

Developing future land use scenarios for the Delaware River Basin

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 <http://drbproject.org>



Delaware River Basin (DRB)

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

4 states, 43 counties

8.2 million residents

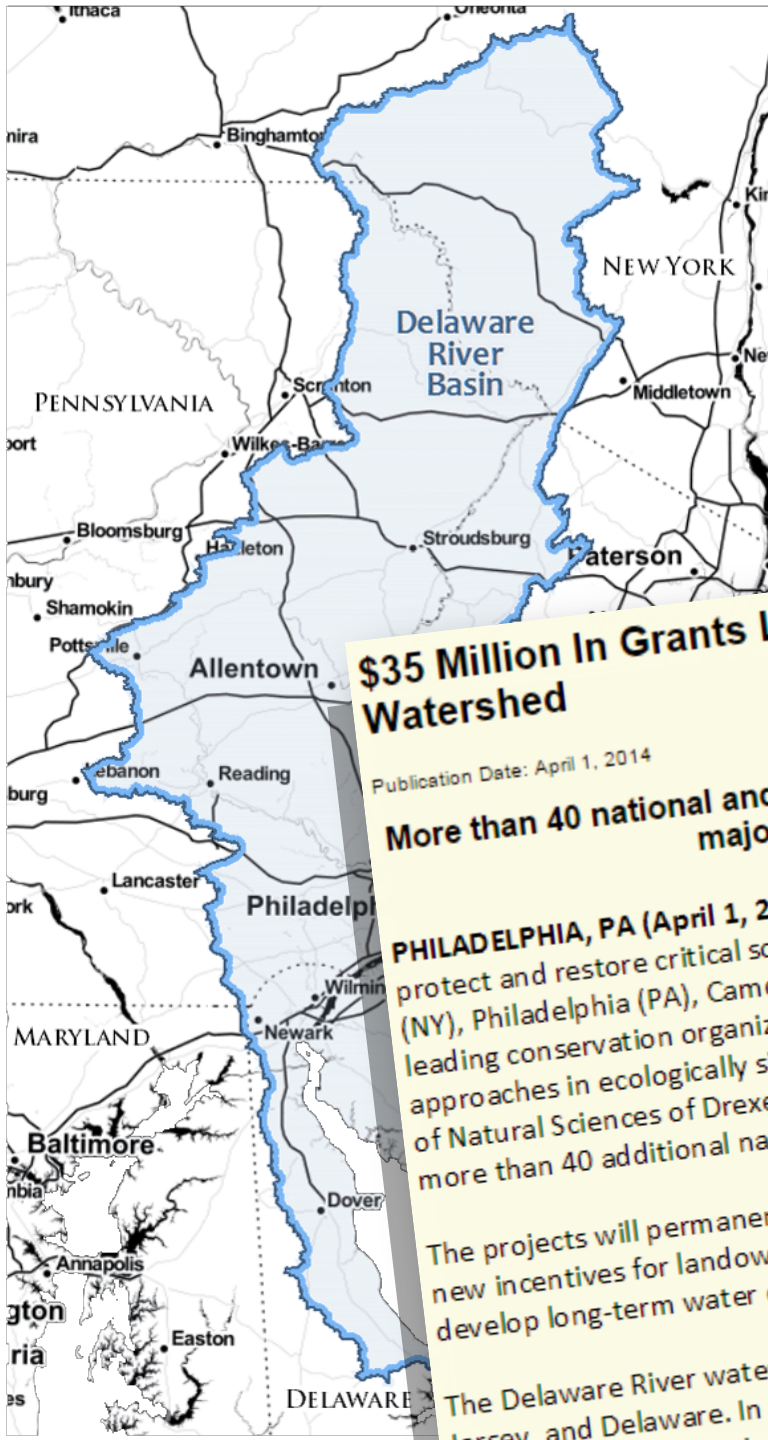
3.6 million jobs*

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



Grand Challenges

- Many waterways do not meet the “fishable and swimmable” Clean Water Act requirements
- Population growth and associated land cover change are a concern for water supply and quality
- Climate change and sea level rise



Delaware River Watershed Initiative



\$35 Million In Grants Launches Multi-State Investment In Delaware River Watershed

Publication Date: April 1, 2014

More than 40 national and regional environmental organizations join to protect Delaware River for major cities in era of increasing threats to water supplies

PHILADELPHIA, PA (April 1, 2014) – The William Penn Foundation announced a \$35 million multi-year initiative to protect and restore critical sources of drinking water for 15 million people, many in major cities including New York (NY), Philadelphia (PA), Camden (NJ), and Wilmington (DE). The grants fund an unprecedented collaboration of leading conservation organizations who will align their work to protect land, restore streams, test innovative approaches in ecologically significant places, and monitor results over time. The organizations include the Academy of Natural Sciences of Drexel University, the National Fish and Wildlife Foundation, the Open Space Institute and more than 40 additional national and regional partners.

The projects will permanently protect more than 30,000 acres, implement more than 40 restoration projects, pilot new incentives for landowners and businesses, provide replicable models for other locations in the watershed, and develop long-term water quality data for the watershed at an unprecedented scale.

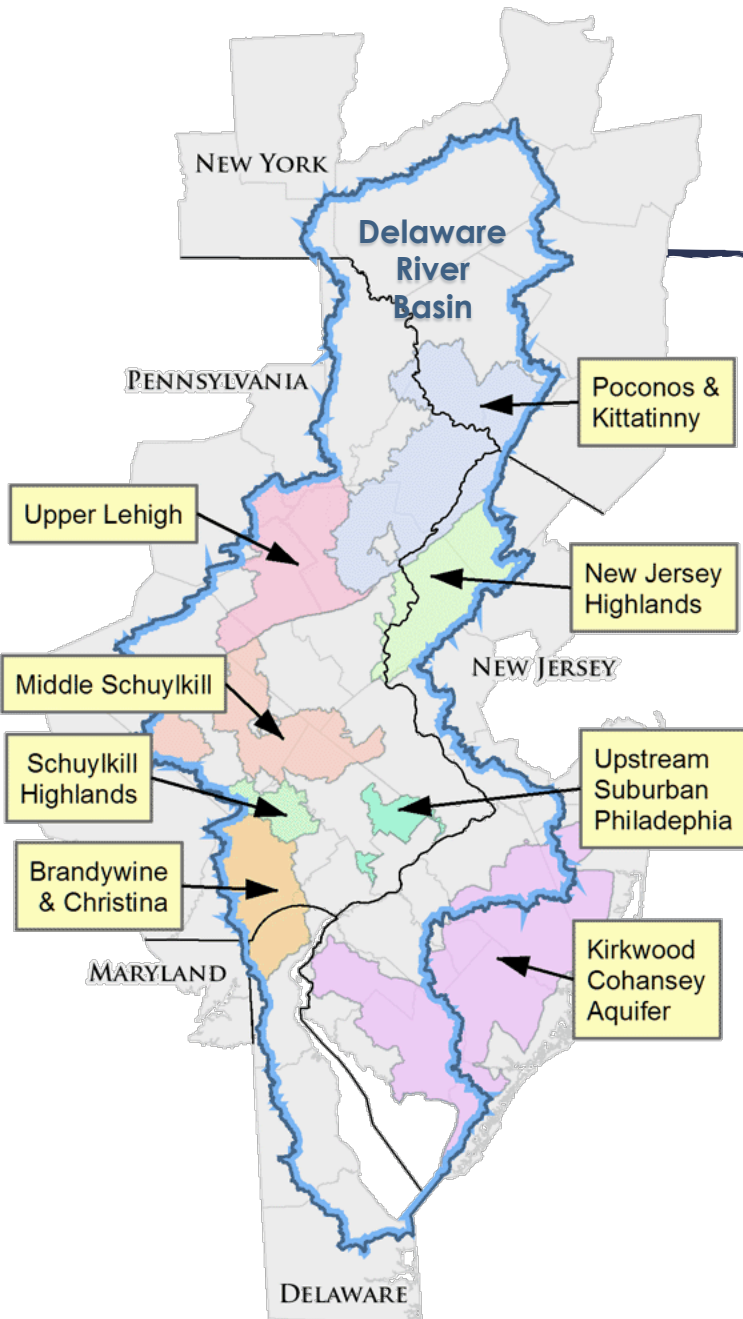
The Delaware River watershed covers more than 13,500-square miles spanning New York, Pennsylvania, New Jersey, and Delaware. In addition to being a major source of drinking water, the watershed supports an array of enterprises valued at \$25 billion per year, as well as hemispherically significant habitat. The watershed also faces threats from land use change, energy development, chemical runoff from farms, and storm

Clusters & Stakeholders

- Nature Conservancy
- Pinchot Institute
- Open Space Institute
- National Park Service
- Delaware River Basin Commission
- Upper Delaware Council
- Delaware Valley Regional Planning Commission
- and others...

More than 50 leading nonprofits have joined together, aligning priorities for land protection and restoration projects and assessing water quality impacts.

The Academy of Natural Science is leading the DRWI's science.



Basin-wide data needs

- Forums
 - 2013 Science of Sourcewater Workshop
 - Common Waters Fund
 - Delaware River Basin Commission
- Identified needs:
 - High resolution land use/land cover mapping and monitoring
 - Land use/land cover change forecasting
 - Land cover/climate interactions



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

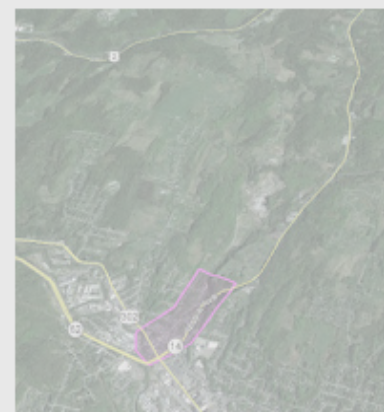
We are thrilled to announce the first public release of the Pennsylvania statewide high-



SEP
10

Montgomery County MD Tree Canopy Explorer

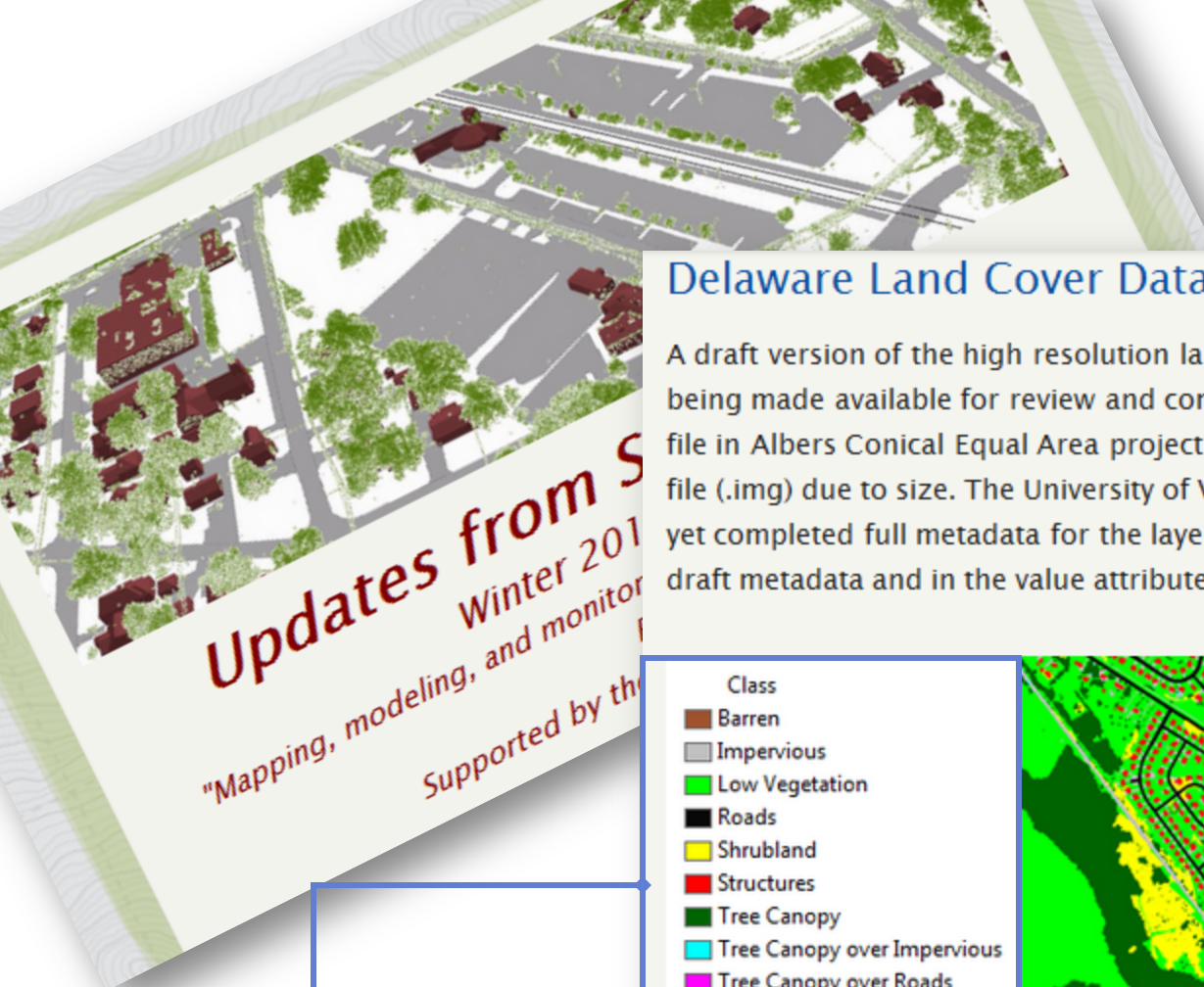
In late spring we completed an updated mapping of Montgomery County, Maryland's land cover. The driving factor for this



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

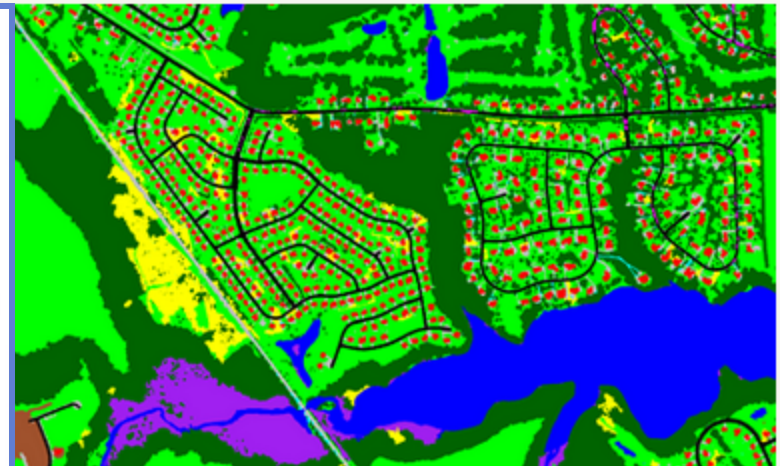


Updates from S
Winter 201
"Mapping, modeling, and monitor
Supported by th

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.



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The Watershed in 2070

Our approach to forecasting land use change:

Community driven

- ▶ What do stakeholders value?
- ▶ Iterative

Data driven

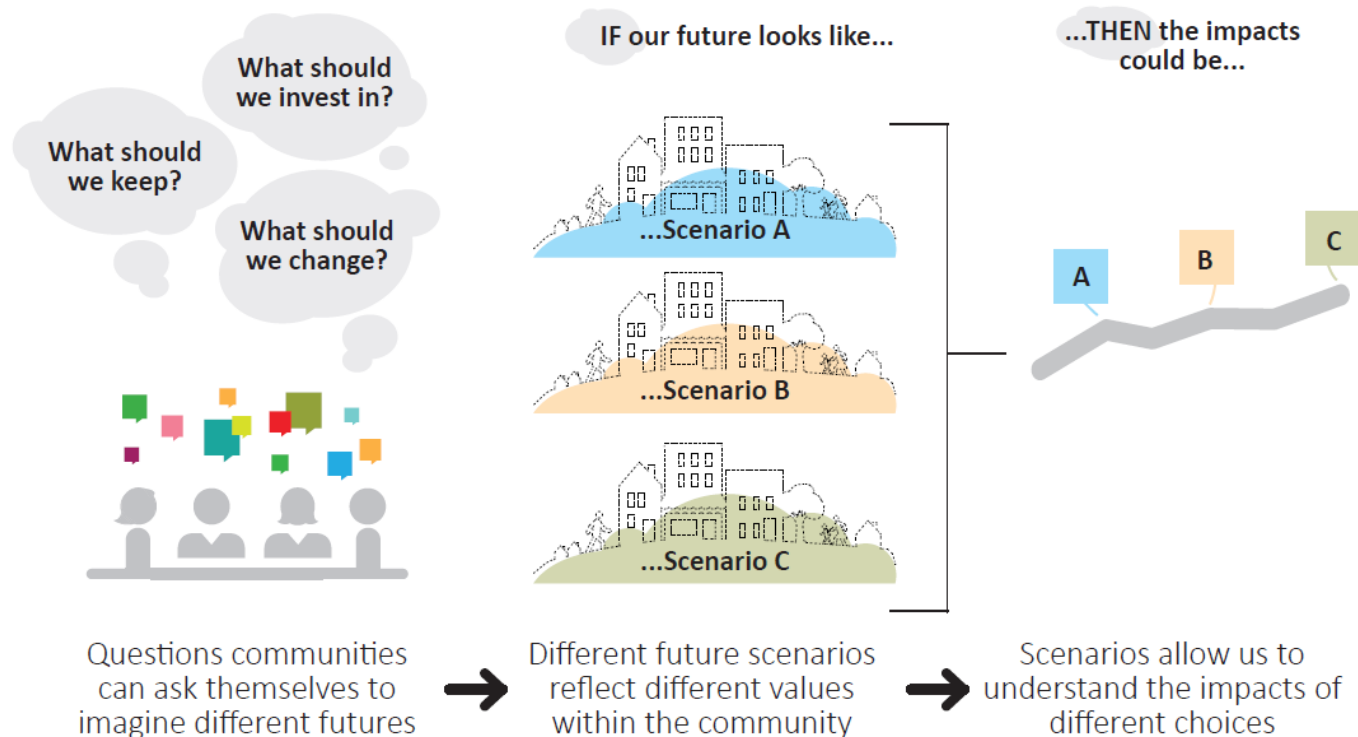
- ▶ Reflect current trends
- ▶ Best available forecast data

Scenario approach

- ▶ To inform CA-based simulation models

The Watershed in 2070

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



Approach to scenarios

Qualitative

What are current strengths and weaknesses; future threats and opportunities

- ▶ Focus groups
- ▶ Surveys

Storylines

- ▶ Future development catalysts
- ▶ Catalysts for future land protection

→ Iterative

Quantitative

Model socio-economic and environmental drivers of urban land change.

- ▶ Suitability layers for CA model calibration

Incorporate best available population and employment forecasts.

Forecasts of climate change, sea level rise

→ Iterative

Related efforts



YAHARA 2070

Yahara 2070 is an exploration of possible futures for human well-being in Wisconsin's Yahara Watershed



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Watershed identity & scenario workshops

Five workshops held between Oct. 2015 – Feb. 2016

60 participants



Workshop format

Pre-workshop survey

- ▶ Perception of watershed identity (fragmented or cohesive)
- ▶ Importance of watershed planning

Introductions and ice-breaker

Overview of the watershed

Modified Strength-Weakness-Threats-Opportunities (SWOT) exercise

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?

Draw

Make lists

Point

Discuss

Annotate

A modified SWOT analysis

Outcomes

Annotated maps

Report outs

Annotated maps

Report outs

Demographics

- Brandywine Valley - Gardens, etc.
- AT
- Railroads
- DE Gap
- Forests in Upper
- Delaware Bay

Data analysis



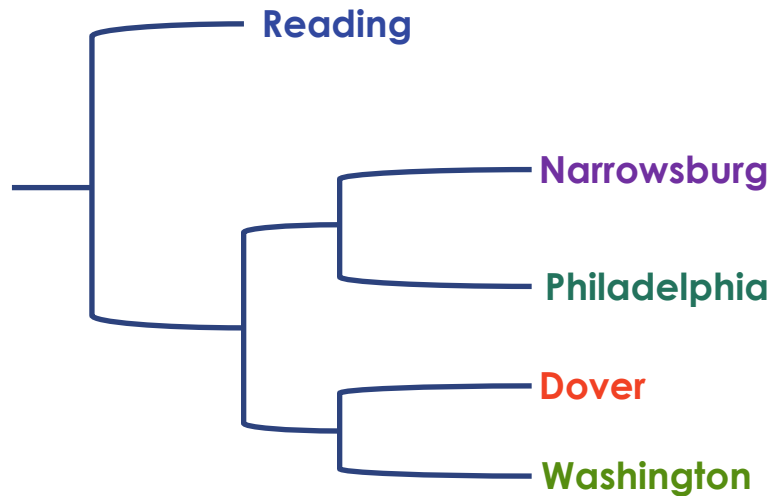
Text data mining, analysis, and visualization

- ▶ Words, themes
- ▶ Frequency, cluster analysis
- ▶ Word clouds, dendrograms

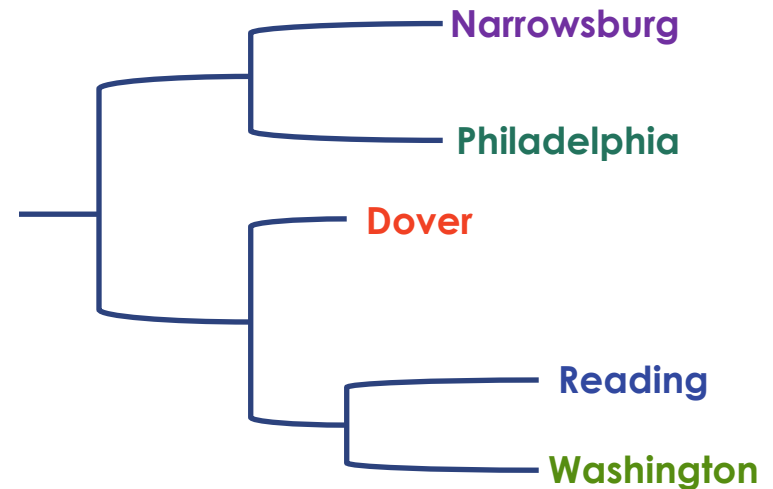


We've learned:

*Workshops, by
word similarity*

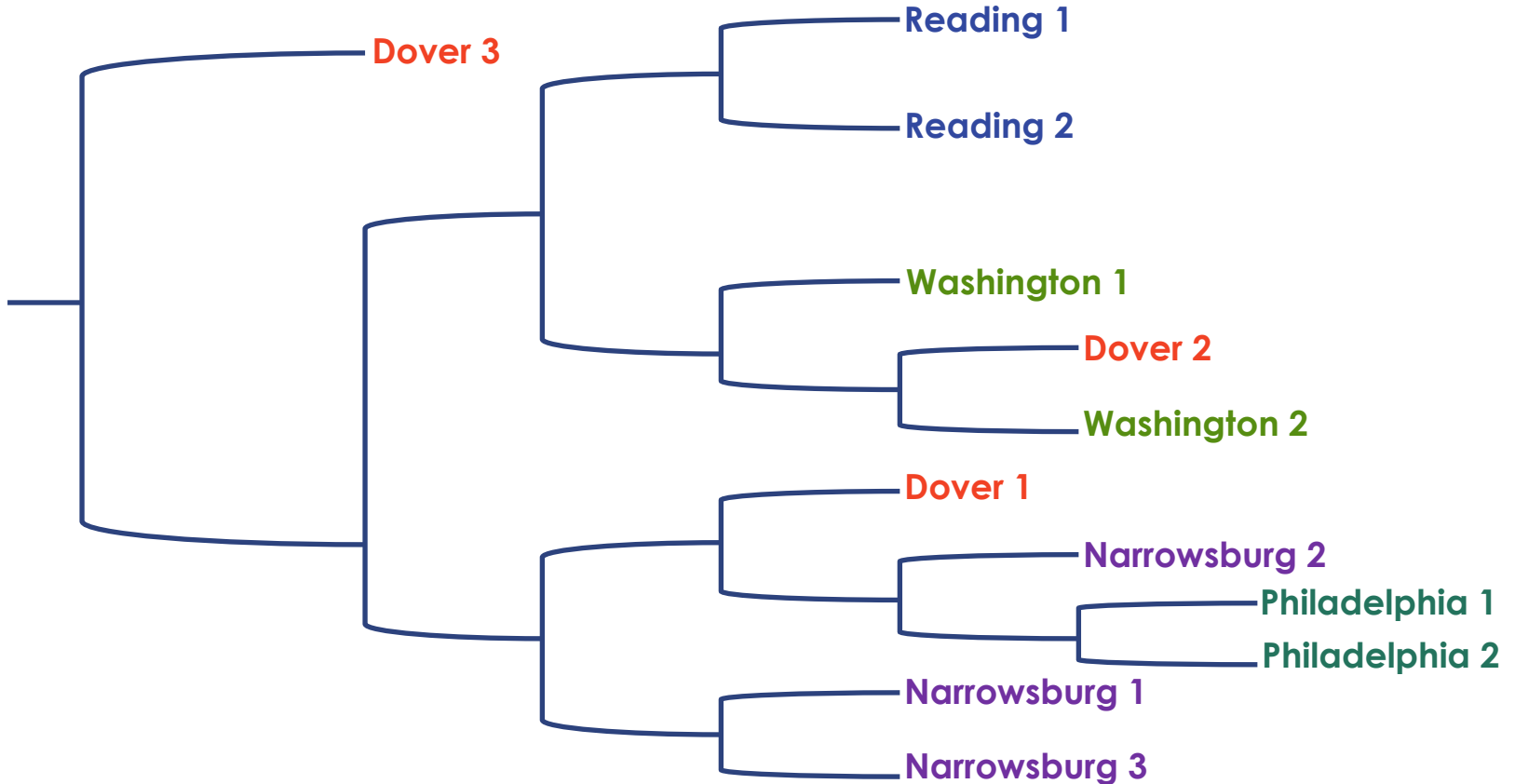


*Workshops, by
theme similarity*

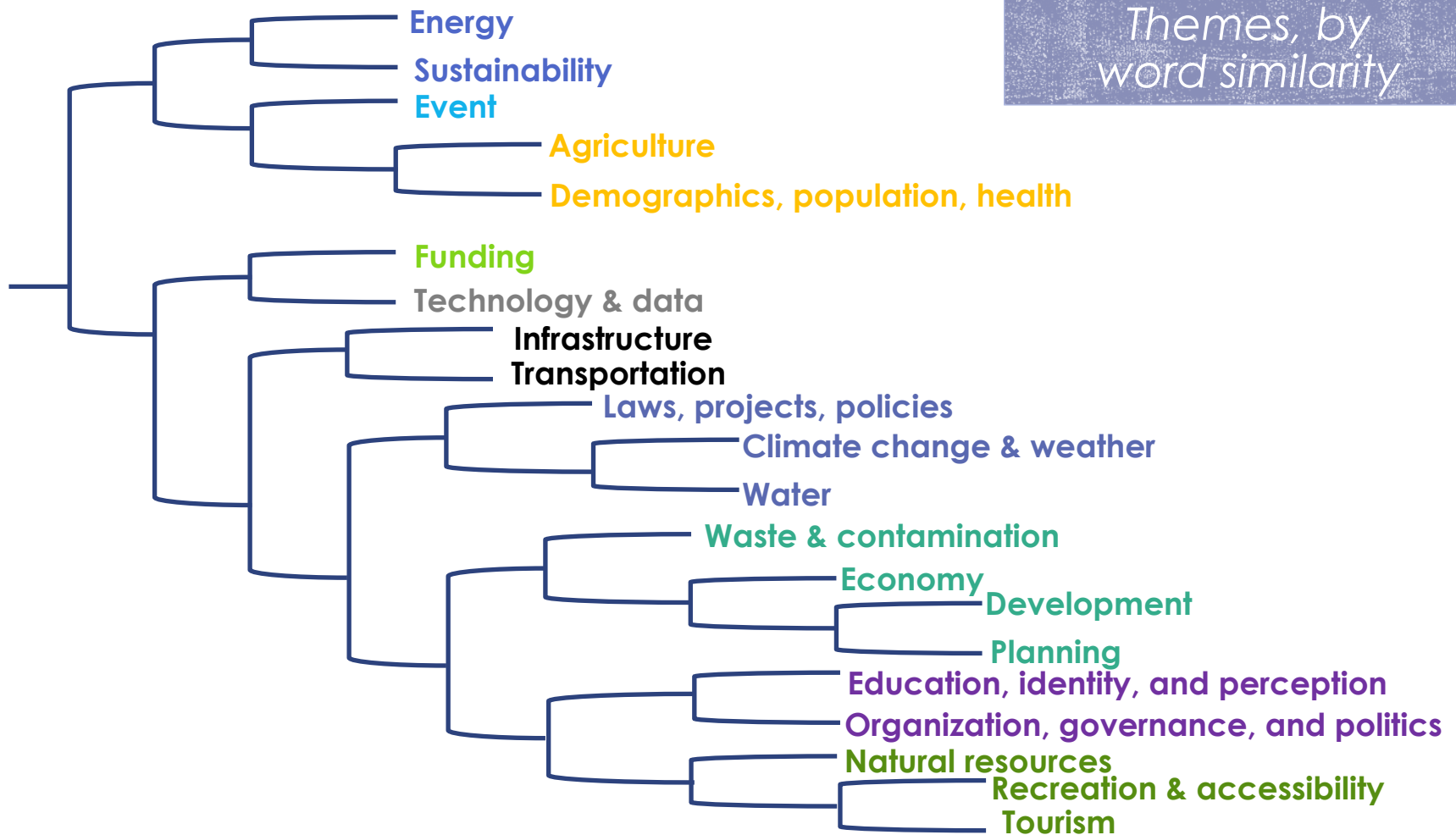


We've learned:

*Participant groups,
by word similarity*



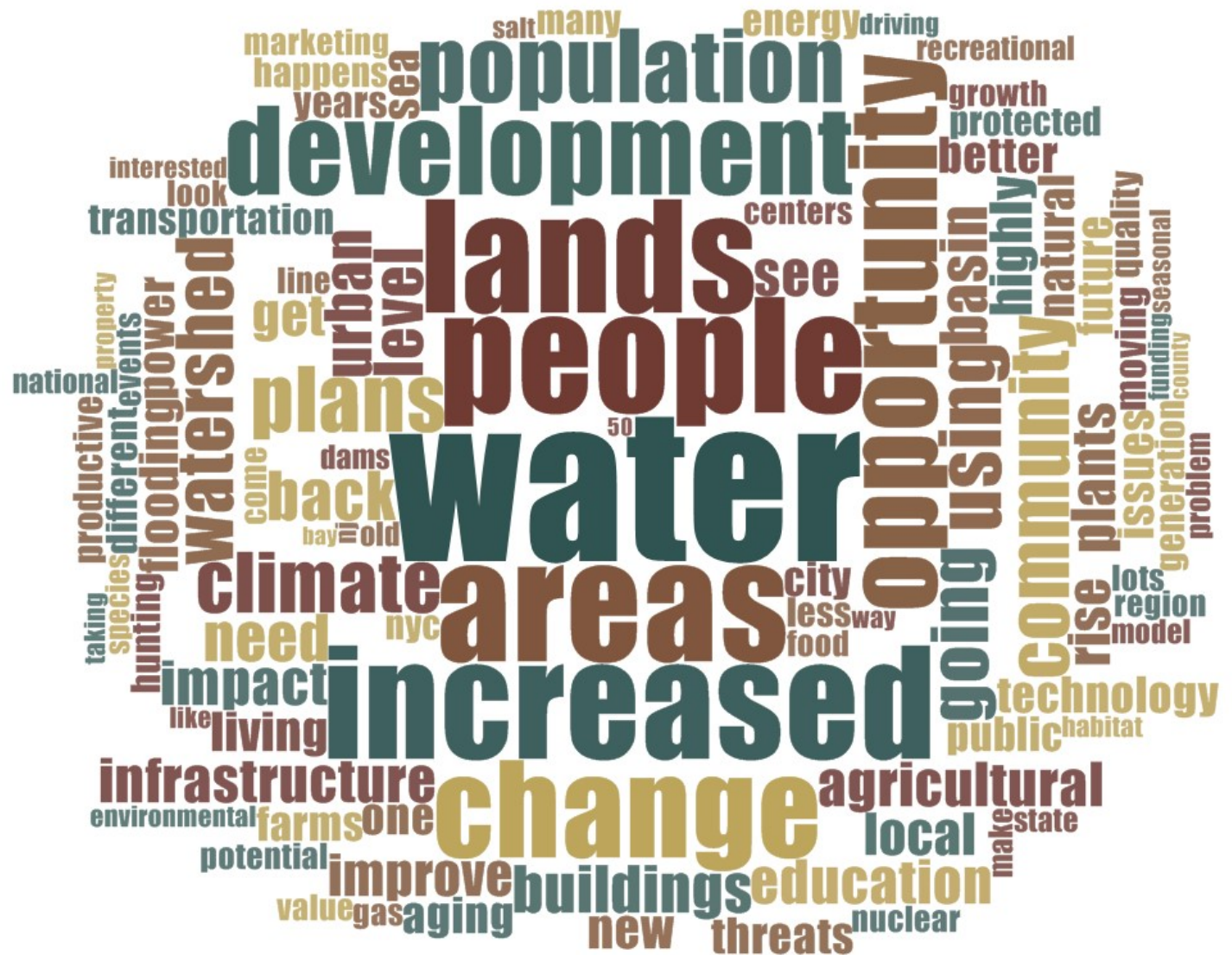
We've learned:



We've learned about
strengths and weaknesses ...



We've learned about **opportunities** and **threats...**



Catalysts for future development

- ▶ New/expanded transportation infrastructure
- ▶ New transportation technology
- ▶ Casinos & expanded tourism
- ▶ Population growth (natural increase, domestic and international migration, climate refugees)
- ▶ Expansion/improvement of cell & wifi service
- ▶ New energy infrastructure
- ▶ Development of new energy resources
- ▶ Change in real estate taxes

Catalysts for future protection

- ▶ Protective land acquisitions
- ▶ New incentives (or regulations) to protect water resources
- ▶ New incentives (or regulations) to foster “smart growth” style of development
- ▶ Monetize ecosystem services

Scenario ideas

- ▶ Current trends/baseline
- ▶ Regional self-reliance
- ▶ Opportunistic growth
- ▶ Forest and infrastructure
- ▶ Build up, not out
- ▶ What if we don't (or didn't) protect land
- ▶ Improved technology/infrastructure
- ▶ National emergency

What's next?

Conduct online survey

Draft scenario storylines (spring 2016)

Finalize scenario storylines (summer 2016)

Generate scenario forecasts (fall/winter 2016)

Related work

Can afforestation and forest conservation save the Chesapeake Bay?

Peter R Claggett (USGS)
Sally W Claggett (USFS)
Fred M Irani (USGS)
Quentin Stubbs (USGS)
Renee L Thompson (USGS)

Monday, 2:00pm to 2:20pm

Coming up next!

The SLEUTH Wizard: Python scripts to automate the SLEUTH urban growth model

Alfonso Yáñez (Shippensburg U)
Claire A Jantz (Shippensburg U)
Tiernan Erickson (Census Bureau)

Monday 6:00pm to 8:00pm
Windsor Ballroom

Poster # 40

also ...

Primary productivity trends of human-managed high-altitude cushion bogs (bofedales) in the Central Andean Puna, 2001-2013?

Paul Marr (Shippensburg U)

Claire Jantz (Shippensburg U)

Wednesday, 11:00am to 11:20am



<http://drbproject.org>

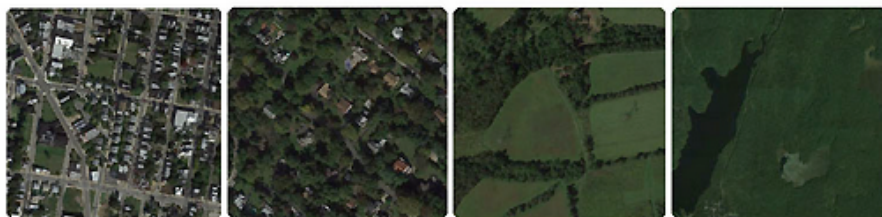


Funding for this project comes from the William Penn Foundation.

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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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Sign up to receive updates about the Delaware River Basin Project!

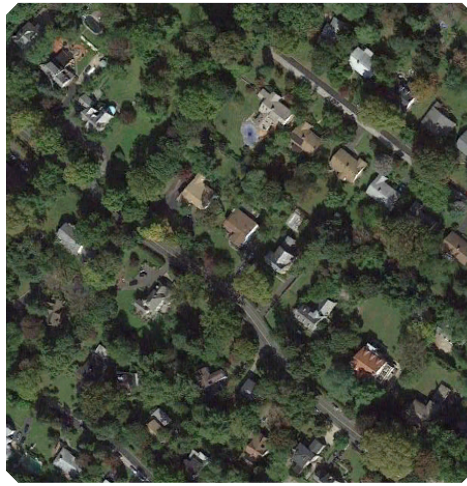
Email Address*

First Name

Last Name

* = required field

Subscribe



The Delaware River Basin Project

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