Expanding The Role Of Observed Monitoring Trends And Explanations In Partnership Activities

October 17, 2016

Introduction: Working with the Water Quality Goal Team

The Integrated Trends Analysis Team (ITAT) has set up a working group with jurisdictions representations to increase interaction between scientists and jurisdiction managers for the MPA. The purpose of the ITAT-jurisdictional team is to share and discuss technical results for use in partnership decision making for water quality. The team will discuss:

- Watershed and tidal trends
- Explaining factors affecting trends, including management practices
- Inform development of Phase III WIPs and implementing actions,
- Ways to assess progress
- Visualization tools to support jurisdictions

The team has lead investigators from ITAT and jurisdictional reps (See list of participants). The team plans to have monthly scheduled calls to bring selected items to Water-Quality GIT.

The presentation to the GIT at the October 2016 meeting will focus on three themes:

- Nontidal trends and synthesis products,
- Tidal trends and integration activities, and
- Visualization tools to support jurisdictions application of monitoring results.

Nontidal Trends And Synthesis Products

The ITAT jurisdictional team will bring readily available monitoring results, topical results from nontidal explaining trends activities, and topical synthesis results forward to support MPA activities.

Available topical results

Selected topics that will be brought forward include analyses of the following data sets as well as the resulting data summaries.

- Nontidal monitoring results
  - Observed yield
  - Recent load changes
  - Long-term load changes
- Land-use change
- Ag-source changes
- BMP implementation over time
- Wastewater treatment changes
- Atmospheric deposition of nitrogen.

In addition, results from ongoing studies will be highlighted during monthly meetings as individual studies come to conclusion.

Synthesis Products

A large focus will be placed on bringing integrative synthesis PowerPoint presentations on key topics. These synthesis efforts will summarize the findings from a different studies of the topic. The topics being addressed here are:

1. Explaining loads and trends at the nine RIM sites
2. Influence of Susquehanna reservoirs on loads and water quality in the Bay (initial draft Oct, 2016)
3. Explaining yields and trends at sites throughout the watershed
4. Influence of groundwater on surface-water trends
5. Sediment sources, transport, and delivery

For each topic, the ultimate summary product will be a journal article. Interim PowerPoint presentations will be prepared to build the materials for the summary so we can share interim findings. During the presentation, we will discuss the timing and priority for these products. A brief summary of the five synthesis products follows

Explaining loads and trends at RIM sites: This product will provide an overview of the nutrient and suspended sediment flux to Chesapeake Bay from its major tributaries. It will describe the following key topics:

- loads and trends in each of the major river basins draining into the Bay, We will include information on the monitored areas upstream from RIM stations and unmonitored regions (e.g. the Coastal Plain downstream of monitoring).
- Major source of loads and how they differ regionally
- Changes in watershed condition over time, such as:
    - Land use,
    - Wastewater treatment, and
    - Atmospheric deposition.
- Describe major changes in nutrient and sediment flux over time.
- Describe differences in BMP implementation over time and among watersheds.

Influence of Susquehanna reservoirs on loads and water quality in the Bay: This ongoing product is complete in its first form, and will be updated as new information is brought forward. The partnership has pulled together a PPT that summarizes and highlights the following topics:

- Historical perspective on the Susquehanna Reservoirs,
- Observed loads and trends across the Susquehanna Watershed,
- The effect of reservoir infill on long-term trends and delivery to Chesapeake Bay,
- Potential effects of increased loading rates on Chesapeake Bay, and
- Management implications for the MPA.

Explaining yields and trends at sites throughout the watershed: This product will bring together findings from 1) watershed change characterization, including sources, BMPs and land usd changge, 2) hydrologic process studies, such as small watershed studies, and 3) integration projects ,such as SPARROW assessments of change to tell a summary story that describes drivers of changes across the watershed. The intent is to rely heavily on lessons learned during small watershed studies and from statistical tools including all variety of SPARROW models, to identify factors driving yields and associated trends. Following an outline similar to that shown for RIM integration (topic 1), the team will identify the best tools to highlight drivers of change in loads locally where possible and across the watershed where supported by regional analyses.

Influence of groundwater on surface-water trends: This product will capitalize on existing tools including MODFLOW models, baseflow analysis, travel-time studies, and mapping activities to prepare a summary of:

- Spatial patterns in ground-water lag times and lag-time distributions across the watershed;
- How different lag time distributions have different expected responses to actions in different settings;
- Assessment of whether observed stream nitrogen loads are consistent with the levels of inputs and BMP implementation over time; and
- The relative role of ground-water denitrification on naturally mitigating nitrogen transport to Chesapeake Bay.

Sediment sources, transport, delivery Provide a synthesis of the state of knowledge of sediment sources, transport, retention, and management in the Chesapeake Bay watershed. Many of these topics have already been brought in to enhance the CBP Phase 6 modeling suite. These topics include:

    - Development of a conceptual model of sediment transport and storage
    - The role of land use change history
    - Sediment characteristics: particle size (grain size matters), organic vs. mineral
    - Upland sediment erosion
    - Upland sediment storage locations
    - Stream internal fluxes (Bank, floodplain, in-channel, reservoirs)

- Fingerprinting to ID sources
- Residence times and path lengths

Tidal trends and Integration activities

A number of researchers in the Bay Community have formed topical research efforts to synthesize the results of available data and ongoing studies into an understanding of the drivers of changes in key estuarine endpoints. The ITAT jurisdictional team will work to bring the results of these teams to jurisdictions to support the midpoint assessment decision-making. A summary of these ongoing activities follows.

Potomac River Basin Synthesis (Leader: Lora Harris)

This group has collaborated to conduct analyses linking water-quality trends in the Potomac watershed with water-quality trends in Potomac tidal waters. They are on track for submitting a manuscript and sharing some findings in the Spring of 2017.

Tidal Water Quality Synthesis (Leader: Jeremy Testa)

This group has recently formed and will begin its work this Fall. The group's goals are to:

(1) synthesize the current state of knowledge to explain bay-wide trends in tidal water quality;
(2) conduct some new analysis to advance our knowledge of factors affecting bay-wide trends in tidal water quality;
(3) *produce a short white paper that will help inform regional managers' next phase of decision-making for the TMDL Mid-Point Assessment. We are projecting a presentation on the white paper in early 2017.*

SAV Technical Synthesis III (Leader: Brooke Landry, Ken Moore)

The third Technical Synthesis of research on Submerged Aquatic Vegetation in Chesapeake Bay highlights the current state of knowledge on SAV populations, including interactions with landscape characteristics, climate change, fisheries practices, and management implications. Presentations on insights from the SAV Technical Synthesis III will be developed starting in Spring 2017.

SAV Trends Synthesis (Leader: JJ Orth and Bill Dennison)

This group has held its first two meetings, is working on a review article, and has defined and committed to two new analytical projects. Both projects aim to advance understanding of factors affecting trends in SAV abundance and distribution. While some in the group focus on

new research, others will work on communicating the current state of knowledge to managers and jurisdictional partners. Stay tuned for communication products coming in Spring 2017.

Water Clarity Synthesis (Carl Friedrichs, Jeni Keisman)

This group first convened in September, during which they discussed the current state of knowledge on factors affecting trends in estuarine water clarity. They have identified analyses to be conducted in the coming months that will help to advance our understanding of the perplexing patterns that have been observed over the past 30 years. Future plans include drafting a synthetic review of the current state of the science on Chesapeake Bay water clarity, as well as a focused set of analyses aimed at advancing our understanding using currently available data. Communication of insights from the synthesis review and preliminary findings from analysis projects will begin in Spring 2017.

Visualization tools

This presentation will request feedback on the audience and types of potential data visualization products to support monitoring and explaining trends efforts. The Water Quality GIT will be asked to provide guidance on the type(s) of products that would be most useful, potentially including data exploration tools, interactive maps or other decision support tools, or data driven "stories". The visualization tools will also provide an important way to integrate nontidal and tidal results.

Monitoring and Explanation of trends visualization products could focus on one or more of the following:

Nontidal information: Nontidal information is from the Nontidal water-quality network in the Chesapeake Bay watershed. There are almost 120 sites, including the nine River-Input Monitoring (RIM) Sites. A statistical package (WRTDS) is used to compute nutrient and sediment loads and trends. Results where visualization can be enhanced include:

- Ten-year trends for all the nontidal network sites (up/down and percent change)
- Long-term (30 year) trends or 10-year trends for RIM sites with plots of change over time.
- Nontidal loads per area: show relative amount of load per area for Nontidal network sites.
- SPARROW Model Yields. The model uses monitoring data to estimate yields in between monitoring sites. Provides and estimate of yields to local streams and yields to tidal waters.

Tidal trends

These trends are based on monitoring data collected from the mainstem and tidal tributaries. The following measures can be visualized:

- A new technical Geographic Additive Models (GAM) are being used to compute trends.
- Nutrient, dissolved oxygen, and water clarity trends in the Bay and tidal rivers
- Water-quality standards attainment in the Bay by designated use category

Other data products that could be presented include

- Conditions upstream (including BASIN characteristics) of nontidal monitoring sites
- Ranging scenarios from the Chesapeake Bay Watershed model
- WIP III Planning Targets
- Watershed Model Inputs from CAST
- BMP Implementation levels

Table 1. List of ITAT jurisdictional team participants

Name	Jurisdiction	Agency
Diane Davis	DC	DOEE
George Onyullo	DC	DOEE
John Schneider	DE	DNREC
Bruce Michael	MD	DNR
Jason Keppler	MD	MDA
Jim George	MD	MDE
Lee Currey	MD	MDE
Jason Dubow	MD	MDP
Sara Latessa	NY	DEC
Amy Williams	PA	DEP
Veronica Kasi	PA	DEP
Kristen Wolf	PA	DEP
James Davis-Martin		VA DEQ
Roger Stewart	VA	DEQ
David Montali	WV	DEP
Karl Berger	Regional	MWCOG
Mukhtar Ibrahim	Regional	MWCOG
Tanya Spano	Regional	MWCOG
Jennifer Keisman	FED	USGS
Joel Blomquist	FED	USGS
Scott Phillips	FED	USGS
John Wolf	FED	USGS
Doug Moyer	FED	USGS
James Davis-Martin		VA DEQ
Roger Stewart	VA	DEQ
David Montali	WV	DEP
Karl Berger	Regional	MWCOG
Mukhtar Ibrahim	Regional	MWCOG
Tanya Spano	Regional	MWCOG
Jennifer Keisman	FED	USGS
Joel Blomquist	FED	USGS
Scott Phillips	FED	USGS
John Wolf	FED	USGS
Doug Moyer	FED	USGS