



A Review of USGS activities to Monitor and Explain Changes in Water Quality: with a discussion of Agricultural BMP's

Approaches to assess and explain water-quality trends in relation to Farm Bill?

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USGS Science Plan Revision (2014-2015)

- SCIENCE THEME: Characterize and explain changes in water quality and its effect on freshwater and estuarine ecosystems
 - **MONITOR:** Characterize status and trends in nutrients, sediment, and streamflow.
 - **EXPLAIN** water-quality changes in response to human actions.
 - **EFFECT:** Collaborate to integrate hydrology and water-quality with freshwater and estuarine ecosystem assessments.

Cross Cutting Questions

- How do land and climate change affect fish communities, fish health, and freshwater habitats?
- What are the relationships among land use water quality, contaminants, and the health of fish and wildlife?
- How is the water quality of rivers and estuaries responding to restoration actions, and changing land use?

Monitoring Questions (selected)

- To what extent are nutrient and suspended sediment concentrations and loads changing in major tributaries to Chesapeake Bay?
- How can we better monitor and explain changes in nutrient and suspended sediment transport in urban and agricultural watersheds undergoing restoration activities?
- How can innovative trend assessment techniques provide insight into the nature of long-term and recent changes in conditions in relation to watershed changes?
- To what extent can the use of state-of-the-art continuous monitoring techniques significantly improve the manner in which environmental change is measured and can this improve the assessment of water-quality and ecological responses in the estuary?



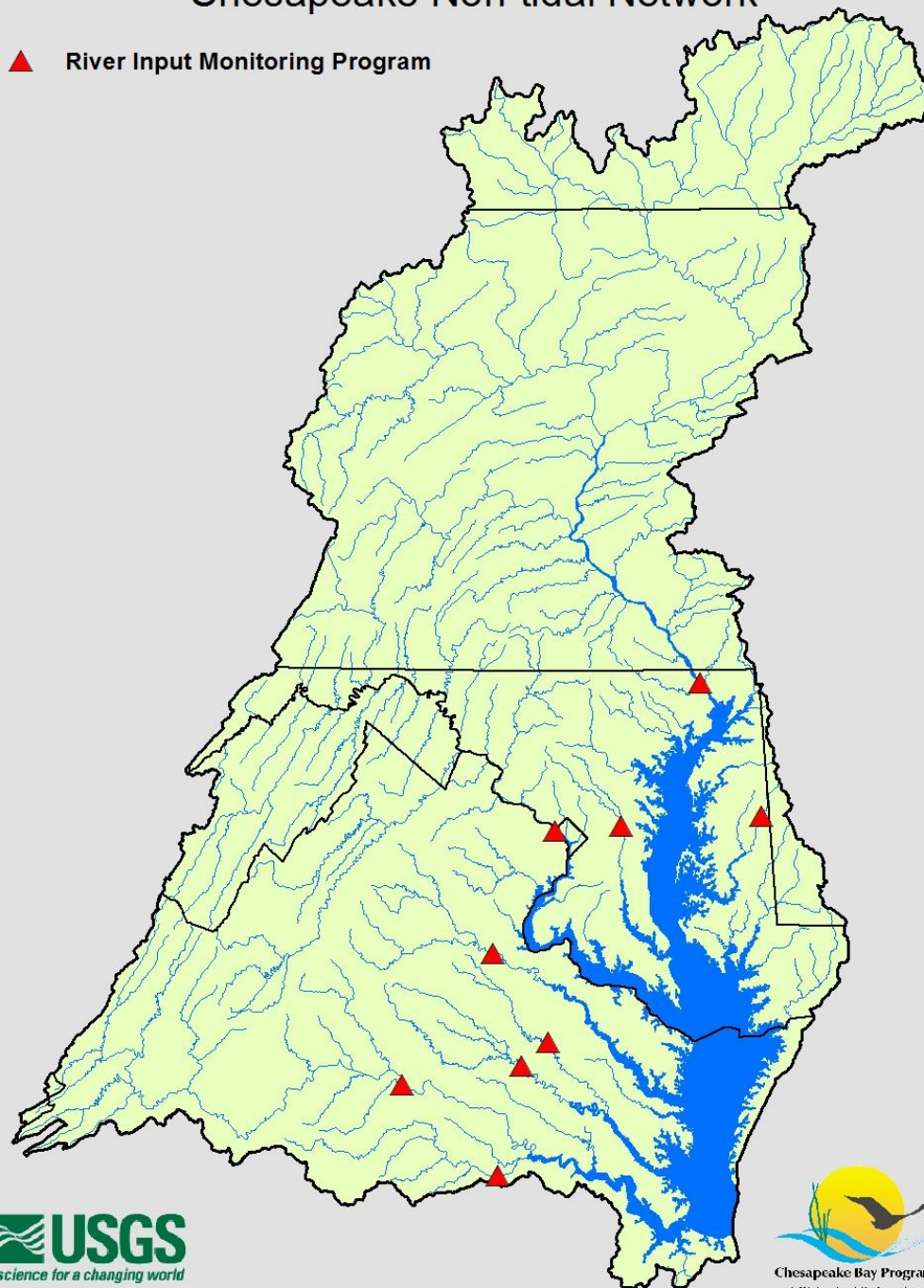
Monitoring Network

Chesapeake Bay Nontidal Water-Quality Monitoring network

- River Input Monitoring Program
 - 9 bay tributary sites
 - Consistent sampling framework
 - 1985-present

Chesapeake Non-tidal Network

▲ River Input Monitoring Program

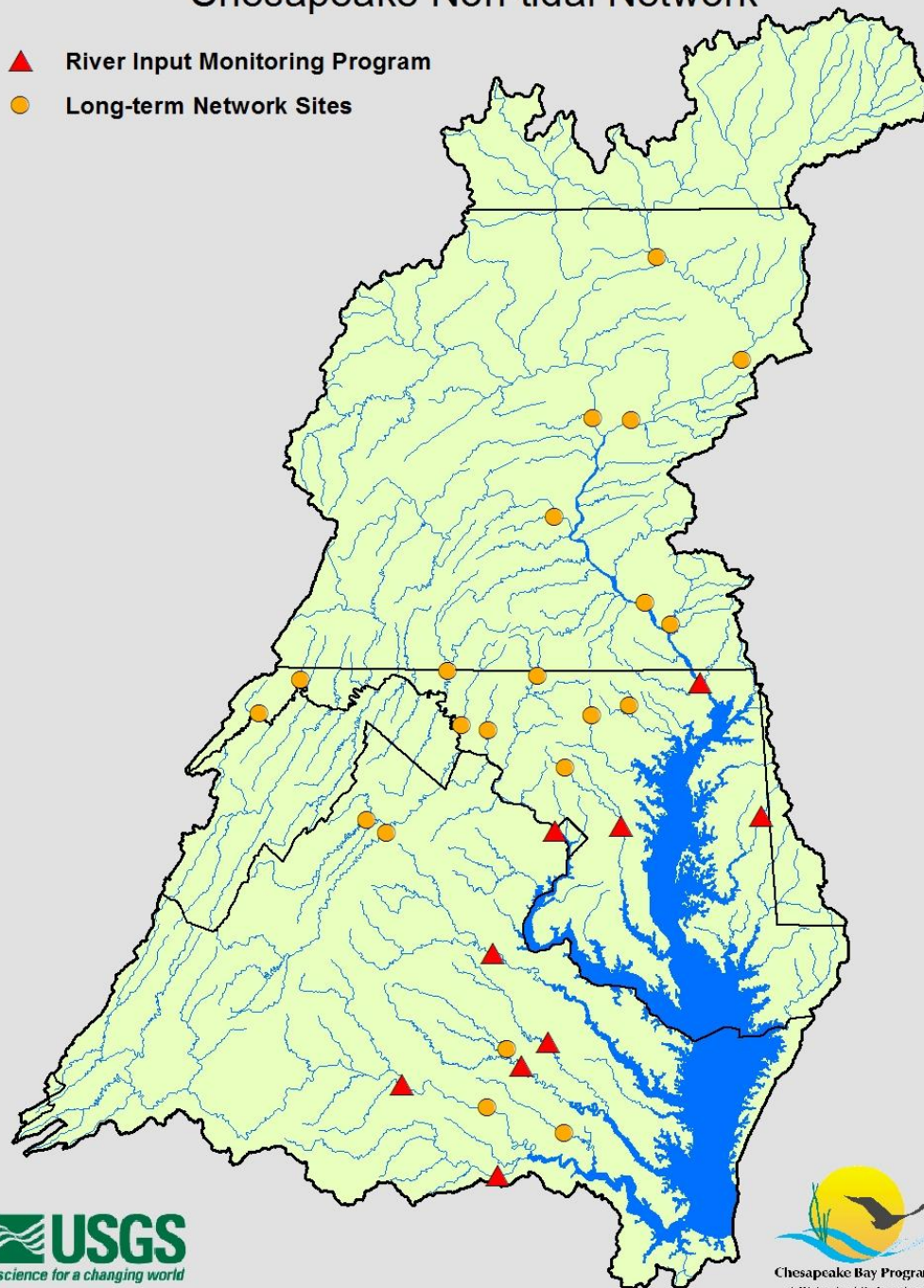


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- Long-term Network Sites

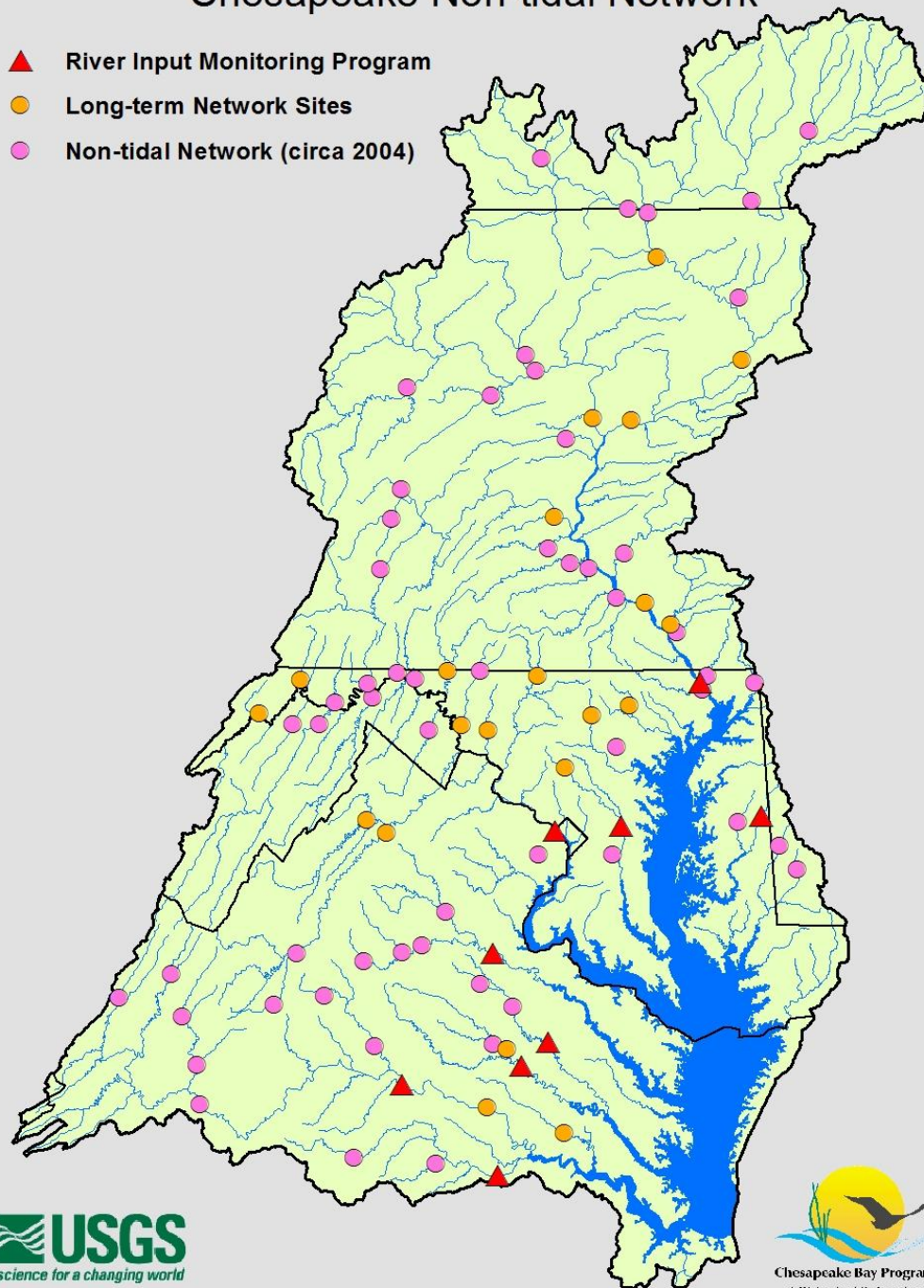


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 - 56 sites

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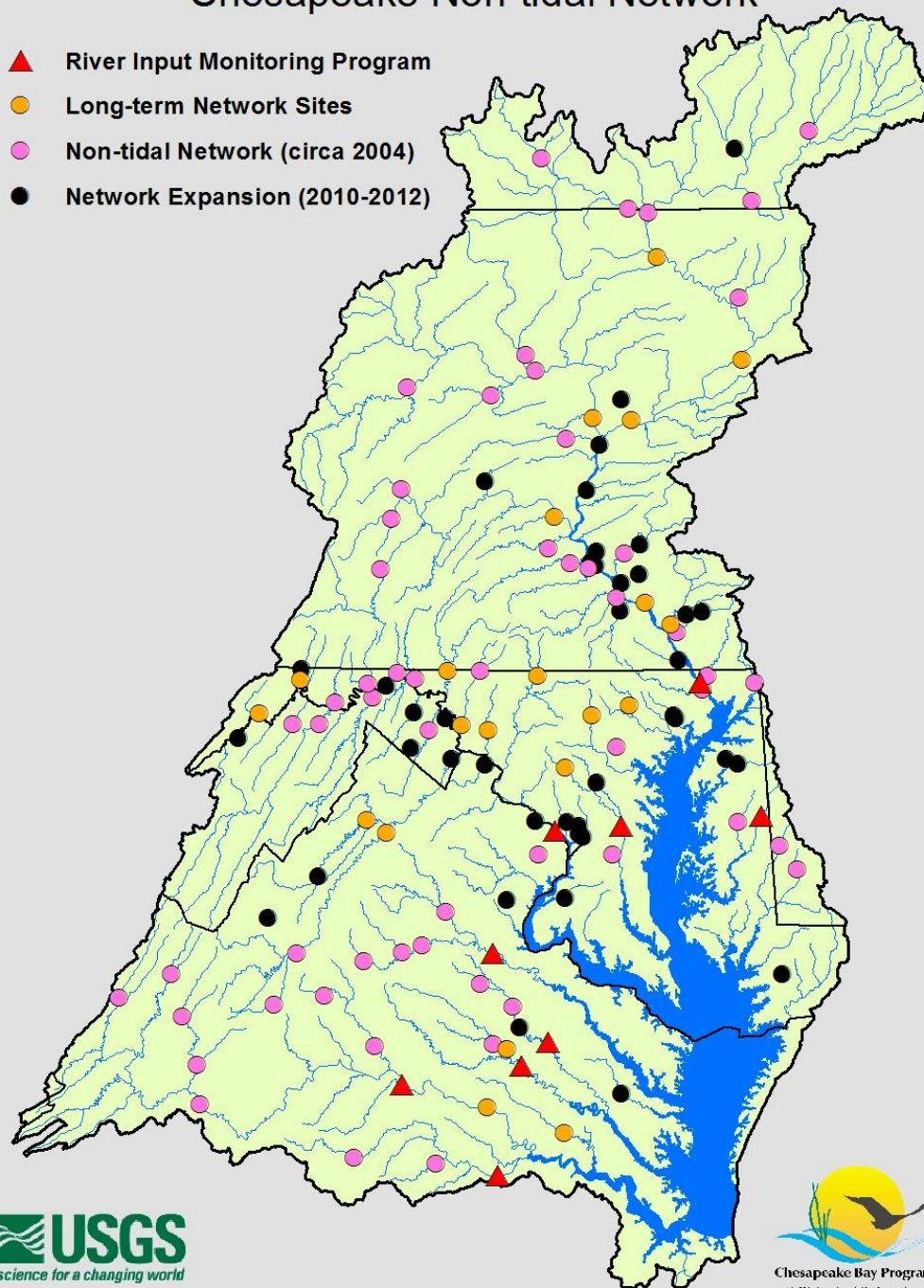


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 - 56 sites
- Network Expansion
 - 40 sites
 - Targeted Land Uses
 - Small Watersheds
 - Important settings

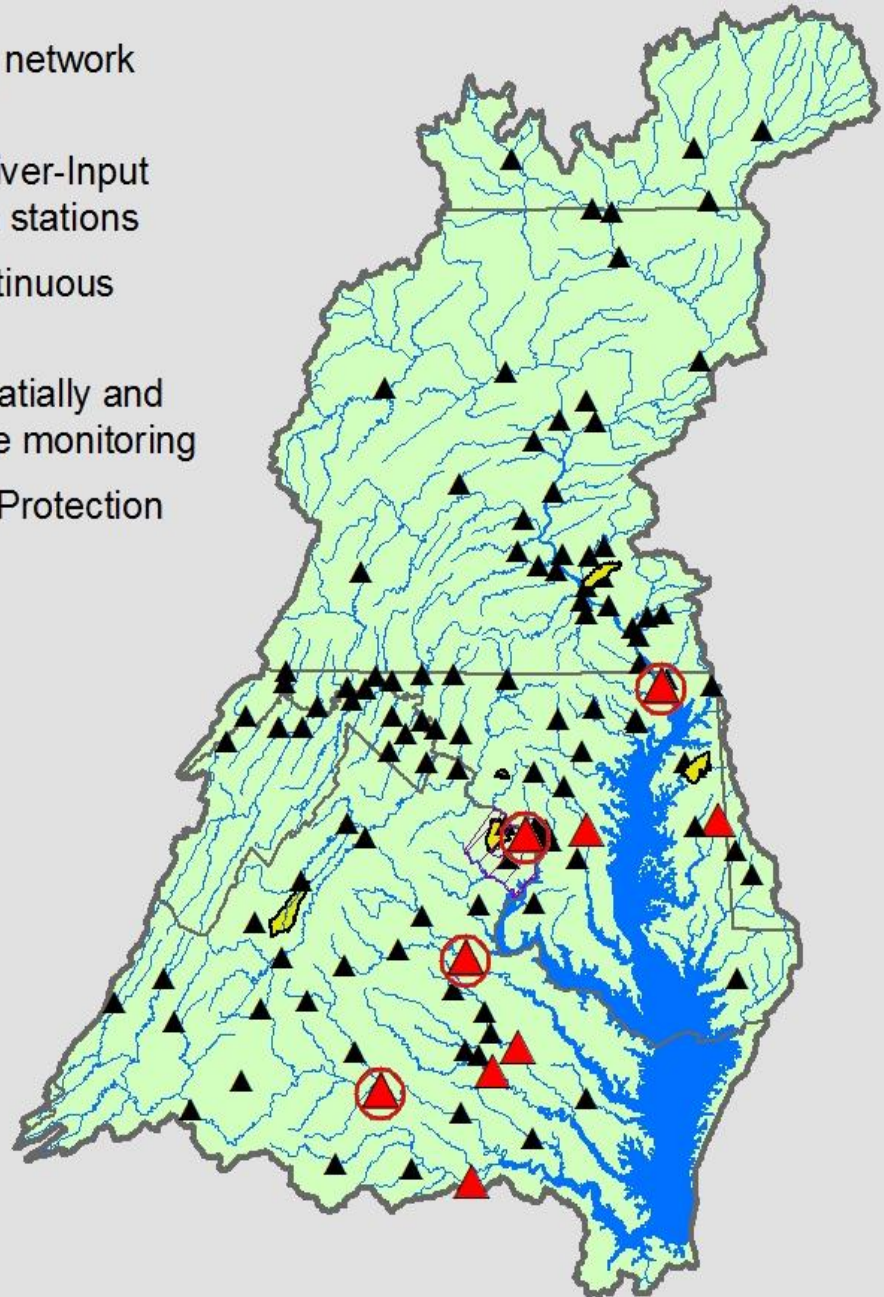
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- Network Expansion (2010-2012)



Explanation

- ▲ Nontidal monitoring network stations
- ▲ Chesapeake Bay River-Input Monitoring Program stations
- Tributaries with continuous monitoring
- Watersheds with spatially and temporally extensive monitoring
- Clarksburg Special Protection Area
- ▨ Fairfax County



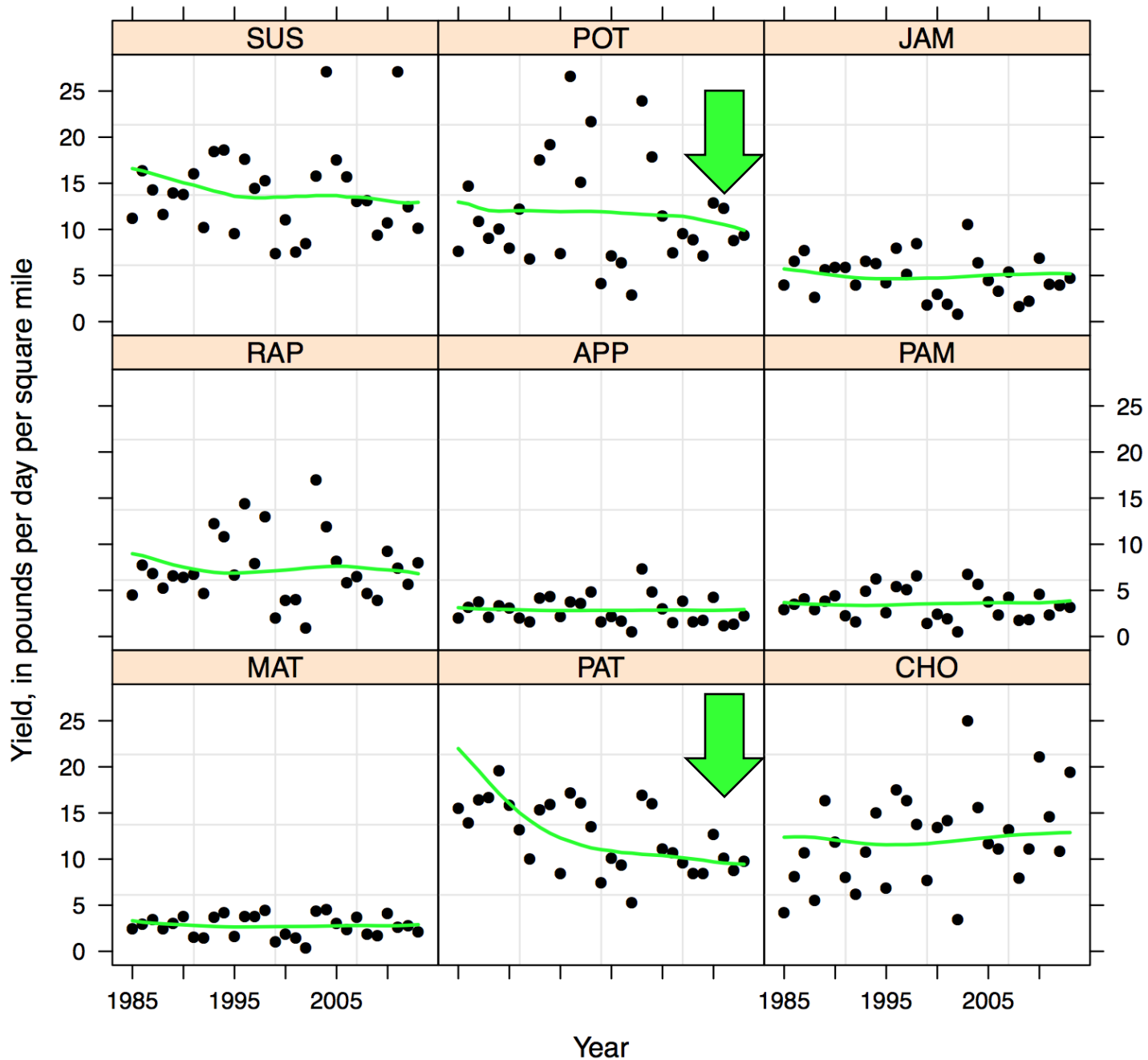
Explain Change (Selected Questions)

- How do landscape characteristics such as land use, soils, slope, geology, aquifer characteristics, wetlands, and floodplains affect fundamental hydrologic transport properties and what is their role in governing nutrient and sediment delivery to streams?
- Which landscape characteristics and their changes are driving observed changes in stream condition and nutrient and sediment loads and can we improve the characterization of pollution contribution from major source sectors for nitrogen, phosphorus and sediment?
- Are measured changes in nutrient and suspended sediment fluxes in streams matching expected levels of load reductions based on implemented restoration actions?
- What is the role of groundwater as a transport process for nutrient delivery to streams and to what extent do these lag times delay responses to management practices?
- To what extent do lengthy sediment transit times from the landscape to estuary delay the effect of sediment management strategies?

RIM Total Nitrogen Yield

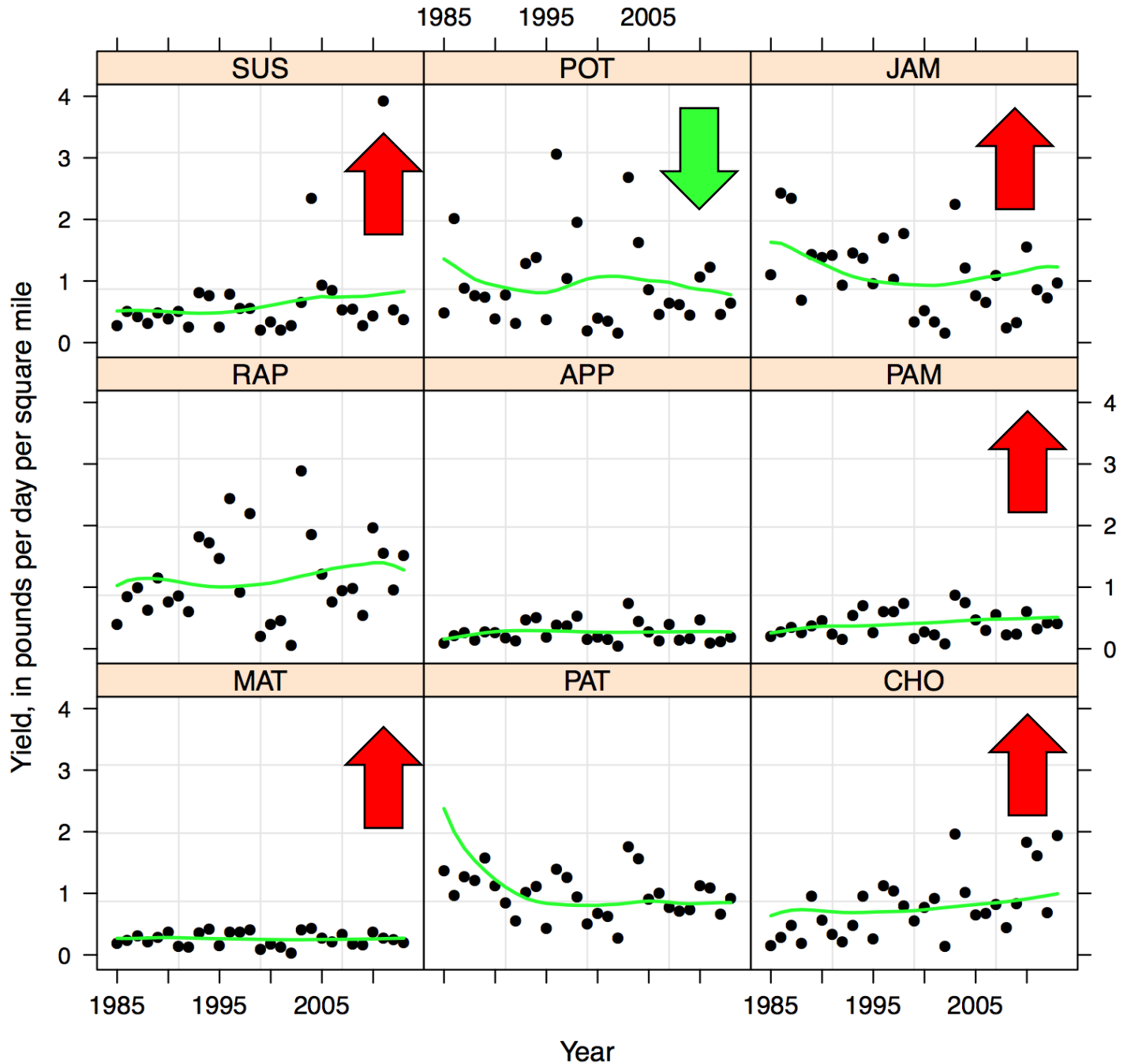
1985 1995 2005

Nitrogen Load



Phosphorus Load

RIM Total Phosphorus Yield



So, What is USGS doing to assess the Farm Bill?

Nothing—Specifically

These activities will provide insight into the cumulative effects of agricultural practice change.

- Regional and Targeted Monitoring of Agricultural Watersheds
 - Annual Reporting
 - 10-year trend period
- Small-Watershed Studies of sources, transport processes, and fate. (including Showcase watersheds)
 - Initial Report in 2015
 - Utilize USDA Geo-located BMP data in conjunction with CBP data.
- Analysis of Observed vs. Expected (WSM) changes in load.
- Continued use of USDA BMP data to better understand implementation, location, rates, timing, and accuracy.

Selected Activities– 2 of 3

- Groundwater assessments
 - Flow and residence time models of
 - Delmarva Peninsula
 - Potomac Watershed
 - Development of new regionalizing techniques
 - Field studies of nitrogen in shallow groundwater and its response to changing agricultural management actions.
 - Development of spatially and time variable statistical models (SPARROW) to link changes in land use and management actions to observed loads in portions of the Chesapeake watershed.

Selected Activities– 3 of 3

- Statistical (SPARROW) models
 - Hybrid Models linking field-scale (APEX) with statistical models of flux.
 - Assessments of Land Use loads for WSM development
 - Assessment of in-stream processing.
 - Time-Variable SPARROW approaches
- Field studies and models to identify sediment sources and quantify the timescales of sediment erosion, storage, and transport
- Regional Synthesis
 - Delmarva
 - Potomac Watershed
- Continued Support of Topical Approaches from STAC Management Effects on Water Quality Trends, March, 2012

Summary

- No Specific evaluation of USDA Farm Bill implementation is planned.
- USDA implementation data is being used to assess cumulative effects of all management practices.
- Many of USGS monitoring and analysis activities are focused on the agricultural sector.
- Urban, suburban, wastewater, and atmospheric effects are also being addressed.