EXPLANATION OF TRENDS IN THE WATERSHED.

CONTRIBUTIONS TO MID-POINT ASSESSMENT BASED ON NONTIDAL MONITORING NETWORK

A discussion to guide interaction to explain change:

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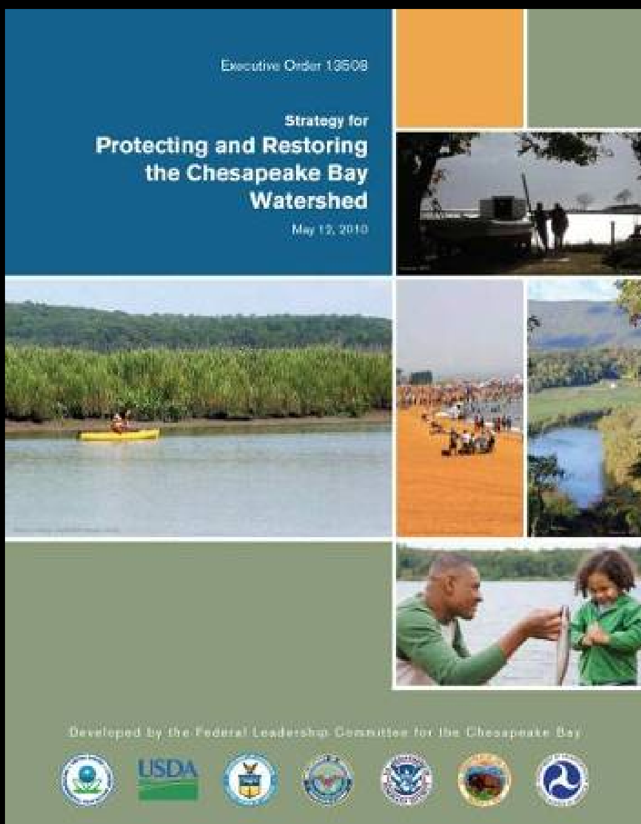
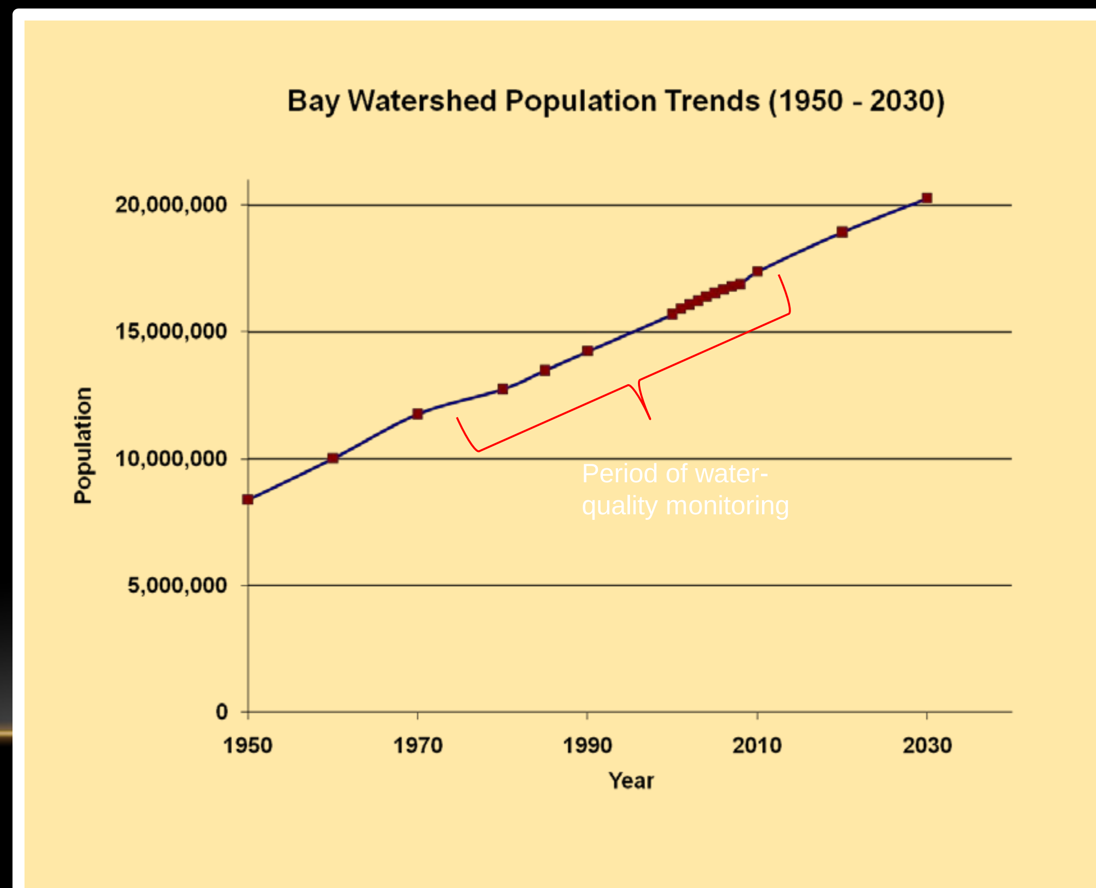
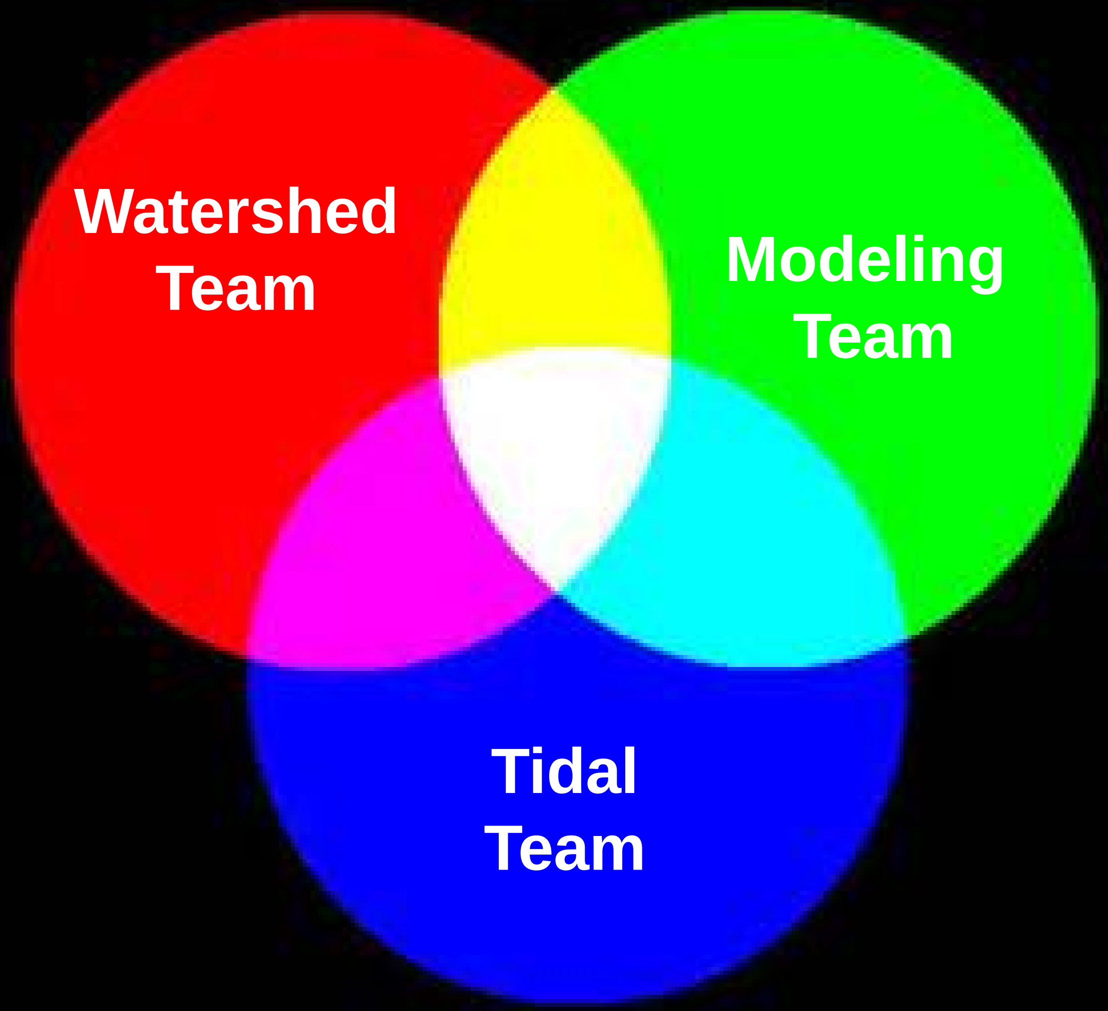
WHY ARE WE HERE?

"The Chesapeake Bay and many of its tributaries remain in poor health. The water continues to be polluted, populations of key species such as oysters are extremely low, and habitats such as underwater grass beds and wetlands are degraded." (EO 13508)



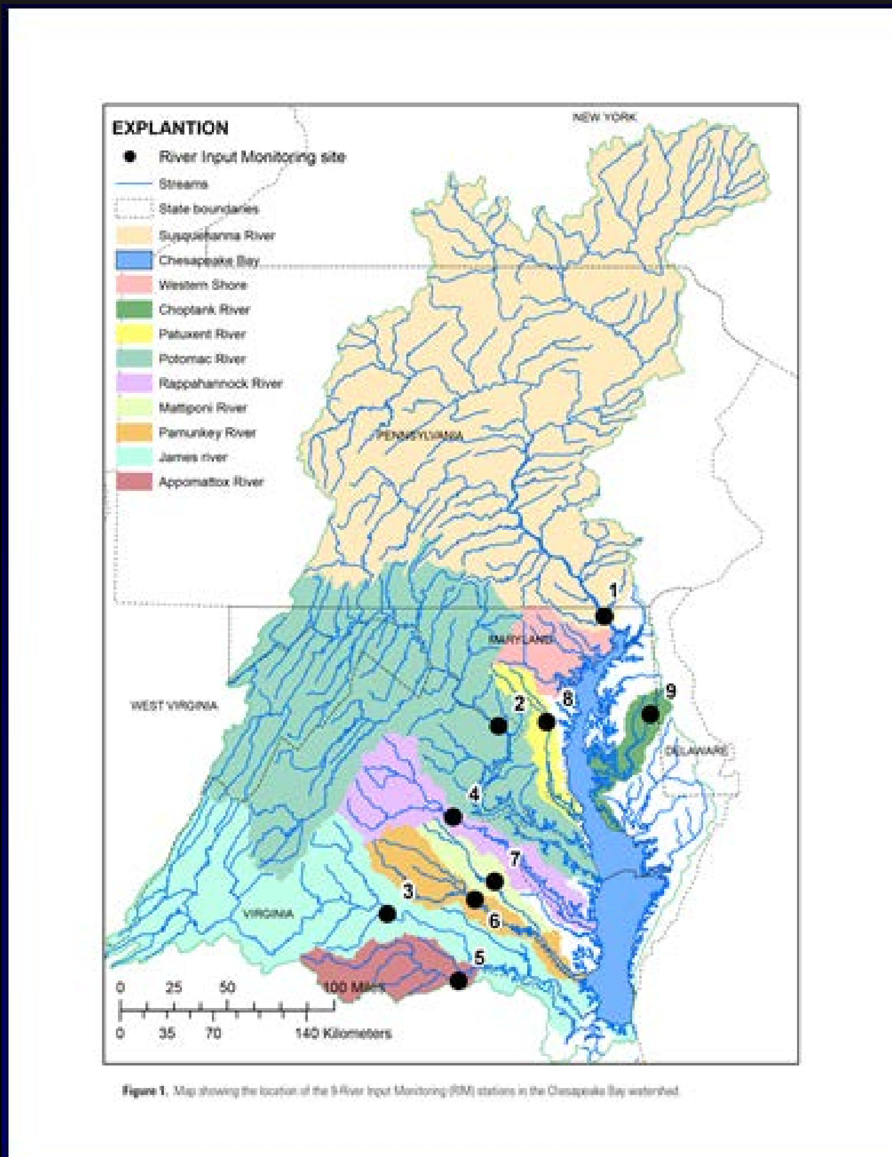


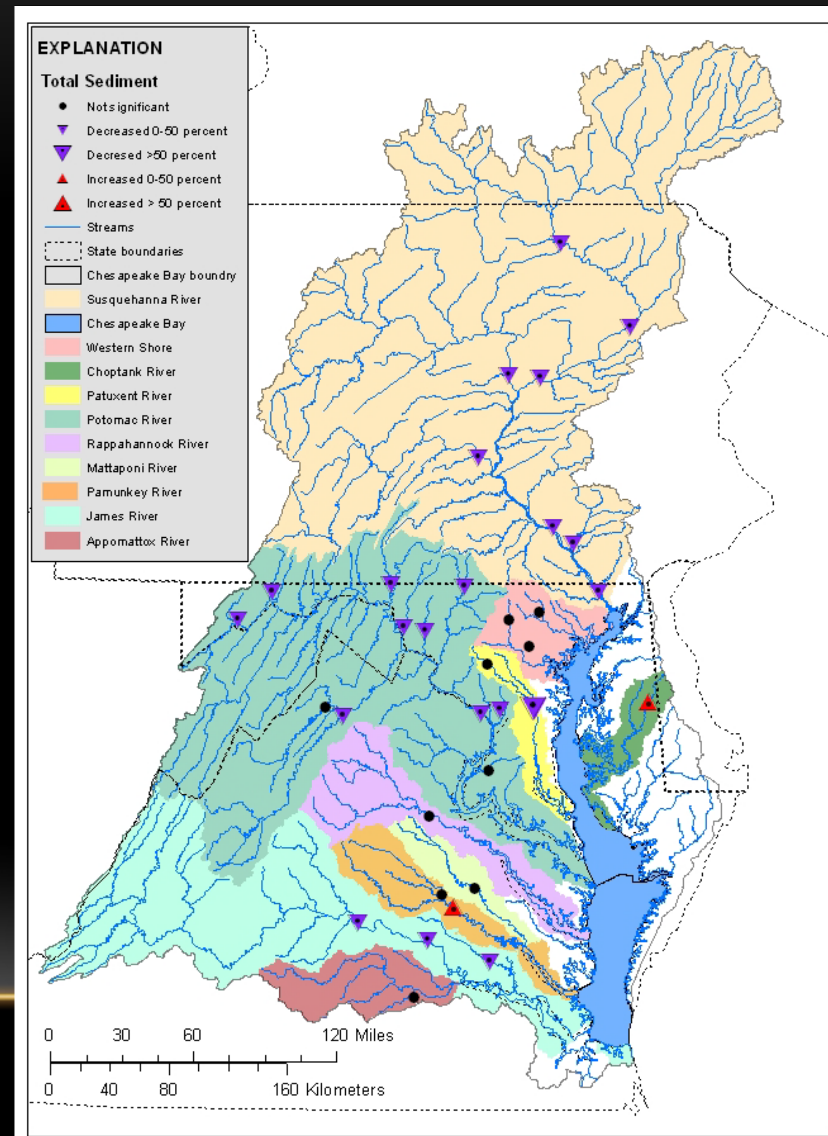
PARADIGM OF COLLABORATION



- Describe the changes in riverine water quality and mass transport over the past three decades.
- Describe changes in watershed condition over historic and recent time periods.
- Explain the observed changes in relation to land cover, land use, restoration actions, source controls, and hydrologic and geomorphic controls
- Evaluate and improve our ability to model historic changes in mass transport in order to improve our ability to predict future conditions.
- Provide insight into management action effectiveness in order to better manage in the future.
- Demonstrate a clear link among watershed condition, stream quality, and Estuarine response.
- Improve our ability to model changes in estuarine condition relative to water-quality inputs.

FRAMEWORK FOR WATERSHED TREND EXPLANATION

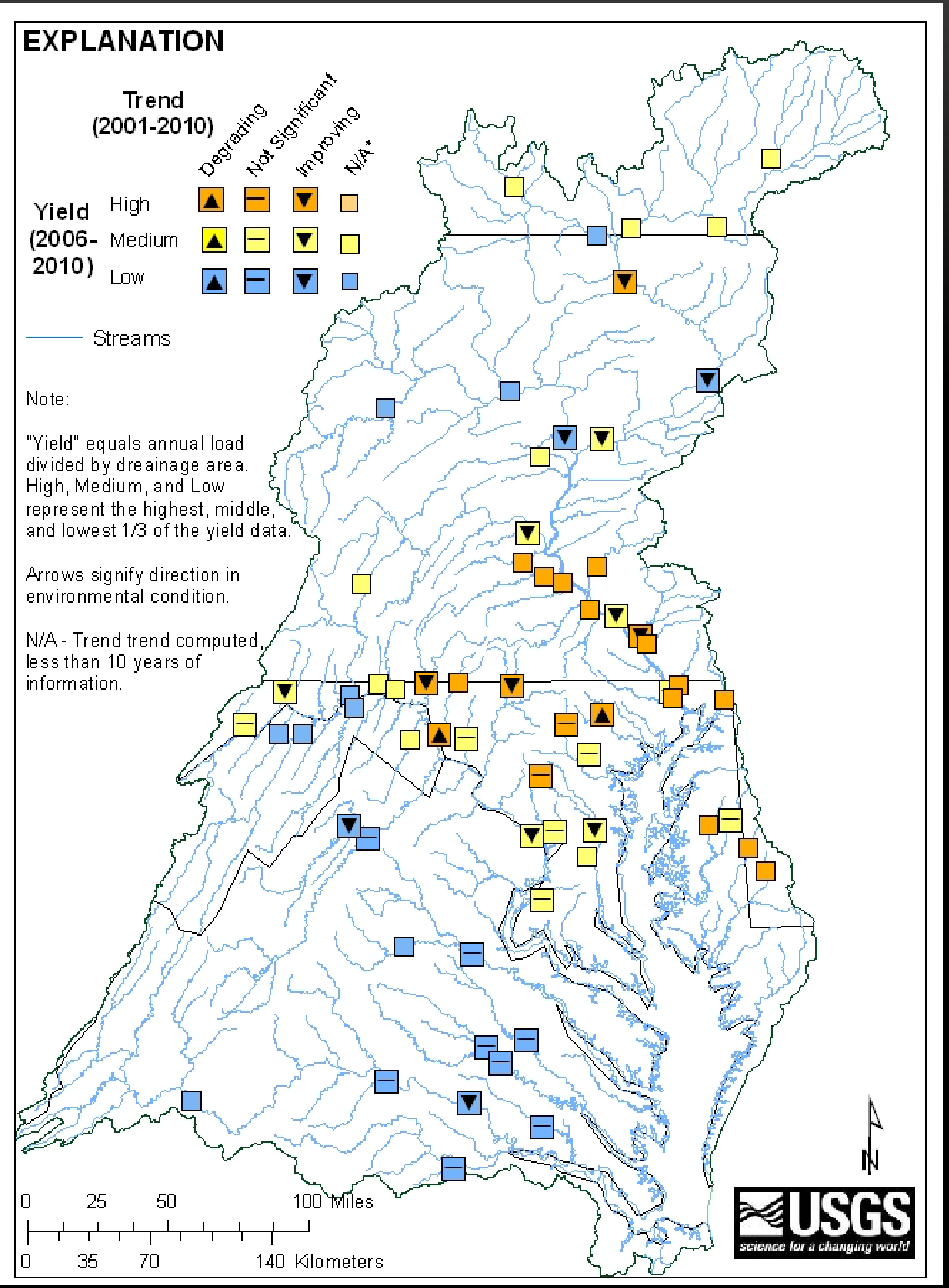




Enhanced Nontidal Network

Example: Total Nitrogen Indicator

Additional supporting data



USGS COMMITMENTS TO MIDPOINT ASSESSMENTS

- Data analysis products:
  - Annual indicators and Nontidal network products
  - CB Tributary Trends in load (RIM) Flow-normalized loads
- Synthesis "Explanations"
  - Coastal Plain
    - Potomac Watershed
      - Virginia Tributaries
        - Susquehanna Watershed
- Other Collaborations
  - WSM evaluation / modeling
  - Tidal explanation (support)
  - Lower Susquehanna River (Conowingo) activities

DEFINING SUCCESS

- "Synthesis" and "Explanation of trends" means different things to different people.
  - Single product bringing together results from multiple independent studies and analyses of varied approaches.
  - Single compilation of a standardized form of analyses. (Sprague and others)
  - Compilation of individual varied products describing single factors, constituents, or processes.
  - Bibliography of significant studies
  - Regional or sub-watershed level products
  - CB watershed scale products
  - Journal article showing novel approach
  - Incorporates at least 2 or more of the following:
    - Monitoring results
    - Models
    - Ground water
    - Sediment processes
    - Nitrogen, Phosphorus or sediment
    - Land Cover, and Land Use Change
    - AG practice change
    - Estuarine response
    - BMP implementation effects
    - Population Change
    - Septic systems
    - Wastewater
    - Add your favorite here..

COMPONENTS OF WATERSHED ASSESSMENTS

- Stream Monitoring Results
- Land Cover Change products
- Population Change (census)
- WSM (input, output, assumptions)
- SPARROW (multiple models and tools)
- Groundwater Models
- Wastewater practices / change
- Land change forecasts / hindcast
- Ag production (CEEP/NASS)
- AG practice data (CBP/USDA)
- Small watershed studies of hydrologic processes
- Literature

ONE PERSON'S VIEW OF PROCESS

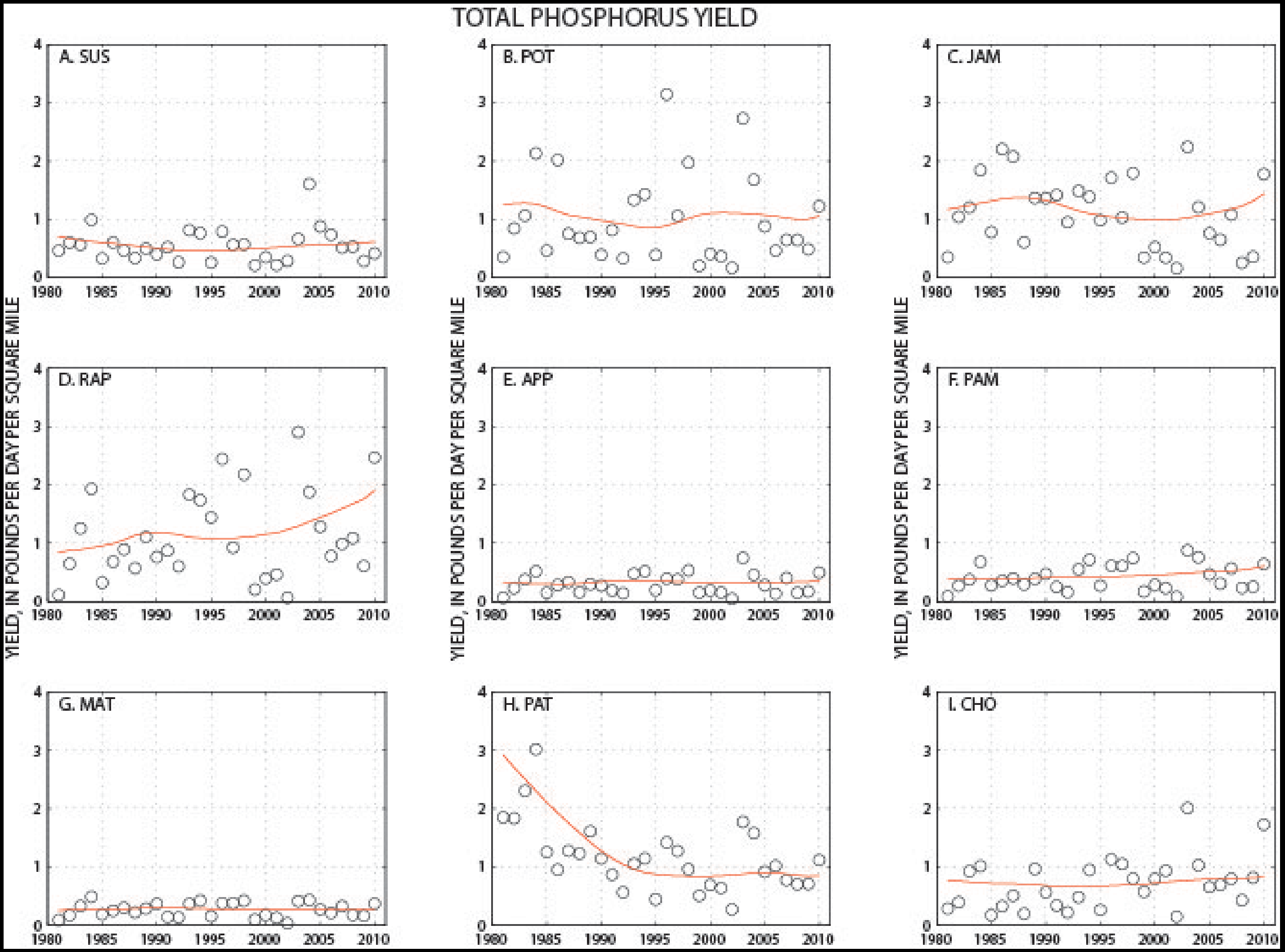
- Compile and refine hypotheses
  - Ongoing– Share and improve over time
- Compile important "first order" analyses
  - Observed WQ trends
  - Major changes in Watershed Characteristics
  - Expected changes from WSM
- Review and exchange ideas as a team
- Conduct topical analyses to test hypotheses.
  - Individually and as a partnership
- Document– Communicate– Publish– Communicate
- Repeat many times (how many?)
- Synthesize into less technical form.
- Repeat for other areas.

Enhanced Load and Trend Estimation: WRTDS

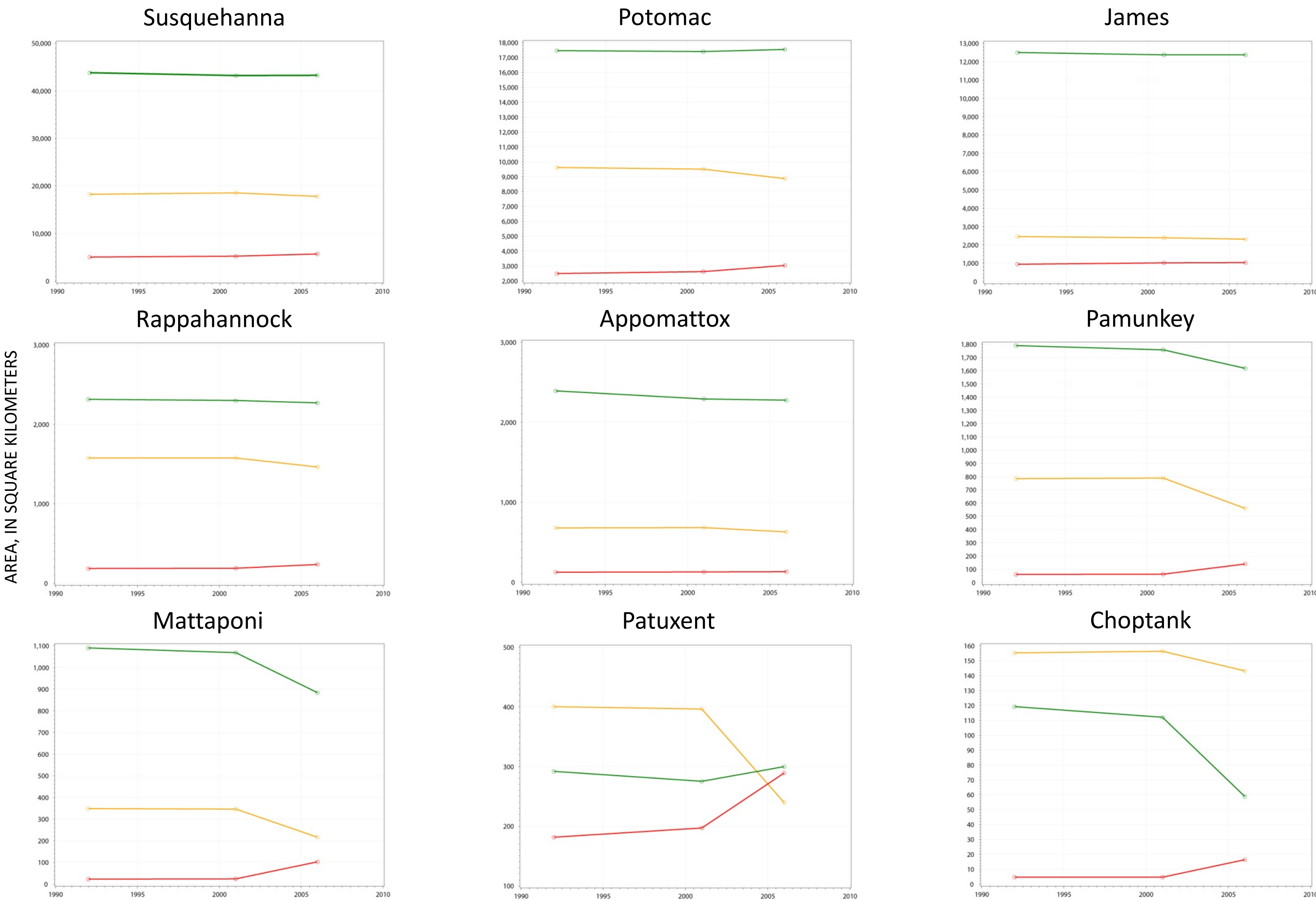
Benefits:
Improved relevance

Used to assess model performance

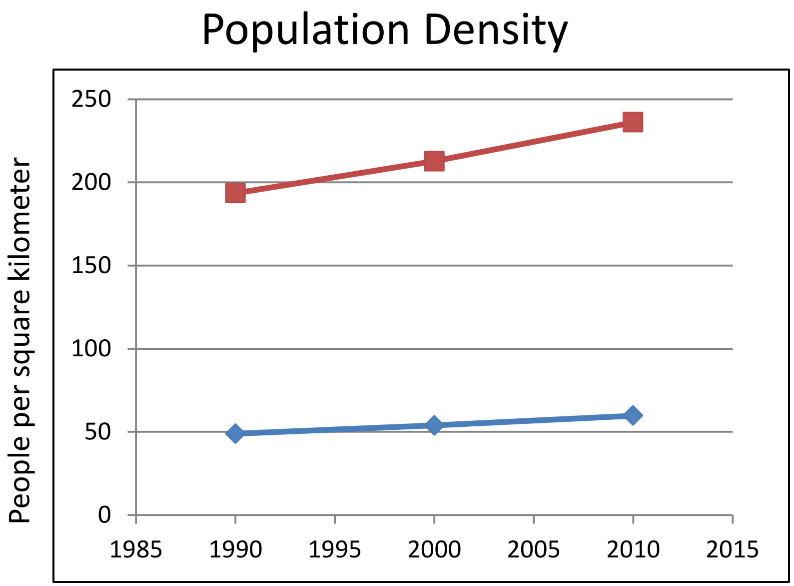
Provide focal point for regional synthesis

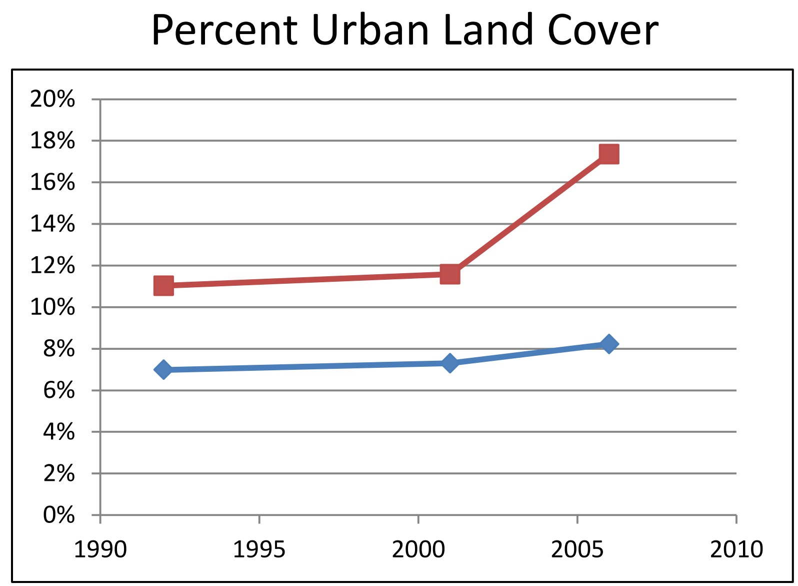


Land Cover Change (NLCD 1992, 2001, 2006)



Population Density and Urban Land Cover in RIM Monitored/Unmonitored drainage areas

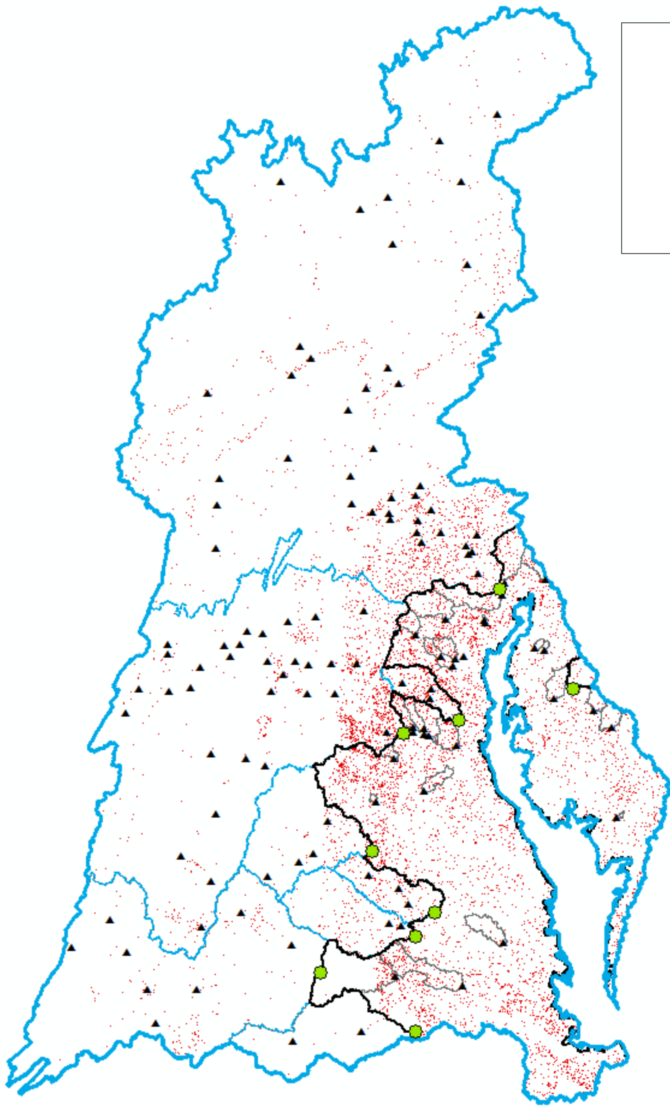




RIM Monitored areas

RIM Unmonitored areas

Land Cover change in RIM Monitored and unmonitored Areas (NLCD)



Section	Urban Land Cover 2006 (square kilometers)	Urban Land Cover 1992 (square kilometers)	Urban Land Cover Percent change from 1992 to 2006
Chesapeake Bay Watershed	17,781.96	13,581.60	30.93%
RIM Monitored	10,810.01	9,151.37	18.12%
RIM Unmonitored	6,971.95	4,430.23	**57.37%**

Section	Ag Land Cover 2006 (square kilometers)	Ag Land Cover 1992 (square kilometers)	Ag Land Cover Percent change from 1992 to 2006
Chesapeake Bay Watershed	41,780.04	47,105.88	-11.31%
RIM Monitored	32,348.48	34,470.28	-6.16%
RIM Unmonitored	9,431.56	12,635.61	-25.36%

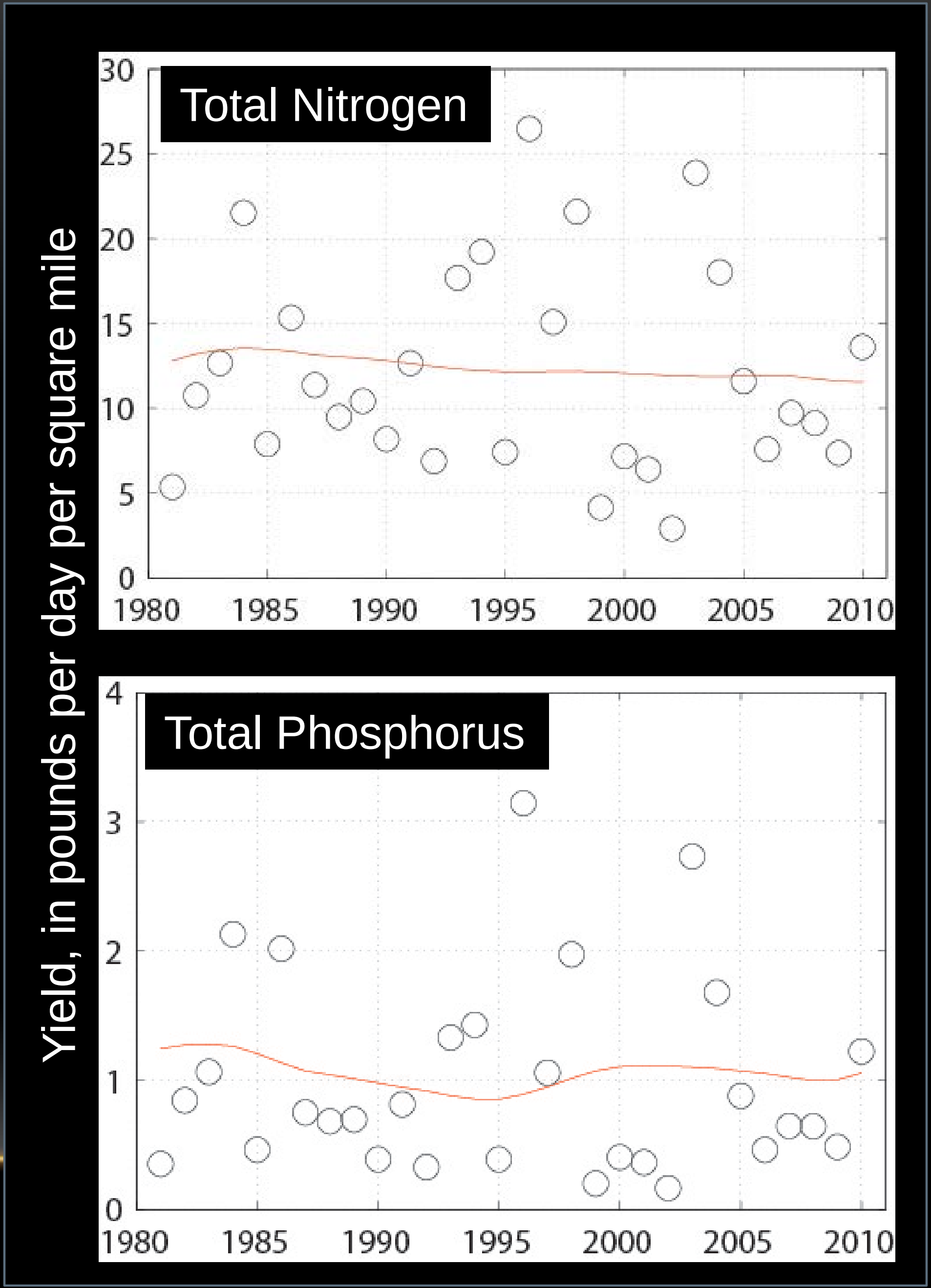
Section	Forest Land Cover 2006 (square kilometers)	Forest Land Cover 1992 (square kilometers)	Forest Land Cover Percent change from 1992 to 2006
Chesapeake Bay Watershed	93,193.20	98,022.97	-4.93%
RIM Monitored	80,746.10	82,008.91	-1.54%
RIM Unmonitored	12,447.11	16,014.05	-22.27%

Enhanced Load and Trend Estimation: WRTDS

Benefits:
Better alignment of water-quality results with Bay management

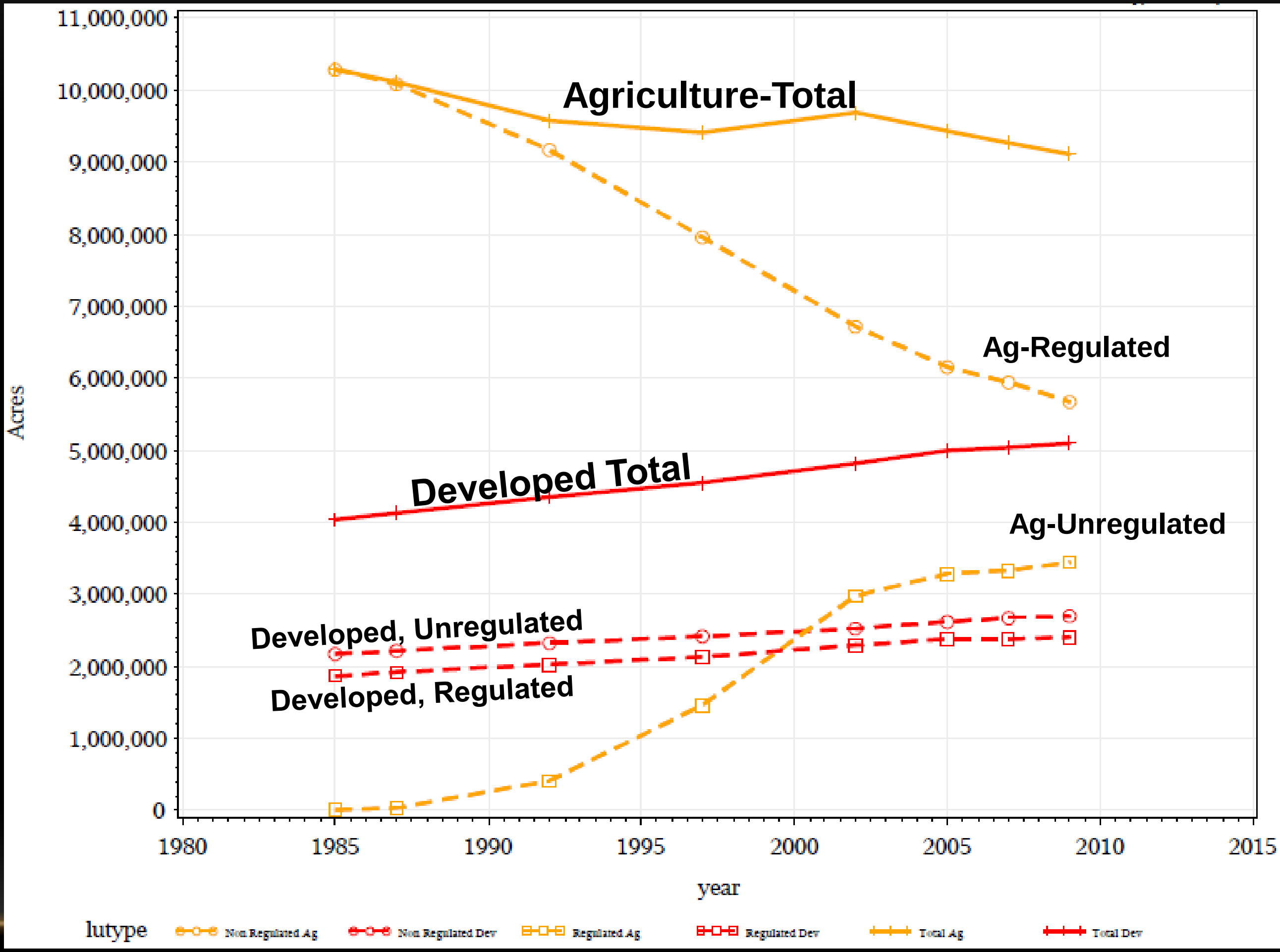
Used to assess model performance

Provide focal point for regional synthesis



CHANGES IN LAND USE: AS DESCRIBED IN WSM 5.32

- 30 Land Use Classes
- 17 Agriculture classes
    - 10 % decrease
    - 1.2 million acres
- 11 Developed classes
    - 26% increase
    - 1 million acres
- 2 Woodland classes
    - Slight increase



NOTES ON MODELS AND MODEL EVALUATION

- Models set our expectations for the response of a stream to changes in the watershed

- Where models and monitoring agree, we may (at some risk) conclude that the model sufficiently describes temporal variations such that:
  - We can use the model components to describe factors affecting change

- Where models and monitoring disagree, additional evaluation is required before model data can be used as explanatory data.
  - Incorrect data or assumptions
  - Lag time unaccounted for?
  - Processes inappropriately incorporated

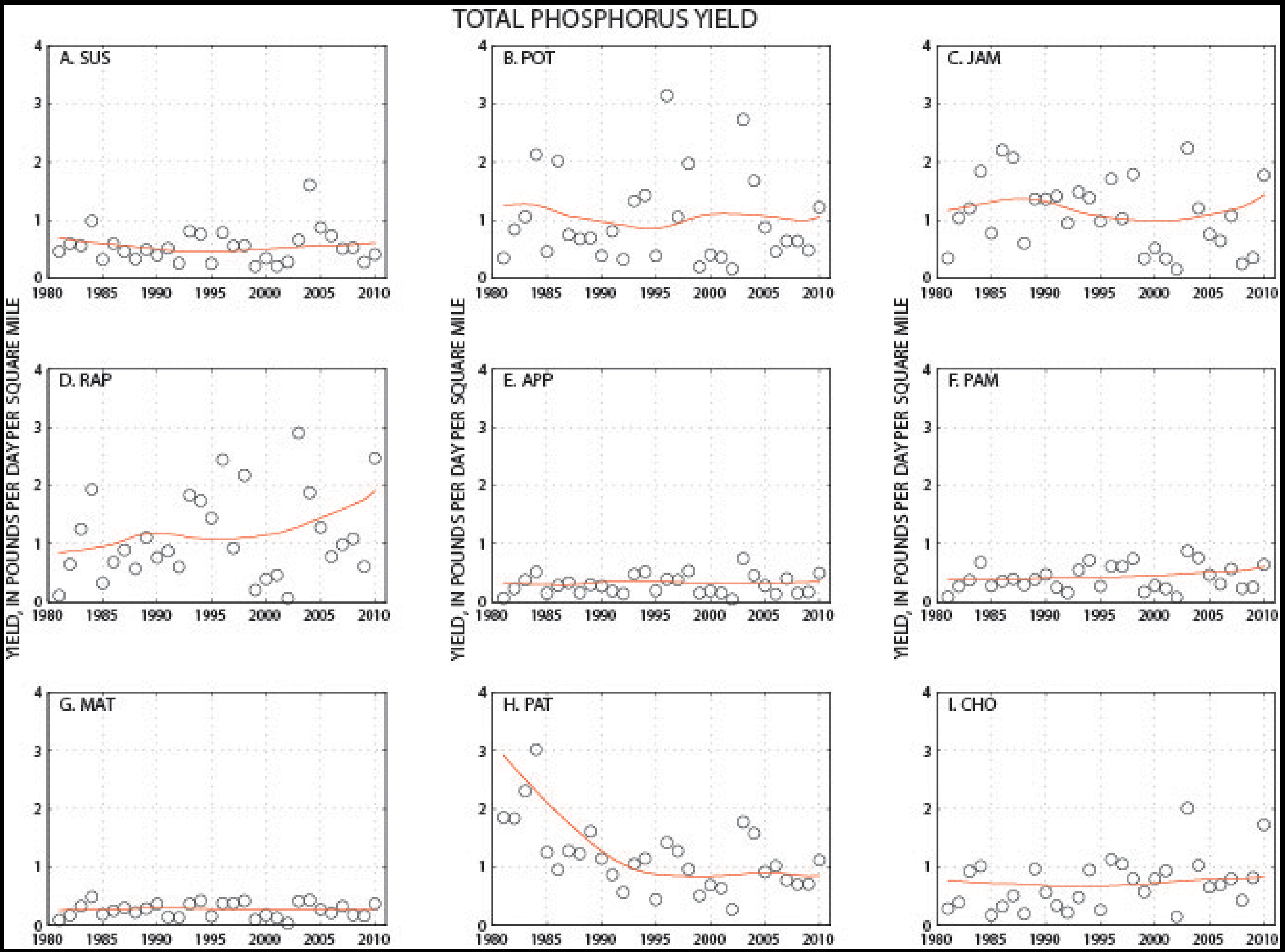
Enhanced Load and Trend Estimation: WRTDS

Benefits:

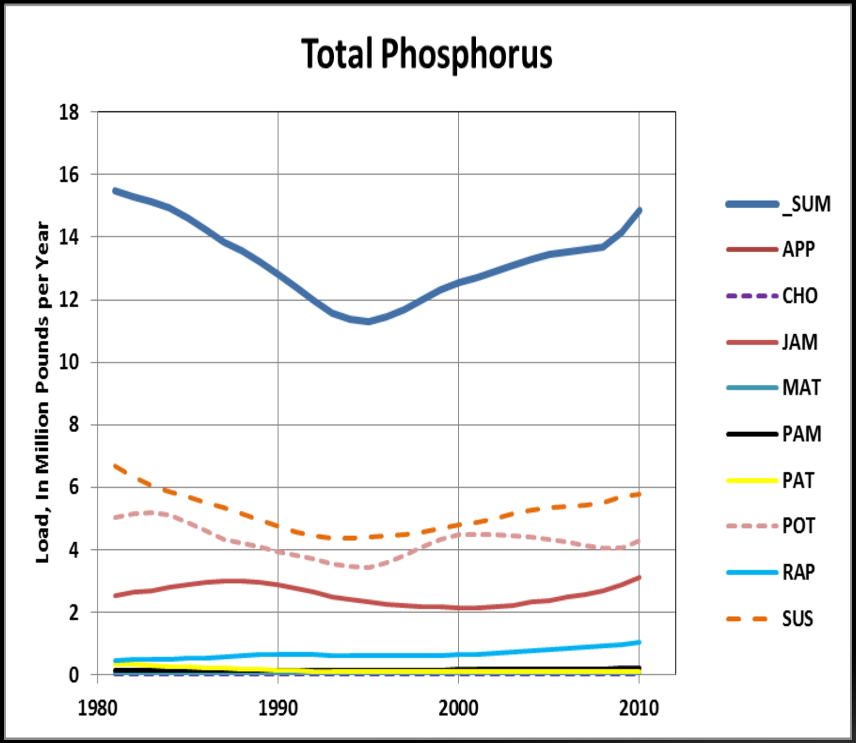
Improved relevance

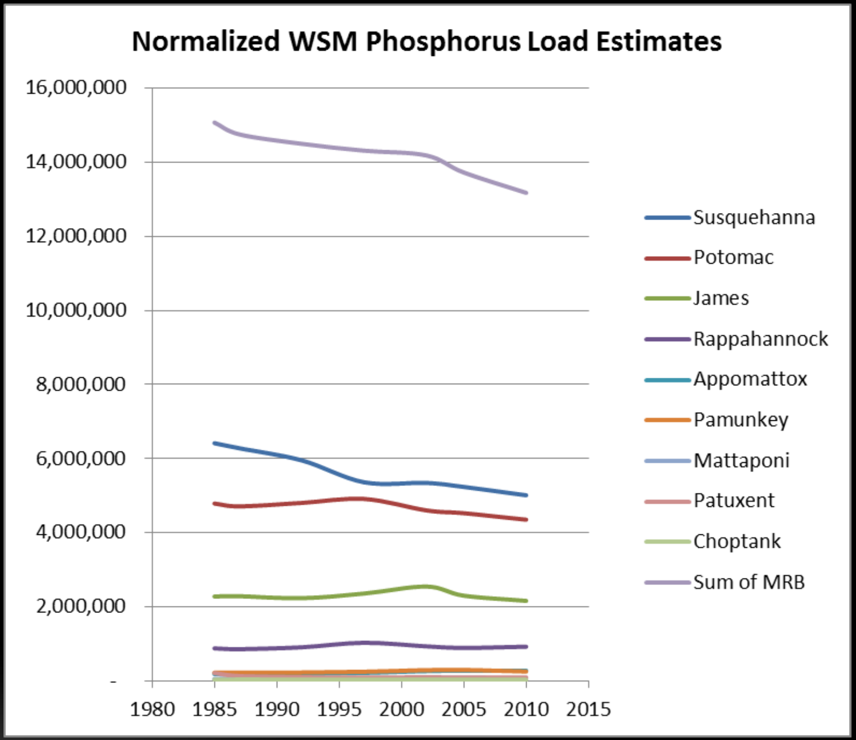
Used to assess model performance

Provide focal point for regional synthesis



COMPARING NORMALIZED LOADS FROM MONITORING DATA TO NORMALIZED LOADS FROM CB WSM: PHOSPHORUS





ASSESSING LOADS AND SOURCES USING SPARROW

Models for Nitrogen, Phosphorus and Sediment

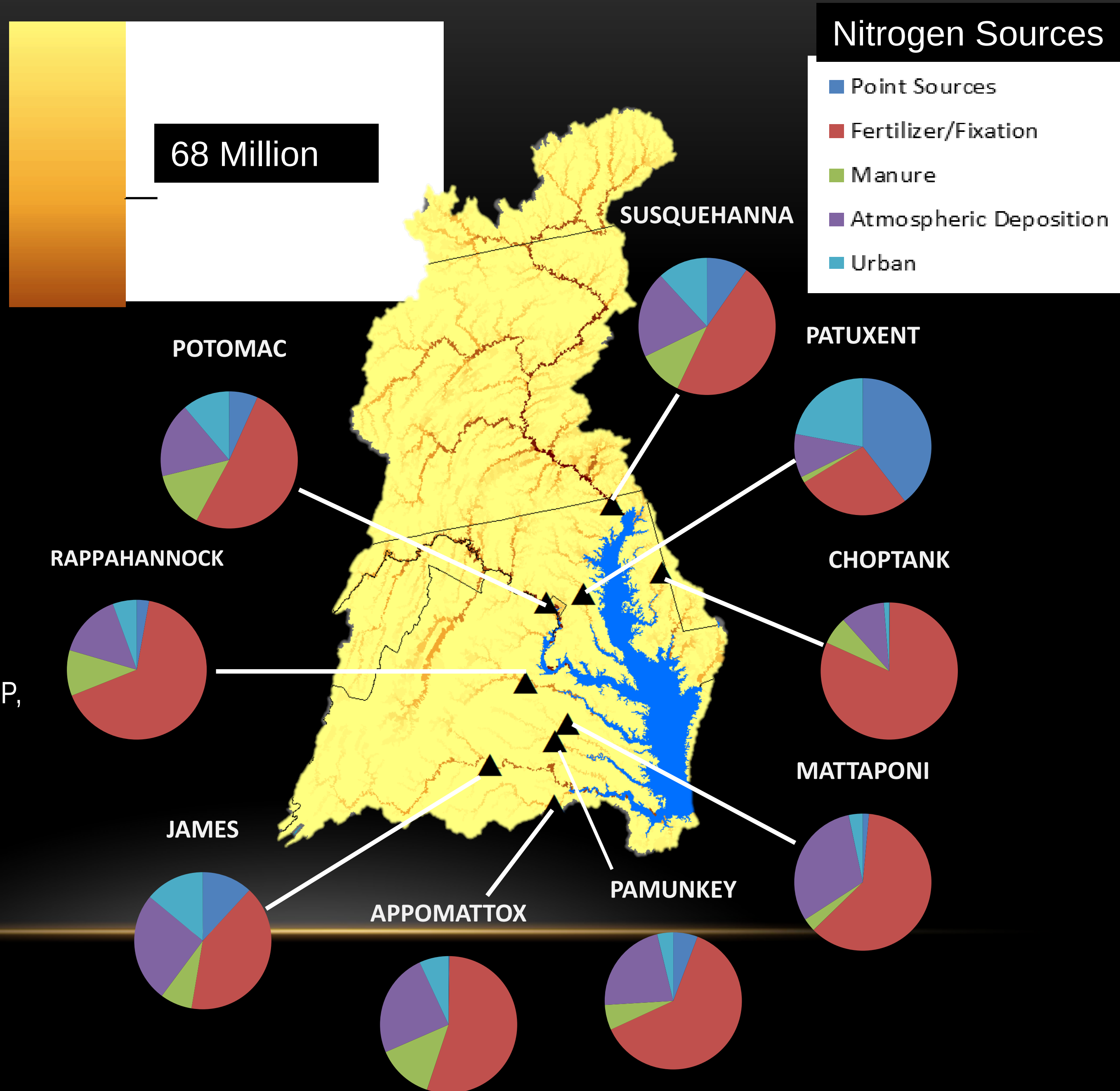
Identify dominant sources at monitoring locations

Identify watersheds with high loads and yields-- Targeting

Statistical tool that may be used as a compliment to CB watershed model.

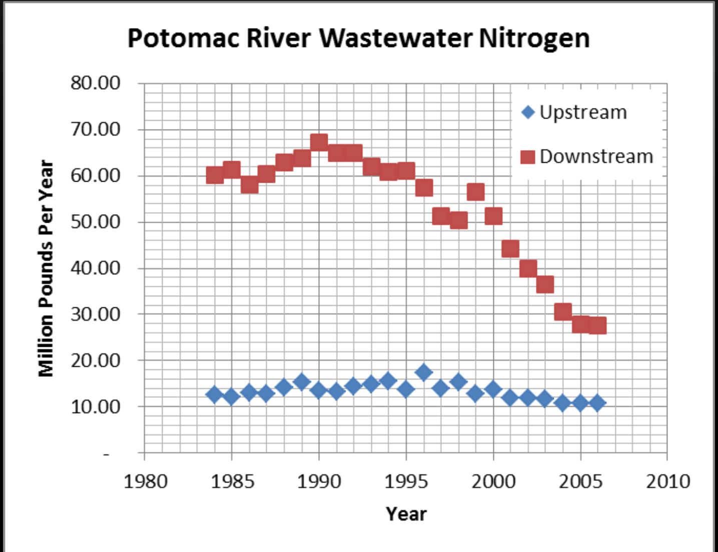
Explain primary drivers in N, P, and S transport.

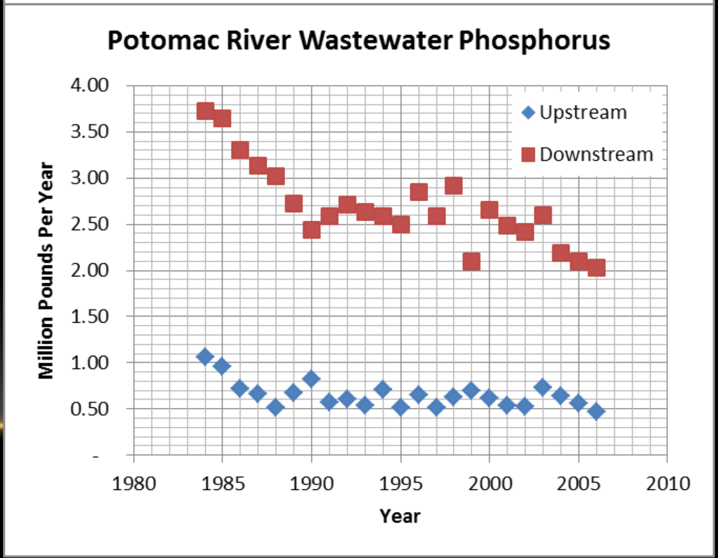
Test additional controlling variables of interest



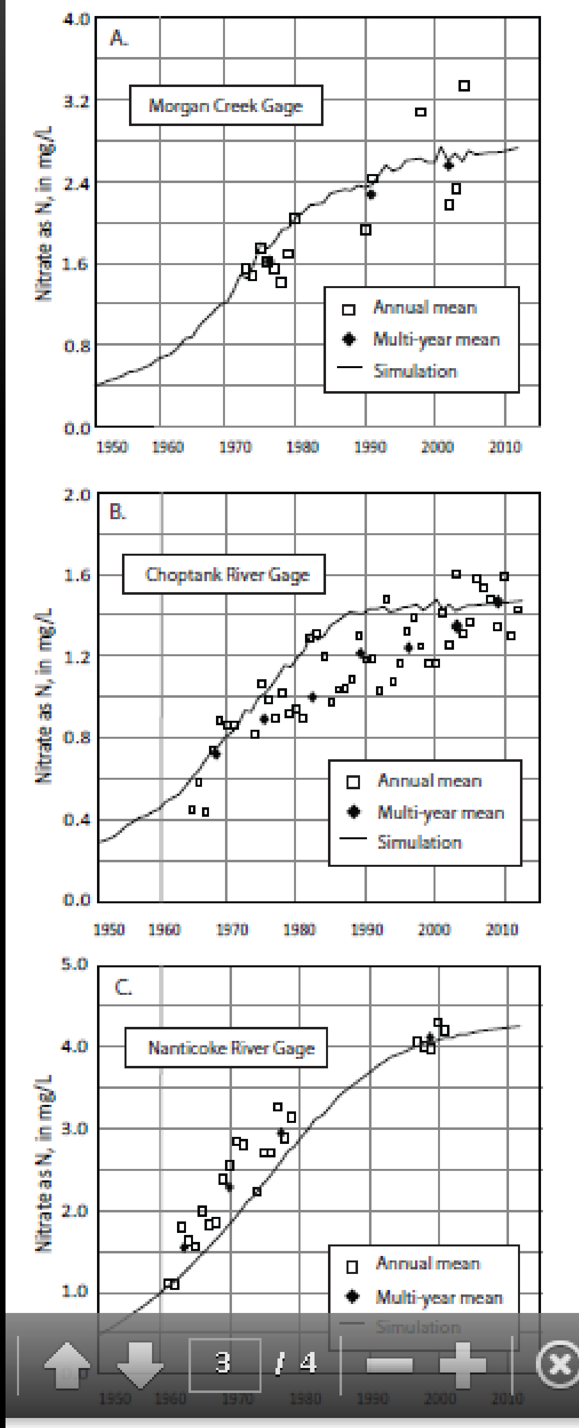
SOURCE CHARACTERIZATION AND SOURCE CHANGE

- It’s not the land use– It's the nutrients that come from the land that matters!
- Sources of Information
  - National Data Sets:
  - CBP WSM time series.
- New analyst to be added to the team:
  - Unravel the drivers in source change.
  - Cross-cutting support for USGS Science teams





GROUNDWATER MODELS



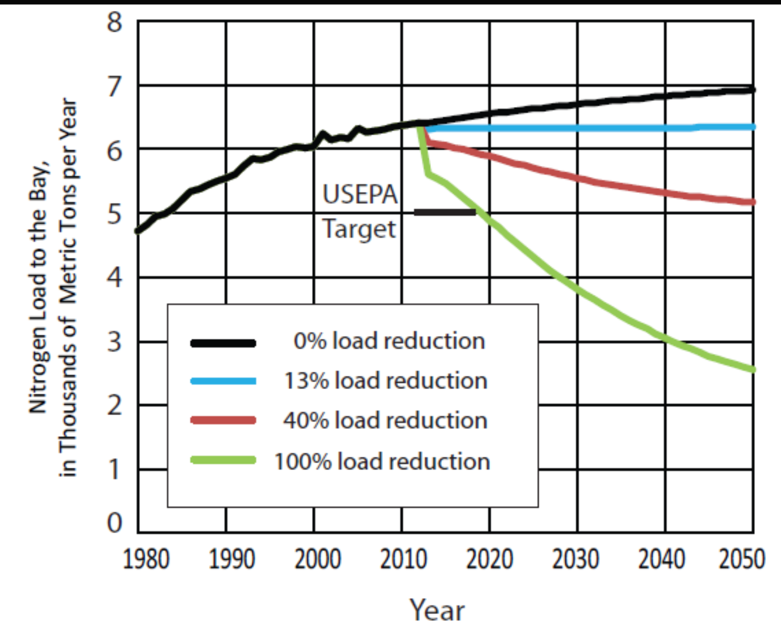
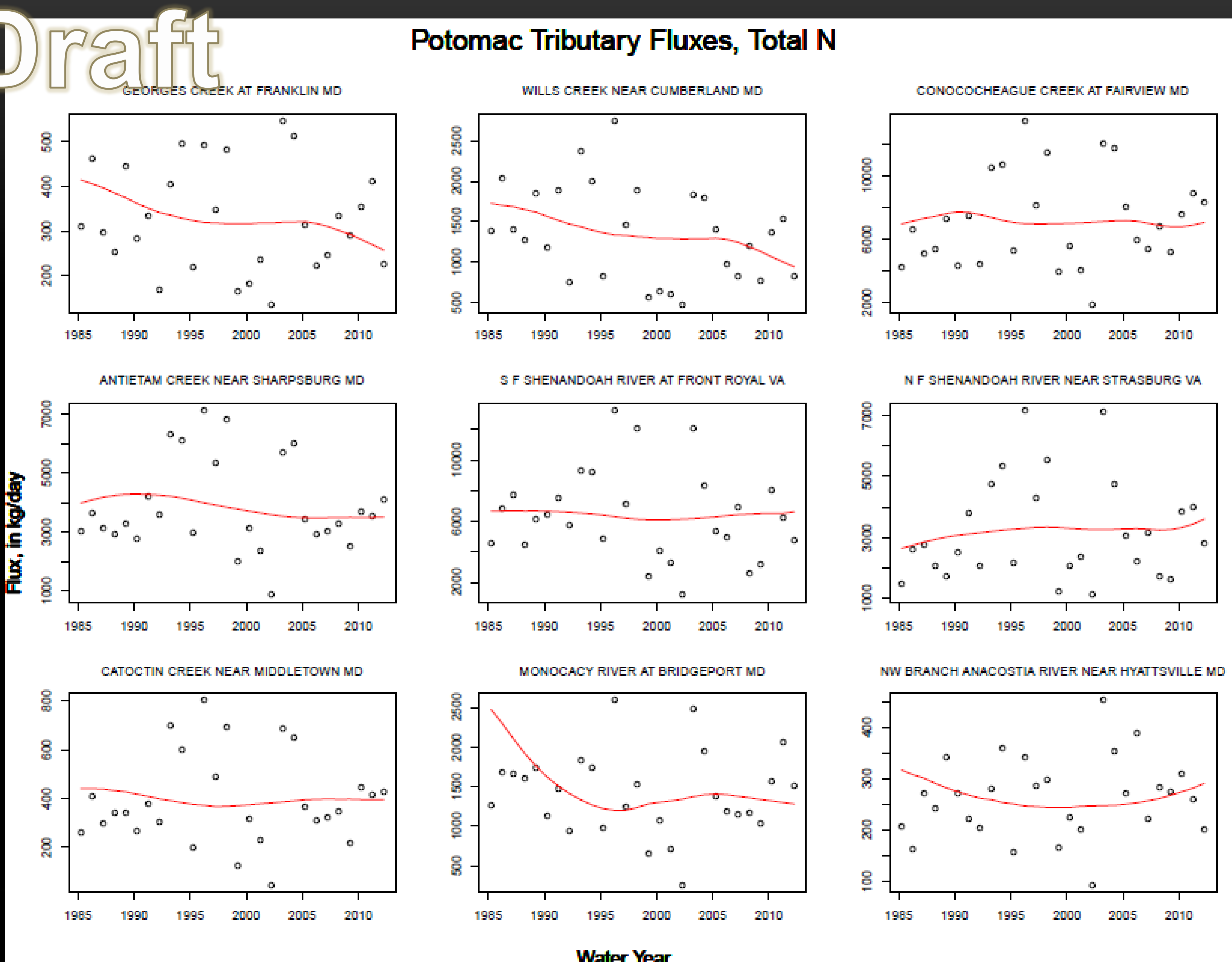
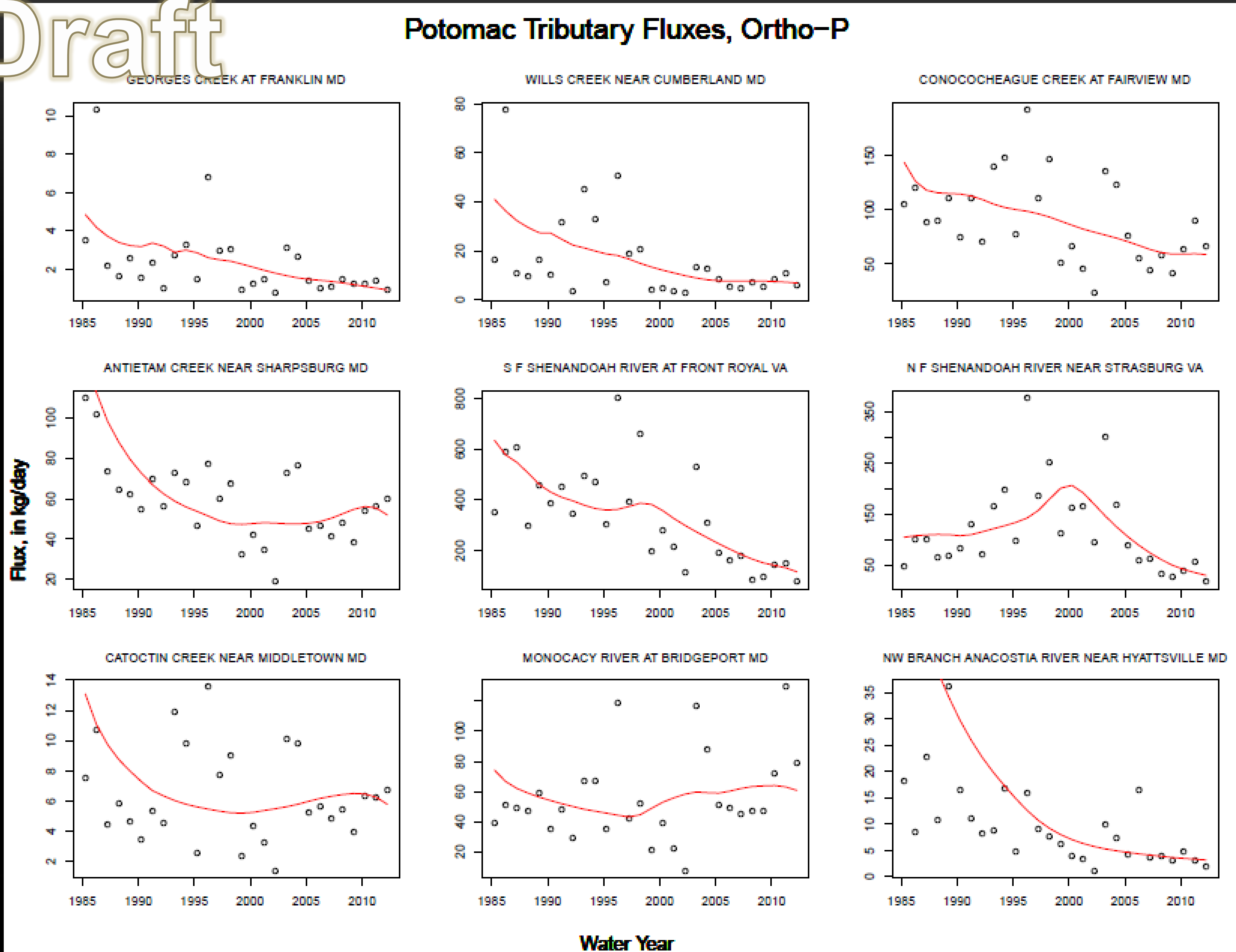


Figure 5. Forecast of nitrogen loading to the Chesapeake Bay from the Delmarva Peninsula based on the nitrogen regression mass-balance model and the simulated distribution of groundwater return times.

MOVING UP INTO THE POTOMAC, SOME VERY PRELIMINARY WORK



Draft
Potomac Tributary Fluxes, Total N
GEORGES CREEK AT FRANKLIN MD
WILLS CREEK NEAR CUMBERLAND MD
CONOCOCHEAGUE CREEK AT FAIRVIEW MD
ANTIETAM CREEK NEAR SHARPSBURG MD
S F SHENANDOAH RIVER AT FRONT ROYAL VA
N F SHENANDOAH RIVER NEAR STRASBURG VA
CATOCTIN CREEK NEAR MIDDLETOWN MD
MONOCACY RIVER AT BRIDGEPORT MD
NW BRANCH ANACOSTIA RIVER NEAR HYATTSVILLE MD
Flux, in kg/day
Water Year


Potomac Tributary Fluxes, Ortho−P
GEORGES CREEK AT FRANKLIN MD
WILLS CREEK NEAR CUMBERLAND MD
CONOCOCHEAGUE CREEK AT FAIRVIEW MD
ANTIETAM CREEK NEAR SHARPSBURG MD
S F SHENANDOAH RIVER AT FRONT ROYAL VA
N F SHENANDOAH RIVER NEAR STRASBURG VA
CATOCTIN CREEK NEAR MIDDLETOWN MD
MONOCACY RIVER AT BRIDGEPORT MD
NW BRANCH ANACOSTIA RIVER NEAR HYATTSVILLE MD
Flux, in kg/day
Water Year

S F SHENANDOAH RIVER AT FRONT ROYAL VA– 00600