USGS science for a changing world

Accelerated Restoration through Multi-Objective Targeting

The Chesapeake Bay Experience

John Wolf, U.S. Geological Survey

USGS Disclaimer

This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damage resulting from the authorized or unauthorized use of the information.

Overview of Presentation

Background

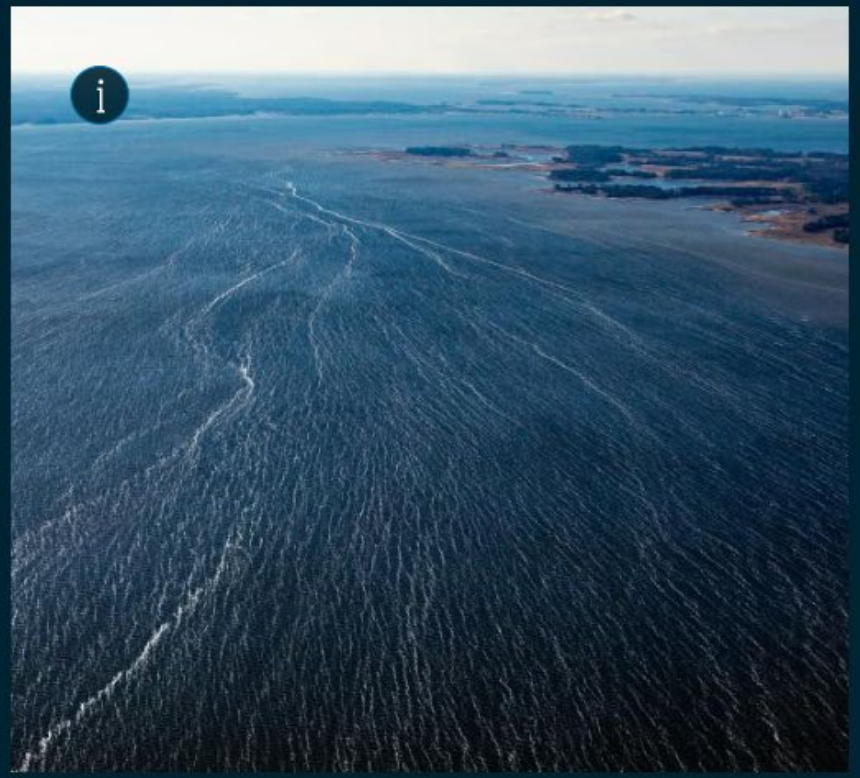
- Chesapeake Bay 101
- Chesapeake Bay Program Partnership

Science-based Targeting

- Targeting Tools Portal
- Lancaster Example

Future Direction

- Beyond 2025



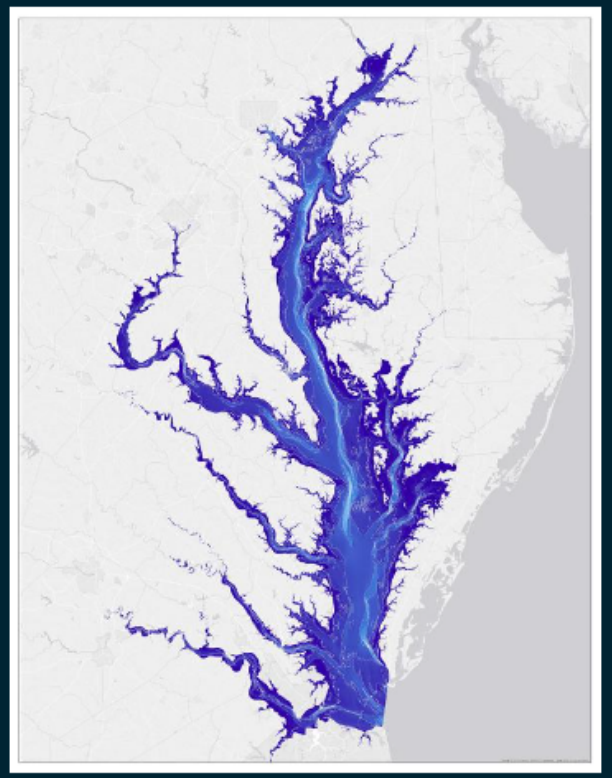
Background

Chesapeake Bay and its Watershed

Chesapeake Bay and its Watershed

Bay

- 200 miles long
- Largest estuary in the U.S.
- Averages 21 feet depth, but most of the Bay is shallow
- Produces 500 million pounds of seafood per year



Chesapeake Bay and its Watershed

Watershed

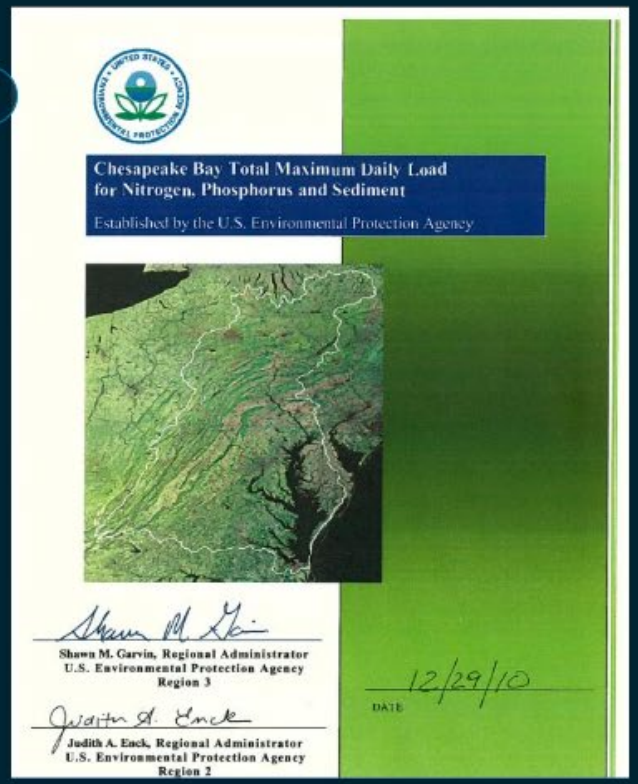
- 64,000 square mile watershed
- 18.6+ million people
- 150 major rivers and streams – Susquehanna contributes about 50% of all freshwater
- Land-to-water ratio makes the Bay particularly susceptible to what happens on the land

Chesapeake Bay Program Partnership

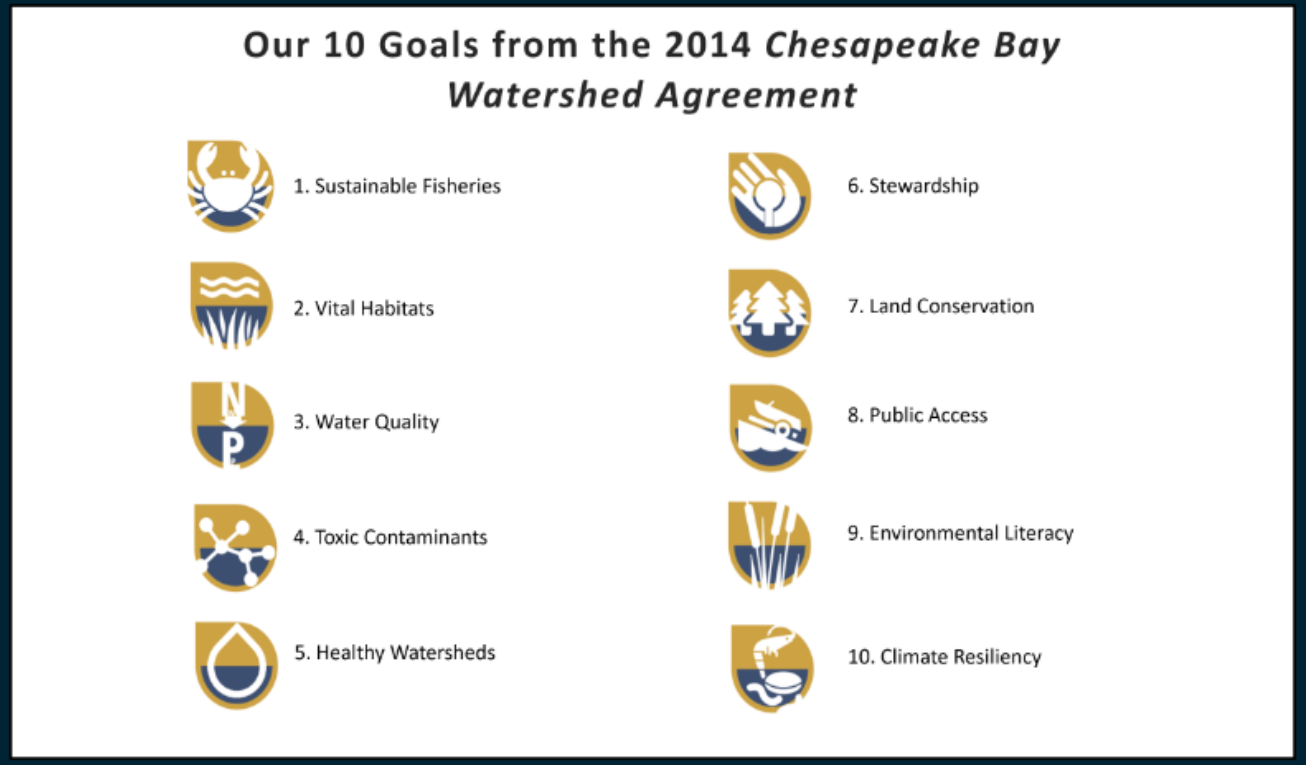
Partnership

- Unique regional partnership that has led and directed the restoration of the Chesapeake Bay since 1983
- Partners include MD, PA, VA, NY, DE, WV, DC
- Multiple federal agencies
- Chesapeake Bay Commission

Chesapeake Bay Governance



Goals of the Agreement



Our 10 Goals from the 2014 *Chesapeake Bay Watershed Agreement*

1. Sustainable Fisheries

2. Vital Habitats

3. Water Quality

4. Toxic Contaminants

5. Healthy Watersheds

6. Stewardship

7. Land Conservation

8. Public Access

9. Environmental Literacy

10. Climate Resiliency

Outcome Attainment Status

Outcome Status
On Course
Off Course
Uncertain

Themes	Goals	Outcomes
Abundant Life	Sustainable Fisheries	Blue Crab Abundance
		Blue Crab Management
		Oysters
		Forage Fish
		Fish Habitat
	Vital Habitats	Wetlands
		Black Duck
		Stream Health
		Brook Trout
		Fish Passage
		Submerged Aquatic Vegetation
		Forest Buffers
		Tree Canopy
Clean Water	Water Quality	2017 Watershed Implementation Plan (WIP)
		2025 Watershed Implementation Plan (WIP)
		WQ Standards Attainment & Monitoring
	Toxic Contaminants	Toxic Contaminants Research
		Toxic Contaminants Policy & Prevention
	Healthy Watersheds	Healthy Watersheds
Conserved Lands	Land Conservation	Protected Lands
		Land Use Methods and Metrics Development
		Land Use Options Evaluation
Engaged Communities	Stewardship	Citizen Stewardship
		Local Leadership
		Diversity
	Public Access	Public Access Site Development
	Environmental Literacy	Student
		Sustainable Schools
		Environmental Literacy Planning
Climate Change	Climate Resiliency	Climate Monitoring & Assessment
		Climate Adaptation

Themes	Goals	Outcomes
Abundant Life	Sustainable Fisheries	Blue Crab Abundance
		Blue Crab Management
		Oysters
		Forage Fish
		Fish Habitat
	Vital Habitats	Wetlands
		Black Duck
		Stream Health
		Brook Trout
		Fish Passage
		Submerged Aquatic Vegetation
		Forest Buffers
		Tree Canopy
Clean Water	Water Quality	2017 Watershed Implementation Plan (WIP)
		2025 Watershed Implementation Plan (WIP)
		WQ Standards Attainment & Monitoring
	Toxic Contaminants	Toxic Contaminants Research
		Toxic Contaminants Policy & Prevention
	Healthy Watersheds	Healthy Watersheds
Conserved Lands	Land Conservation	Protected Lands
		Land Use Methods and Metrics Development
		Land Use Options Evaluation
Engaged Communities	Stewardship	Citizen Stewardship
		Local Leadership
		Diversity
	Public Access	Public Access Site Development
	Environmental Literacy	Student
		Sustainable Schools
		Environmental Literacy Planning
Climate Change	Climate Resiliency	Climate Monitoring & Assessment
		Climate Adaptation

Science-based Targeting

Assessing Needs and Opportunities

Multi-Objective Targeting for Conservation and Restoration

Accelerate progress to meet 2025 deadlines:

- Water-quality practices
- Lagging CBP outcome
- More emphases on climate resiliency and diversity

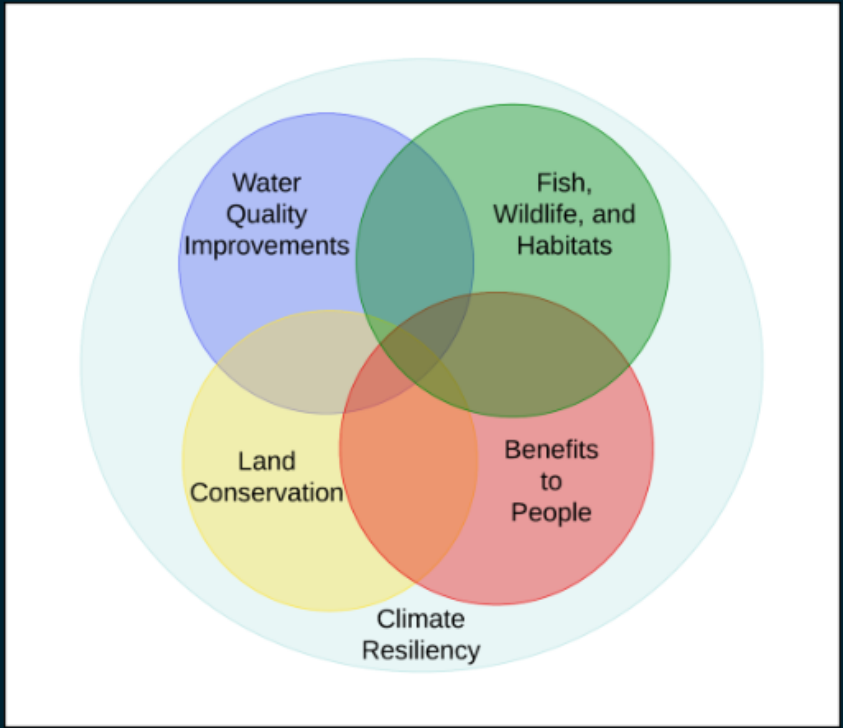
New Funding Opportunities

- $1.2B federal and state existing funding
- Infrastructure Law and other federal programs
- State and local govt. programs
- NGOs and private capital

Growing interest from stakeholders

- Federal and state agencies, CBC, local governments, NGOs
- Expand use of tools to focus and attract resources

Science-based Approach for Targeting Resources



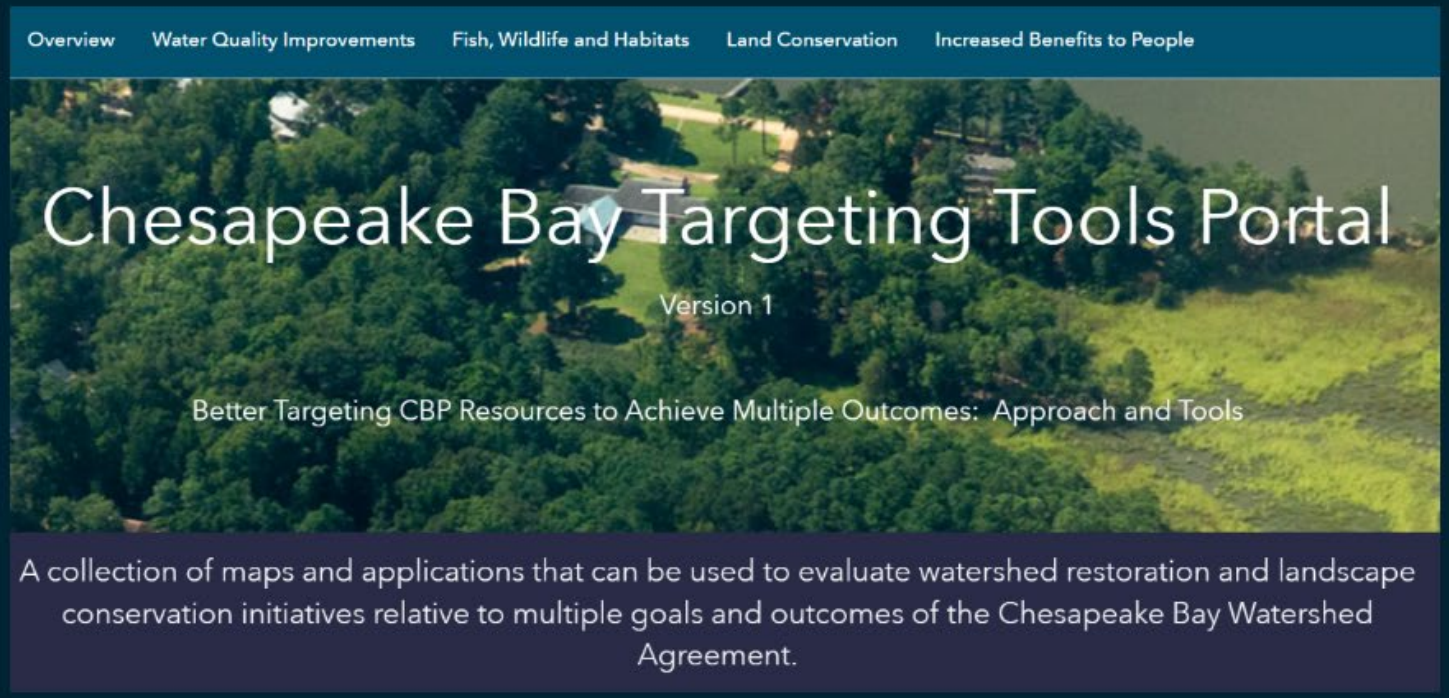
Organize around topics:

- Water quality improvements
- Fish, wildlife, and habitat
- Land Conservation
- Benefits to people
- Improve climate resiliency

Strive for multiple benefits

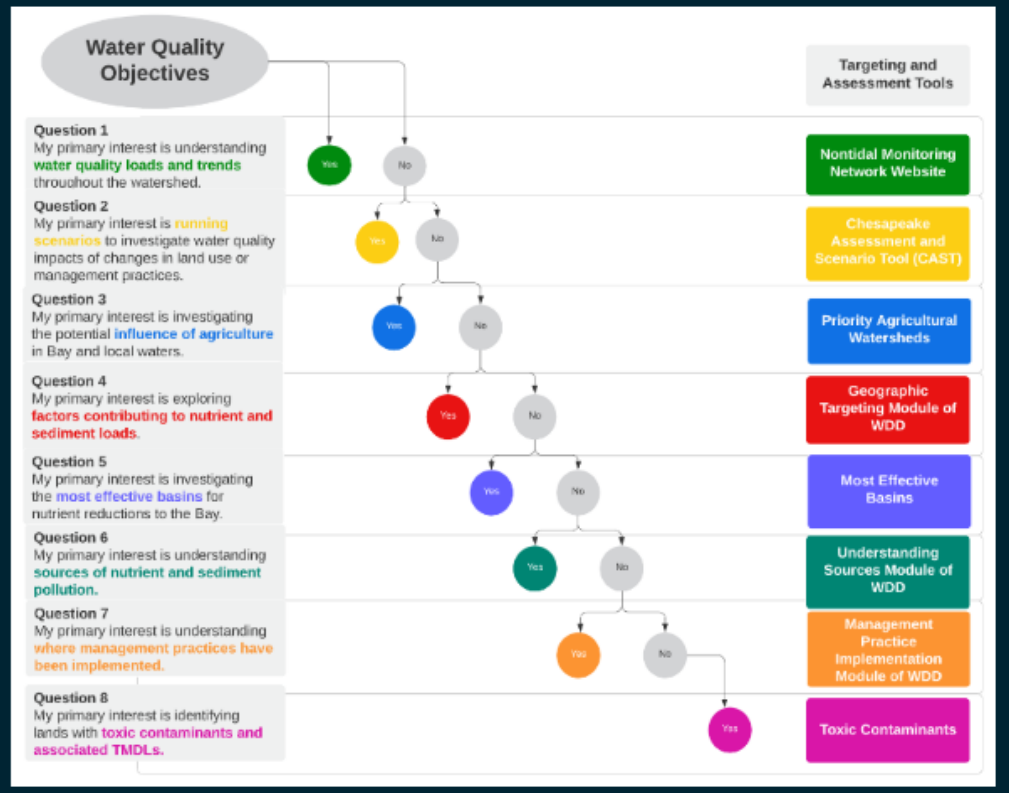
Build from existing tools and stakeholder programs

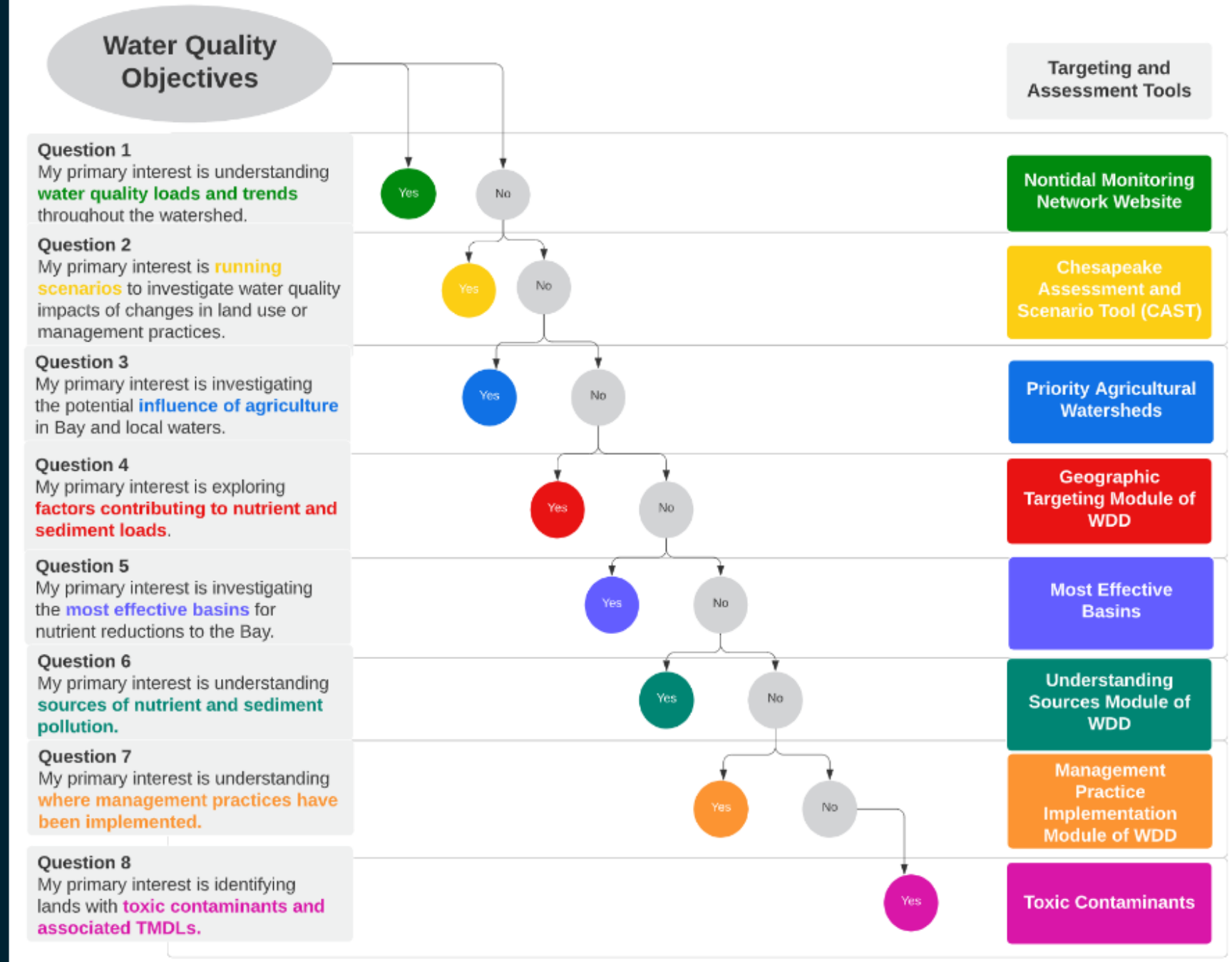
Targeting Tools Portal (gis.chesapeakebay.net/targeting)



Tool Identification

- Guiding the user to a subset of resources aligned with their interests
- Decision support tools, mapping applications and geonarratives

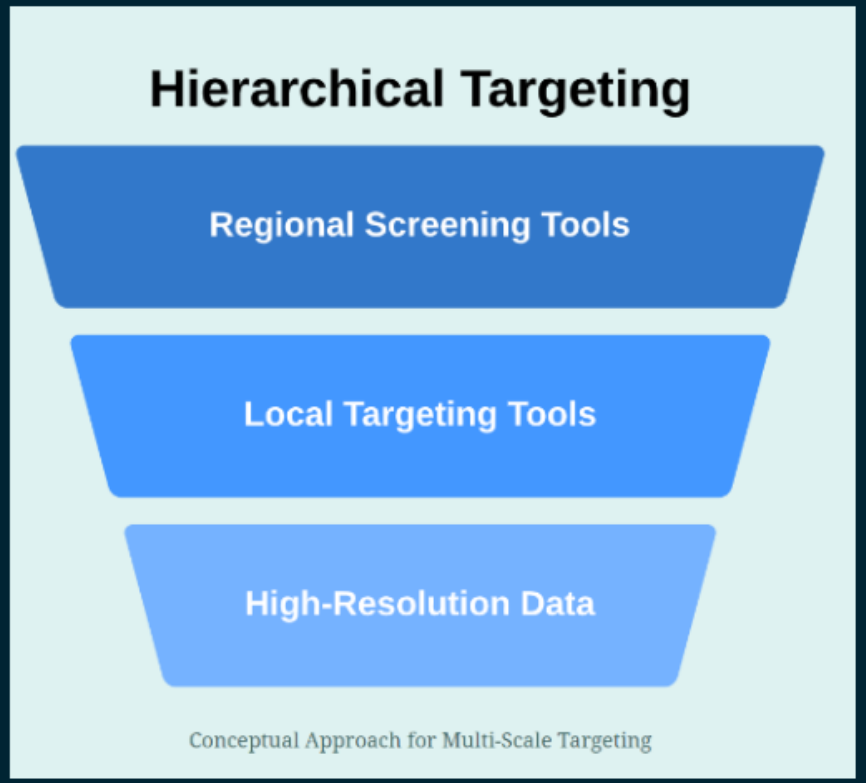



Water Quality Objectives
Targeting and Assessment Tools
Question 1
My primary interest is understanding water quality loads and trends throughout the watershed.
Yes
No
Nontidal Monitoring Network Website
Question 2
My primary interest is running scenarios to investigate water quality impacts of changes in land use or management practices.
Yes
No
Chesapeake Assessment and Scenario Tool (CAST)
Question 3
My primary interest is investigating the potential influence of agriculture in Bay and local waters.
Yes
No
Priority Agricultural Watersheds
Question 4
My primary interest is exploring factors contributing to nutrient and sediment loads.
Yes
No
Geographic Targeting Module of WDD
Question 5
My primary interest is investigating the most effective basins for nutrient reductions to the Bay.
Yes
No
Most Effective Basins
Question 6
My primary interest is understanding sources of nutrient and sediment pollution.
Yes
No
Understanding Sources Module of WDD
Question 7
My primary interest is understanding where management practices have been implemented.
Yes
No
Management Practice Implementation Module of WDD
Question 8
My primary interest is identifying lands with toxic contaminants and associated TMDLs.
Yes
Toxic Contaminants

Conceptual Approach - Multi-Scale, Multi-Outcome

Lancaster County, PA

Objective - demonstrate how geographic priorities (1) at multiple spatial scales and (2) across multiple Watershed Agreement Outcomes can be combined to identify conservation and restoration opportunities.



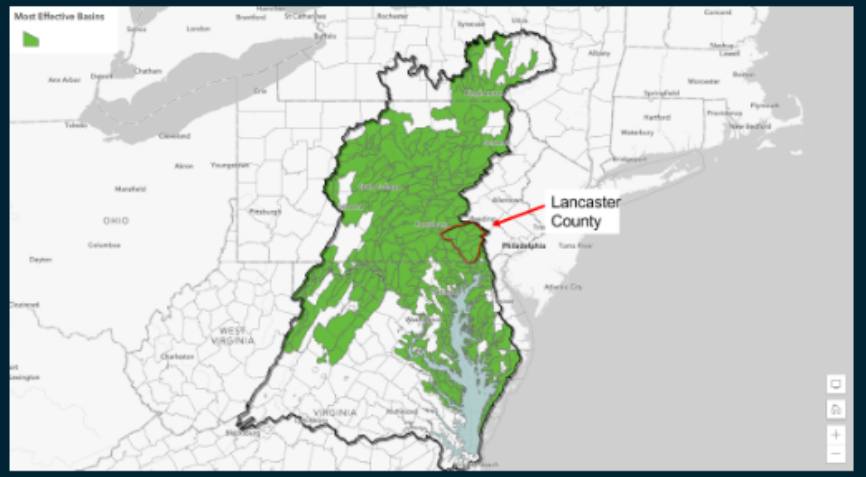
Conceptual Approach for Multi-Scale Targeting

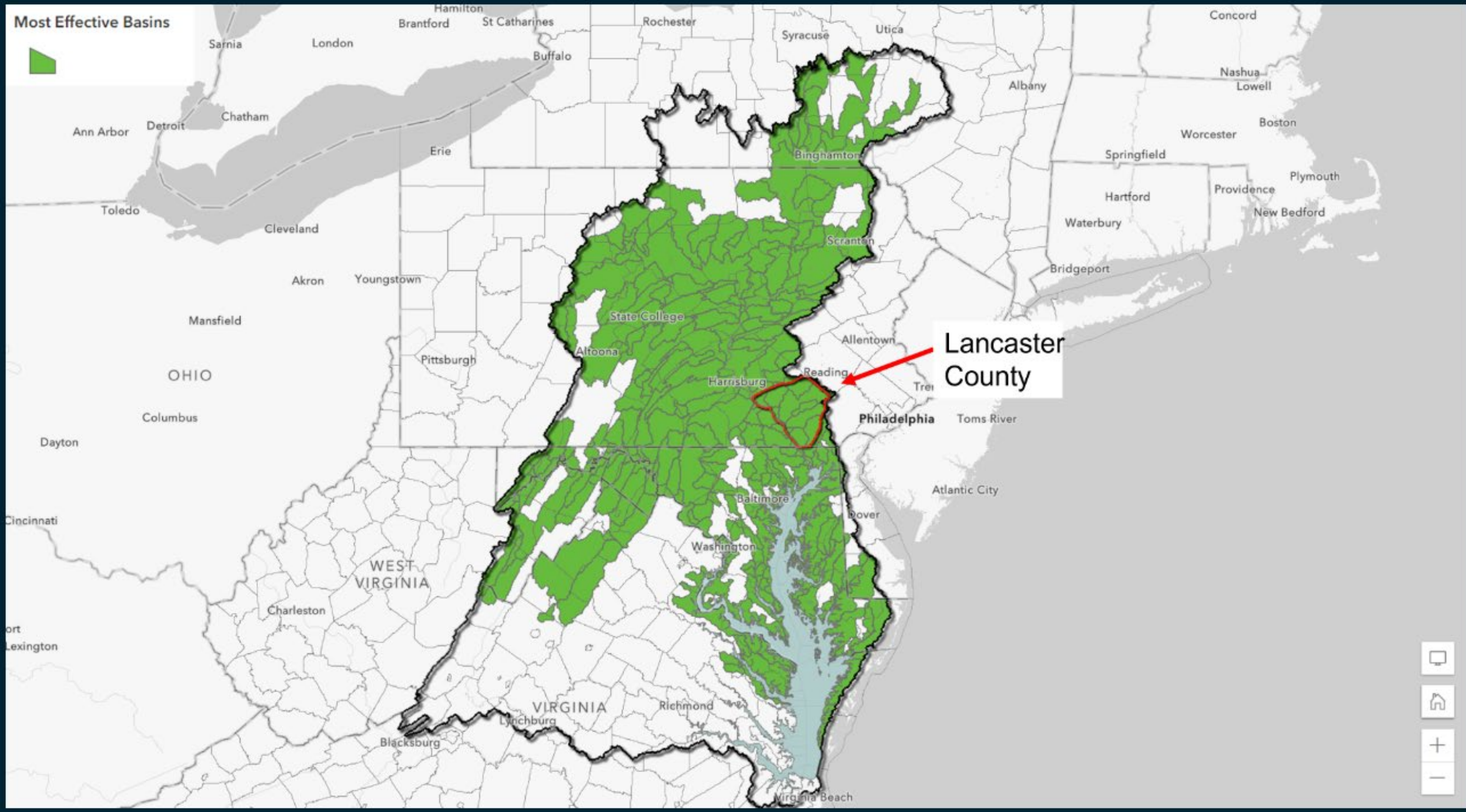
Regional Evaluation

Most Effective Basins (MEB)

Benefit – Dissolved Oxygen in the Mainstem of the Bay

- MEB grant funds are available to target reducing nitrogen, phosphorus, and sediment pollution by focusing on areas that have the greatest effect on improving dissolved oxygen in the Bay.



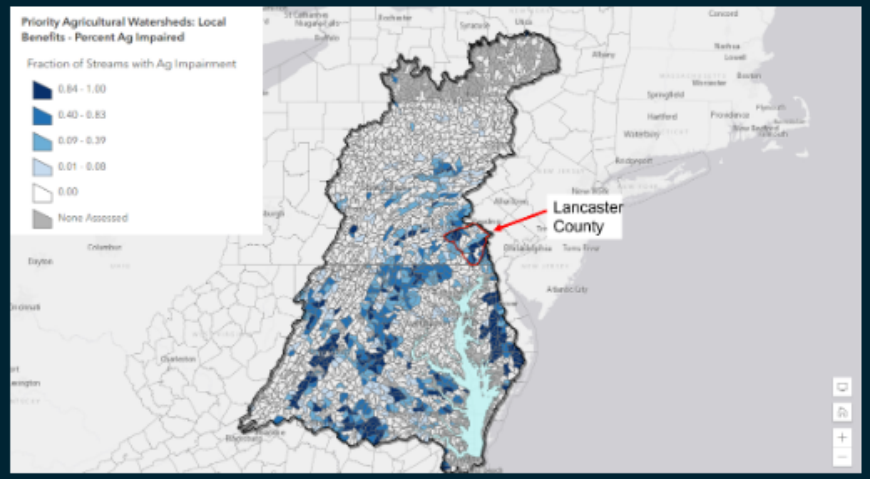

Most Effective Basins
Lancaster County
Hamilton
Brantford
St Catharines
Rochester
Syracuse
Utica
Concord
Sarnia
London
Buffalo
Albany
Nashua
Lowell
Ann Arbor
Detroit
Chatham
Boston
Worcester
Erie
Binghamton
Springfield
Plymouth
Providence
Hartford
Toledo
Cleveland
Waterbury
New Bedford
Scranton
Bridgeport
Akron
Youngstown
Mansfield
State College
Allentown
Pittsburgh
Altoona
Reading
OHIO
Harrisburg
Philadelphia
Toms River
Columbus
Dayton
Atlantic City
Baltimore
Cincinnati
Dover
Washington
WEST VIRGINIA
Charleston
Lexington
VIRGINIA
Richmond
Lynchburg
Blacksburg
Virginia Beach

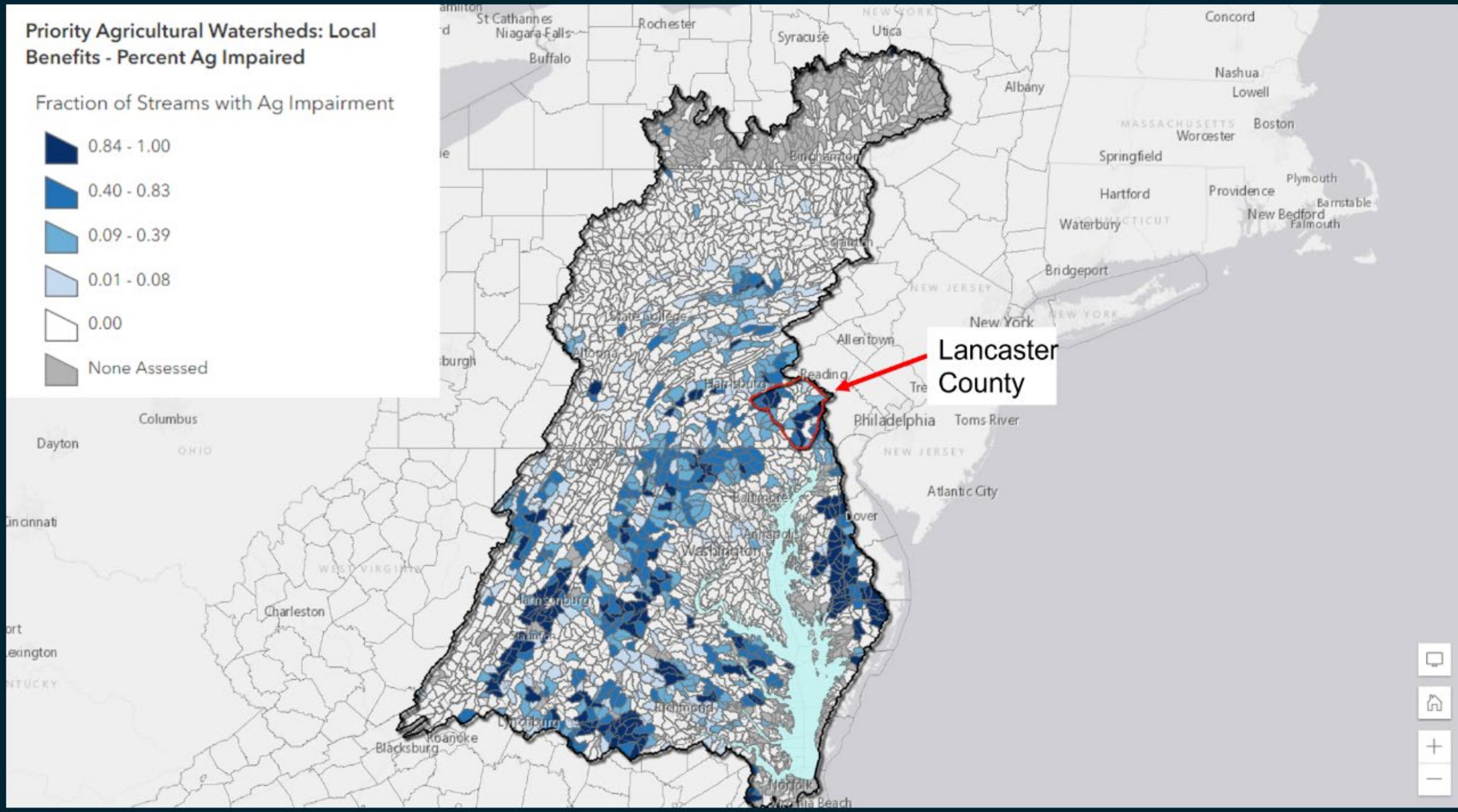
Regional Evaluation

Priority Agricultural Watersheds

Benefit – Local Water Quality

- In addition to Bay water quality benefits, the implementation of best management practices (BMPs) can benefit local communities and help to address local water quality impairments.



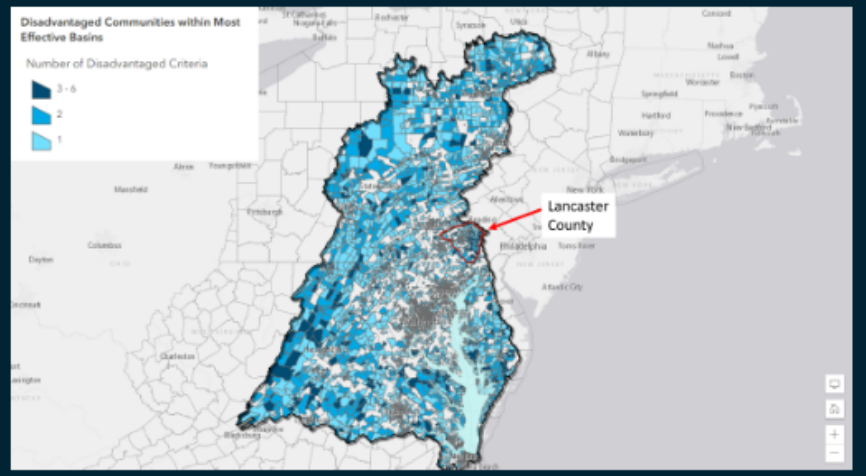

Priority Agricultural Watersheds: Local Benefits - Percent Ag Impaired
Fraction of Streams with Ag Impairment
0.84 - 1.00
0.40 - 0.83
0.09 - 0.39
0.01 - 0.08
0.00
None Assessed
Lancaster County
Rochester
Syracuse
Utica
Buffalo
Albany
Concord
Nashua
Lowell
Boston
Worcester
Springfield
Hartford
Providence
Plymouth
Barnstable
New Bedford
Falmouth
Waterbury
Bridgeport
New York
Allentown
Reading
Harrisburg
Philadelphia
Toms River
Atlantic City
Columbus
Dayton
Charleston
Roanoke
Blacksburg

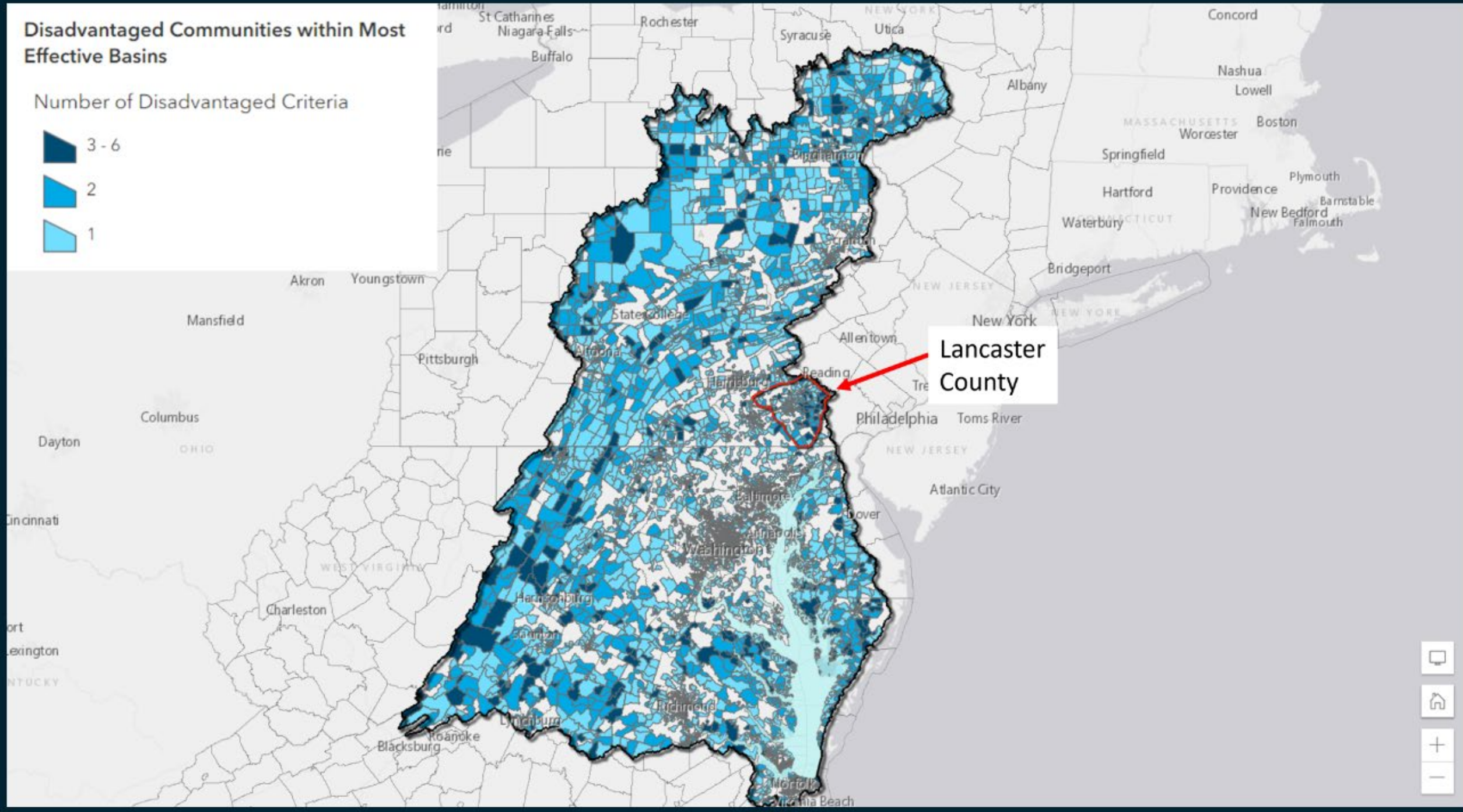
Regional Evaluation

Disadvantaged Communities

Disadvantaged communities were identified based on demographic variables from the American Community Survey as mapped in EPA's ***EJ Screen*** tool, including

- percent low-income
- percent linguistic isolation
- percent unemployment
- percent less-than-high school education
- percent under age 5
- percent over age 64




Disadvantaged Communities within Most Effective Basins
Number of Disadvantaged Criteria
3 - 6
2
1
Lancaster County
St Catharines
Niagara Falls
Buffalo
Rochester
Syracuse
Utica
Albany
Concord
Nashua
Lowell
Boston
Worcester
Springfield
Hartford
Providence
Plymouth
Barnstable
New Bedford
Falmouth
Waterbury
Bridgeport
New York
Allentown
Reading
Philadelphia
Toms River
Atlantic City
Akron
Youngstown
Mansfield
Pittsburgh
Columbus
Dayton
Cincinnati
Charleston
Lexington
Roanoke
Blacksburg
Lynchburg
Richmond
Norfolk
Virginia Beach
Harrisburg
Baltimore
Washington
Annapolis
Dover
Binghamton
Scranton
Harrisonburg
State College
Altoona

Flood Resiliency - Local Targeting

Flood Resiliency

- The ***National Flood Hazard Layer*** (NFHL) is a geospatial database that contains current effective flood hazard data. FEMA provides the flood hazard data to support the National Flood Insurance Program (FEMA 2023).

Forest Buffers - Local Targeting

Forest Buffers

- EPA's ***Watershed Resources Registry*** contains state-specific riparian restoration and preservation prioritization models that can be used to prioritize opportunities. The map on the right shows restoration potential scores along Pequea and neighboring creeks.

Wetlands - Local Targeting

Wetland Restoration

- EPA's ***Watershed Resources Registry*** contains state-specific wetland restoration and preservation prioritization models that can be used to prioritize opportunities. The map on the right shows wetland restoration potential scores along Pequea and neighboring creeks.

Land Use/Cover - High-Resolution Data

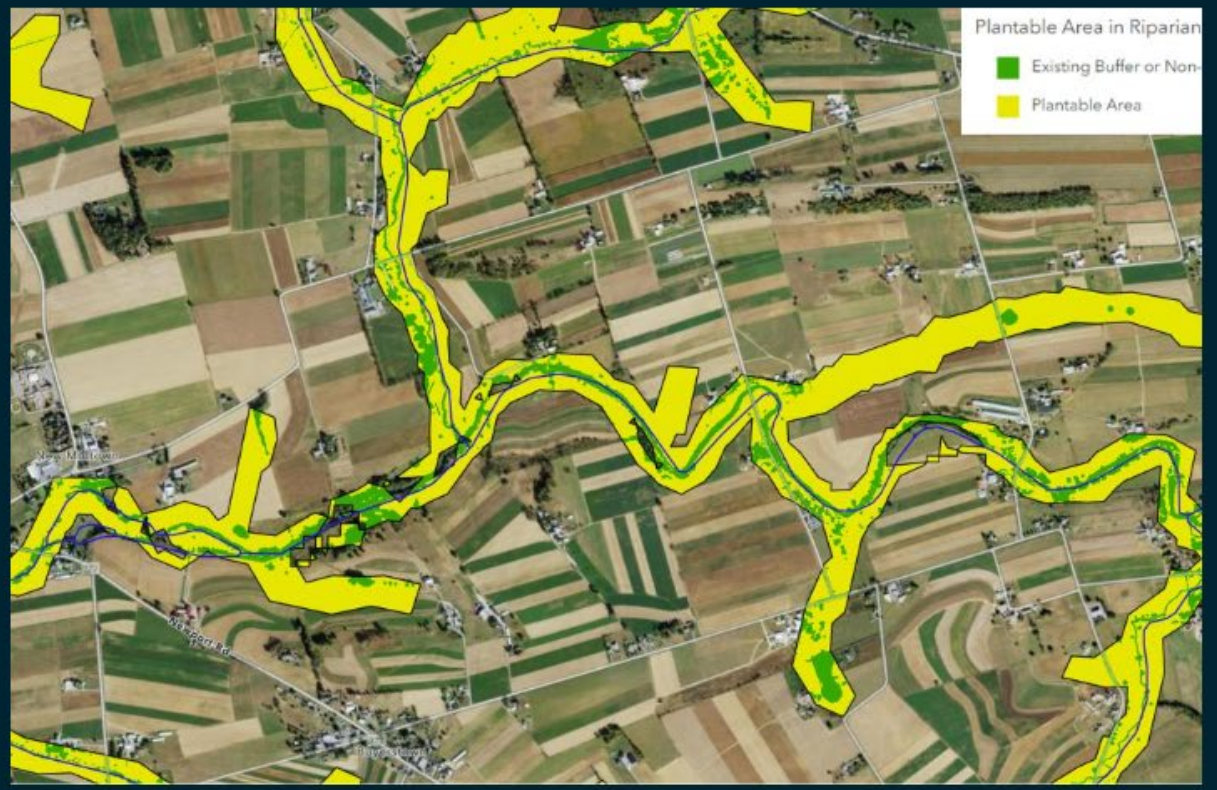
Land Use in Riparian Corridor

- The high-resolution land use/cover data can be used to verify opportunities identified by coarser targeting tools.

Plantable Area - High-Resolution Data

Plantable Area

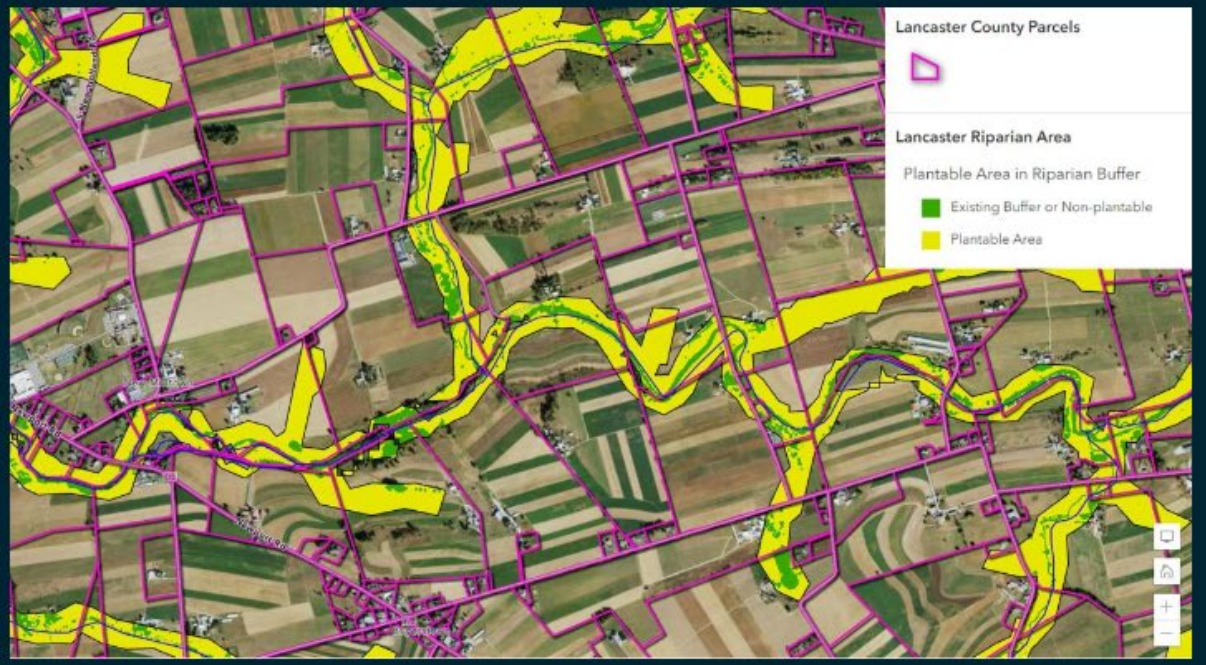
- The riparian land use/land cover can be further refined to identify opportunities for specific management actions. In this case, the riparian corridor has been interpreted to identify **plantable vs. non-plantable areas**.



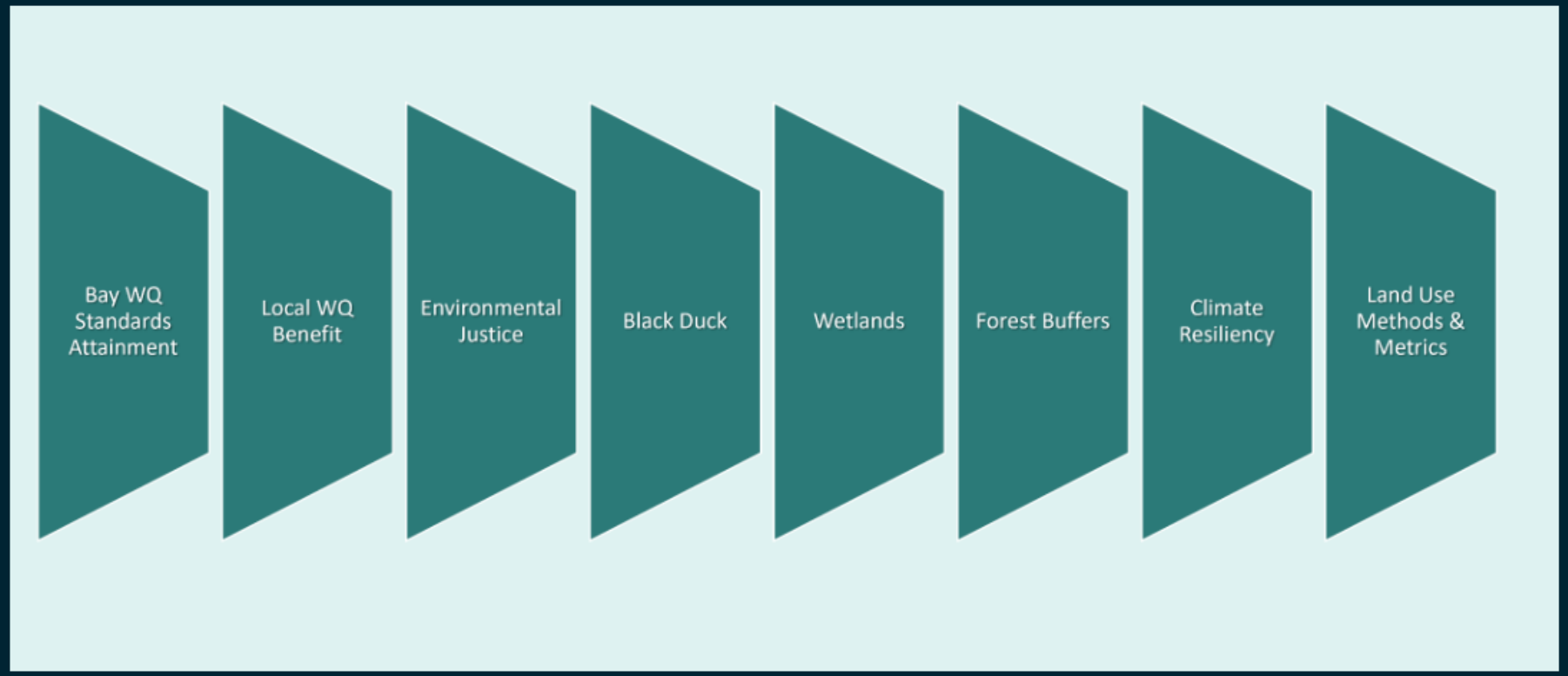
Parcels/Ownership - High-Resolution Data

Parcel Boundaries

- Finally, opportunities for riparian forest buffer plantings can be evaluated for feasibility in the context of land ownership.

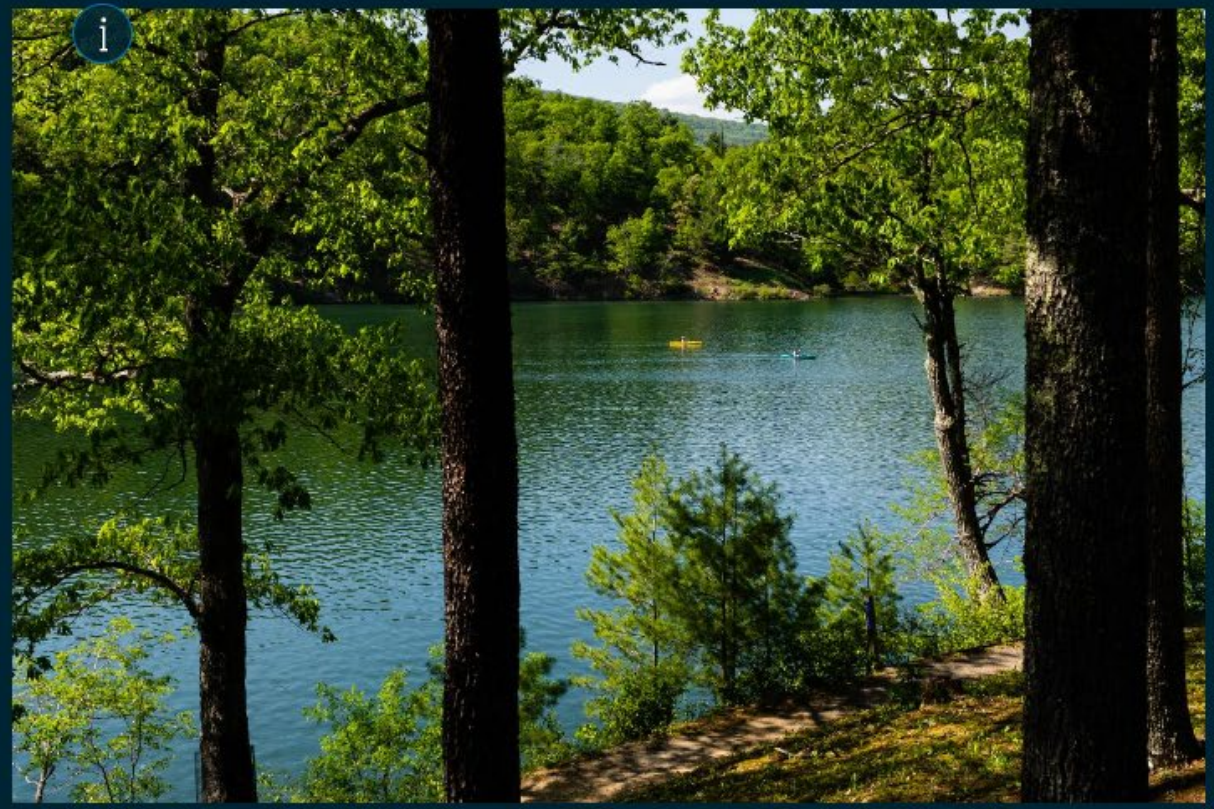


Geographic Targeting to address Multiple Outcomes



Future Directions

Targeting Work Plan



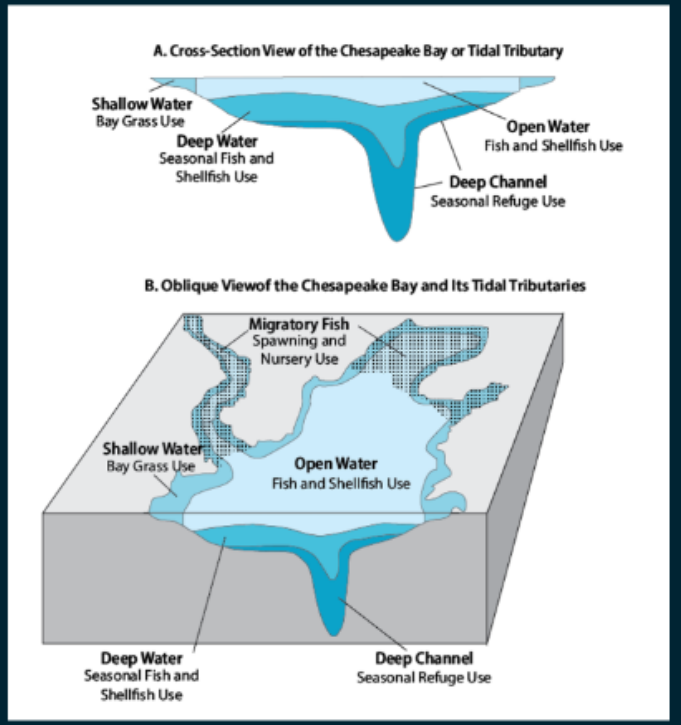
Future Directions

Comprehensive Evaluation of System Response (CESR)

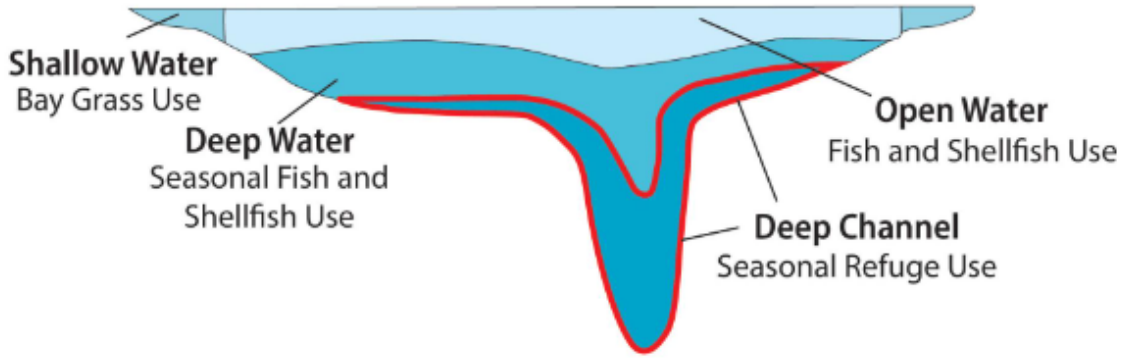
Finding: Significant enhancement of living resources can be achieved through additional management actions without the complete achievement of water quality standards across all habitats.

Policy Implication: Opportunities exist to adjust approaches to prioritize management actions that improve living resource response

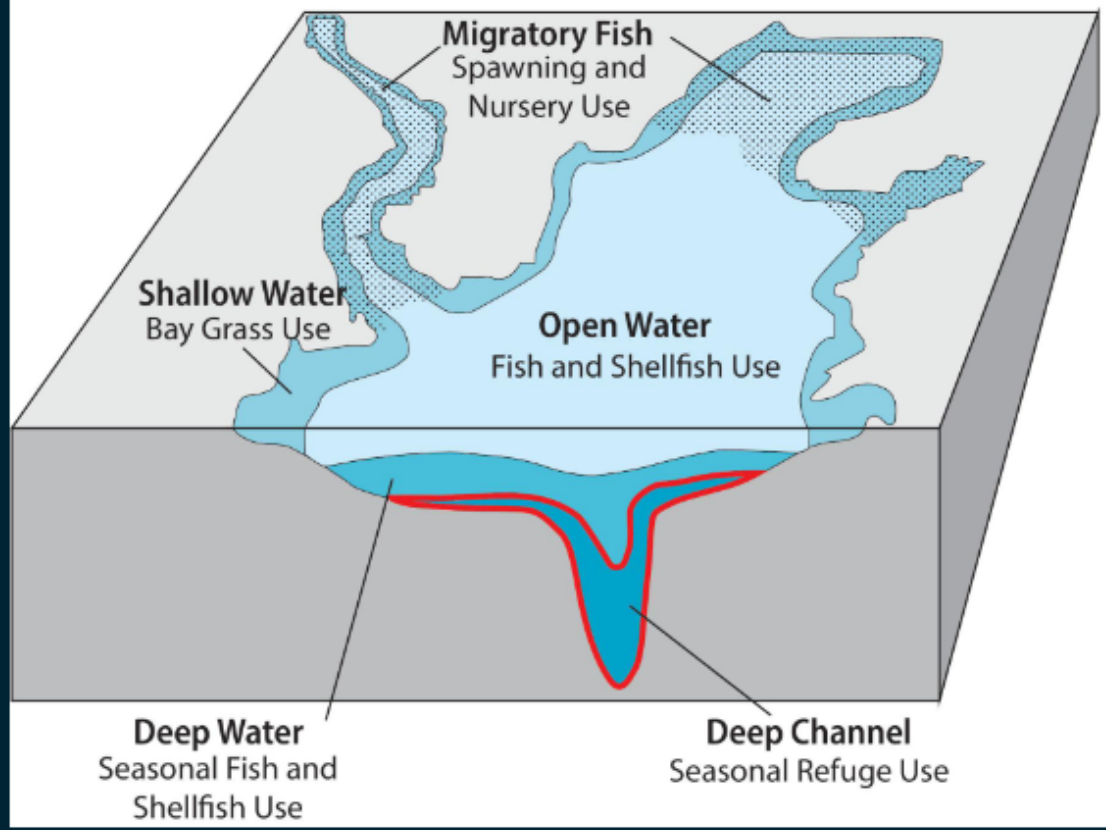
(Scientific and Technical Advisory Committee 2023)



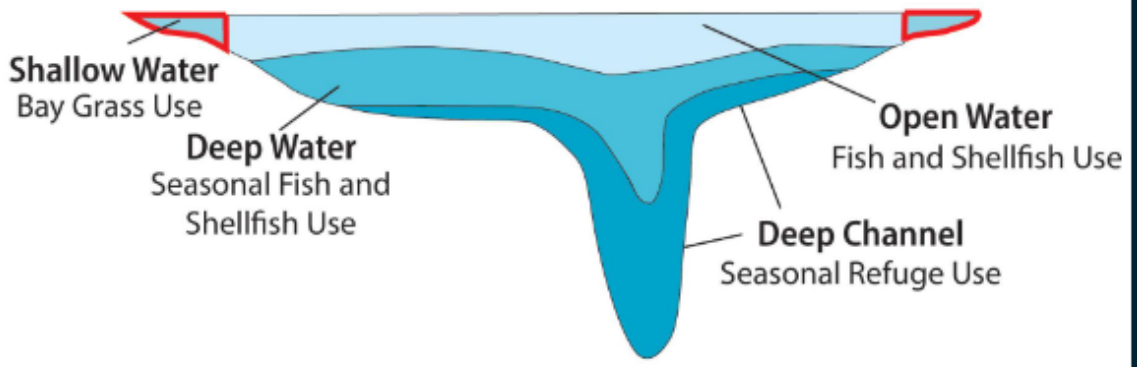
A. Cross-Section View of the Chesapeake Bay or Tidal Tributary



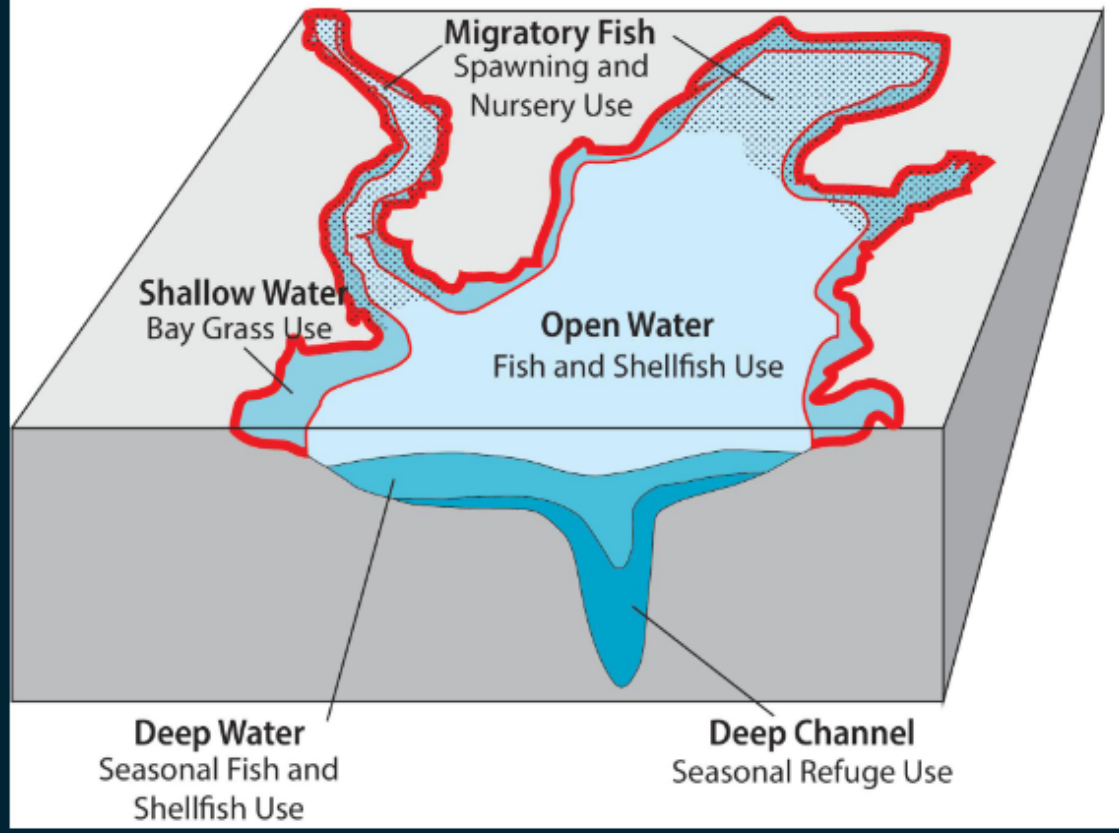
B. Oblique View of the Chesapeake Bay and Its Tidal Tributaries



A. Cross-Section View of the Chesapeake Bay or Tidal Tributary



B. Oblique View of the Chesapeake Bay and Its Tidal Tributaries



Future Directions

Local Utility

Develop locally-applicable tools and data to facilitate conservation and restoration decisions.

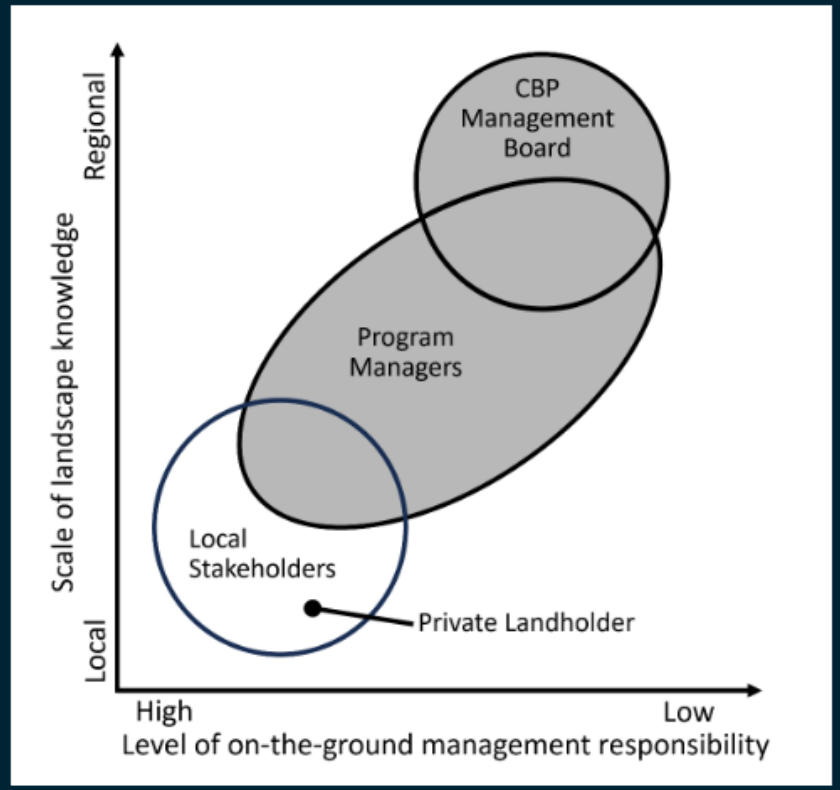
- 1 m resolution land use/cover
- Hyper-resolution hydrography and channel characteristics
- LiDAR derivatives
- Parcel and field-scale targeting and evaluation

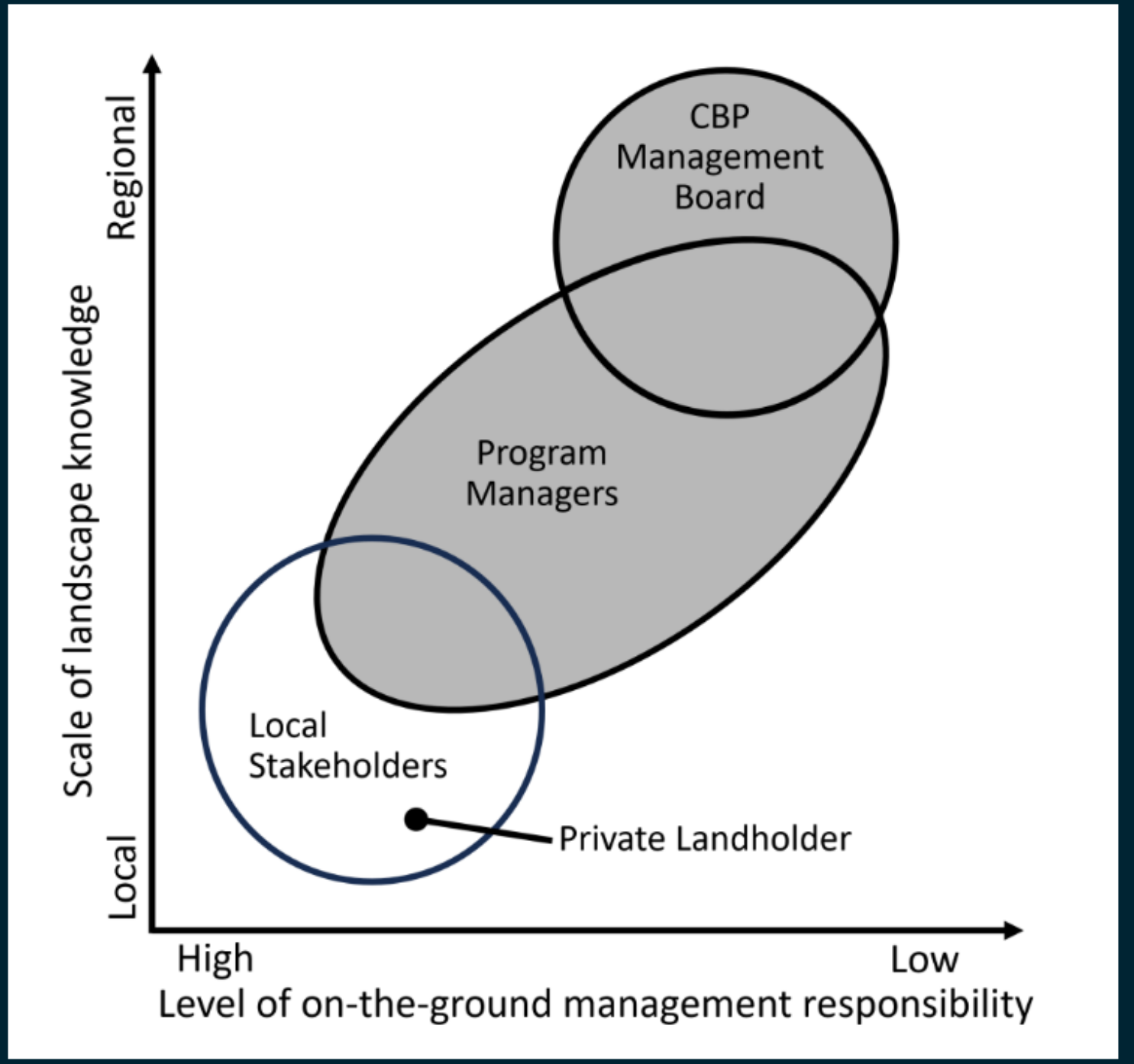
Future Directions

User-Centric Tools and Applications

Incorporate stakeholder involvement throughout tool and data development.

- Develop training materials on best practices for using and integrating tools.




Regional
Scale of landscape knowledge
Local
CBP
Management
Board
Program
Managers
Local
Stakeholders
Private Landholder
High
Low
Level of on-the-ground management responsibility

Future Directions

Cross-Outcome Tool Integration

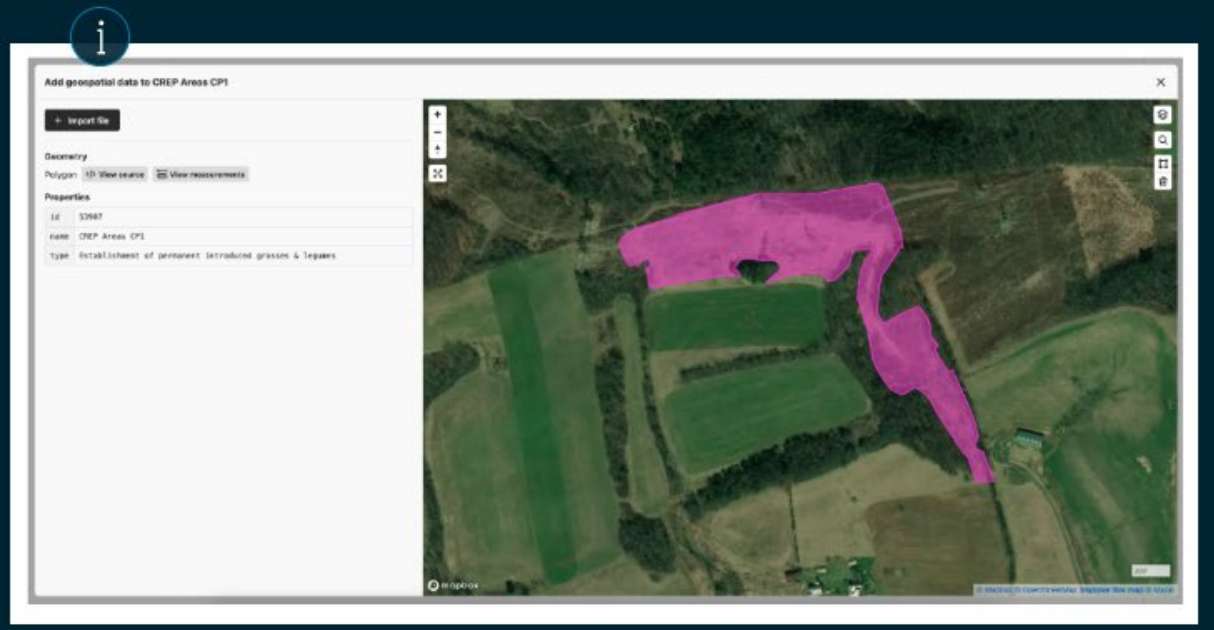
Strive to achieve and track co-benefits through space and time.

- Consider ecosystem services as a common currency across Outcomes
- Identify foundational data sets common to multiple Outcomes.
- Highlight example use cases and case studies highlighting targeting for multiple benefits.

Future Directions

Geography of Implementation

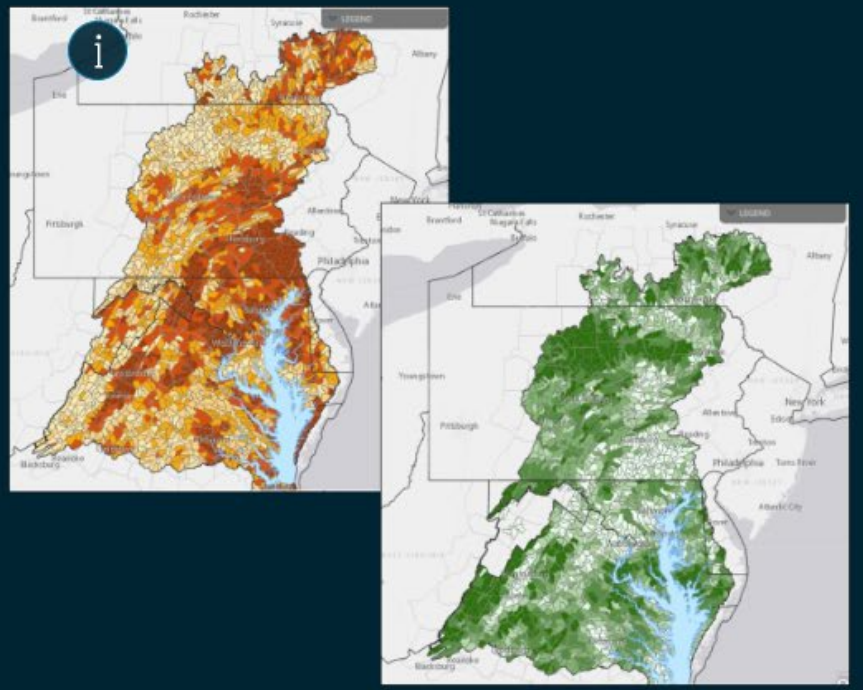
- Management Practices
- Grant awardees
- Project locations associated with Federal Funding
- Geographic "turf" of partners



Future Directions

Connecting Conservation and Restoration

- Protecting restoration investments
- Keeping healthy watersheds healthy



Next Steps

Targeting Workplan 2024

- Cast studies/use cases
- Training
- Parcel-based data storage and analytics
- Stakeholder engagement
- Integration with Action Plans (Forests, Wetlands, DEIJ, Climate)

Thank you!

John Wolf
USGS Lower Mississippi-Gulf WSC
jwolf@usgs.gov
jwolf@chesapeakebay.net