



Brook Trout Restoration Prioritization



Michael Evans, PhD - Deputy Director, Conservation Innovation Center
Charlotte Weinstein - Geospatial Data Analyst
Alicia Sabatino - Web GIS Specialist



Chesapeake
Conservancy

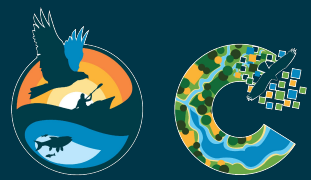


Conservation
Innovation Center

To conserve and restore the natural
and cultural resources of the
Chesapeake Bay watershed for the
enjoyment, education and inspiration
of this and future generations.



Goal: Make brook trout habitat restoration as effective as possible

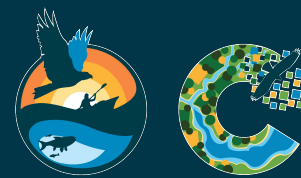
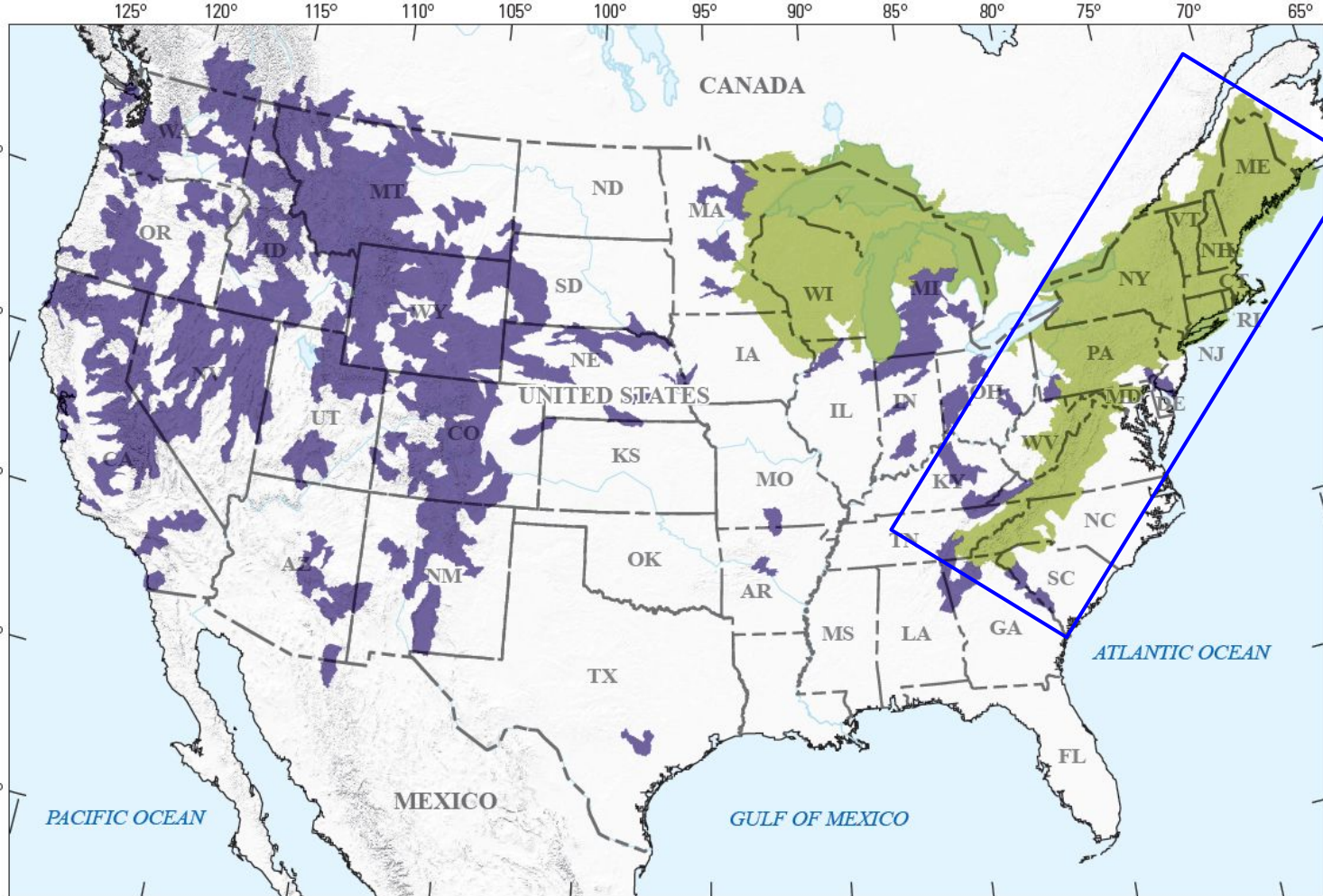


Objectives

1. Quantify stream sensitivity to restoration actions (buffer planting & forest conservation)
2. Identify stream reaches with the greatest restoration potential
3. Measure changes in restoration opportunities and priority with Hyper-Resolution Hydrography Data
4. Build a restoration scenario web mapping application



Photo by Peter Abdu
remotecaptures@gmail.com



Brook Trout Native
range in Northeastern
United States

 Introduced species range
 Native species range

Shaded relief from U.S. Geological Survey, 2016
Albers Equal-Area Conic, U.S. Geological Survey contiguous United States projection
North American Datum of 1983

0 200 400 600 800 1,000 MILES
0 200 400 600 800 1,000 KILOMETERS



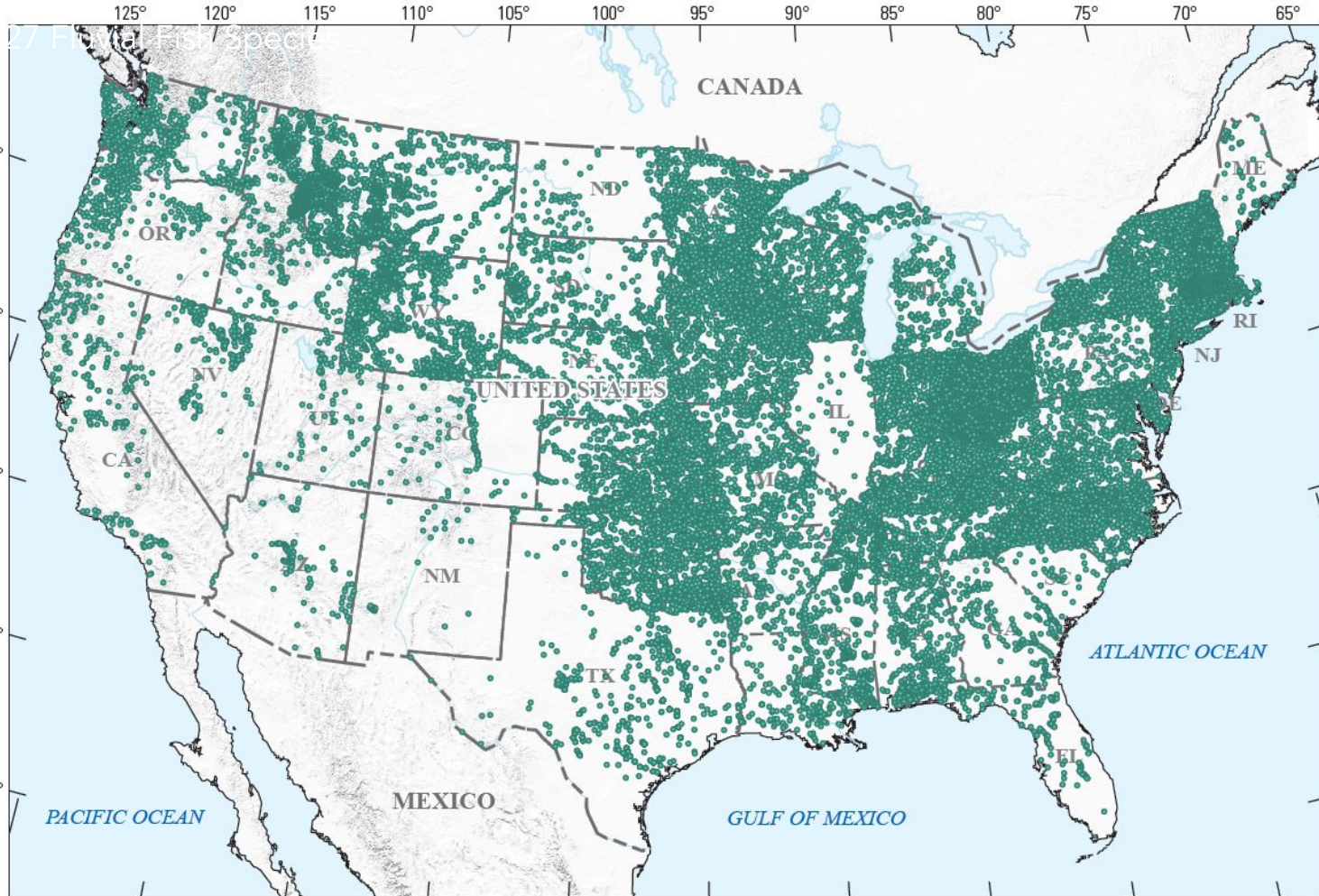
Science Analytics and Synthesis Program

Prepared in cooperation with Department of Fisheries and Wildlife, Michigan State University

Developing Fluvial Fish Species Distribution Models Across the Conterminous United States—A Scientific Framework to Support Management and Conservation

Associated data for this publication:

Wieferich, D.J., McKerrow, A., Cooper, A.R., Yu, H., Ross, J., and Infante, D.M., 2022, Aquatic Gap Analysis Project (Aquatic GAP) aquatic species distribution modeling on the National Hydrography Dataset Plus version 2.1: U.S. Geological Survey data release, <https://doi.org/10.5066/P94XM9XV>.



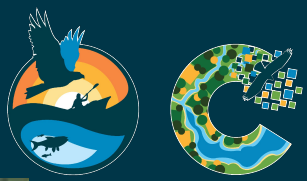
Aquatic Gap Analysis Program

- 35,918 Samples
- 227 Fluvial Fish Species

Shaded relief from U.S. Geological Survey, 2016
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0 200 400 600 800 1,000 MILES
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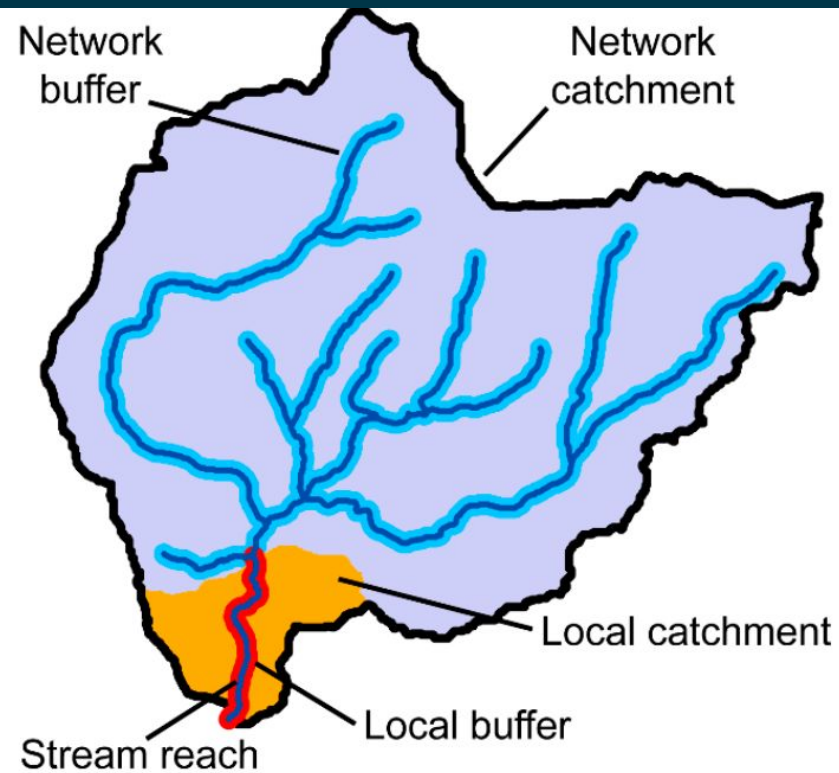
Aquatic Gap Analysis Program



Occurrence
Probabilities

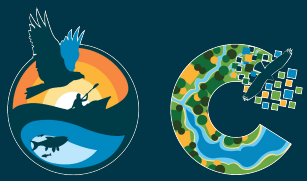


NHD Stream Segment Attributes



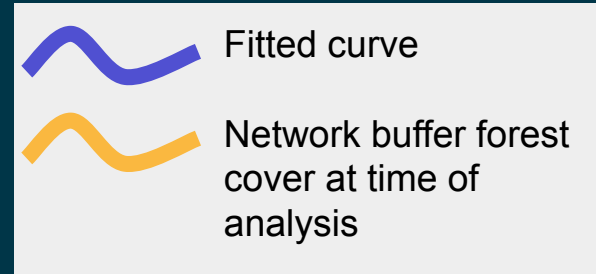
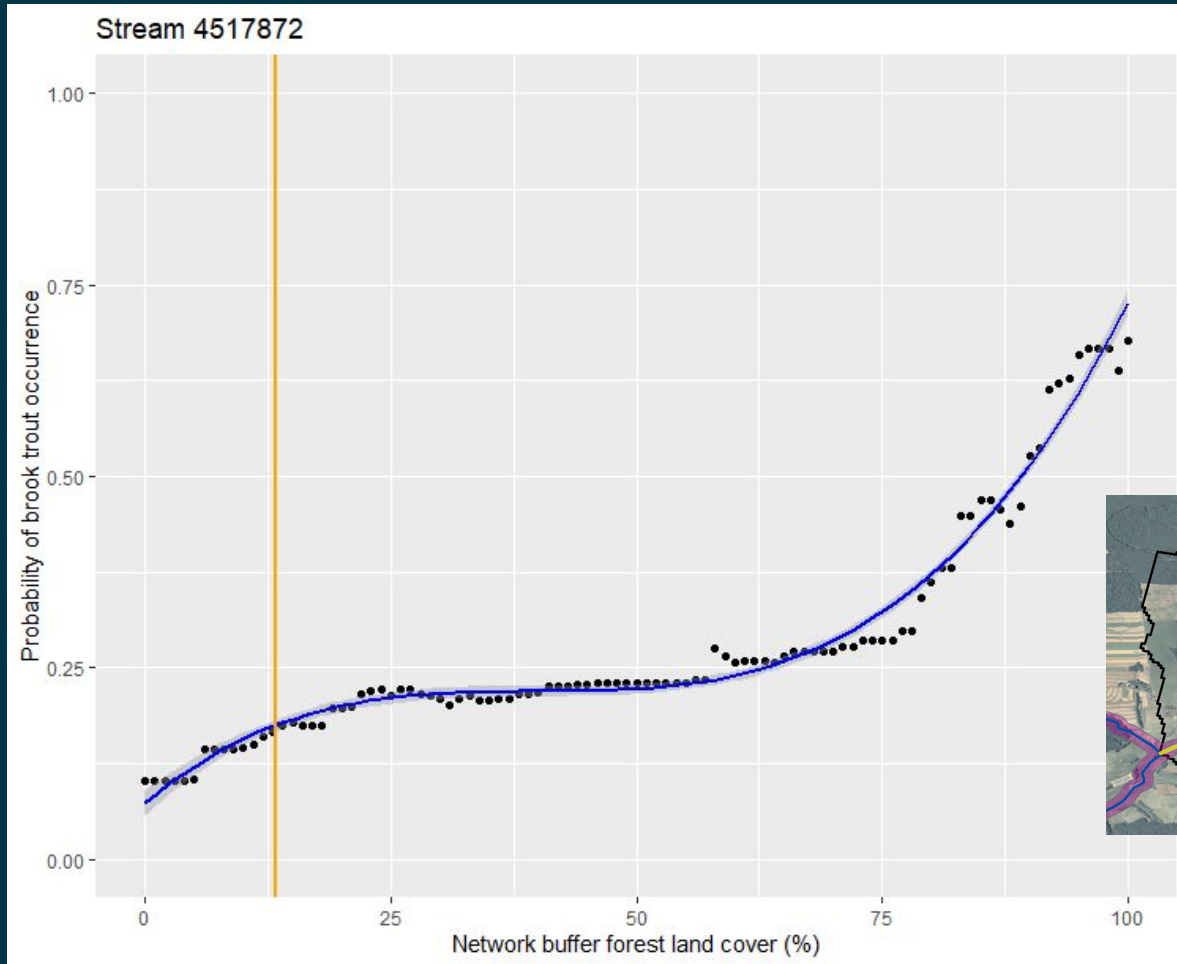
Variable and description (units)	Source	Dataset	Scale or resolution
Predictor variable type: Natural			
N_areaqkm: network catchment area (km ²)	Ross and others, 2022	National Hydrography Dataset Plus version 2	1:100,000
N_bfi: network catchment base-flow index (% of base flow contribution to total flow)	Ross and others, 2022	Base-Flow Index Grid for the Conterminous United States (2003)	1 km
N_precip: network catchment mean annual precipitation (mm)	Ross and others, 2022	OCS PRISM 1990–2010	4 km
L_temp: local catchment mean annual air temperature (°C)	Ross and others, 2022	OCS PRISM 1990–2010	4 km
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NB_nlcd11_41_43: network buffer forest land cover (%)	Ross and others, 2022	2011 National Land Cover Database	30 m
N_nlcd11_11c: network catchment water land cover (%)	Ross and others, 2022	2011 National Land Cover Database	30 m
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N_allepa_den: network catchment density of EPA point-source pollution sites (PCS, ICIS, SEMS, NPDES, and TRIS sites) (no./km ²)	Ross and others, 2022	EPA Facility Registry Service	NA
N_allmine_den: network catchment mineral, coal, and uranium mine density (no./km ²)	Ross and others, 2022	Locations of mines and mining activity in the United States	NA
N_total_p_yield: network catchment total phosphorus yield (kg/km ²)	Ross and others, 2022	SPARROW	HUC8
N_totww_mgalc: network catchment total water withdrawal (million gallons/year)	Ross and others, 2022	EnviroAtlas	HUC12
UDOR: degree of regulation: estimated annual discharge stored in upstream reservoirs (%)	Cooper and Infante (2022)	Dam fragmentation	1:100,000
UNDR: upstream network dam density (no./100 km)	Cooper and Infante (2022)	Dam fragmentation	1:100,000
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DM2D_fishtail: distance to downstream main stem dam if present; otherwise distance to network outlet if no downstream dam is present (km)	Cooper and Infante (2022)	Dam fragmentation	1:100,000
N_rx_stlen_dens: stream network road crossing density (no./km)	Ross and others, 2022	2006 TIGER Roads SE	1:100,000

Sensitivity Analysis: Example

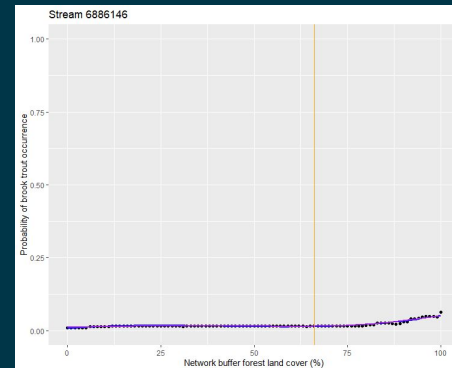
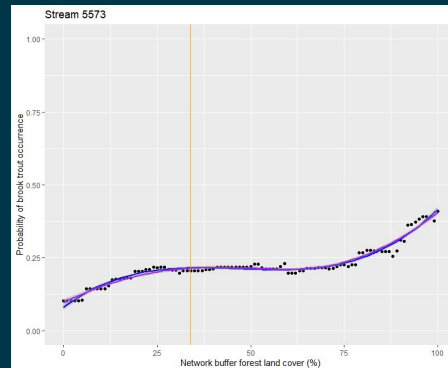
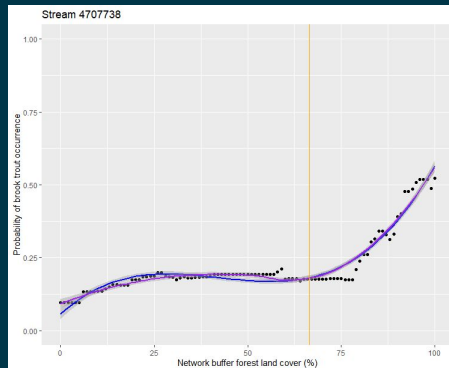
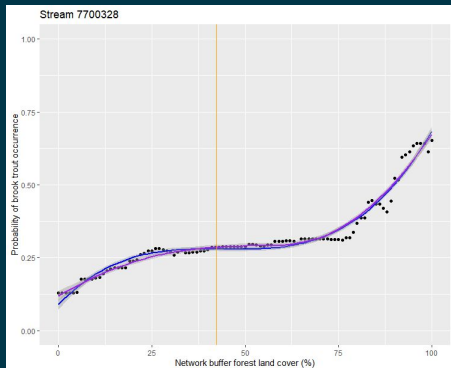
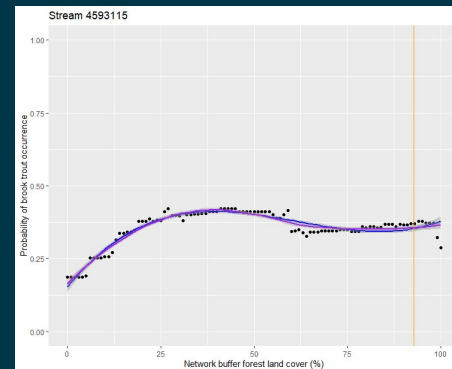
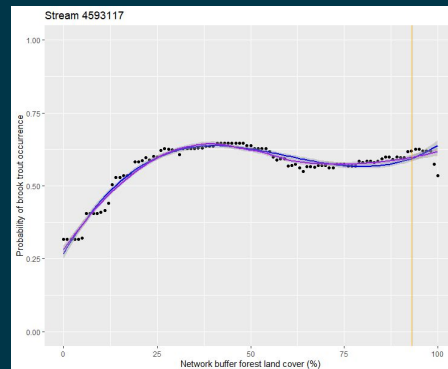
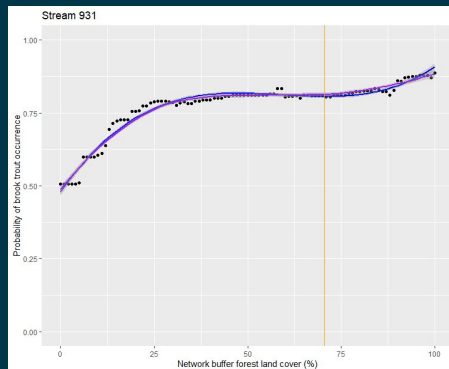
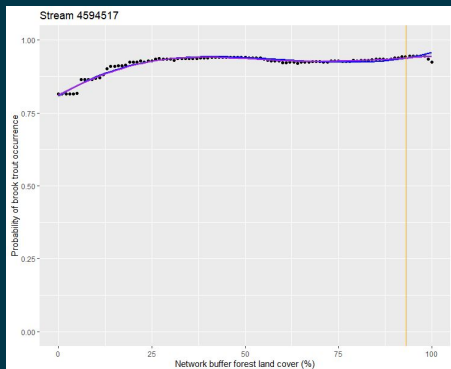


 Stream Reach (modeled)  Stream Reaches  90m Buffer  Network Catchment

Sensitivity Analysis: Example

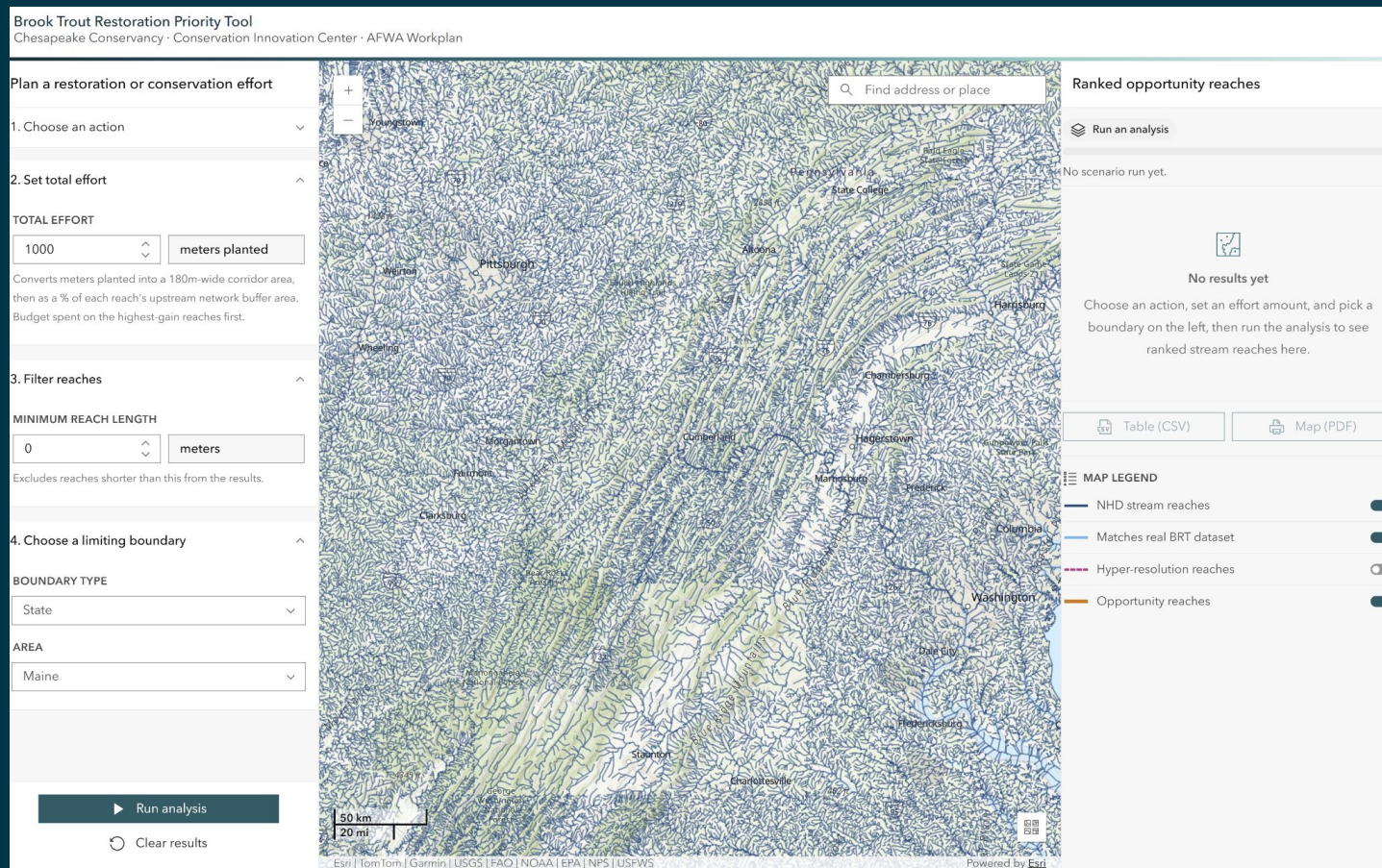


Sensitivity Analysis: Reach-specific Curves



...where should buffer planting be directed to have the most impact?

App lets users create a ranked, actionable list of priority stream reaches for their effort





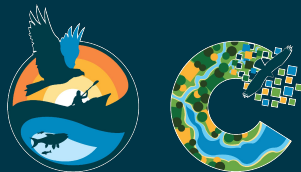
Set total effort
Enter a budget in meters planted

Filter reaches
Optionally exclude reaches below a
minimum length

Choose a limiting boundary
Pick County, State, or HUC8
watershed

Run analysis
Generates a ranked list of
opportunity reaches

Export
Download results as CSV or print
the map to PDF



Discussion & Questions

How to allocate effort among reaches? Prefer all at one location? Or distributed across a bunch?

What information/format should CSV have?

Is magnitude of prob gain be the priority metric?
What about thresholds? Is a 30% gain from 20 to 50 the same as 70 to 100?

What other layers would be helpful to see?
Catchments? Land Cover?

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https://docs.google.com/forms/d/e/1FAIpQLSePz_DPbc3AvL6UqRboB6dD4JG1C9sHMg6_QfDX_L4c8EgnGQ/viewform?usp=publish-editor

Hyper-Resolution Hydrography



Download: <https://www.sciencebase.gov/catalog/item/66d72996d34eef5af66ca61b>

View: <https://experience.arcgis.com/experience/a06bf28c58994a8e9aef44f02e8051f3/page/Hydrography-Viewer>

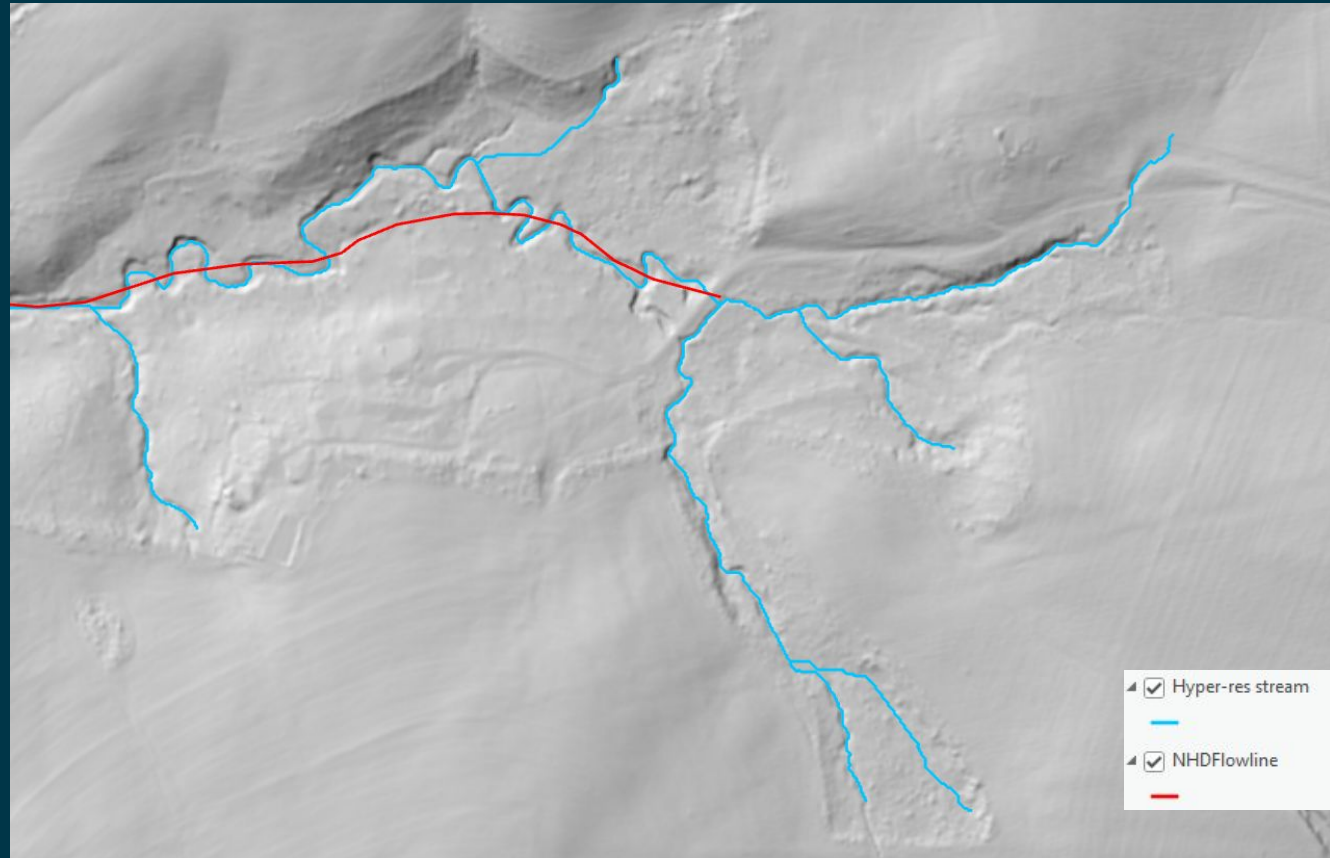
Hyper-Resolution Hydrography



Produced in partnership between
CC, UMBC, and EPA's Chesapeake
Bay Program

Maps headward extent and lateral
positioning of stream channels
more precisely than existing data
(red)

Covers entire Chesapeake Bay
watershed



Hyper-Resolution Hydrography

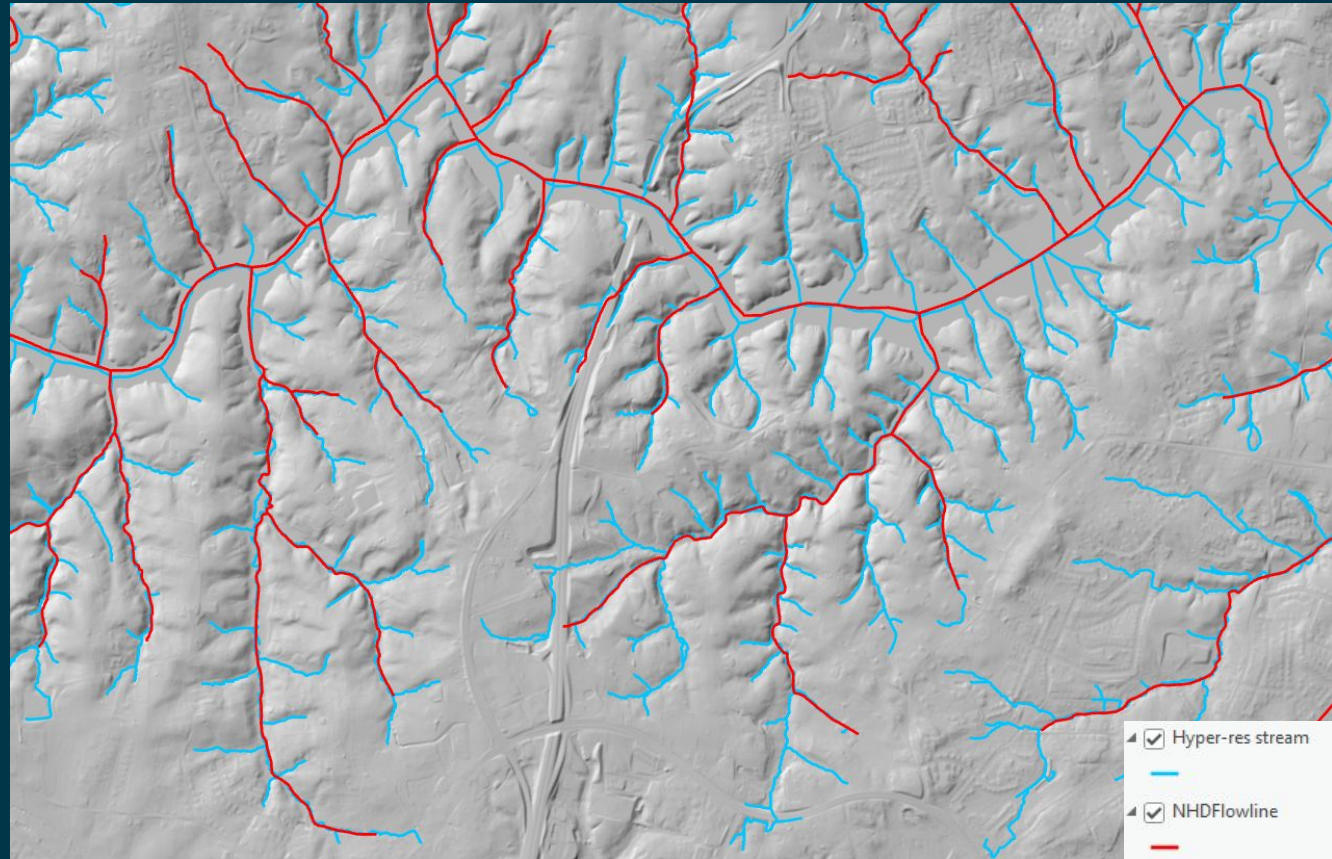


Maps 2.5x more stream miles than existing data

94% accurate for streams represented in existing data

67-82% accurate for previously unmapped streams

Increasing accuracy for larger streams





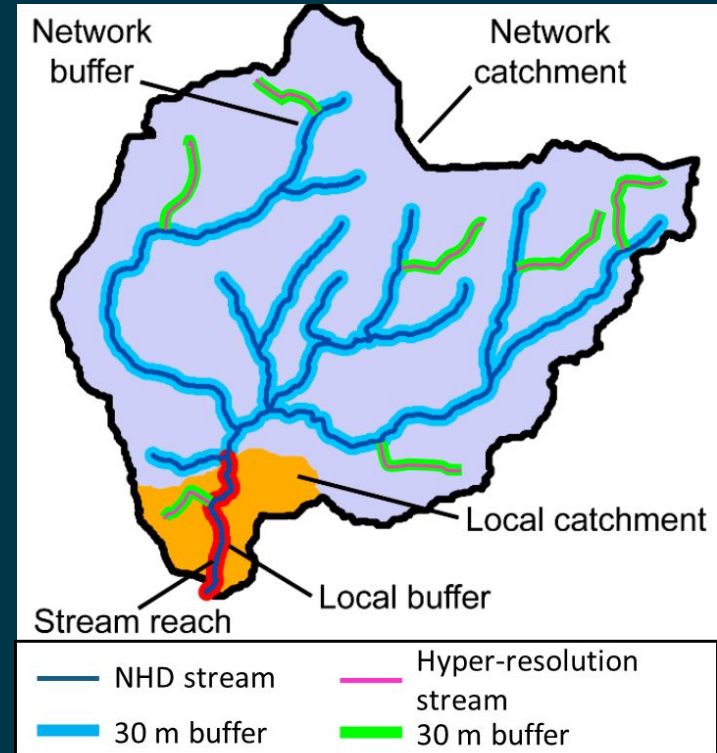
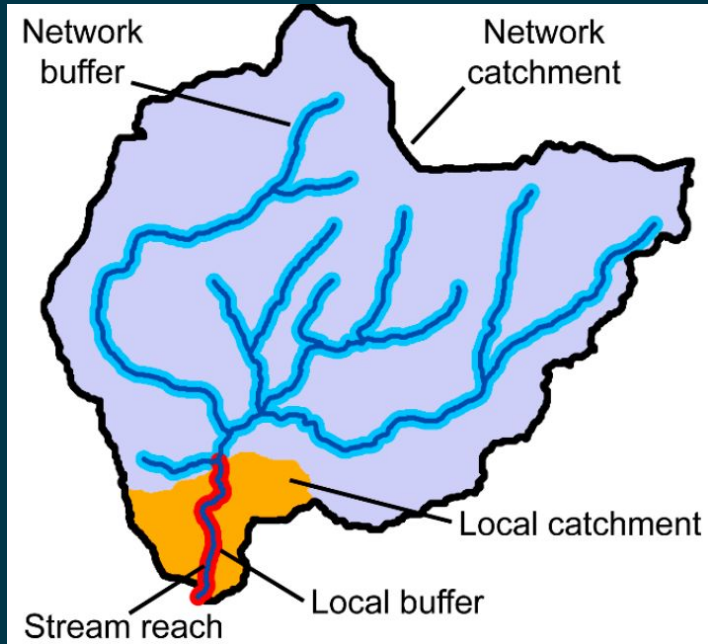
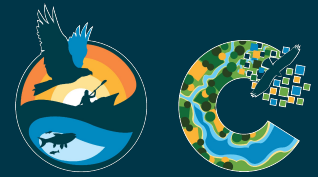
Unbuffered
tributary

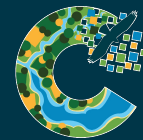
Riparian forest buffer

Hyper-res stream

NHDPlus HR

NHD vs Hyper-Resolution Hydrography Data



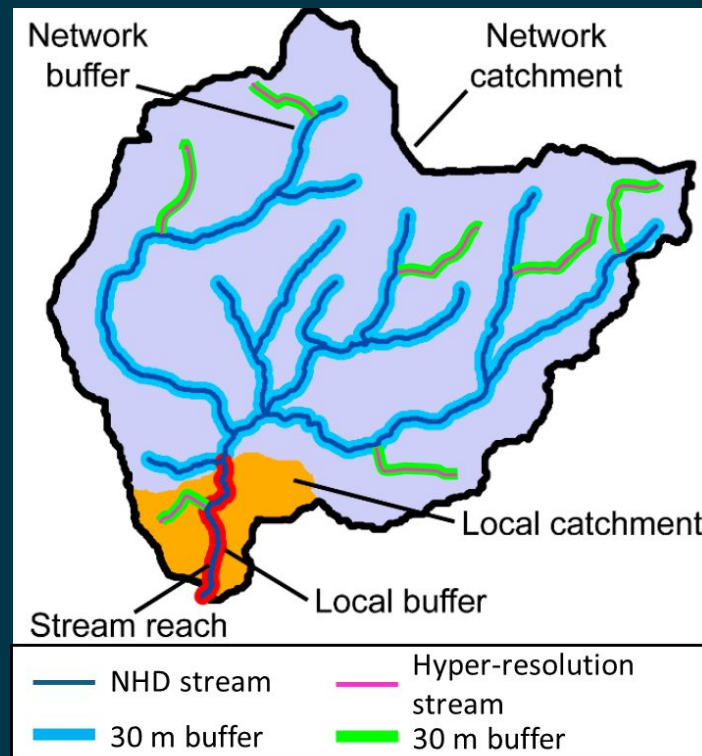
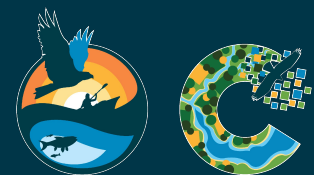


NHD Catchment

Network Forest Buffer
(NHD) = 30%

Network Forest Buffer
(HRH) = 15%

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Download results as CSV or print
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