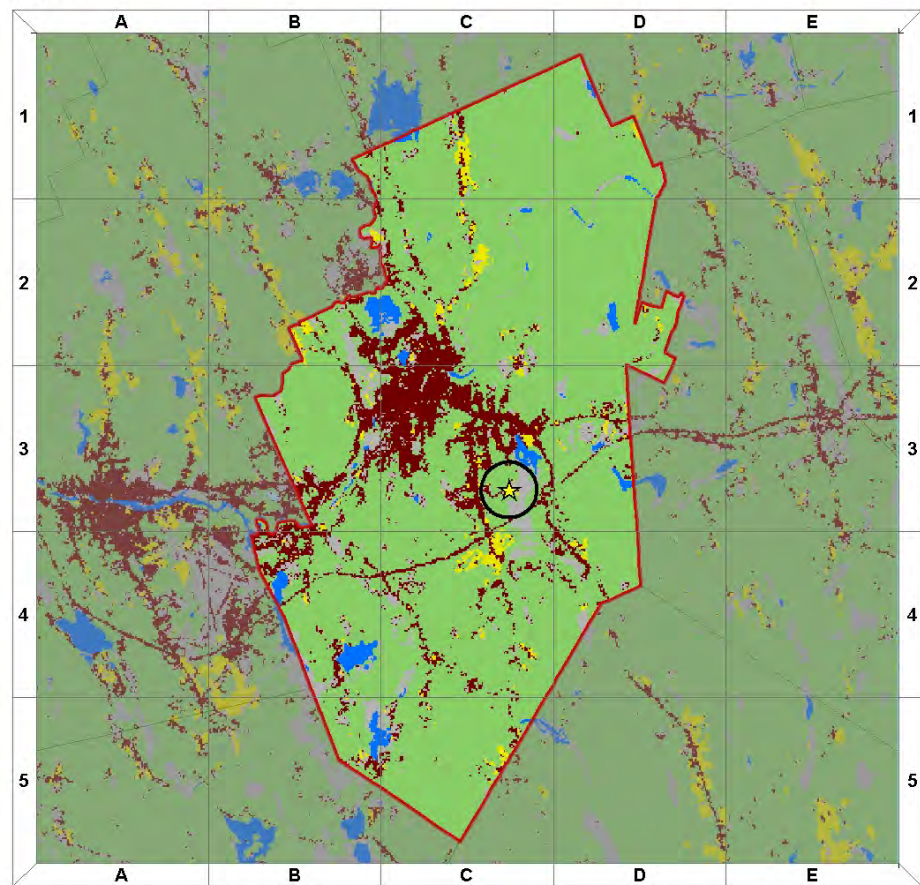
# Athol Royalston Middle School



Land Cover Change 1985-2012 = 8.55 ha



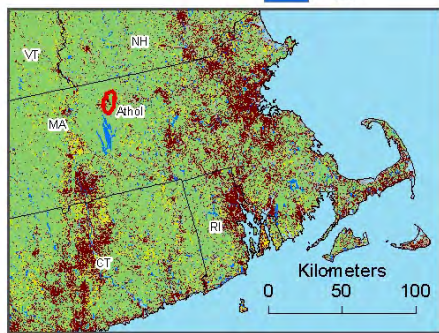
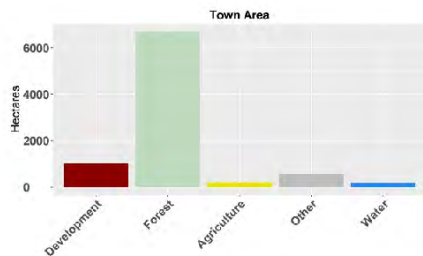
# Athol



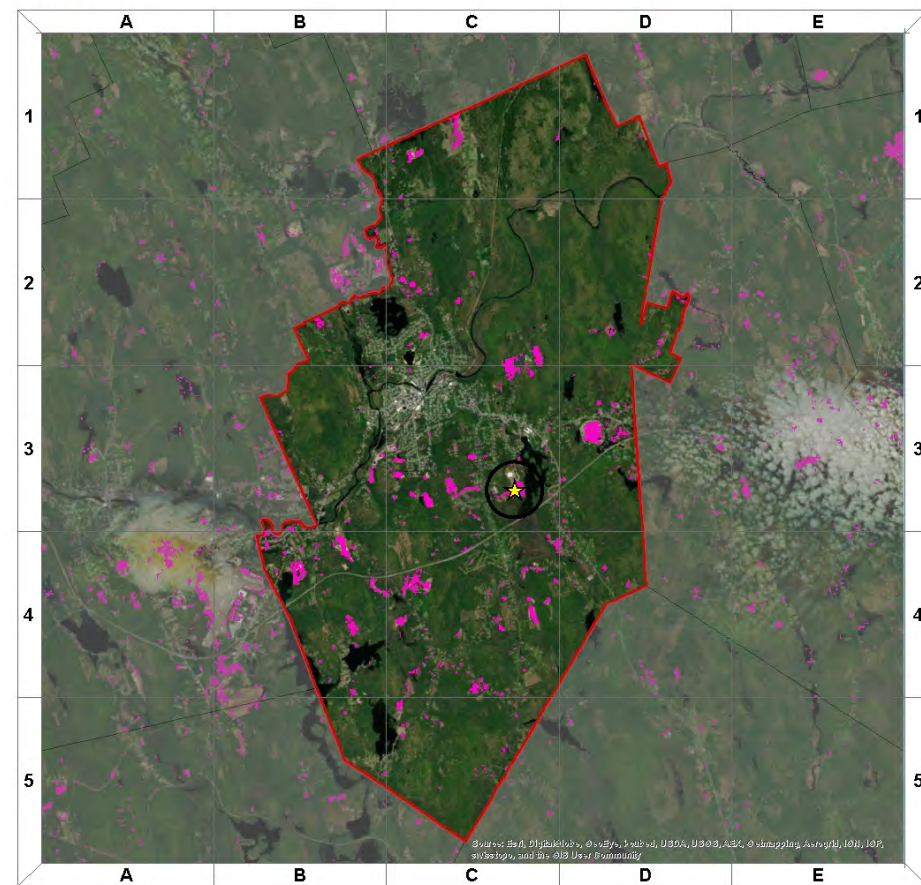
0 Meters 3,500 7,000

- Town Boundaries
- 1km Square Buffer
- ★ School
- Development
- Forest
- Agriculture
- Other
- Water

Total Forest Carbon = 1103713 Mg  
Average Carbon Per Forest ha = 165 Mg



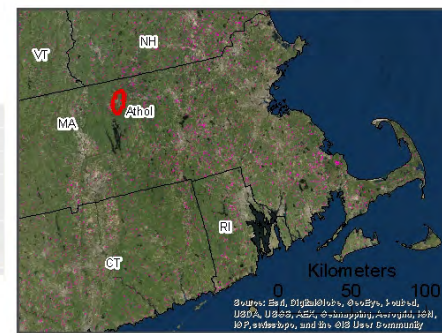
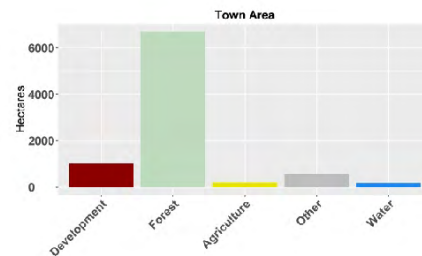
# Athol



0 Meters 3,500 7,000

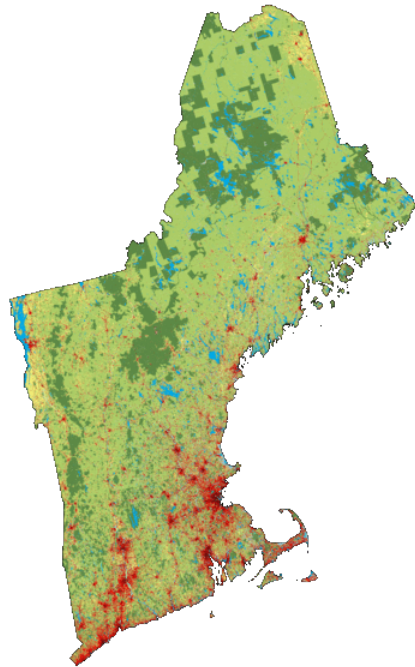
- Town Boundaries
- 1km Square Buffer
- ★ School
- Landcover Change 1985-2012

Land Cover Change 1985-2012 = 196.65 ha



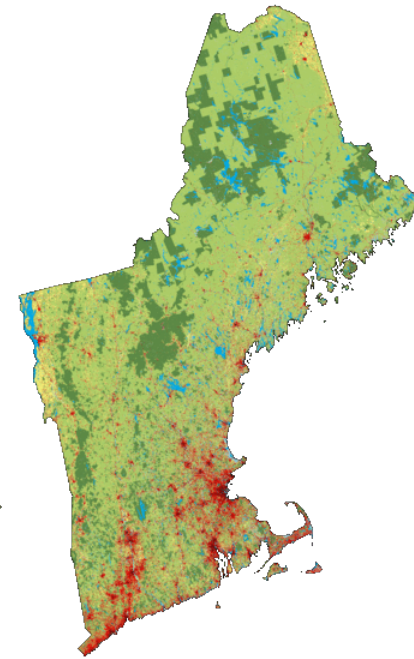
# Scenarios

Connected Communities

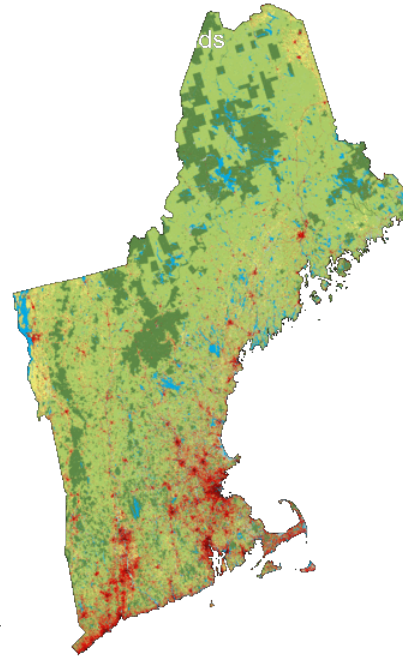


2010

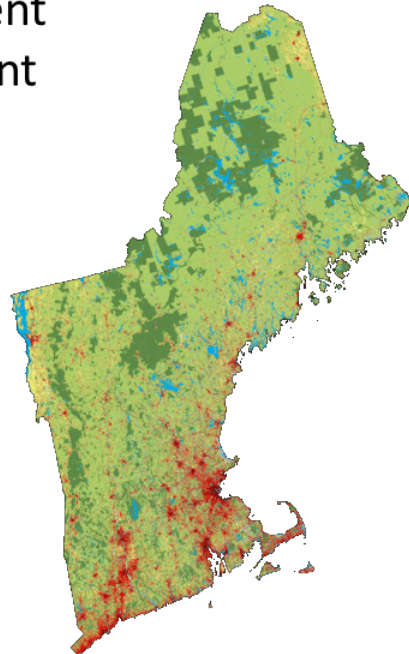
Yankee Cosmopolitan



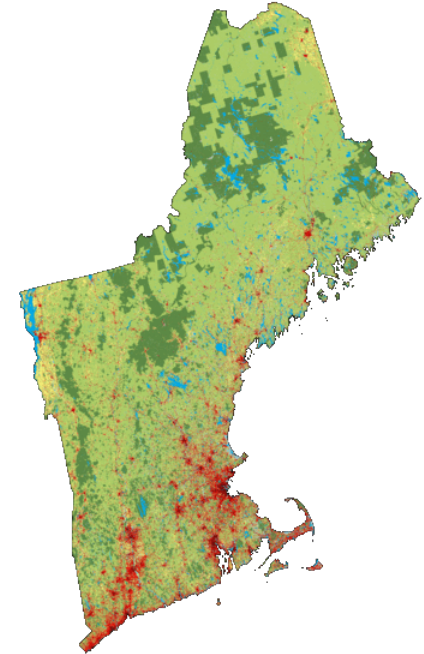
Recent Trends










Go it Alone



Growing Global



-  High Density Development
-  Low Density Development
-  Unprotected Forest
-  Conserved Forest
-  Agriculture
-  Other
-  Water

<http://unca.maps.arcgis.com/apps/MapJournal/index.html?appid=294b0e293f844d40b17e122e7a233eae>