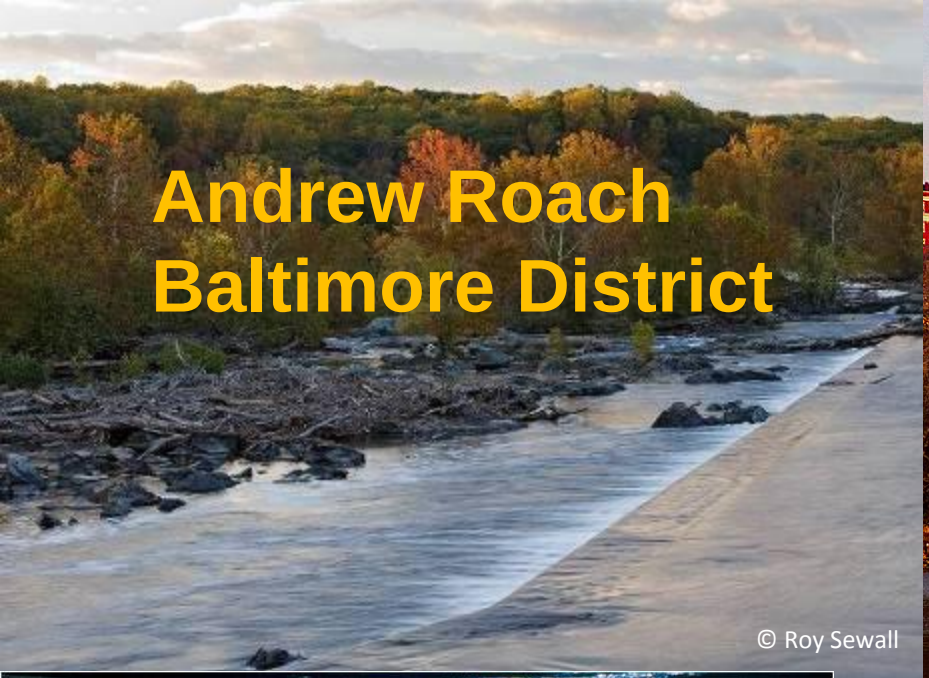
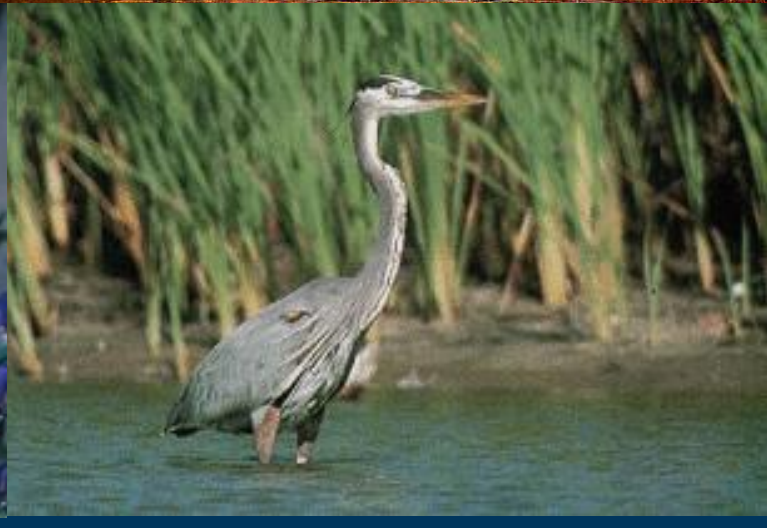




Middle Potomac River Watershed Assessment:
Potomac River Sustainable Flow and Water Resource Analysis
March 31, 2015

2009-2012 Partnership

The Middle Potomac River Watershed Assessment was a multi-agency partnership:

- U.S. Army Corps of Engineers (USACE)
- The Nature Conservancy (TNC)
- Interstate Commission on the Potomac River Basin (ICPRB)
- National Park Service

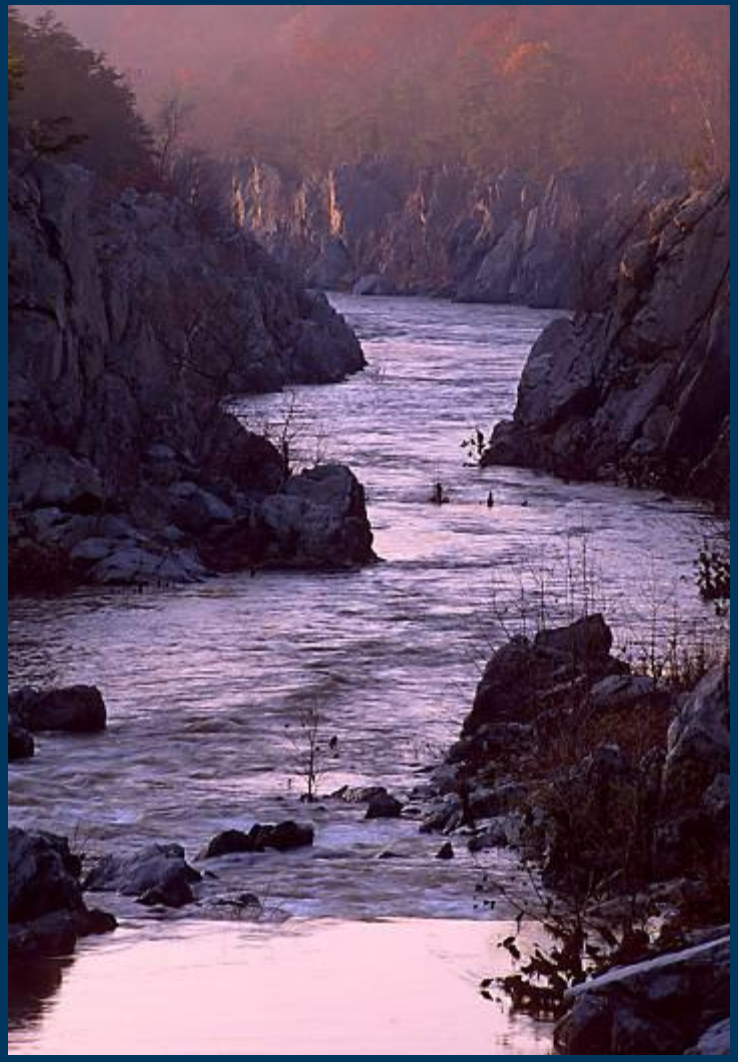
Purpose of project

To develop information and tools that enable the Potomac watershed jurisdictions to protect

environmental flows,

defined as the flow of water that **sustains healthy river ecosystems** and the **goods and services** that **people** derive from them.

Why protect environmental flows in the Potomac watershed?



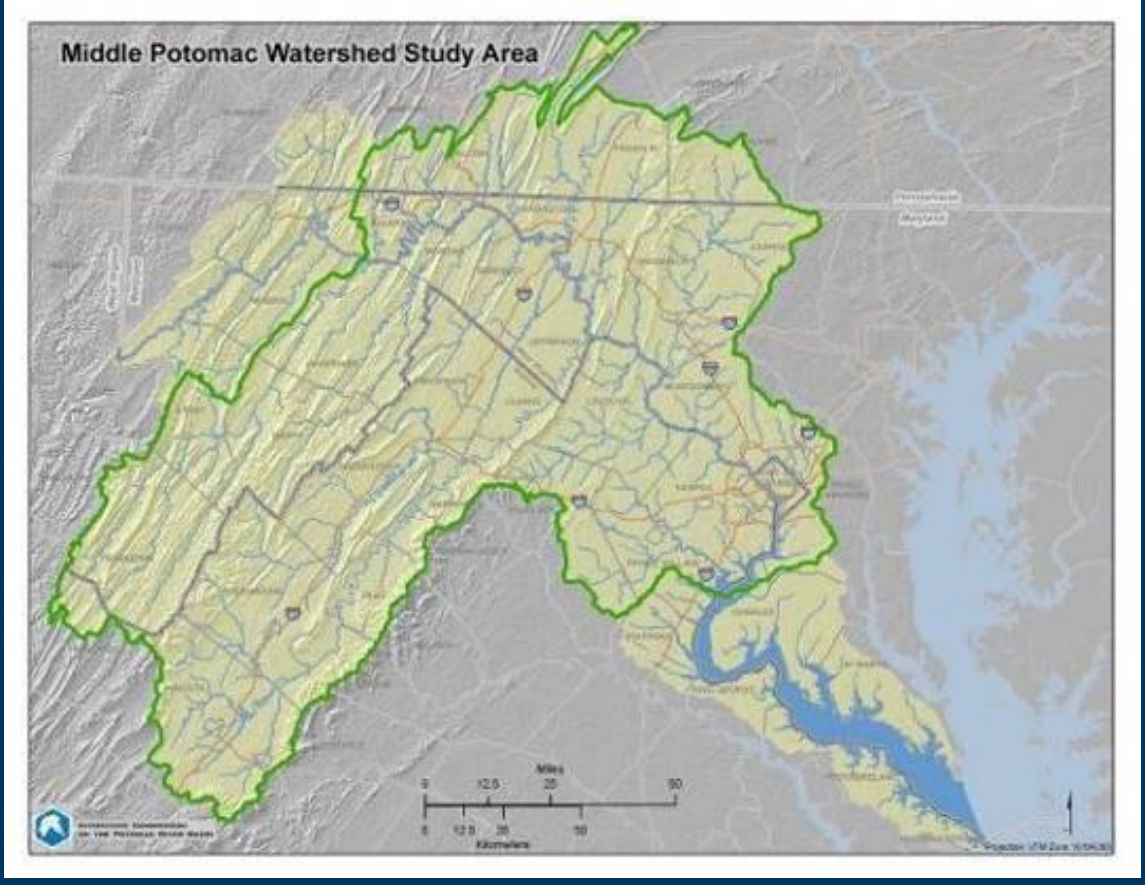
- **Scientific foundation** to minimize potential future environment/water use conflicts in the basin

- **Common approach** to bring together watershed jurisdictions for a **basin-wide planning and management** effort

Main project components

- Identify ecological needs of river flow-dependent species
- Assess projected needs for water and land use
- Determine effects of current and future human activities on the basin's hydrology
- Examine how these might be balanced and mitigated to prevent water use conflicts and ecological degradation over the long-term

Study Area



Geography:

- 383 mile mainstem
- 14,670 sq. mi.
- MD, VA, PA, WV and DC

Land use:

- 58% forested
- 32% agriculture
- 5% developed

Population

- 5.8 million (2005)
- 81% urban
- 19% rural
- 0.7% agricultural
- 4.35 million in DC region

Two Methodologies

1) Small streams

- An adaptation of the Ecological Limits of Hydrologic Alteration (ELOHA) approach (Poff et al. 2010)
- Estimate current and future human water uses and watershed impacts on flows
- Quantify relationships between flow alteration and aquatic ecosystem health
- Provide baseline information and analyses to support water use decision making

2) Large rivers

- Flow-ecology hypotheses developed for key species from literature review and expert judgment
- Hypotheses translated into flow component needs
- Flow statistics identified for flow components, and calculated
- Review with stakeholders

Small Stream Methodology

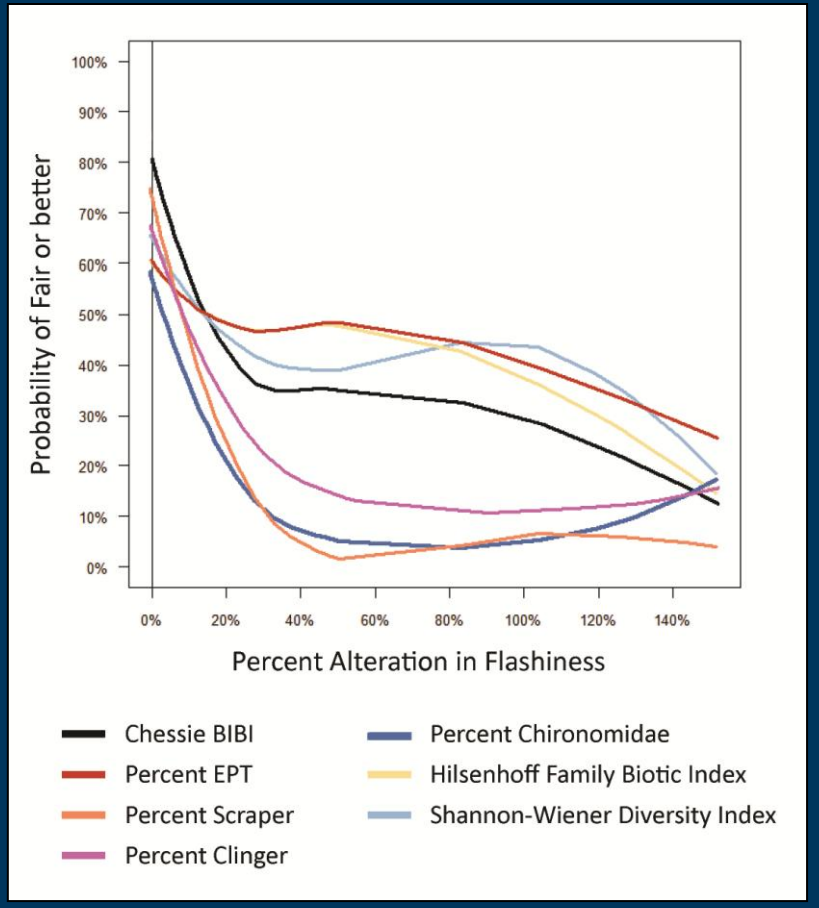
- Stream macroinvertebrates – biological response variable
- Streamflow and flow alteration simulated at biological sampling sites (747)
  - Chesapeake Bay watershed model (HSPF), VA DEQ WOOOMM routing module
- 6 flow metrics and 7 biometrics used to generate flow alteration – ecological response relationships

Small Streams: Flow Alteration and Ecosystem Health

Alteration in these aspects of the flow regime is associated with ⇨	Degradation in:	Possible mechanisms that could explain the association are:
• Higher maximum flows • Shorter duration of high flows • Shorter duration of low flows • More low flow pulses • More high flow pulses • Faster rates of change in flow (flashier)	All family-level macroinvertebrate metrics tested and the Chessie BIBI multi-metric index	• Scour of periphyton and organic matter (food) during high flows • Catastrophic accidental drift during floods • Displacement from habitat and stranding when waters recede • Physical alteration of stream bed habitat • Indirect effects of poor runoff water quality (sedimentation, pollutants) • Interruption of development or dispersal cues
• Lower middle and low magnitude flows, includes median flow, August median flow, summer Q85 flow, baseflow index, 3-day and 1-day annual minima, and 7Q10	None of the biometrics	• Swift recovery due to adaptations to low flow (drought resistant or diapausing life stages) • Multi-voltine (short) life cycles • High mobility, able to find refugia and later recolonize

Small Streams: FA-E

Conditional probability plots of flow alteration-ecological response (FA-E) relationships for positive alteration (increase) in flashiness



Potential Usage of Information and Outcomes

- Inform water allocation decisions
- Inform water withdrawal/permit decisions
- Inform land use decisions
- Develop hydroecological monitoring plan
- Indicates how flow alteration will impact ecological communities

Small Stream Information Needs

- Limited availability of information on flow requirements for aquatic species compared to velocity requirements
- Investigate flow-ecology relationships with different stream classification factors
- Investigate reliability of data at extreme ends of FA-E curves
- Confounding influences of non-flow factors impacting ecosystems and biological communities
- Efficacy of best management practices for low and high flows
- Ability of hydrologic model to incorporate groundwater withdrawals

Potential Next Steps

- Basin Comprehensive Water Resources Plan
- Development of a computer-based evaluation tool to evaluate implications of land and water use management decisions
- Build consensus on acceptable levels of biological degradation resulting from changes in the flow regime

For more information

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For more information, visit potomacriver.org/sustainableflows