

# Nontidal Water-Quality Monitoring: Small Watershed Studies / Conewago Creek Management Actions and Changes in Water-Quality



# Cooperators

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- USDA/NRSC
- EPA
- PADEP
- Conservation Districts
- Penn State / Millersville Universities
- Elizabethtown Collage
- TCCCA

# Theme of talk

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- Many studies collect data for characterization of water-quality patterns.
- Few studies able to relate BMP implementation and land-use change to water-quality response.
- Why?
  - cost \$\$
  - length of project (lag times)

# Small Watershed Study: Objectives

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**Objective:** Describe responses in water quality within small watersheds and relate those changes to watershed processes, BMP implementation, and other watershed changes

Work in basins where we have or plan to have infrastructure and data collection opportunities.

Currently USGS and it's partners are monitoring in 5 small watersheds

## **Agricultural Watersheds (USDA Showcase Watersheds):**

- Conewago Creek (PA)
- Smith Creek (VA)
- Upper Chester River (MD)

## **Suburban Watersheds:**

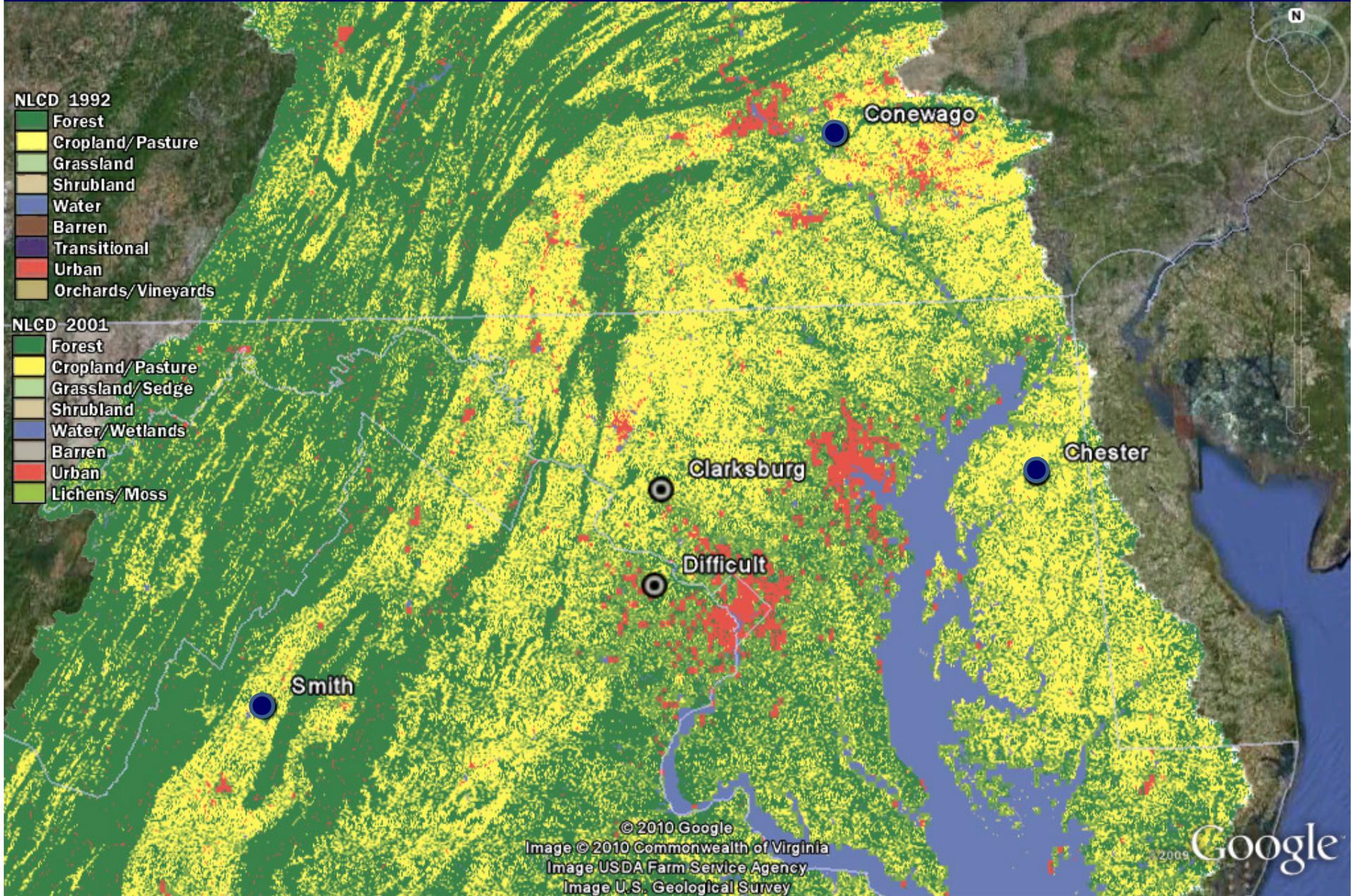
- Difficult Run, Fairfax County, VA
- Montgomery County, MD

NLCD 1992

- Forest
- Cropland/Pasture
- Grassland
- Shrubland
- Water
- Barren
- Transitional
- Urban
- Orchards/Vineyards

NLCD 2001

- Forest
- Cropland/Pasture
- Grassland/Sedge
- Shrubland
- Water/Wetlands
- Barren
- Urban
- Lichens/Moss



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Image U.S. Geological Survey

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# Small Watershed Study - Study Designs Issues

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## Potential Study Designs: each has own situational use and benefit

- Before and after implementation (pre-post)
- Nested watersheds (upstream-downstream)
- Paired watersheds (most costly)

## Concerns: \$\$

- Maintaining the monitoring in 5 sites will be a real budget challenge
- We must avoid spreading ourselves too thin
- We cannot do Everything, Everywhere, Every time
- Can we devise a monitoring program with “core” and rotational “intensive” monitoring

# Small Basin Studies: Core Response Metrics

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**“Core monitoring” at multiple sites to detect changes in water quality –**

- Water-quality monitoring stations include: a stream gage, autosampler, routine sampling, and continuous water-quality monitoring (turbidity, DO, specific conductance, pH, and temperature).
- Seasonal synoptic water-quality sampling – to quantify baseflow nitrate contributions.
- Ecological health monitoring
- BMP implementation tracking, changes in watershed sources, and land-use change analysis. (Reliance upon our partners)

# Small Watershed Study - Source-Data Needs

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- To interpret the effects of the conservation practices on nutrient discharges, watershed monitoring alone is not sufficient. It will be necessary to collect detailed data on the practices and other agricultural activities that affect nutrient discharges, including: areas, spatial distribution, and types of agricultural lands (croplands, pastures, etc.); fertilizer application rates; livestock populations; and the locations of riparian buffers and wetlands.

Weller, D.E., T.E. Jordan, K.G. Sellner, K.L. Foreman, K.E. Shenk, P.J. Tango, S.W. Phillips, and M.P. Dubin. 2010. Small Watershed Monitoring Designs. A report prepared for the Chesapeake Bay Program Scientific and Technical Advisory Committee (STAC), STAC Publ. #10-004, Annapolis, MD. 18 pp.

# Small Watershed Study: Intensive Monitoring

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Study designs will be geared to identify the sources, sinks, and transport processes within each watershed

Ultimate goal - how do these change in relation to management actions in the short and long term? (lag times)

More intensive-research type monitoring (every 5 years?)

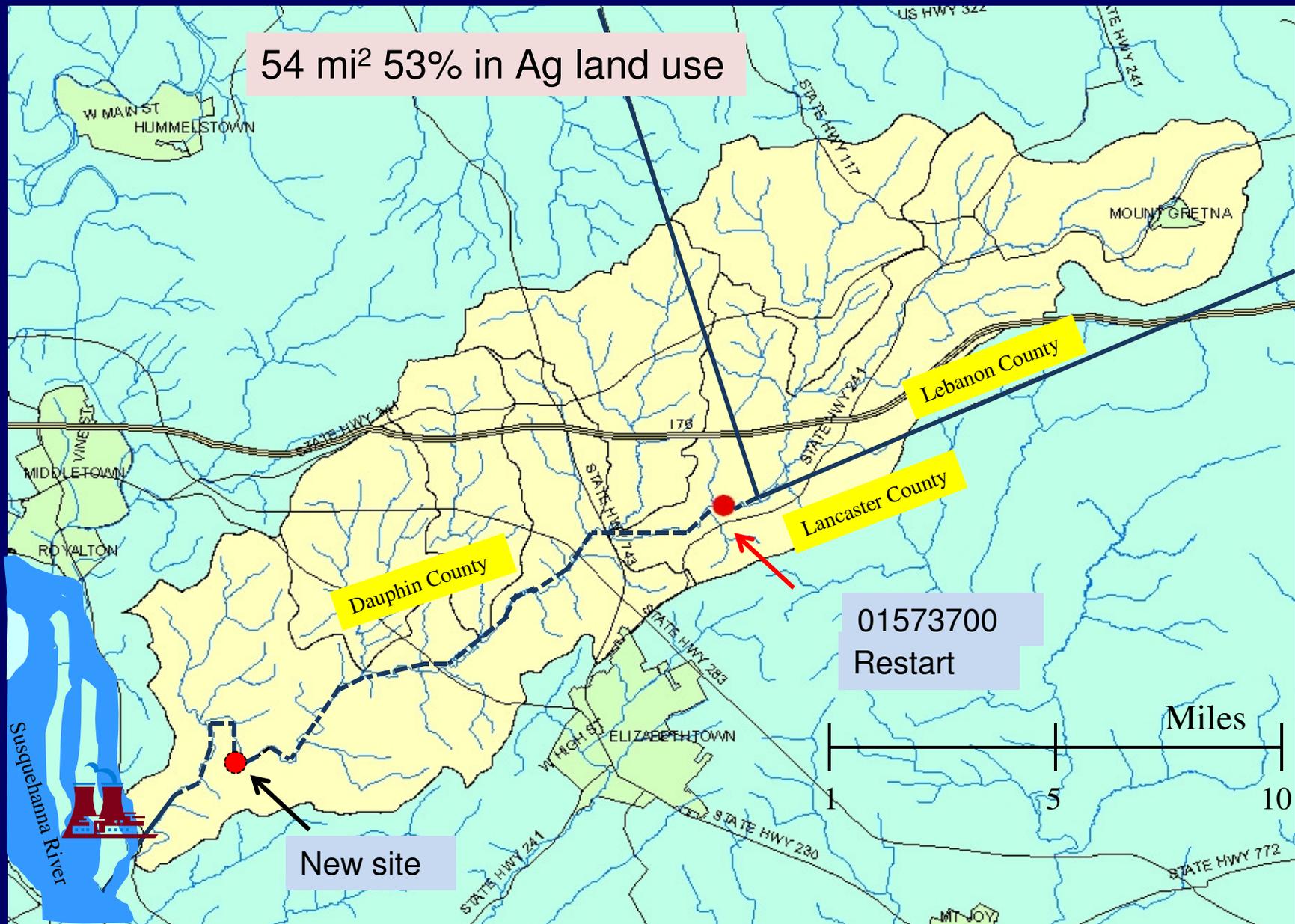
## **Nitrogen:**

- Isotopic analysis of nitrate
- Continuous nitrate (UV-spec)
- Groundwater nitrate models
- Isotopic analysis
- In-stream processes

## **Sediment and Phosphorus:**

- Sediment-source characterization
- Evaluation of floodplain dynamics
- Documenting channel change
- Phosphorus source characterization
- Geochemical tracers

# USGS PA Site - Conewago



# USGS PA Projects -

## ~~Conewago~~

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- Selected as 1 of 3 “showcase watersheds” by USDA, NRCS, USGS, and EPA
- Strong Partnership between USGS, NRCS, conservation districts, Universities, and volunteer groups
- Implement targeted BMP’s and long-term water-quality monitoring (chemical and biological)
- Useful information from previous sampling, studies, and current work

# USGS PA Projects - Conewago

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## IMPACTS

- Stream impairments (40%) - excess nutrient and sediment loads from agriculture
- Majority of pastured stream corridors have free livestock access
- Streambank erosion with few riparian buffers

## PLANS

- NRSC, USDA, CD implementing BMP's
- USGS proposes to monitor for resultant water-quality change (core and intensive)

# USGS PA Projects - Conewago

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## Recommended Practices

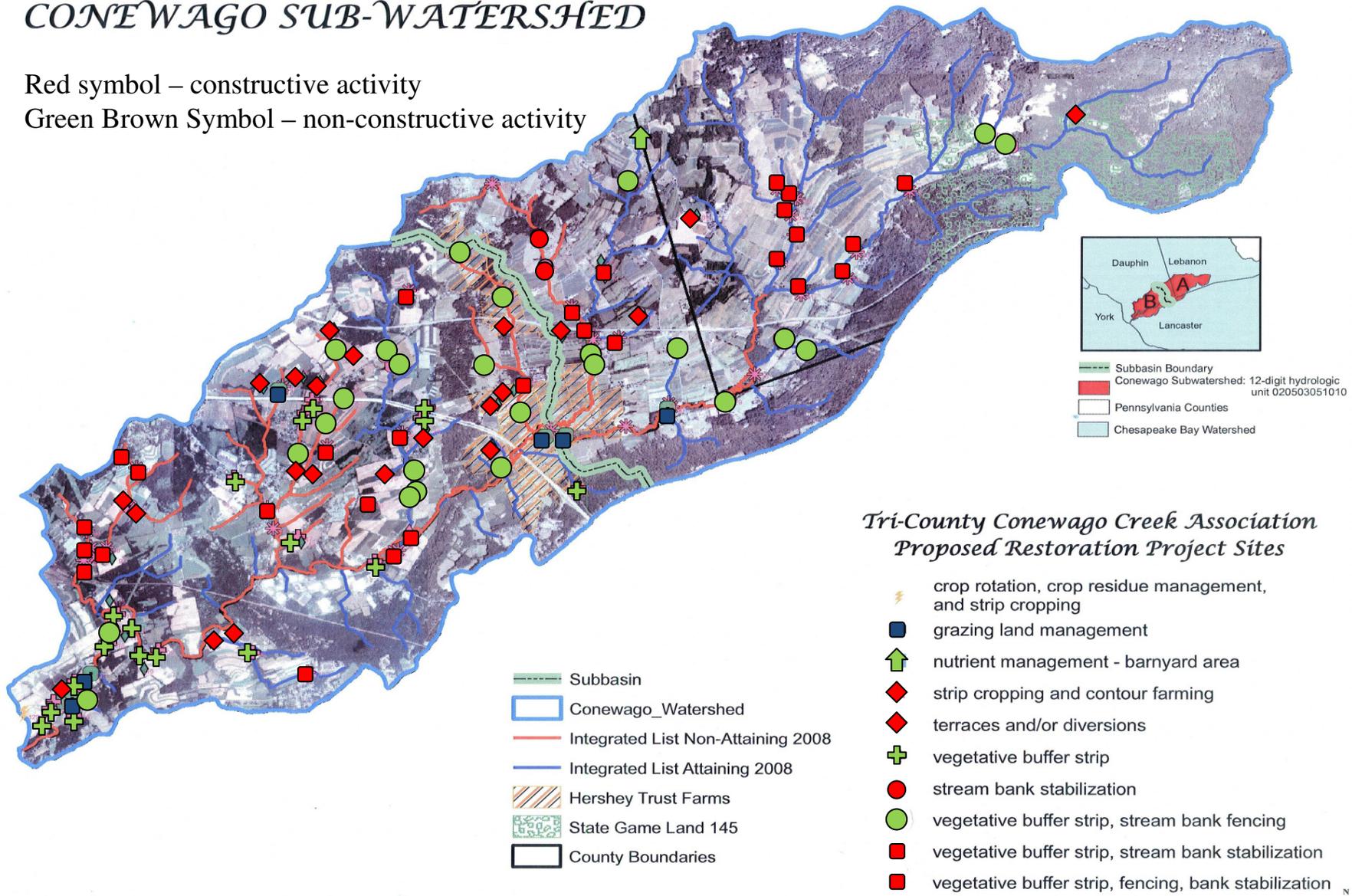
- Riparian Buffers
- Stream Access Control
- Alternative or In-stream Watering Facilities
- Stream Bank Stabilization
- Conservation Plans
- Cover Crops
- Waste Management

# Proposed Restoration Activities

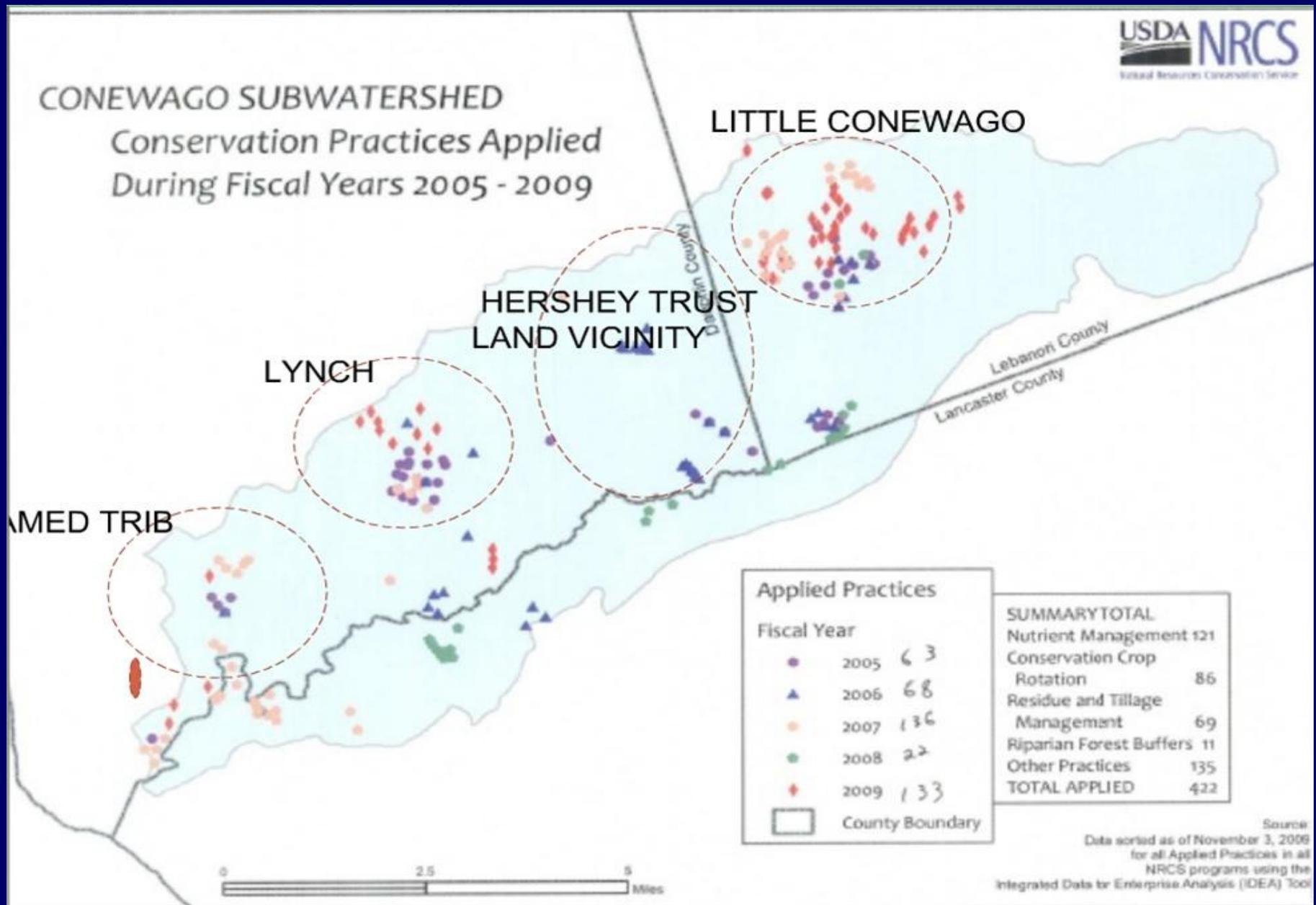
## CONEWAGO SUB-WATERSHED

Red symbol – constructive activity

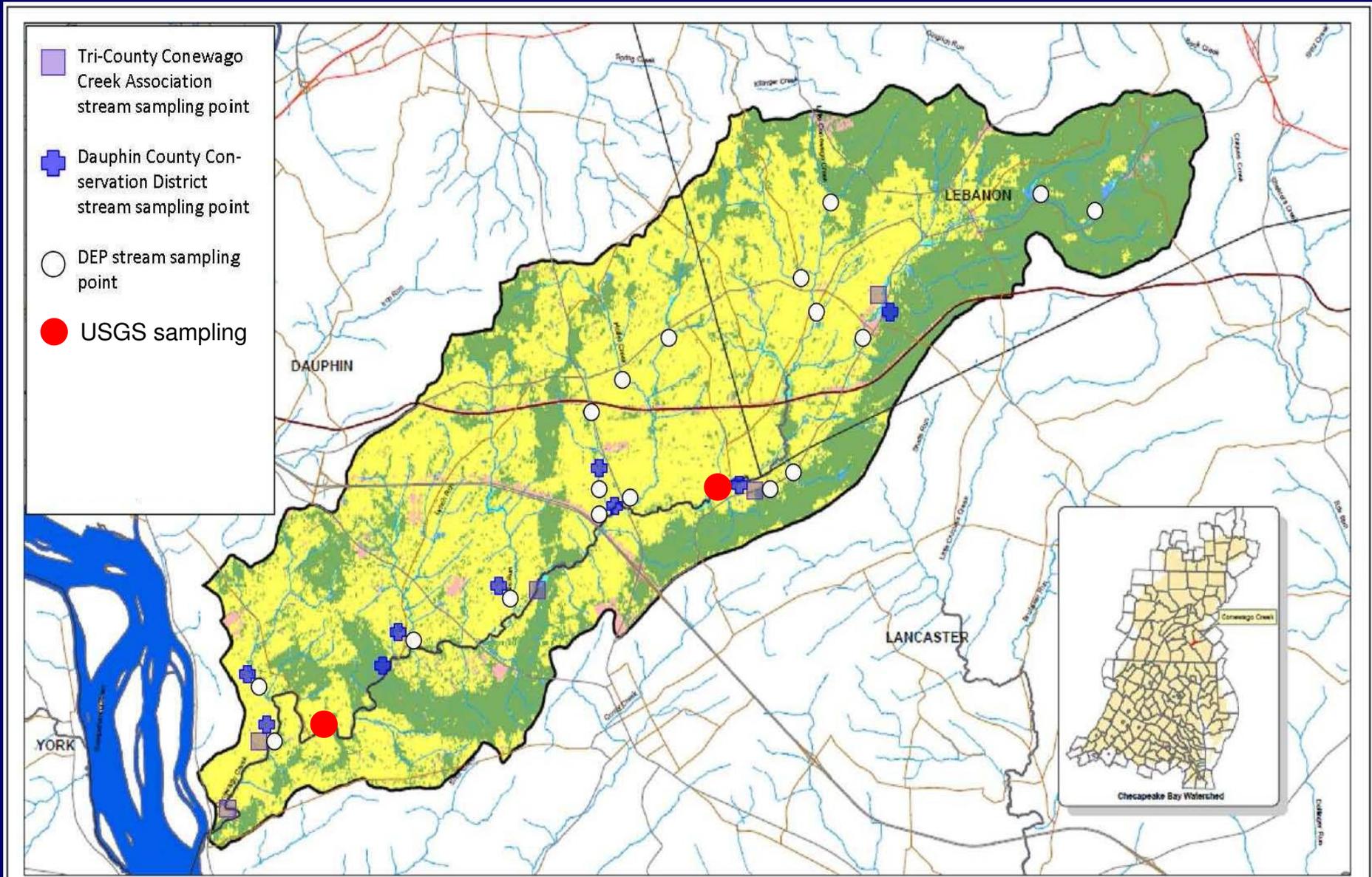
Green Brown Symbol – non-constructive activity



# Known conservation practices



# Current WQ Sampling



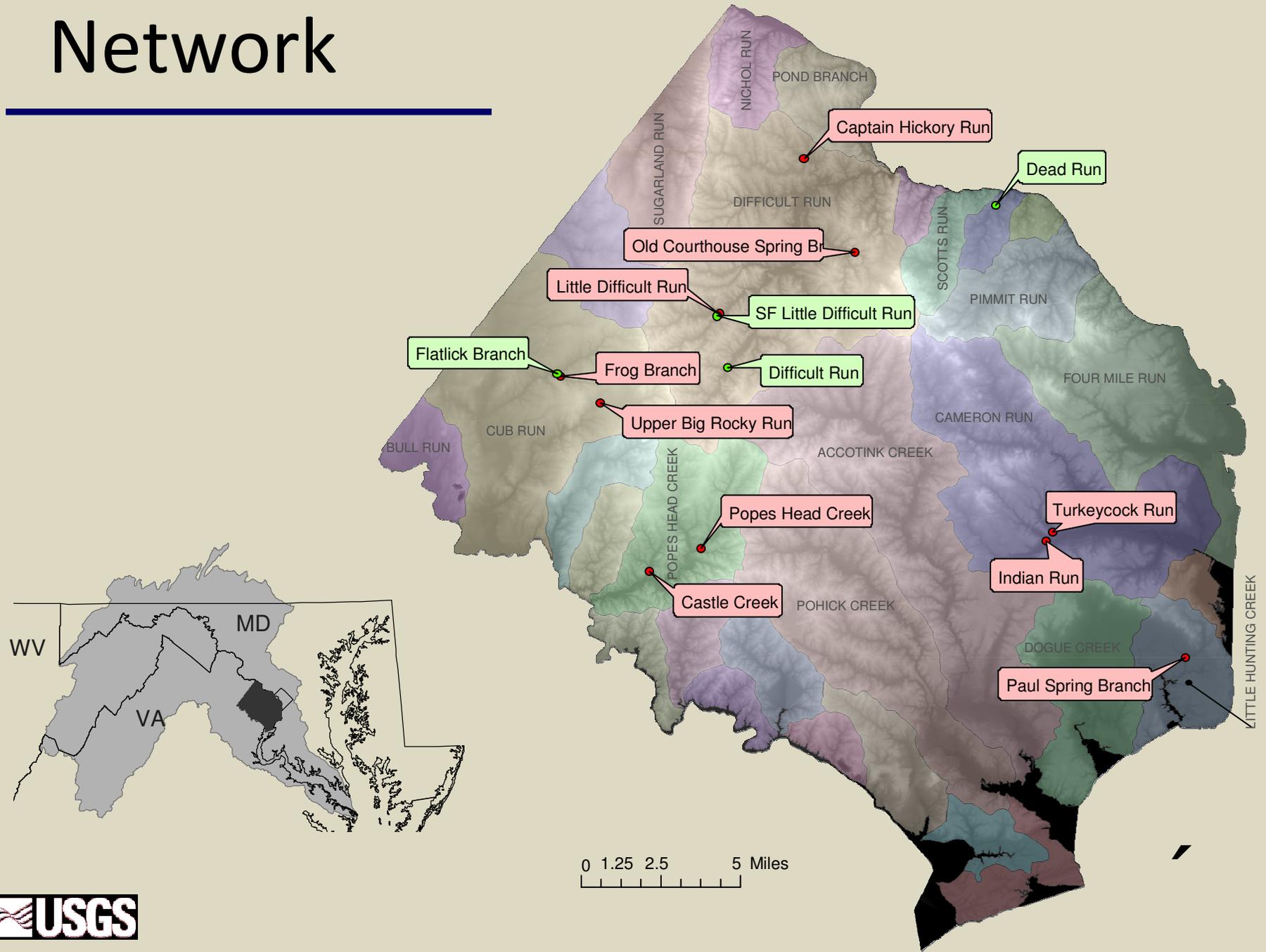
# Fairfax County, VA Network

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## Study Objectives

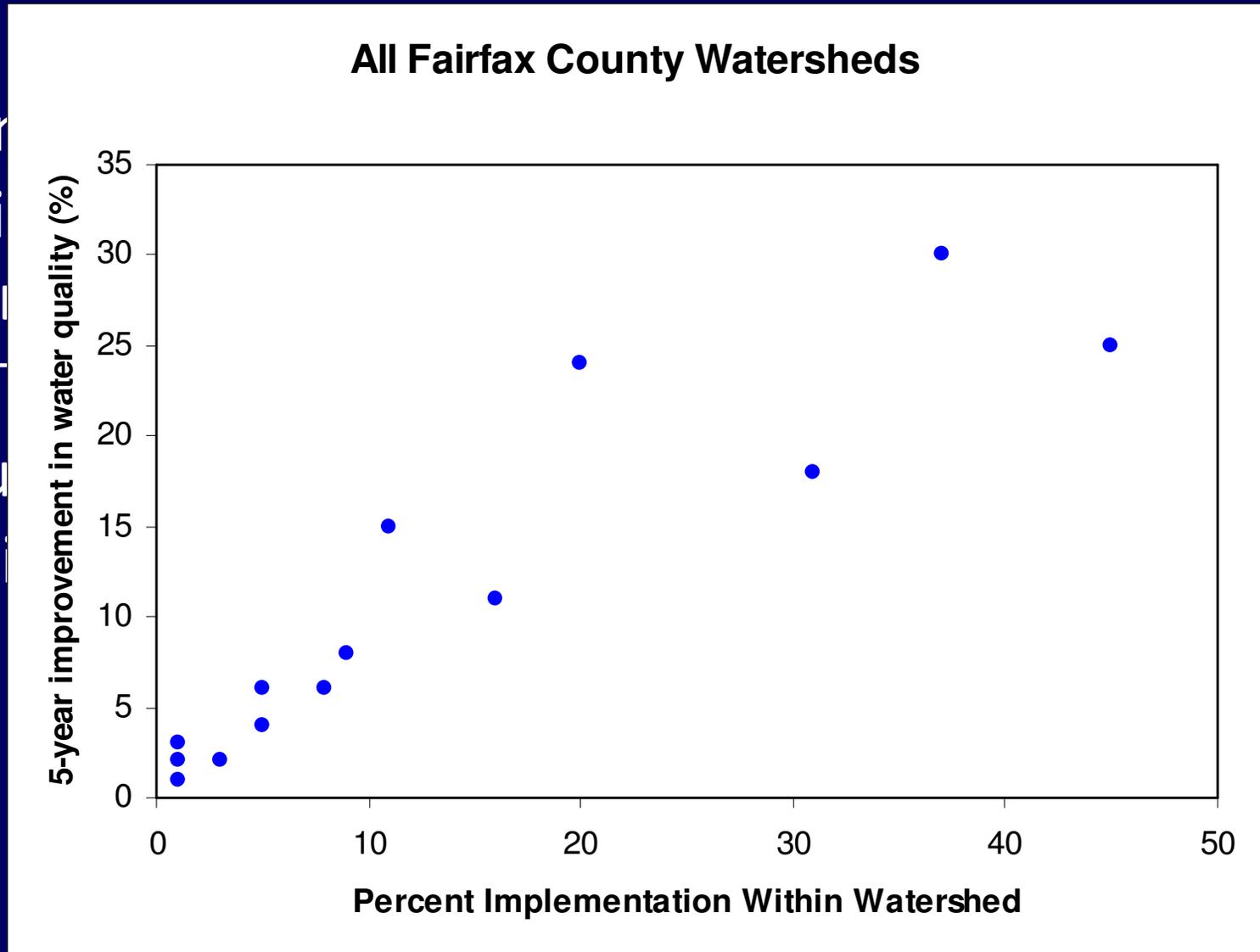
1. Collect monitoring data to describe:
  - Current water-quality (sediment and nutrients) and quantity conditions (short-term)
  - Nutrient and Sediment Loads and Yields (short-term)
  - Trends in water-quality and quantity (long-term)
2. Evaluate relations between observed conditions/trends and BMP implementation.
3. Transfer the understanding gained to other less-intensively monitored watersheds.

# Network



# Approach: BMP Evaluation

- Assessment  
• monitoring
- Evaluation  
• conditions





Peak 15.7 ft