Quantification of Forest Cover Change in the Pawcatuck River Watershed:

A Multi-Method Analysis

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Trends in Forest Cover:

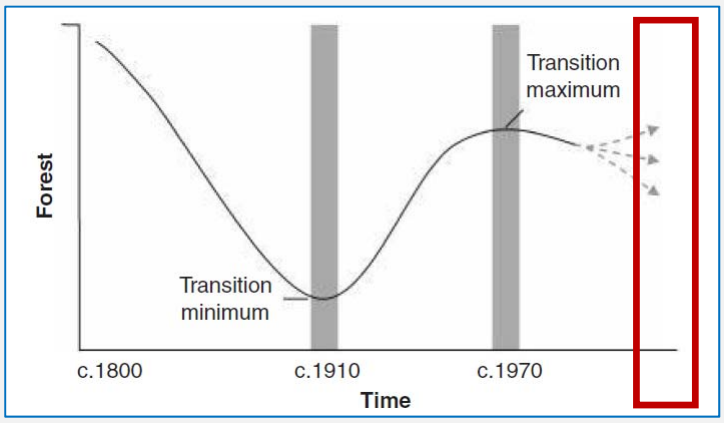


Figure 1. "Diagram of forest-cover changes in the East over time. Dashed lines indicate possible future trends(Drummond, 2010)"

Explanation of Decline:

-Urban sprawl
-Population Increases
-Increased Land Use
-Silviculture

Consequences for Watersheds:

-Erosion
-Flooding
-Reduced carbon sequestration

Software and Data:

Software Used:

ArcMap 10.2

ToolBox:
Clip
Re-class
Raster Calculator

CLEAR

UConn Center for Land Use Education And Research (CLEAR): Forest Fragmentation Tool

Data Used:

Multi-Resolution Land Characteristics Consortium (MRLC)
National Land Cover Database (NLCD)

RIGIS

- National Land Cover Database (NLCD) 2001 and 2006 (Raster)
- Pawcatuck River Watershed Clipped from RIGIS RI Watershed Boundary Layer (Vector)

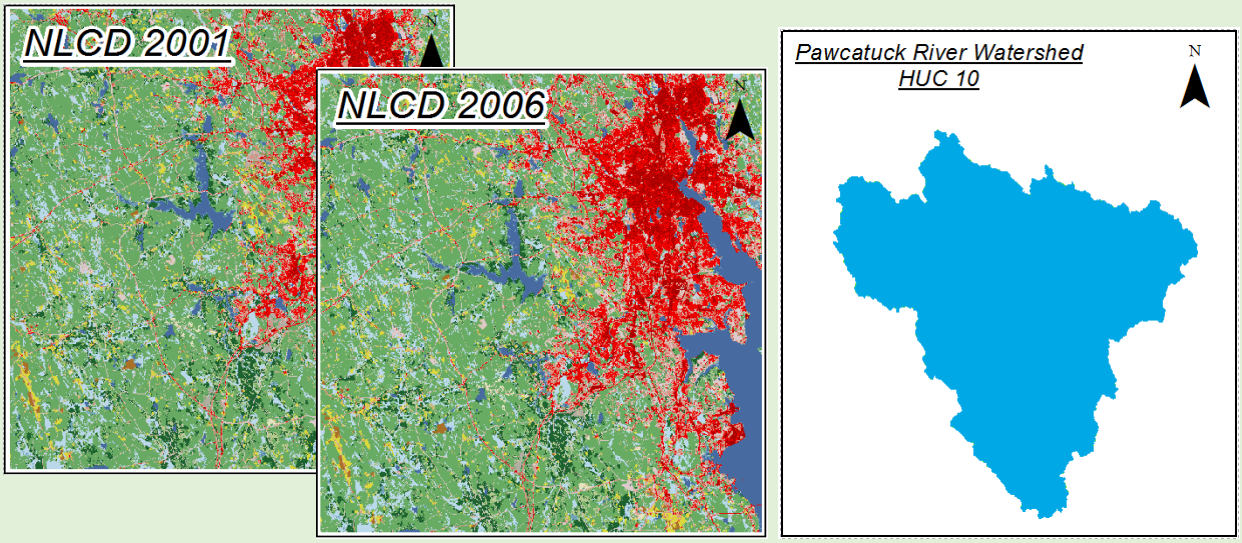
Methods:

1. Extraction of HUC 10 Watershed from NLCD Data
2. Reclassification of NLCD 2001 and 2006 to Forest and Non-Forest
3. Extraction of Individual HUC 12 Watersheds from HUC 10
4. Quantification of Forest Cover in 2001 and 2006 HUC 12 Watersheds

5. Two Methods:
    1. ArcMap10
    2. Forest Fragmentation Tool

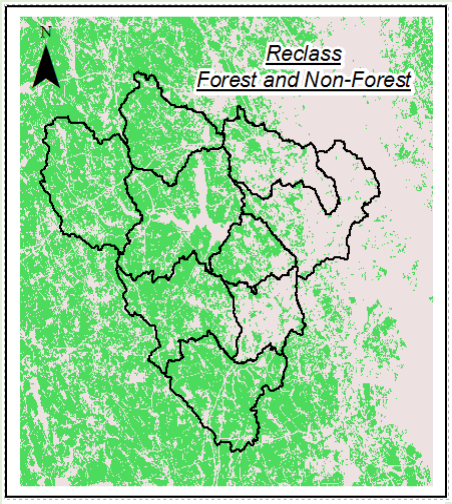
6. Comparison of Method Results

Methods: Preparing the Data

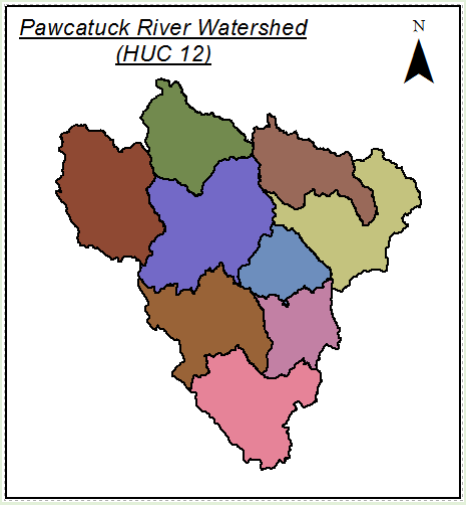


Extraction of the Pawcatuck River Watershed from NLCD 2001 and 2006 Land Cover Data

Methods: Preparing the Data

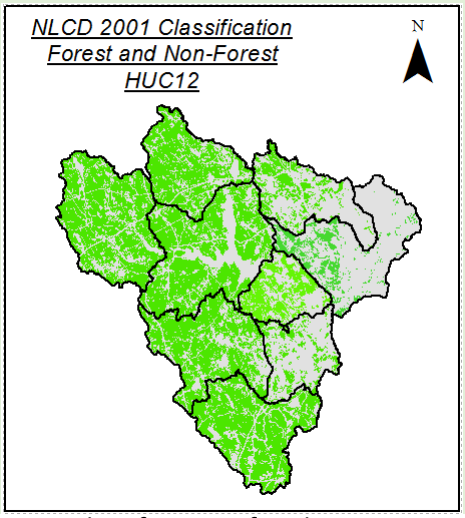


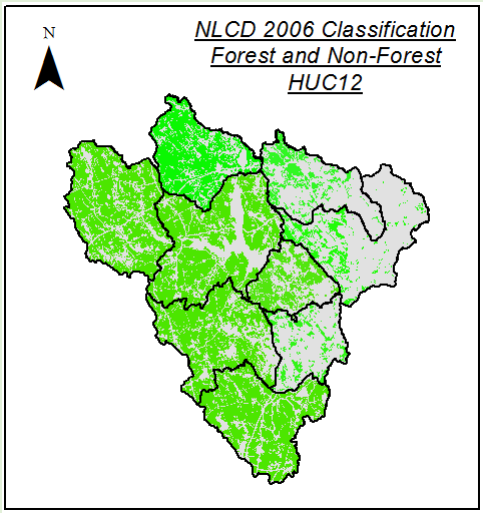
Reclassification of NLCD Subsets into Forest and Non-Forest



Break-up of HUC10 Watershed into HUC12 Levels Using ArcMap Re-class Function

Methods: ArcMap

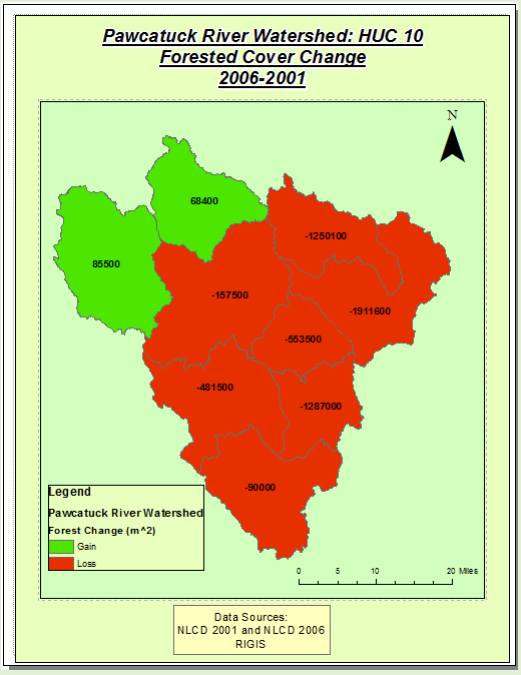




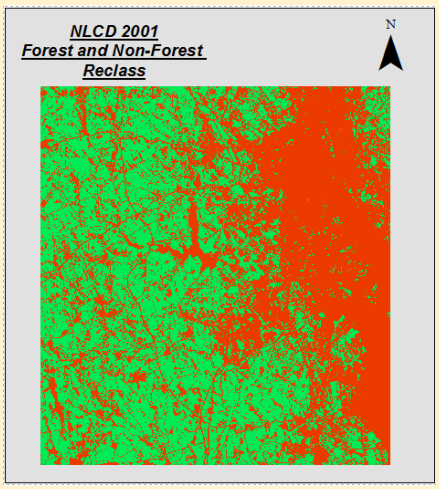
- Classification of Each HUC 10 Level by Forest and Non-Forest using ArcMap Raster Calculator Function

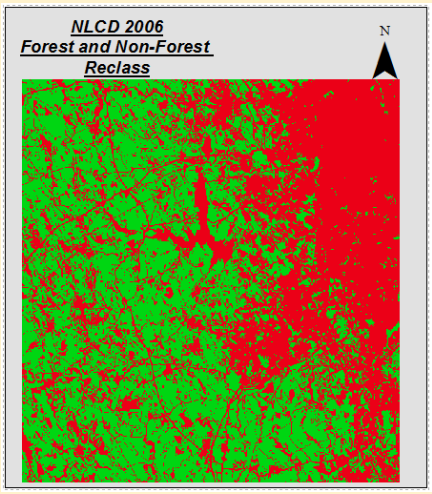
Results: ArcMap

Forest Cover Change (2001-2006) Using ArcMap10			
HUC10 Watershed	2001 Area (m^2)	2006 Area (m^2)	Difference (2006-2001) (m^2)
1	40554000	40622400	**68400**
2	61290900	61376400	**85500**
3	16125300	14875200	**-1250100**
4	65079900	64922400	**-157500**
5	14417100	12505500	**-1911600**
6	19492200	18938700	**-553500**
7	48639600	48158100	**-481500**
8	10673100	9386100	**-1287000**
9	53705700	53615700	**-90000**



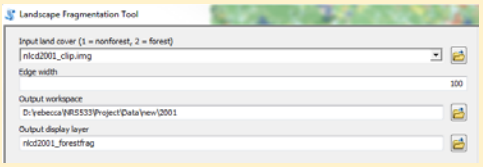
Methods: Forest Fragmentation



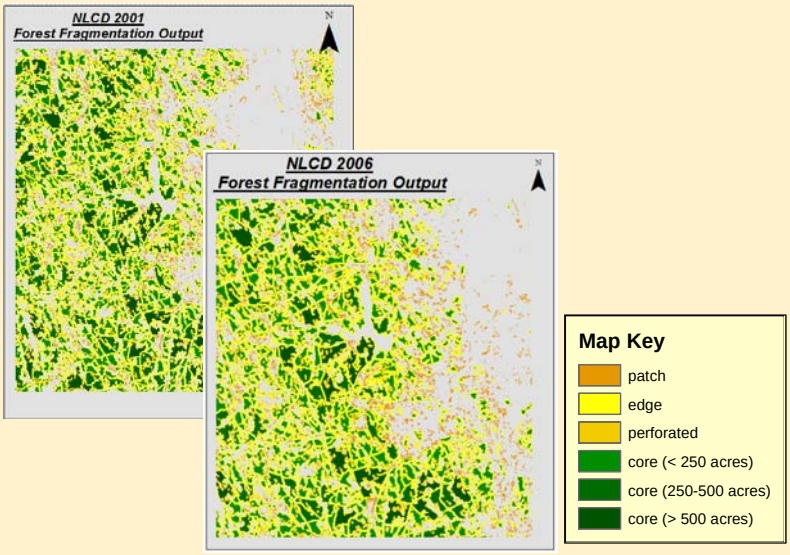


Reclassification of NLCD Subsets into Forest and Non-Forest

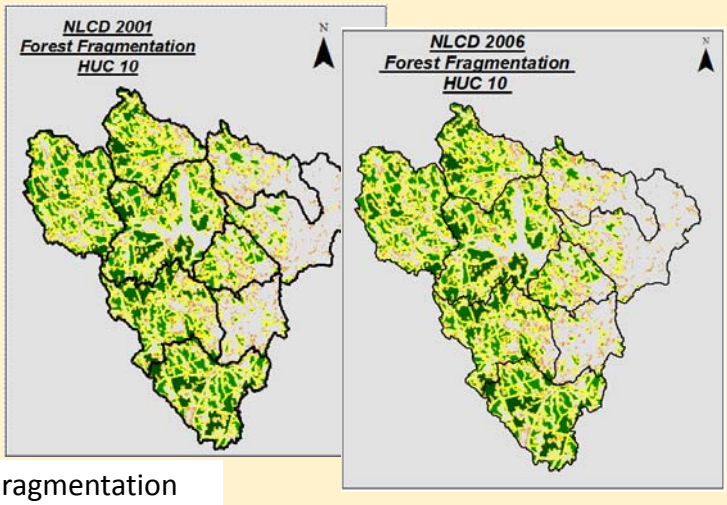
Methods: Forest Fragmentation



- Run Forest Fragmentation Tool in ArcMap for each NLCD Raster



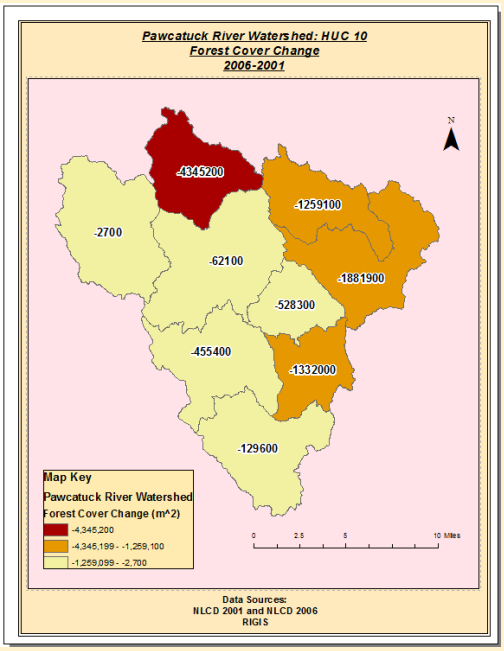
Methods: Forest Fragmentation



Extraction of Forest Fragmentation Output by HUC10 Watersheds

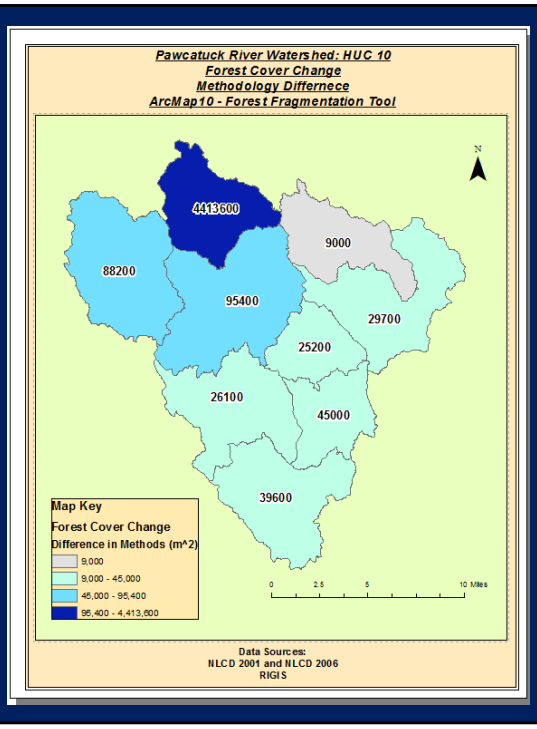
Results: Forest Fragmentation

Forest Cover Change (2001-2006) Using CLEAR Forest Fragmentation Tool			
HUC10 Watershed	2001 Area (m^2)	2006 Area (m^2)	Difference (2006-2001) (m^2)
1	40689900	36344700	**-4345200**
2	61394400	61391700	**-2700**
3	161465100	14886000	**-1259100**
4	65043000	64980900	**62100**
5	144322500	12540600	**-1881900**
6	19497600	18969300	**-528300**
7	48654900	48199500	**-45400**
8	10704600	9372600	**-1332000**
9	3756100	53626500	**-129600**



Difference in Methodologies:

Difference in Methods			
HUC10 Watershed	ArcMap10 (m^2)	Forest Fragmentation Tool (m^2)	Difference (Absolute Value) (m^2)
1	68400	-4345200	**4413600**
2	85500	-2700	**88200**
3	-1250100	-1259100	**9000**
4	-157500	62100	**95400**
5	-1911600	-1881900	**29700**
6	-553500	-528300	**25200**
7	-481500	-45400	**26100**
8	-1287000	-1332000	**45000**
9	-90000	-129600	**39600**



Conclusions

Benefits of Land Change Quantification:

- Ability to quantify change/trends of specific land cover/use types
- Relation of change to human/ecological processes

Going Further:

- Examine Key Areas of Varying Classifications
- Quantify Error
- Refine Process

References:

- Drummond, Mark A., Thomas R. Loveland. Land-use Pressure and a Transition to Forest-cover Loss in the Eastern United States, *BioScience,* Vol. 60, No. 4 (April 2010), pp. 286-298 Published by: University of California Press on behalf of the American Institute of Biological Sciences
- NLCD 2001 Data http://www.mrlc.gov/
- NLCD 2006 Data http://www.mrlc.gov/
- RIGIS Data http://www.edc.uri.edu/rigis/data/