Measuring and Modeling Water and Watersheds

USGS Regional Stream Quality Assessments

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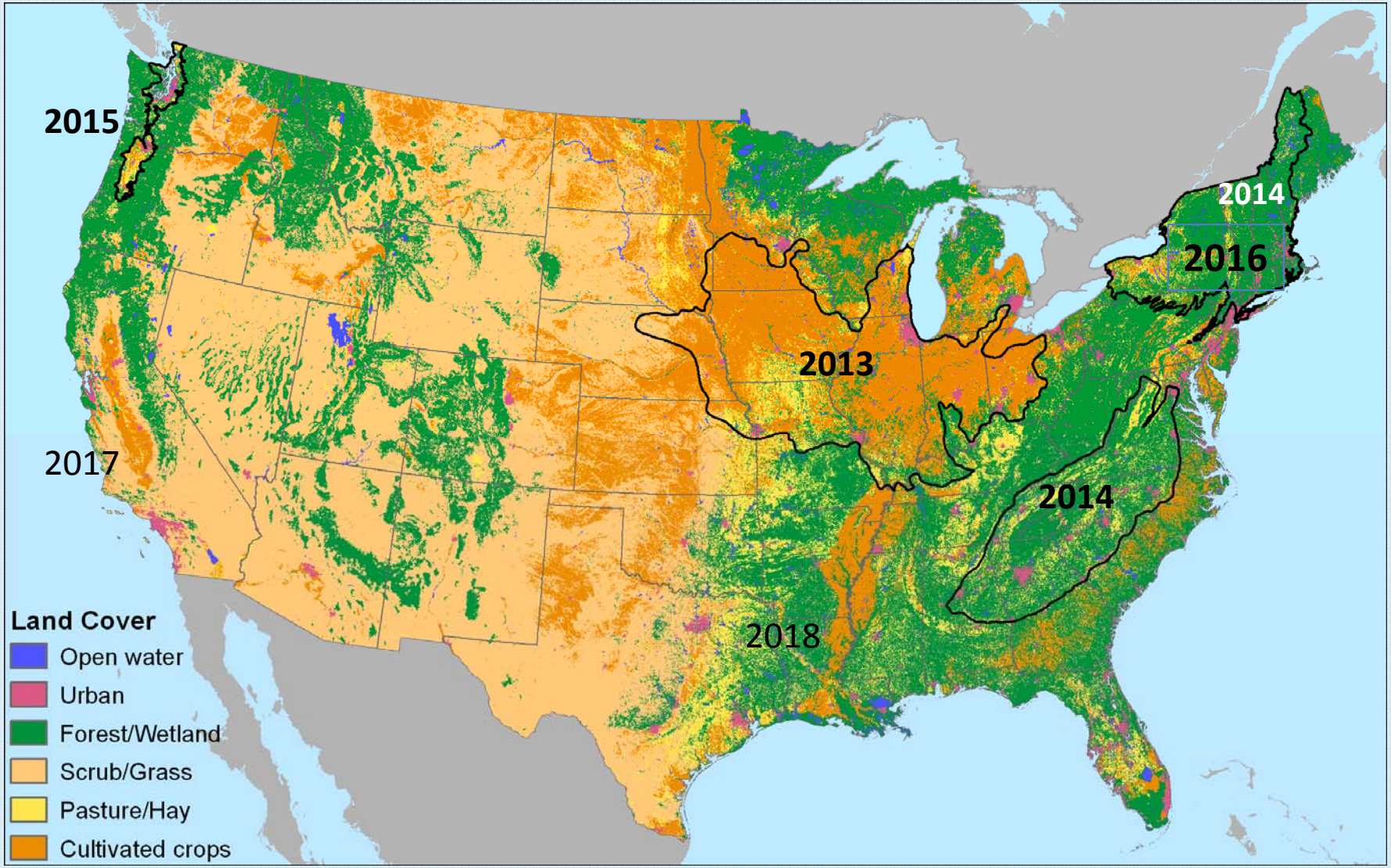
USGS Regional Stream Quality Assessments



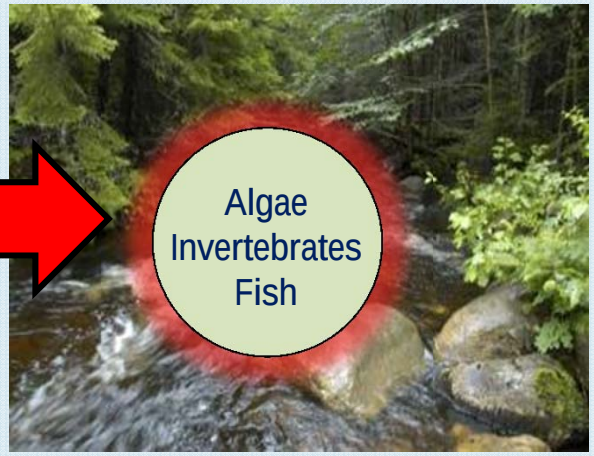
Stream Quality Assessment Concepts

Watershed Setting

Stressors

Ecological Health

Contaminants
Nutrients
Sediment
Hydrology
Habitat



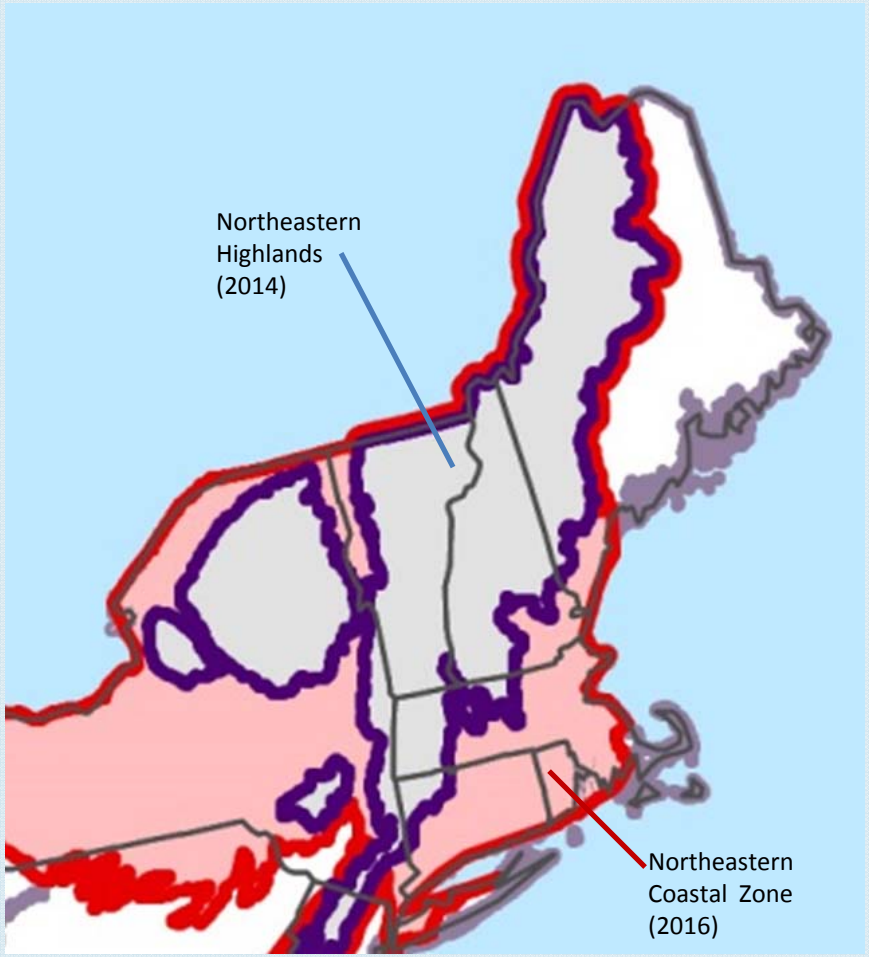
USGS Regional Stream Quality Assessments

- Assess stream quality with focus on multiple stressors
- Explore relations between stressors and biological condition
- Evaluate how these relations vary with environmental setting

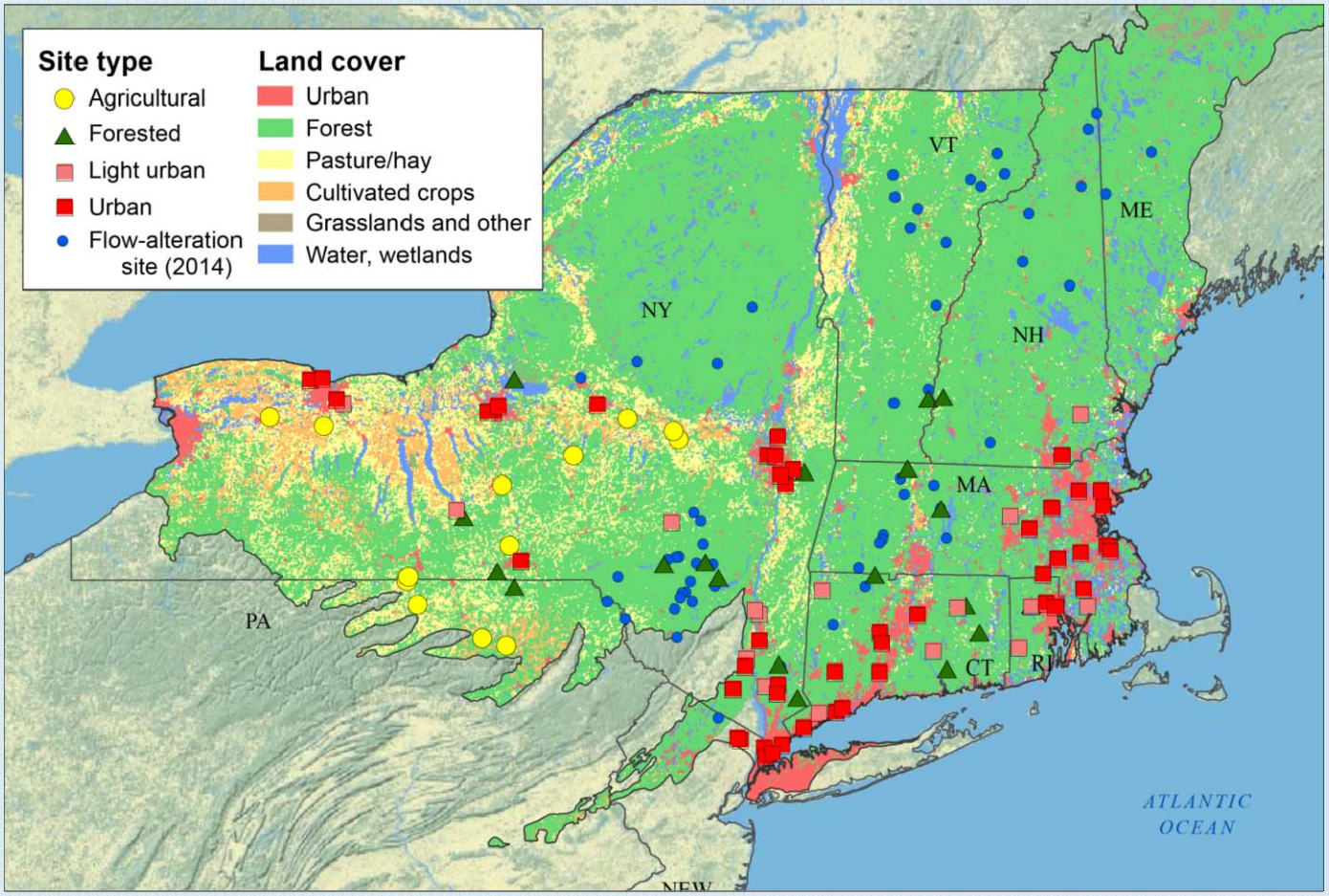
Multiple Stressors

Stream Quality,
using various endpoints

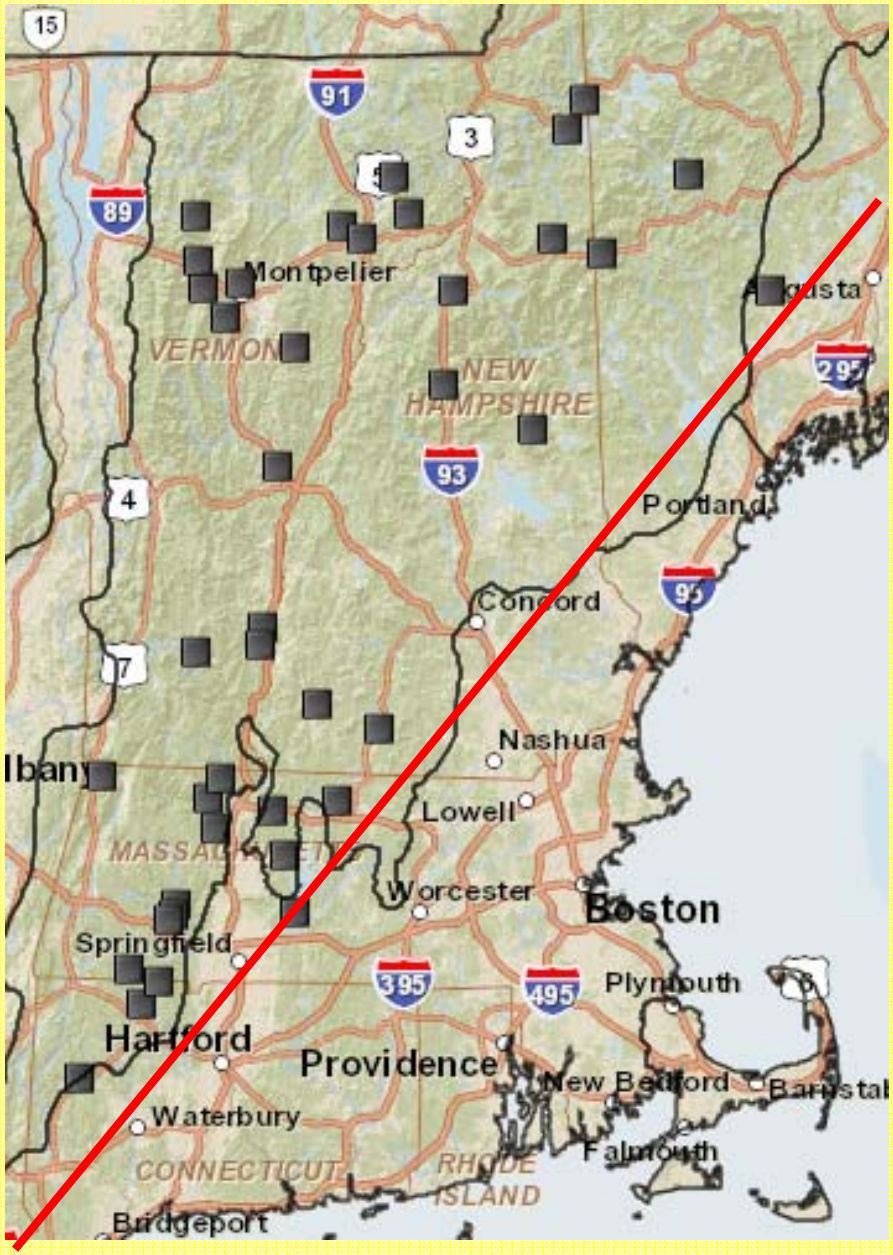
In New England, two Ecoregions have been the focus.



USGS Stream Quality Assessments in the Northeast



Northeastern Highlands (2014)



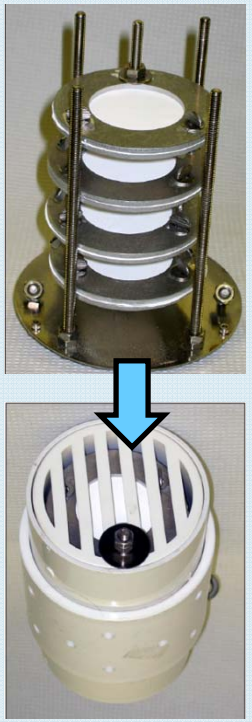
2014 Stations (Highlands)
WILD RIVER AT GILEAD, ME
SWIFT RIVER NEAR ROXBURY, ME
NEZINSCOT RIVER AT TURNER CENTER, ME
DIAMOND RIVER NEAR WENTWORTH LOCATION, NH
ANDROSCOGGIN RIVER AT ERROL, NH
ANDROSCOGGIN RIVER NEAR GORHAM, NH
BEARCAMP RIVER AT SOUTH TAMWORTH, NH
PEMIGEWASSET RIVER AT WOODSTOCK, NH
CONTOOCOOK RIVER AT PETERBOROUGH, NH
AMMONOOSUC RIVER AT BETHLEHEM JUNCTION, NH
OTTER BROOK BELOW OTTER BROOK DAM, NEAR KEENE, NH
NORTH BRANCH WINOOSKI RIVER AT WRIGHTSVILLE, VT
DOG RIVER AT NORTHFIELD FALLS, VT
MAD RIVER NEAR MORETOWN, VT
RANCH BROOK AT RANCH CAMP, NEAR STOWE, VT
LITTLE RIVER NEAR WATERBURY, VT
EAST BRANCH PASSUMPSIC RIVER NEAR EAST HAVEN, VT
MOOSE RIVER AT VICTORY, VT
POPE BROOK (SITE W-3) NEAR NORTH DANVILLE, VT
SLEEPERS RIVER (SITE W-5) NEAR ST. JOHNSBURY, VT
EAST ORANGE BRANCH AT EAST ORANGE, VT
WHITE RIVER AT WEST HARTFORD, VT
WILLIAMS RIVER NEAR ROCKINGHAM VT
SAXTONS RIVER AT SAXTONS RIVER, VT
WEST RIVER AT JAMAICA, VT
GREEN RIVER AT WILLIAMSTOWN, MA
MILLERS RIVER AT SOUTH ROYALSTON, MA
MILLERS RIVER AT ERVING, MA
NORTH RIVER AT SHATTUCKVILLE, MA
SOUTH RIVER NEAR CONWAY, MA
GREEN RIVER NEAR COLRAIN, MA
WEST BRANCH SWIFT RIVER NEAR SHUTESBURY, MA
SWIFT RIVER AT WEST WARE, MA
WESTFIELD RIVER AT KNIGHTVILLE, MA
MIDDLE B WESTFIELD RIVER AT GOSS HEIGHTS, MA
WEST BRANCH WESTFIELD RIVER AT HUNTINGTON, MA
WEST BRANCH FARMINGTON RIVER NEAR NEW BOSTON, MA
WEST BRANCH FARMINGTON RIVER AT RIVERTON, CT
HUBBARD RIVER NR. WEST HARTLAND, CT.
SHEPAUG RIVER AT PETERS DAM AT WOODVILLE, CT

2016 Stations (mainly Lowlands)

SAXTONS RIVER AT SAXTONS RIVER, VT
LAMPREY RIVER AT LANGFORD ROAD, AT RAYMOND, NH
COLD RIVER AT HIGH STREET, AT ALSTEAD, NH
BEAVER BROOK AT NORTH PELHAM, NH
STILLWATER RIVER NEAR STERLING, MA
ASSABET RIVER AT ALLEN STREET AT NORTHBOROUGH, MA
FORT POND BROOK AT RIVER ROAD NEAR SOUTH ACTON, MA
SHAWSHEEN RIVER NEAR WILMINGTON, MA
IPSWICH RIVER AT SOUTH MIDDLETON, MA
SAUGUS RIVER AT SAUGUS IRONWORKS AT SAUGUS, MA
CHARLES RIVER AT MEDWAY, MA
NEPONSET RIVER AT NORWOOD, MA
MONATIQUOT RIVER AT EAST BRAINTREE, MA
OLD SWAMP RIVER NEAR SOUTH WEYMOUTH, MA
WADING RIVER NEAR NORTON, MA
SEGREGANSET RIVER NEAR DIGHTON, MA
MILL RIVER AT SUMMER STREET NEAR BLACKSTONE, MA
GREEN RIVER NEAR COLRAIN, MA
WEST BRANCH SWIFT RIVER NEAR SHUTESBURY, MA
MOUNT HOPE RIVER NEAR WARRENVILLE, CT
FENTON RIVER AT MANSFIELD, CT
LITTLE RIVER NEAR HANOVER, CT
HUBBARD RIVER NEAR WEST HARTLAND, CT
PEQUABUCK R AT FORESTVILLE, CT
HOCKANUM RIVER NEAR EAST HARTFORD, CT
SALMON RIVER NEAR EAST HAMPTON, CT
EIGHTMILE RIVER AT NORTH PLAIN, CT
QUINNIPIAC RIVER AT SOUTHINGTON, CT
MILL RIVER NEAR HAMDEN, CT
SALMON CREEK AT LIME ROCK, CT
POOTATUCK RIVER AT SANDY HOOK, CT
ROOSTER RIVER NEAR FAIRFIELD, CT
MILL RIVER NEAR FAIRFIELD, CT
NORWALK RIVER AT SOUTH WILTON, CT
RIPPOWAM RIVER AT STAMFORD, CT
MOSHASSUCK RIVER AT PROVIDENCE, RI
WOONASQUATUCKET RIVER AT CENTERDALE, RI
HUNTINGHOUSE BK AT ELMDALE RD AT N SCITUATE, RI
RUSH BROOK NEAR ELMDALE RD NEAR NORTH SCITUATE, RI
WOOD RIVER NEAR ARCADIA, RI

2016 Water Quality Sampling

- **Weekly samples at all sites:** pesticides, nutrients, major ions, sediment, and organic carbon
- **Selected weeks:** mercury, waste indicator compounds, and pharmaceuticals
- **Passive Samplers:** (POCIS and SPMDs) pesticides, waste indicator compounds, pharmaceuticals, and estrogen assays (endocrine disrupting compounds).



2016 Streambed Sediment Sampling

- **Chemistry:** metals (including Tot-Hg and Me-Hg), PAHs, organohalogens, hormones, waste indicator compounds, radionuclides (origin of sediment)

- **Toxicity:** *Hyalella, Chironomus*, mussels

2016 Ecological Assessments

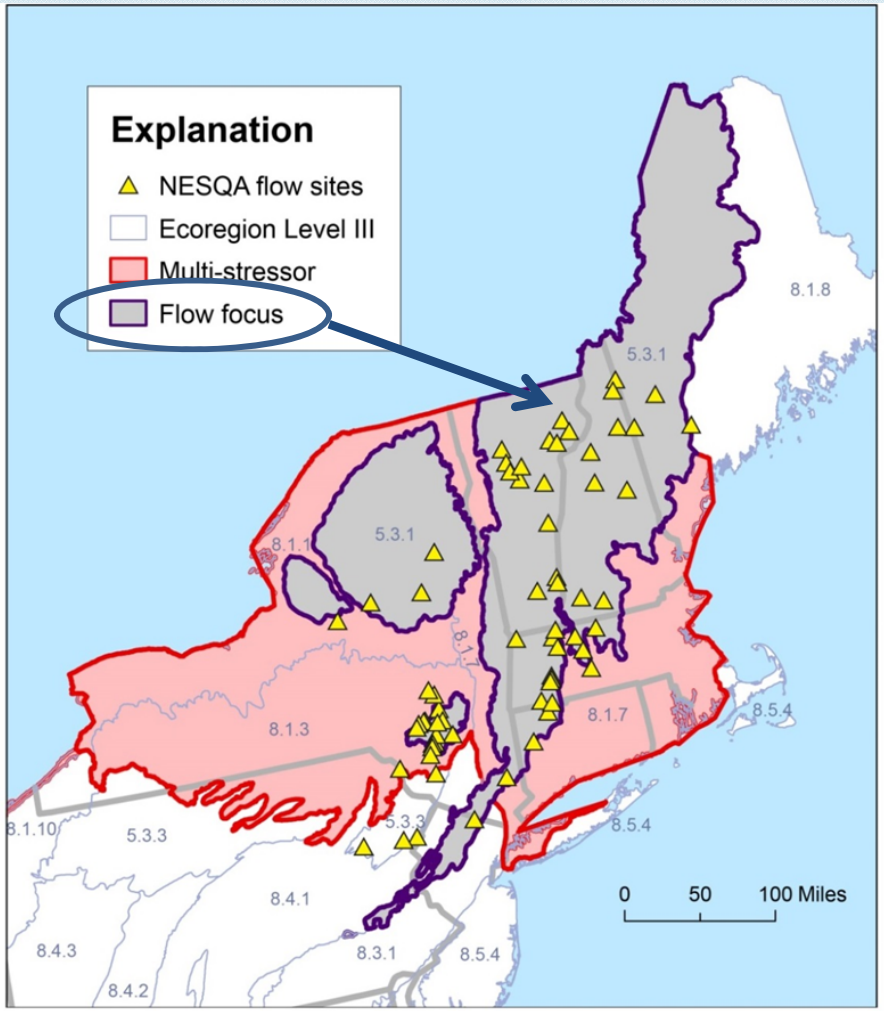
Biological Surveys: Invertebrates, Algae, Fish, and Habitat

Mercury in fish: total concentration & isotopes (source)

2016 Sampling Schedule

	Date	JUN 6	JUN 13	JUN 20	JUN 27	JUL 4	JUL 11	JUL 18	JUL 25	AUG 1	AUG 8
Urban Sites n=22	WQ	1	2	3	4	5	6	7	8	9	
	ECOLOGY									1	2
Forest & Low Dist. n=18	WQ						1	2	3	4	
	ECOLOGY									1	2

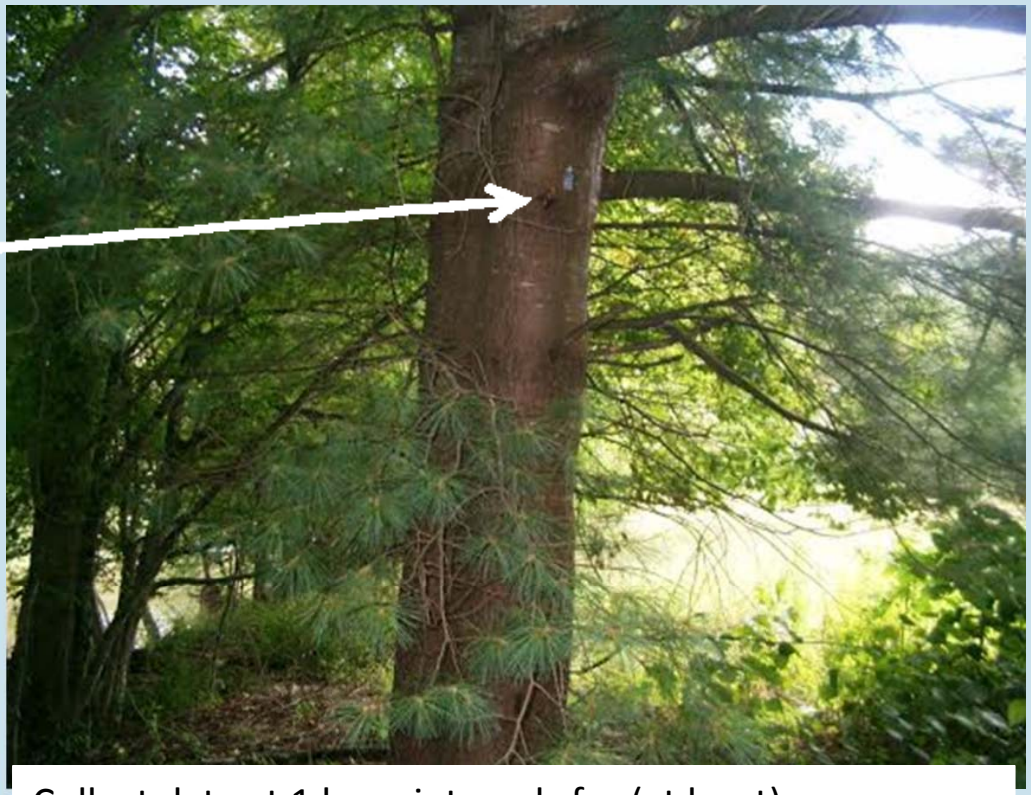
Streamflow Alteration component of the Northeast Stream Quality Assessment



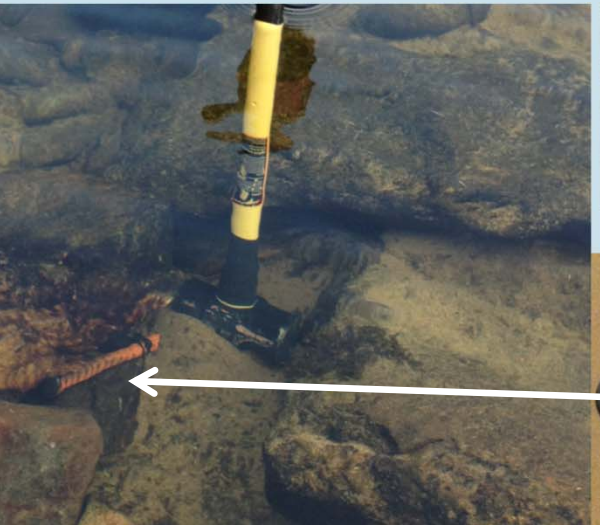
2014

- Hydrology (USGS gage)
- Water & Sediment Chemistry
- Algae & Macroinvertebrates
- Habitat Surveys
- Air & Water Temperature

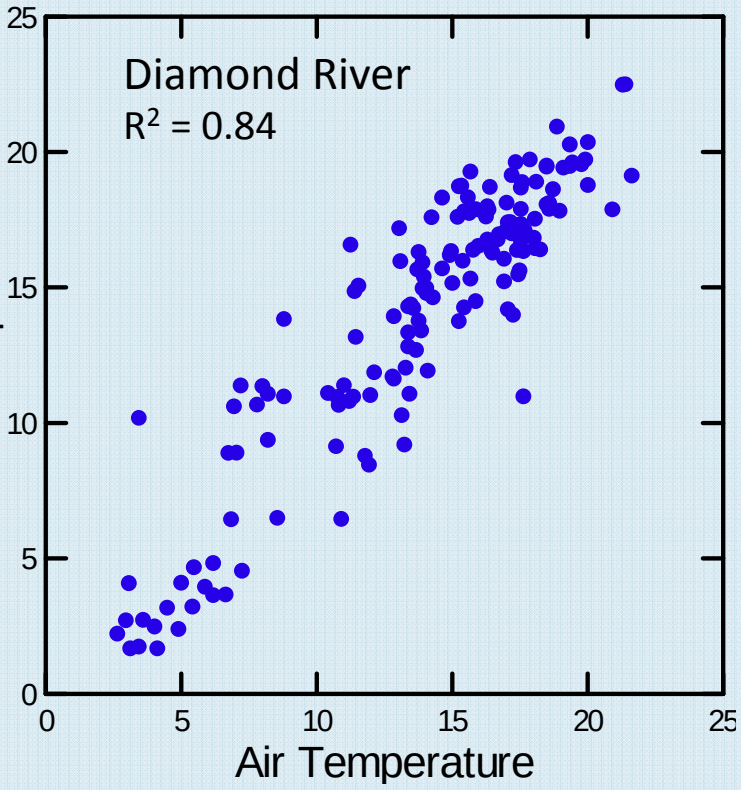
Air and Water Temperatures at sites

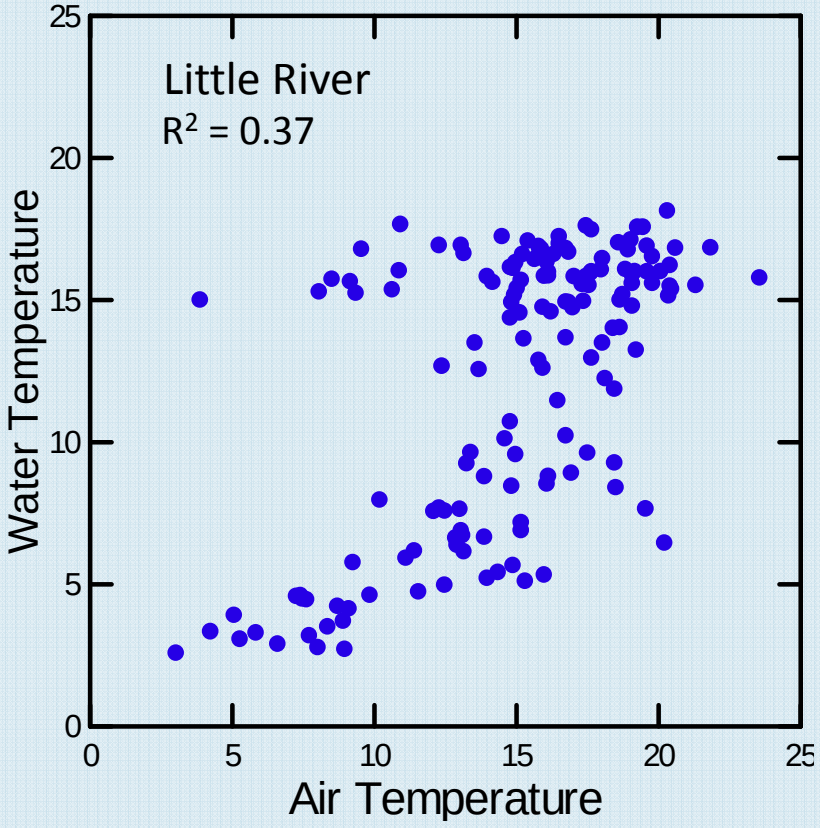


Collect data at 1 hour intervals for (at least) a year

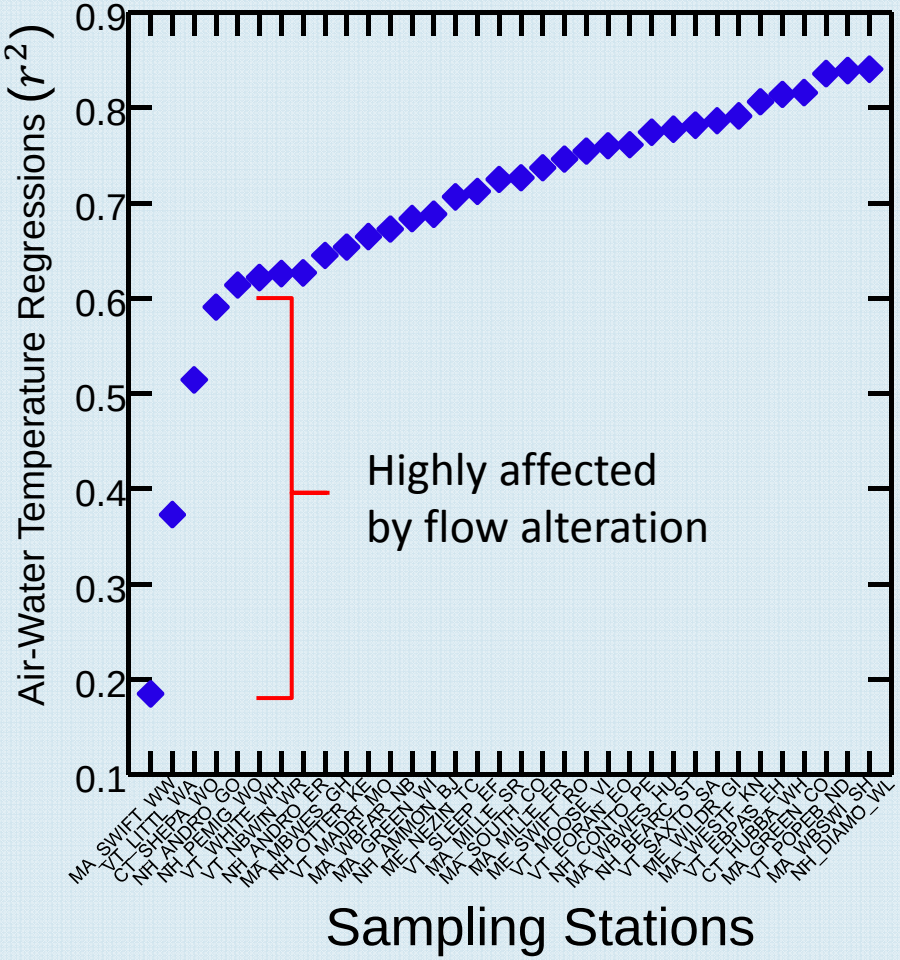


Comparison between water and air temperature from spring through summer

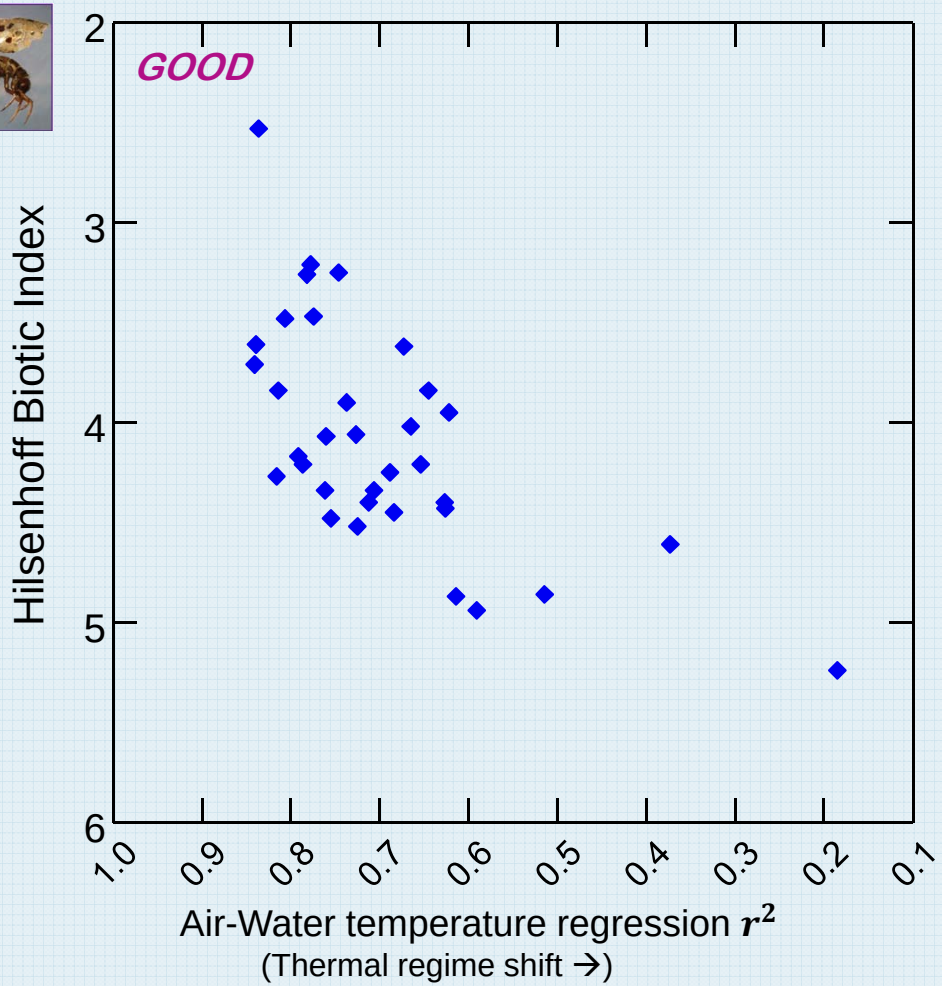


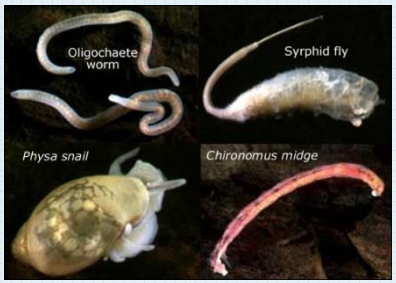


Coefficient of Determination (r^2) as estimate of *thermal regime shift*



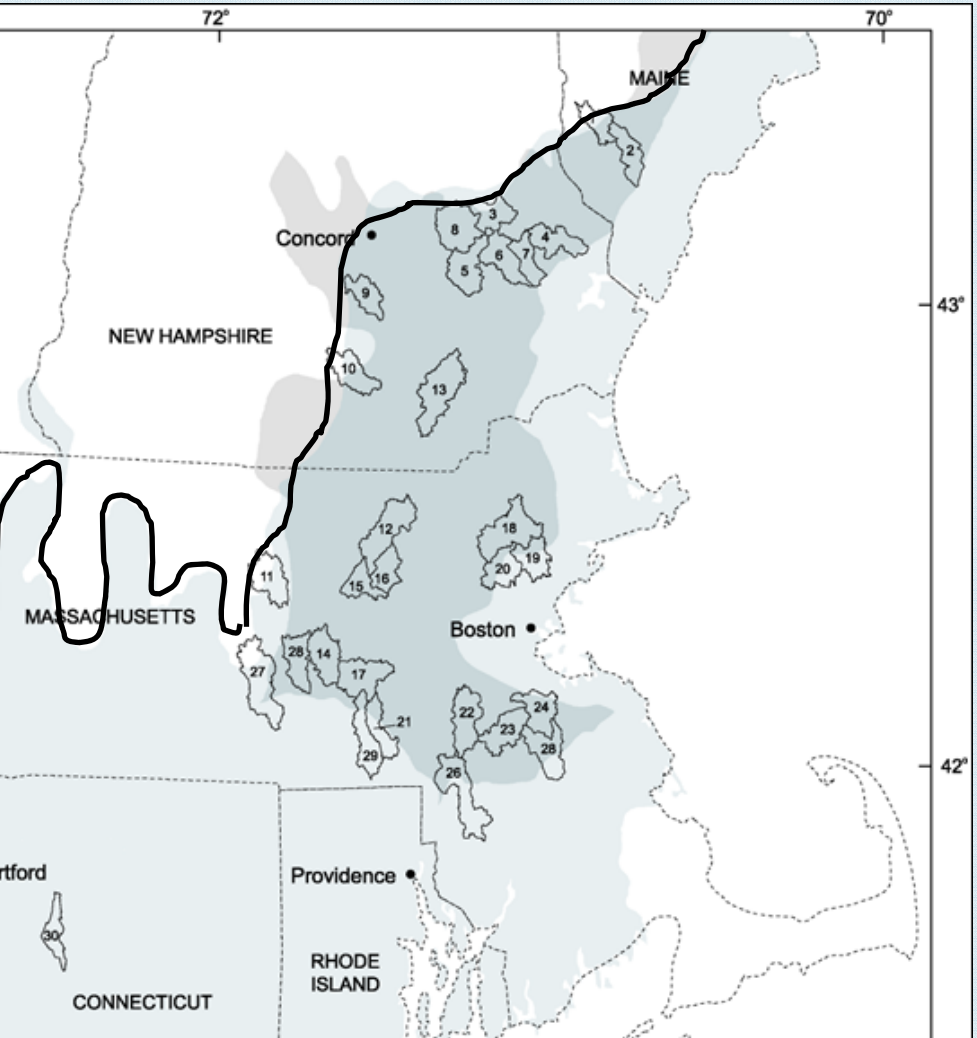
Apparent Loss of Sensitive Invertebrates with Shift in Thermal Regime





USGS Urban Study in the Northeastern Coastal Zone,

Study conducted 1999-2000

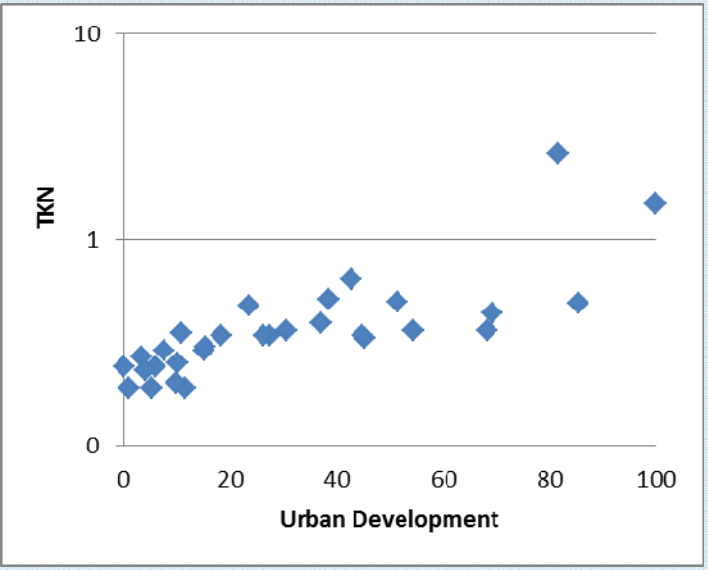


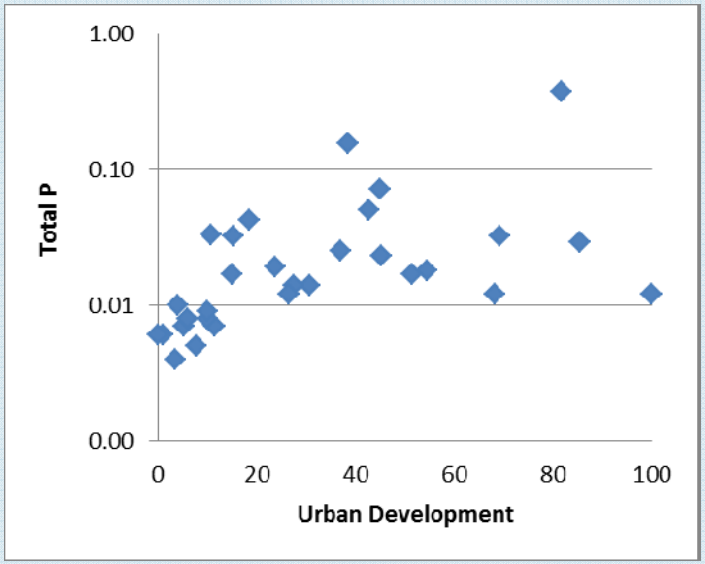
Thirty streams were selected that ranged from very low to high levels of watershed development.

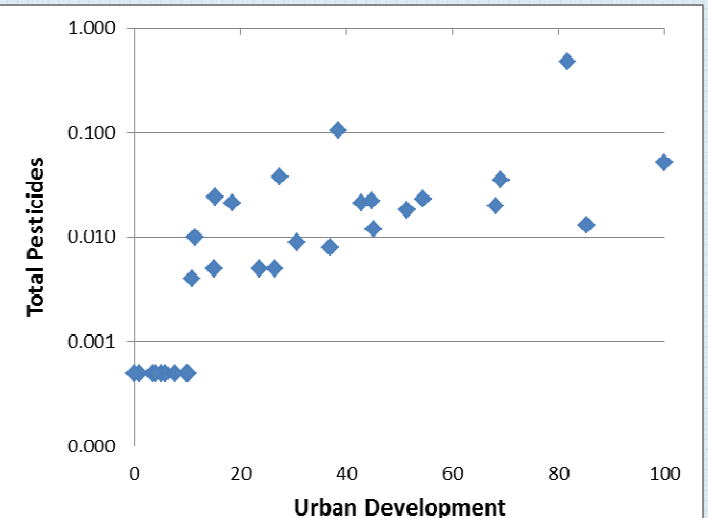
The streams and watersheds were characterized by their level of urban development, scaled 0 to 100.

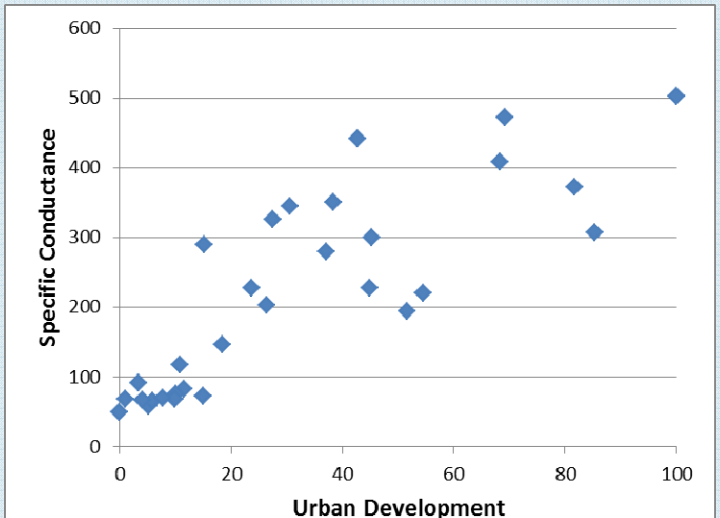
Chemical Constituents and Urban Development

(Results are from 2000 study)

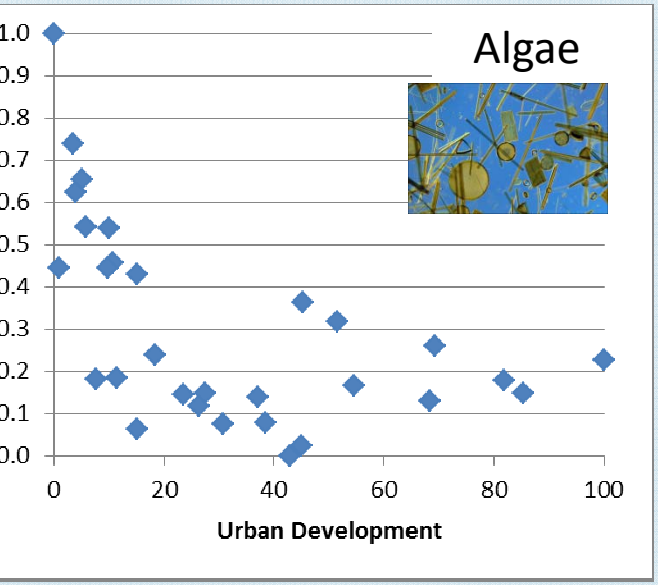


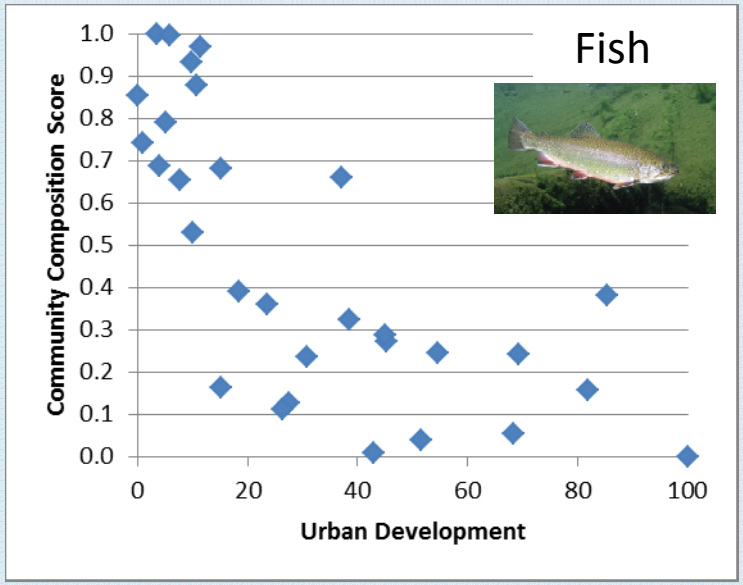


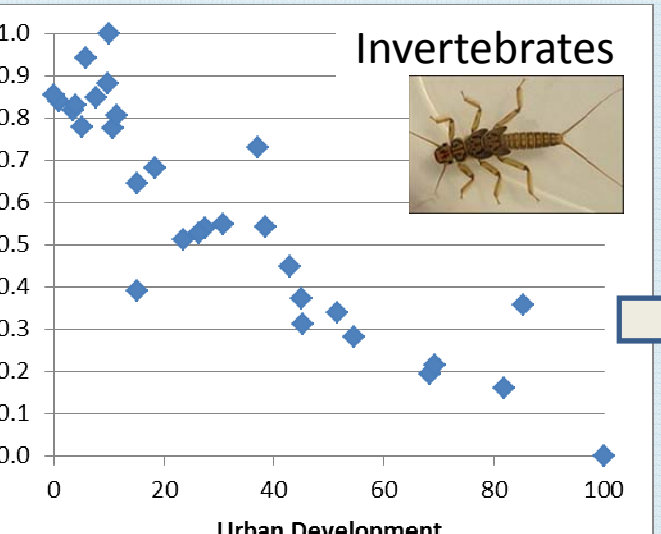


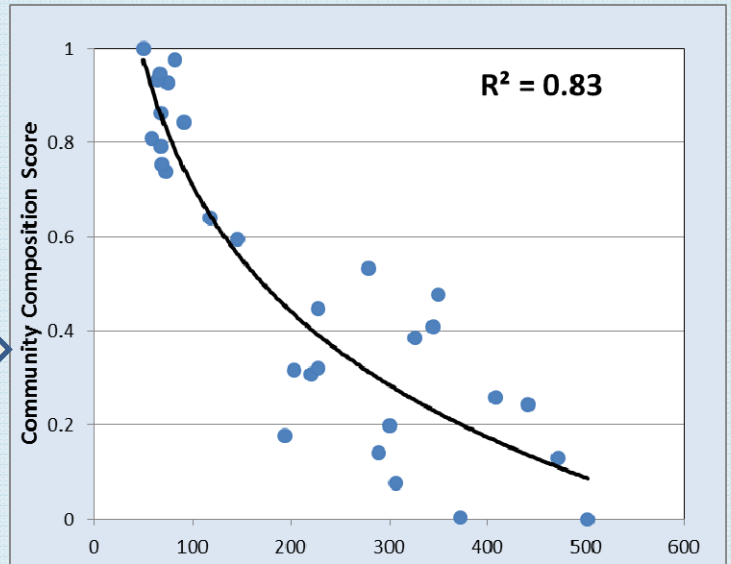


ponse of Aquatic Communities to Urban Development (2000)









Microcystin in streams of the Northeast.

ae may make for stinky water, but it poses no health risks”

-Concord Monitor, Concord, NH July 7, 2006

USGS science for a changing world

Environmental Health - Toxic Substances

Science Features

U.S. Geological Survey Scientists Complete First Systematic Regional Survey of Algal Toxins in Streams of the Southeastern United States

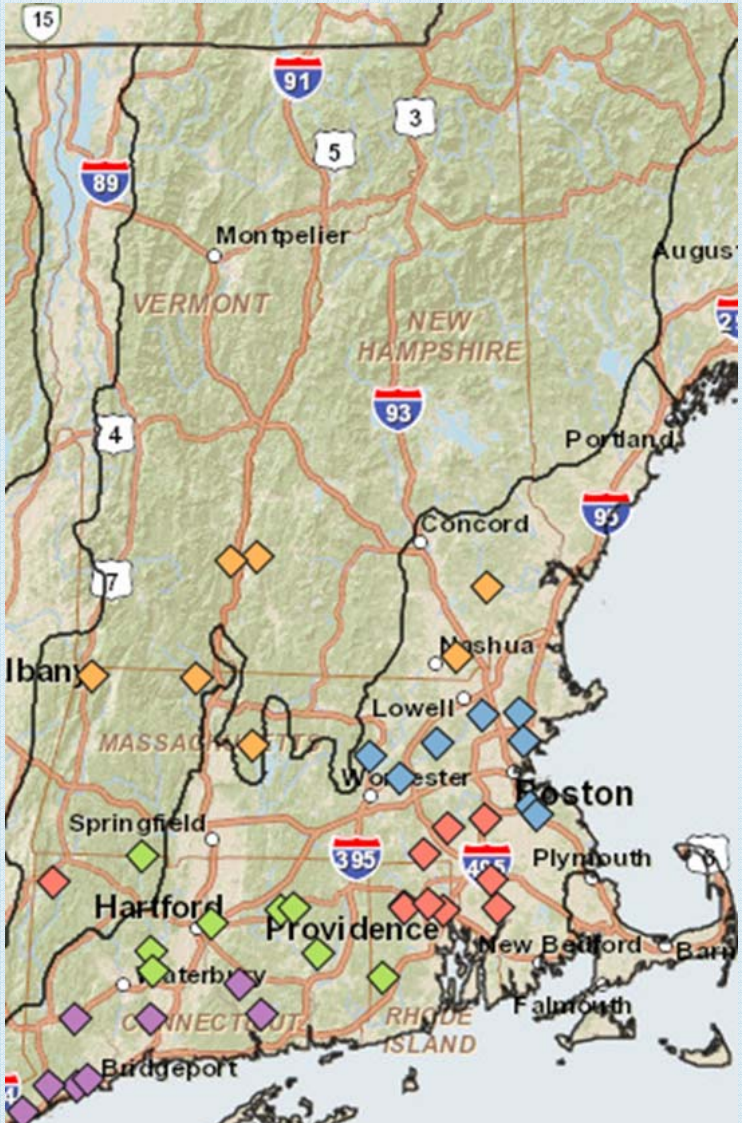
U.S. Geological Survey (USGS) scientists detected microcystin—an algal toxin—in 39 percent of 75 streams assessed in the southeastern United States. These results will inform and become part of a larger, systematic national survey of algal toxins in small streams of the United States.

U.S. Geological Survey (USGS) scientist collects periphyton samples from Nantahala river near Hewitt, North Carolina
Photo Credit: Celeste Journey, USGS.

Cyanobacteria are photosynthetic microorganisms that are present in streams, lakes, wetlands, and oceans worldwide. Cyanobacteria are known to intermittently produce toxins (cyanotoxins) that can have adverse effects on a wide range of organisms including bacteria, algae, insects, plants, bivalves, fish, and humans, but the factors that trigger toxin production are not well understood. Microcystins are among the most commonly reported and widely studied cyanotoxins, and concerns are growing due to apparent increases in the frequency and severity of human and ecological health effects.

As a first step toward designing a survey to advance our understanding of microcystin occurrence in small streams, USGS scientists utilized historical periphyton data (1993–2011) and identified cyanobacteria (including *Leptolyngbya*, *Phormidium*, *Pseudoanabaena*, and *Anabaena* species) in 74 percent of headwater streams in Alabama, Georgia, South Carolina, and North Carolina during this time period. Although microcystins were not measured during that initial research, the presence of microcystin producing cyanobacteria provided critical evidence that enabled the scientists to prioritize and design subsequent research.

With that evidence in hand, USGS scientists then collected environmental samples from 75 targeted streams with varying urban and agricultural land use in the southeastern United States for microcystin analyses. Five sites representative of a land use gradient were resampled monthly in August, September, and October 2014 to provide additional insight into the persistence and temporal variability of microcystin occurrence within the study area. Overall, microcystins were



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