

Land Prioritization Mapping to Protect Drinking Water

From Regional Prioritization to Local Applications

Chesapeake Bay Program Land Use Workgroup

October 6, 2026

Presented by Renee Thompson, Water Resources Planner,
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Land Prioritization Mapping to Protect Drinking Water Quality (2025)



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Water Resource Planner, ICPRB
and

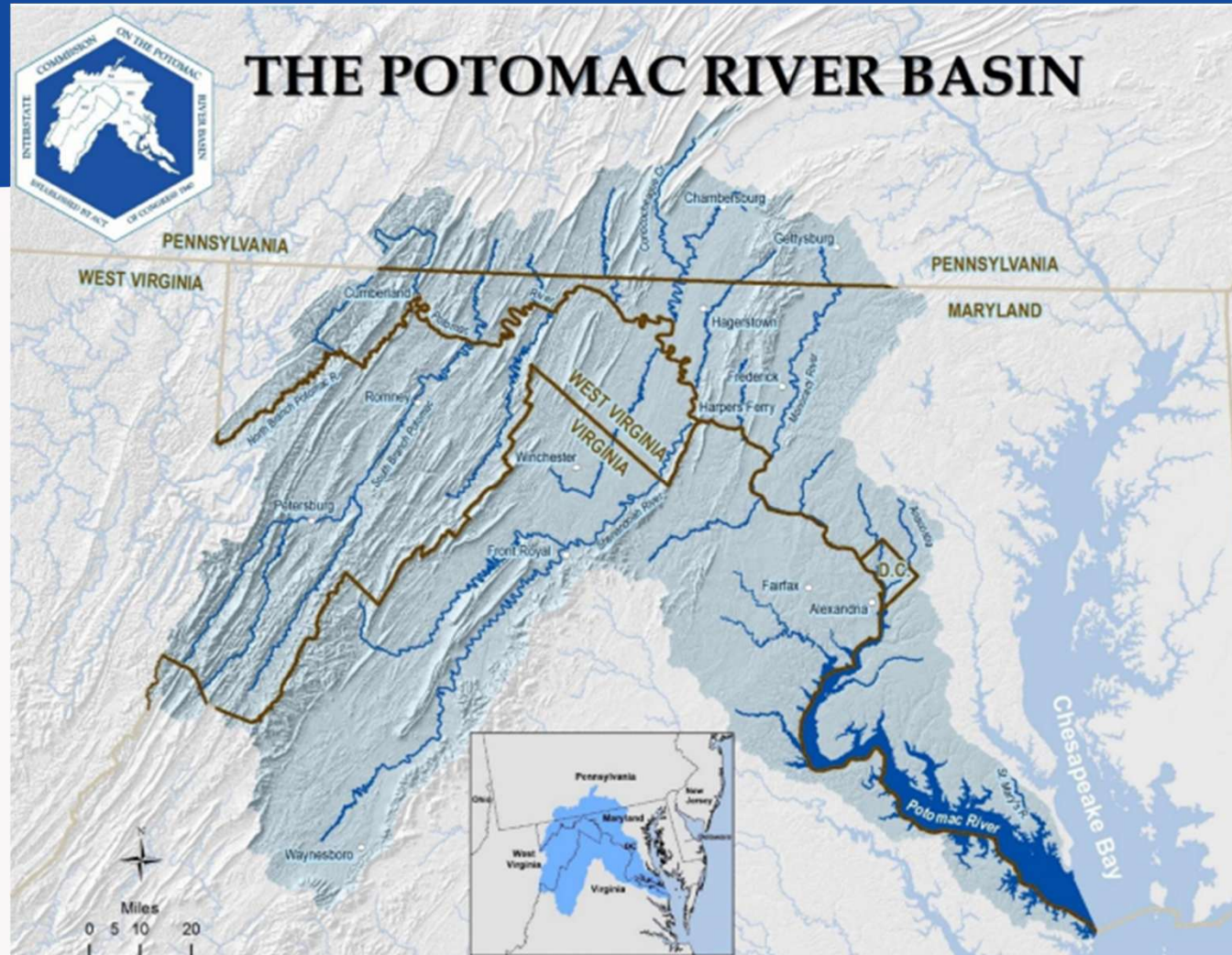


Megan McClaugherty
Aquatic Ecologist I, ICPRB



Background on the Potomac and ICPRB

- The Potomac River Basin spans approximately 14,700 square miles across Maryland, Virginia, West Virginia, Pennsylvania and Washington, DC.
- About 6 million people rely on the Potomac for drinking water.
- ICPRB provides interstate, science-based coordination



What is ICPRB

What is ICPRB?

- The **Interstate Commission on the Potomac River Basin (ICPRB)** was established in **1940**, with a mission to **protect and enhance the waters and related resources of the Potomac River Basin**.
- It works across state lines to solve water issues that **no single jurisdiction can address alone**.
- Because the basin spans 5 political jurisdictions, ICPRB serves as a **neutral, science-based convener**.





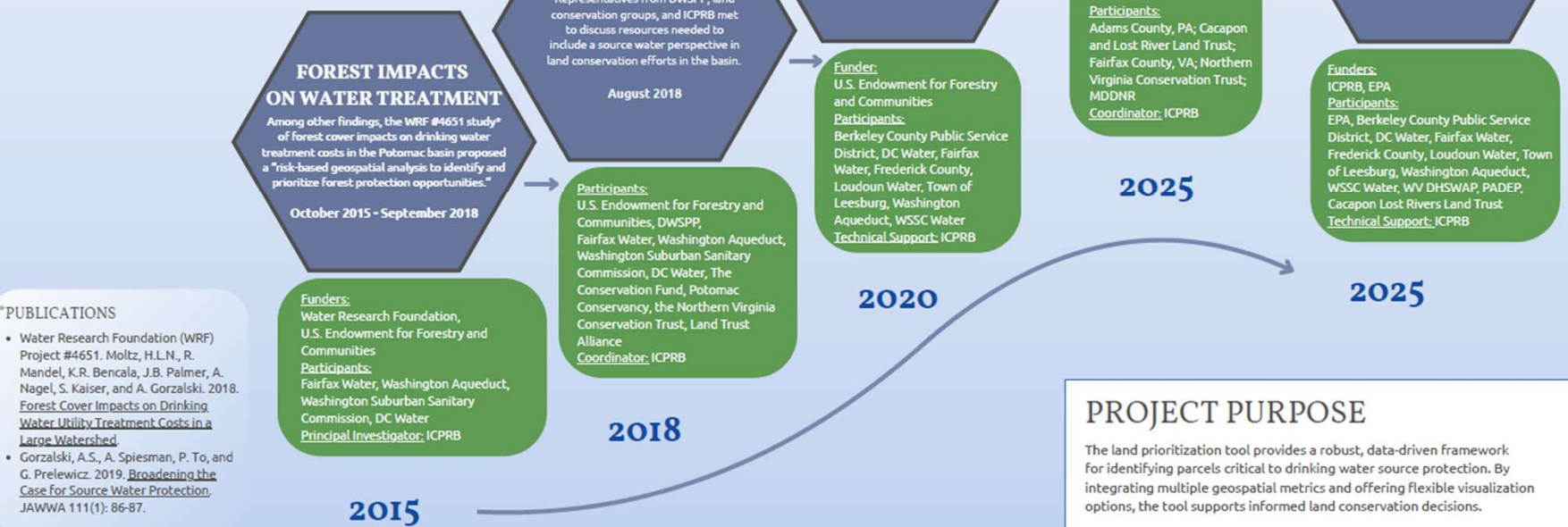
LAND PRIORITIZATION MAPPING TO PROTECT DRINKING WATER QUALITY: A TIMELINE

www.potomacriver.org www.potomacdwspp.org



A DECADE OF PROGRESS

Sparked by discussions among land conservation groups and the Potomac River Basin Drinking Water Source Protection Partnership (DWSPP) a decade ago, this tool for prioritizing lands for protection from a drinking water source perspective has evolved through the collaborative efforts of many funders and stakeholders, who have informed ICPRB's technical and participatory work. Key milestones are shown on the timeline below.



Land Prioritization Mapping: A Decade of Progress

Collaboration. Data. Tools. Real-World Applications.



Interstate Commission on the Potomac River Basin
Protecting and preserving the Potomac through science and cooperation



Partners

Built Through Collaboration

Land protection partners and drinking-water utilities have been involved throughout the development of the tool.



Drinking Water Utilities

- Berkeley County Public Service District
- DC Water
- Fairfax Water
- Frederick County
- Loudoun Water
- Town of Leesburg
- Washington Aqueduct
- WSSC Water



Land & Watershed Partners

- Adams County, PA
- Cacapon and Lost Rivers Land Trust
- Fairfax County, VA
- Land Trust Alliance
- Northern Virginia Conservation Trust
- Potomac Conservancy



State & Federal Partners

- EPA
- U.S. Endowment for Forestry and Communities
- Maryland DNR
- PADEP



Regional Coordination & Technical Support

- Potomac River Basin Drinking Water Source Protection Partnership (DWSPP)
- ICPRB
- Water Research Foundation



Evolution of the Tool

Partner Input Shaped the Tool

Ongoing engagement improved the methods, data, and usability.



2015–2020 Build the Framework

- Research established the drinking-water rationale.
- Utility and land-protection partners helped identify useful metrics and approaches.



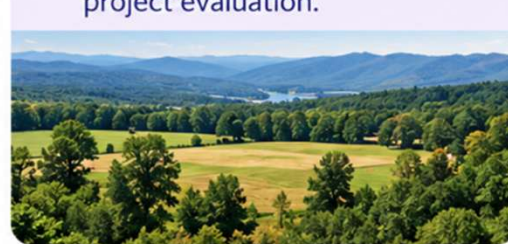
2025 Test & Refine

- End users reviewed the updated tool before finalization.
- Feedback informed methods, data, usability, and presentation.



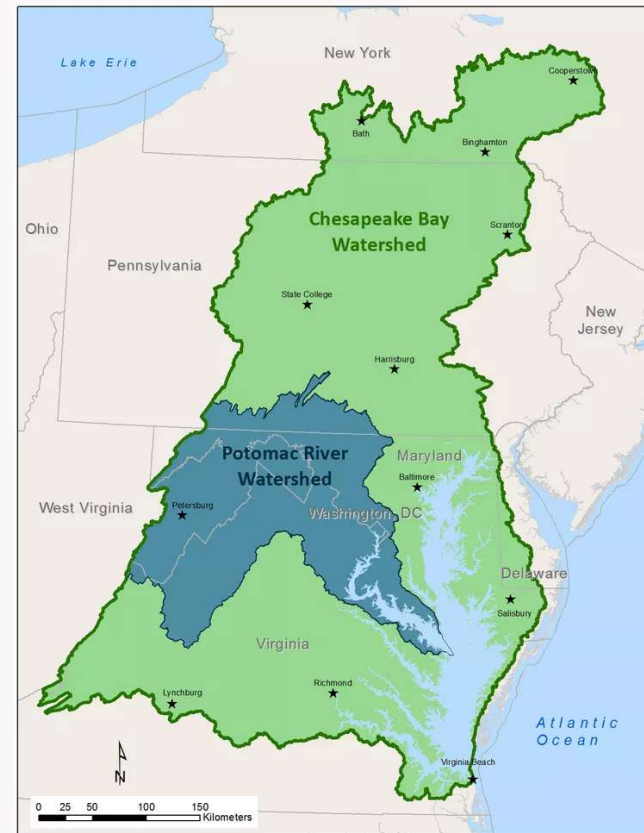
2026 Put It to Work

- Partners are now applying the data to real land-protection decisions.
- The tool supports local planning, program targeting, and project evaluation.



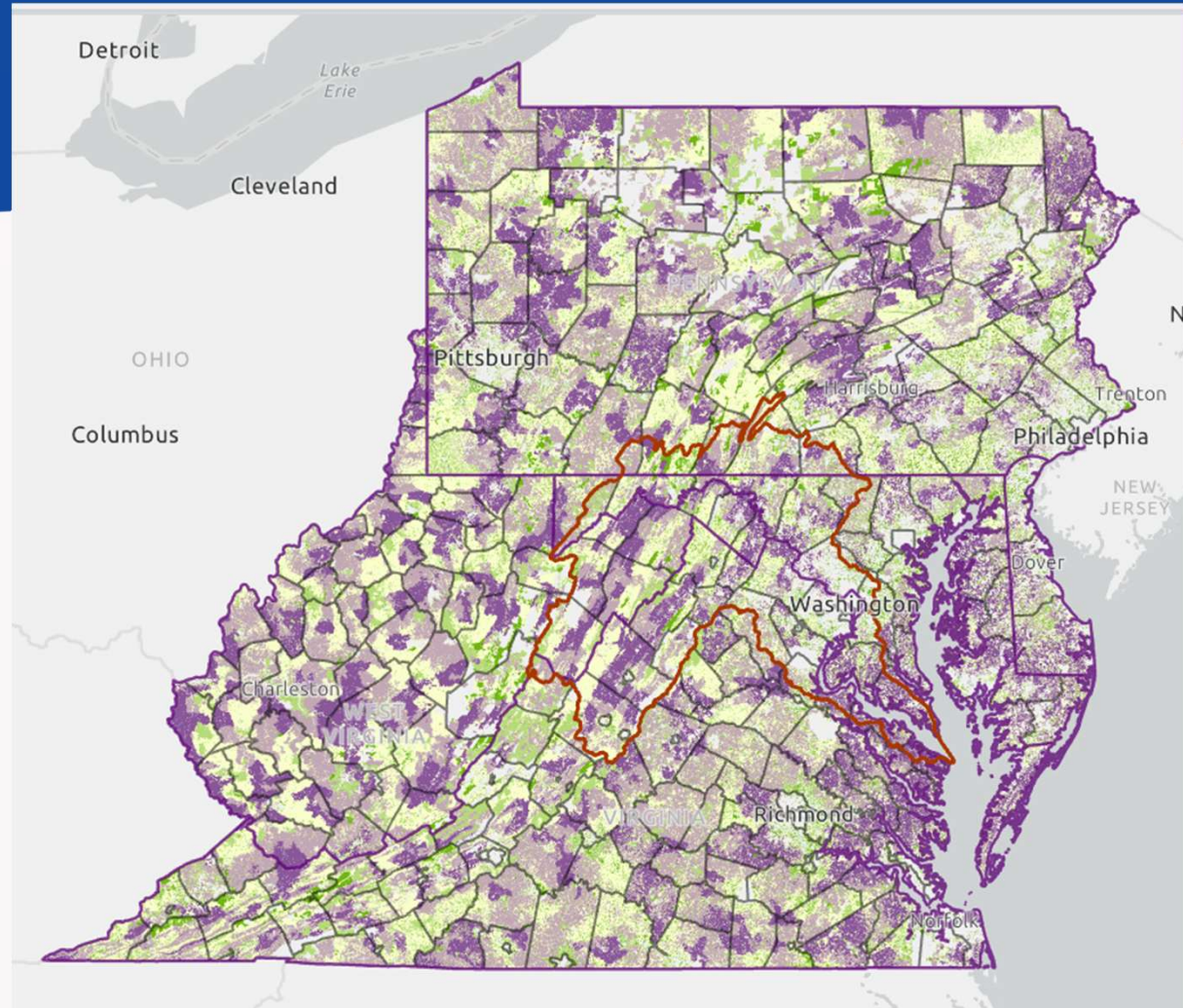
Which lands provide the greatest opportunity to protect drinking-water quality?

- Where is the land?
- How important is it for source water?
- Where can protection make a difference?

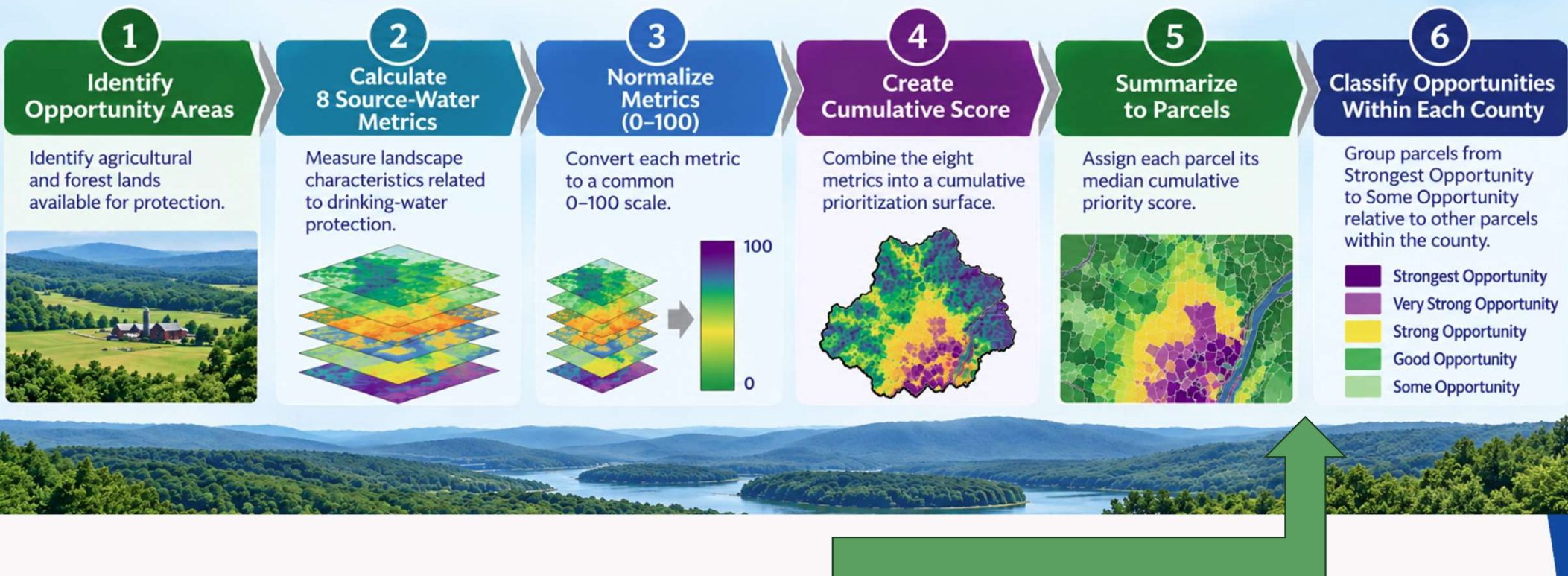


2025 Study Area

Expanded to full states and include Delaware in the final regional product.



Overview of Land Prioritization Process

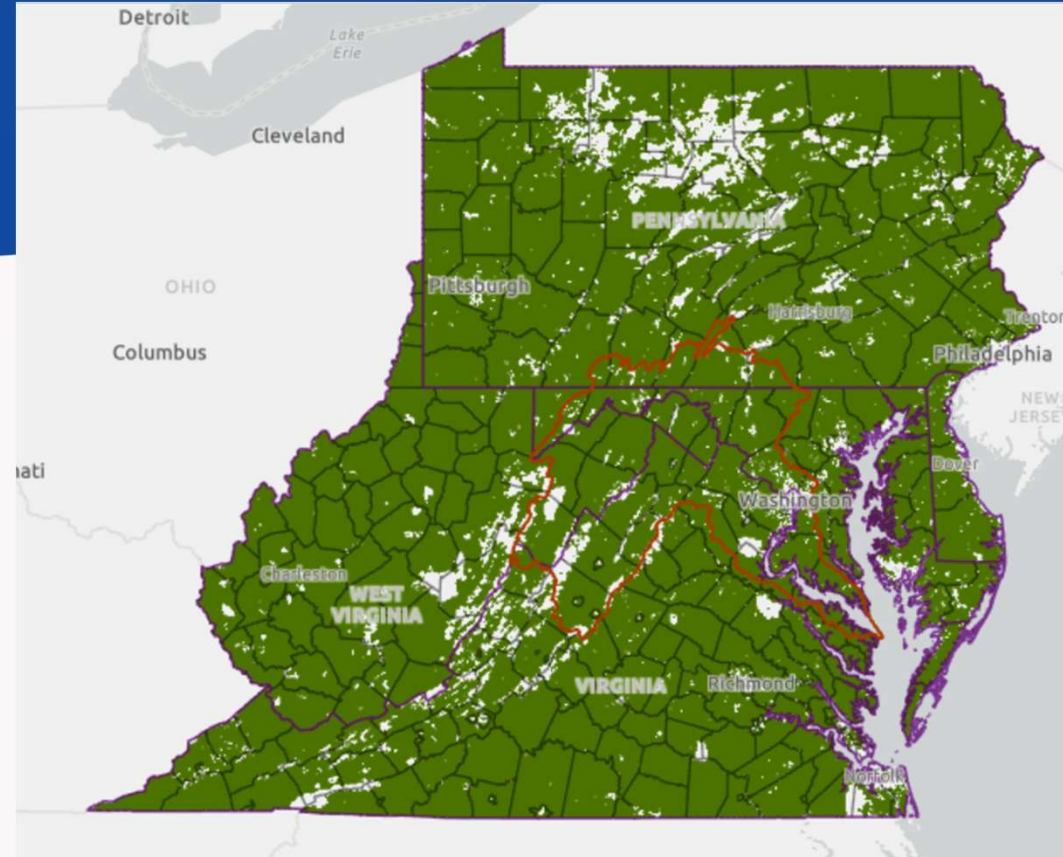


Non-parcel areas were backfilled using the underlying cumulative prioritization to maintain continuous coverage.

Opportunity Areas

$$\begin{array}{l} \text{Forests} \\ + \text{Agricultural Areas} \\ - \text{Protected Areas} \\ = \text{Opportunity Areas} \end{array}$$

U.S. Geological Survey (USGS) Gap Analysis Project (GAP), 2024,
Protected Areas Database of the United States (PAD-US) 4:
Chesapeake Bay Program Protected Lands Dataset 2023.

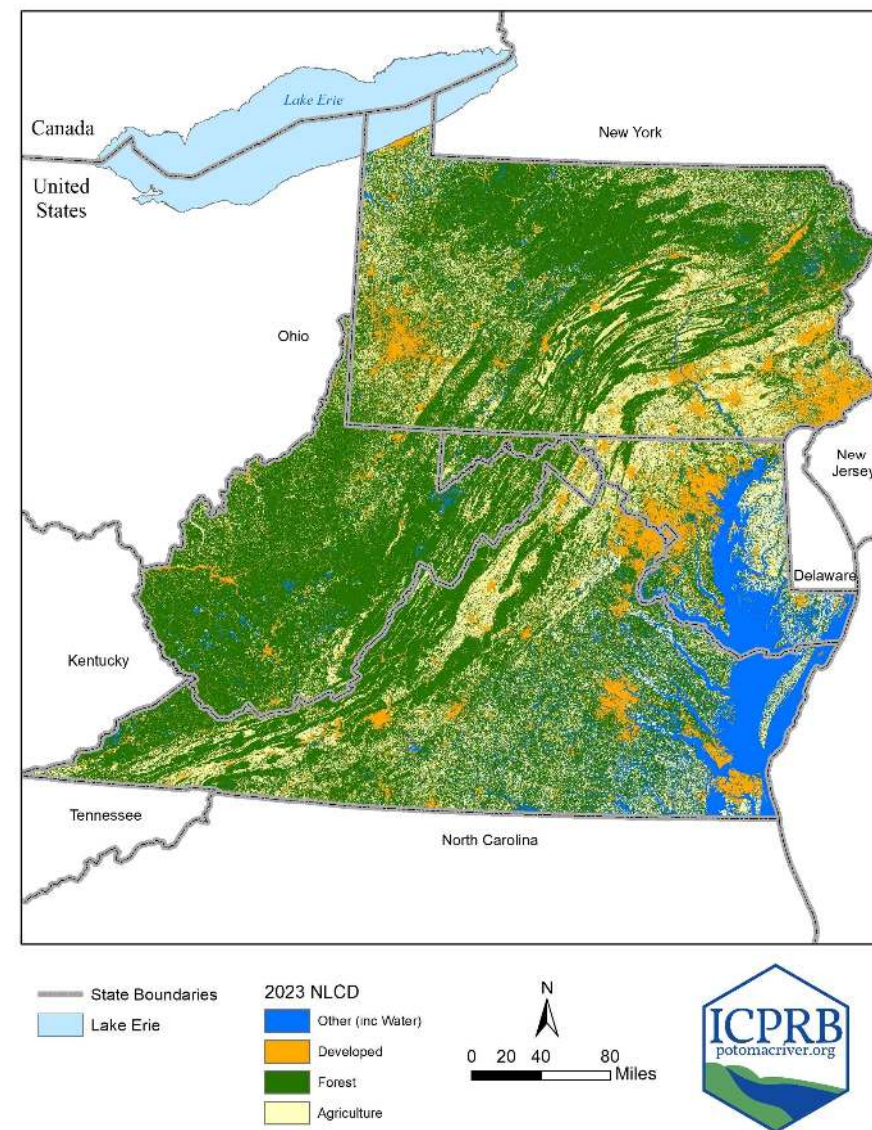


Opportunity areas include agricultural and forested lands in the study area that are not already protected (government owned, under easement, etc.) USGS. 2023. Annual National Land Cover Database (NLCD)

Land Use

Land Cover	Percent
Forest	57
Agriculture	20
Developed	12
Other	11

Data source: 2023 National
Land Cover Database (NLCD)





Forest (FOR)

Includes:

- **NLCD Code 41** – *Deciduous Forest*: Dominated by trees that shed leaves seasonally.
- **NLCD Code 42** – *Evergreen Forest*: Dominated by trees that retain leaves year-round.

These areas are typically used for **timber production, wildlife habitat, watershed protection, and recreation**. They are critical for maintaining ecological balance and water quality.



Agriculture (AG)

- **NLCD Code 71** – *Grassland/Herbaceous*: Natural or semi-natural grasslands, often used for grazing.
- **NLCD Code 81** – *Pasture/Hay*: Managed grasslands for livestock grazing or hay production.
- **NLCD Code 82** – *Cultivated Crops*: Areas used for growing crops like corn, soybeans, vegetables, etc.

These lands are primarily used for **food production, livestock grazing, and agricultural operations**. They may also include **rural open space** and **managed landscapes**.



Eight Metrics Used in the Prioritization

We evaluated eight landscape characteristics that are important for drinking-water protection. Each metric was normalized to a 0–100 scale and combined to create a cumulative prioritization score.

Metric	What it represents	Why it matters for drinking-water protection
 Distance from Waterways	Distance to streams and rivers.	Parcels closer to streams and rivers have a higher potential to impact drinking water quality.
 Percent Source Water Protection Area	Percent of parcel within a designated source-water protection area (e.g., EPA SWA).	Lands within source-water protection areas are a higher priority for conservation.
 Distance from Urban Areas	Distance to urban areas.	Parcels near urban centers are prioritized due to increased risks from runoff, road salt application, and spills.
 Karst Transmissivity	Karst transmissivity.	Karst landscapes have a higher potential for rapid contaminant transport to drinking water sources.
 Future Land Use (2050)	Projected land use (e.g., agricultural, forest, urban, other) for 2050.	Future land use influences the potential for contaminant sources and the long-term risk to drinking water quality.
 High-Quality Streams	Proximity to high-quality streams (e.g., high biological condition).	Parcels near high-quality streams are a higher priority for protection due to their ecological importance and role in drinking water supplies.
 Floodplain/Riparian Areas	Proximity to 100-year floodplains and riparian areas.	Floodplains and riparian areas help filter pollutants, reduce runoff, and maintain water quality.
 Opportunity Area in Parcel	Percent of parcel that is agricultural or forested land (not currently protected).	Parcels with a larger share of opportunity area have greater potential for conservation and protection of drinking water quality.

Normalized Metric Values (0–100)

Each metric was scaled from 0 to 100, where higher values indicate a greater opportunity for drinking-water protection.

**Lowest priority
for conservation**

**Highest priority
for conservation**

0



100

General direction for each metric

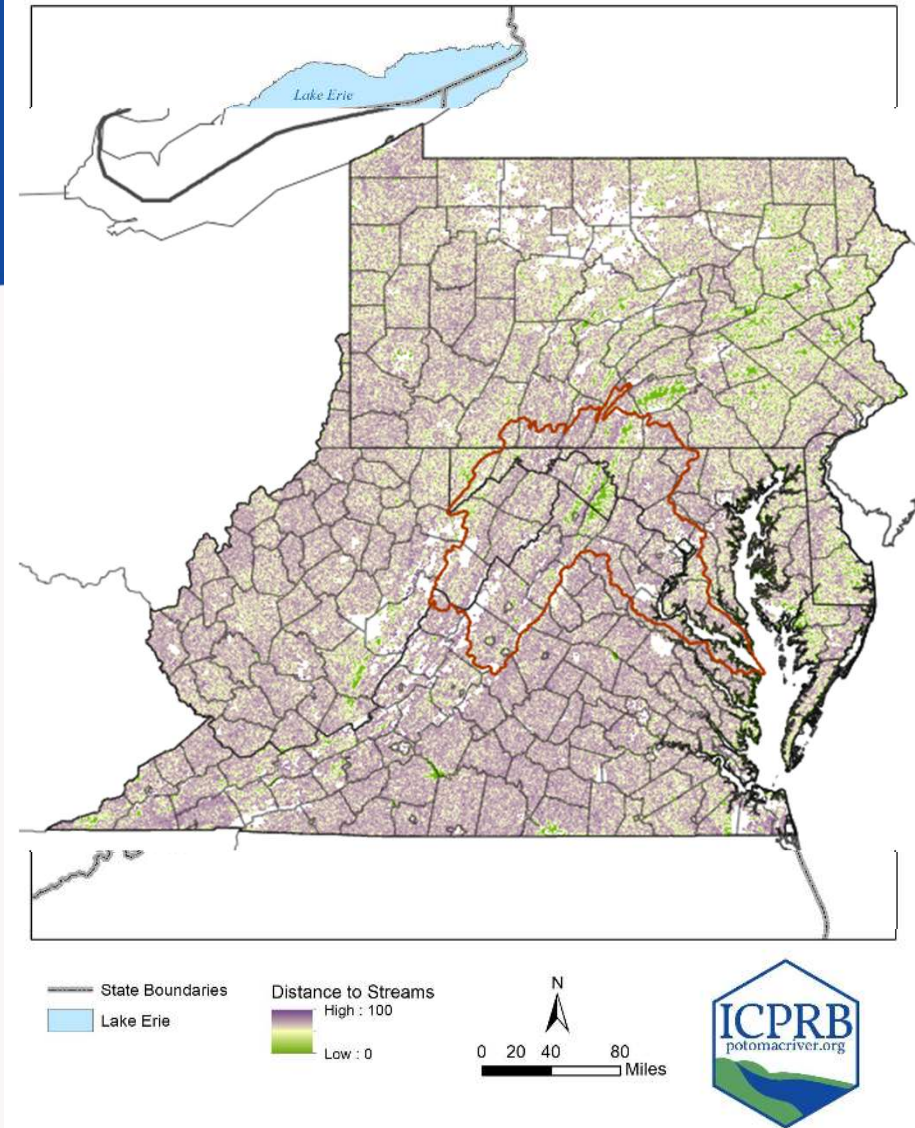
Metric values were calculated so that:

	Distance from Waterways	Longer distance	→	Shorter distance (higher priority)
	Percent Source Water Protection Area	Lower percent in protection area	→	Higher percent in protection area
	Distance from Urban Areas	Longer distance	→	Shorter distance (higher priority)
	Karst Transmissivity	Lower transmissivity	→	Higher transmissivity (higher priority)
	Future Land Use (2050)	Other/Urban	→	Agriculture/Forest (higher priority)
	High-Quality Streams	Longer distance	→	Shorter distance (higher priority)
	Floodplain/Riparian Areas	Longer distance	→	Shorter distance (higher priority)
	Opportunity Area in Parcel	Lower percent ag or forest	→	Higher percent ag or forest (higher priority)

Distance from Waterway

Parcels closer to streams and rivers are prioritized due to higher potential to impact water quality

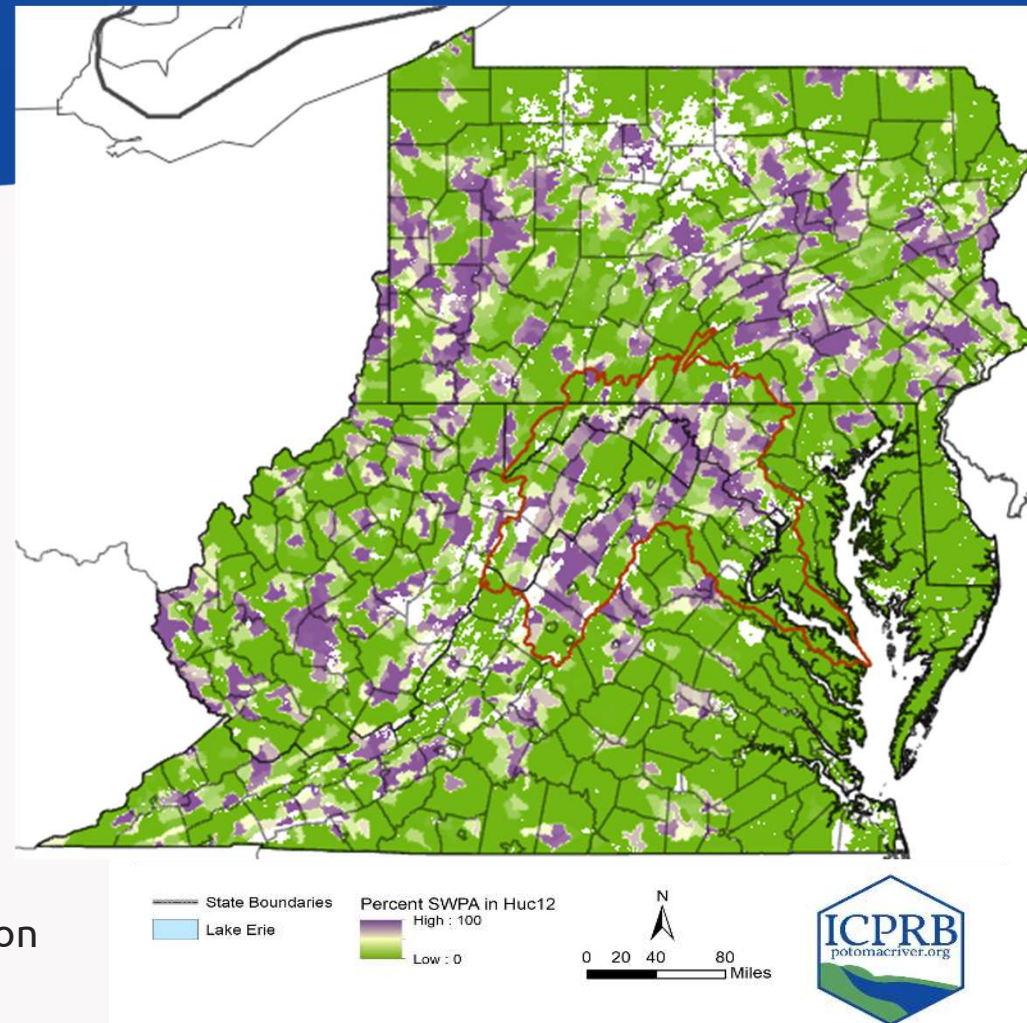
Data Source: US EPA. 2024. ATTAINS Assessments.
<https://www.epa.gov/waterdata/attains>



% Source Water Protection Area in HUC12*

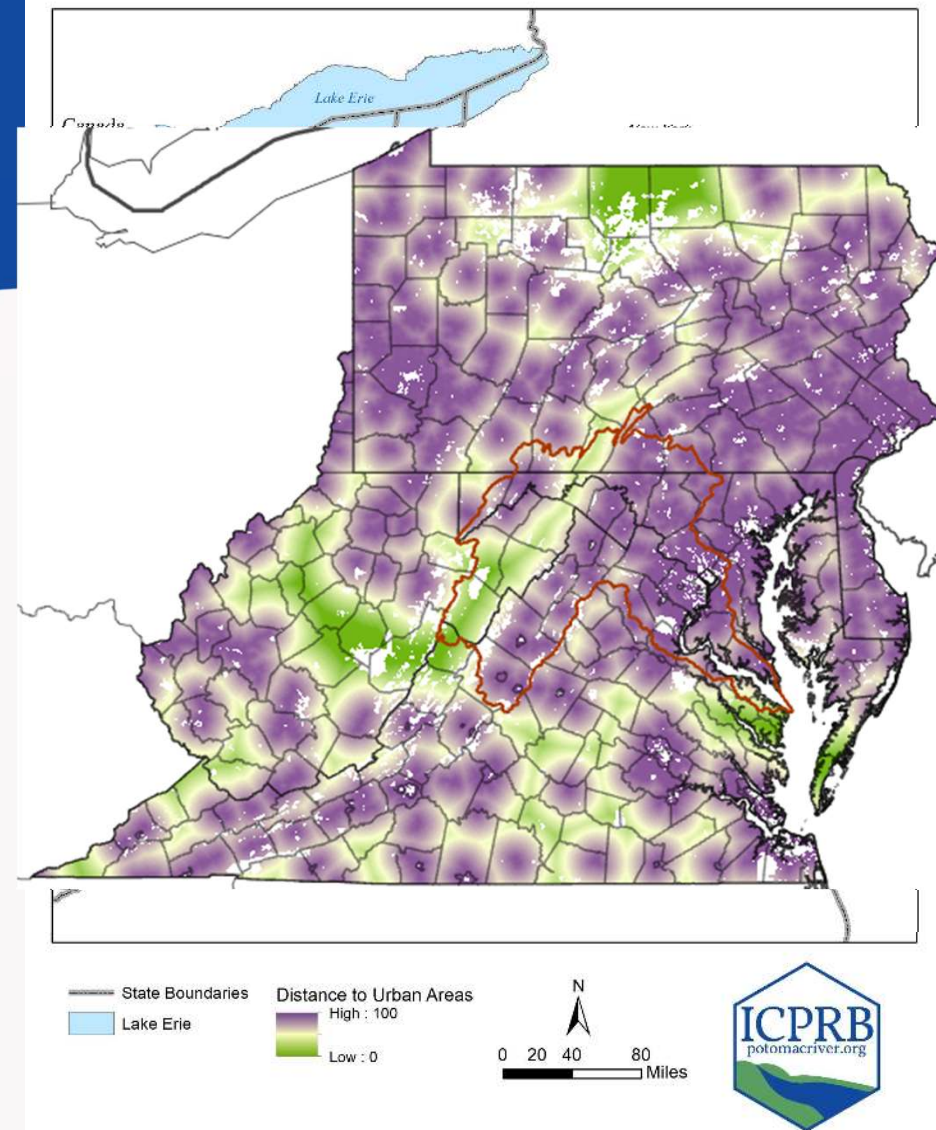
Areas identified as important for Source Water Protection

Data Source: US EPA. 2023. Surface water Source Protection Area (SPA) for each HUC12 unit in the NHDPlus version 2.1 National Watershed Boundary Dataset snapshot.



Distance from Urban Areas

Areas near urban zones are prioritized due to risks like road salt, spills, and runoff.

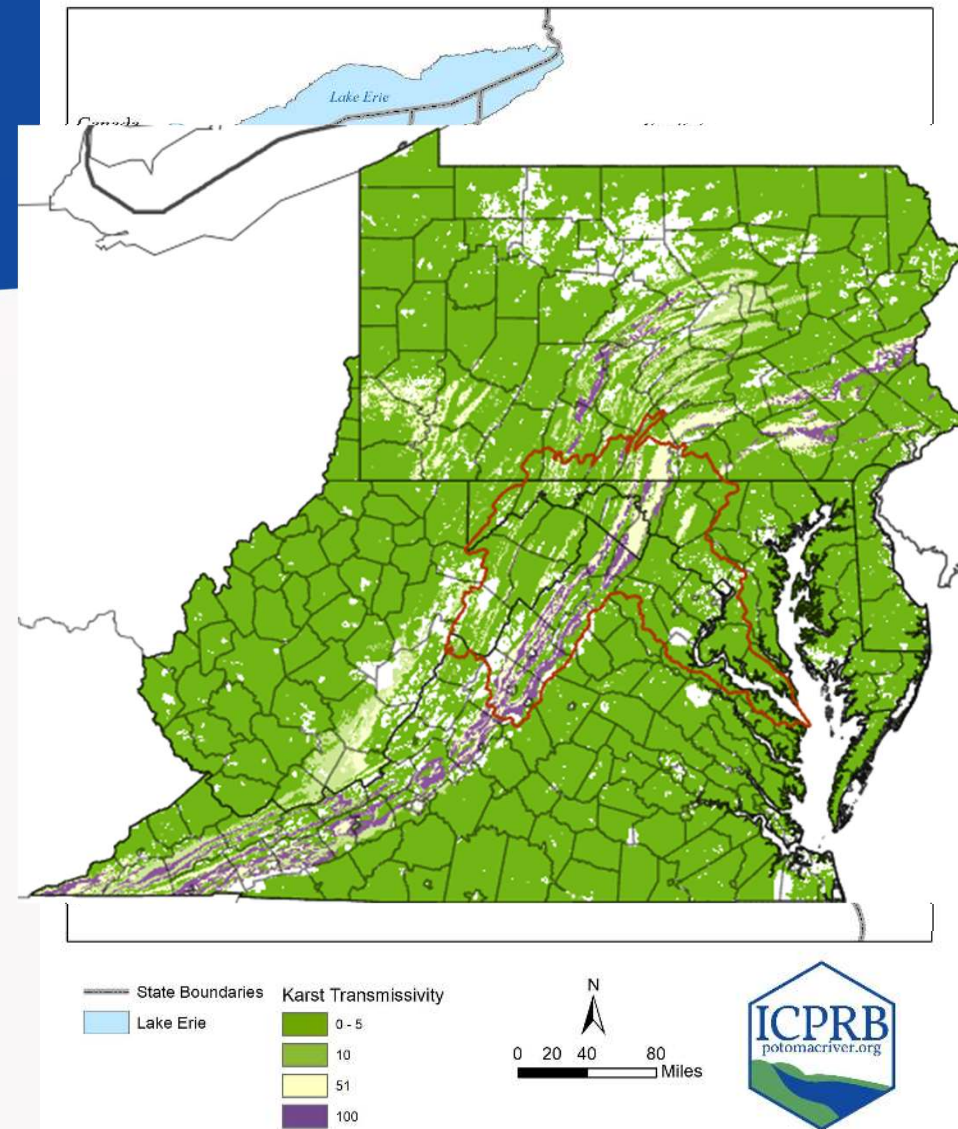


Data Source: TIGER/Line Shapefile, 2020 Census Urban Areas / prepared by the U.S. Census Bureau, 2020.

Karst Transmissivity

Areas with high karst transmissivity are prioritized because they allow faster contaminant transport.

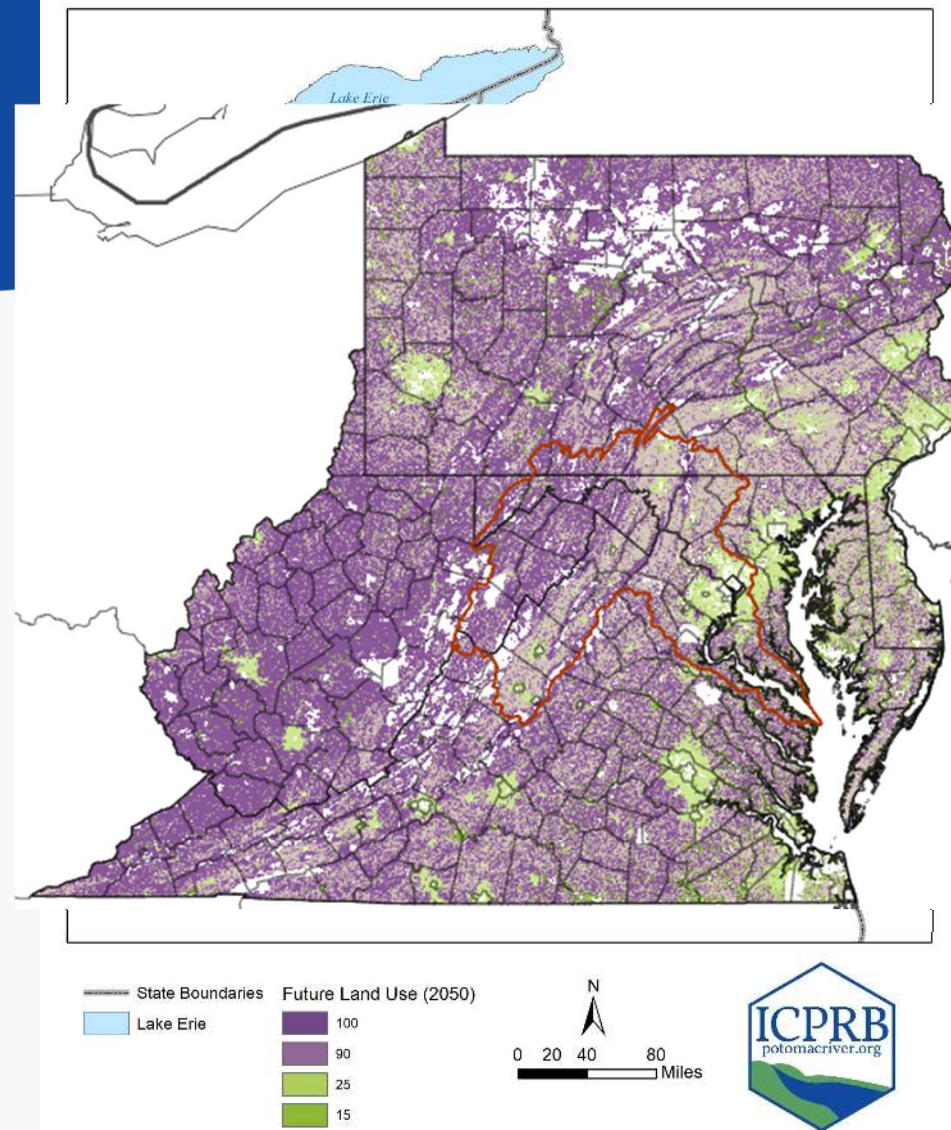
Data Source: Weary, D.J., and Doctor, D.H., 2014, Karst in the United States: A digital map compilation and database: U.S. Geological Survey Open-File Report 2014-1156, 23 p., <http://dx.doi.org/10.3133/ofr20141156>.



Future Land Use

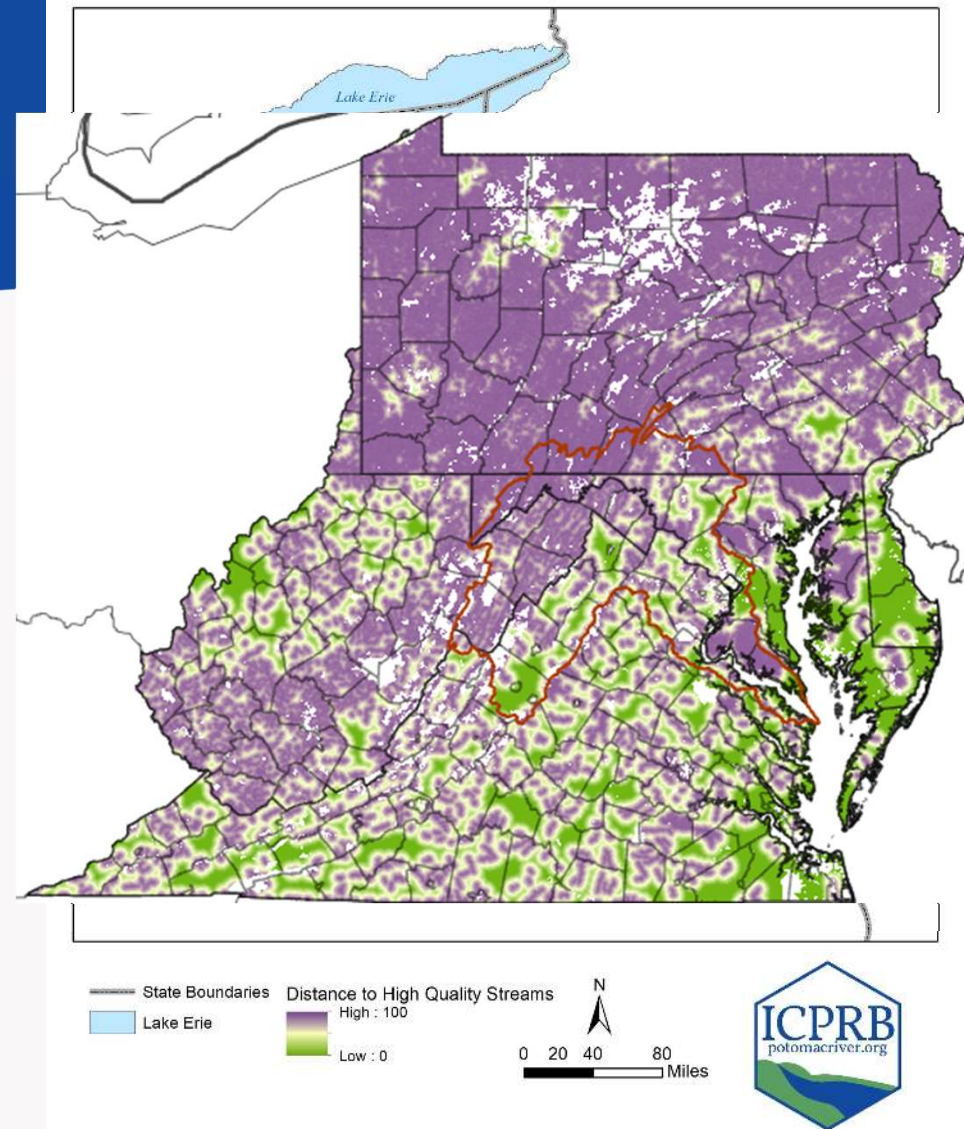
Future land use, where major land use categories are given priority rankings, with forest and then ag being the highest priority for conservation

Data Source: USGS Conterminous United States Land Cover Projections - 1992 to 2100. Sohl, TL et al., 2018; 250m scale



High Quality Streams

Protects existing high-quality water bodies by prioritizing nearby parcels.

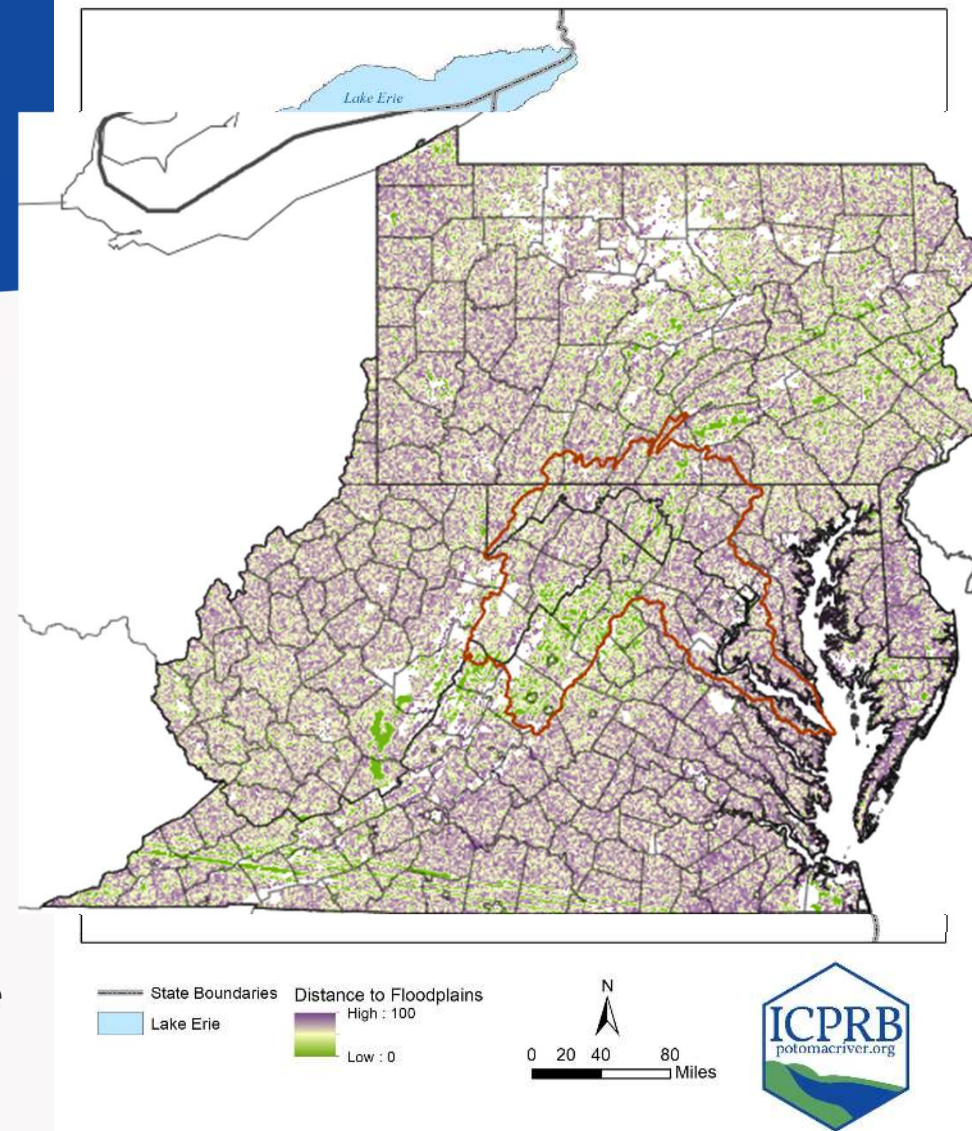


Data Source: US EPA. 2024. ATTAINS Assessments.
<https://www.epa.gov/waterdata/attains>

Floodplains*

Areas closer to the floodplains received a higher priority because they are more hydrologically connected to the surface waters, making them vulnerable to events that may impact downstream drinking water quality.

Data Source: Abood, Sinan A.; Spencer, Linda; Wieczorek, Michael. 2022. U.S. Forest Service national riparian areas base map for the conterminous United States in 2019. Fort Collins, CO: Forest Service Research Data Archive.
<https://doi.org/10.2737/RDS-2019-0030>

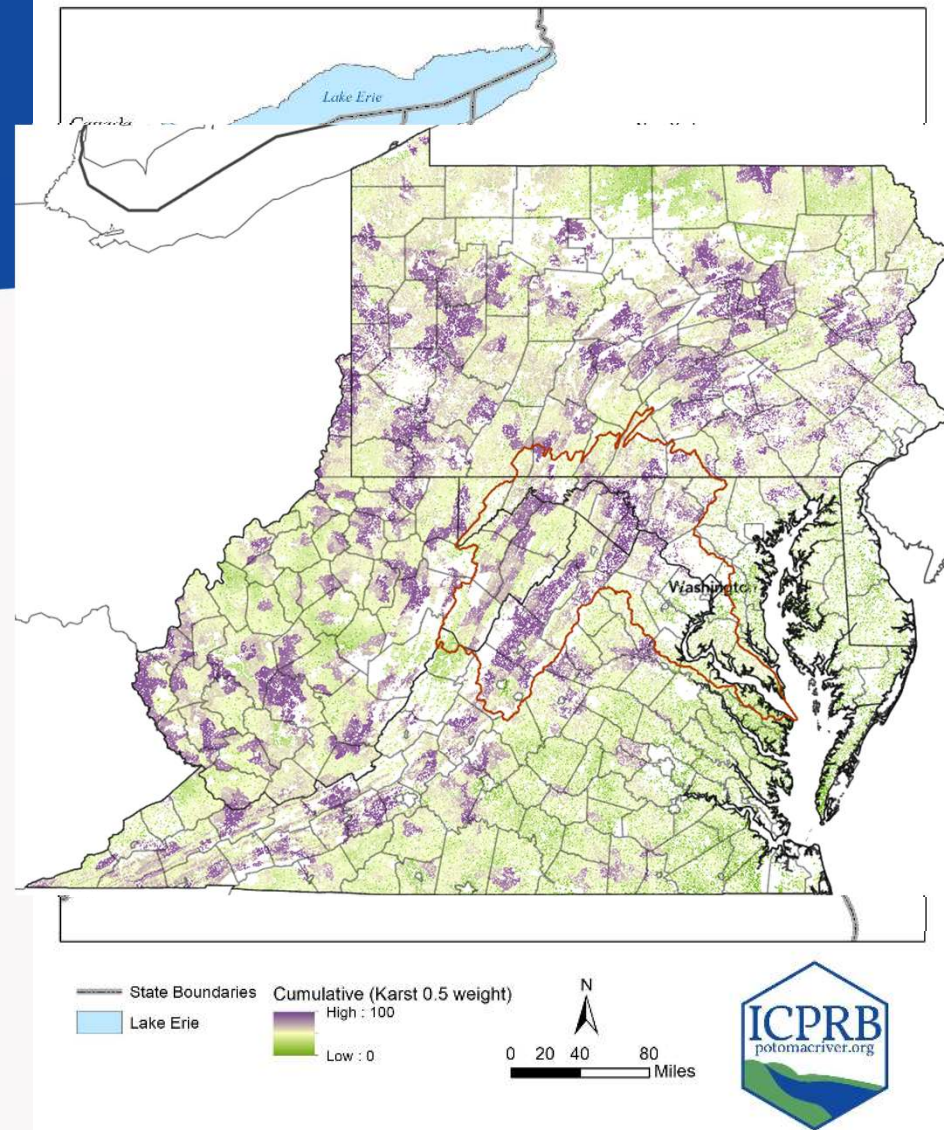


Metric Correlation

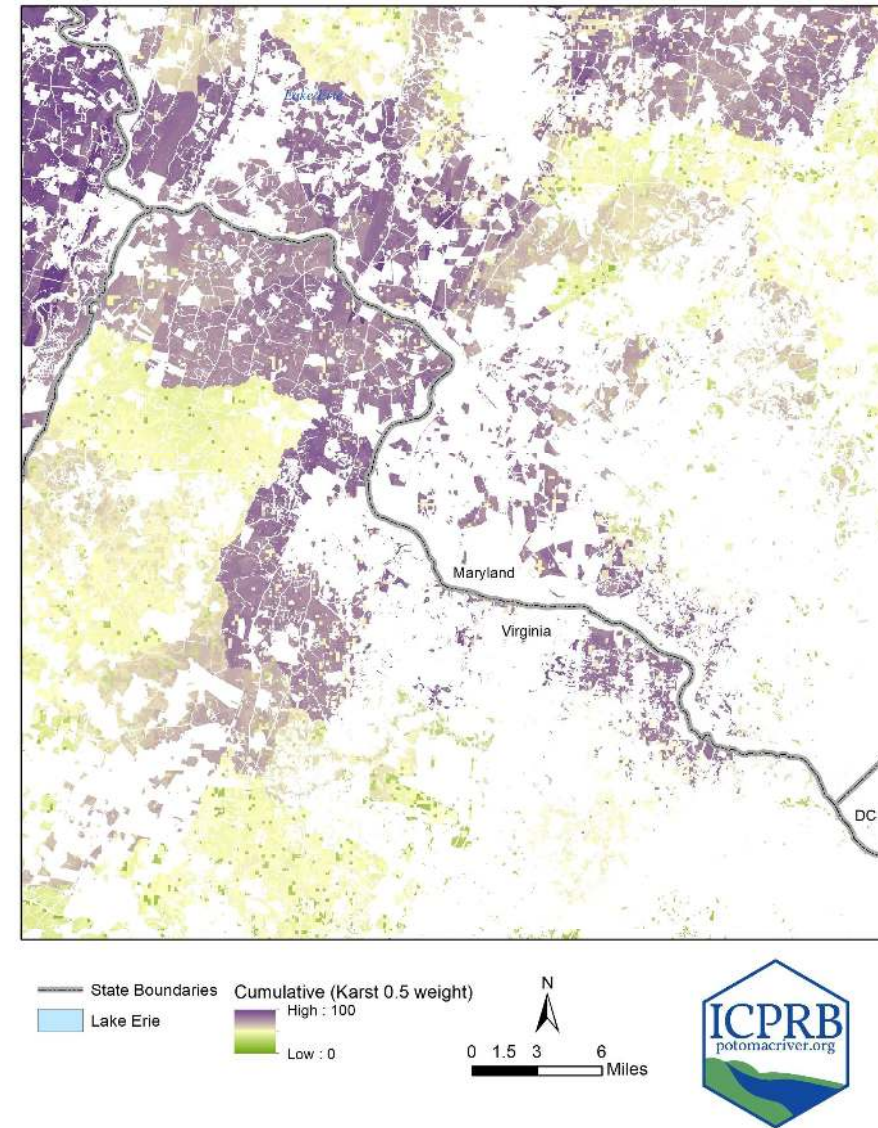
Layer	Waterways	High Quality Streams	Floodplains	% HUC in SWPA	Karst	Urban Area	Future Land Use
Distance from Waterways	1	0.00	0.34	-0.05	-0.07	-0.06	0.01
Distance from High Quality Streams		1	0.01	0.13	-0.10	0.01	0.07
Distance from Floodplains			1	-0.06	-0.11	-0.02	-0.02
Percent HUC in SWPA				1	0.13	0.15	0.01
Karst Transmissivity					1	0.13	-0.03
Distance from Urban Areas						1	-0.14
Future Land Use (2050)							1

Cumulative Prioritization, Grid

All 7 metrics summed using equal weights
(except Karst) and normalized 0-100.

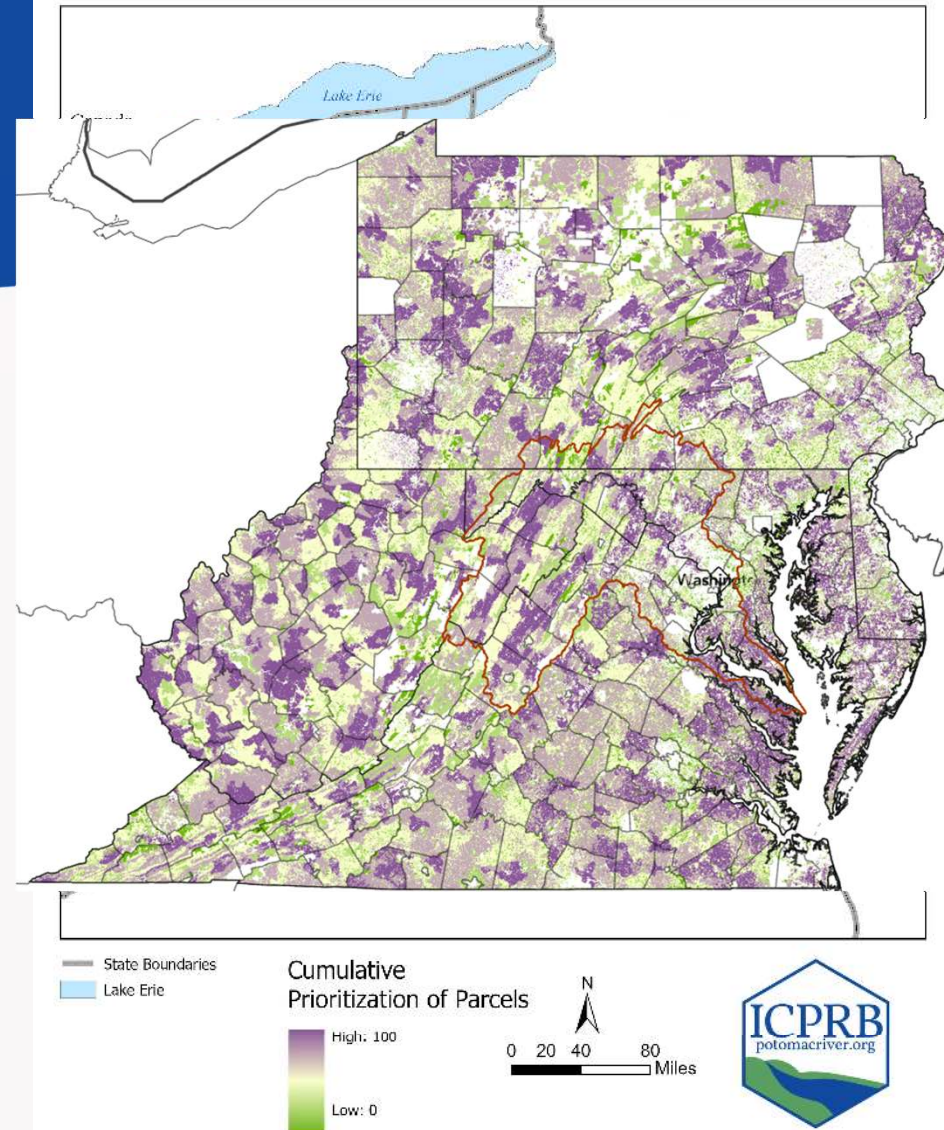


Cumulative Prioritization, Zoomed In

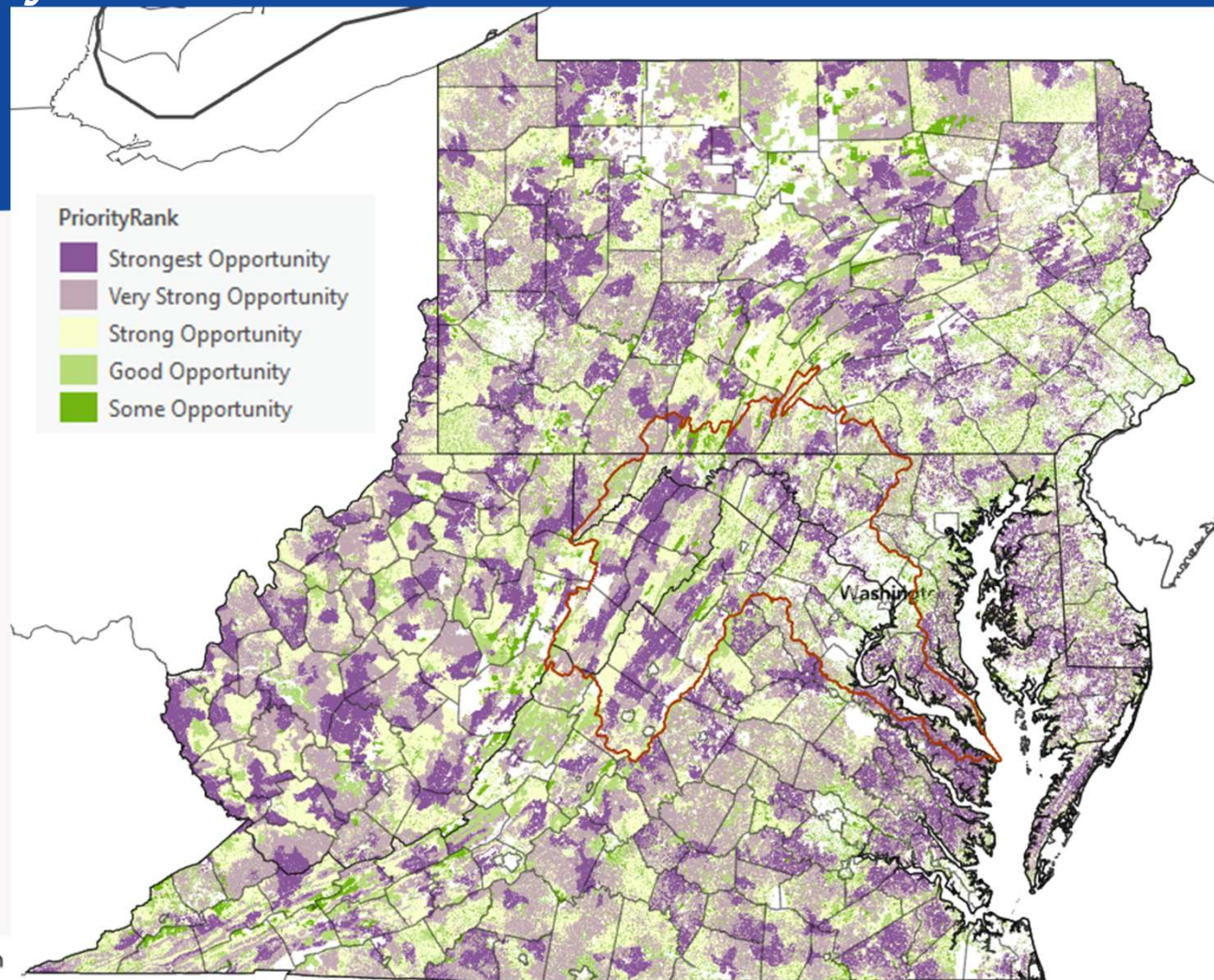


Cumulative Prioritization, Parcels

Cumulative prioritization at the parcel scale with an additional metric that gives higher priority to parcels with more opportunity area within them.



“High Priority” Parcels, Study Area



Parcels ranked using a natural breaks classification method for the entire study area

High priority acres / Call to Action

Study area and County Scale

Jurisdiction	County or County Equivalents (#)	High Priority Areas (Counties, Acres)	High Priority Areas (Study Area, Acres)
District of Columbia	1	53	0
Maryland	24	756,151	323,092
Pennsylvania	67	4,369,724	3,638,808
Virginia	133	3,249,311	1,866,894
West Virginia	55	2,988,571	2,391,232

- Users are encouraged to obtain the geospatial layers and identify local high-priority areas based on their own threshold of interest.
- GIS data are available upon request.
- ICPRB is available individually to discuss how you might use this data and talk about your specific areas of interest.



Scan to request the data
or learn more!

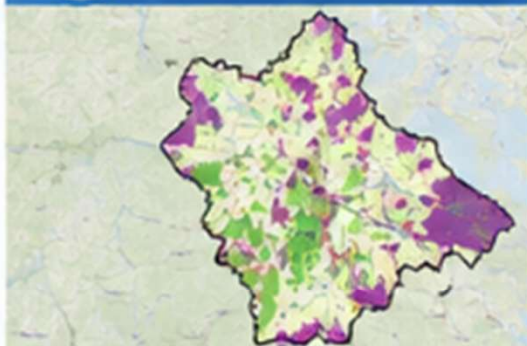


From Mapping to Application

One regional dataset. Different decisions.



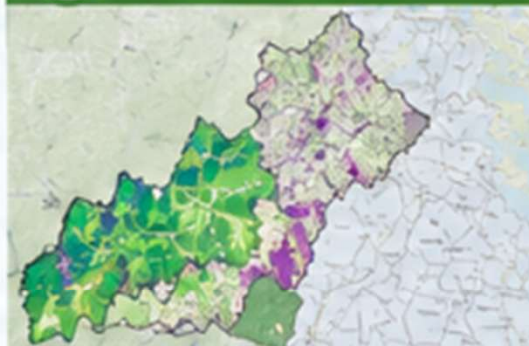
LOCAL PLANNING
Prince William County



Where do local priorities and drinking-water opportunities overlap?



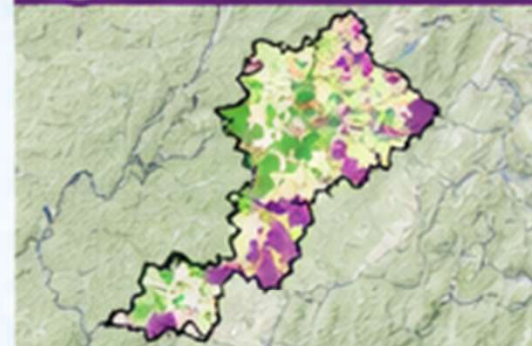
PROGRAM TARGETING
Virginia NRCS



Where can source-water information support program targeting?

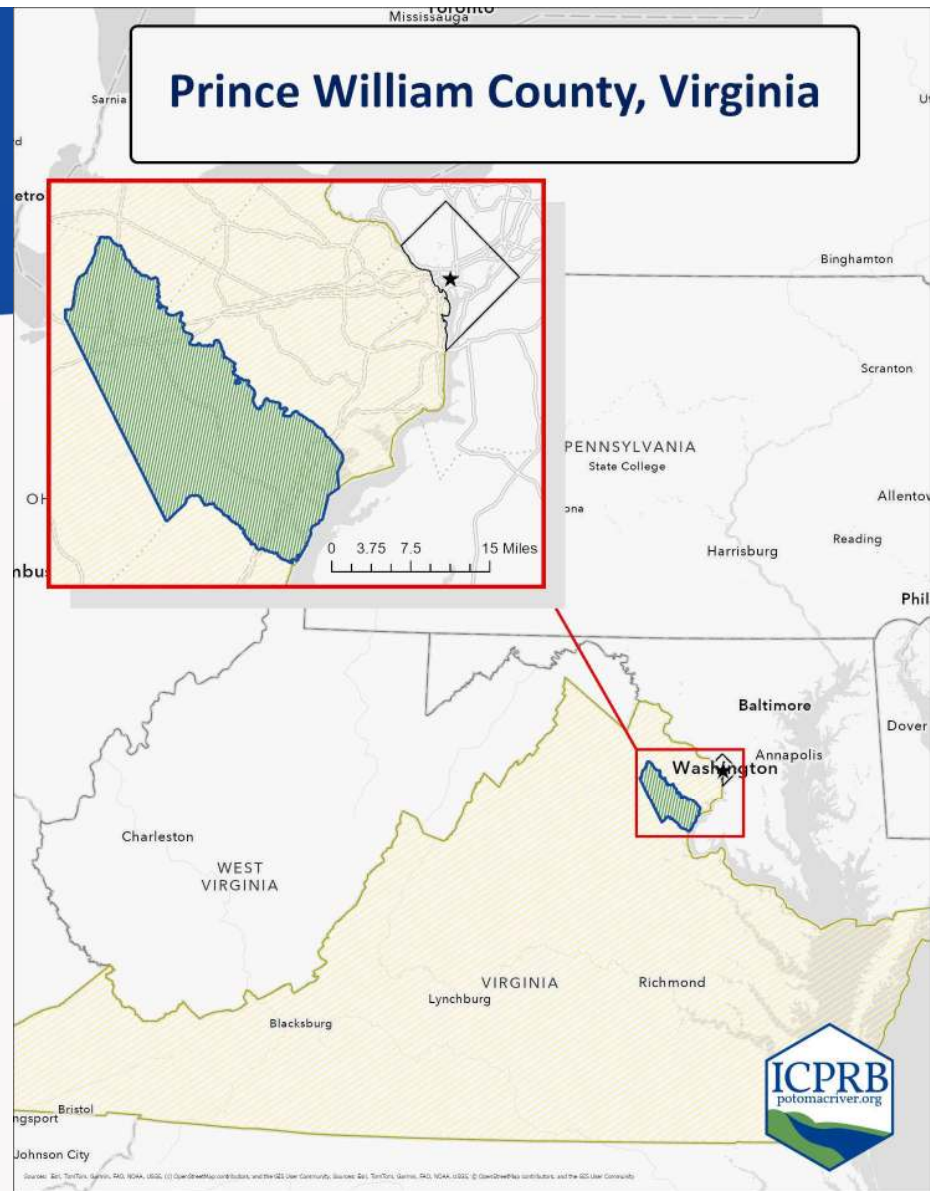
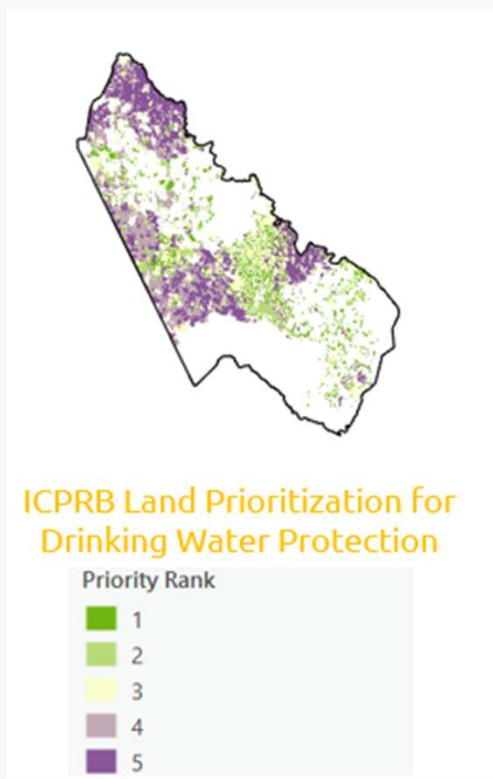


PROJECT EVALUATION
WV Forest Legacy

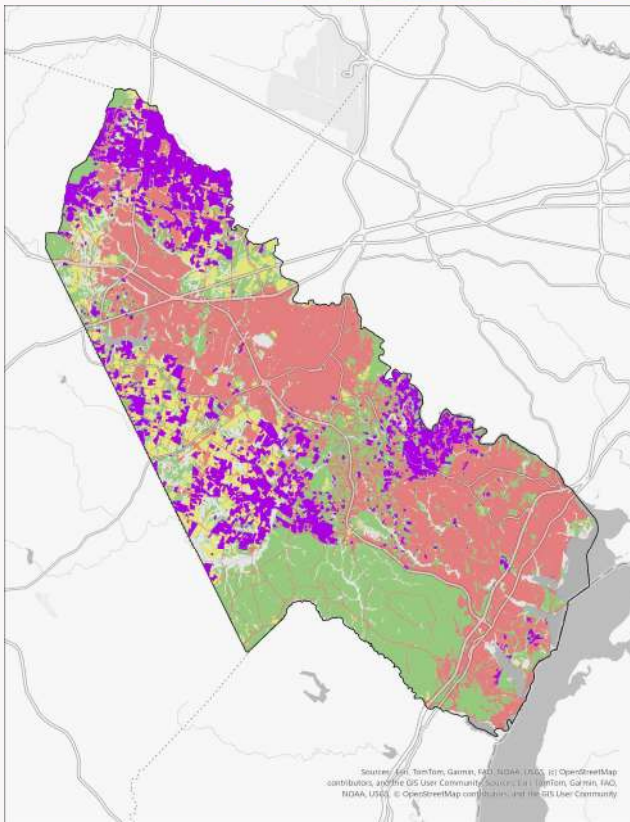


What drinking-water benefits can a proposed land-protection project provide?

Water Protection: Prince William Conservation Alliance



Prince William: Turning the Overlay into Actionable Information



High-Priority Areas by Land Use Type

Prince William County



FOREST

13,265 acres

16% of forest area
in high priority



AGRICULTURE

11,542 acres

27% of agricultural area
in high priority



DEVELOPED

500 acres

0.5% of developed area
in high priority



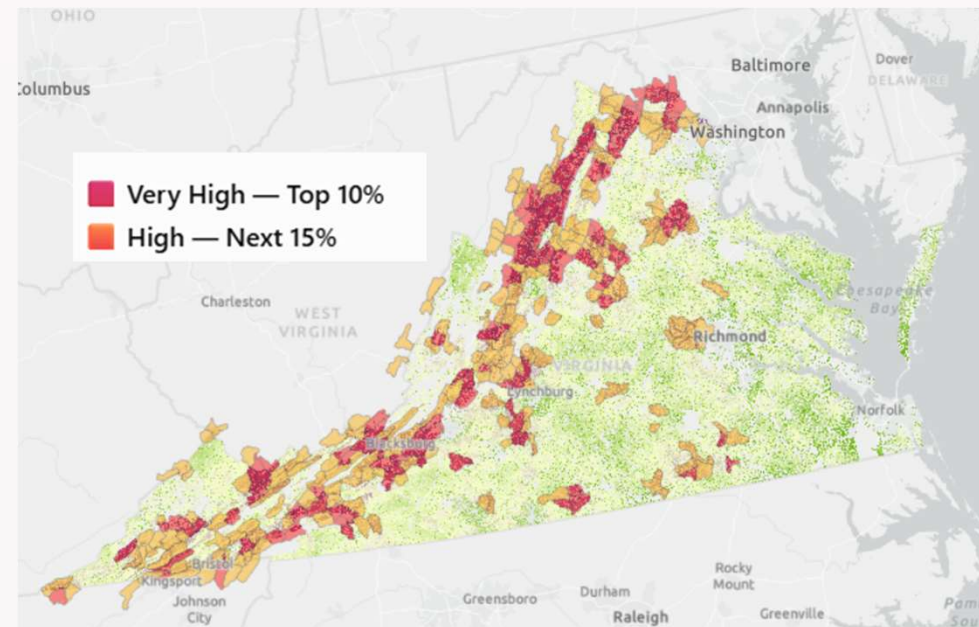
Agricultural lands had the **greatest proportion** of their area identified as high priority, while forests accounted for the **largest number of high-priority acres**.

The analysis identified where local land priorities and drinking-water protection priorities reinforce one another—and quantified those opportunities by land-use type.



Virginia NRCS: Supporting Source-Water Program Targeting

- **1,267 HUC12s**
Prioritization results summarized across Virginia watersheds
- **Complete ranking provided**
Allows NRCS to select thresholds appropriate to its programs
- **Demonstration categories**
Top 10% — Very High
Next 15% — High



Translate drinking-water priorities into the geography used by an existing program to help inform where resources could be targeted.

WV Forest Service: Evaluating a Proposed Project

The West Virginia Division of Forestry asked ICPRB to evaluate the drinking-water source-protection benefits associated with lands proposed for the South Branch Valley Forest Legacy Project.

- Compared proposed project lands with ICPRB's land-prioritization results
- Evaluated the project through a drinking-water source-protection lens
- Provided a source-water assessment and letter of support for the Forest Legacy proposal
- Identified drinking-water benefits that could complement the project's other forest, habitat, and land-protection objectives

The tool can help demonstrate an additional public benefit of a proposed land-protection project: protecting drinking-water sources.



Questions/Discussion



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