

The Delaware River Basin Project

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**Center for Land Use
and Sustainability**
SHIPPENSBURG UNIVERSITY

 <http://drbproject.org>

Workshop agenda

Introductions

Project background

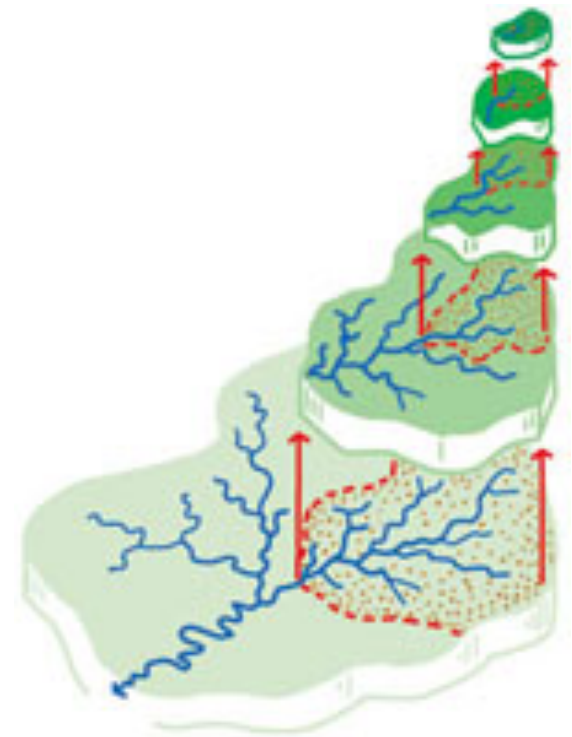
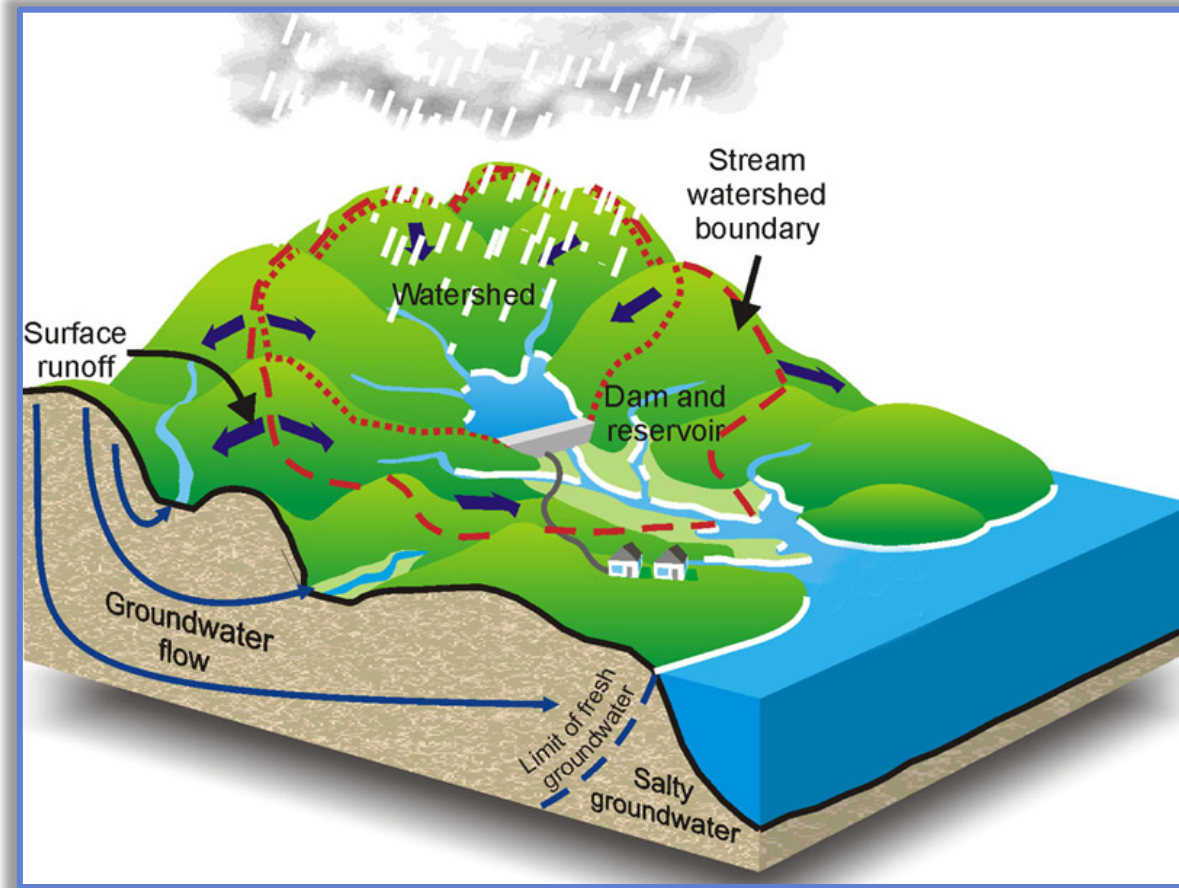
Watershed characteristics

Lunch

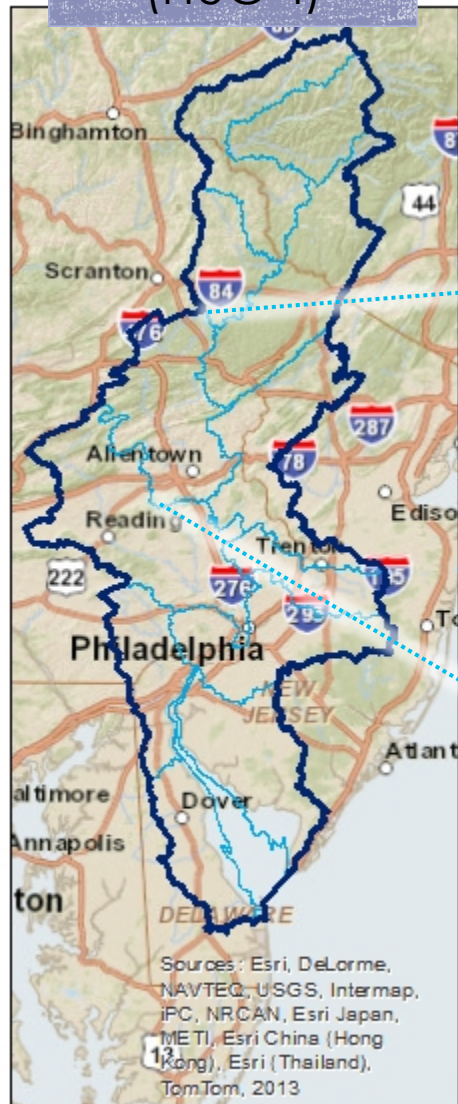
Scenario development

Watersheds 101

Watersheds
are nested...



Delaware River Basin
(HUC 4)



0 15 30 60 Miles

Lehigh River Watershed
(HUC 8)



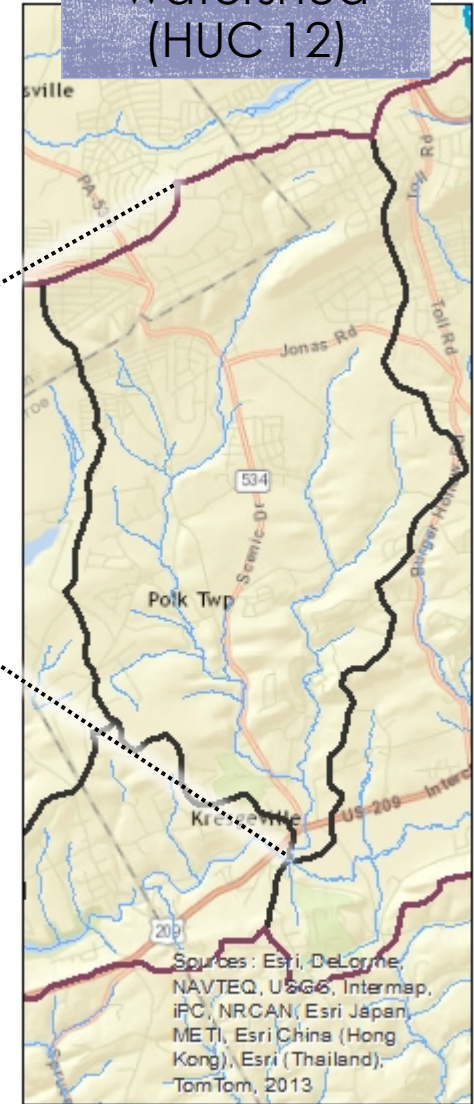
0 5 10 20 Miles

Pohopoco Creek Sub-watershed
(HUC 10)



0 2.25 4.5 9 Miles

Middle Creek Sub-watershed
(HUC 12)



0 0.5 1 2 Miles

Delaware River Basin (DRB)

35,000 sq.km (13,500 sq.mi)

8.2 million residents

3.6 million jobs*

Provides water resources and
ecosystem services to more than
15 million people (5% of US pop.)

William Penn
W I L L I A M P E N N
F O U N D A T I O N



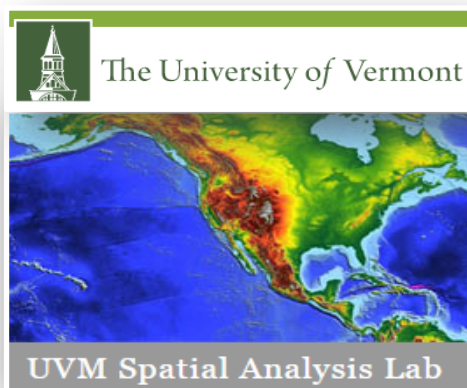


Our purpose & objectives

To help decision-makers think holistically about the DRB



1. Listen to stakeholders, read, and mine their data
2. Produce high resolution land cover data
3. Develop useful modeling tools
4. Conduct a feasibility study to gauge interest in long-term land cover change monitoring



OCT
14

OpenStreetMap Post Earthquake Mapping, Coquimbo, Chile

On September 27th, the Spatial Analysis Lab held its first Mapathon of the fall 2015 semester. The focus of this Mapathon was to create a detailed digital dataset of roads, buildings and open areas, in Coquimbo, Chile in response to the 8.3 magnitude earthquake that hit off of Chile's coast on September 16th. Coquimbo experienced widespread damage to infrastructure

and flooding due to the earthquake and subsequent Tsunami that swept through parts of the city. In fact, in parts of Chile the ground shifted 4.6 feet (1.4 meters) as a result of the earthquake.

Students and community members using OpenStreetMap

Coquimbo already had some data before this recent OpenStreetMap activation in its road network.



OCT
5

UAS team deployed to aid in train derailment

This morning the Amtrak Vermonter train derailed in Northfield, VT. Responding to a request from the Vermont Agency of Transportation, we immediately



SEP
18

Pennsylvania Statewide High-Resolution Tree Canopy

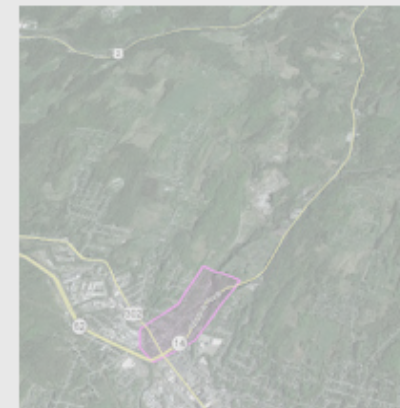
We are thrilled to announce the first public release of the Pennsylvania statewide high-



SEP
10

Montgomery County MD Tree Canopy Explorer

In late spring we completed an updated mapping of Montgomery County, Maryland's land cover. The driving factor for this



JUL
24

UAS Mapping of July 2015 Storm Damage in Barre, VT

The severe storm that dumped close to half a foot of rain on Central Vermont in a matter of hours on July 19, 2015 caused

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Metadata

This page provides a summary of the dataset's metadata.

Select one of the links to view the full metadata document or download the dataset.

Metadata Summary

Pennsylvania Statewide High-Resolution Tree Canopy

Title: Pennsylvania Statewide High-Resolution Tree Canopy
Originator: University of Vermont Spatial Analysis Laboratory
Publication Date: 2015

Abstract:

Pennsylvania Statewide High-Resolution Tree Canopy We are thrilled to announce the first public release of the Pennsylvania statewide high-resolution tree canopy dataset (data download link - 2.3GB!). (Technically this is the second version as the first one was for internal review). This dataset maps tree canopy for the entirety of Pennsylvania at a resolution of 1m, making it 900 times more detailed than the National Land Cover Dataset (NLCD)! With our landscapes becoming increasingly fragmented and heterogeneous high-resolution datasets add precision and accuracy to any analysis. We primarily relied upon Pennsylvania's publicly available LiDAR data, which was acquired in 2006, 2007, and 2008. We supplemented the LiDAR data

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Metadata

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Metadata Summary

Landcover - Delaware River Basin 2010

Title: Landcover - Delaware River Basin 2010

Originator: University of Vermont Spatial Analysis Laboratory

Publication Date: 20140109

Abstract:

High resolution land cover dataset for the Delaware River Basin, an area comprised of parts of six counties in the state of New York and four counties in Pennsylvania. Seven land cover classes were mapped: (1) tree canopy, (2) grass/shrub, (3) bare earth, (4) water, (5) buildings, (6) roads, and (7) other paved surfaces. The minimum mapping unit for the delineation of features was set at six square meters. The primary sources used to derive this land cover layer were 2008 LiDAR data and 2010 - 2011 NAIP imagery. LiDAR coverage was complete for the Pennsylvania portion of the AOI, however, LiDAR was unavailable for large portions of the New York portion. Where LiDAR was not available, imagery was the primary data source. Ancillary data sources included GIS data (eg. such as hydrology, breakline and buildings) provided by the counties of Lackawana, Monroe, Pike and Wayne, PA, as well as the New York State GIS Clearinghouse. Some of these vector datasets were edited by the



Updates from S
Winter 201
"Mapping, modeling, and monitor
Supported by the

Delaware Land Cover Data– Coming Soon!

A draft version of the high resolution land-cover map for the state of Delaware is being made available for review and comments by end-users! The layer is a 4-bit file in Albers Conical Equal Area projection, and is provided as an ERDAS Imagine file (.img) due to size. The University of Vermont Spatial Analysis Lab (SAL) has not yet completed full metadata for the layer, but the coding scheme is labeled in the draft metadata and in the value attribute table (see below).

Class
Barren
Impervious
Low Vegetation
Roads
Shrubland
Structures
Tree Canopy
Tree Canopy over Impervious
Tree Canopy over Roads
Tree Canopy over Structures
Water
Wetlands



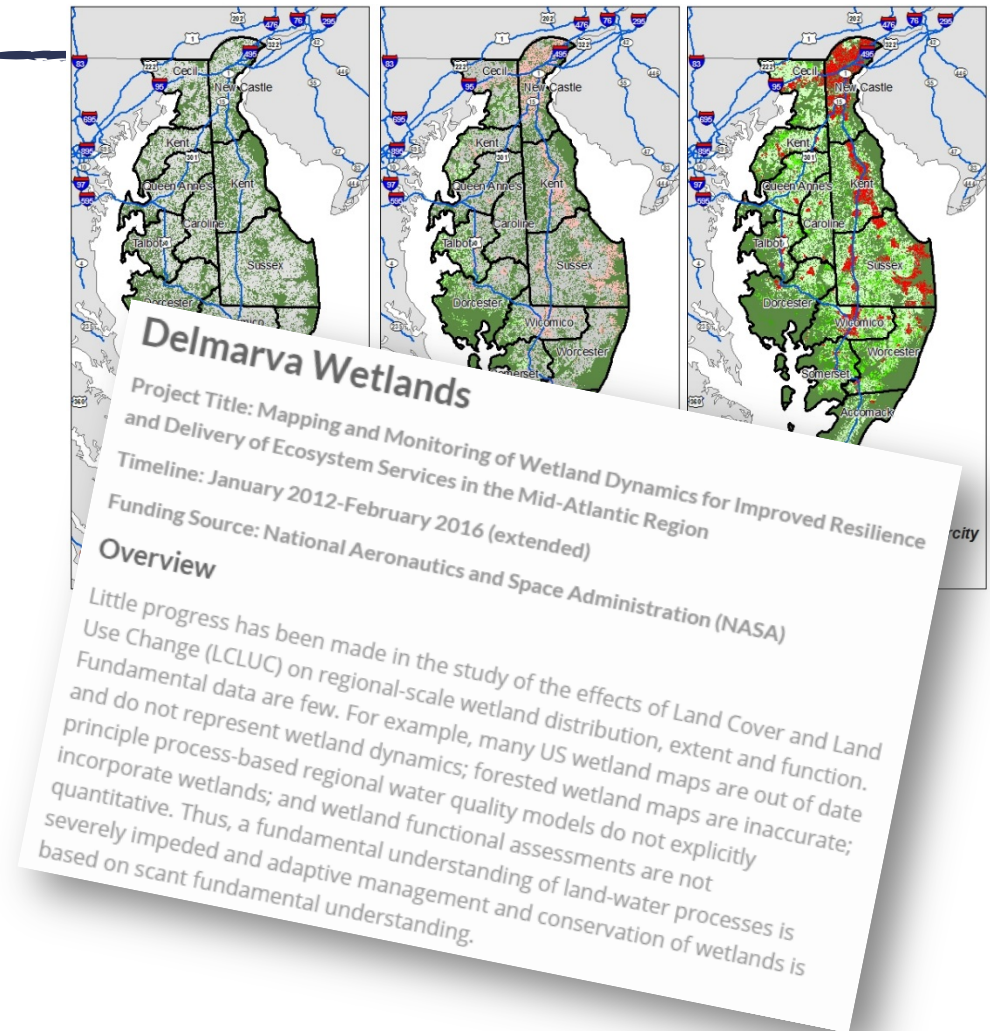
Final product will have expanded classes: emergent wetlands, scrub/shrub, and impervious surfaces under tree canopy

In the meantime, SAL will continue working to improve automated feature extraction of the classes in this dataset, and will also manually review and edit a near-final version of the map to eliminate obvious errors and inconsistencies. Contact Jarlath O'Neil-Dunne (joneildu@uvm.edu) at SAL to request access to the draft data set.

DRB & Delmarva synergies

Scenarios for the Delmarva Peninsula are being developed in tandem with the DRB

- ▶ Specific focus on wetland vulnerability
- ▶ NASA-funded



Article

Calib Drive Metro

Claire J.

¹ Depart

Shipp

² City P

Hattie

* Autho

Tel.: -

Received

Publishe

Ab

Modeling Urban Land Use Change in the Upper Delaware River Basin



Report prepared by:

Dr. Claire Jantz
Associate Professor
Dept. of Geography-Earth Science
Shippensburg University

Leslie Morlock
GIS Specialist
National Park Service
Delaware Water Gap NRA



Listen to stakeholders

Philadelphia, PA

Oct. 29, 2015

Narrowsburg, NY

Nov. 10, 2015

Reading, PA

Jan. 13, 2016

Washington, NJ

Feb. 16, 2016

Dover, DE

Feb. 18, 2016



Goals for Today

Discuss current characteristics of the basin

Modified SWOT analysis

- ▶ Strengths and Weaknesses - Current
- ▶ Opportunities and Threats - Future

We need your input !

Questions?

The DRB - what do the data tell us?

Introduction: physical setting

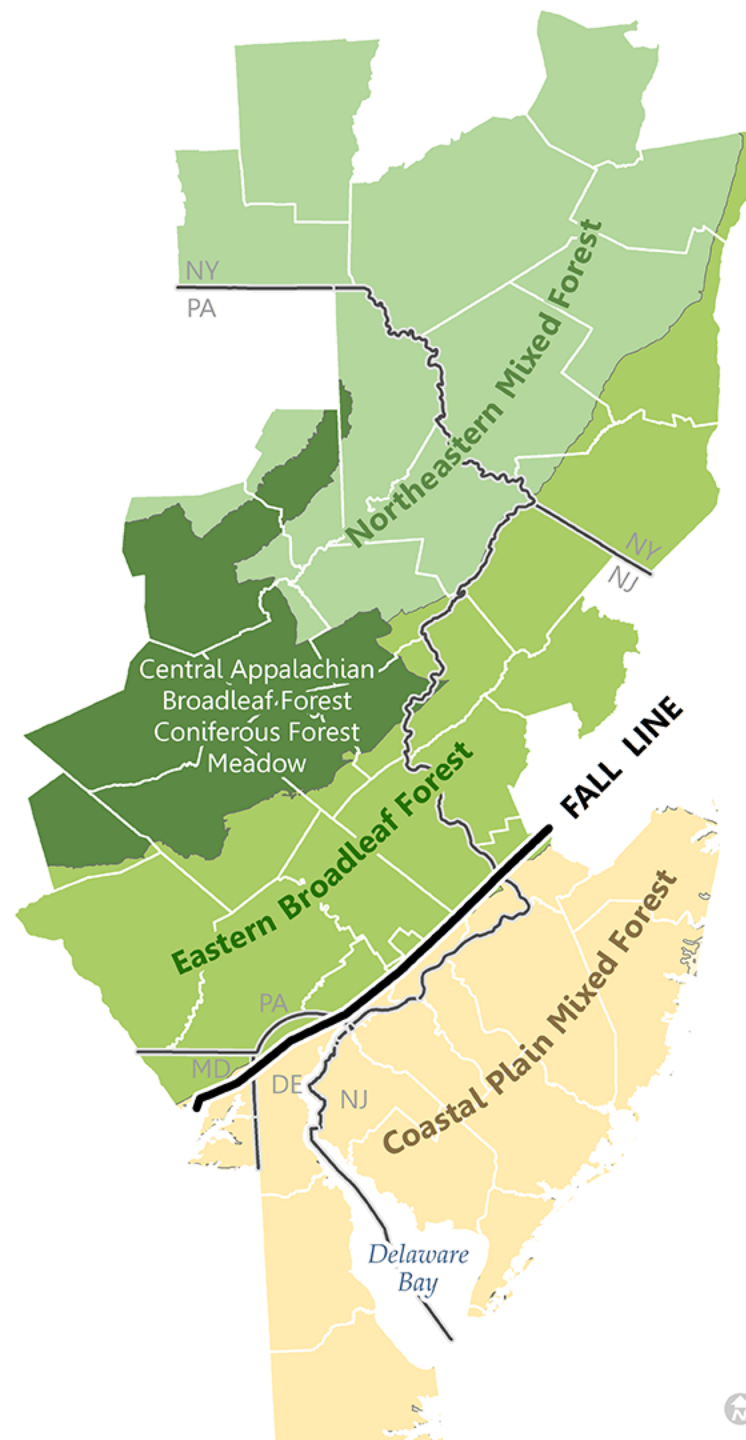
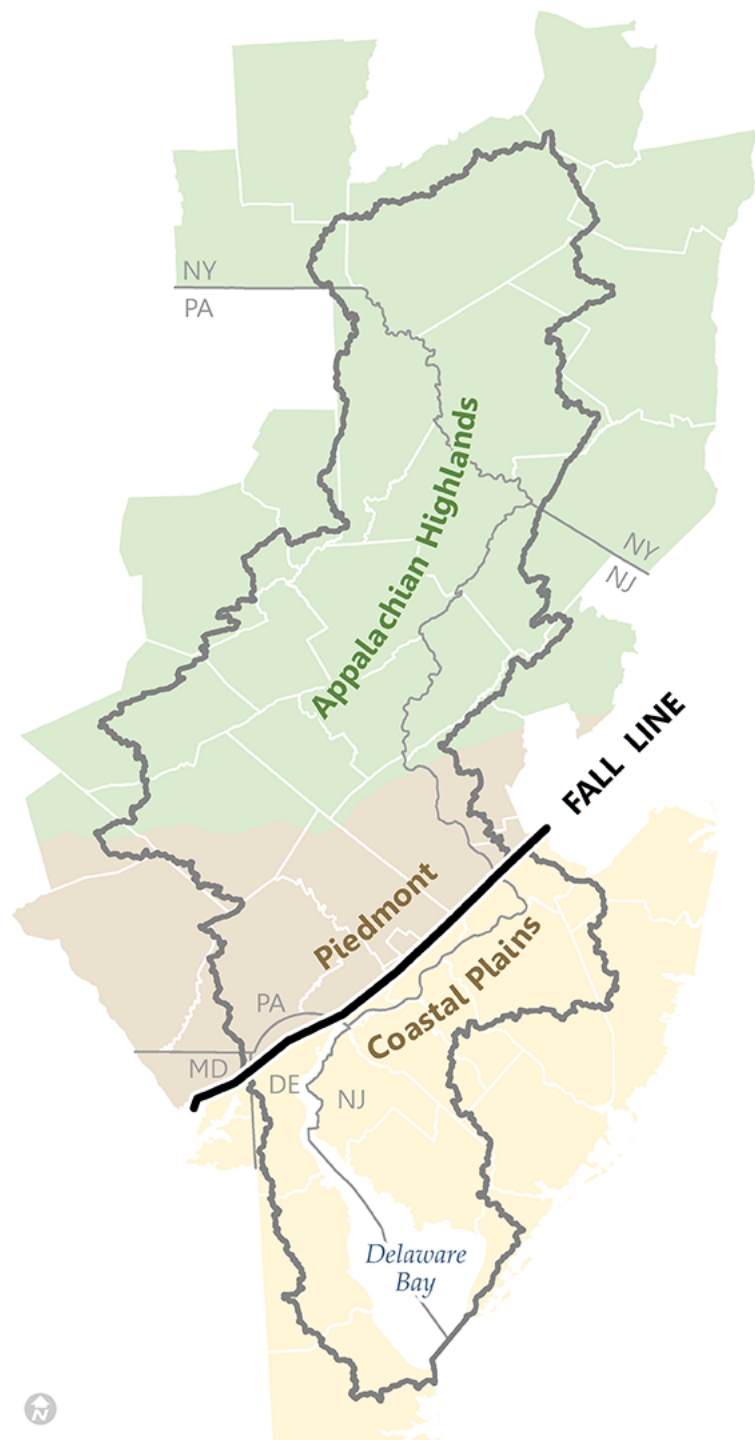
People & housing

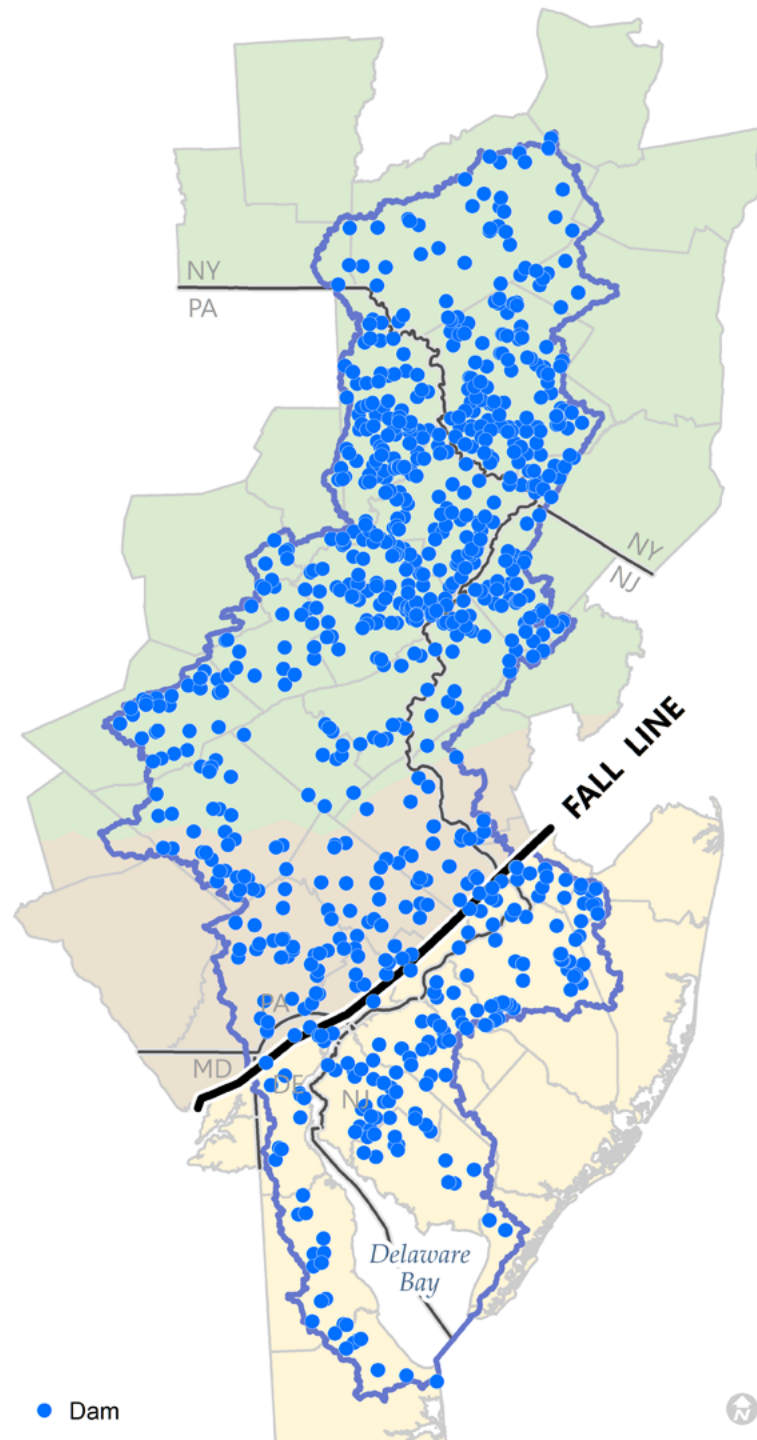
Economics & commuting patterns

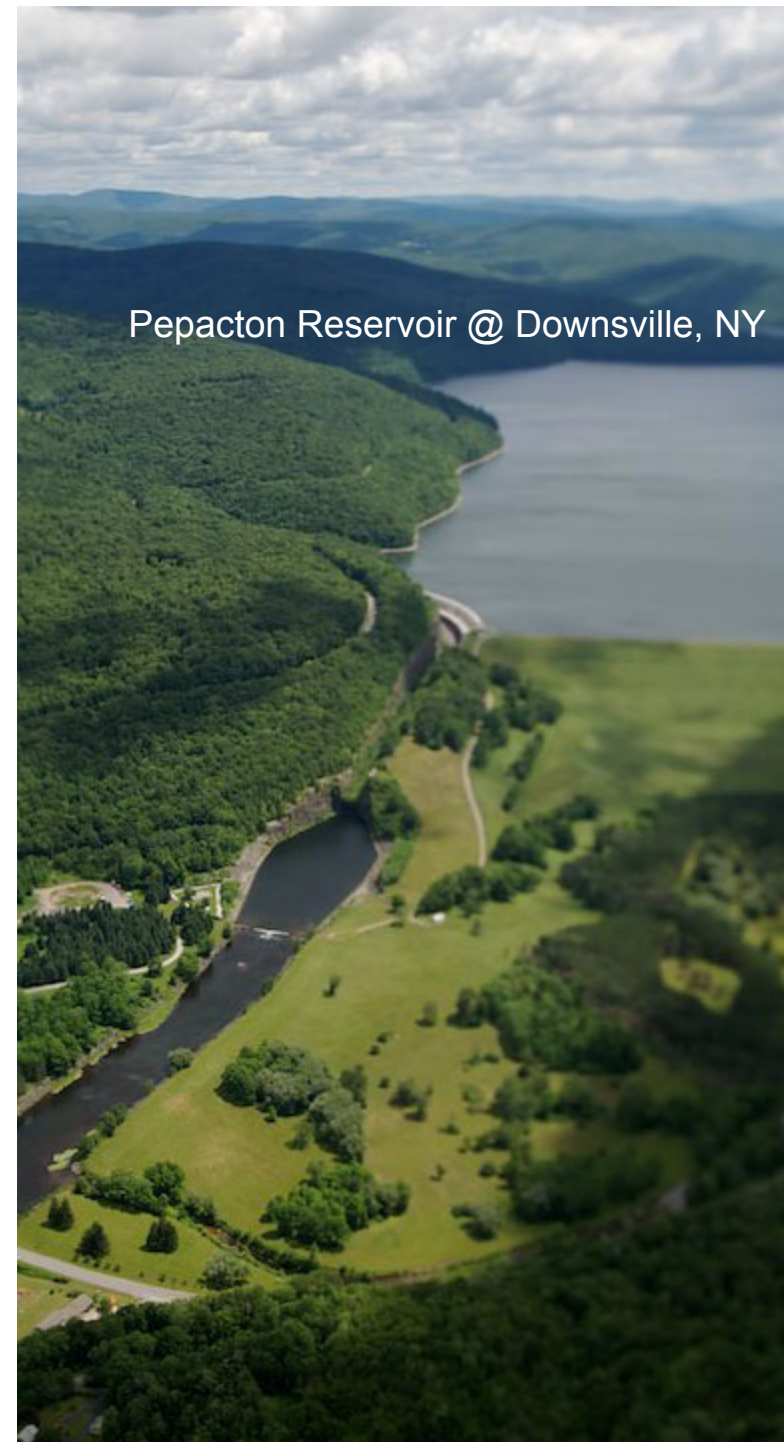
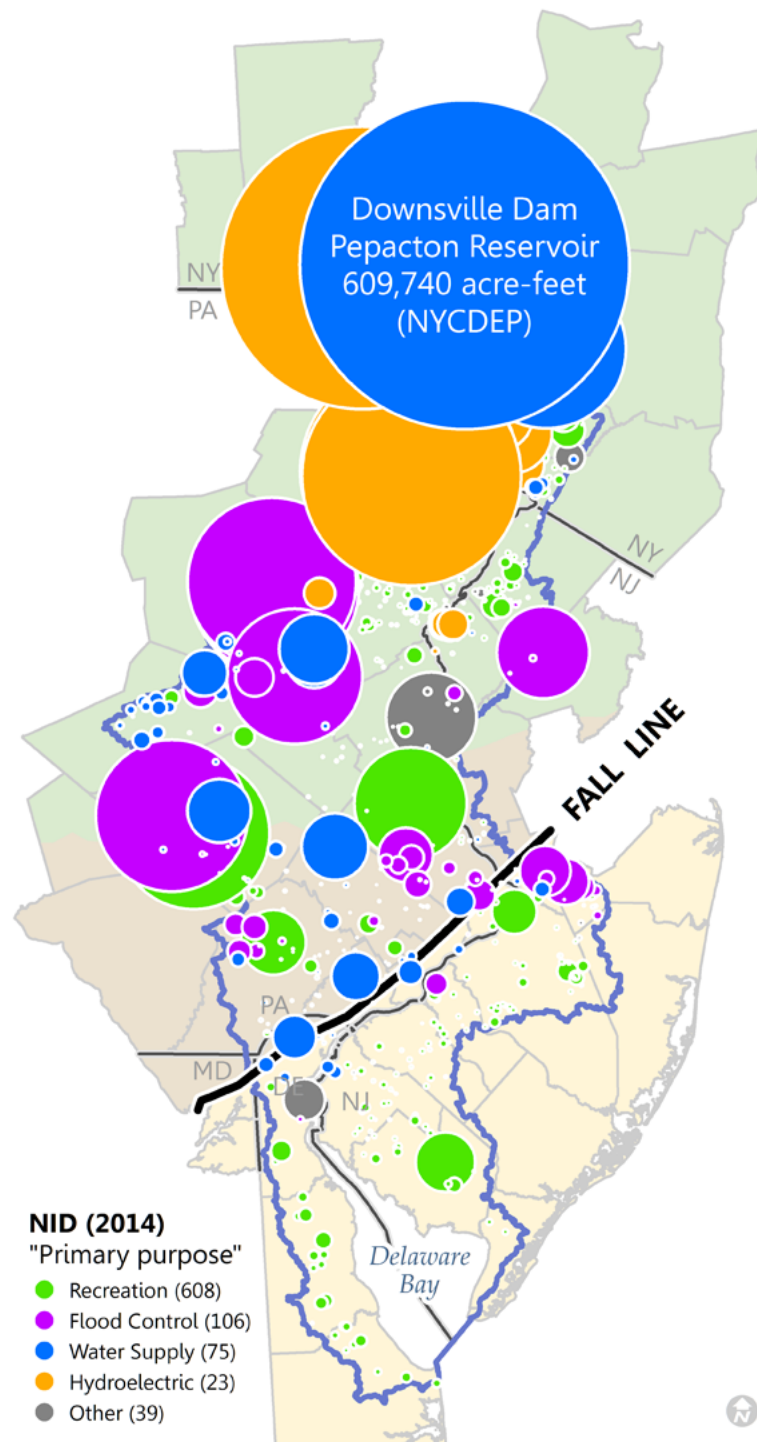
Recent land use change trends

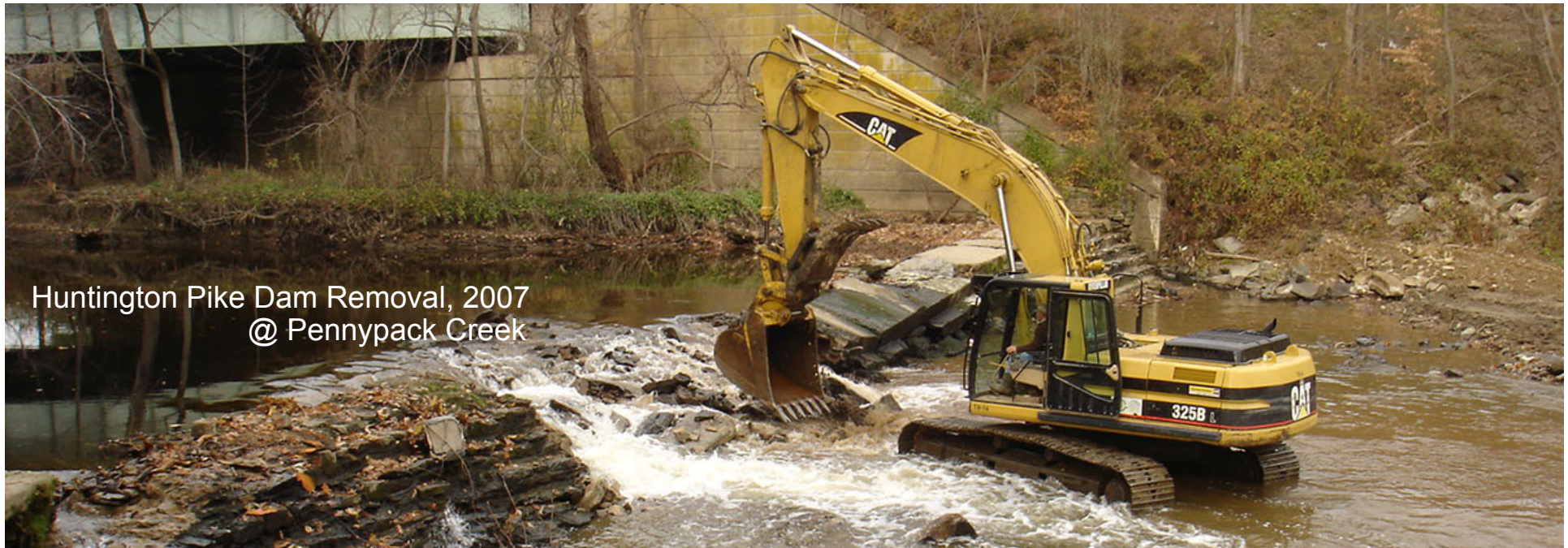
Fragmented or cohesive
regional identity?

Watershed-wide
planning?



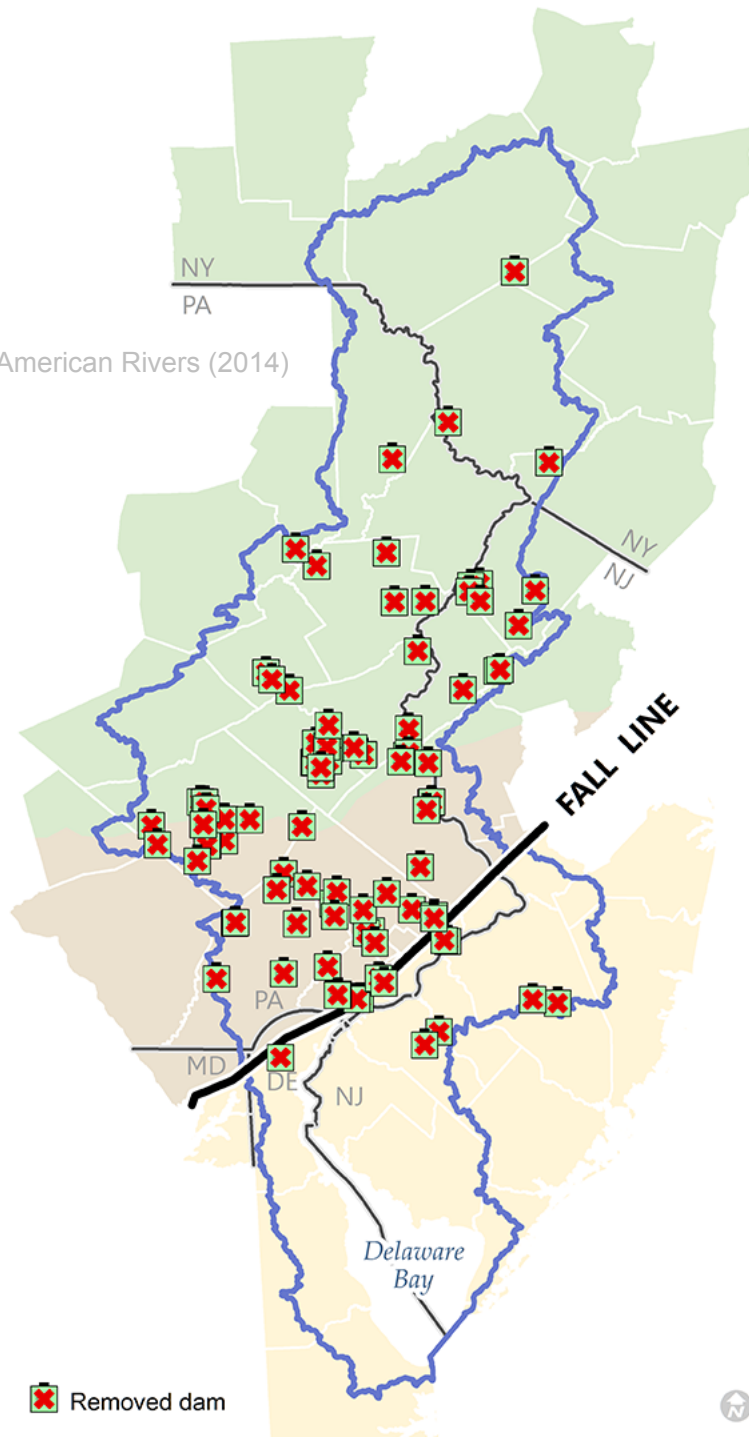


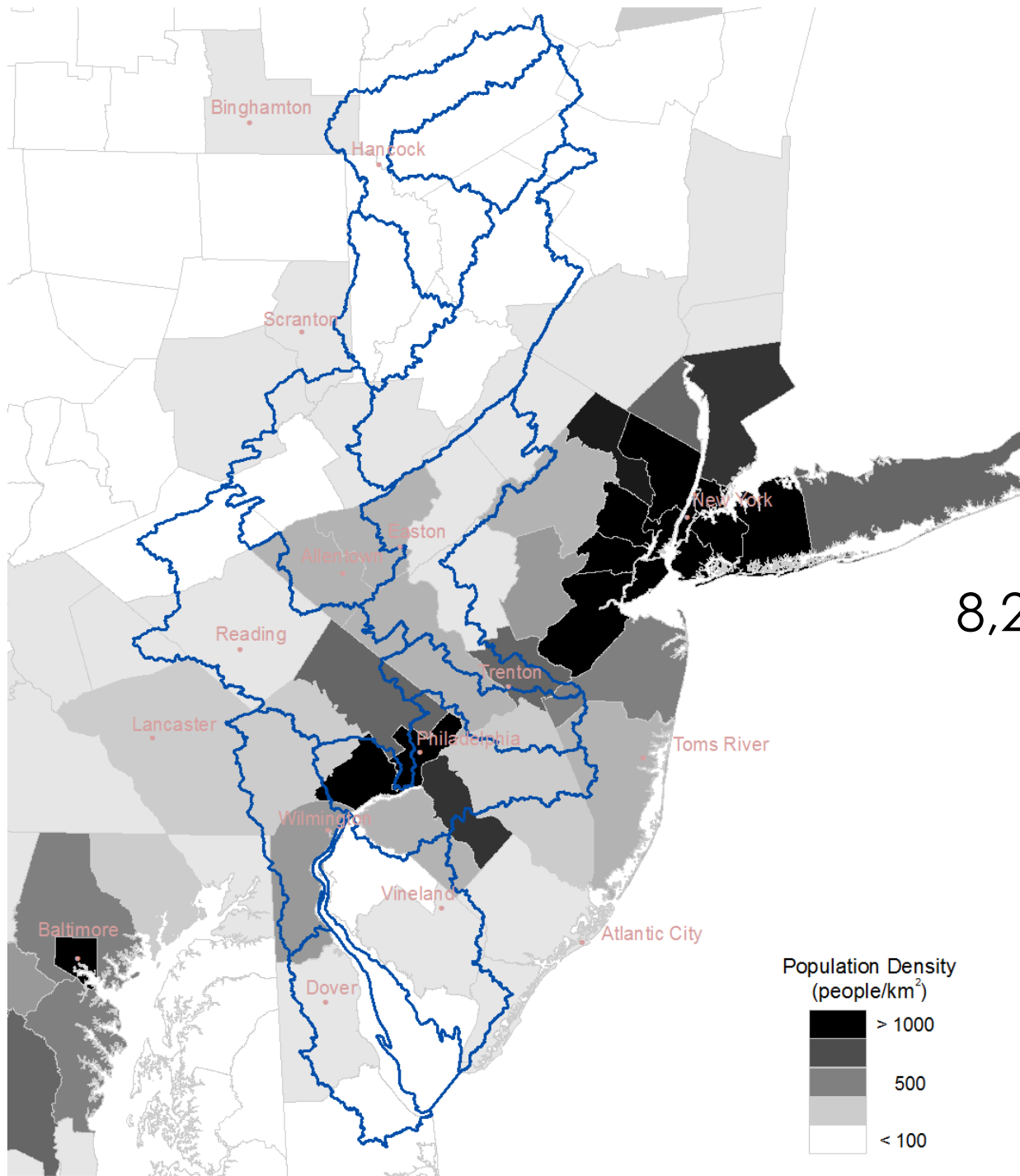




Primary purpose of dam	Count	Avg. age (yrs)	Storage (acre-ft)
Recreation	608	82	585930
Flood control	103	41	847630
Water supply	75	95	926350
Hydroelectric	23	68	1128900
Other	17	62	59170
Fire protection, stock, fish pond	13	50	960
Fish & wildlife pond	4	95	5770
Irrigation	3	56	340
Tailings	2	35	1330
Source: USACE NID (2014) and our calculations	851	76	3,556,400

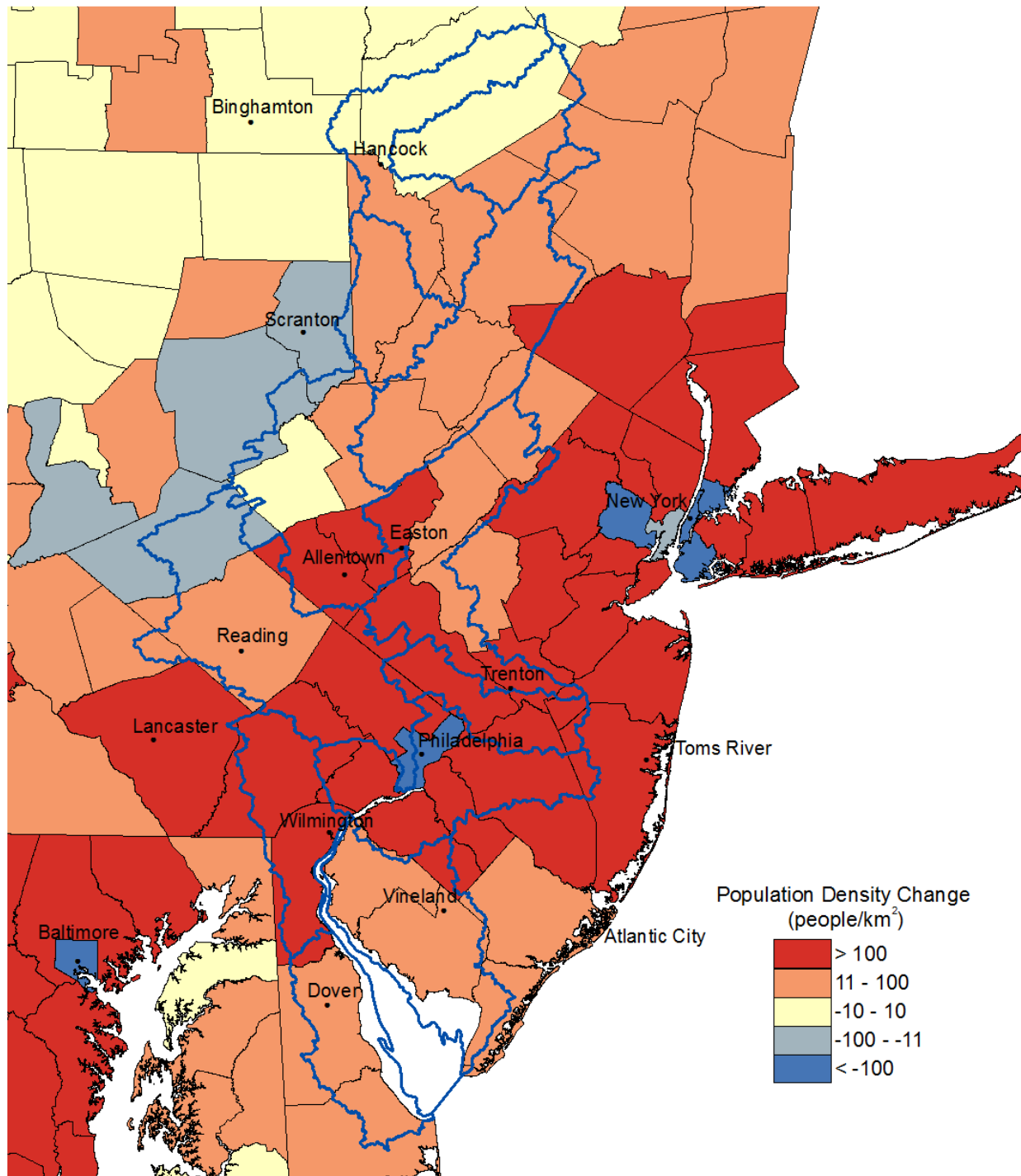
Source: American Rivers (2014)





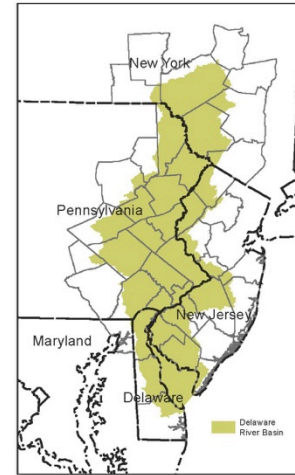
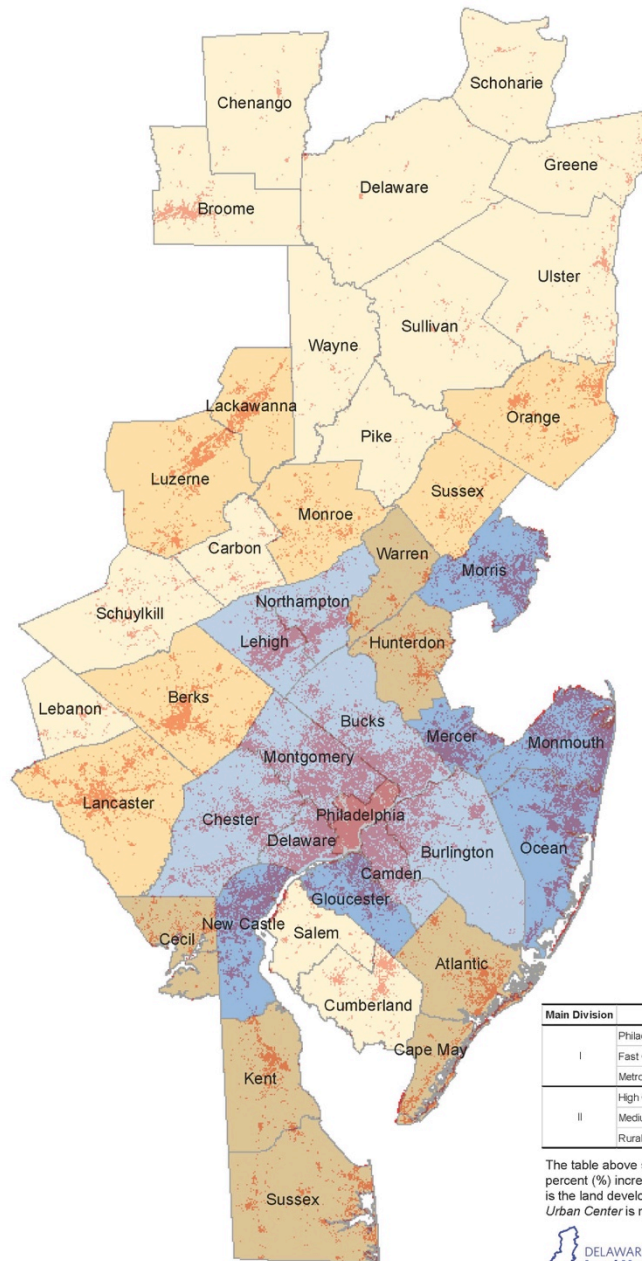
8,268,500 people call
somewhere in the
DRB 'home'.

3,625,600 workers*
work somewhere
in the DRB.



Over the last 50 years and despite regional growth, a lesser share of people live in the DRB's largest city.

DELAWARE RIVER BASIN COUNTY CLASSIFICATION BASED ON URBAN GROWTH AND URBANIZATION DEGREE

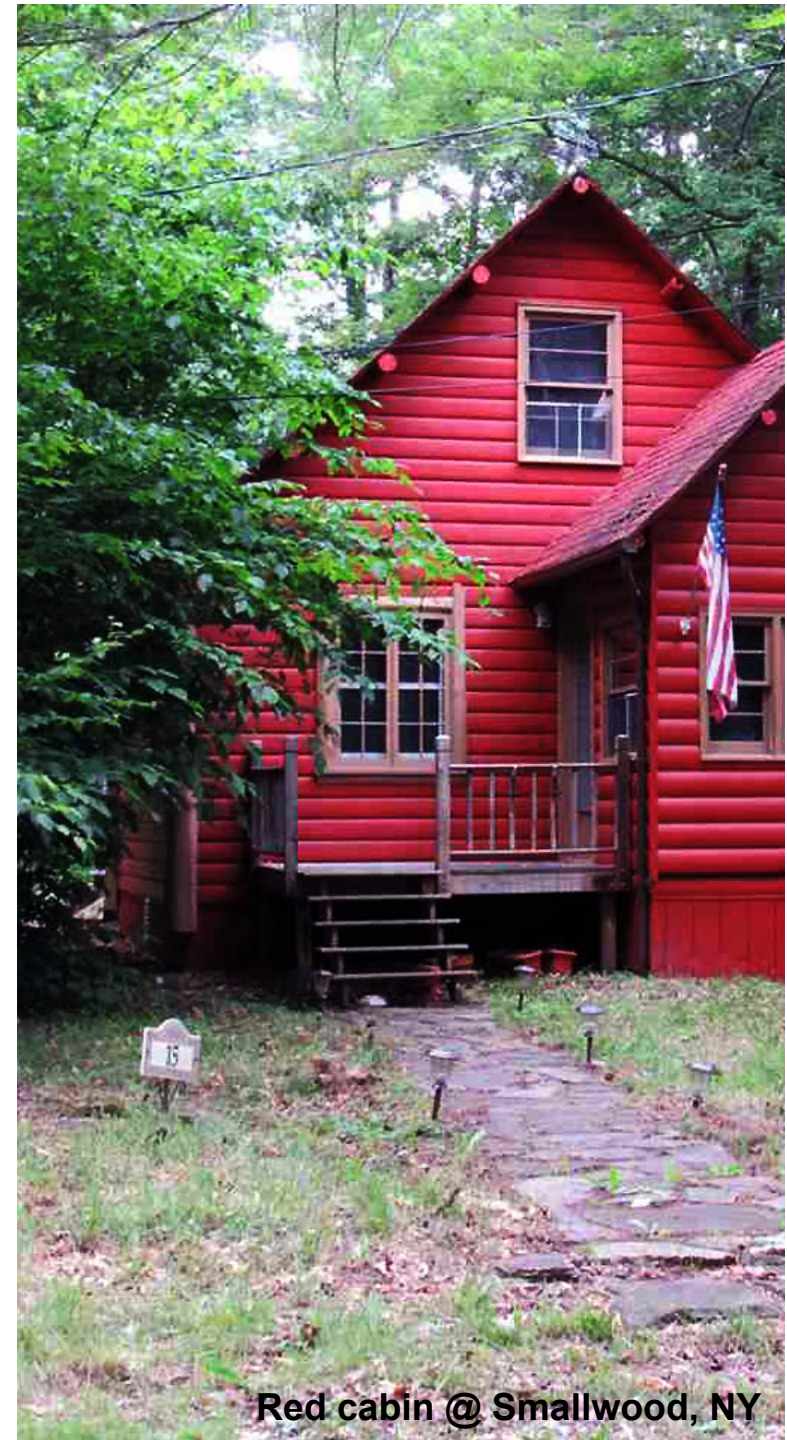
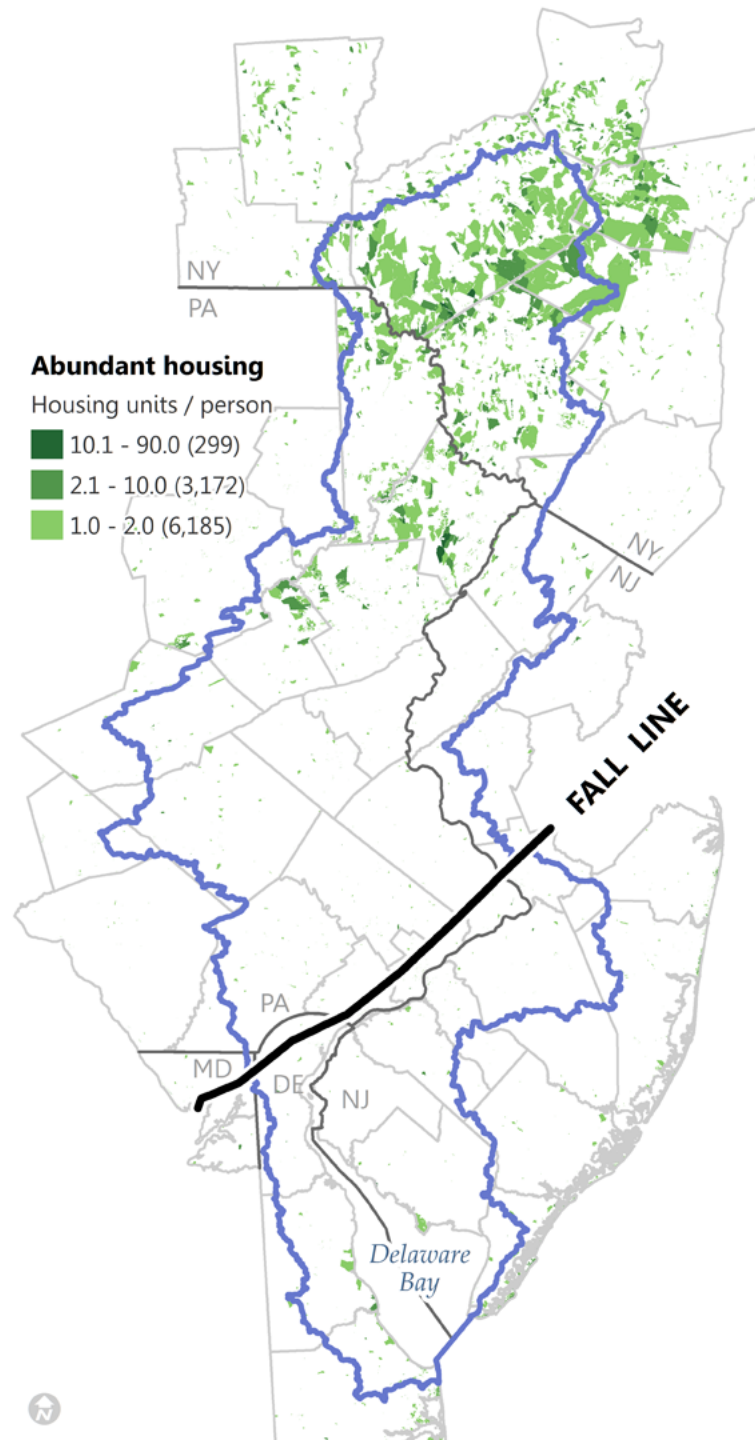


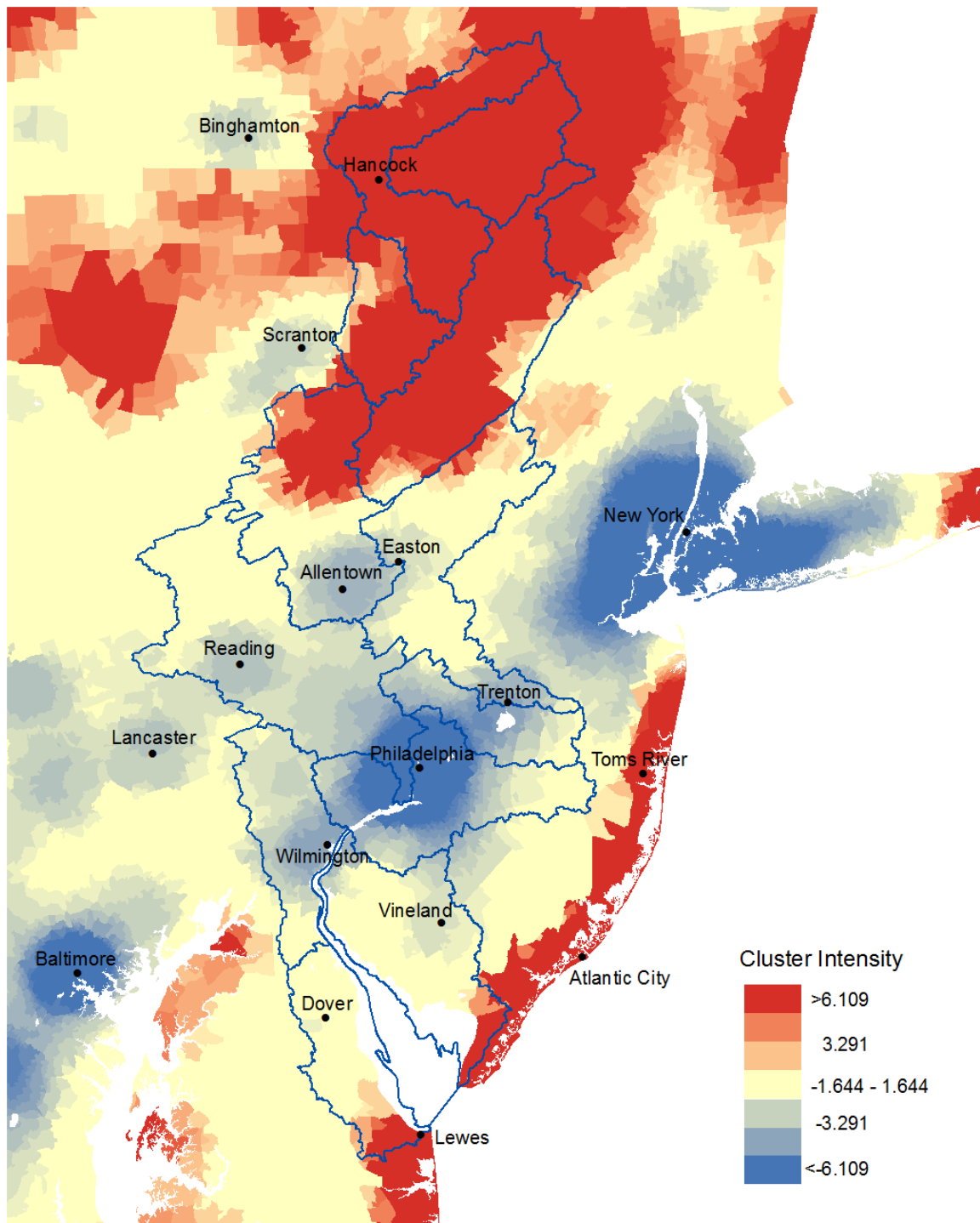
Counties Stratification	
	Philadelphia
	Fast Growth Metro Areas
	Metro Areas
	High Growth Sub-Urban
	Medium Growth Sub-Urban
	Rural Areas
	Urbanized

Scale 1:2,000,000

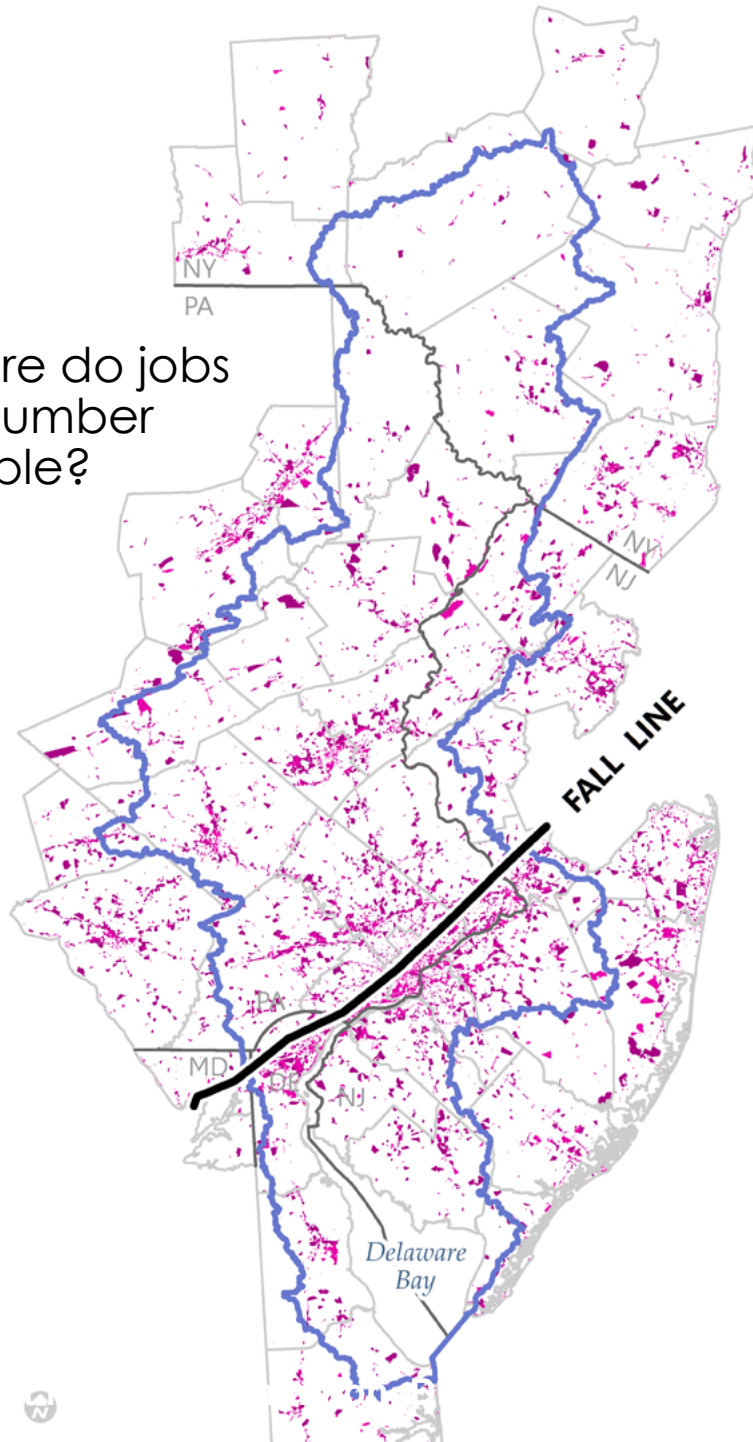
Main Division	Groups	Total Growth	Urban Area	Largest Urban Center
I	Philadelphia	12.05	83.07	304.81
	Fast Growth Metro Areas	2.55	30.78	196.35
	Metro Areas	1.15	32.95	221.99
II	High Growth Sub-Urban	0.55	9.95	32.29
	Medium Growth Sub-Urban	0.31	9.45	67.93
	Rural Areas	0.09	3.17	14.41

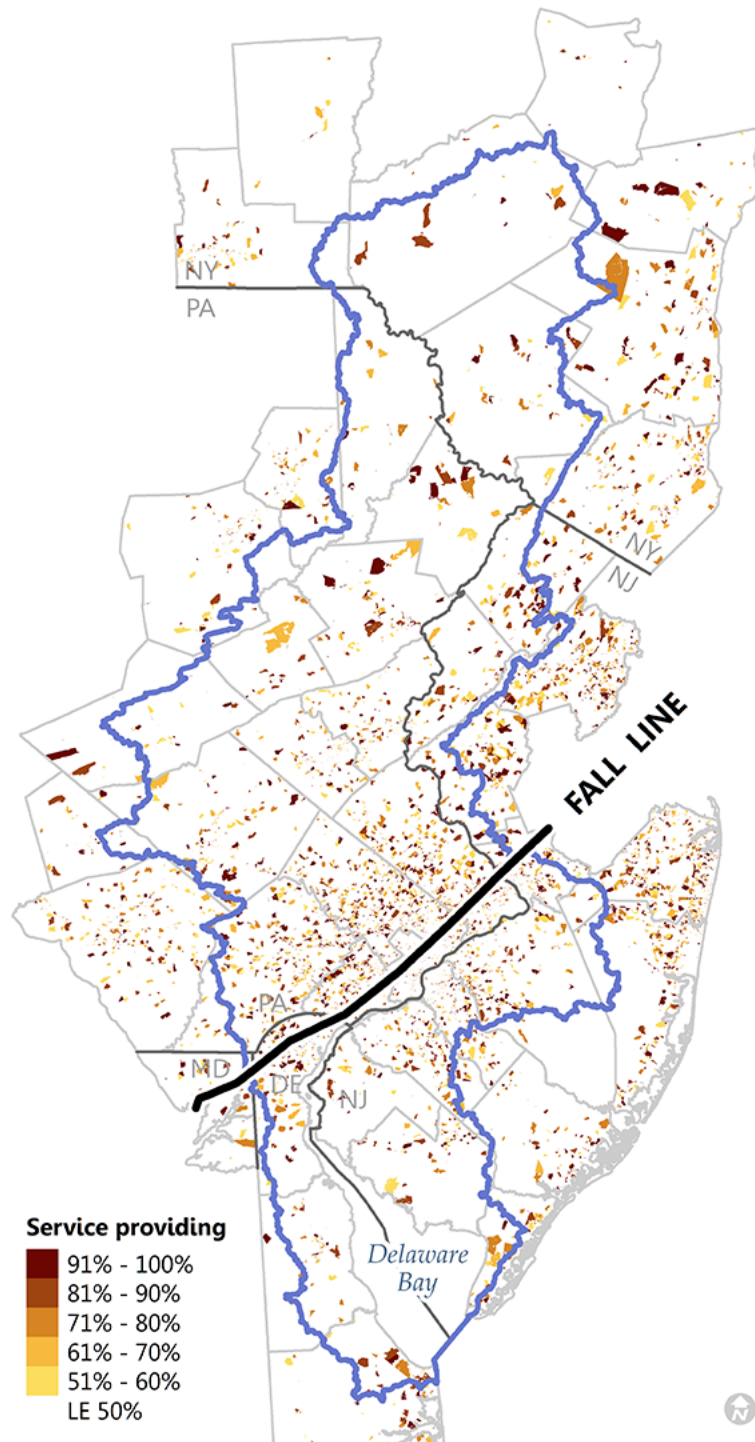
The table above shows the mean value within each group. *Total Growth* is the percent (%) increase of urban area during the period (1996-2010). *Urban Area* is the land developed out of the available land in each county (%). *Largest Urban Center* is measured in square kilometers (km²).

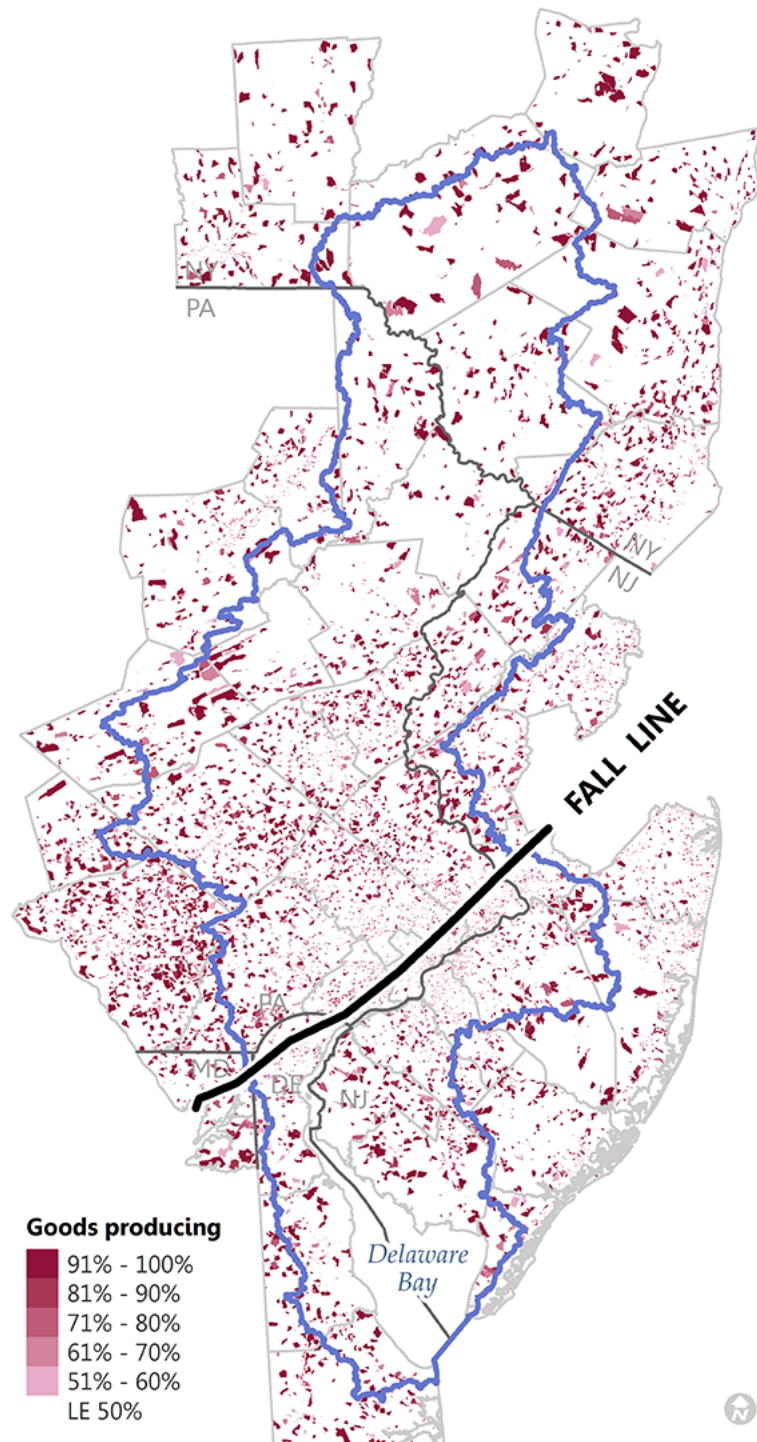




Where do jobs
outnumber
people?









What do the green colors mean?

Employment LQ

- 2.001 - 20.00 Concentrated
- 1.101 - 2.000
- 0.901 - 1.100 on par
- 0.501 - 0.900
- 0.060 - 0.500 Sparse

How were the LQs calculated?

$$LQ_{iwB} = \frac{SE_{iw}/TE_w}{SE_{iB}/TE_B}$$

Where:

LQ = the Location Quotient for industry sector *i* in watershed *w* and relative to the base region *B* (see map at right);

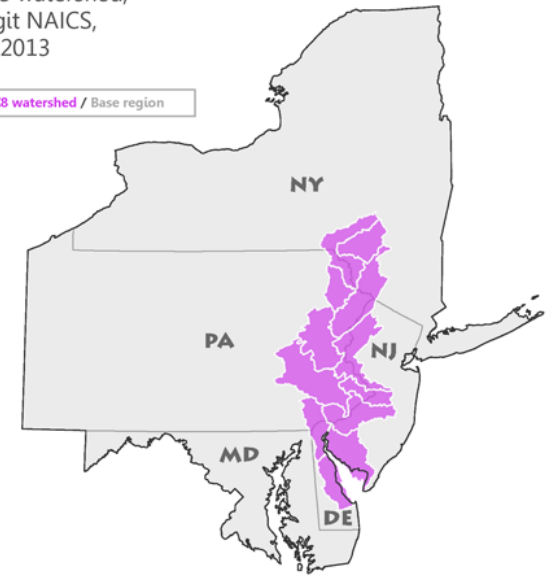
SE = Employment in sector *i*; and

TE = Total employment.

Employment concentration

by HUC8 watershed,
by 2-digit NAICS,
and for 2013

HUC8 watershed / Base region



Summary

The maps at left were built using the US Census Bureau's 2013 Longitudinal Employer-Household Dynamics data, which track payroll employment by census block and by 2-digit NAICS. We aggregated the census blocks that comprise each HUC8 watershed for analysis. Note: self-employed persons are not represented by these data.

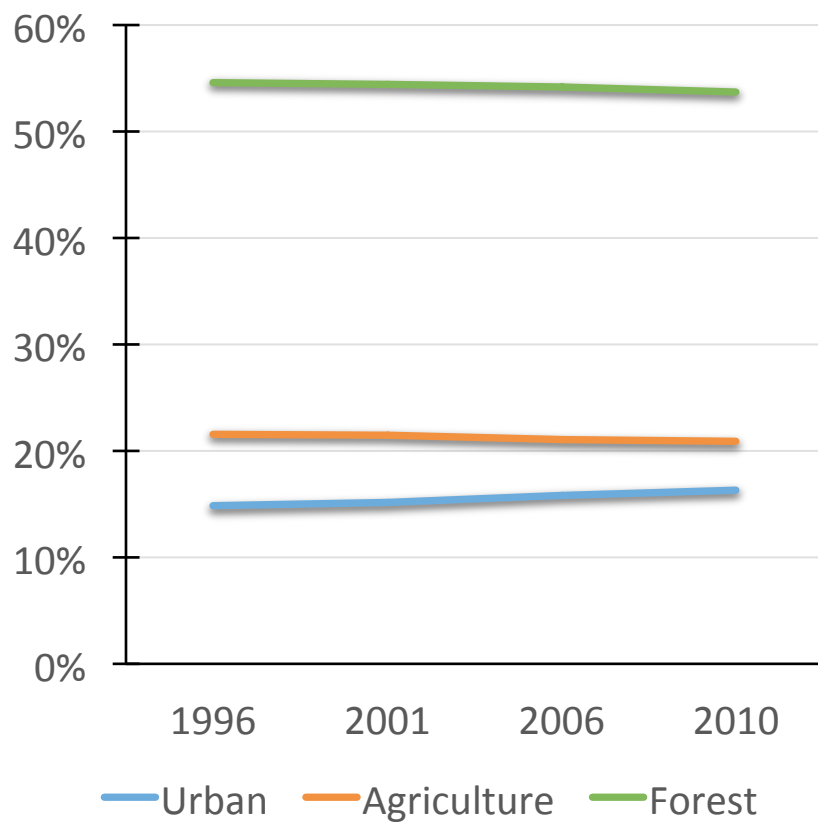
A Location Quotient (LQ) is a valuable way to quantify how employment is concentrated in a particular industry in a particular watershed relative to how much it is concentrated in the hosting base region (the map above shows the five-state base region we used). A LQ can reveal what makes a particular region unique; in this case, unique in terms of jobs.

Light grey tones indicate a watershed that hosts a smaller share of workers than the base region (e.g., the paucity of those working in the Upper Delaware and in the Finance and Insurance sector). Dark green hues indicate a watershed that hosts a share of employment that is larger than the base region share (e.g., those working in the Manufacturing sector and in watersheds containing cities like Allentown, Bethlehem and Trenton). We're interested in the dark green areas because the predominance of jobs in just one or a few sectors can influence the uniqueness - identify - of the area.

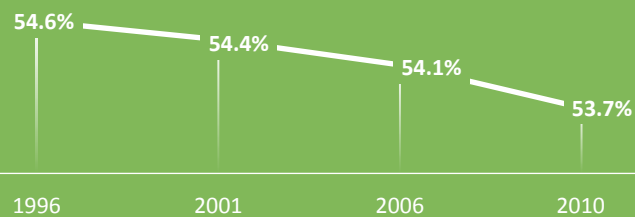


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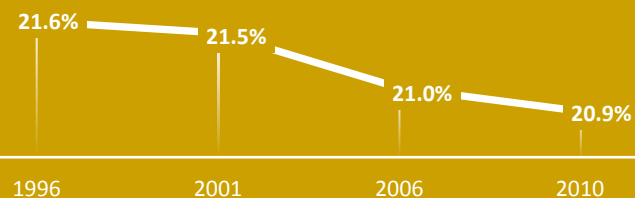
Selected Land Covers



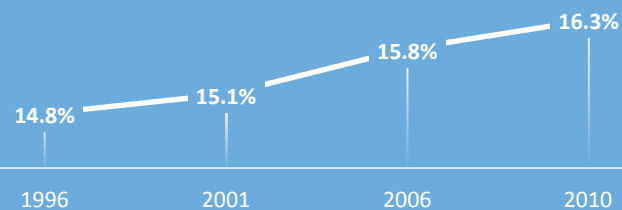
TOTAL FOREST COVER

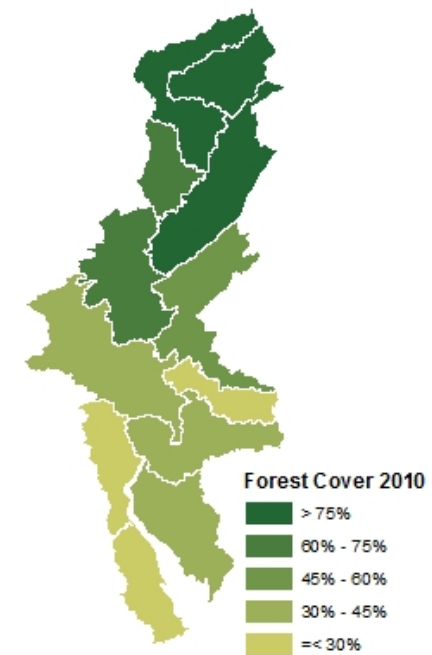
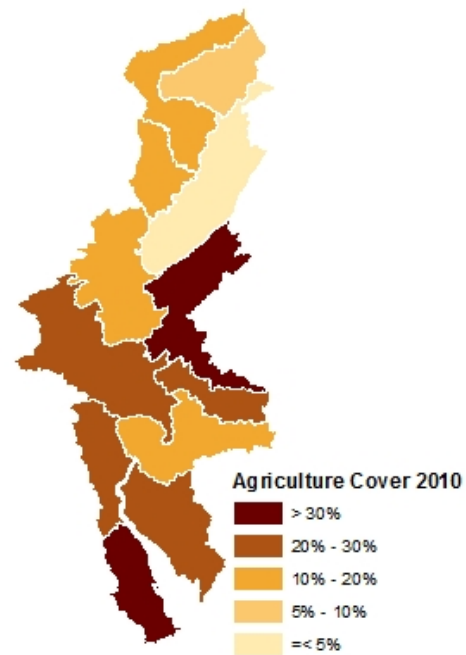
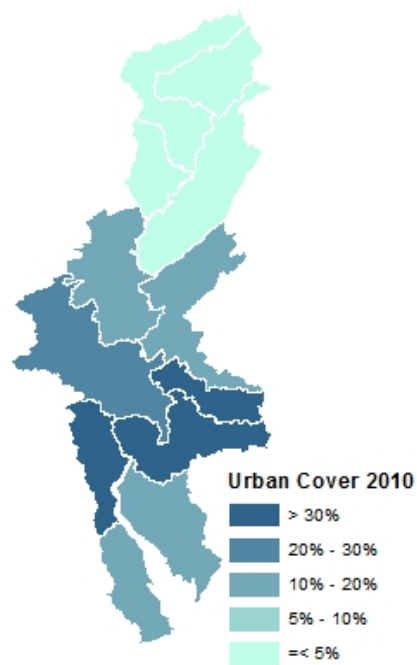


TOTAL AGRICULTURE AREA

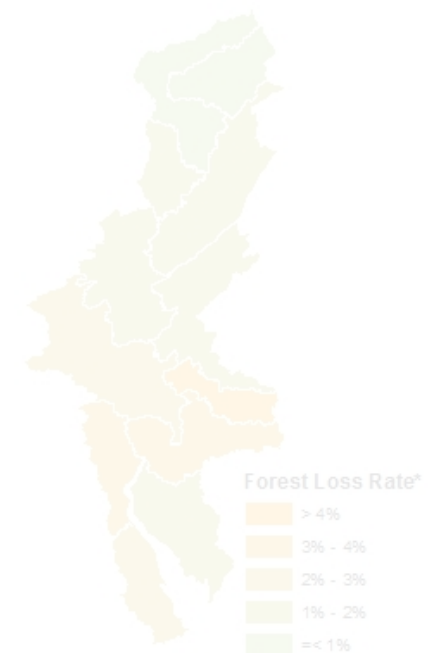
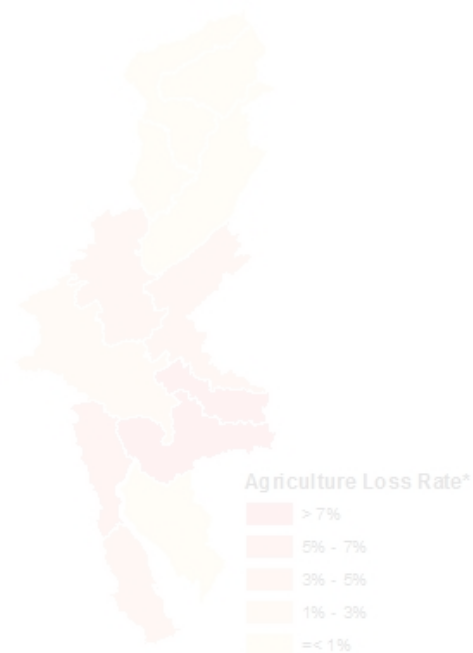


TOTAL URBAN AREA

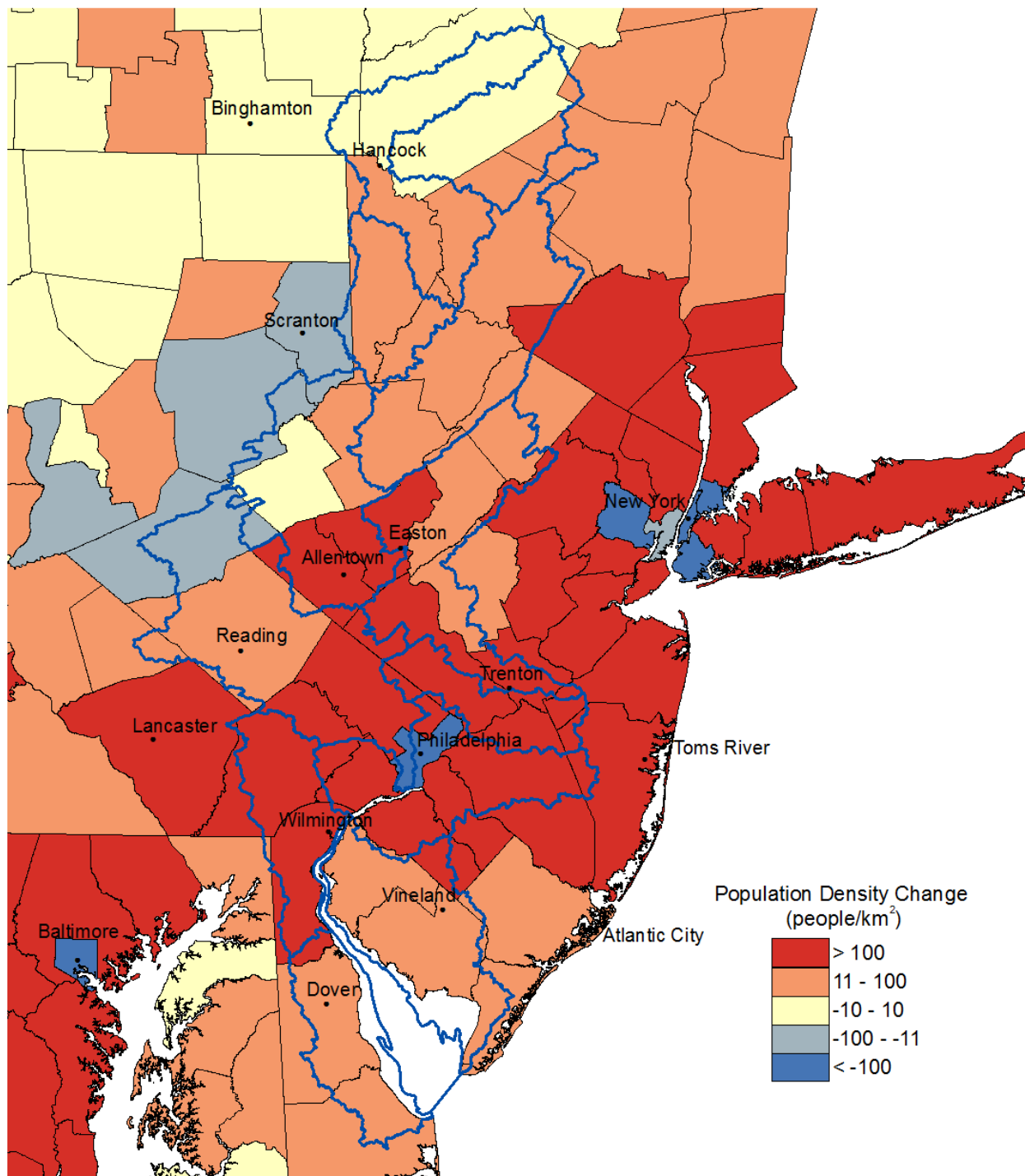




Short term - stable



*period of analysis from 1996 to 2010



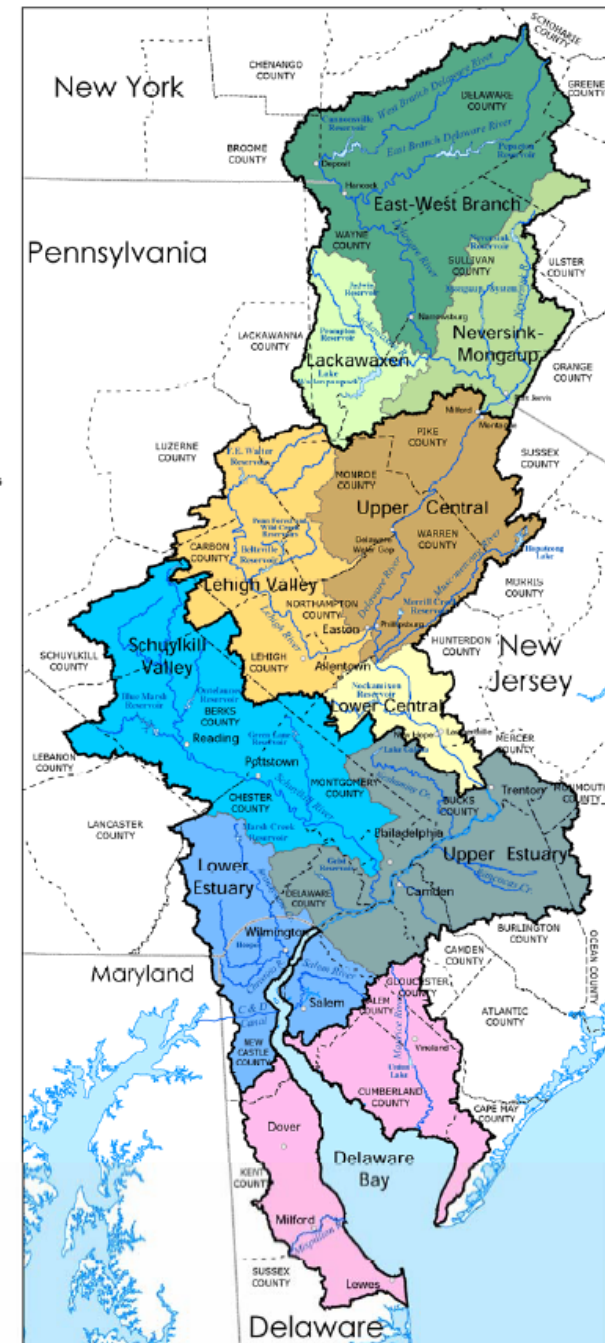
Long term -
dynamic

Watershed planning

How important is it to plan for the future by thinking about the whole watershed?

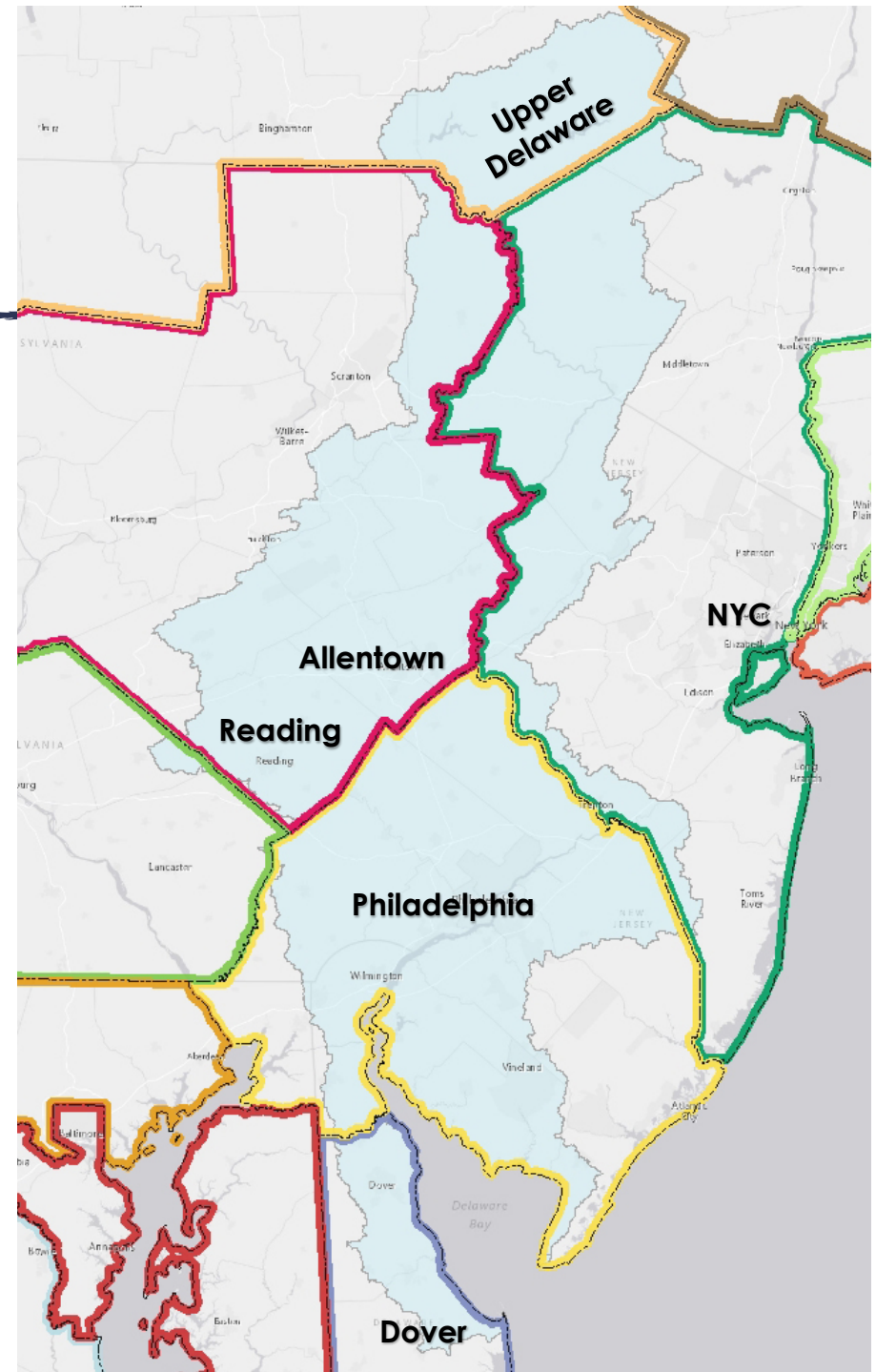
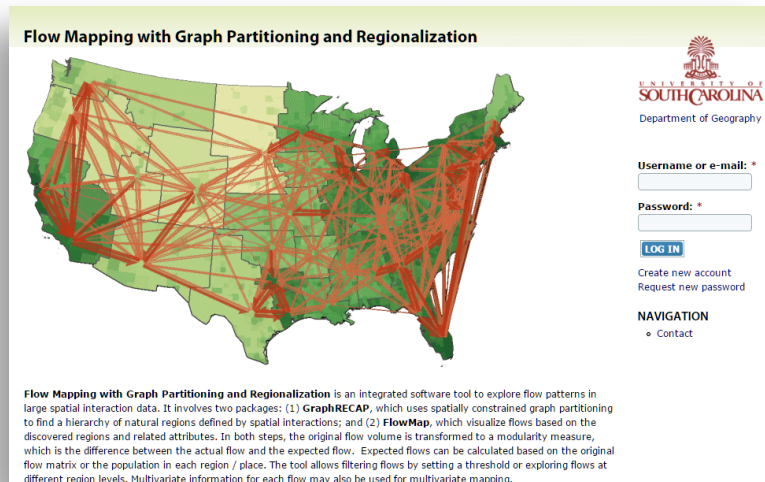
Watersheds of the Delaware River Basin

- East-West Branch Watersheds
- Lackawaxen Watersheds
- Neversink-Mongaup Watersheds
- Upper Central Watersheds
- Lower Central Watersheds
- Lehigh Valley
- Schuylkill Valley
- Upper Estuary Watersheds
- Lower Estuary Watersheds
- Delaware Bay Watersheds



Watershed identity

Does the DRB have a cohesive regional identity or many fragmented identities?





The Watershed in 2070



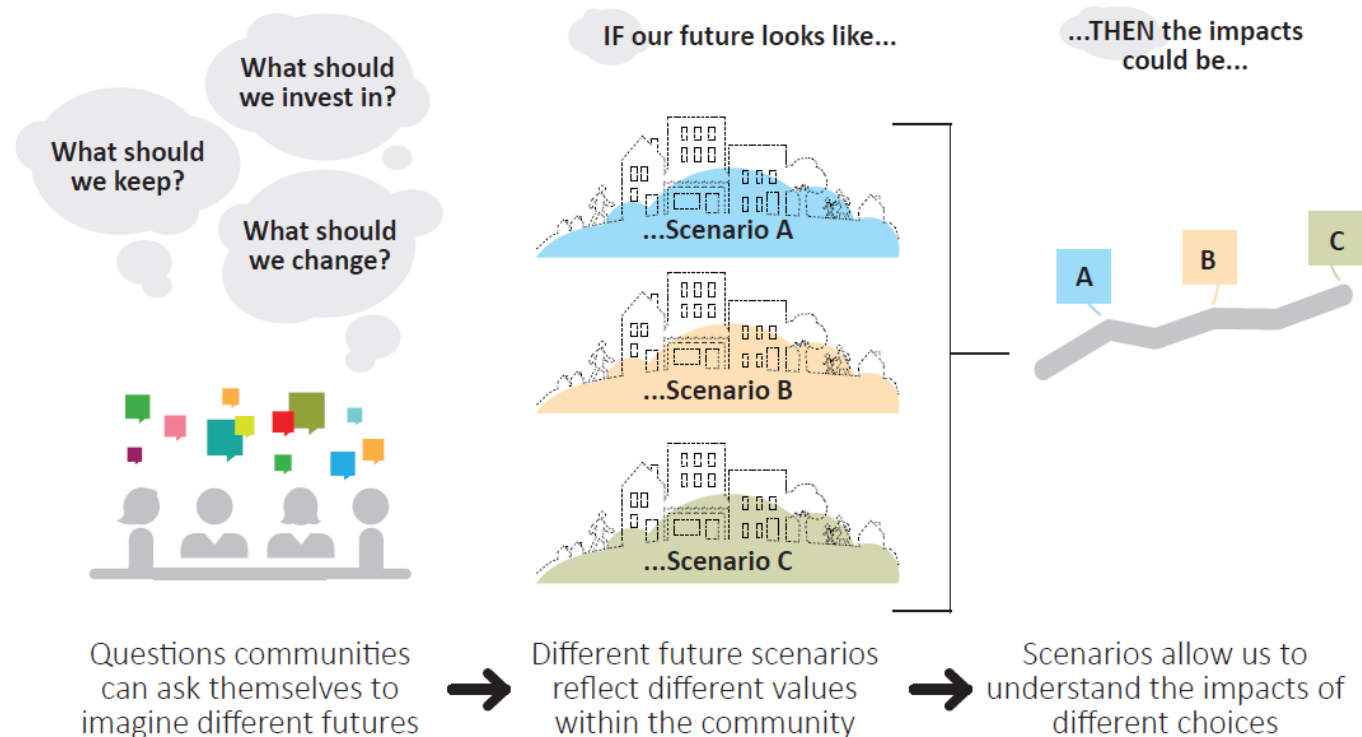
Our approach to forecasting land use change

- ▶ Community driven
 - ▶ What do you value?
 - ▶ Iterative
- ▶ Data driven
 - ▶ Reflect current trends
 - ▶ Best available forecast data
- ▶ Use scenarios

The Watershed in 2070



Scenarios are plausible stories about the possible futures and range of changes that could occur





Let's get to work

Session 1

- ▶ What do you value? What would you like to preserve? What are the current challenges & opportunities?
- ▶ Report back

Session 2

- ▶ What would you like to change? What are future challenges & opportunities?
- ▶ Report back

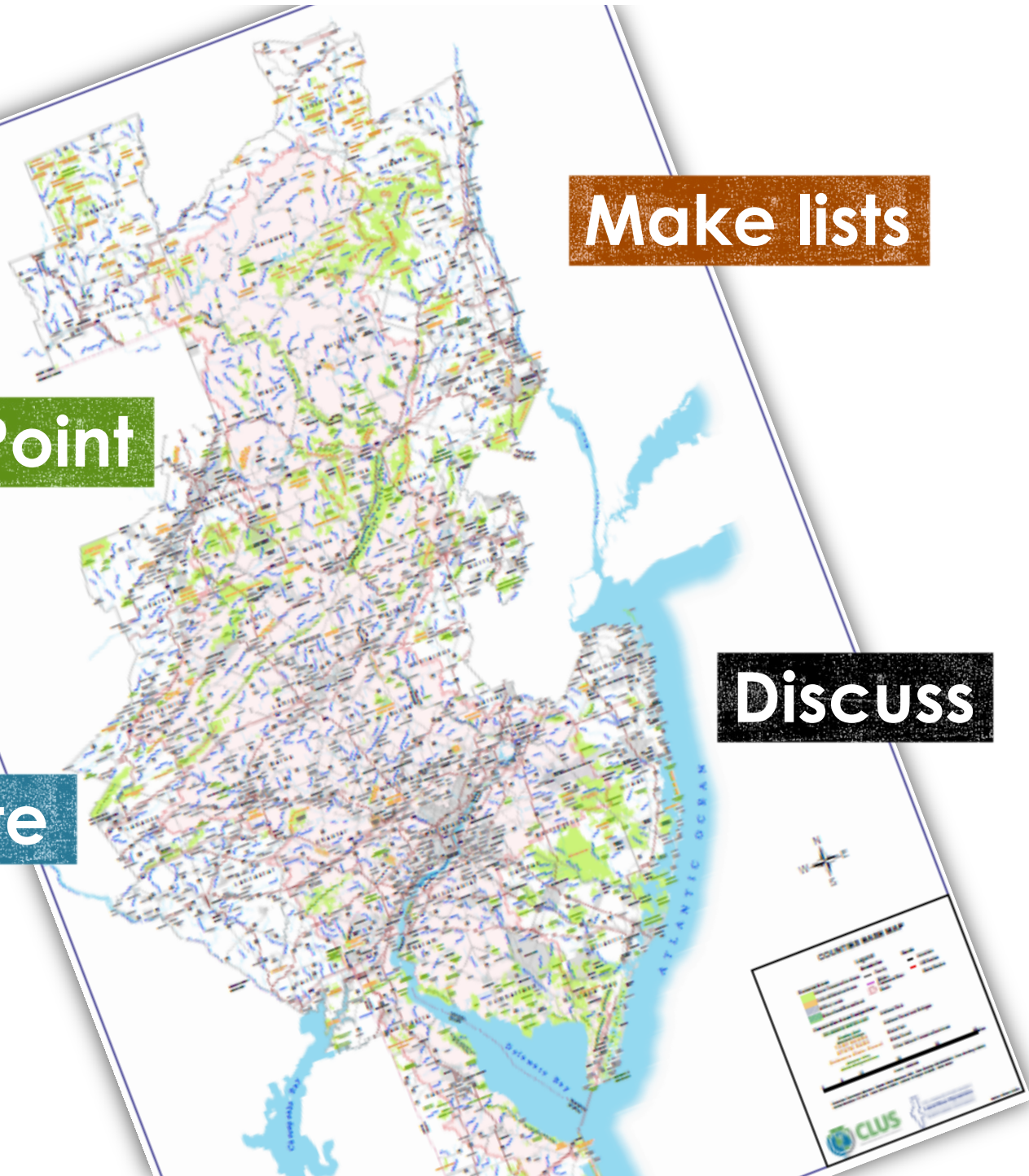
Draw

Make lists

Point

Discuss

Annotate



Sev. Demographics

Lots of beautiful spots in the West

Ag Land

Great Restaurants

Philadelphia Smores

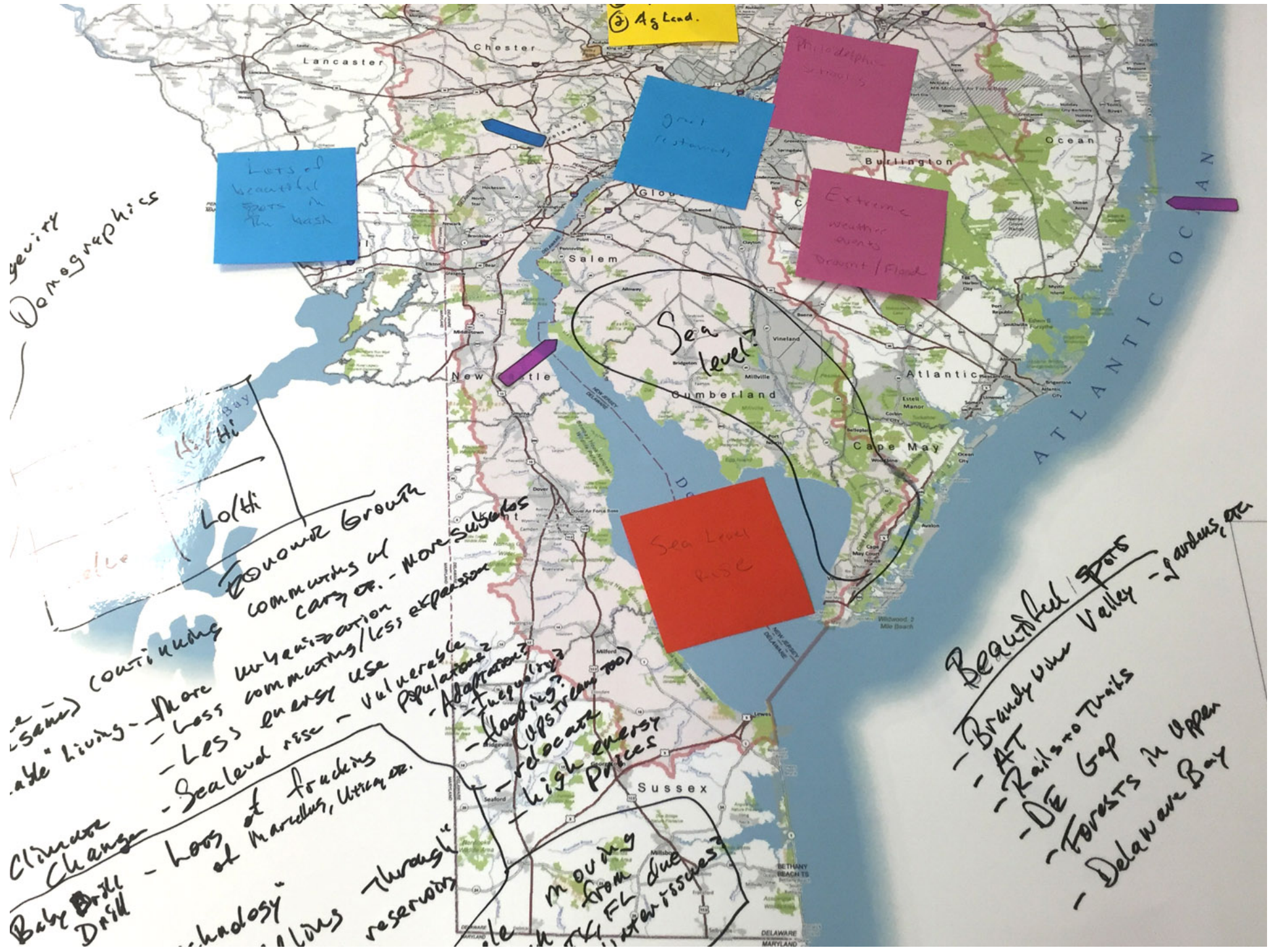
Extreme weather events
Drought / Flood

Sea level

Sea Level rise

Beautiful spots
Brandywine Valley - Gardens, etc.
AT
Railroad Trails
DE Gap
Forests in Upper
Delaware Bay

Climate Change
Baby Drill
Drill
- Continuing Economic Growth
- Communities of color - More suburbs
- Less urbanization
- Less energy use
- Sea level rise - vulnerable populations
- Flooding? (upstream too)
- High energy prices
- Moving from FL due to weather issues
- Loss of forests of Maryland, Virginia, etc.
- "hology" along through reservoirs





What's next?

On-line survey (coming soon)

- ▶ A chance for you to contribute individually
- ▶ A chance for others to contribute

Draft scenario storylines (coming in spring 2016)

- ▶ Incorporate best data and findings from workshops and survey
- ▶ We'll be asking for your feedback

Final scenario storylines (summer 2016)

Scenario forecasts (fall/winter 2016)

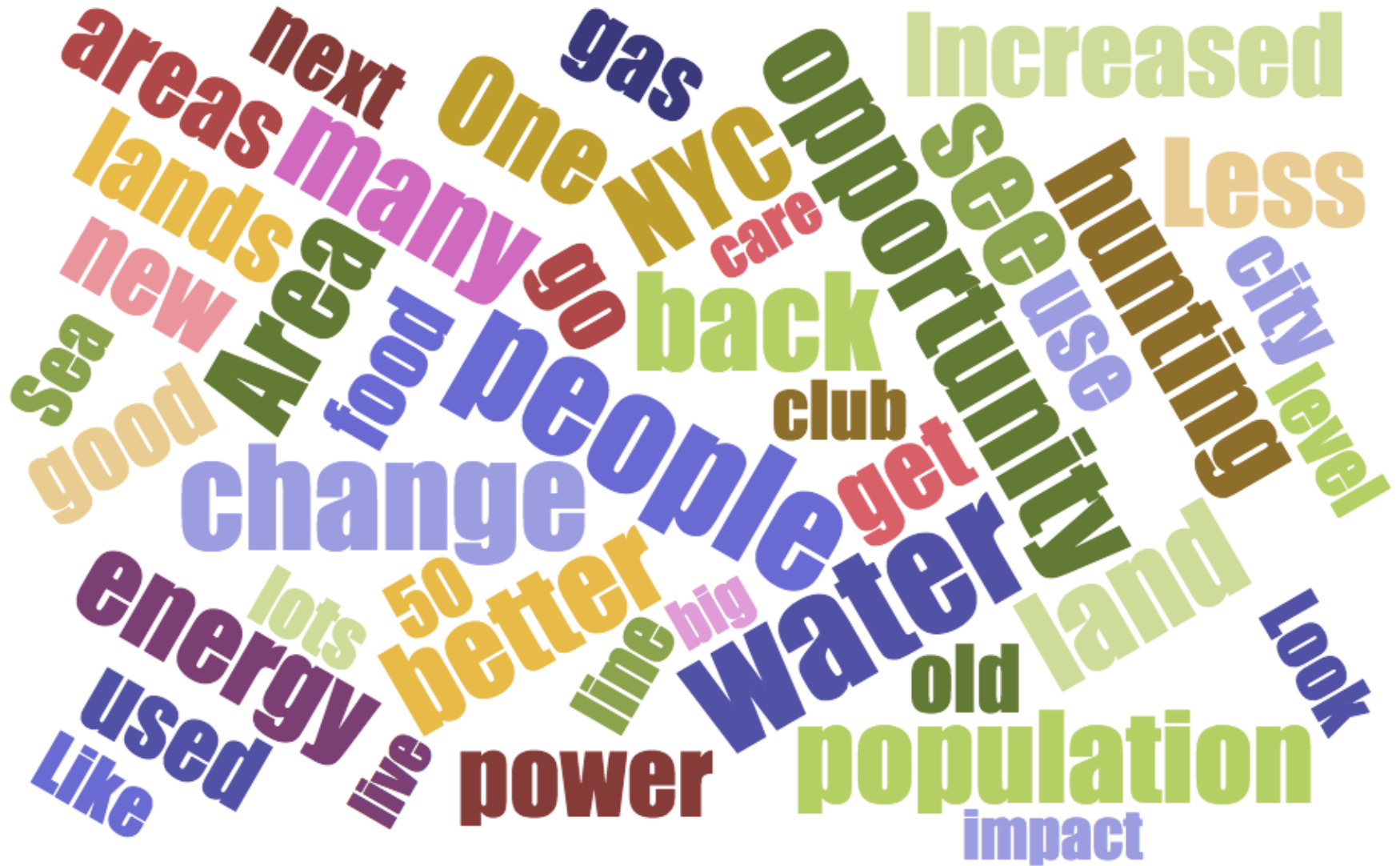
Strengths (SWOT)



Weaknesses (SWOT)



Opportunities (SWOT)



Threats (SWOT)



Welcome to the Delaware River Basin Project!



A watershed of over 13,000 square miles, the Delaware River Basin (DRB) provides water resources for roughly 5% of the US population. This 2-year project based at Shippensburg University aims to develop a land cover mapping, modeling, and monitoring system for the Delaware River Basin in support of maintaining and restoring water resources.

Thank you for your interest!

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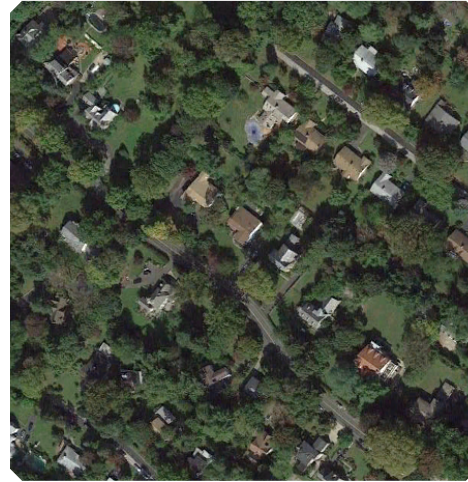
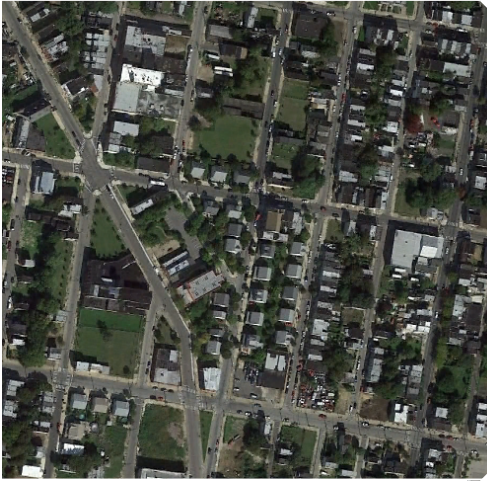
Email Address*

First Name

Last Name

* = required field

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Project lead
Co-investigator
Research analyst
Project coordinator
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