The Delaware River Basin Project

Claire Jantz, PhD
Scott Drzyzga, PhD, GISP
Alfonso Yañez Morillo
Antonia Price
Joshua Barth

Project lead
Co-investigator
Research analyst
Project coordinator
Student fellow

http://drbproject.org
Workshop agenda

- Introductions
- Project Background
- Watershed characteristics
- Lunch
- Scenario Development
Watersheds 101

Watersheds are nested...
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 FOUNDATION
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 gage interest in long-term land cover change monitoring
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.
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
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 PASDA Project Office and others were edited by the PA-DOT.
Final product will have expanded classes: emergent wetlands, scrub/shrub, and impervious surfaces under tree canopy.

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).

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.
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
Delaware Water Gap NRA
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 gage interest in long-term land cover change monitoring
Listen to stakeholders

Narrowsburg, NY: Nov. 10, 2015
Reading, PA: Jan. 13, 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?
<table>
<thead>
<tr>
<th>Primary purpose of dam</th>
<th>Count</th>
<th>Avg. age (yrs)</th>
<th>Storage (acre-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreation</td>
<td>608</td>
<td>82</td>
<td>585930</td>
</tr>
<tr>
<td>Flood control</td>
<td>103</td>
<td>41</td>
<td>847630</td>
</tr>
<tr>
<td>Water supply</td>
<td>75</td>
<td>95</td>
<td>926350</td>
</tr>
<tr>
<td>Hydroelectric</td>
<td>23</td>
<td>68</td>
<td>1128900</td>
</tr>
<tr>
<td>Other</td>
<td>17</td>
<td>62</td>
<td>59170</td>
</tr>
<tr>
<td>Fire protection, stock, fish pond</td>
<td>13</td>
<td>50</td>
<td>960</td>
</tr>
<tr>
<td>Fish &amp; wildlife pond</td>
<td>4</td>
<td>95</td>
<td>5770</td>
</tr>
<tr>
<td>Irrigation</td>
<td>3</td>
<td>56</td>
<td>340</td>
</tr>
<tr>
<td>Tailings</td>
<td>2</td>
<td>35</td>
<td>1330</td>
</tr>
</tbody>
</table>

Source: USACE NID (2014) and our calculations
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.
Abundant housing

Housing units / person

- Green: 10.1 - 90.0 (299)
- Blue: 2.1 - 10.0 (3,172)
- Gray: 1.0 - 2.0 (6,185)

Delaware Bay
FALL LINE

Red cabin @ Smallwood, NY
Where do jobs outnumber people?
Employment concentration
by HUC8 watershed,
by 2-digit NAICS,
and for 2013

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?
\[ LQ_{i,j} = \frac{SE_{i,j}}{SE_{i}} \times \frac{TE_{j}}{TE} \]

Where:
- \( LQ \) is the Location Quotient for industry sector \( i \) in watershed \( j \) and relative to the base region \( b \) (see map at right);
- \( SE \) = Employment in sector; and
- \( TE \) = Total employment.

Summary

The maps at left were built using the US Census Bureau’s 2013 Longitudinal Employer-Household Dynamics data, which tracks payrolled 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.
Selected Land Covers

TOTAL FOREST COVER

1996: 54.6%
2001: 54.4%
2006: 54.1%
2010: 53.7%

TOTAL AGRICULTURE AREA

1996: 21.6%
2001: 21.5%
2006: 21.0%
2010: 20.9%

TOTAL URBAN AREA

1996: 14.8%
2001: 15.1%
2006: 15.8%
2010: 16.3%
Short term - stable

Urban Cover 2010
- > 30%
- 20% - 30%
- 10% - 20%
- 5% - 10%
- <= 5%

Agriculture Cover 2010
- > 30%
- 25% - 30%
- 15% - 20%
- 5% - 10%
- <= 5%

Forest Cover 2010
- > 75%
- 60% - 75%
- 45% - 50%
- 30% - 45%
- <= 30%

Urban Growth Rate*
- > 12%
- 10% - 12%
- 8% - 10%
- 6% - 8%
- <= 6%

Agriculture Loss Rate*
- > 7%
- 0% - 7%
- 3% - 5%
- 1% - 3%
- <= 1%

Forest Loss Rate*
- > 4%
- 3% - 4%
- 2% - 3%
- 1% - 2%
- <= 1%

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

The Watershed in 2070

What should we invest in?
What should we keep?
What should we change?

Questions communities can ask themselves to imagine different futures

Different future scenarios reflect different values within the community

Scenarios allow us to understand the impacts of different choices
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
What’s next?

Narrowsburg, NY  Nov. 10, 2015
Reading, PA  Jan. 13, 2016
Dover, DE  Feb. 18, 2016
On-line survey (coming in winter 2016)
  ▶ 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)
Preliminary Findings - 2015 Workshops
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!
The Delaware River Basin Project

Claire Jantz, PhD
Scott Drzyzga, PhD, GISP
Alfonso Yañez Morillo
Antonia Price
Joshua Barth

Project lead
Co-investigator
Research analyst
Project coordinator
Student fellow

http://drbproject.org