The Chesapeake Bay Program's Modeling and Accountability System

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Chesapeake Bay Commission

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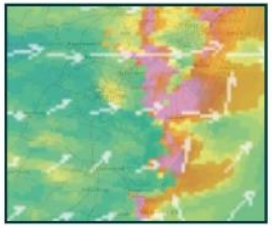
Data and Model Inputs

Pollution Control Data
Land Use Data
Point Sources Data
Septic Data
U.S. Census Data
Agricultural Data

Land Use Change Model



Airshed Model

Precipitation Data
Meteorological Data
Elevation Data
Soil Data

Phase 6 Watershed Model/CAST

How much nitrogen, phosphorus, and sediment reaches the Bay under different management scenarios?

Estuary Model

How does oxygen in the Chesapeake respond to different levels of nitrogen, phosphorus, and sediment?

What are the inputs?
How is the watershed managed?

Summary

- The CBP models to explain monitoring data, to plan management actions, and to combine the effects of different management actions
- The CBP has a long history of modeling
- The models are built by the partnership as the expression of the CBP partnership's knowledge about the Chesapeake system.

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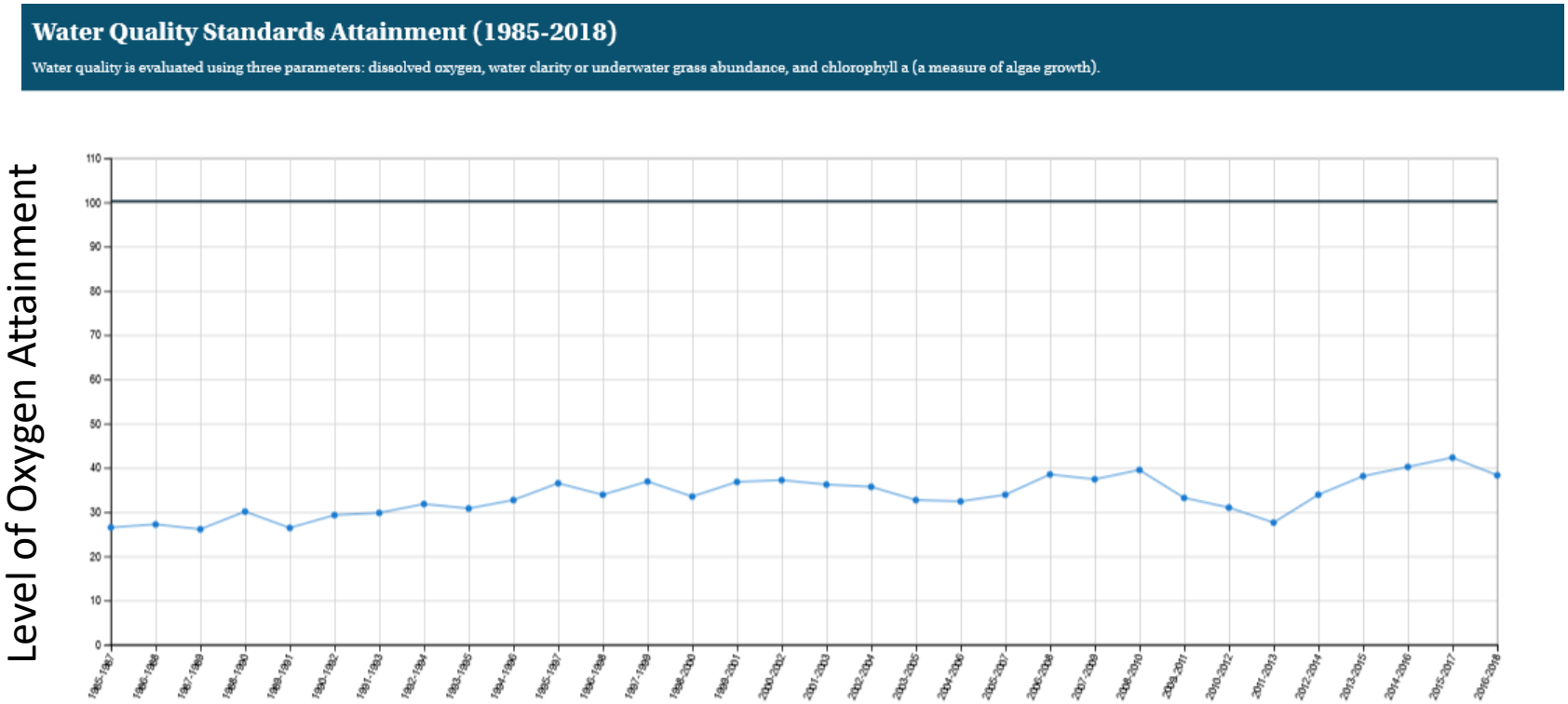
Modeling and Monitoring



Monitor for attainment.

Model to understand why we are seeing this level of attainment

- Weather
- Nutrient Loads

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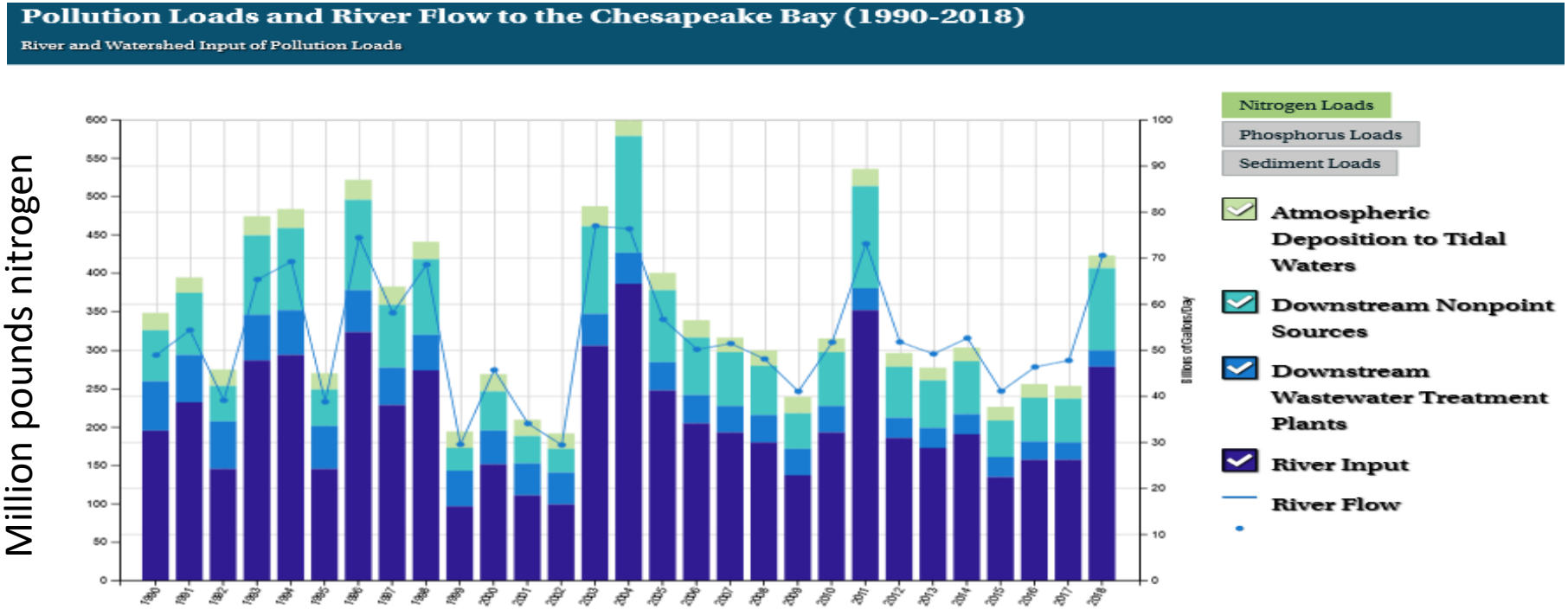
Modeling and Monitoring



Monitor for nitrogen loads.

Model to understand why we are seeing these loads.

- Weather
- Natural processes
- Human activities
- Human interventions

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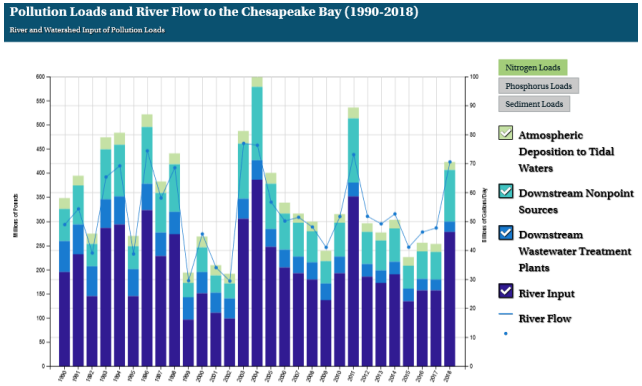
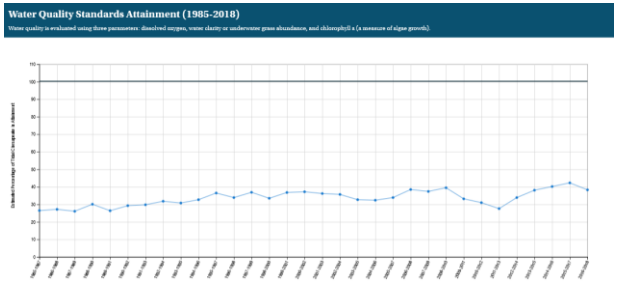
Modeling to plan

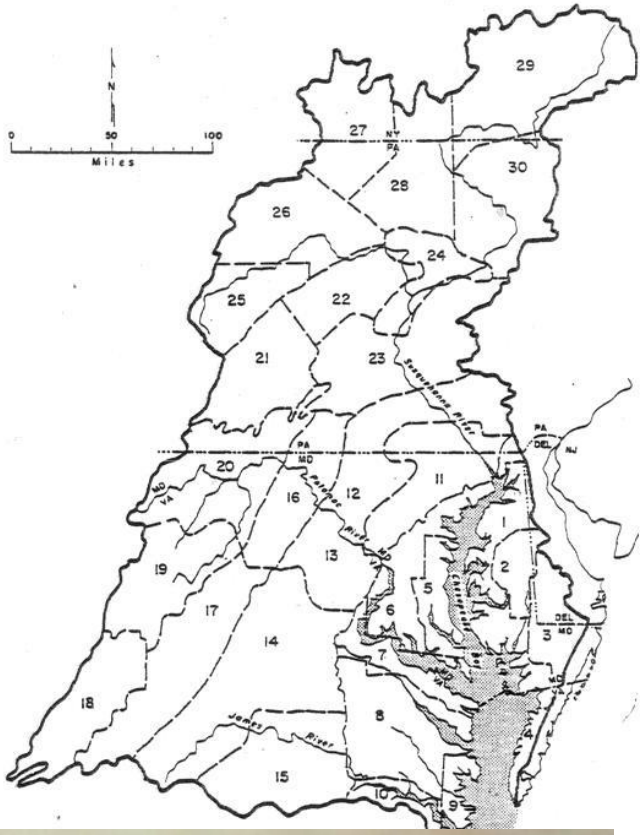




- Plan for the management practices that will allow us to reach our water quality goals
- Estimate the effectiveness of various BMPs
- Provide a common currency

First Version of the Watershed Model:

- Completed in 1982
  - 30 segments (now 2000)
  - 2 years of simulation (now 30)
  - 5 land uses (now 50)
- IBM mainframe platform
  - (Now in the cloud)



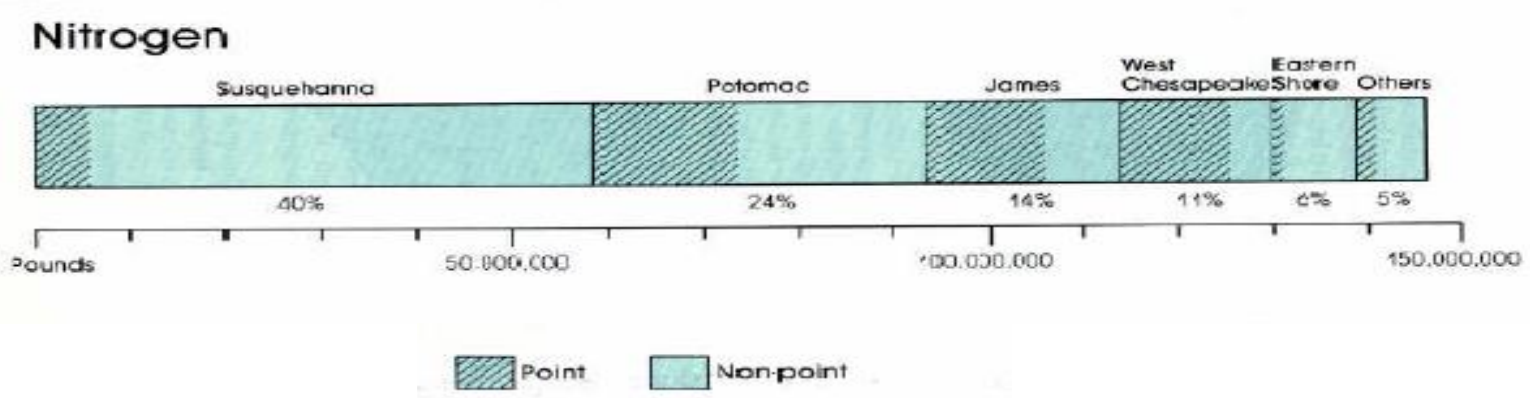
Northern Virginia Planning District Commission
7630 Little River Turnpike
Annandale, Virginia 22003

January 1983

Primary Products of the First Version of the Watershed Model:

Nonpoint > Point

Informed the 1987 40% agreement



Model has grown with the Partnership

Time	Name	Scenarios
• Mid 1980s		0
• Early 1990s	Phase 2	<10
• Late 1990s	Phase 4.1	37
• Early 2000s	Phase 4.3	400+
• 2009-2010	Phase 5.3.0	300+
• 2011 - 2017	Phase 5.3.2	1000 or so
• 2017	Phase 6	1000s per year

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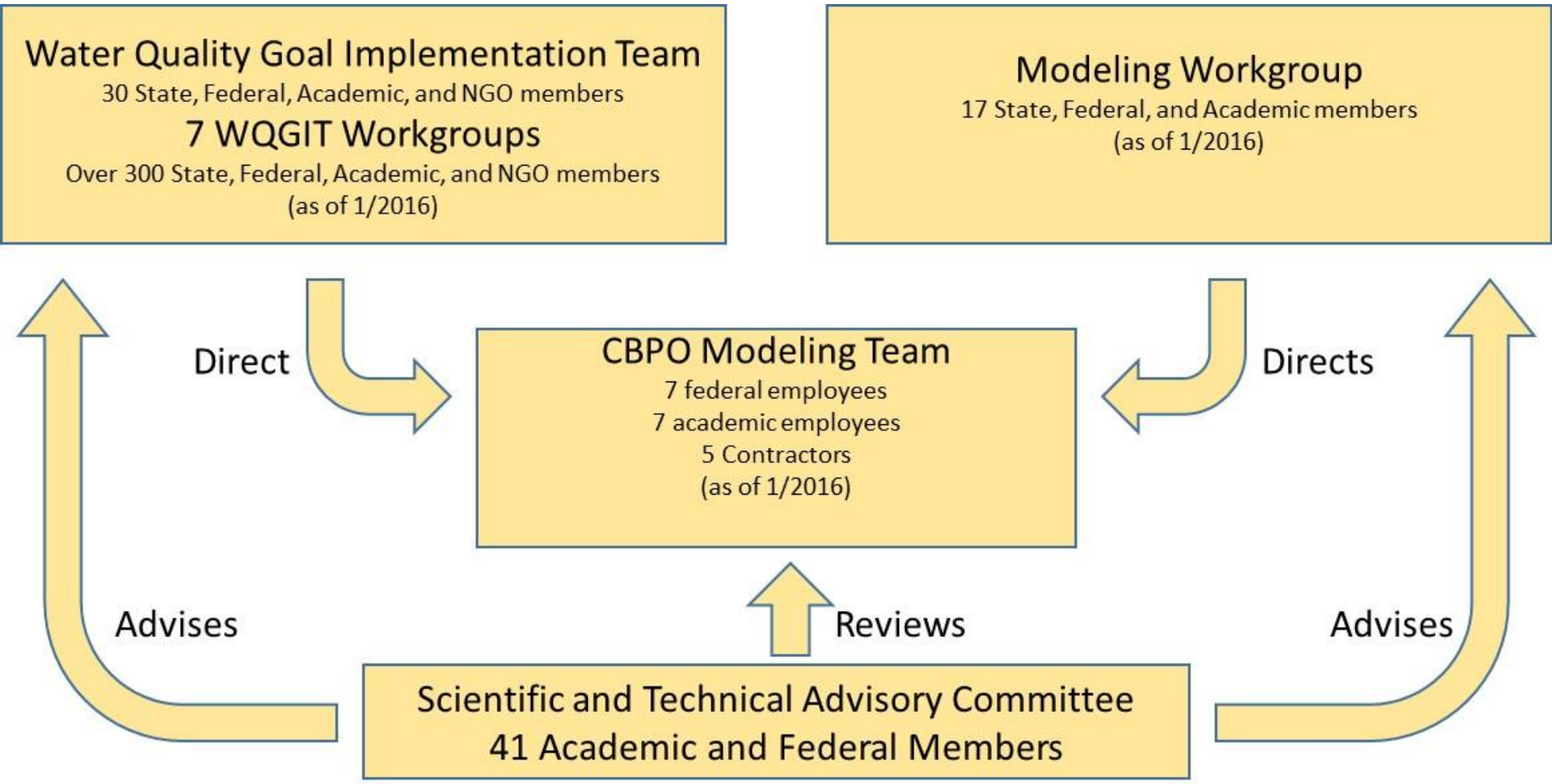
Participatory Modeling



Goal – Stakeholder understanding

- Understandable model
- Inclusive process
- Better and more local input data
- More monitoring data

Phase 6 Model Structure

Average Load + ΔInputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

*

River Delivery

Direct Loads

Phase 6

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Keep It Simple

Include Everything

Average Load + ΔInputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

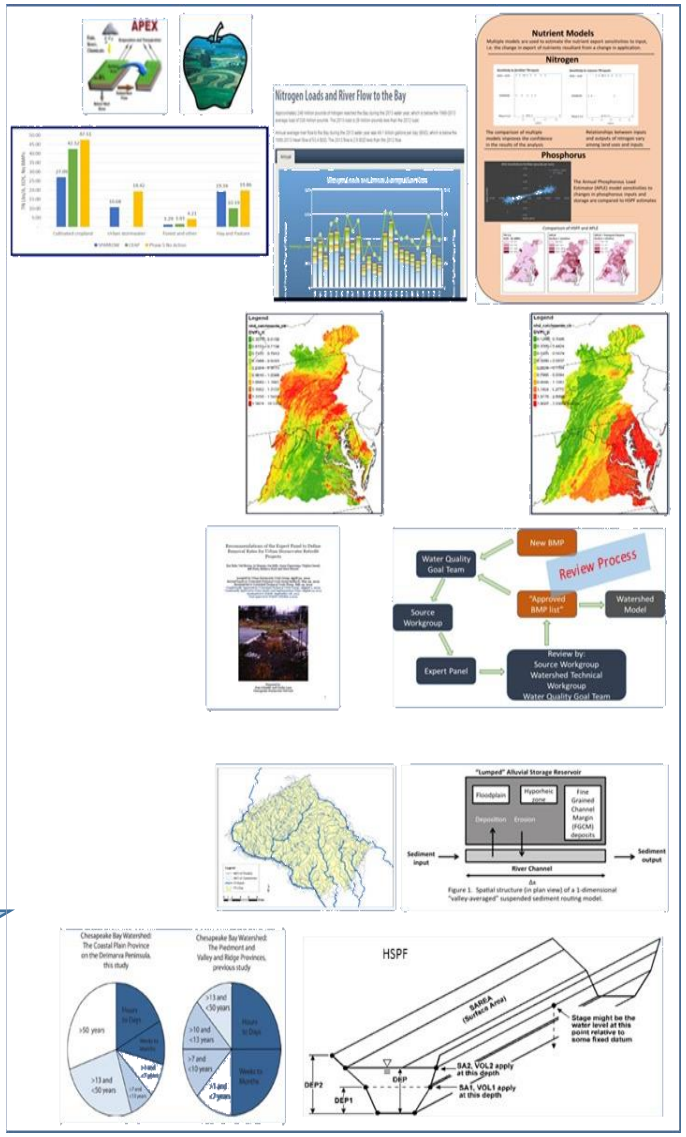
*

Stream Delivery

*

River Delivery

Direct Loads



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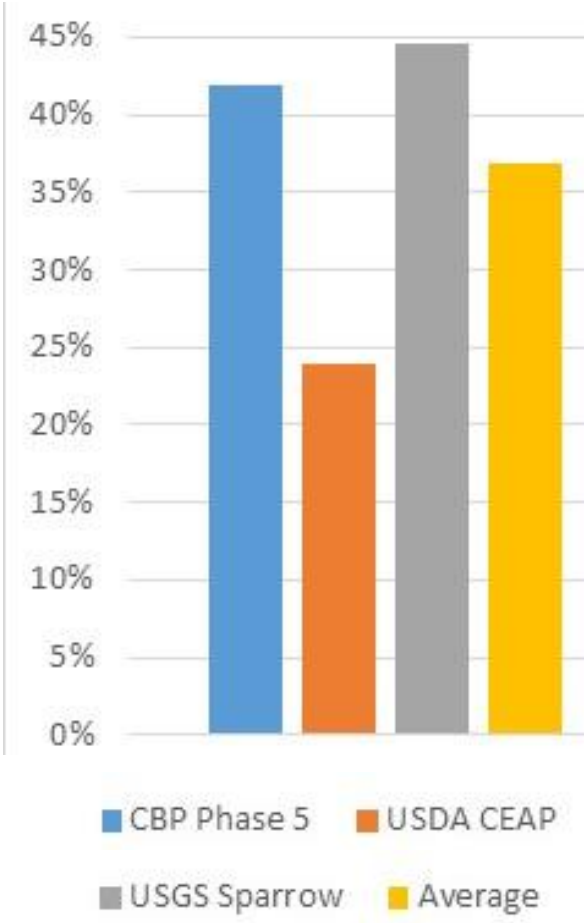
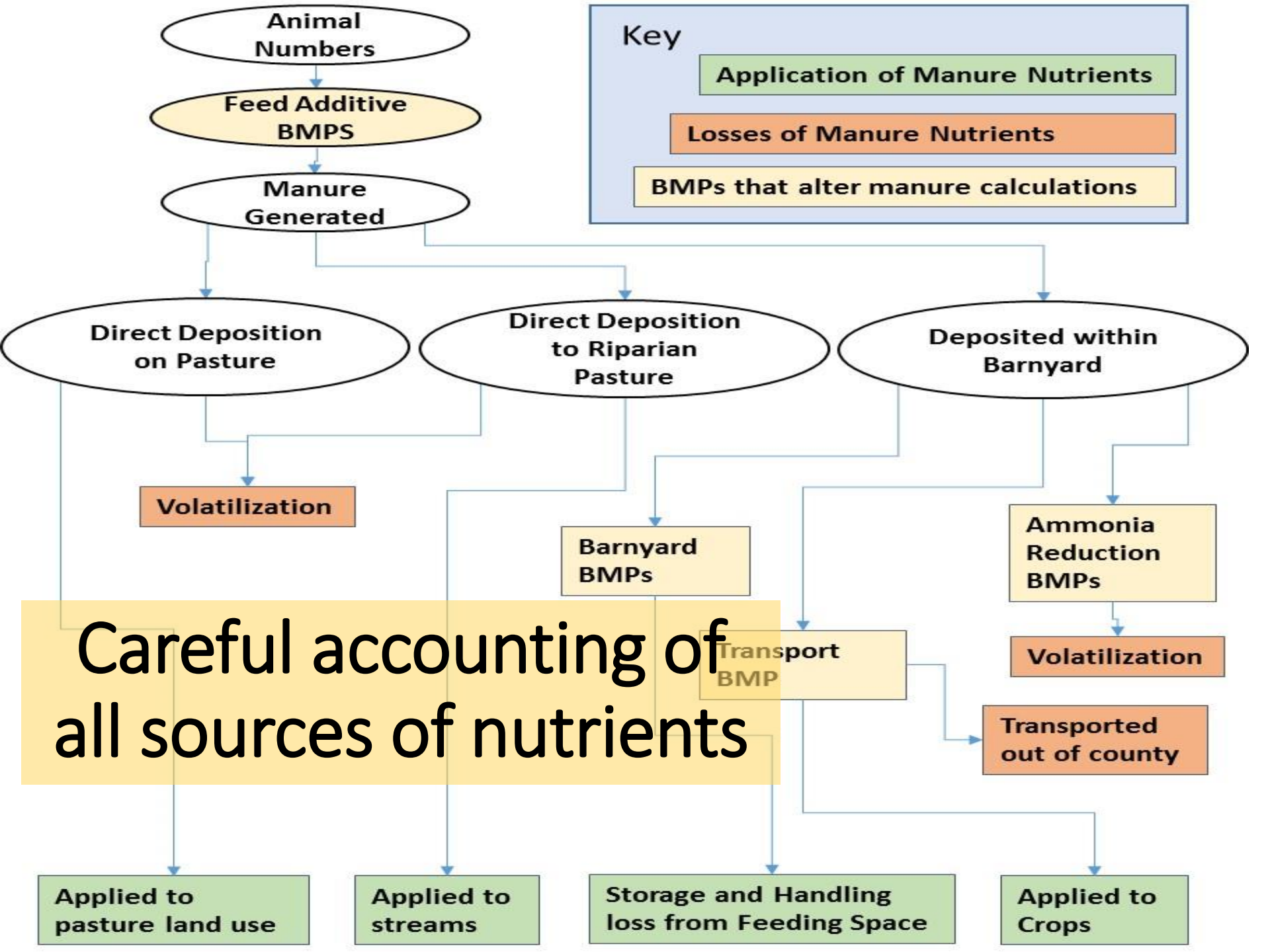
Gathering Knowledge from Multiple Sources

Pasture Nitrogen load compared to Crop

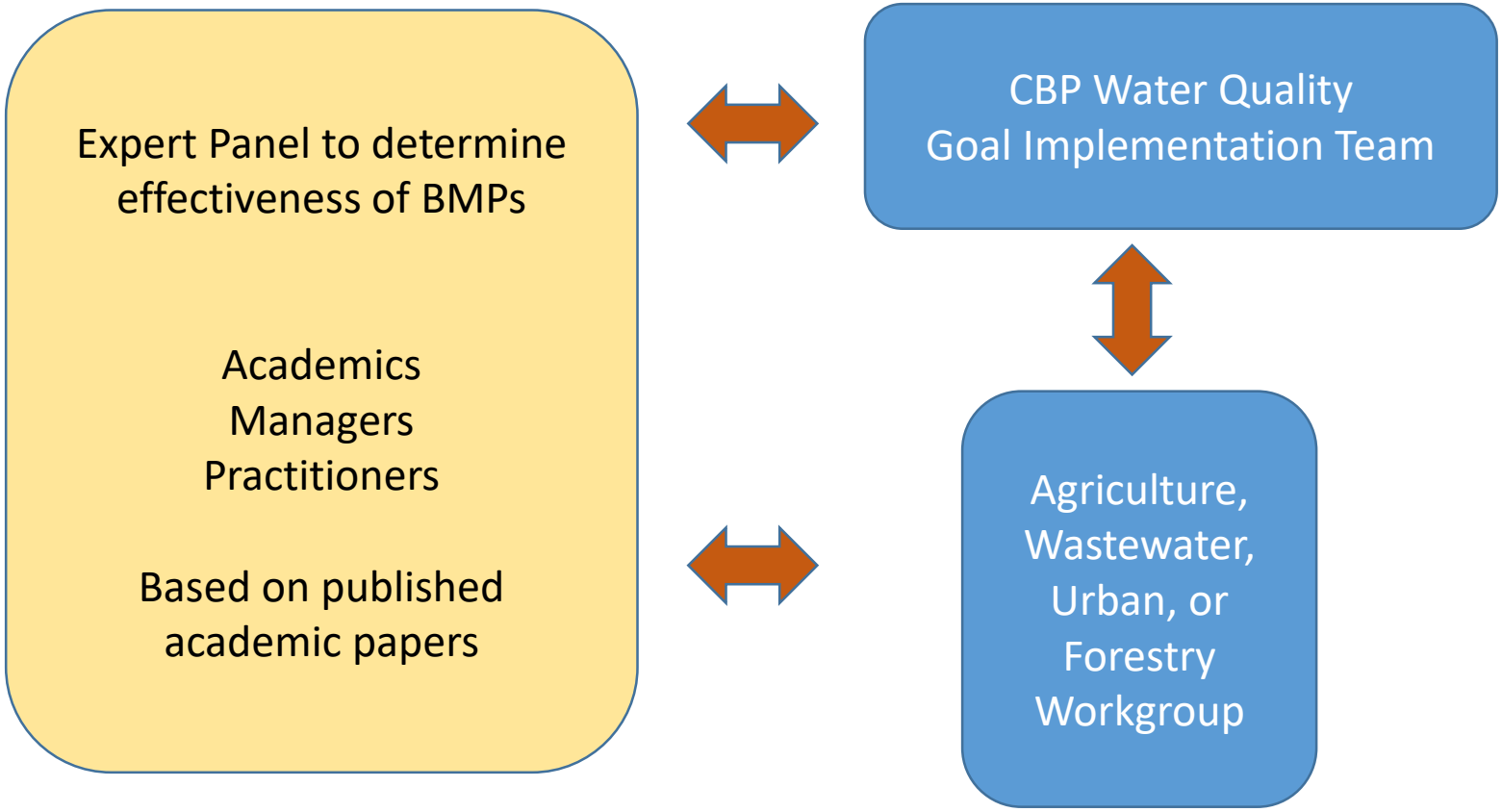


- Followed the advice of the CBP's Scientific and Technical Advisory Committee
- Averaged information from Multiple sources
  - USDA
  - USGS
  - CBP

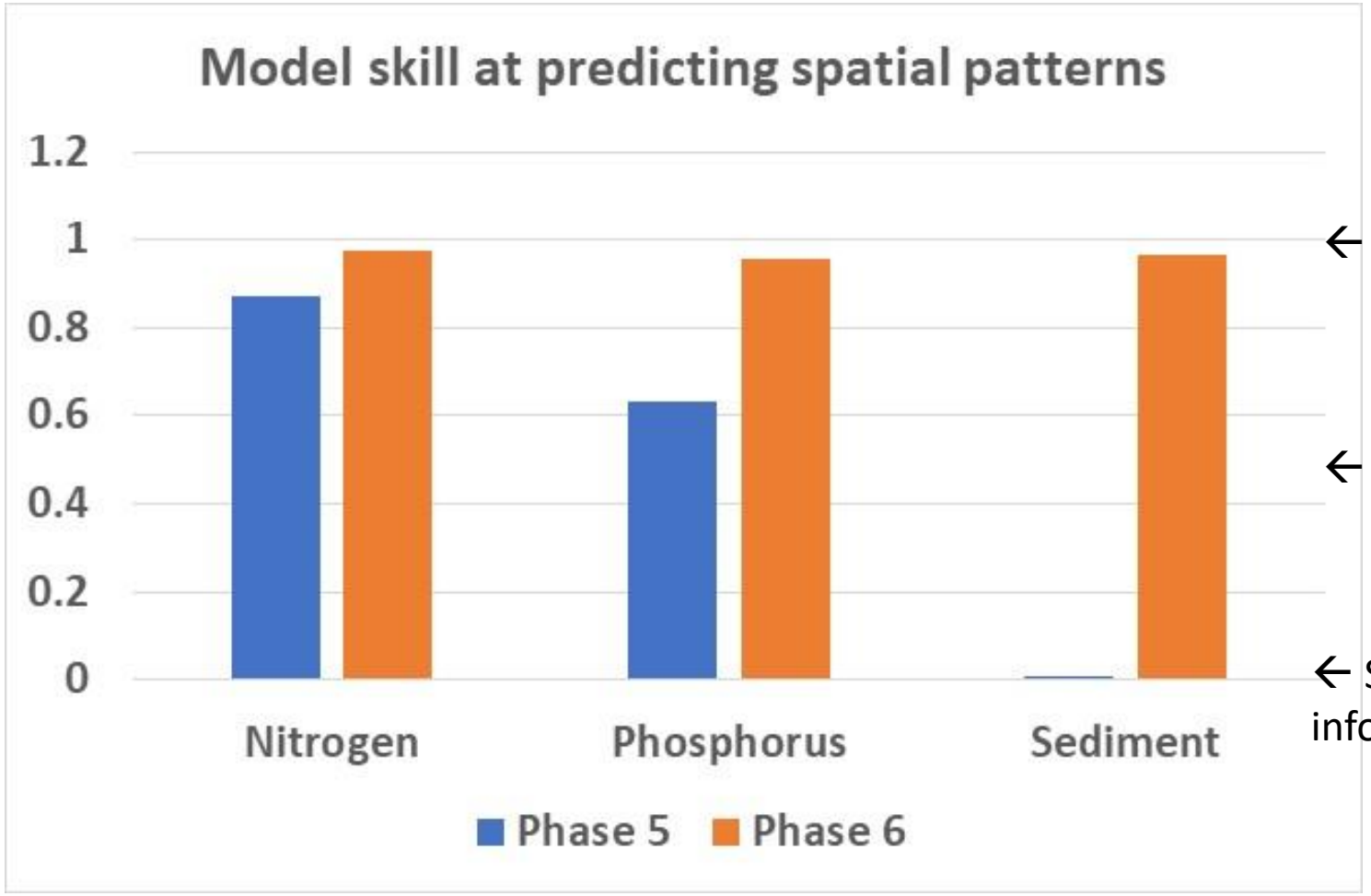

Animal Numbers
Feed Additive BMPS
Manure Generated
Key
Application of Manure Nutrients
Losses of Manure Nutrients
BMPs that alter manure calculations
Direct Deposition on Pasture
Direct Deposition to Riparian Pasture
Deposited within Barnyard
Volatilization
Barnyard BMPs
Ammonia Reduction BMPs
Transport BMP
Volatilization
Transported out of county
Careful accounting of all sources of nutrients
Applied to pasture land use
Applied to streams
Storage and Handling loss from Feeding Space
Applied to Crops

Chesapeake Bay Program
A Watershed Partnership

Collaborative Stakeholder Processes to Determine BMP Effectiveness



How did it work?



← perfect

← Pretty good

← Still adding information

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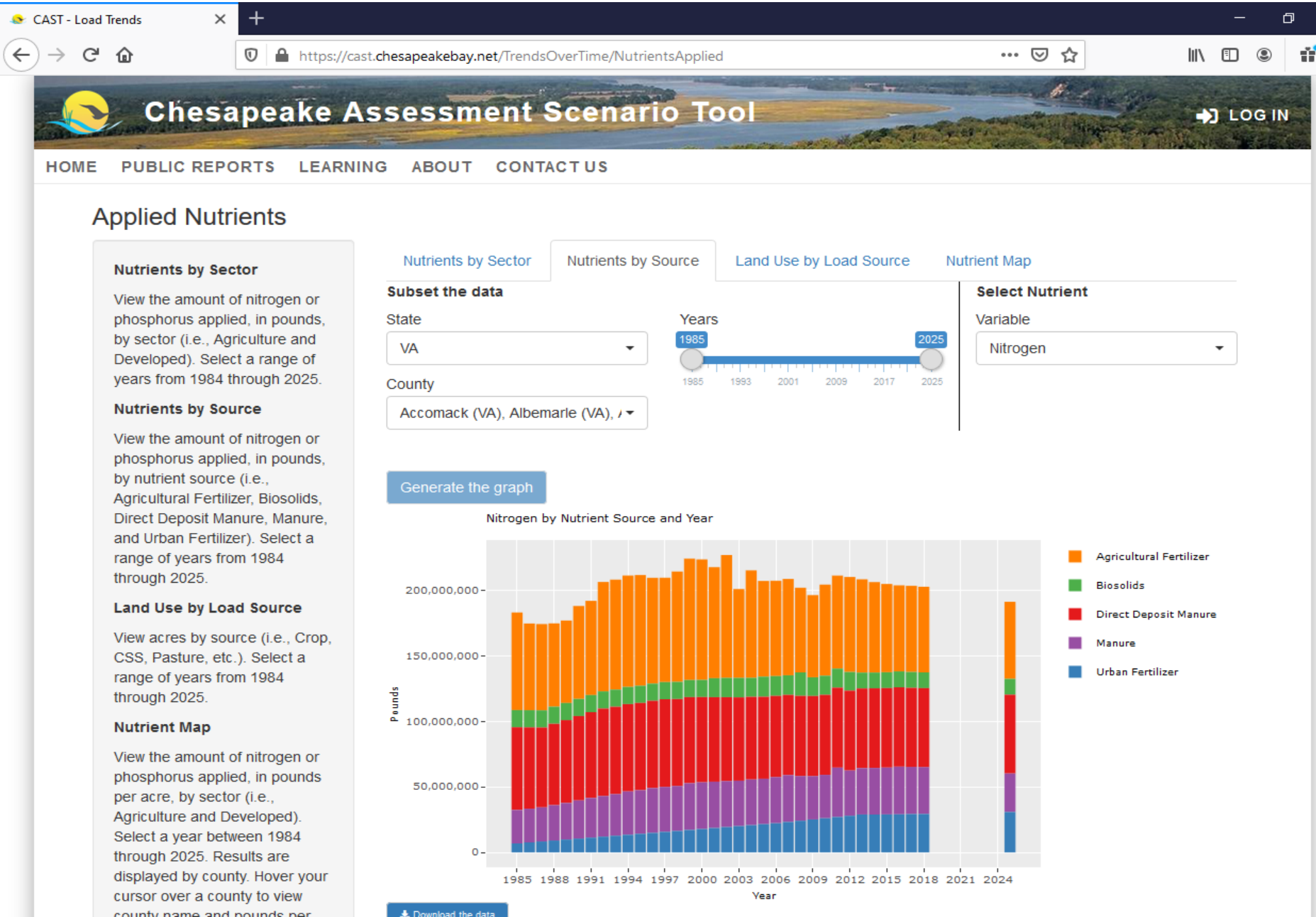
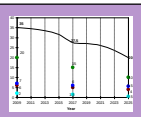
On Line Version -- CAST



Modeling as part of the TMDL accountability framework

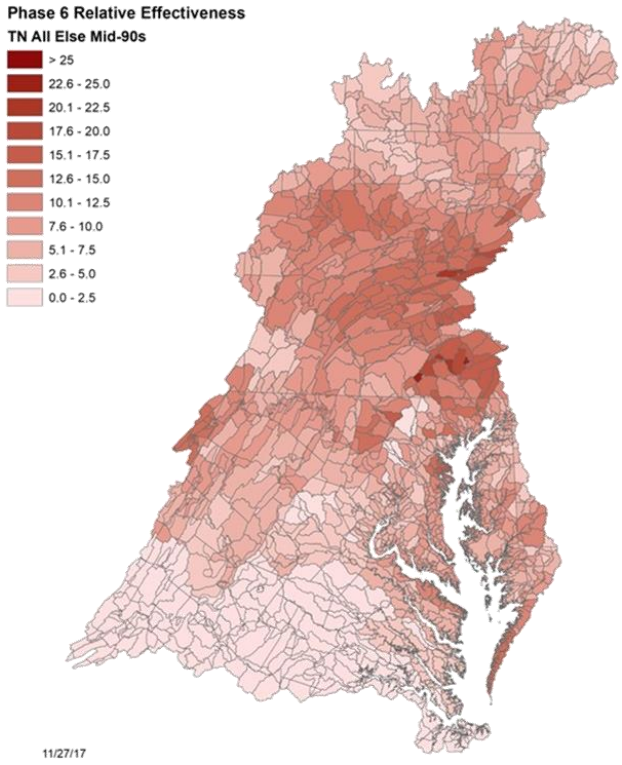
Watershed Implementation Plans identify nutrient and sediment targets that meet water quality standards.

2-Year Milestones with programmatic and pollutant reduction commitments



Annual Progress Runs

Summarizing implementation to date



Strive to include all management changes that represent real changes on the ground

Summary

- We model to explain data, to plan actions, and as a way to combine the effects of different management actions
- The CBP has a long history of modeling
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