STAC Workshop: Using Local Monitoring Results to Inform the Chesapeake Bay Program's Watershed Model

Workshop Co-Chairs: KC Filippino and Karl Berger

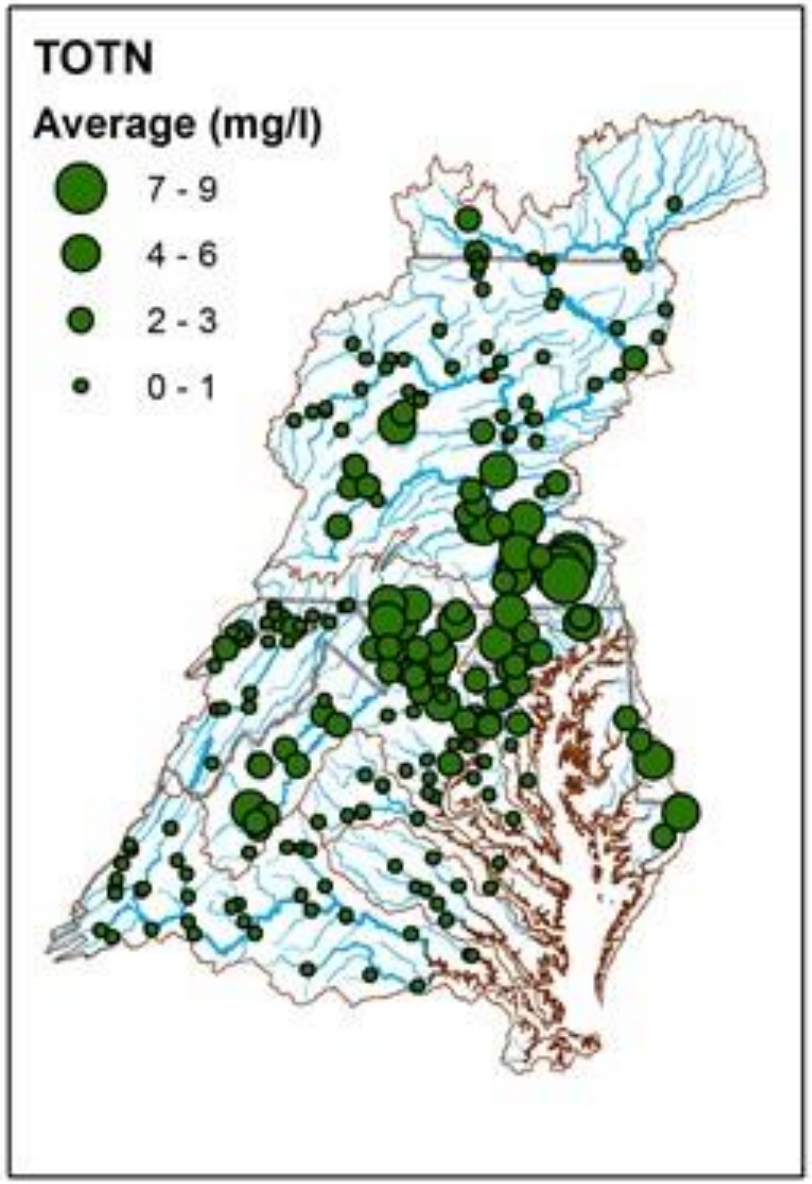
March 7-8, 2023

Adapted from presentation by KC Filippino

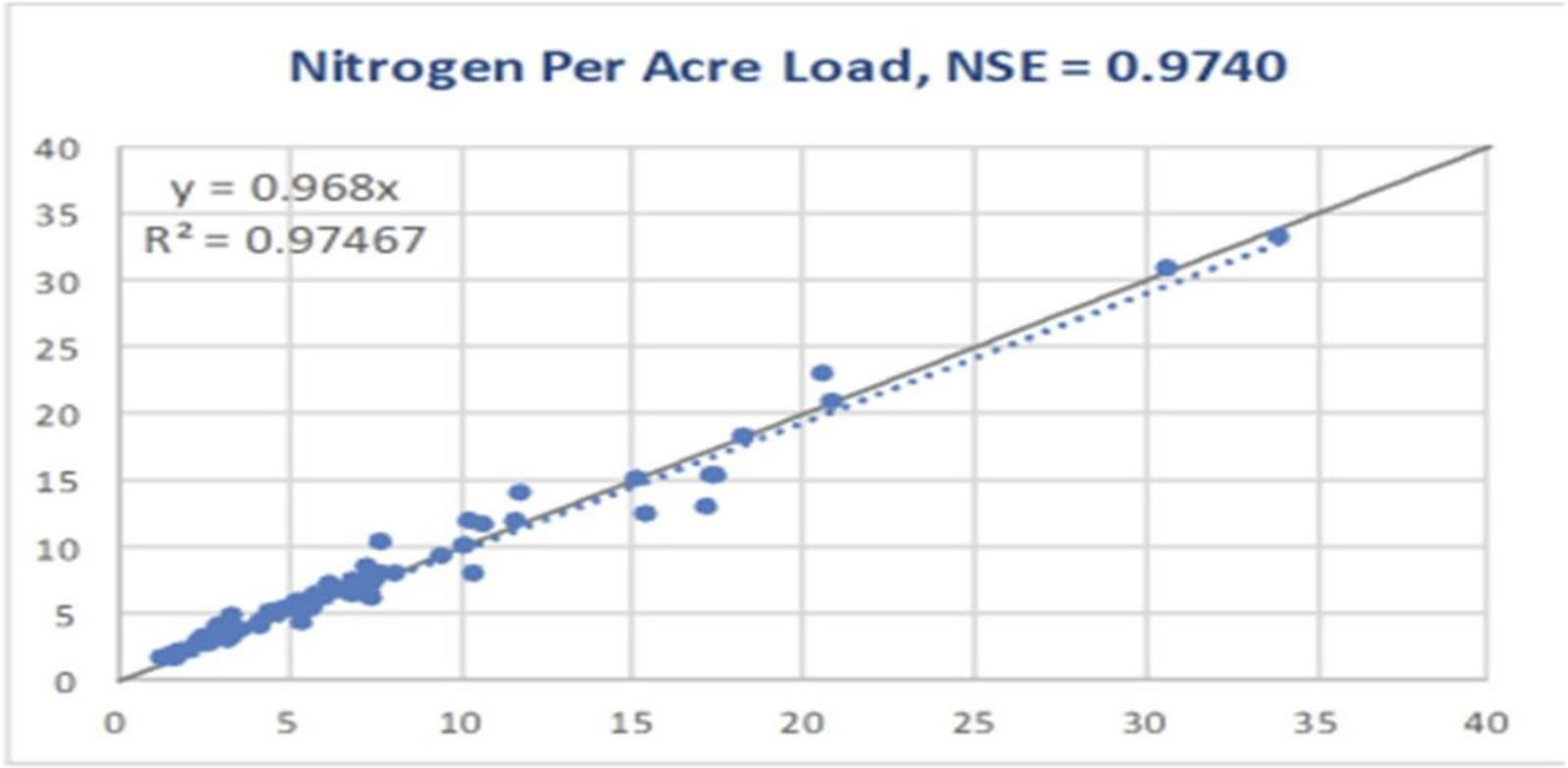
Three uses of monitoring data in the CBP watershed model

- Calibration
- Comparison with trends
- Knowledge generation

1. Calibration –

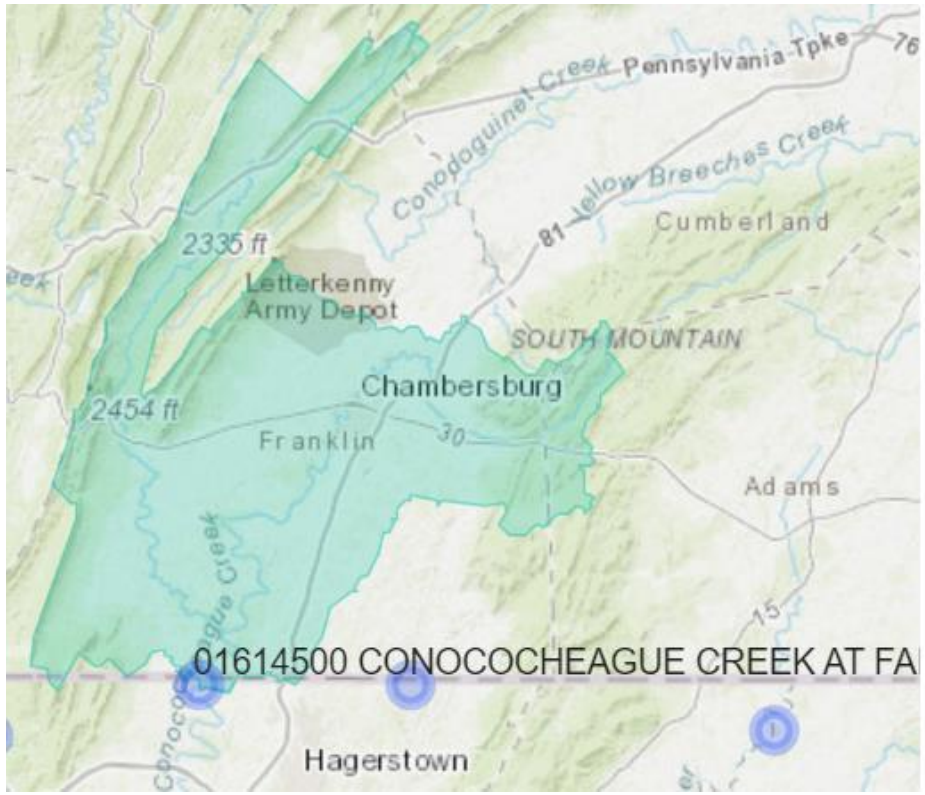


- Do we understand ***where*** the loads are coming from?



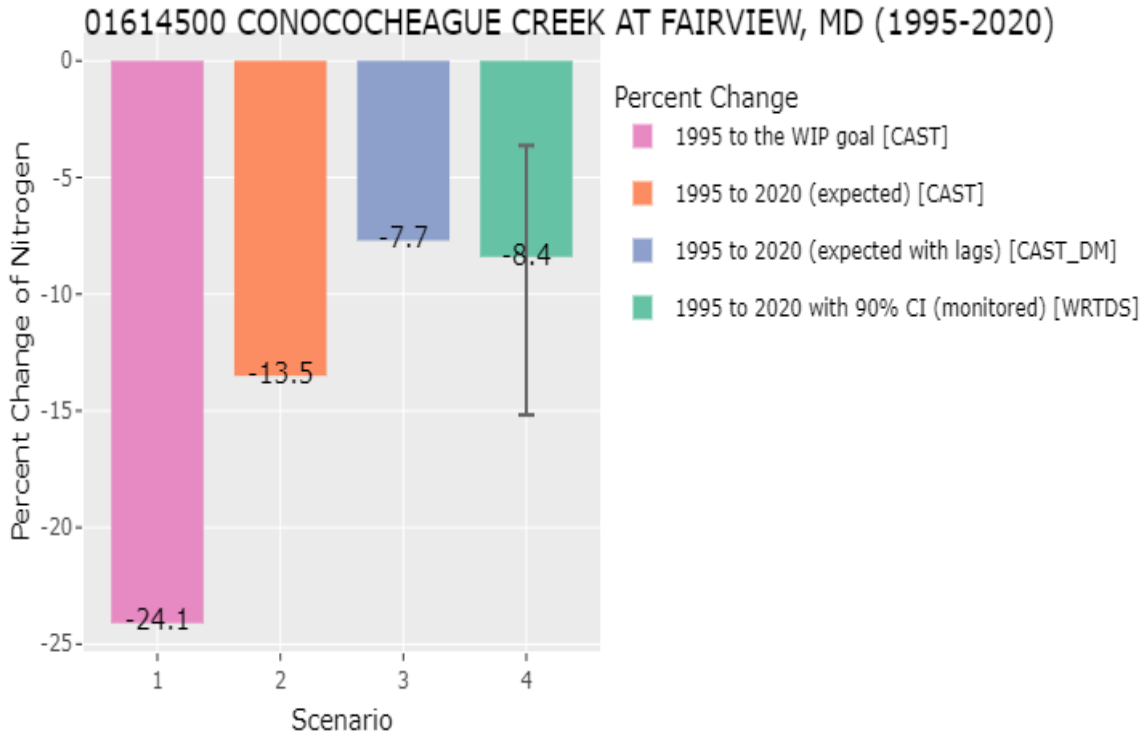
- Not necessarily a local benefit
  - Improves the overall model
  - Improves similar areas the most

2. Comparison with trends



Are we representing load ***changes*** well?

…particularly good example



https://zhangqian0324.shinyapps.io/CBNTN_TMDL_Indicator/

- Local benefit

CAST

Average Load

+

△ Inputs * Sensitivity

*****

BMPs

*****

Acres

*****

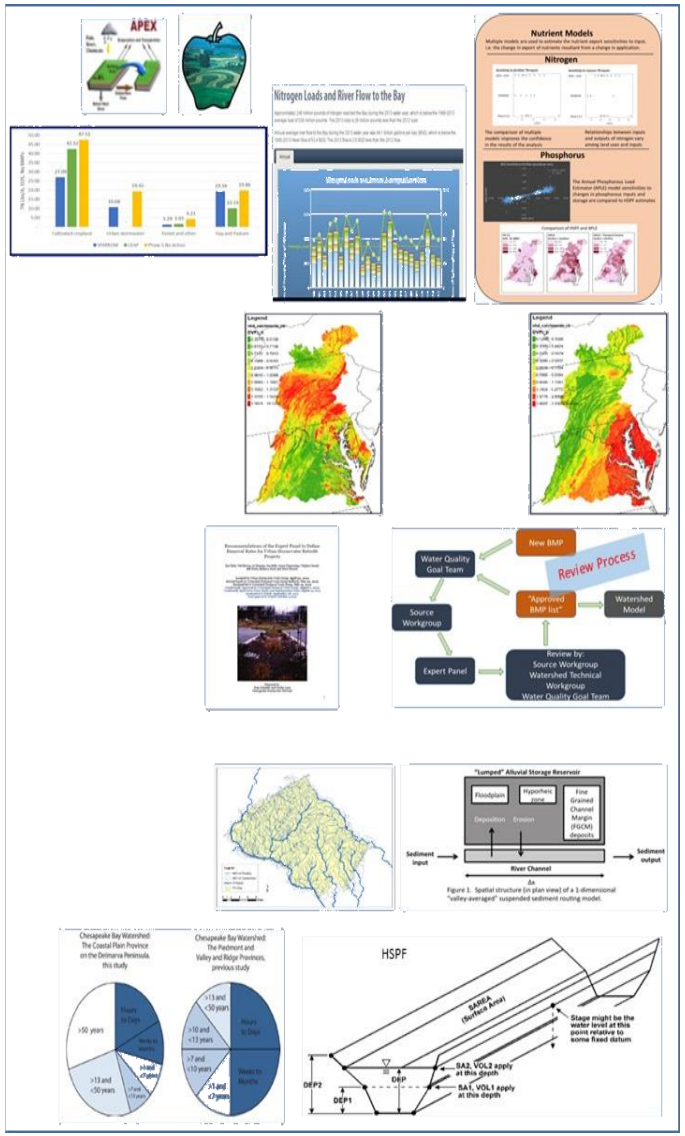
Land to Water

*****

River Delivery

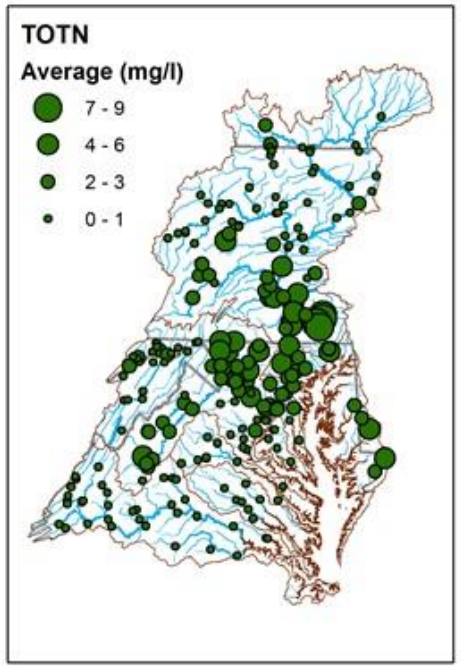
Load by land-river segment and land use

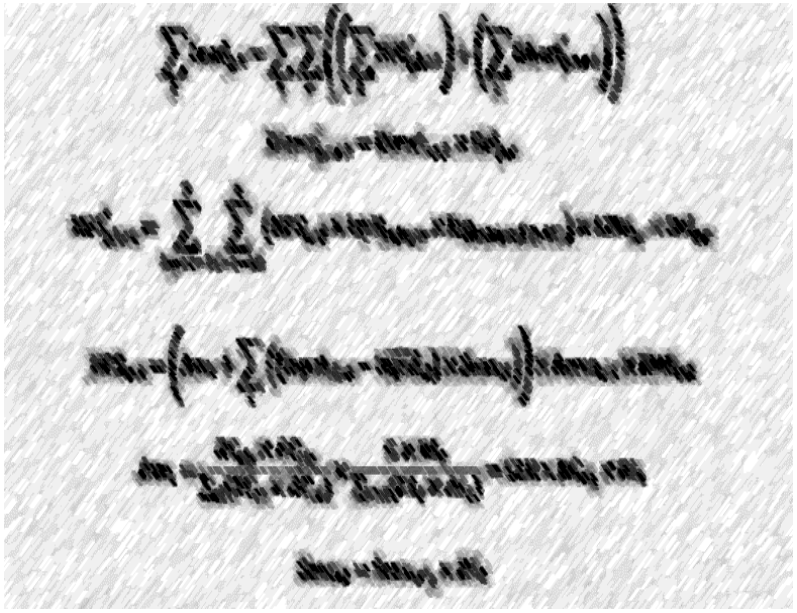
3. Knowledge Generation



CalCAST is a Bayesian Sparrow-like model

Loads + **Equations** + **Prior information about parameters**





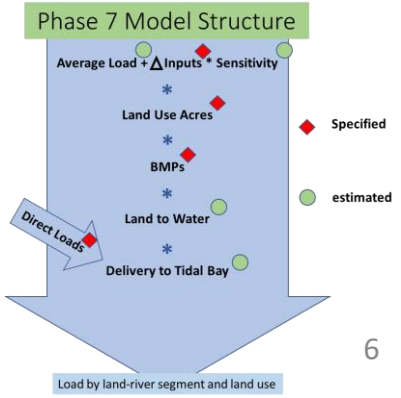
Pasture loads average 44% of crop loads

Turf Grass average 50% of Roads

Septic loads depend on distance to streams

A pound of manure applications causes about half the load increase as a pound of fertilizer

= **Estimates of parameters For CAST**

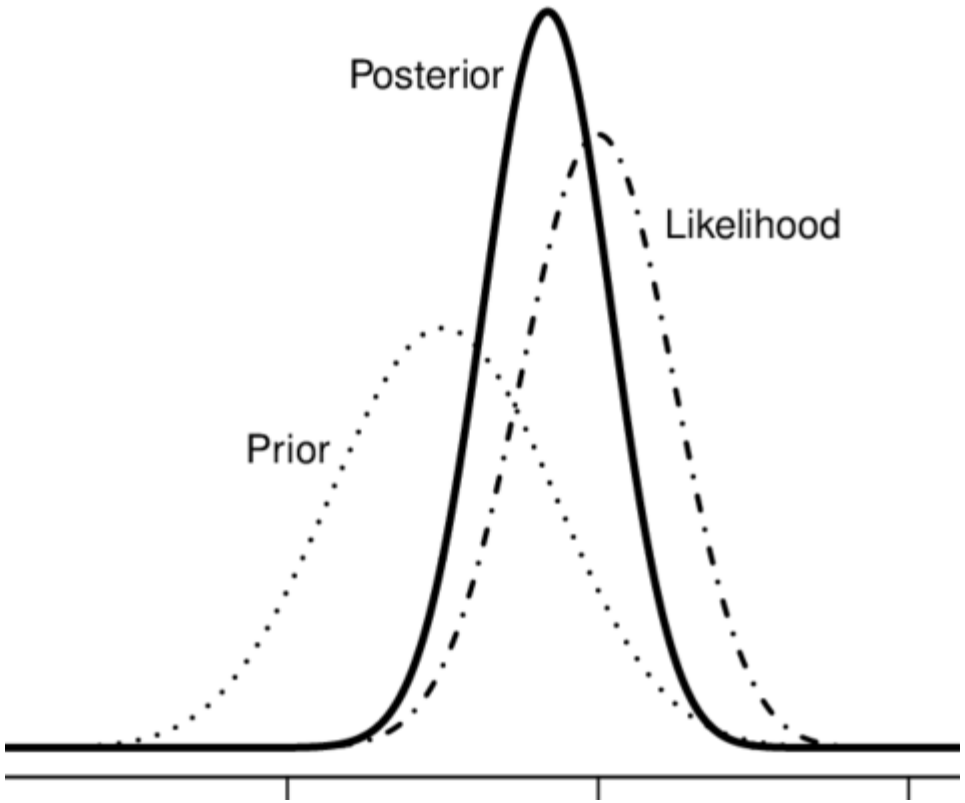


Types of prior information

Model Structure

- At one point in CBP history, we didn't know that atmospheric deposition was a load

Model Parameters



Workshop Structure

- Provide overview of model structure
- Hear from monitoring case studies
  - Urban and Agriculture
- Break out urban and agriculture groups and discuss
  - What generalizable knowledge can be produced?
  - How can monitoring studies create generalizable knowledge?
- Reconvene to discuss and establish recommendations

RECOMMENDATIONS

For the Bay Program to consider

Include local data in model calibration

Compare with TMDL expectations

Include as generalized knowledge

RECOMMENDATIONS

For the Bay Program to consider

Include local data in model calibration

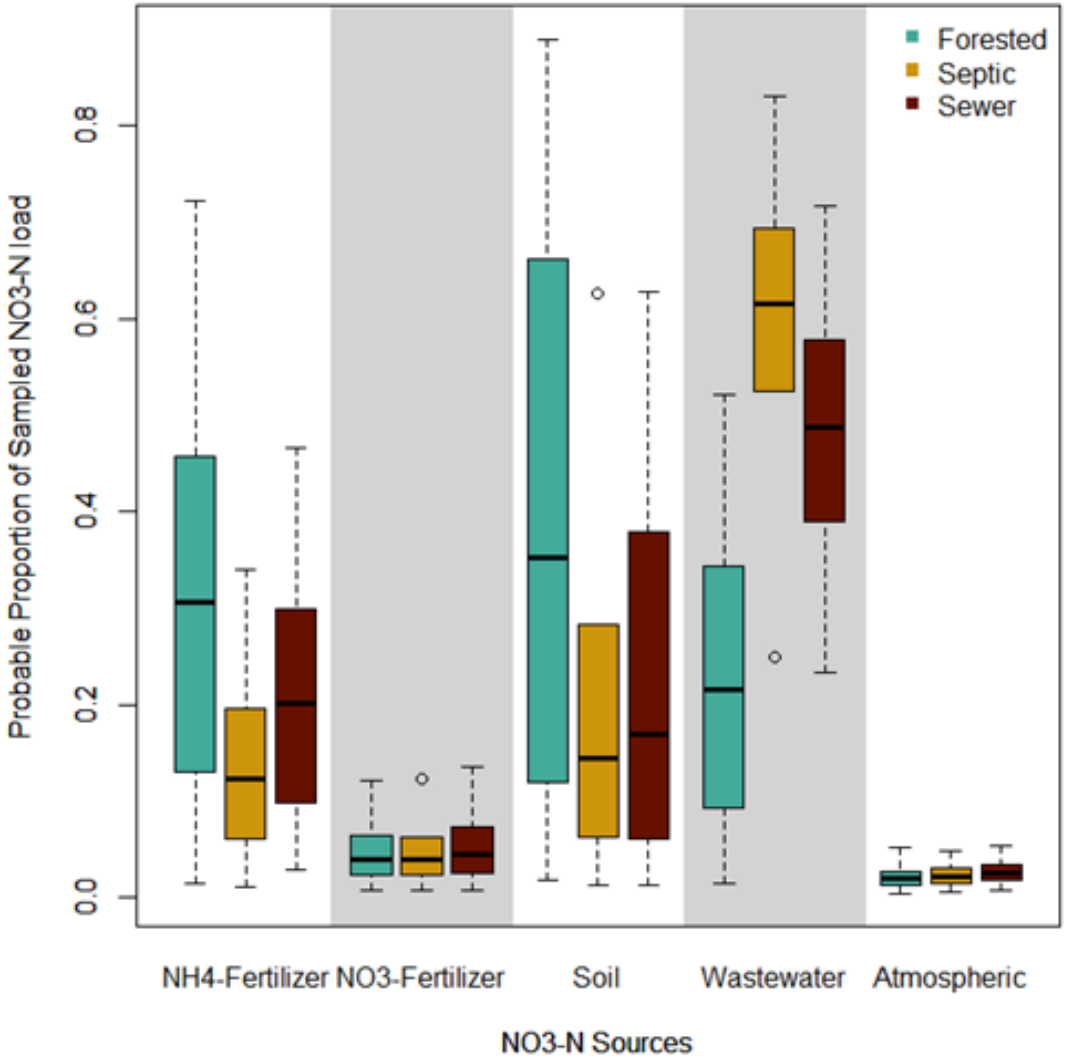
Compare with TMDL expectations

Include as generalized knowledge

Look for other established data sets

Discuss policy changes to incorporate monitoring

Generalized Knowledge - Urban



Potential new load sources

- Urban 'karst'
- exfiltrated wastewater
- residential groundwater pumping
- illicit discharges
- new look at septic

Potential parameters

- …

Joseph Delesantro

Generalized Knowledge - Ag

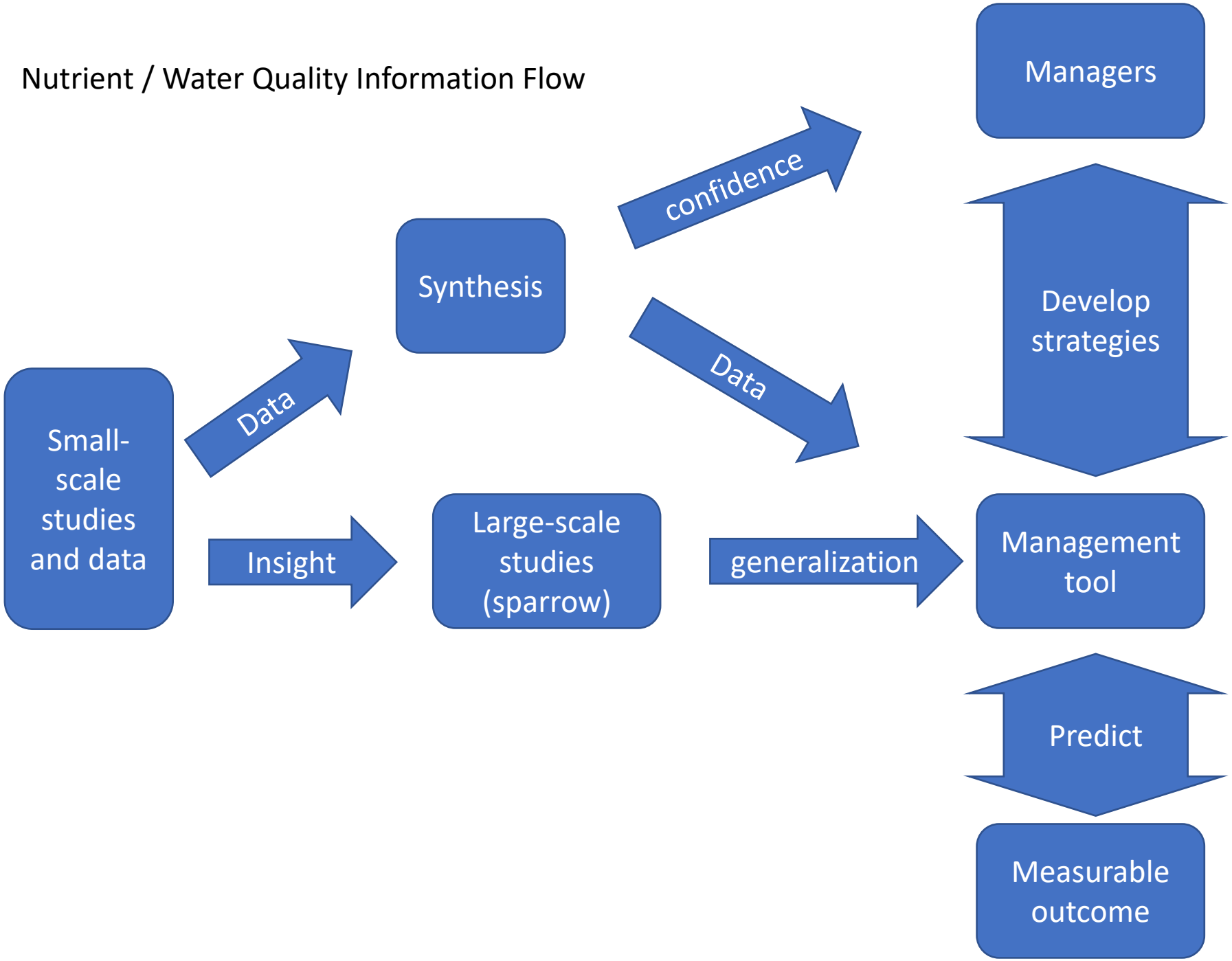
Potential new load sources

- …

Potential parameters

- …

Nutrient / Water Quality Information Flow

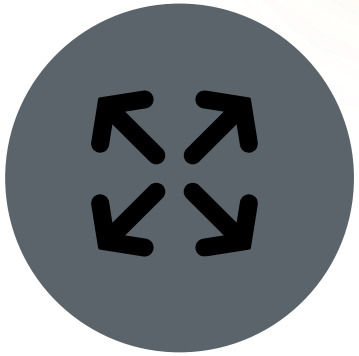


RECOMMENDATIONS

For local networks to consider

Design for BMP effectiveness

Identify new statistical tools



Expand existing programs

Consider climate change

Include as generalized knowledge

- Hypothesis-driven – design a study to answer a specific question needed for management
  - Sites
  - Frequencies
  - Parameters
  - Watershed inputs
  - Watershed properties
  - Stream metrics

- New statistical tools
  - Determine causes of loads and trends in small watershed data.
    - Inputs
    - Practices
    - Physical properties in small watersheds.
  - Synoptic data
    - Much collected, little used
    - Stakeholder involvement in community science projects.

Summary

- More direct use of monitoring data in calibration
- More meaningful comparison of output
- Better design and methods for watershed studies to produce generalizable knowledge

Thank you

Workshop Steering Committee:

Karl Berger, Metropolitan Washington Council of Governments (Chair)
K. C. Filippino*, Hampton Roads Planning District Commission
Normand Goulet, Northern Virginia Regional Commission
John Jastram, U.S. Geological Survey
Michael Lookenbill, Pennsylvania Department of Environmental Protection
Douglas Moyer, U.S. Geological Survey
Greg Noe*, U.S. Geological Survey
Aaron Porter, U.S. Geological Survey
James Shallenberger, Susquehanna River Basin Commission
Gary Shenk, U.S. Geological Survey
Bryant Thomas, Virginia Department of Environmental Quality
Guido Yactayo, Maryland Department of the Environment

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Rachel Tardiff of Rachel Tardiff LLC (facilitator), Lewis Linker (virtual facilitator)