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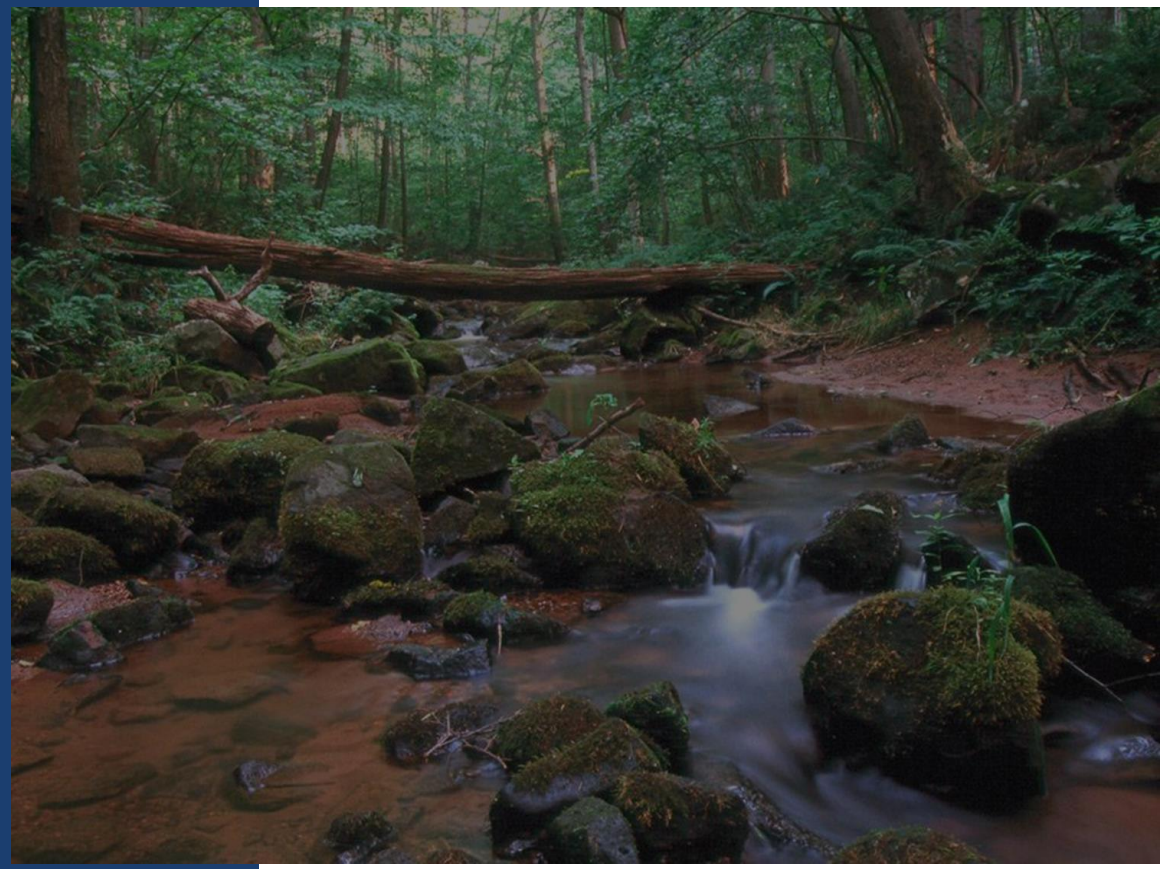
Rapid Delisting?

Aggregating Restoration Efforts and Addressing Multiple Stressors in Small Watersheds to Achieve Ecosystem Response



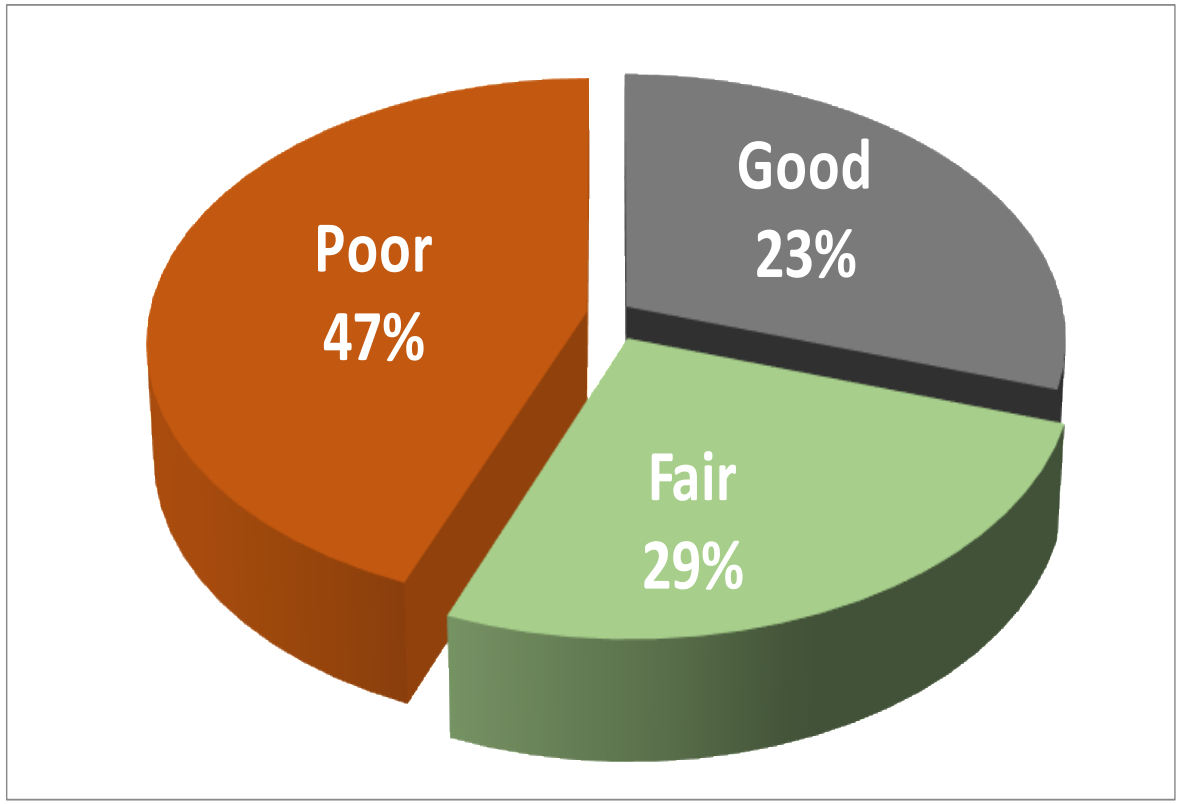
Matthew J Ehrhart

10 September 2024

Our Efforts to Address Impaired Streams and Rivers Have Proven Inadequate

The National Rivers and Streams Assessment 2013-2014: A Collaborative Survey
https://www.epa.gov/national-aquatic-resource-surveys

- 47% of the "Southern Appalachian" river and stream miles do not support healthy populations of aquatic life



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Why are we not seeing streams delisted, or at least larger improvements?

1. Not Enough Time?
2. Not Enough Intensity?
3. Wrong Prescription?
4. Missed Something?

Chesapeake Bay Driven Restoration

Estuarine Driven Restoration Yielded:

1. **Distributed Projects**
   - Distributed Funding
   - Early Adopters

2. **Limited Perspective on Stressors**
   - Nitrogen
   - Phosphorous
   - Sediment

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Urban Runoff is a chemical cocktail

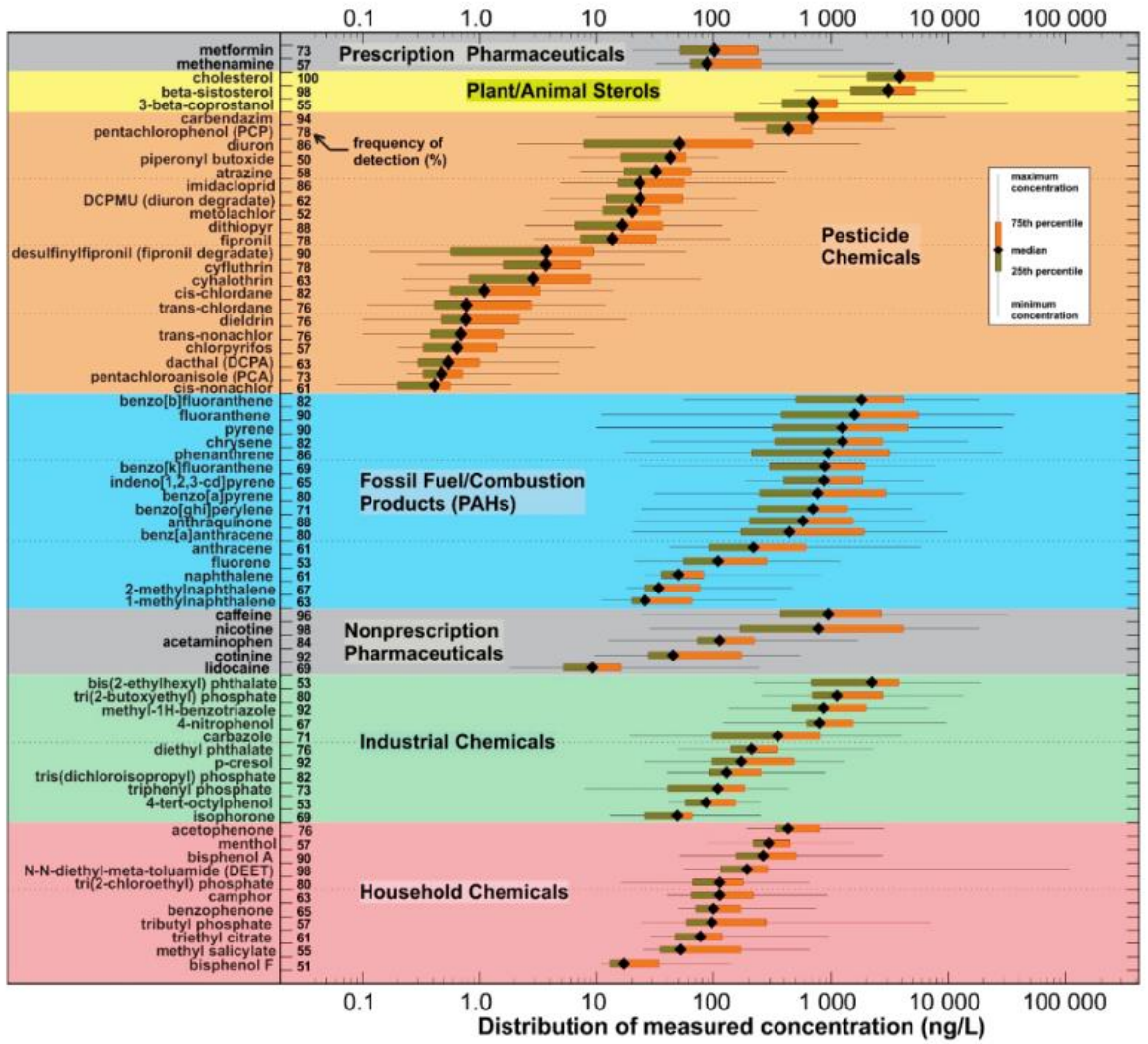

Figure 2. Box-plot distributions of measured concentrations for the 69 organic chemicals detected in 50% or more of 49 urban stormwater samples. Sorted alphabetically from top to bottom by chemical class and decreasing median concentrations.

https://sanantonioreport.org/commentary-will-san-antonio-remember-the-river-ban-coal-tar-sealers/sealcoat-runoff-to-stream-in-fredericksburg-texas_courtesy-usgs/

- Pesticides
- PAHs

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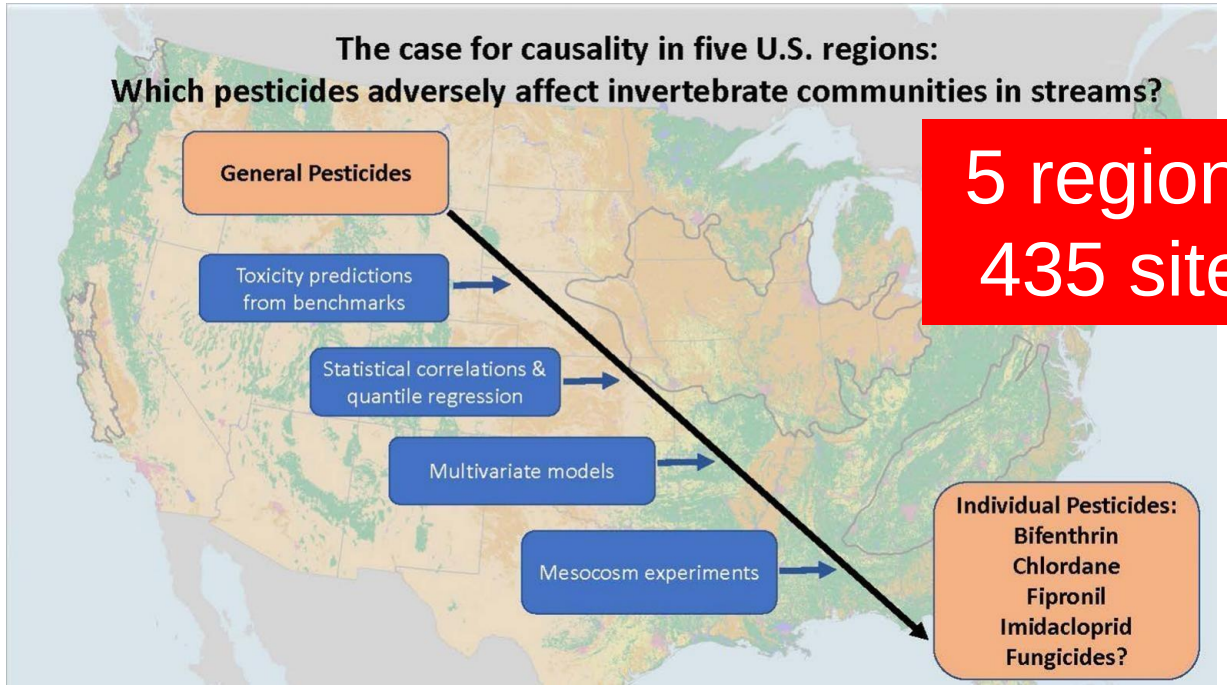
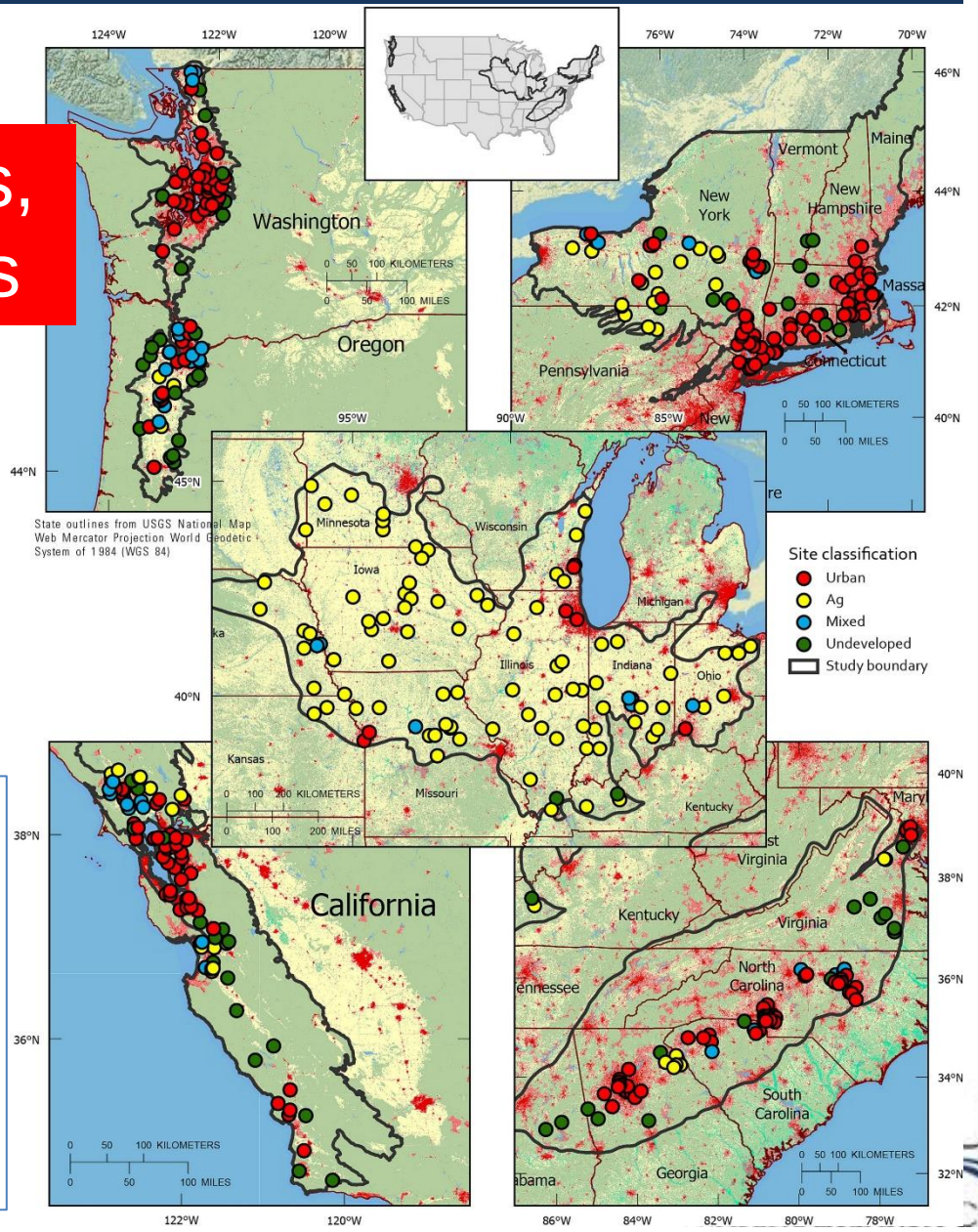
Pesticides are everywhere, and important



5 regions,
435 sites



Novell, Moran, Waite, et al. (2024)

Multiple lines of evidence point to pesticides as stressors affecting invertebrate communities in small streams in five United States regions

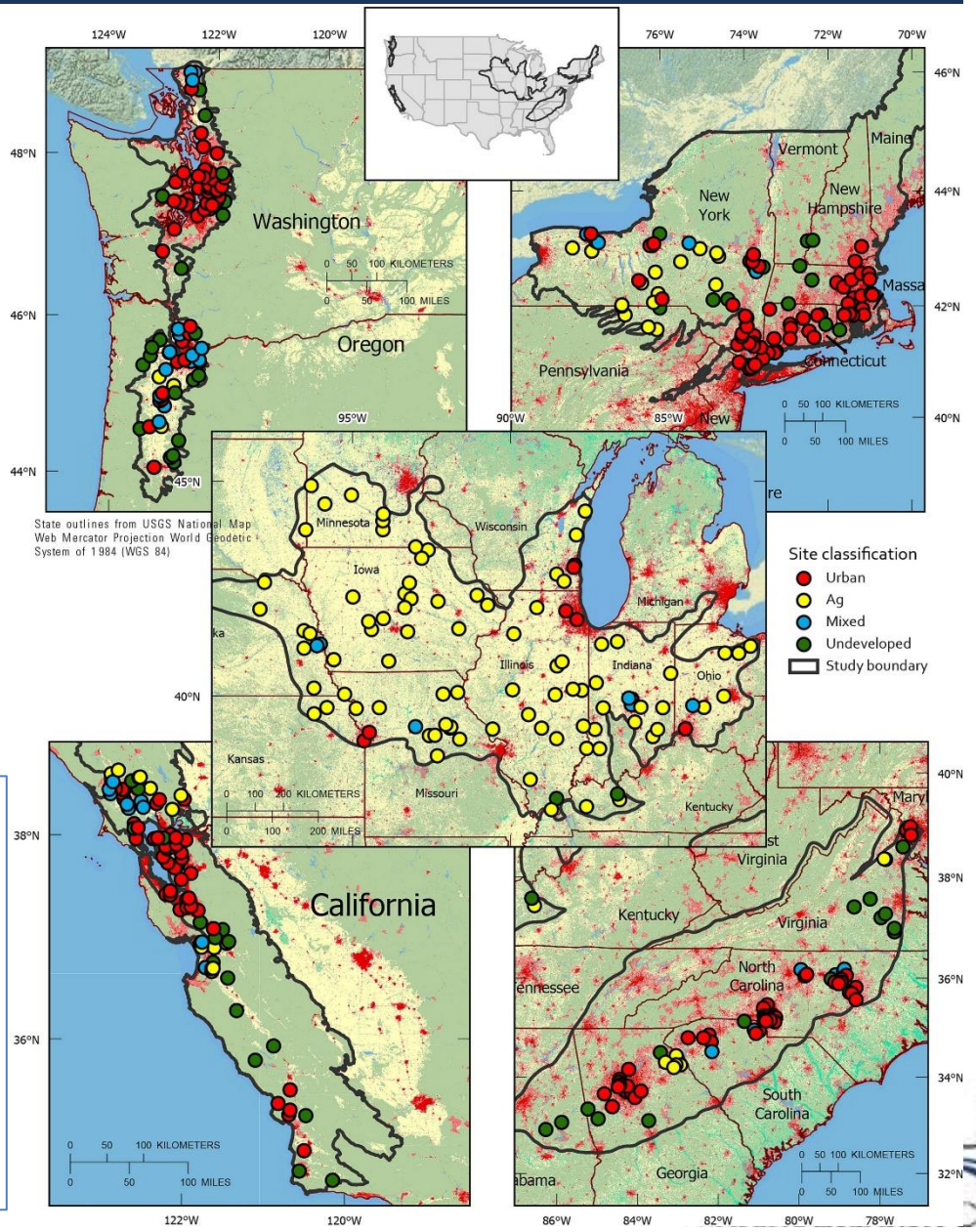
Science of the Total Environment, 915, p.169634

Pesticides are everywhere, and important

Weight of evidence: insecticides are probable contributor to stream invertebrate impairment.

Bifenthrin, chlordane (1988), fipronil & imidacloprid were important regional stressors.

Pyrethroid, organochlorine, phenylpyrazolen, neonicotinoid



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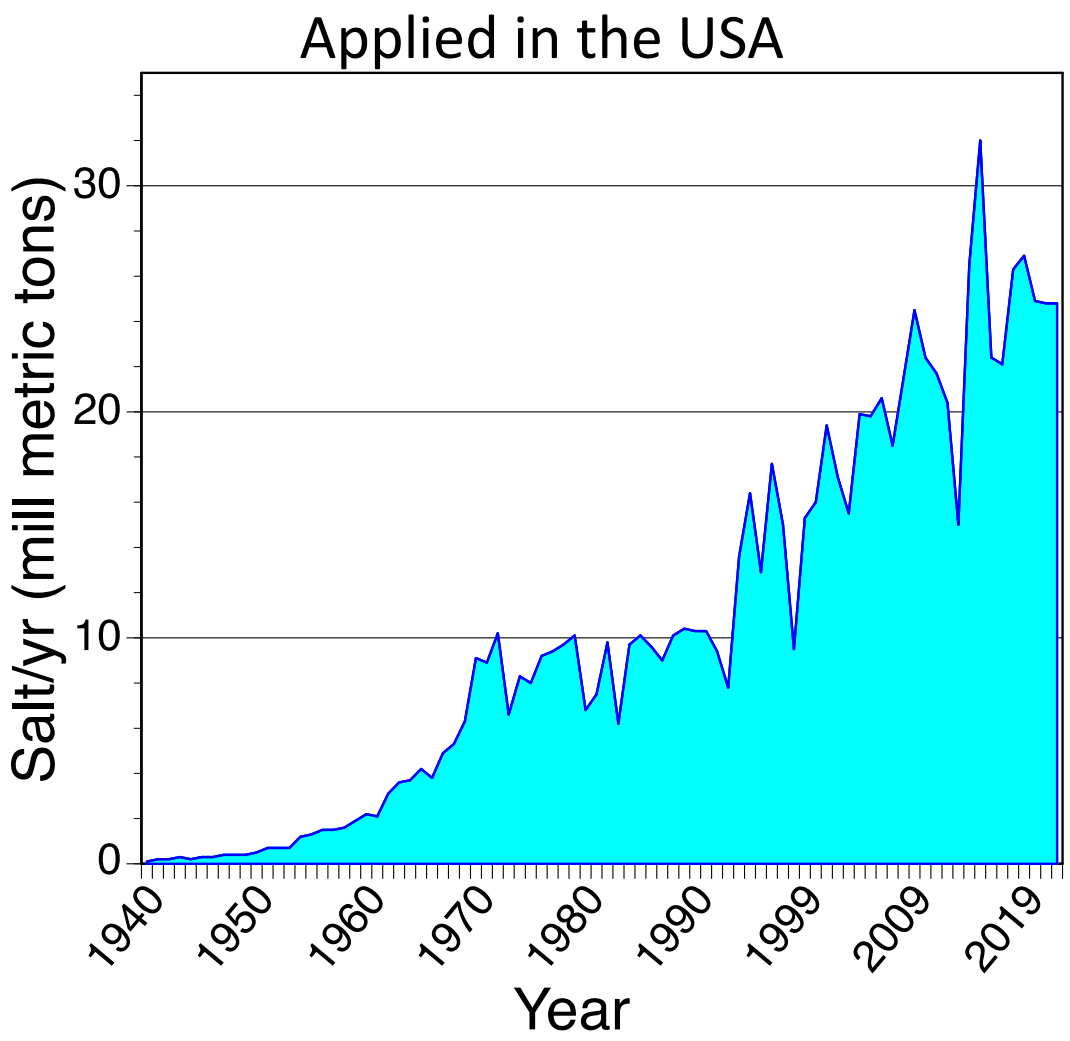
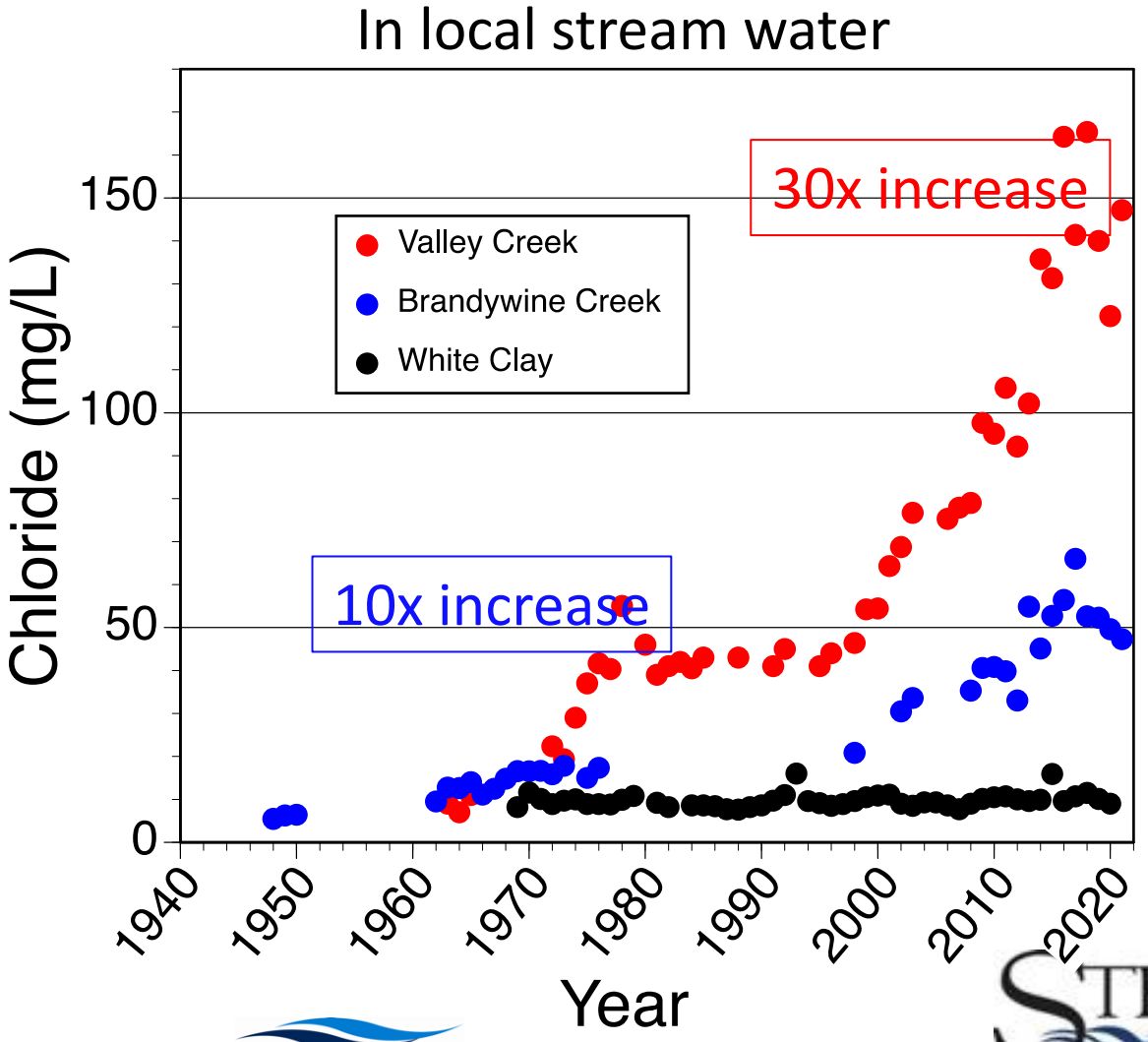
Road salt use is much greater than decades ago. That salt is contaminating our streams





USGS

Chester County Water Resources Authority
CHESTER COUNTY – PENNSYLVANIA

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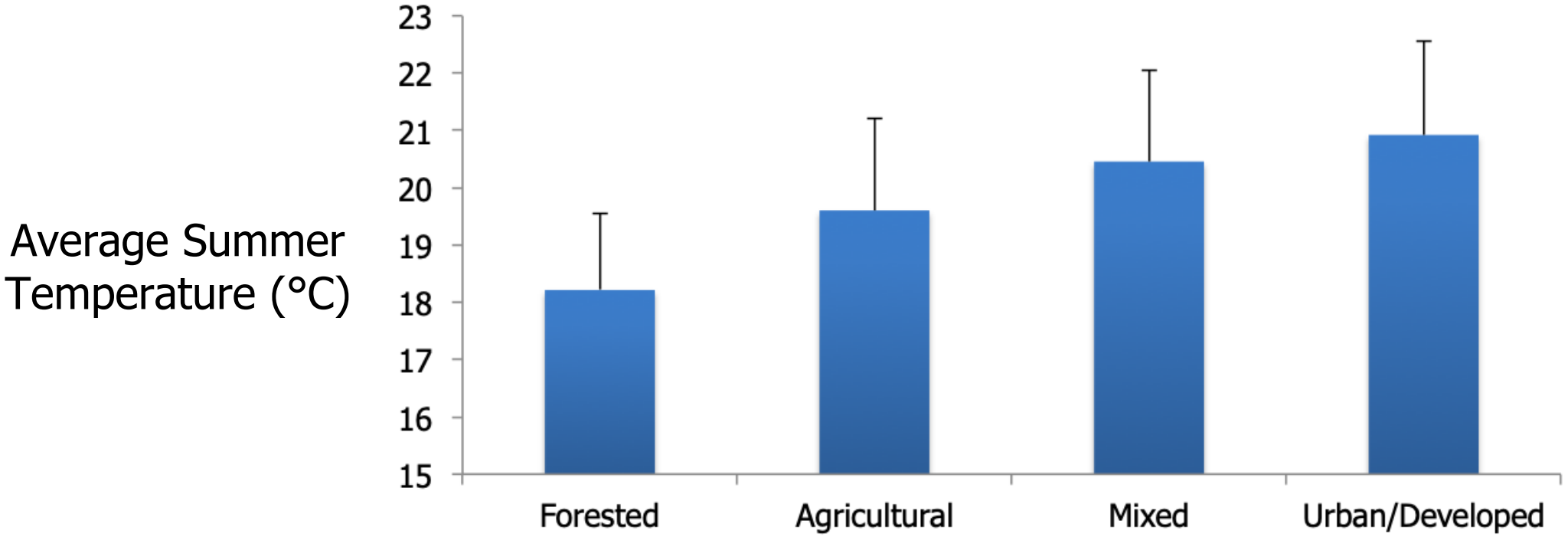
Some of today's pollutants were also an issue in 1972 – Thermal Pollution – stream temperature as a function of land & water use

39 Delaware River watersheds of different size with varying land uses



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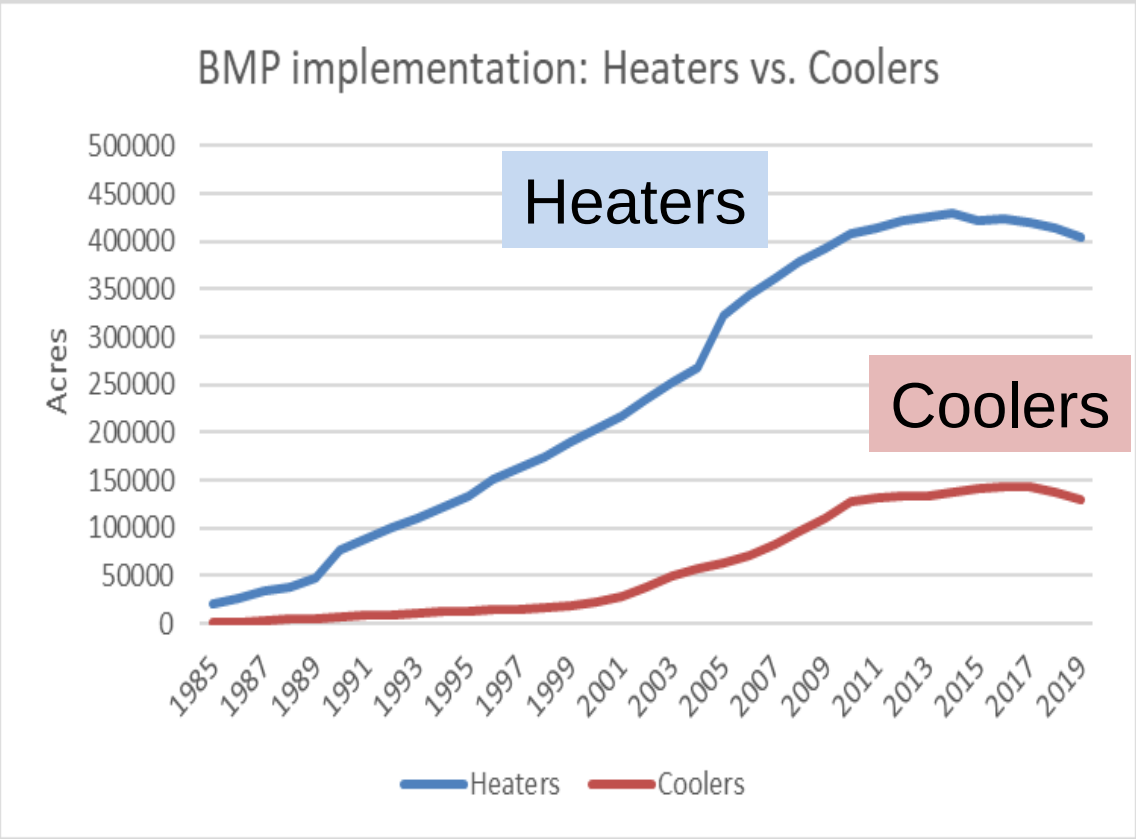
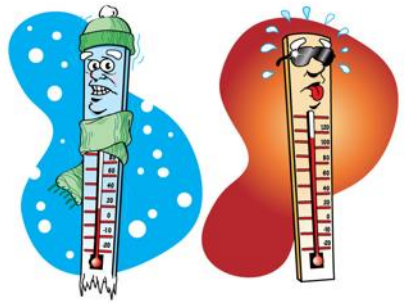
Pollution-reduction/stormwater BMPs act as "Heaters" or "Coolers"





3x more Heaters in Chesapeake watershed

"Heaters" include stormwater retention ponds, floating treatment wetlands and vegetated open channels.

"Coolers" include riparian forest buffers, upstream tree planting, urban stormwater infiltration, and wetlands restoration, enhancement and rehabilitation.

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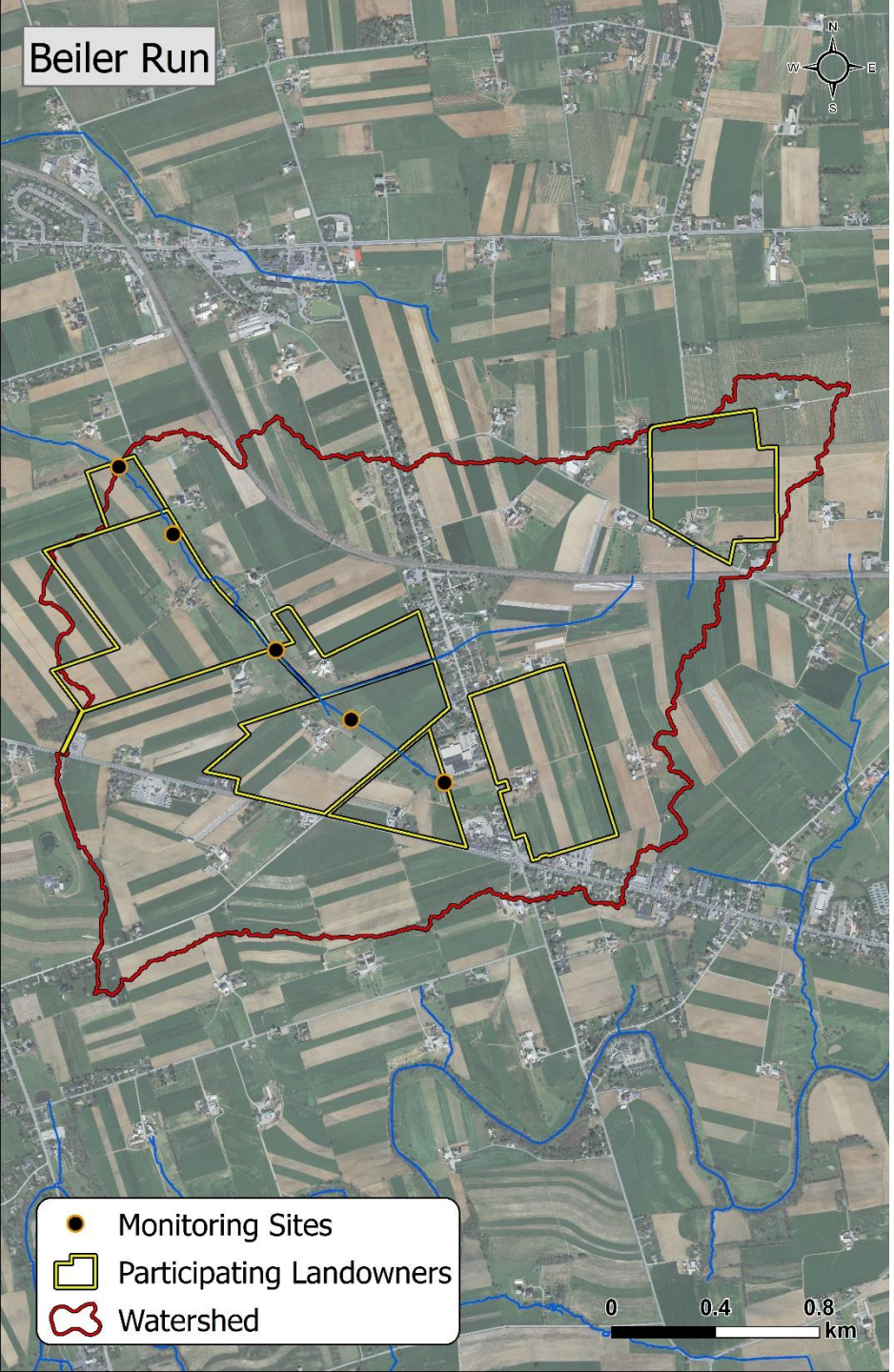
Our Context

- Goal: high farmer participation in catchment
- Whole farm conservation, including buffers
- Measure changes in stream, over long term
- First farms joined in 2010, participation on-going



Beiler Run

2 square miles

5 square kilometers

1,236 acres

Forest	1%
Agriculture	75%
Urban	22%

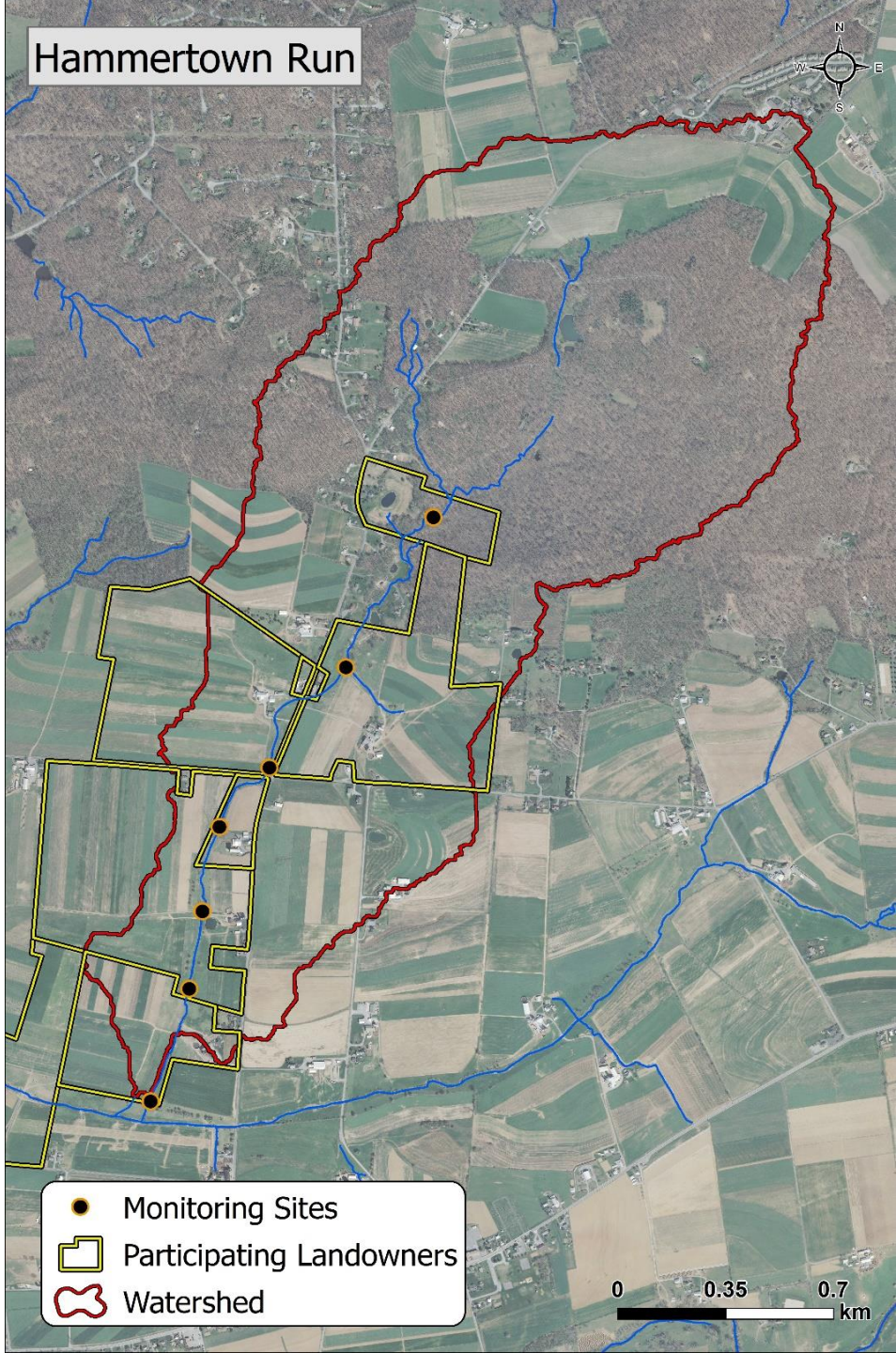
Hammertown Run

1.5 square miles

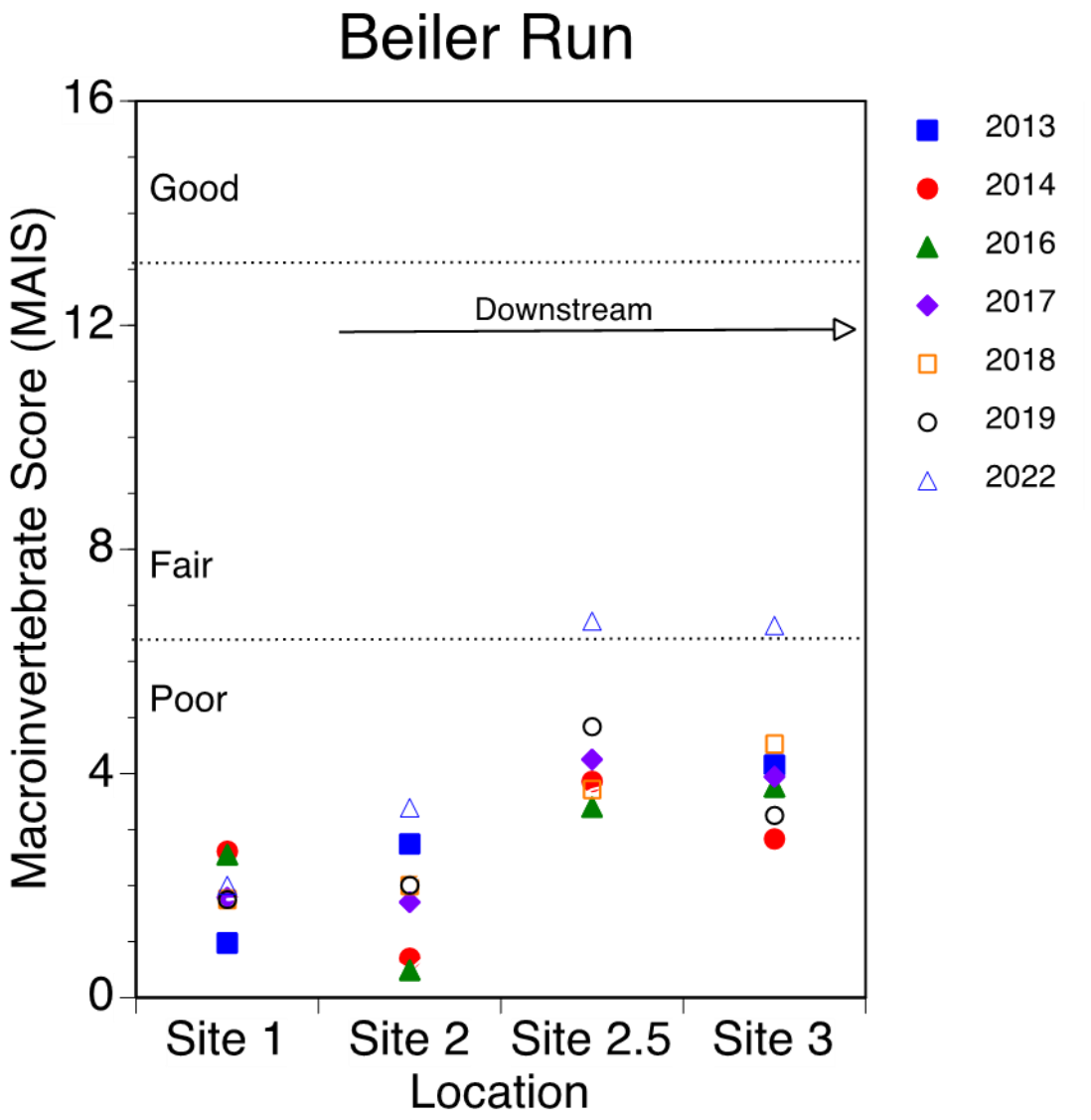
4 square kilometers

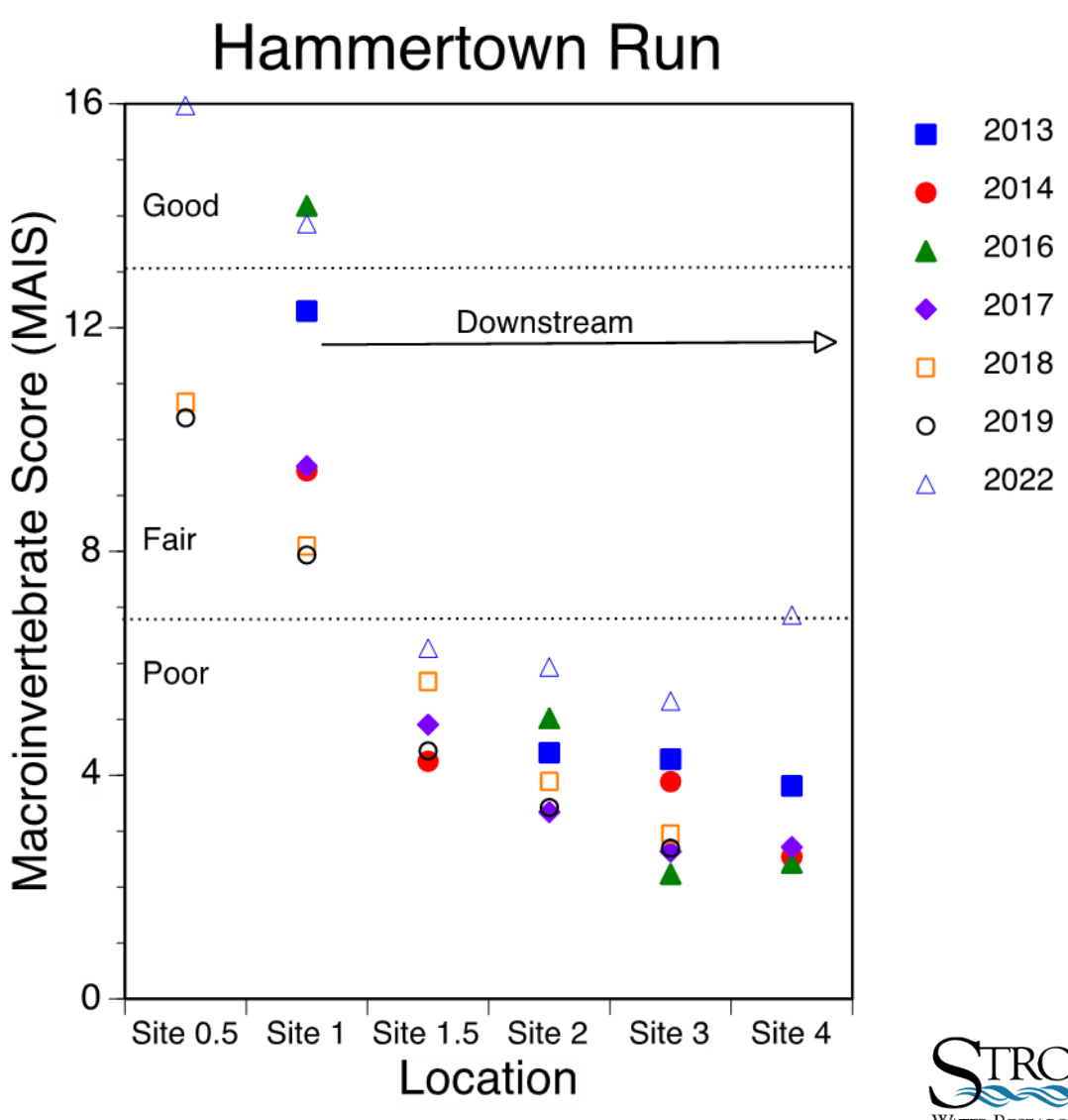
988 acres

Forest	42%
Agriculture	57%
Urban	2%



Macroinvertebrate Sampling





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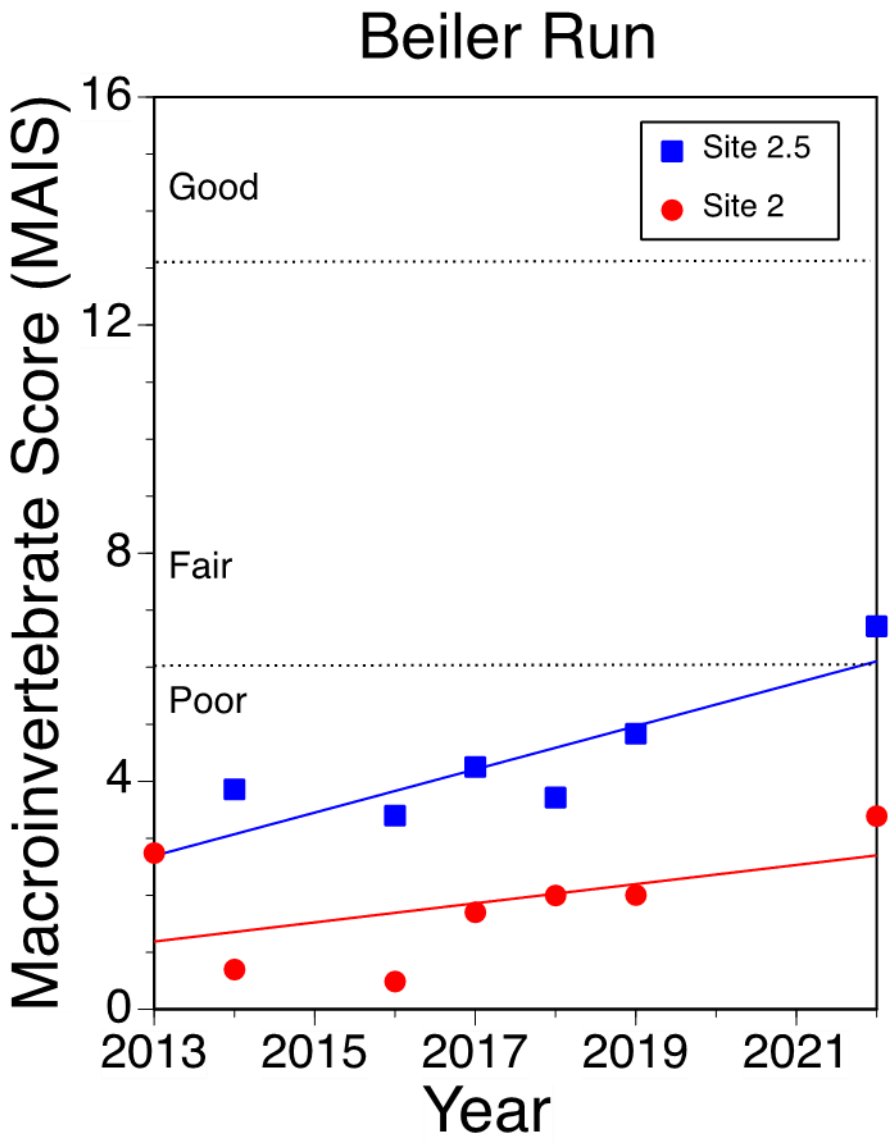
Beiler Run Macroinvertebrates

MAIS vs Year
P Values Simple Linear Regressions

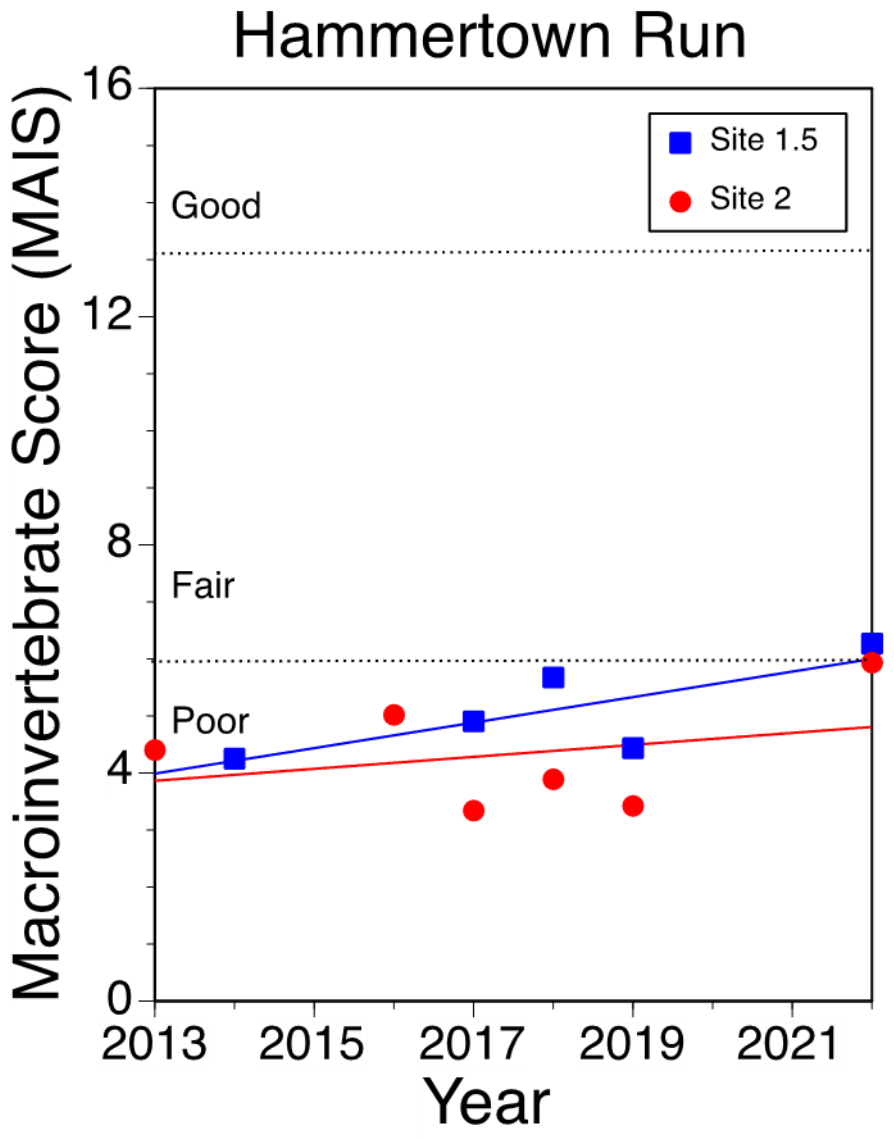
	vs Year
Site 1	0.839
Site 2	0.257
Site 2.5	0.030
Site 3	0.091



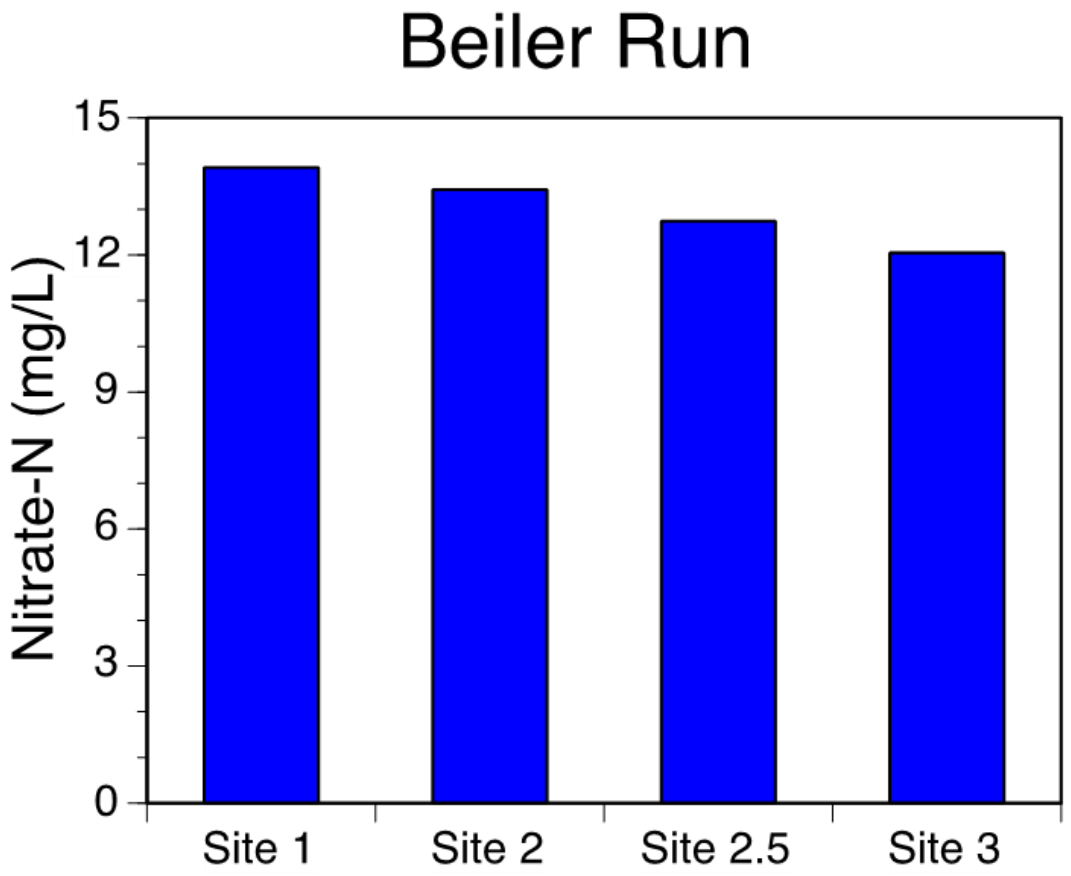
Hammertown Run Macroinvertebrates

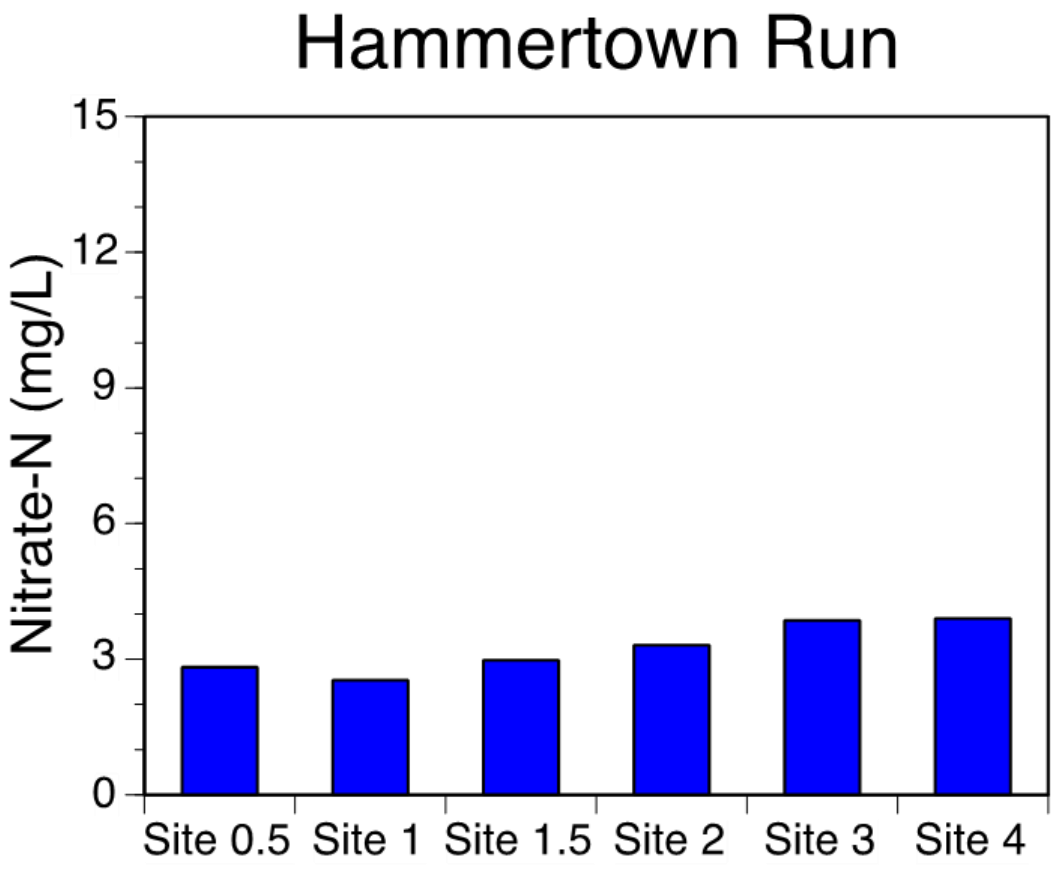
MAIS vs Year
P Values Simple Linear Regressions

Site	vs Year
Site 0.5	0.183
Site 1	0.945
Site 1.5	0.131
Site 2	0.543
Site 3	0.676
Site 4	0.132



Nitrate Concentrations (baseflow only)





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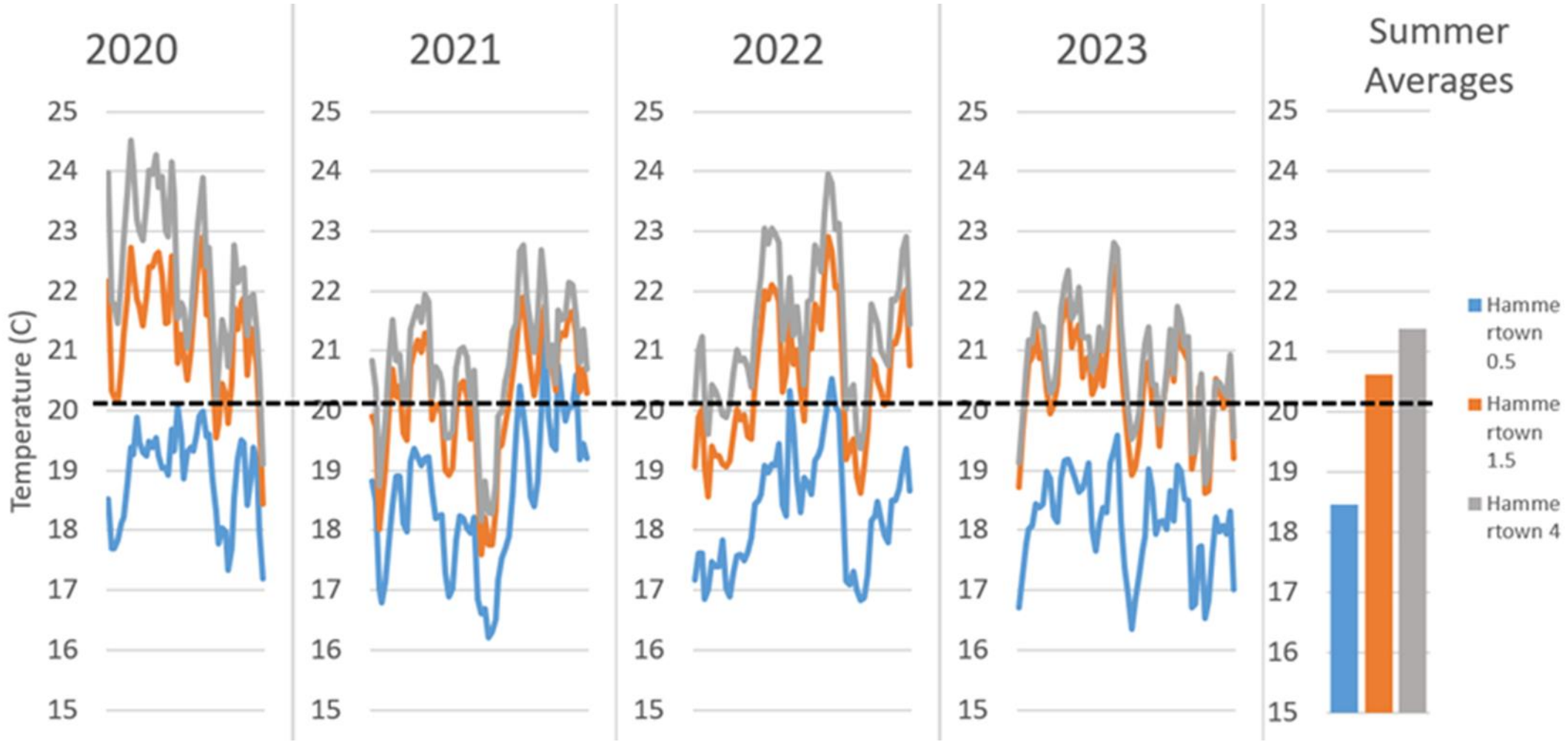
Summer Temperatures – Hammertown Run, upstream & downstream



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Hammertown Run

Winter 2014

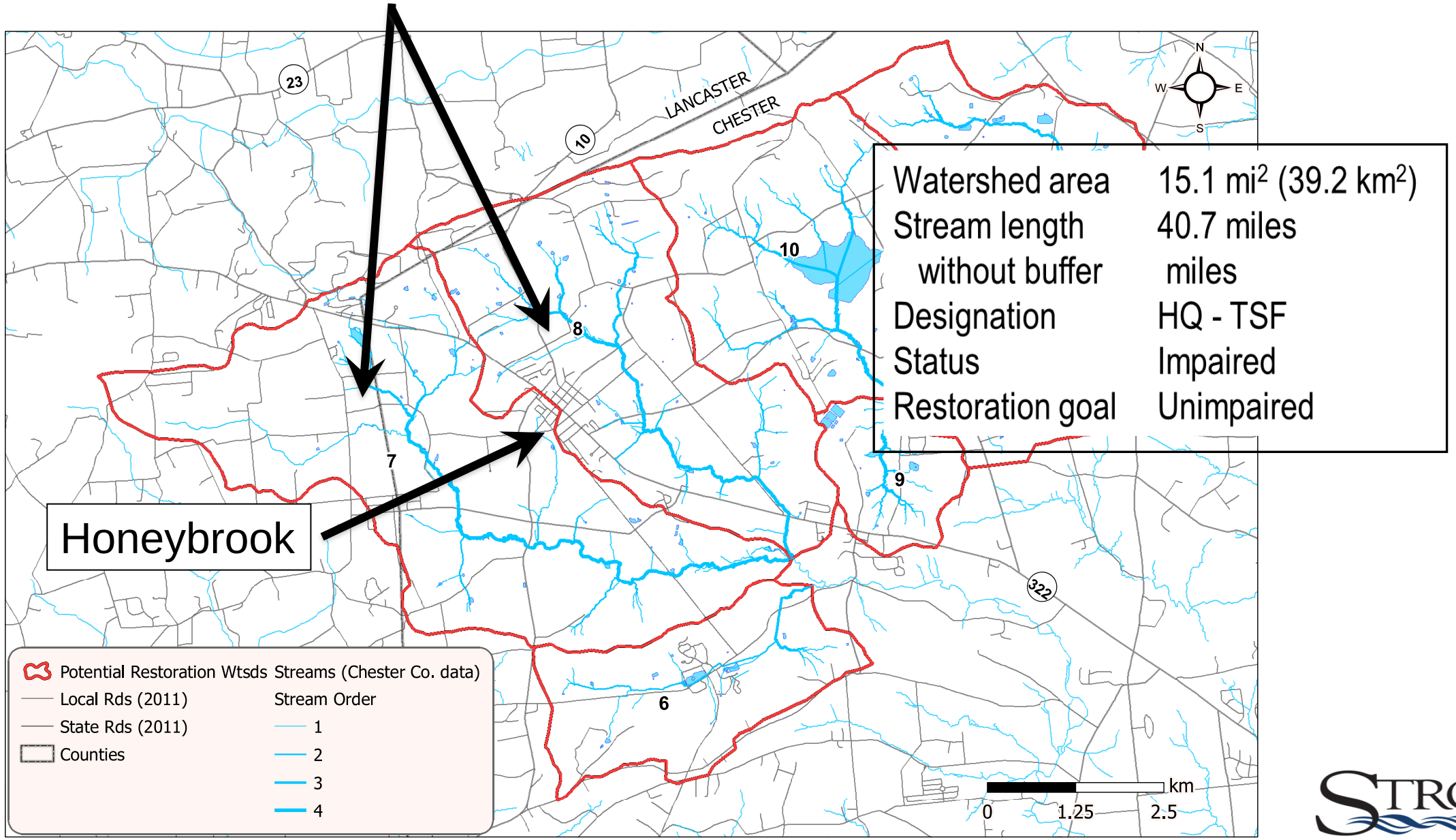
Hammertown Run

Spring 2024

What have we learned?

- Small catchments are ideal size for engagement *and* monitoring
- Project is balancing between needs of the farms, and the stream
- Celebrate incremental victories while encouraging patience
- **How to enable local "ownership" of watershed protection?**

West Branch Brandywine Creek - Honeybrook



Watershed area	15.1 mi^2 (39.2 km^2)
Stream length	40.7 miles
without buffer	miles
Designation	HQ - TSF
Status	Impaired
Restoration goal	Unimpaired

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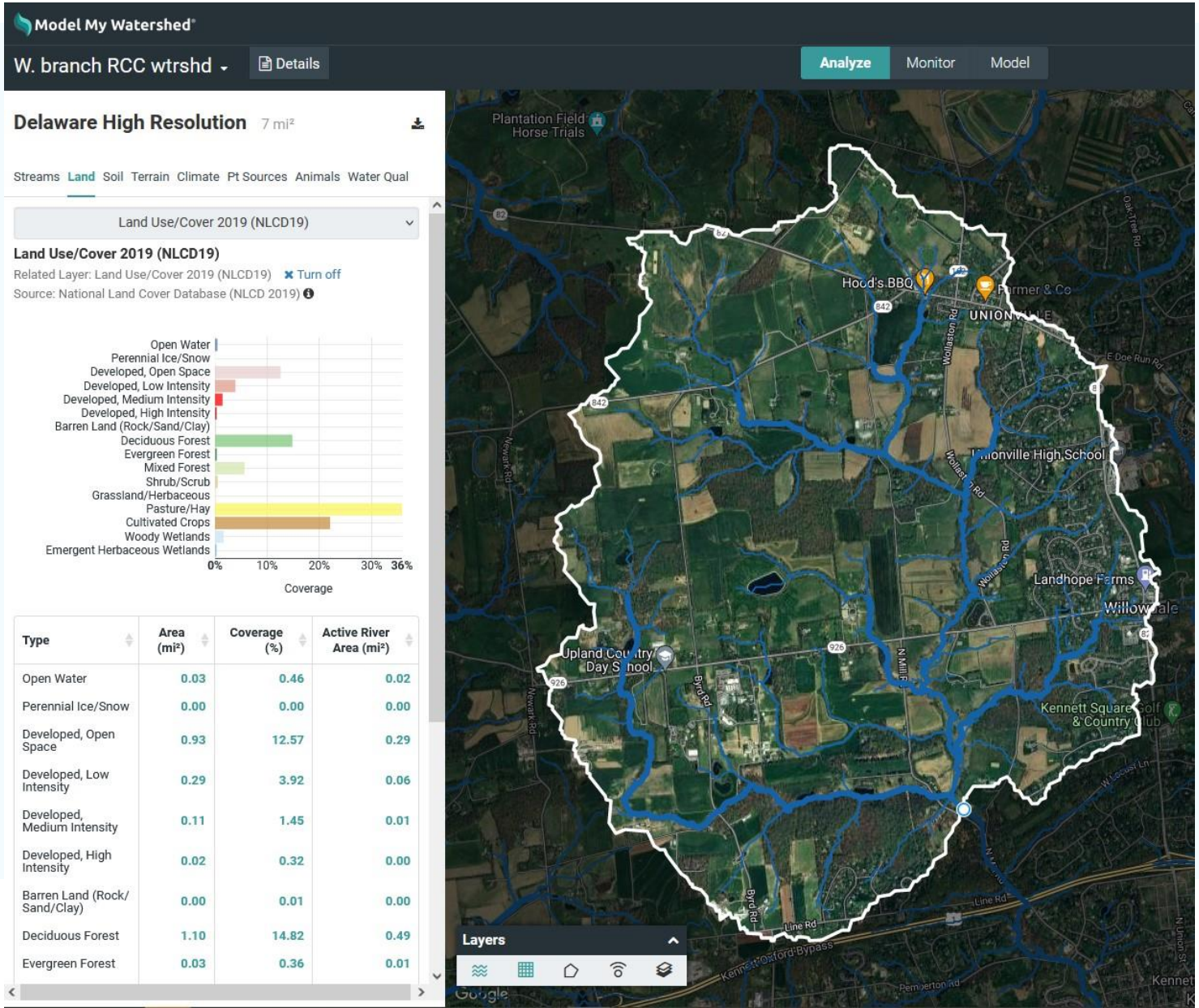
Delisting is just the Beginning – What are our Restoration Goals?

Red Clay Creek Watershed, Chester County, PA



- 7.41 Square Miles
- 7.18 Miles of Stream
- 1018 Acres of Forest
- 1043 Acres of Cropland
- 1696 Acres of Pasture and Hay
- 864 Acres of Developed Land

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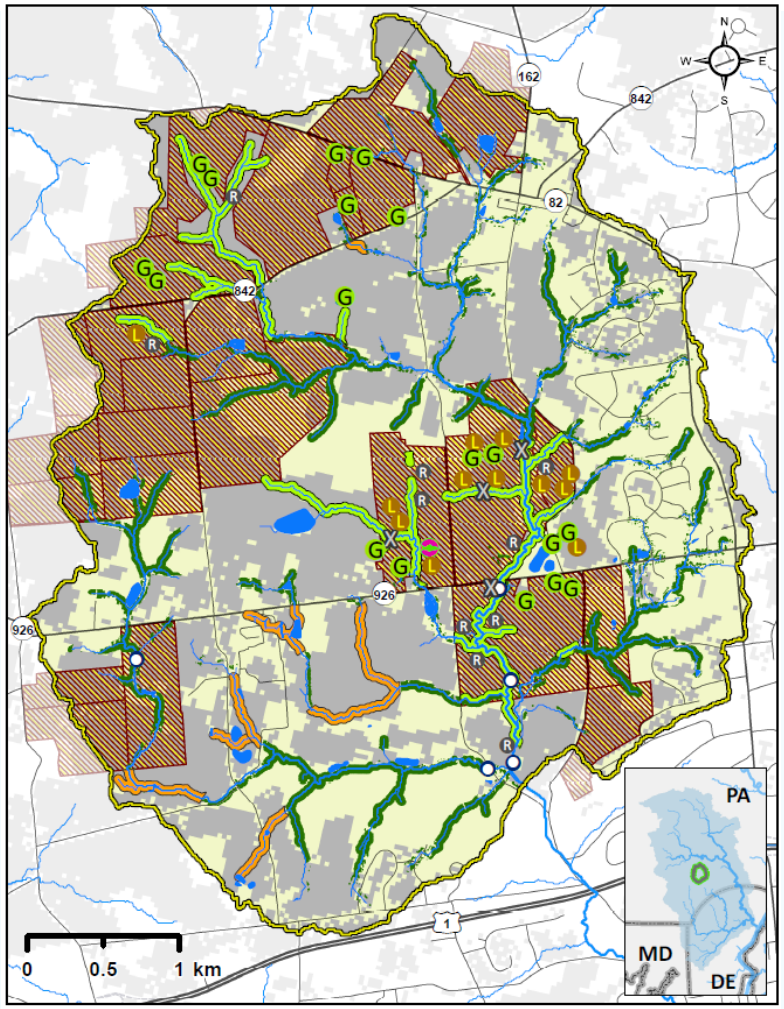
How Much Effort Does It Take To Restore Wild Trout?

Red Clay Creek Watershed, Chester County, PA



Forested Buffer Status
- Recently Implemented
- Discussion Beginning
- Existing woody cover

Agricultural Best Management Practices
- G Grassed waterway & similar BMP
- L LivestockBMP
- X Stabilized stream crossing
- Improved Soil Health Practice Properties

Other Info
- Brook Trout reported
- R Reforestation research plots
- Water Quality Monitoring Sites
- West Br. RCC watershed
- Agricultural fields

10 Year Effort In the Red Clay Creek Watershed has Yielded

- 25 Farmer Workshops/Meetings
- Comprehensive Conservation Planning & Work on 35 farms
- 808 Acres Transitioned to No-Till and Cover Crop System
- 11.14 Miles of Riparian Forest Buffer planting yielding 122.25 Acres of new Forest Buffer (>90 feet Average Width)
- Modeled Pollutant Reductions: 912 tons of sediment/yr, 21,754 lb nitrogen/yr, 2769 lb phosphorous/yr, 41 million gallons of surface runoff/yr
- Current Discussions with 2 Additional Landowners Encompassing Approximately 600 Acres

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