Delaware River Watershed Initiative

American Water Resources Association
Philadelphia Metropolitan Area Section
Philadelphia, PA
11/12/2014

Nathan Boon

WILLIAM PENN FOUNDATION

Stefanie A. Kroll, Ph.D.

THE ACADEMY OF NATURAL SCIENCES *of* DREXEL UNIVERSITY

The William Penn Foundation

- Private family foundation based in Philadelphia since 1945
  - OUR MISSION is to close the achievement gap for low-income children, ensure a sustainable environment, foster creativity that enhances civic life, and advance philanthropy in the Philadelphia region
- ~$2B in assets translating to ~$90M/year in grants:
  - Education: “Great Learning"
  - Art: “Creative Communities”
  - Environment : “Watershed Protection”
- www.williampennfoundation.org

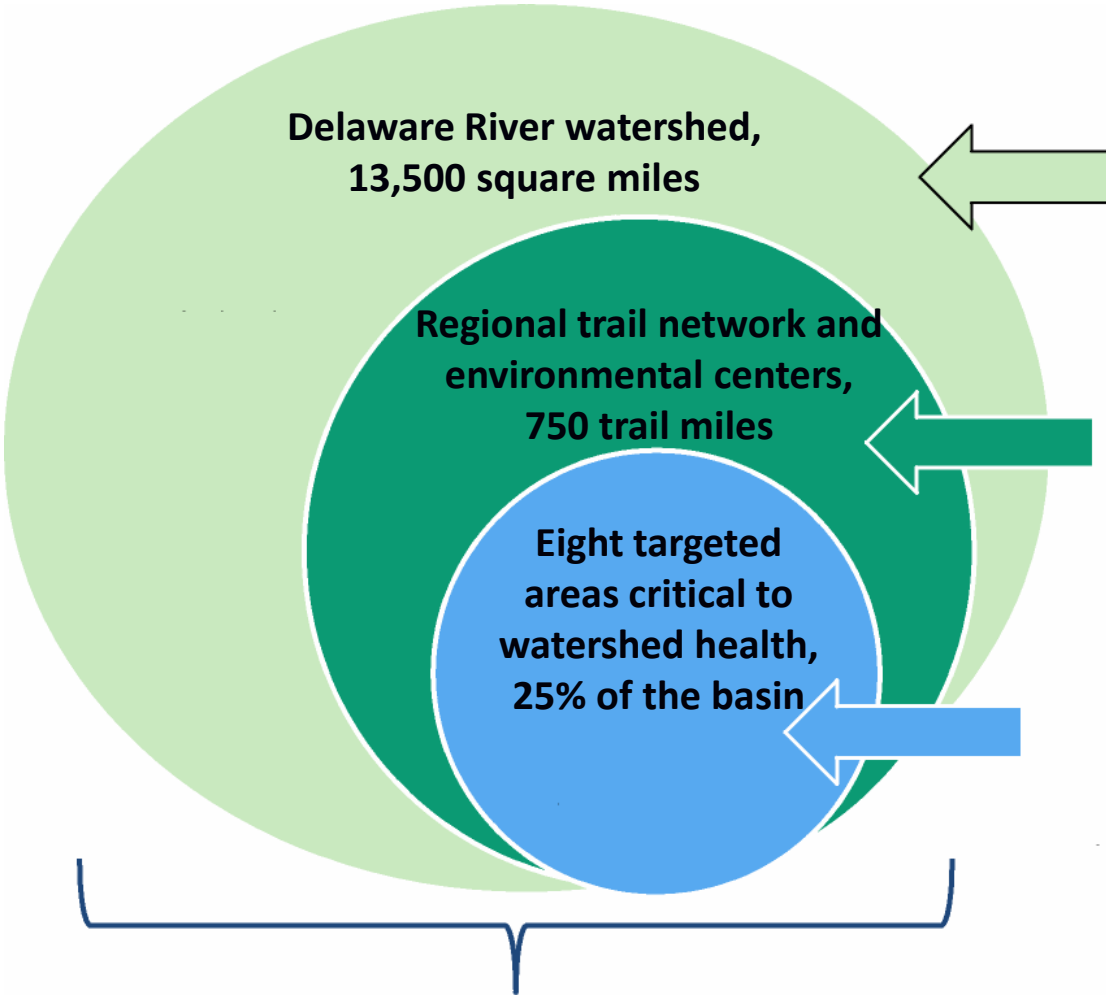
(source: Michael W Murphy)

Delaware River Watershed

… an extraordinary resource

- Spans **13,500** sq. miles
- Provides drinking water for over **15 million** people
- Sustains a **$25 billion** economy
- Supports globally rare species & habitats
- Offers abundant recreation

Goal: By 2023, drive measurable improvement in the quality of the Delaware River watershed so there is a sustainable supply of clean water for ecological health and human consumption, enjoyment, and economic opportunity.

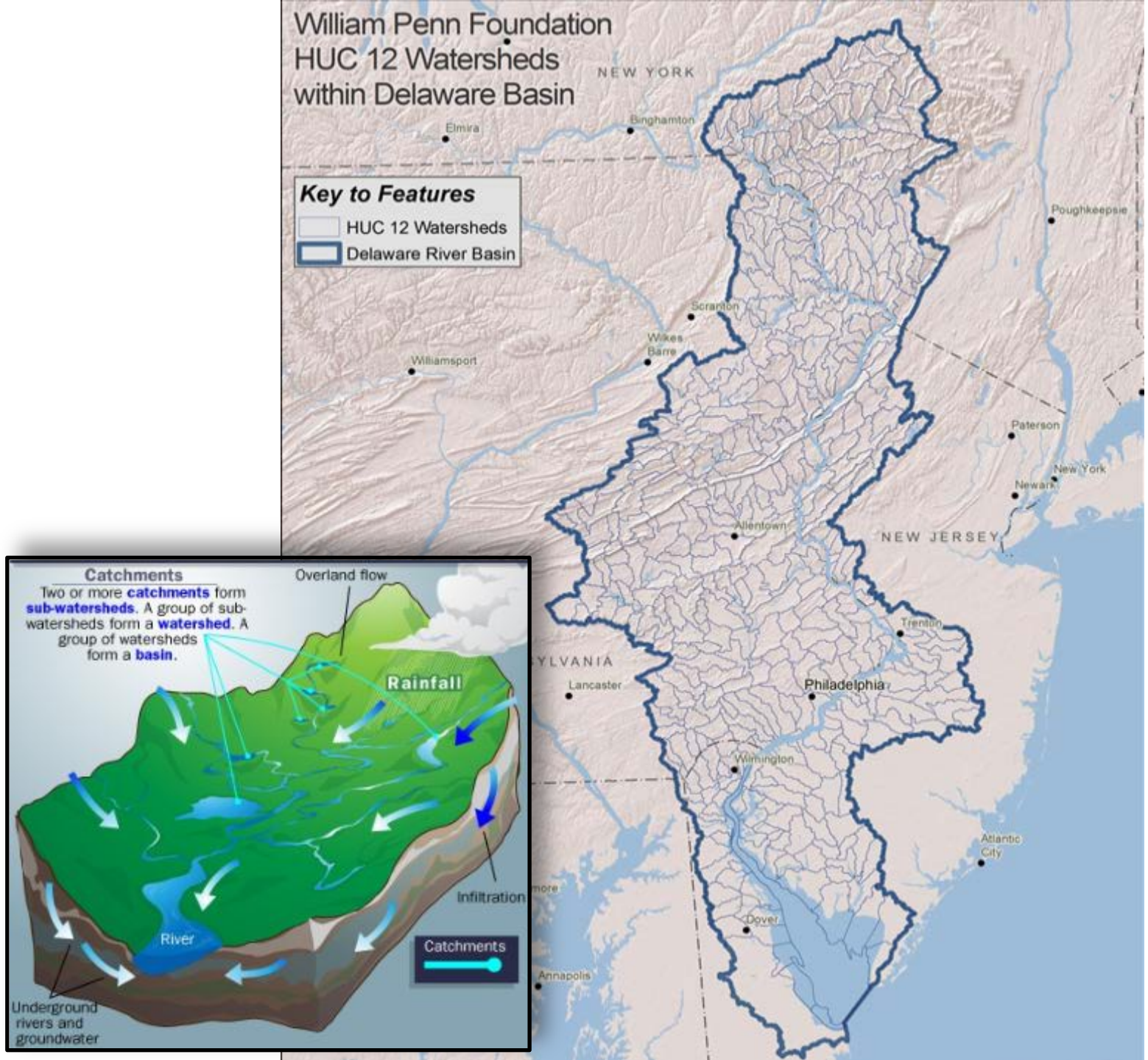


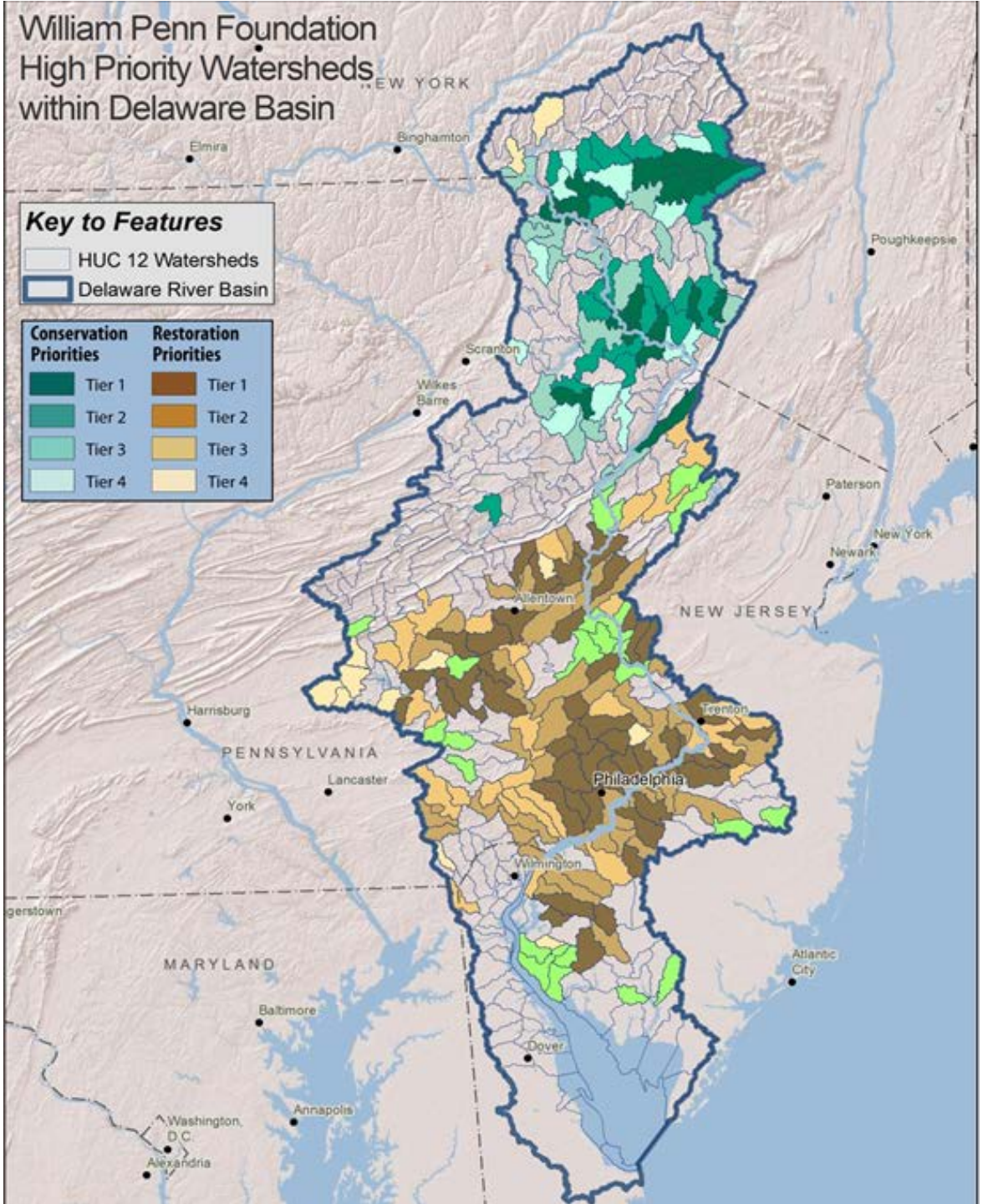
Support Watershed-wide Research, Policy, and Practice

Engage and Activate Regional Trails and Centers

***Protect and Restore Places of Ecological Significance**: includes the Delaware River Watershed Initiative*

Ongoing and integrated data collection and communication


William Penn Foundation
HUC 12 Watersheds
within Delaware Basin
NEW YORK
Elmira
Binghamton
Key to Features
HUC 12 Watersheds
Delaware River Basin
Poughkeepsie
Scranton
Wilkes Barre
Williamsport
Paterson
New York
Newark
Allentown
NEW JERSEY
Trenton
Lancaster
Philadelphia
Wilmington
Atlantic City
Dover
Annapolis
Catchments
Two or more catchments form sub-watersheds. A group of sub-watersheds form a watershed. A group of watersheds form a basin.
Overland flow
Rainfall
Infiltration
River
Catchments
Underground rivers and groundwater


William Penn Foundation
High Priority Watersheds
within Delaware Basin
NEW YORK
Elmira
Binghamton
Key to Features
HUC 12 Watersheds
Delaware River Basin
Conservation Priorities
Tier 1
Tier 2
Tier 3
Tier 4
Restoration Priorities
Tier 1
Tier 2
Tier 3
Tier 4
Poughkeepsie
Scranton
Wilkes Barre
Paterson
New York
Newark
Allentown
NEW JERSEY
Harrisburg
Trenton
PENNSYLVANIA
Lancaster
Philadelphia
York
Wilmington
MARYLAND
Atlantic City
Baltimore
Dover
Annapolis
Washington, D.C.
Alexandria

Focusing in on specific targets

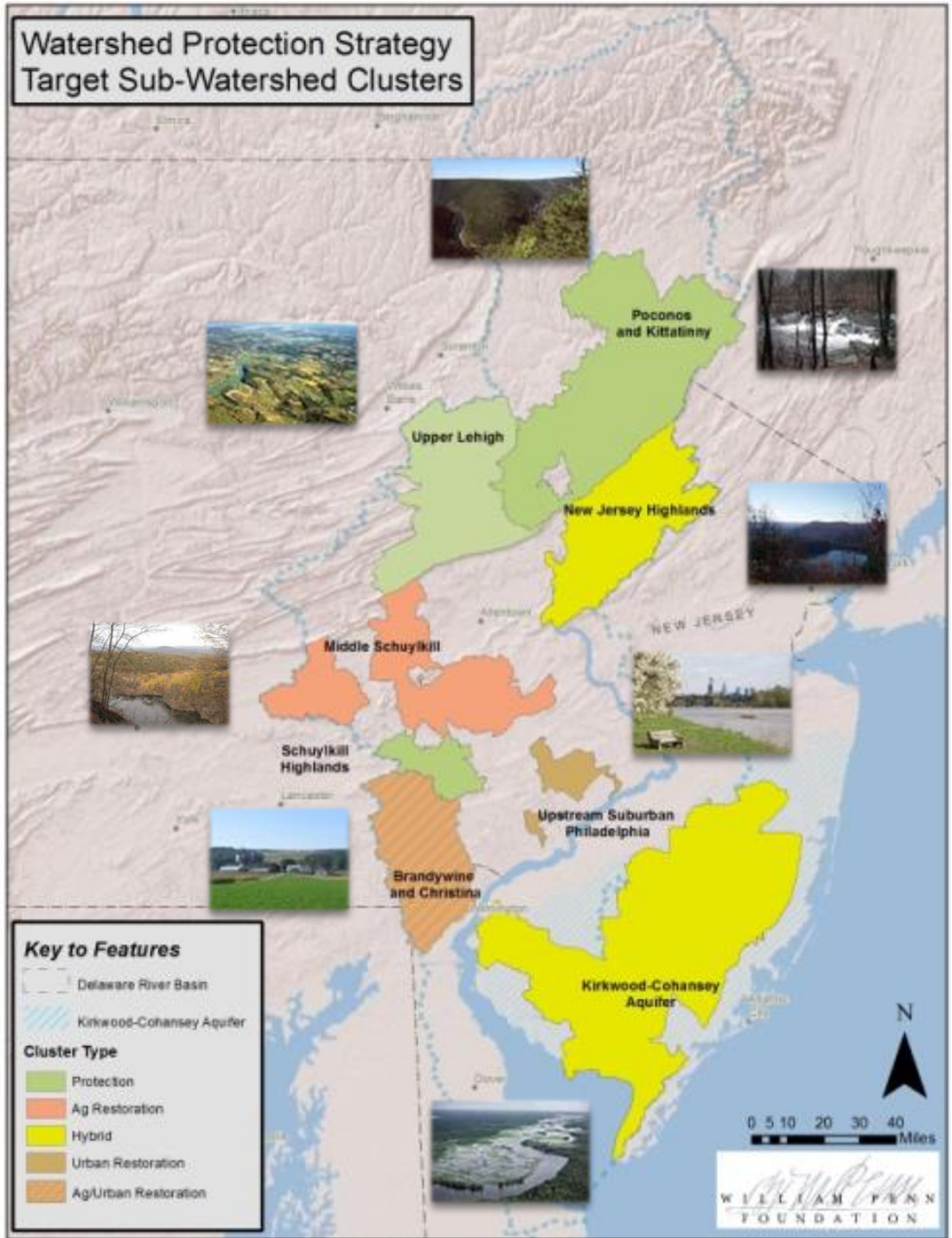
- Subset of watershed stressors essential to water quality and quantity
  - Forest fragmentation and loss in headwaters
  - Stormwater run-off
  - Agricultural run-off
  - Aquifer depletion
- Subset of conservation opportunities defined by:
  - Potential for Significant Impact
  - Urgency to Act
  - Organization Capacity
  - Cost Efficiency
  - Ability to Measure Impact


(source: DRN)


(source: PEC)


(source: BCC)


(source: PPA)


Watershed Protection Strategy
Target Sub-Watershed Clusters
Poconos and Kittatinny
Upper Lehigh
New Jersey Highlands
Middle Schuylkill
Schuylkill Highlands
Upstream Suburban Philadelphia
Brandywine and Christina
Kirkwood-Cohansey Aquifer
NEW JERSEY
Key to Features
Delaware River Basin
Kirkwood-Cohansey Aquifer
Cluster Type
Protection
Ag Restoration
Hybrid
Urban Restoration
Ag/Urban Restoration
N
0 5 10 20 30 40
Miles
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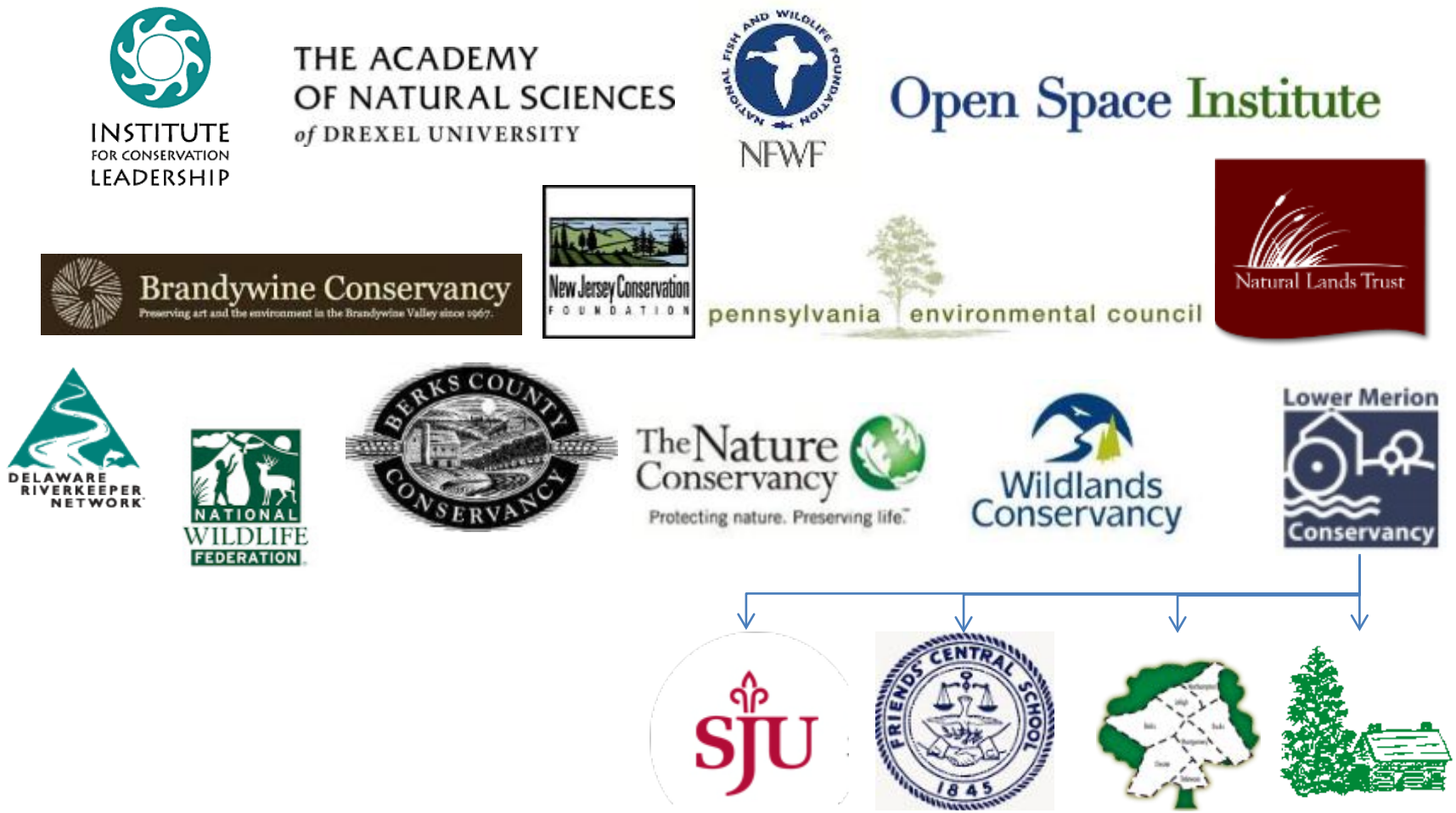
Reaching out and forging strong partnerships

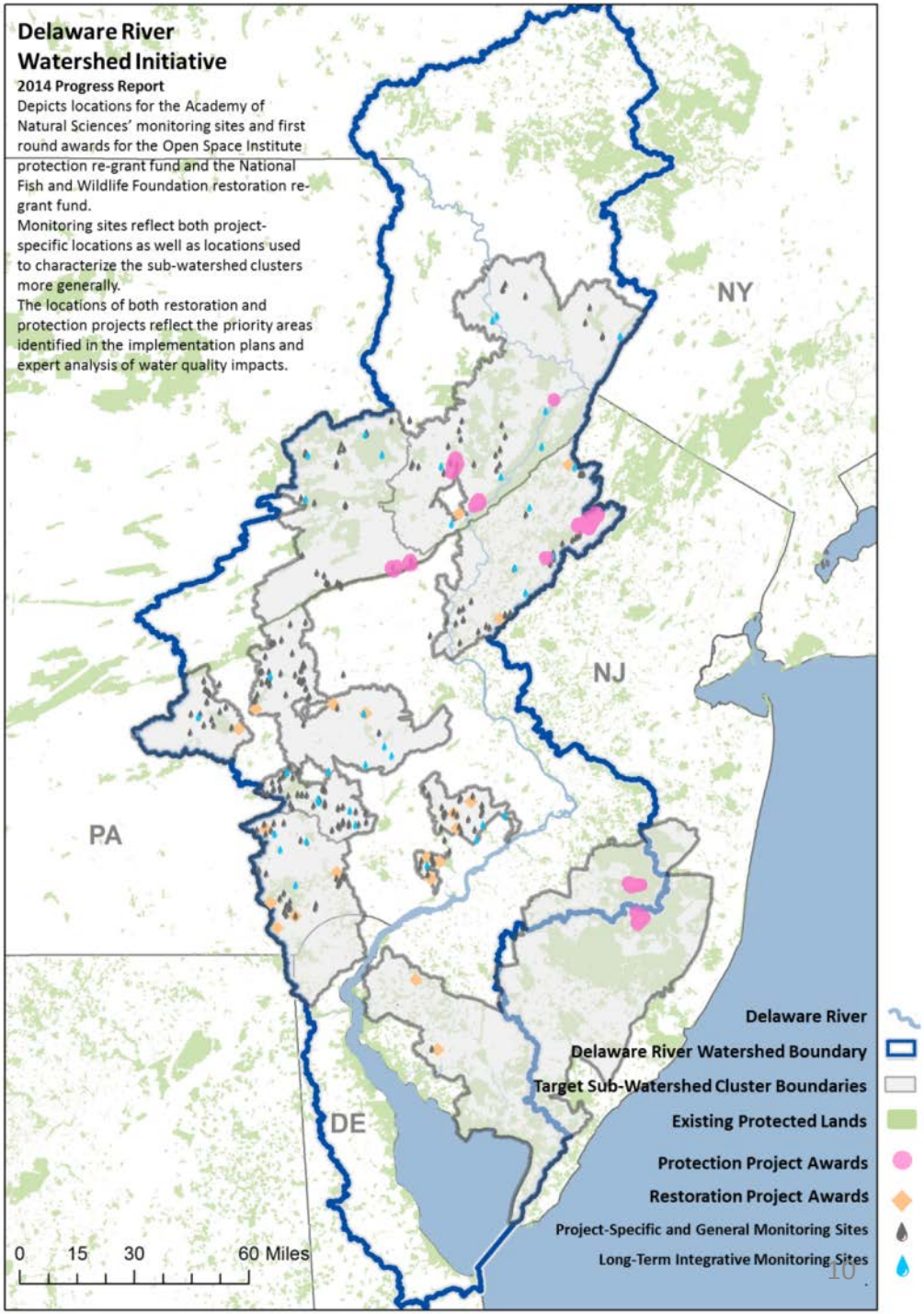
Currently partnering with 119 organizations through active grants



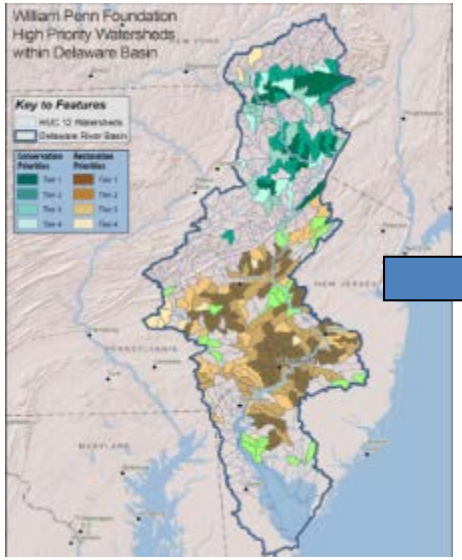
Supporting well over 150 organizations including our partners' partners

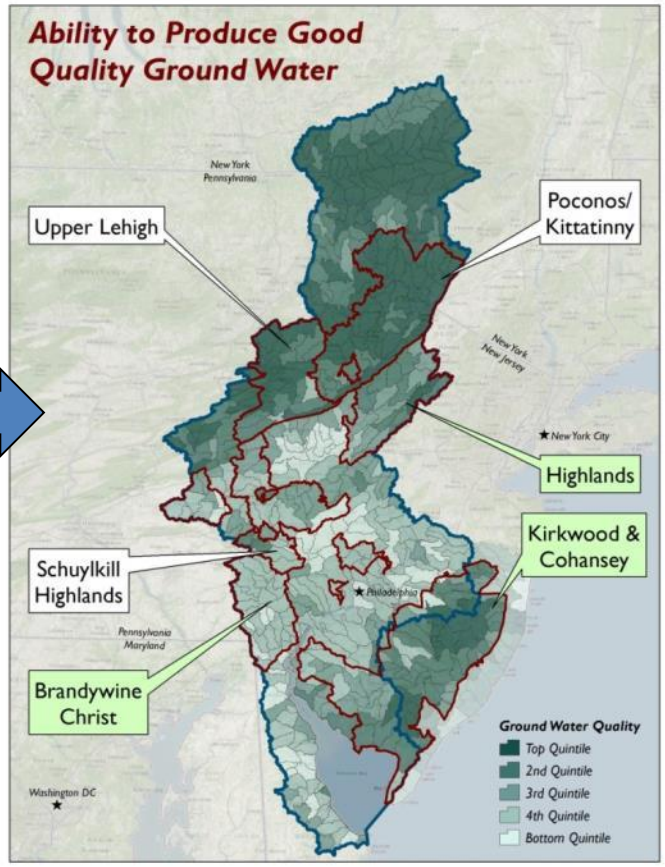
Implementation

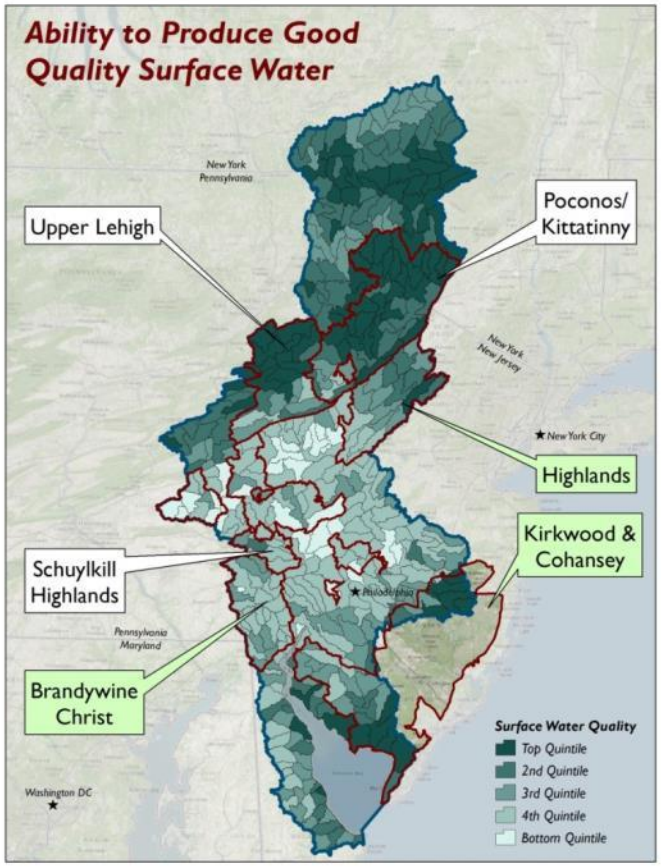
- $15MM for operational
  - Supporting over 50 organizations
- $3MM for monitoring
  - Maintaining or collecting data from over 300 stream monitoring and water quality sampling sites
- $7MM for restoration
  - Received 16 protection applications totaling $5.8MM in round one. Approved 9 projects worth $2.0MM to protect 7,267 acres of forest
- $10 for protection
  - Received 30 restoration applications totaling over $6MM in round one. Awarded $2.4MM to 14 organizations for work in 19 priority locations



Constant feedback and adaptation





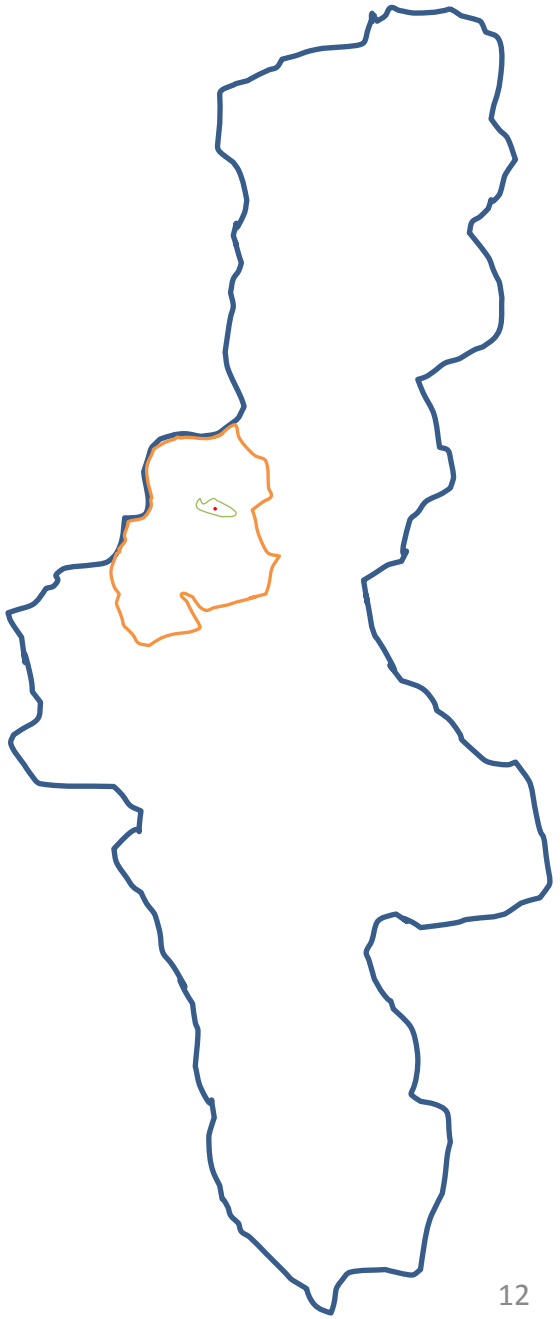


- Addressing teaming dynamics and facilitation needs
- Pursuing outreach and long-term funding strategy
- Ongoing monitoring, reassessment to adapt investments

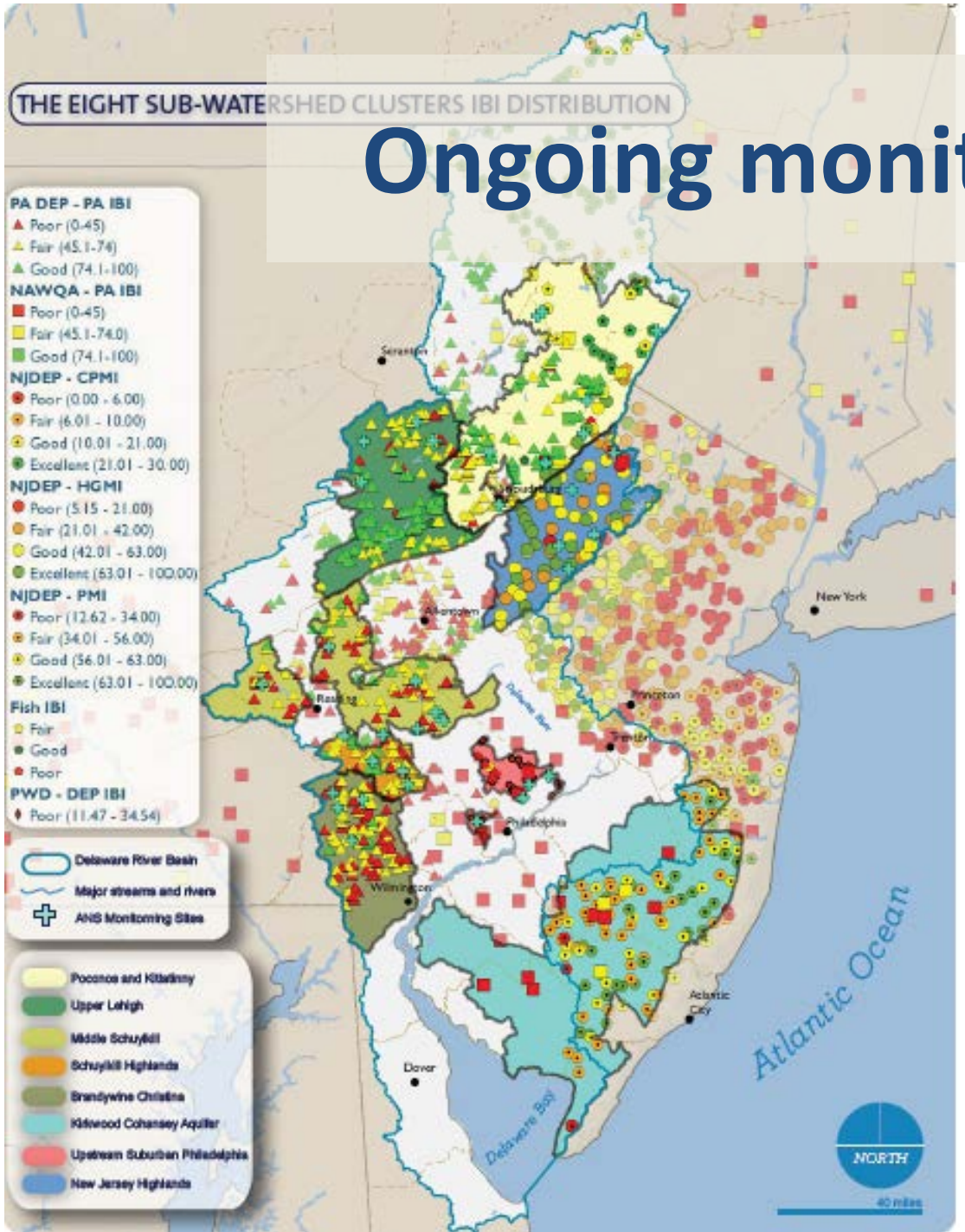
Challenges of scale and impact

- Scale of the basin (8 million acres 10^6) →
- Scale of the Cluster (500,000 acres 10^4) →
- Scale of the HUC12 (20,000 acres 10^3) →
- Scale of the project site (4 acres 10^0) →

- Communicating lessons-learned across Clusters and building a basin-wide narrative
- Assessing methods, e.g., stormwater infiltration vs. stream corridor restoration
- Requires careful selection of project sites and developing relevant monitoring plans
- Data-sharing and collaboration tools



Ongoing monitoring



ANS Data Inventory & Monitoring

Combining data from different sources with different monitoring protocols

- Good spatial distribution, variable temporal
- Objectives of monitoring , protocols
  - un-/impaired vs. fine-scale change
- Methods and indicators for maximum capacity to detect changes in short- and long-term
  - Progressive changes in ecosystems due to conservation, lag time

Building database for our research questions, making it available to others

Monitoring & Assessment

- Fish
- Macroinvertebrates (Stroud & ANS)
- Algae
- Water chemistry
- Storm sampling
- Edge-of-field
- Emerging contaminants

- Scale of projects, scale of effects
- Climate change impacts?

ANS & “Cluster” Team Monitoring

Sampling

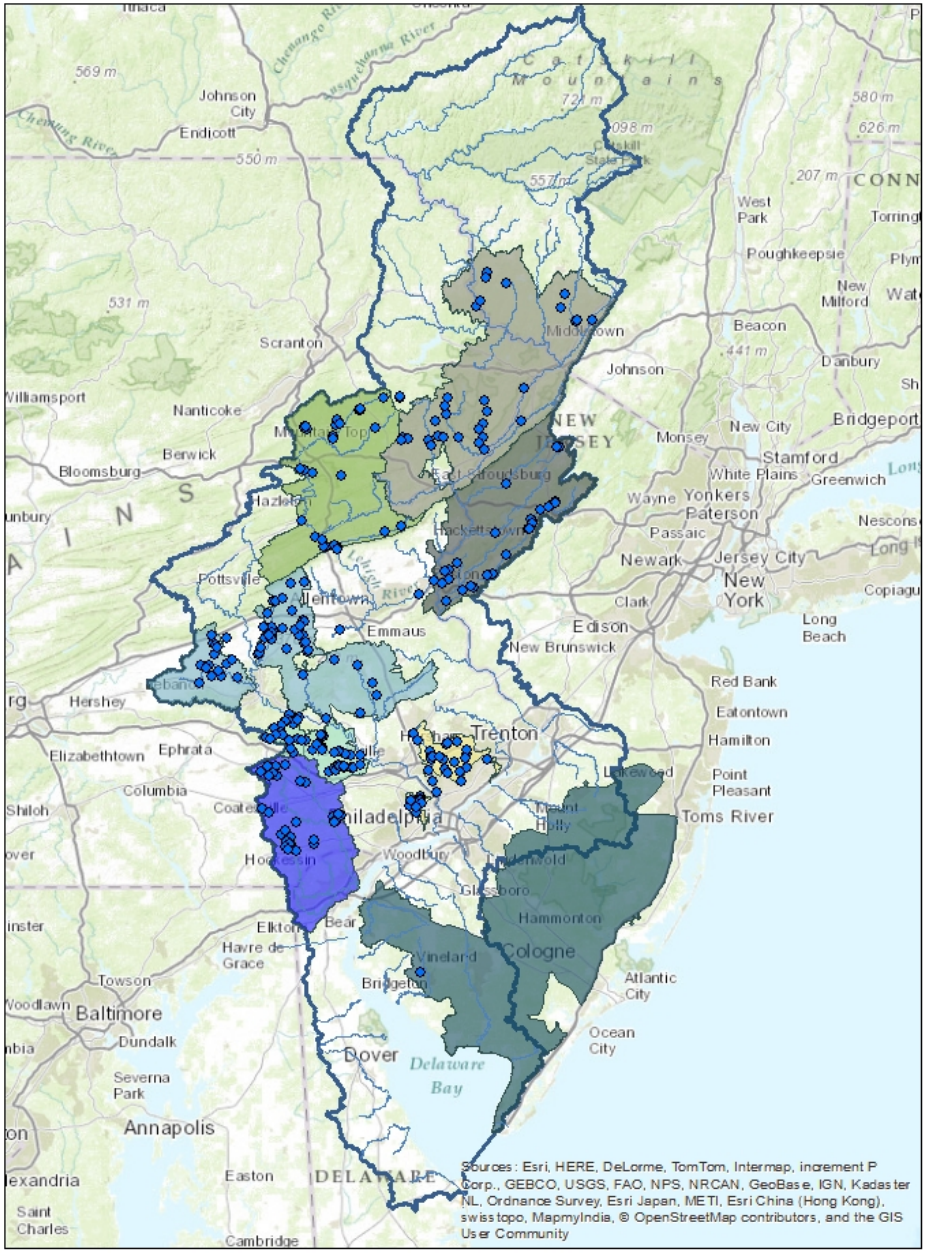
- 2013-2014 Baseline
  - Integrated Cluster-Scale
  - “Before,” “Control,” “Impact” Project Scale Sampling
  - In-house Software for Site Selection
- Ongoing Monitoring After Project Completion (“After, “Control,” “Impact”)

“Cluster”Team Monitoring Plans

- Planning
- Support
- QA

Integrative and Project Monitoring Sites

Monitored by ANS, Stroud, “Cluster” teams

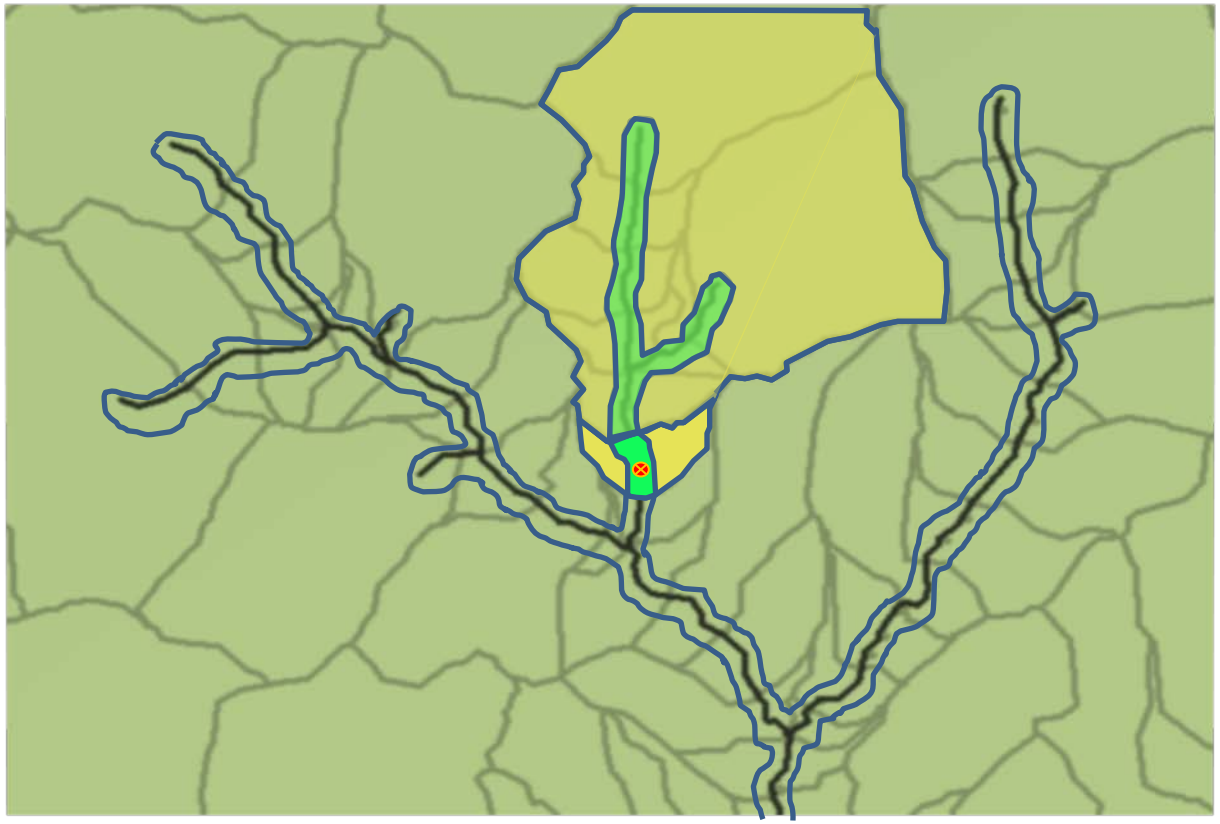


Stream Hiker: Modeling Template

Variables are calculated for Riparian and Drainage Areas at Reach and Network Scales

Climate & environmental variables

Landscape variables

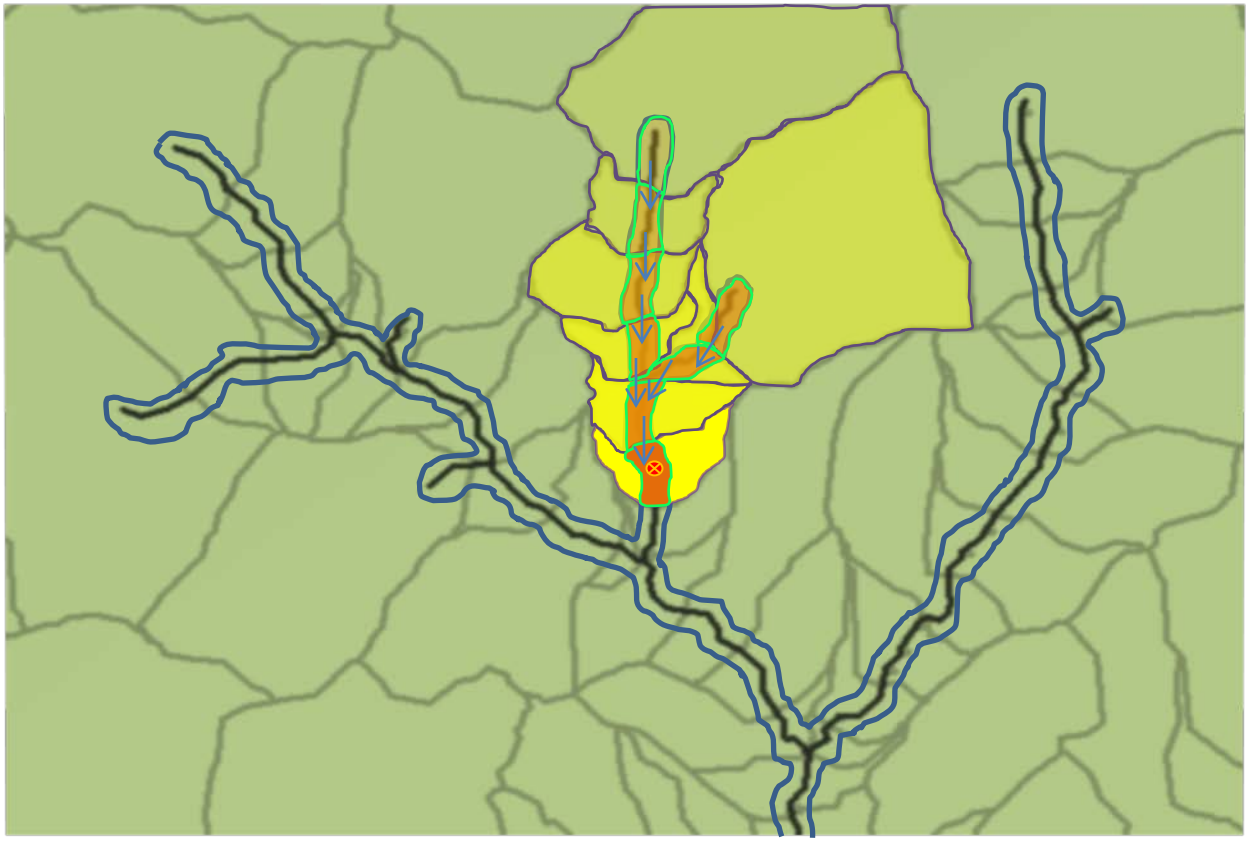


Stream Hiker

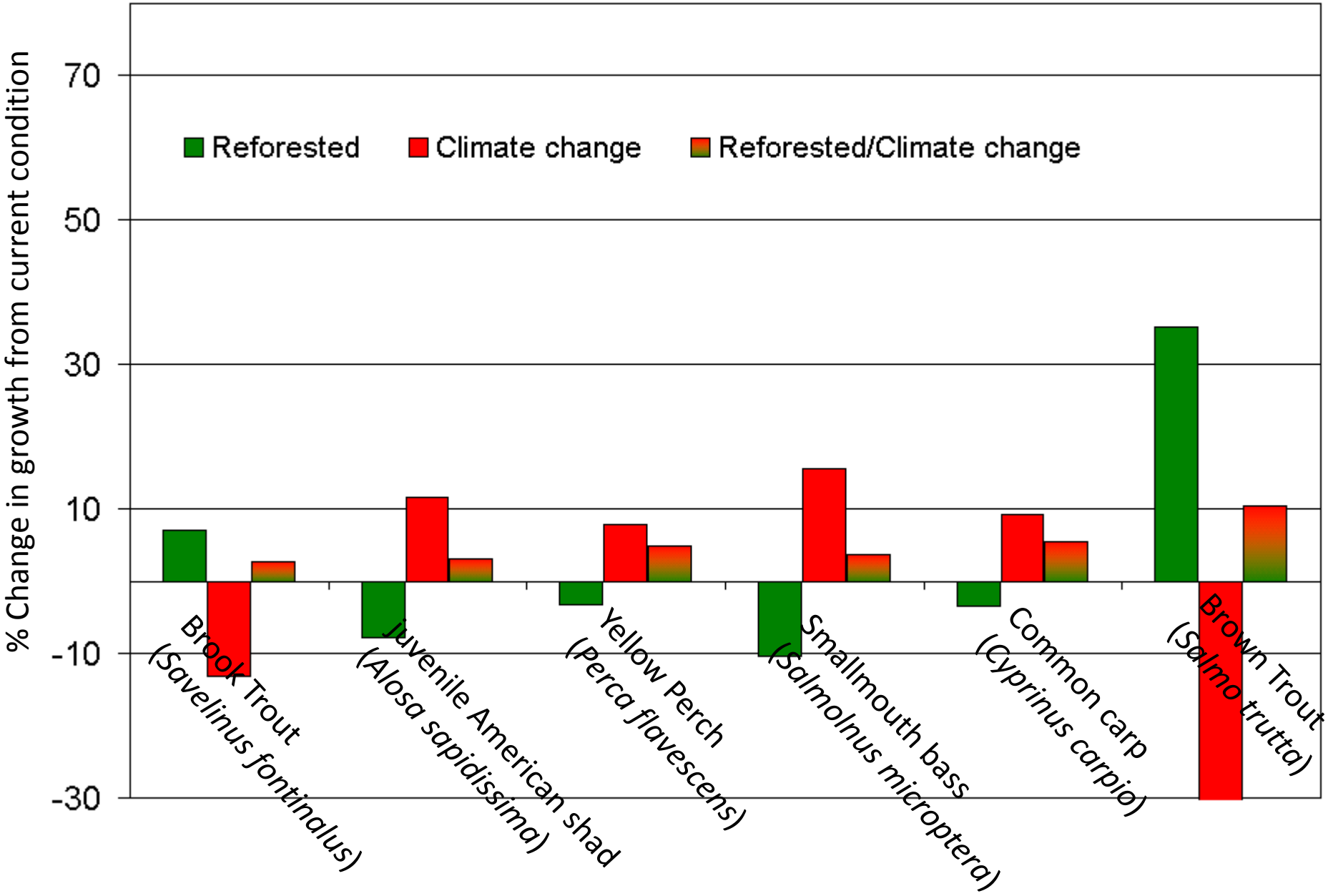
Network routing enables analysis of variable correlation at different scales

Spatial configurations of variables within the stream network

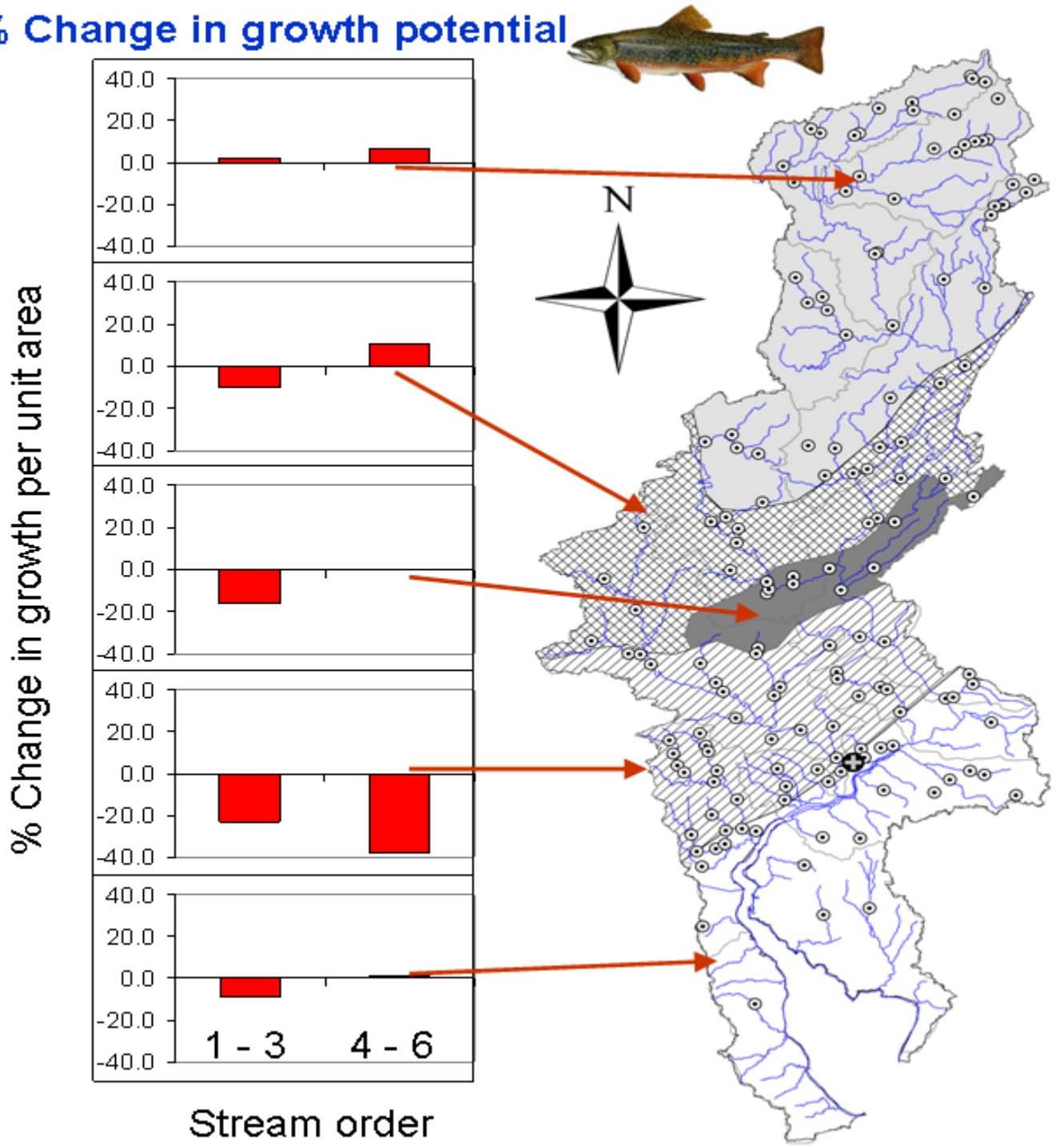
Extrapolation to unmonitored streams



With high carbon emissions scenario



Climate change



Monitoring & Models in DRWI

- Connecting models and monitoring in clusters for watershed-wide understanding of water quality and ecosystem integrity
- Conservation action effects on stream ecosystem: IBI development & ecosystem response research
  - Beyond water chemistry
- Use model output to inform monitoring/project planning
  - Target monitoring locations where higher sample size will increase power of models
  - Feedback to conservation practice planning (location and/or type for greatest impact)

Monitoring, Models & Scale in DRWI

- ArcSWAT: process-based, for whole Delaware River Basin, daily time step
- Mapsheds: loads HUC12, process-based
- SPARROW: loads, stream segments, statistical
- StreamHiker: reach-scale (flexible/ user-specified), framework for developing statistical models (temperature, biological metrics, etc.)
- Temple & Villanova Stormwater Control Measure models (Pixel/parcel scale, “microwatershed”)

Data & Collaboration

How can our data compilation benefit others?

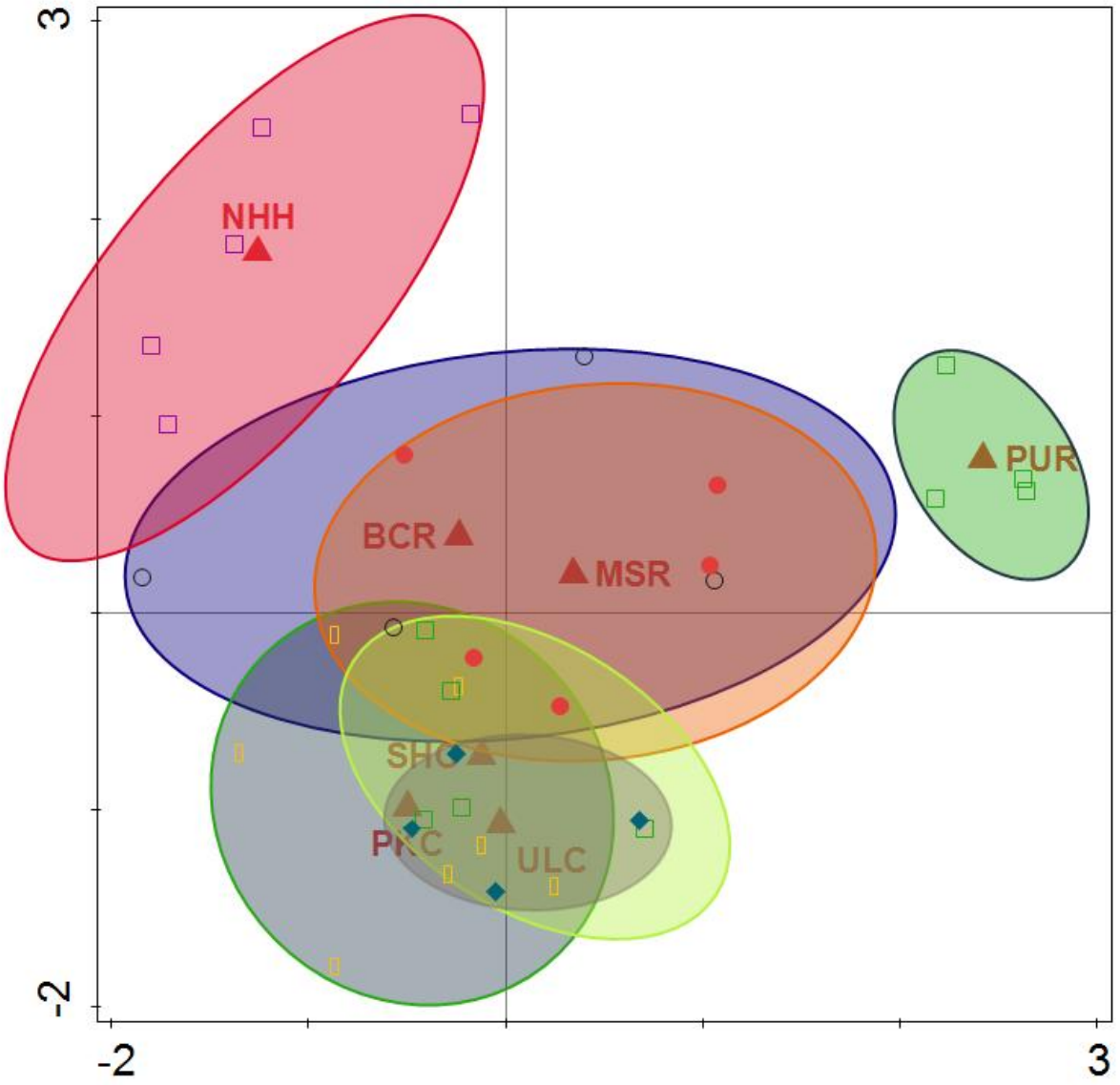
- User & use of models, data

Shared Research Agenda

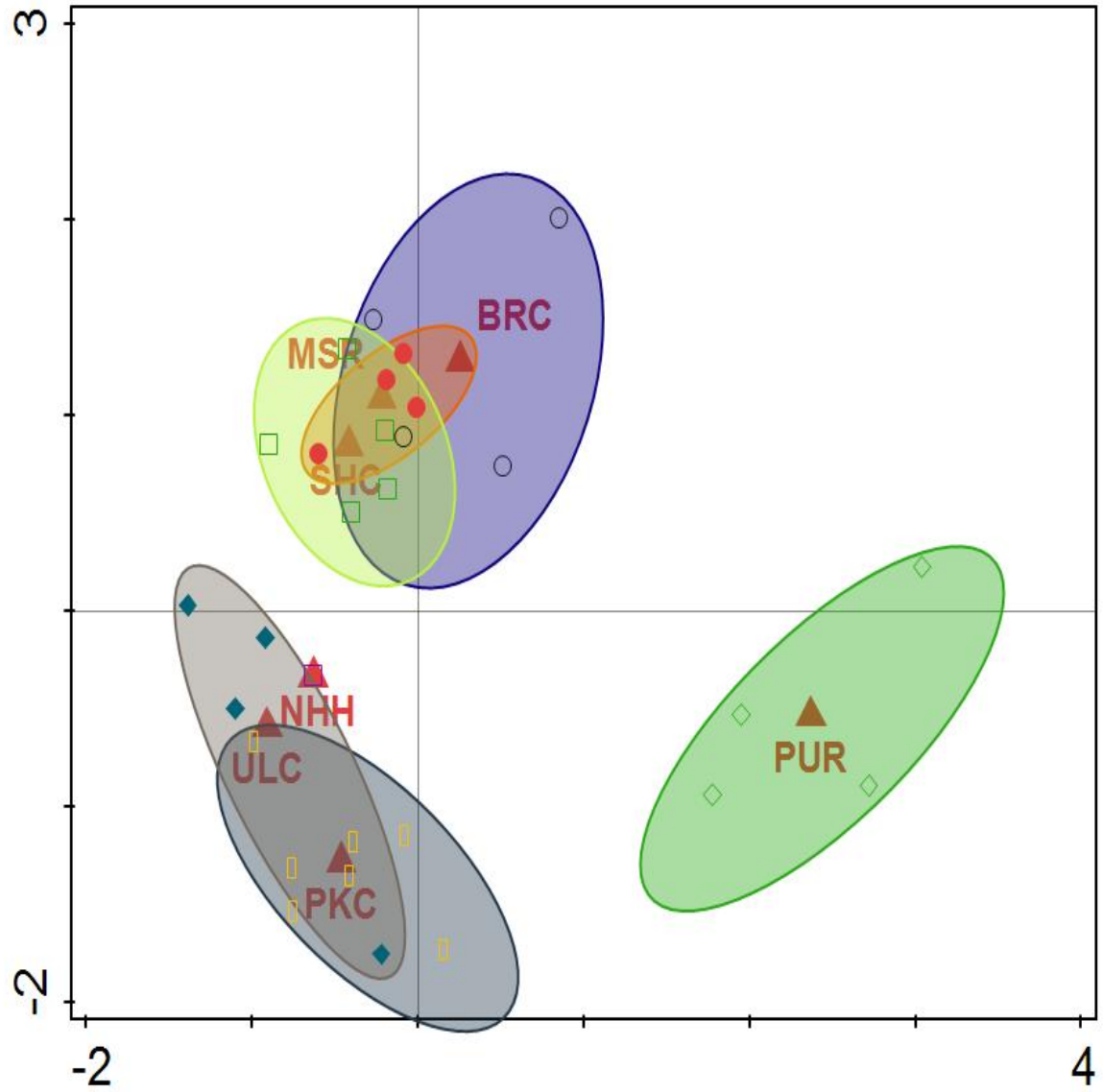
- Steering Committee Meetings: Building collaborations, aligning partners
- Integrated, multi-disciplinary research agenda supporting ecological protection and restoration:

"In-stream" researchers
Land-water interface researchers
Modelers

Macroinvertebrates and “clusters”



Fish assemblages and “clusters”



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Gov't Liason: Carol Collier, crc92@drexel.edu

Web Mapper: Lin Perez, lbp43@drexel.edu ANS Water Quality Monitoring for the Delaware River Watershed Initiative: https://ansdu.maps.arcgis.com/home/

Twitter: @ANSStreamTeam

Website: http://ansp.org/research/environmental-research/projects/watershed-protection-program/