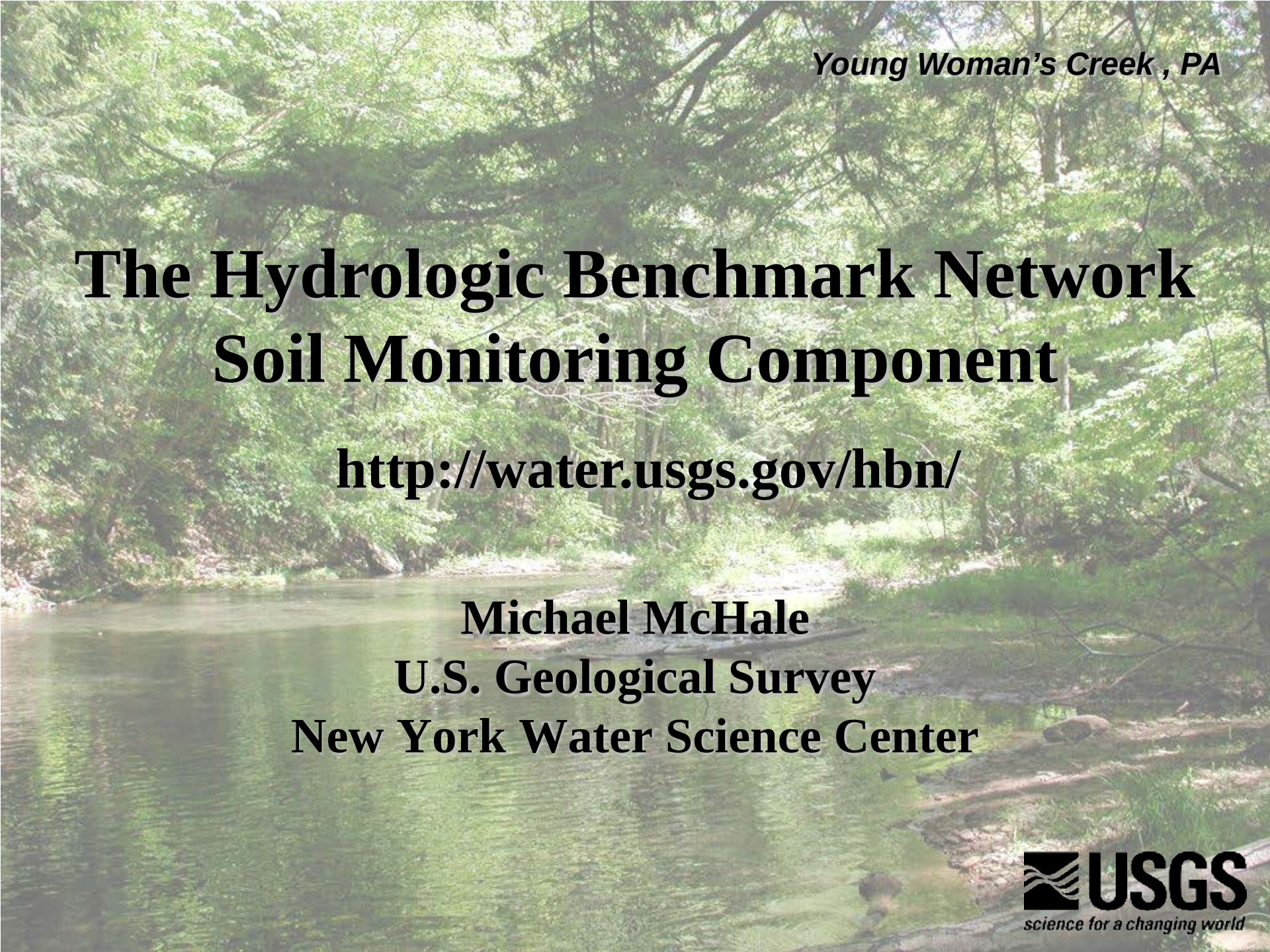


The Hydrologic Benchmark Network Soil Monitoring Component

http://water.usgs.gov/hbn/

Michael McHale
U.S. Geological Survey
New York Water Science Center

USGS
science for a changing world

The Hydrologic Benchmark Network (HBN) was established in 1963 to provide long-term measurements of streamflow and water quality in areas that are minimally affected by human activities. These data were used to study long-term trends in surface water flow and water chemistry and as a benchmark against which to compare changes in flow and chemistry in developed watersheds. At its peak the network consisted of 58 drainage basins in 39 States. Over time, changes in funding and land use within the watersheds reduced the number of stations and samples collected by HBN. In the mid-1990s, the USGS conducted a complete review of the network, and selected 5 eastern stations to conduct a pilot study to assess the optimum sampling strategy for assessing long-and short-term trends.

In 2003, the USGS re-established a 15-station water-quality and 36-station discharge monitoring network with a new design that allows tracking of trends in water quality at a range of river flow conditions. Additional stations are anticipated to be added to the network as funding allows.

Site Map

Move the cursor over the map to identify sites,
click on a site to go to the site page.

PART B

A National Network of Hydrologic Bench Marks

By Luna B. Leopold

We are engaged in great national programs of water control and development. An expanding population demands ever-increasing supplies of the natural resources which are to be found in or upon the landscape—soil, water, minerals, food, timber, and fiber. By his works, by his extractions, man's mark upon his environment becomes ever deeper, his effects more indelible.

We often read that water tables are falling, that floods are increasing, that springs go dry more often now than in grandfather's time, or that rivers are muddier than before. Such changes, if true, are troublesome—but water is a fluctuating resource, responding over time to changes in the environment. A recurring question of our times, and one that we anticipate will be increasingly vexing to posterity, is to know how much of the change in our environment is caused by man and how much is natural. In trying to answer this question we immediately face the insurmountable fact that changes must be measured relative to some standard base or datum. What can we compare against?

The most pervasive—and probably the most important—of the slow and subtle changes result directly or indirectly from variations in climate. Over a shorter or longer period of time, pulsations in precipitation and temperature change the amounts of water that are evaporated or transpired by the soil and vegetation, the amount of water that replenishes soil water, the quantity of water for recharge to ground water and for riverflow. Climatic variations also cause changes in the pattern of erosion, of which some spectacular consequences can be observed in the arid zones. Changes in climatic pattern, through their effects on the hydrologic cycle, on soil, and on vegetation, can produce results remarkably similar to those effected by the works of man.

Oraibi Wash, Navajo County, Ariz., July 1960.

About 20 miles upstream from Oraibi Village. The gully is about 20 feet deep, 30 feet wide, and tens of miles in length. Like many others in the Southwest, this gully was formed in the 1880's.

These are direct practical reasons for our concern. The division of water of highly developed streams between bordering States is often based on the so-called virgin flow. What constitutes the flow unvexed by the hand of man cannot be determined at the council tables of negotiation, or even in the halls of justice, without essential hydrologic facts.

It therefore becomes a matter of practical concern, as well as a matter of scientific interest, that the specific causes of given observed effects be identified. The chain of events—the linkage of interrelated factors—must be known in far more detail than is possible at present. Attainment of this objective requires a means for dissociating the direct and indirect effects of man's use from similar effects which are brought about by natural variations in climatic factors.

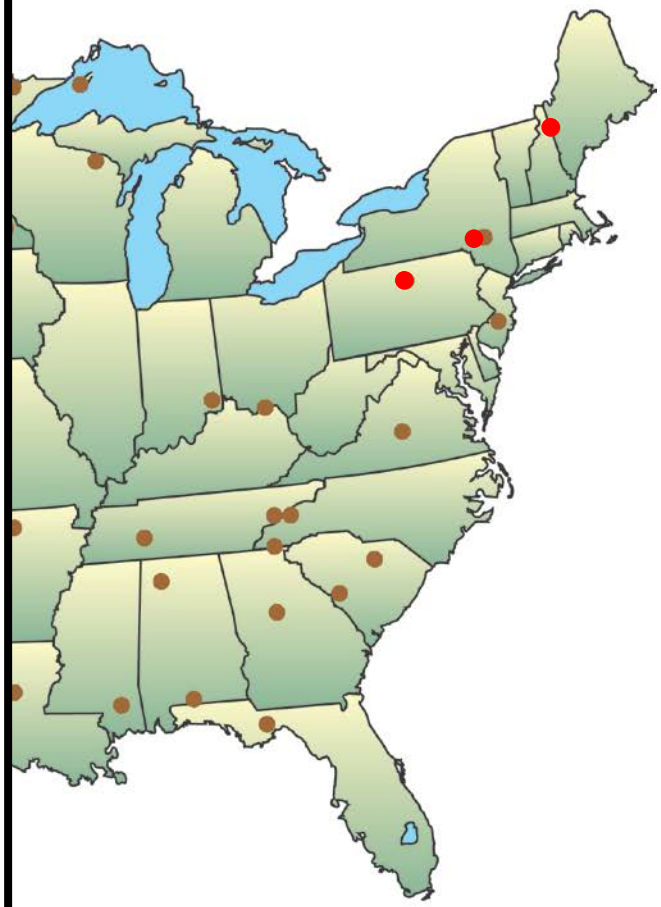
Determination of these changes is often sought in the analysis of records of streamflow, but the answer usually is neither simple nor unequivocal. Natural daily, seasonal, and secular changes in precipitation cause changes

Leopold, L.B., 1962, A national network of hydrologic benchmarks: U.S. Geological Survey Circular 460-B, 4 p.

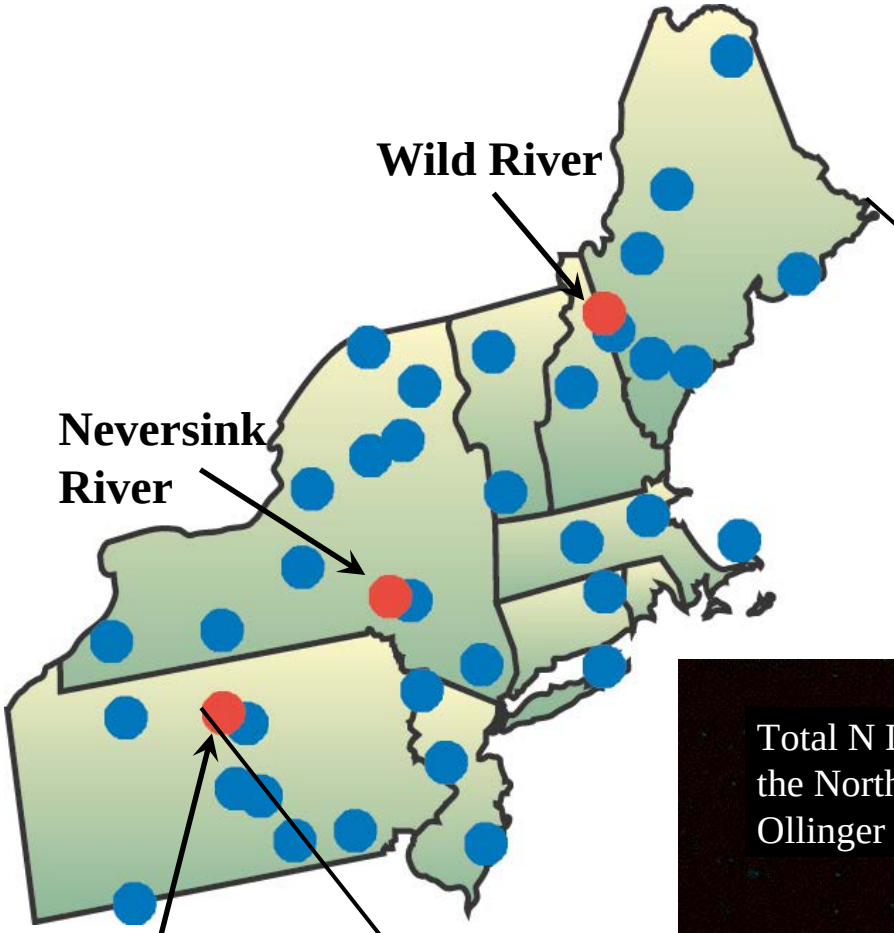
Original Network

<u>Types of Observations</u>

Discharge
Water chemistry
Sediments
Water temperature
Groundwater level
Groundwater temperature
Precipitation
Channel geomorphology
Wind-blown pollen
Geology
Topographic characteristics
Vegetation (to some extent)
Soil characteristics and chemistry

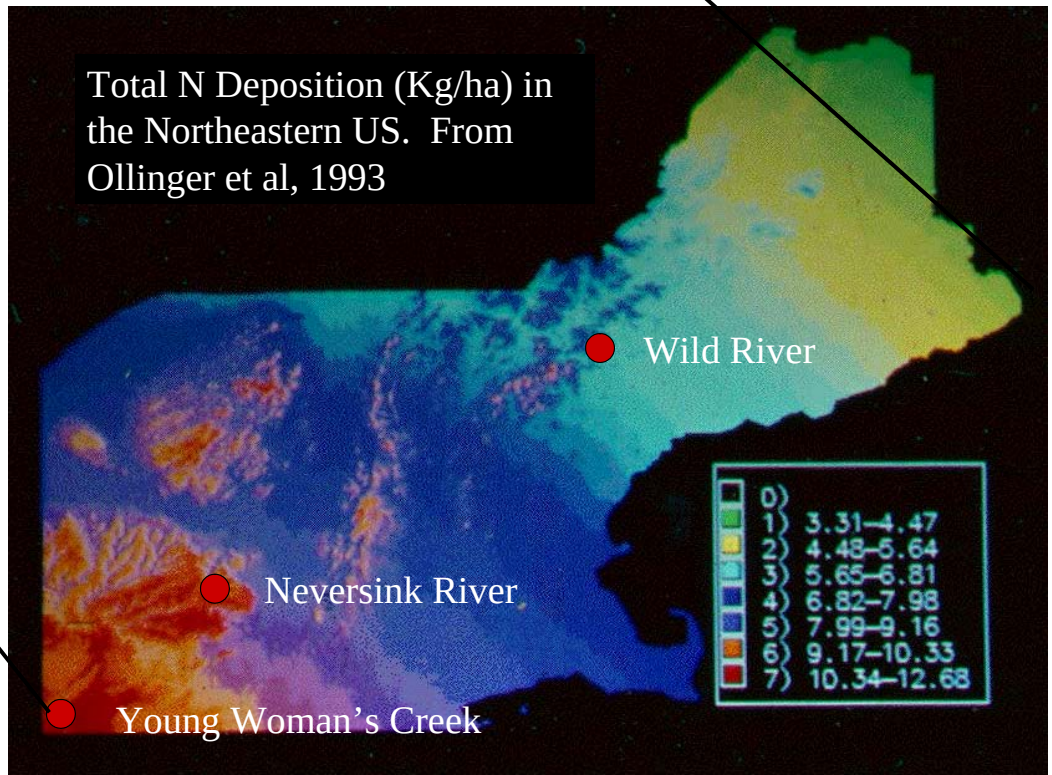


HBN Study in the Northeast

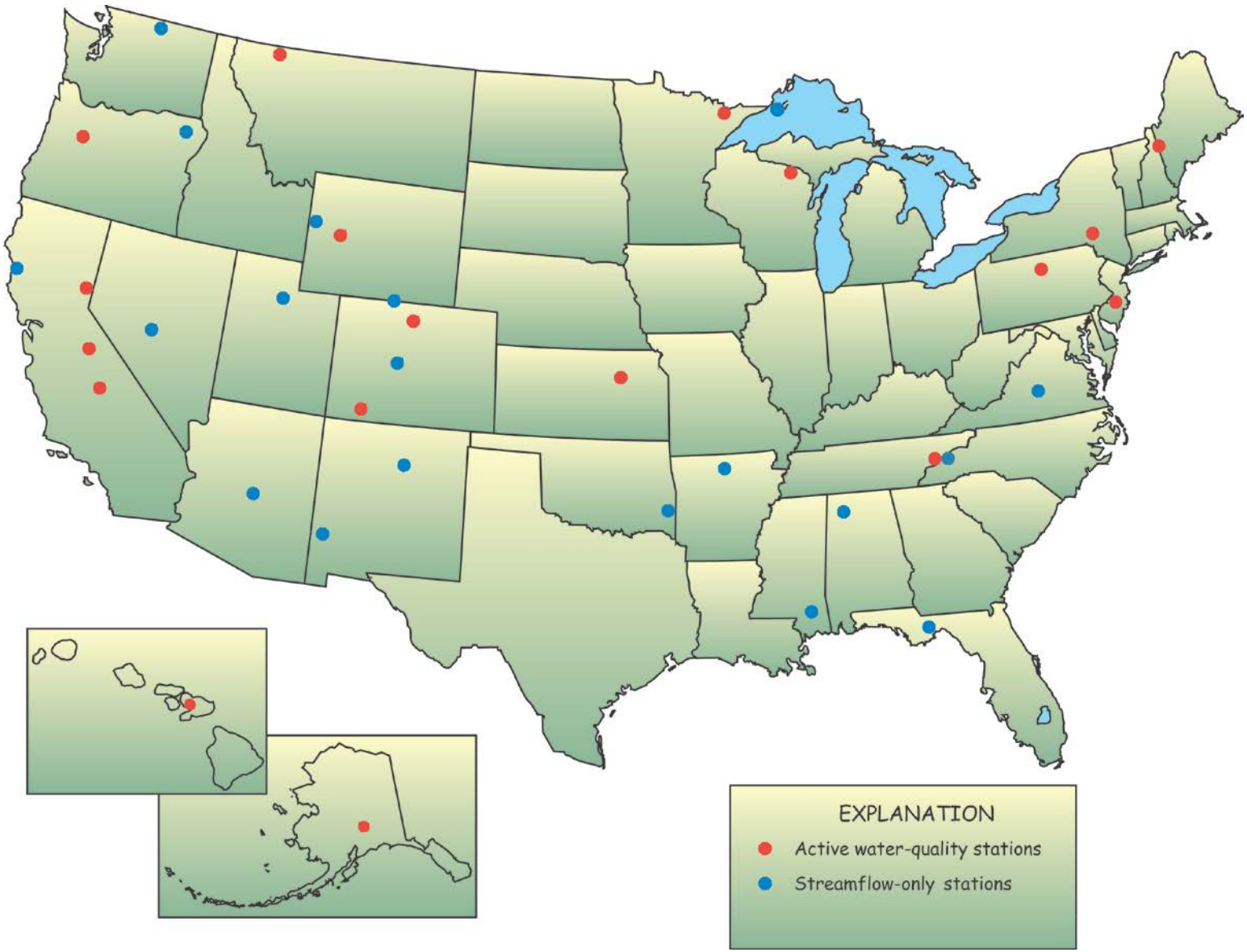


National Atmospheric Deposition Program Site

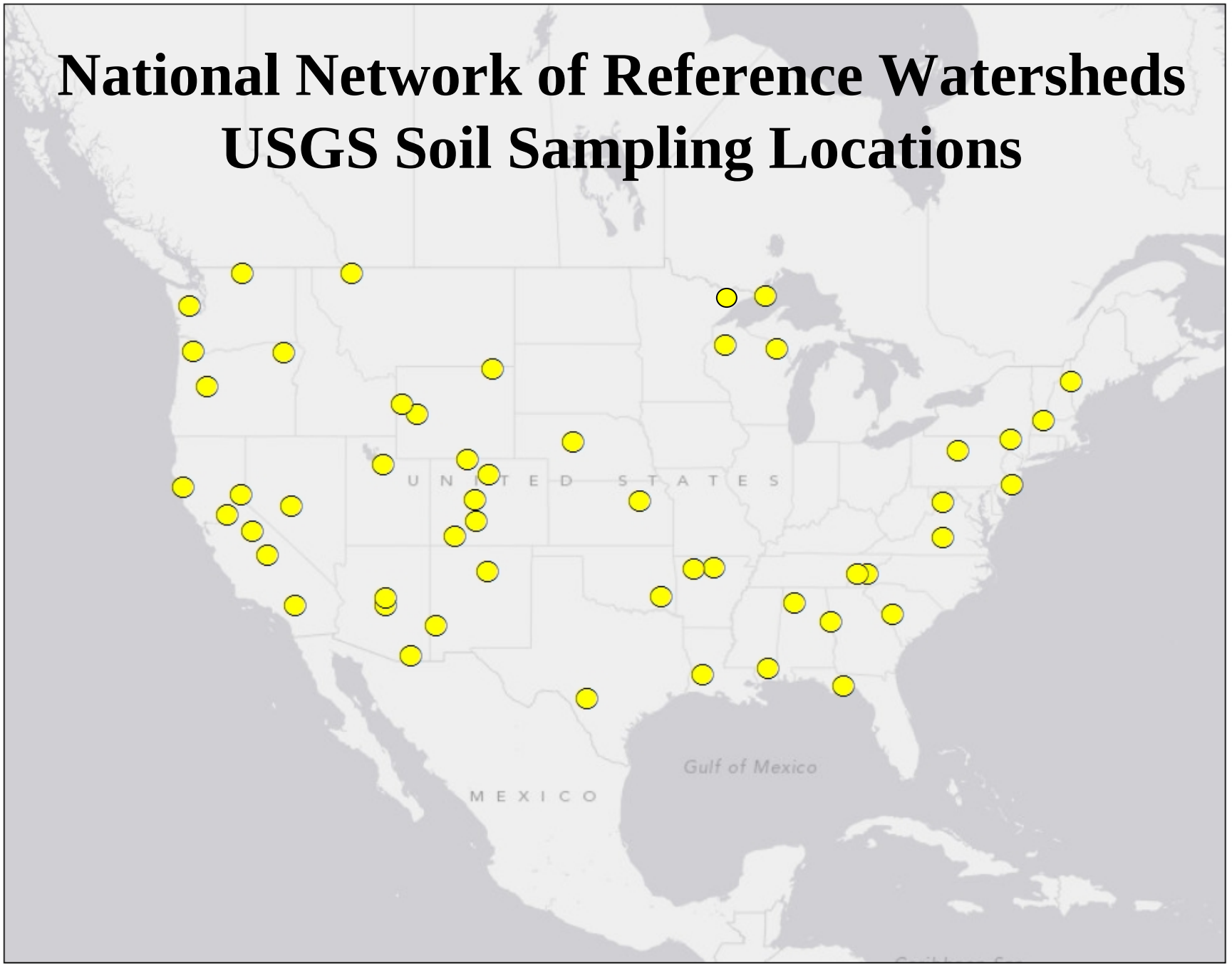
HBN Gaging Station



HBN 2012

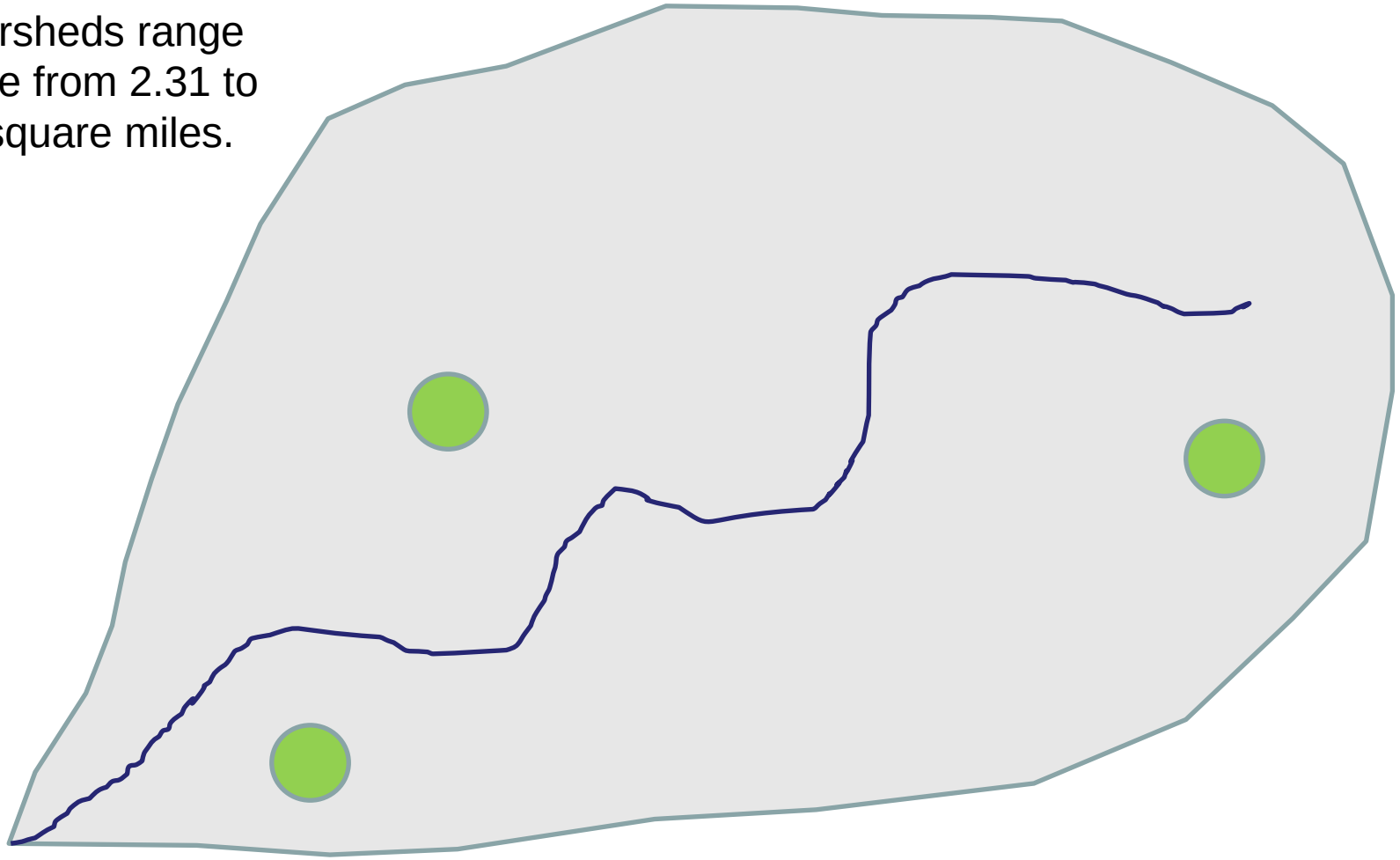

EXPLANATION
Active water-quality stations
Streamflow-only stations

National Network of Reference Watersheds
USGS Soil Sampling Locations

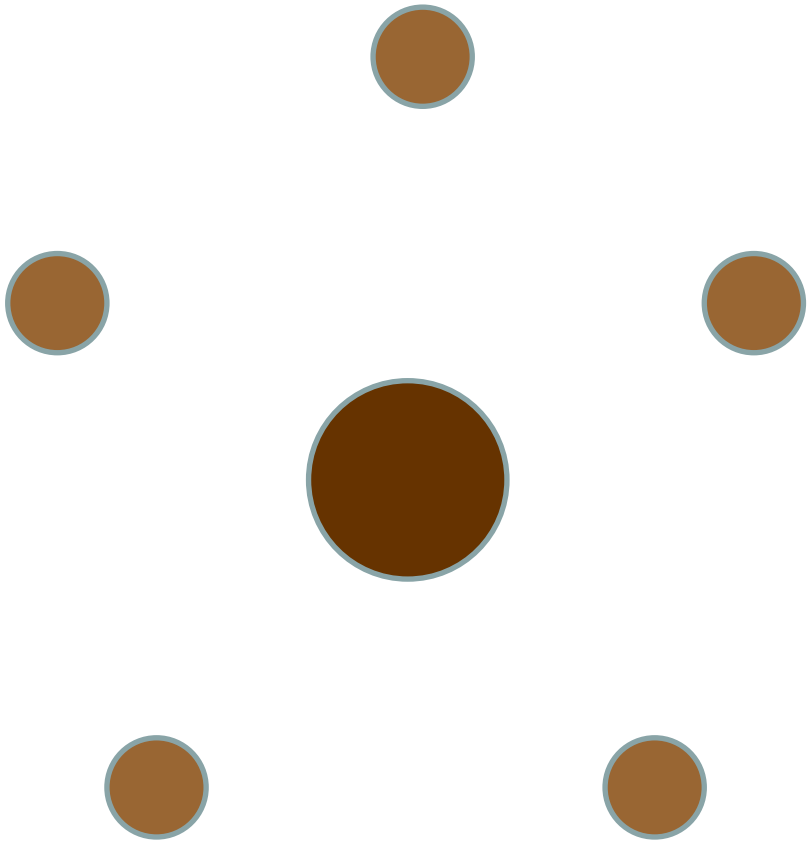


Watershed Sampling Design

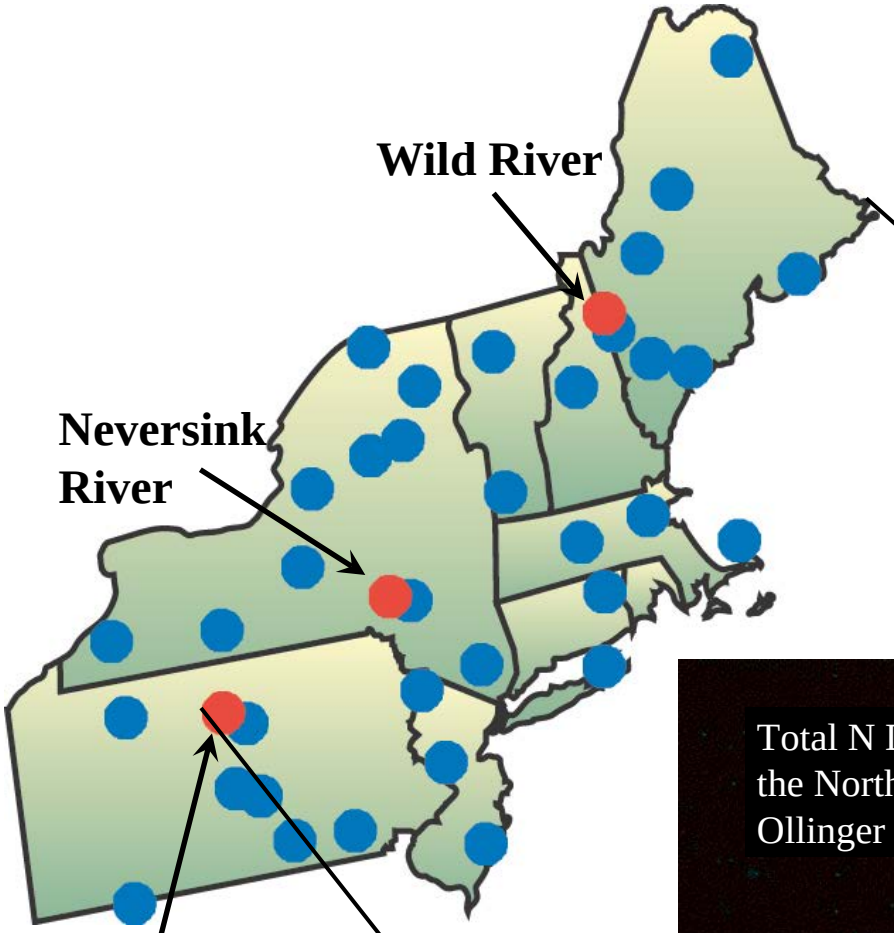
Watersheds range in size from 2.31 to 960 square miles.



Sampling Location

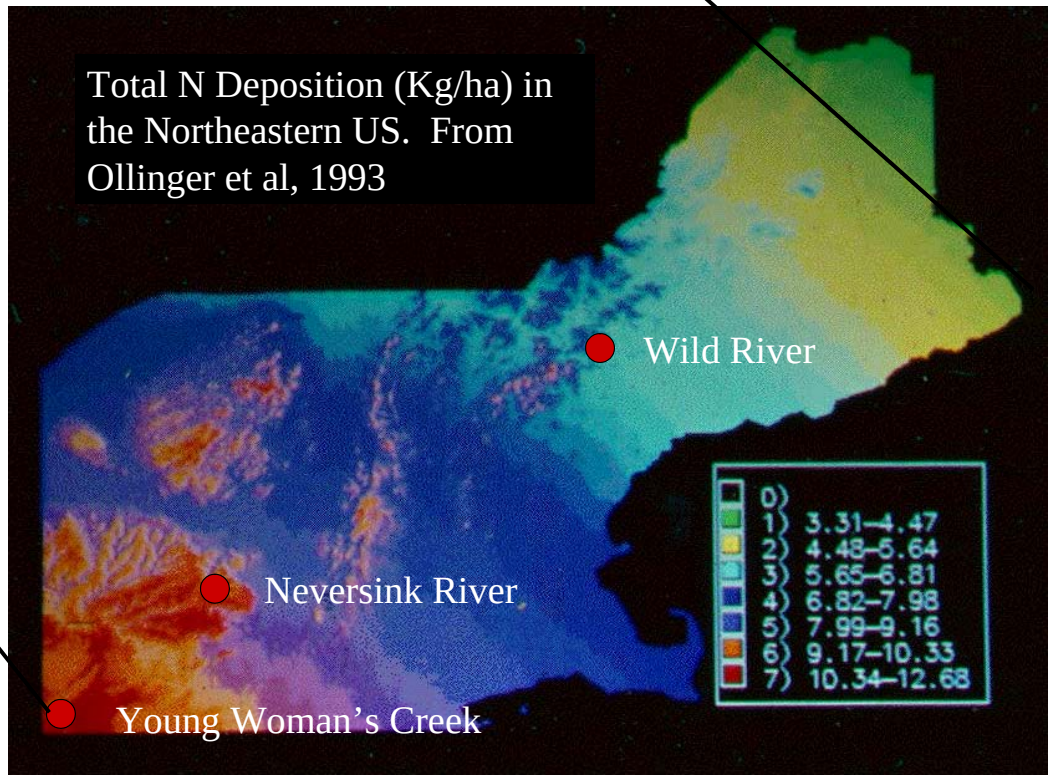


HBN Study in the Northeast



National Atmospheric Deposition Program Site

HBN Gaging Station



Laboratory Analyses

- **Soils are air dried and sieved - 4 mm sieve (organic samples) or a 2 mm sieve (mineral samples).**
- **Moisture content of the air-dried samples is determined by oven drying at 65^{o}C for organic samples and 105^{o}C for mineral samples.**
- **Soil samples are analyzed for exchangeable acidity and exchangeable aluminum (Al_{ex}), by KCl vacuum extraction and titration. Exchangeable bases are determined by NH_4Cl vacuum extraction, and measurement by inductively coupled plasma-emission spectrometry.**

USGS Hydrologic Benchmark Network Soil Description Form

Site ID: LF10	HBN Watershed: Young Womans Creek	Date: 9-28-11
Describer(s): MRM, JS	Latitude (dd.ddd): 41.38972	Longitude (dd.ddd): 77.64043
Vegetation: Oak, Red and Sugar Maple, Fern understory with some small White Pine	Slope: 3%	Aspect: South-West
Elevation:	Hillslope Profile Position: Upper Plateau (no defined ridge)	Weather: Rain

Field Notes: GBL's original site had been harvested, moved new similar location outside of harvest area. Not a closed canopy, trees not in good shape (oak slightly better than maple).

Horizon	Depth (cm)	Color (moist)	Texture	Structure	Consistence (moist)	Rock Fragments	Roots	Mottles	Redox. Features	Concentra-tions
Oe	0-1	na	na	na	na	na	na	na	na	na
Oa	7-Jan	10YR2/1	na	na	na	na	na	na	na	na
E	14-Jul	10YR5/2	SL	1FSBK	FR	10%	F	na	na	na
Bs	14-16	7.5YR4/4	SL	1FSBK	FR	10%	C	na	na	na
Bw1	16-33	10YR6/6	SL	1FSBK	FR	10%	C	na	na	na
Bw2	33-82	7.5YR5/6	SL	1MSBK	FR	10%	F	na	na	na
BC	82-92	5YR5/6	LS	1MSBK	FR	30%	0	na	na	na


LF30 9.29.11