Putting it all together: integrating monitoring, modeling, and research to inform management across the Bay watershed

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EPA Chesapeake Bay Program Office
LGAC Meeting
March 21, 2018

Contributions from: Jimmy Webber, Doug Moyer, Joel Blomquist, Jeni Keisman, John Wolf, Rebecca Murphy, Matt Johnston, Qian Zhang, Lindsey Gordon & more

A LOT of new and updated info available…

Monitoring & Trends

Nontidal water quality

Tidal water quality

Tidal attainment

Stream & tidal benthic

Submerged aquatic vegetation

Modeling Tools

CBP Watershed Model

Geographic load distribution

Geographic influence on Bay

BMP progress reports

New Research

USGS Non-tidal Syntheses

-Regional Nitrogen, Phosphorus and Sediment

-Groundwater

SAV Syntheses

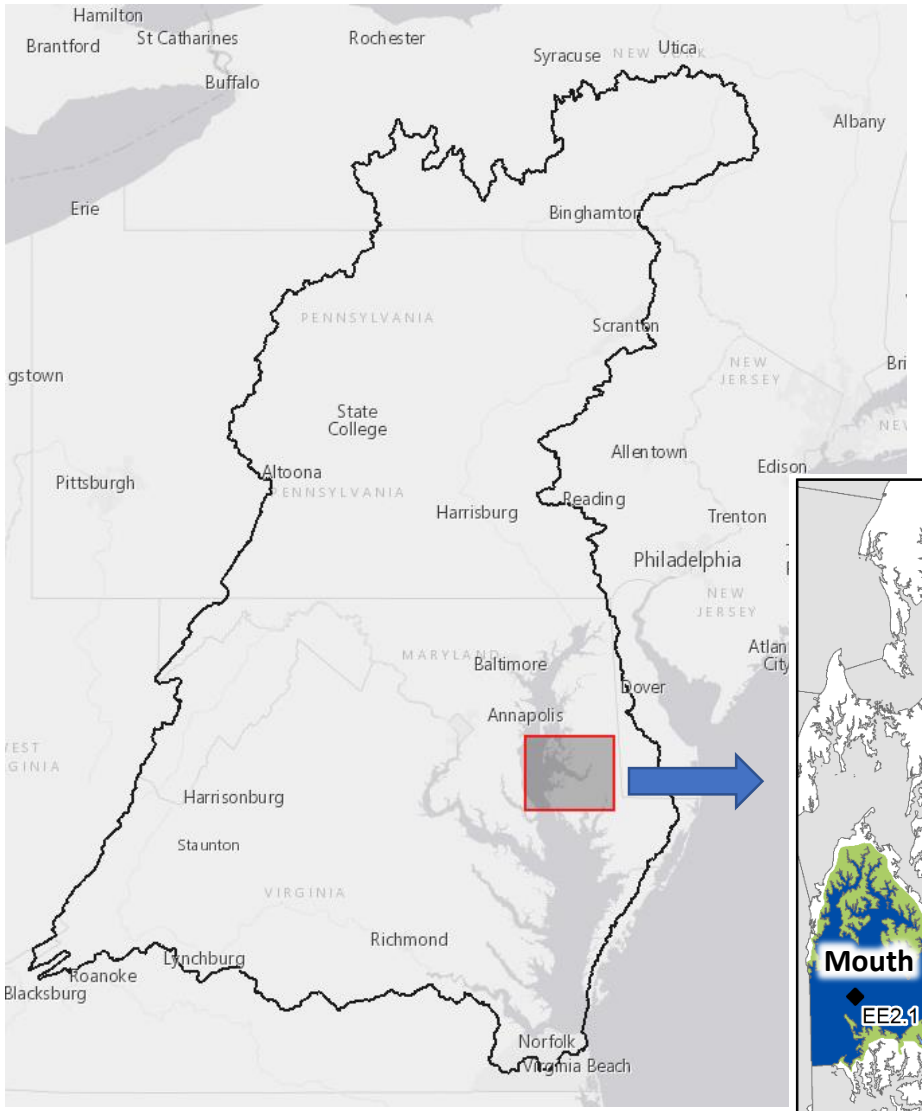
Water Clarity Synthesis

Water Quality Synthesis

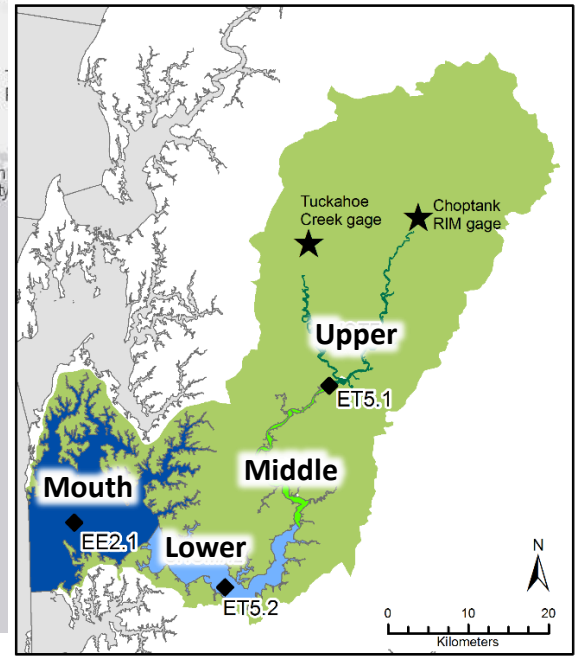
…and more to come

Developing storylines: A Choptank River example

- Storylines were developed to demonstrate to jurisdictions how the information just shown can be integrated and at smaller scales to inform planning efforts
- Received positive feedback on concept of storylines and their utility
- We've been working with jurisdictions and local groups to develop storylines across the watershed (tidal and non-tidal)



Choptank River



Feedback requested from LGAC

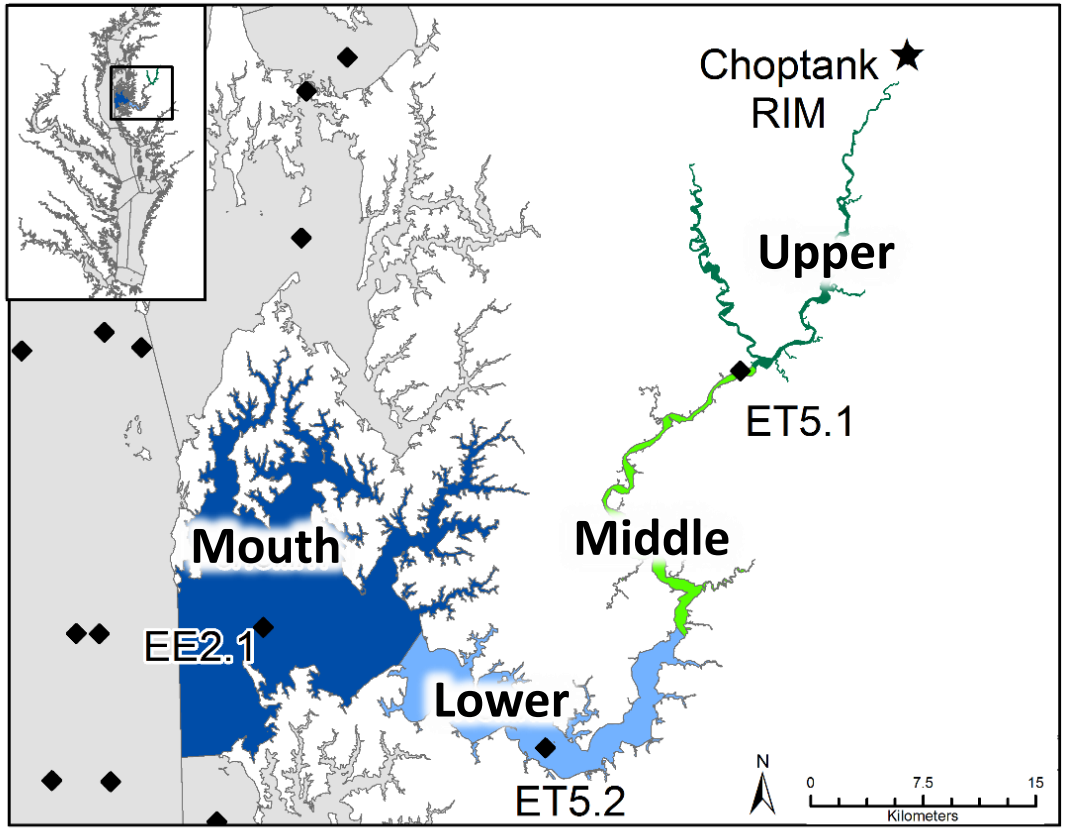
We are working with jurisdictions to use the storyline concept and the compiled information during local engagement and WIP-3 planning efforts

We want to make this relevant to your local planning efforts

- **Does this concept of introducing planning-relevant information through a local story resonate with you?**
- **What information is actually useful for you to see at a local level for planning efforts?**
- **What channels and mechanisms are the best way for jurisdictions to provide this information?**

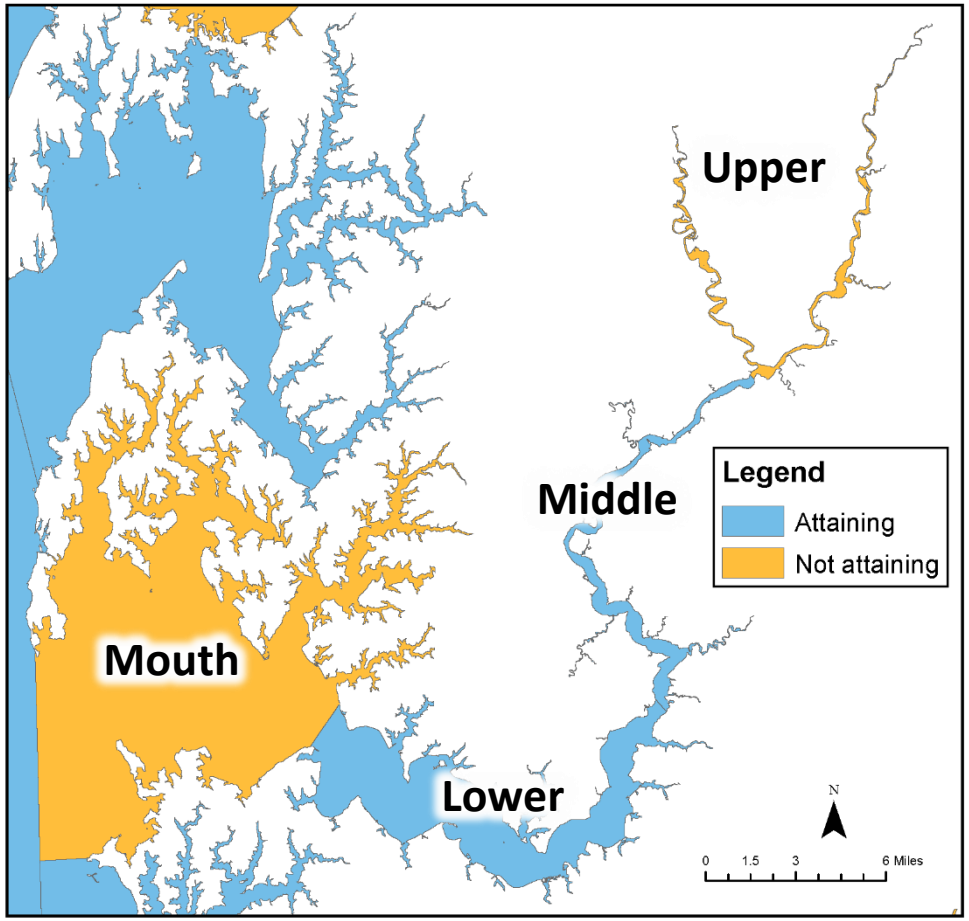
Starting in the tidal waters: water quality standards

Choptank River tidal segments



Map and graph: Rebecca Murphy, UMCES

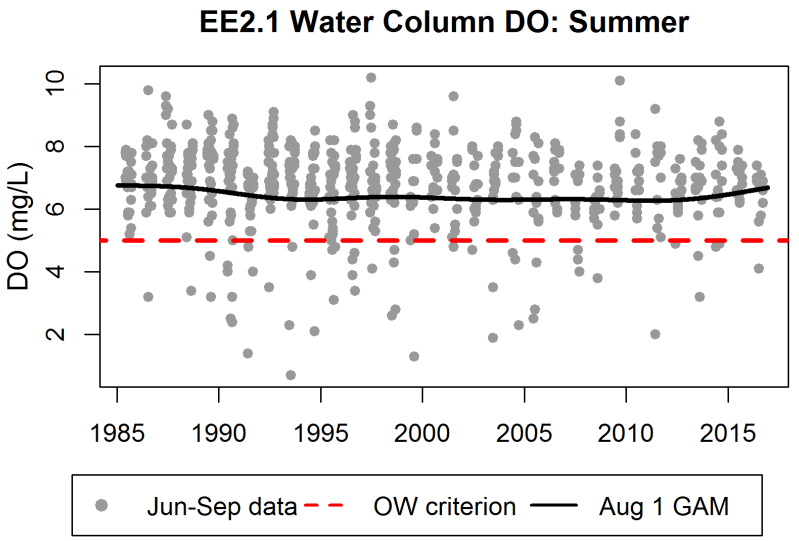
Choptank River attainment of open water dissolved oxygen criterion

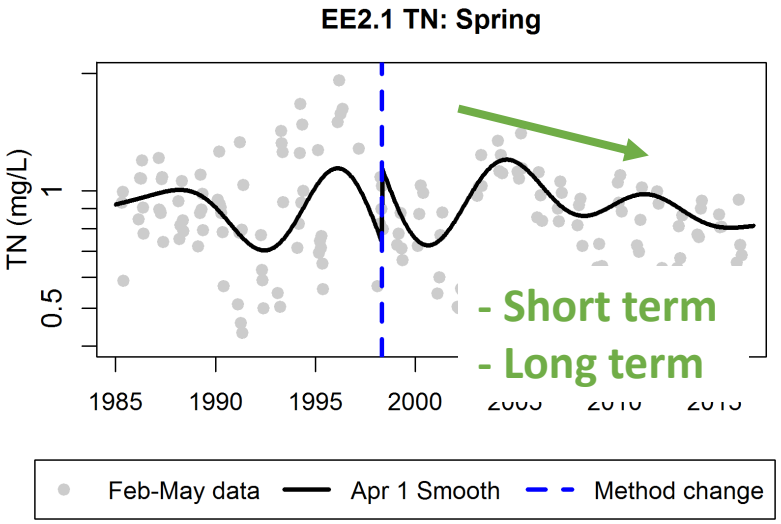


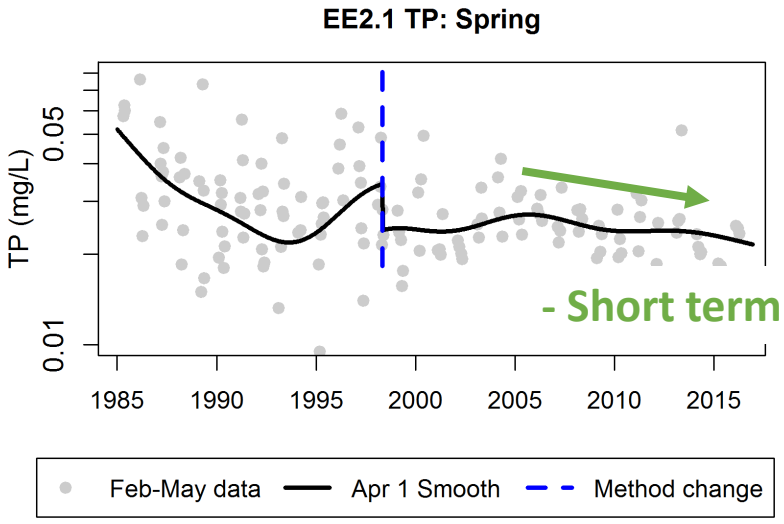
- Portions of the river are not attaining water quality standards
- Sources, drivers, and trends are different along the river

Water quality drivers of attainment

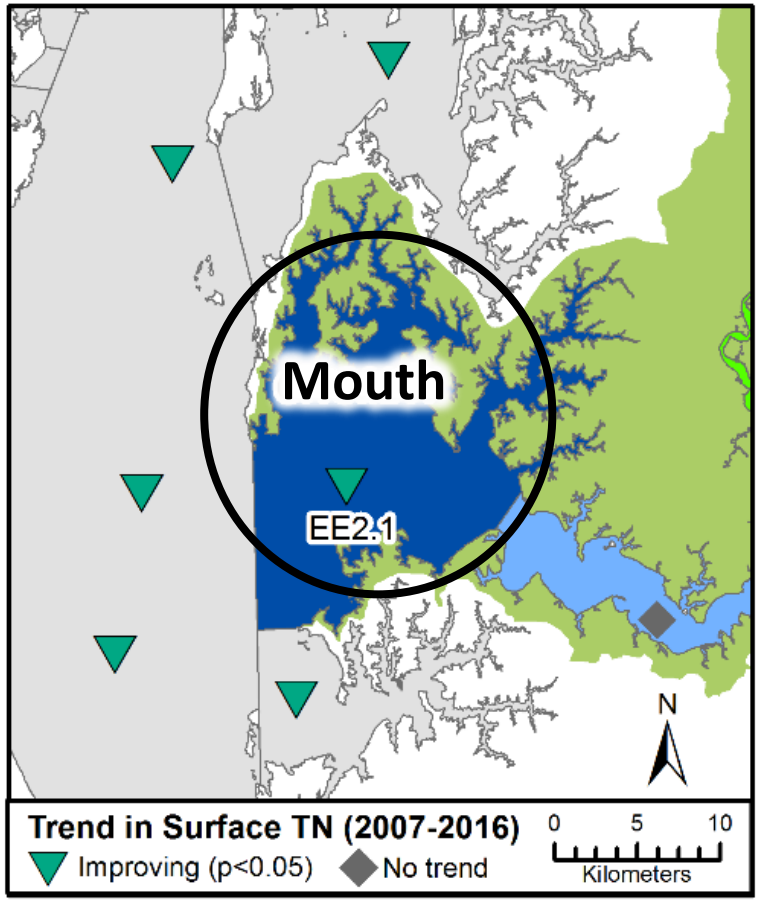
- Mouth of the river already has good dissolved oxygen in the summer and is rarely hypoxic
- Nutrients have been decreasing at and around the mouth







Nitrogen trends 2007-2016

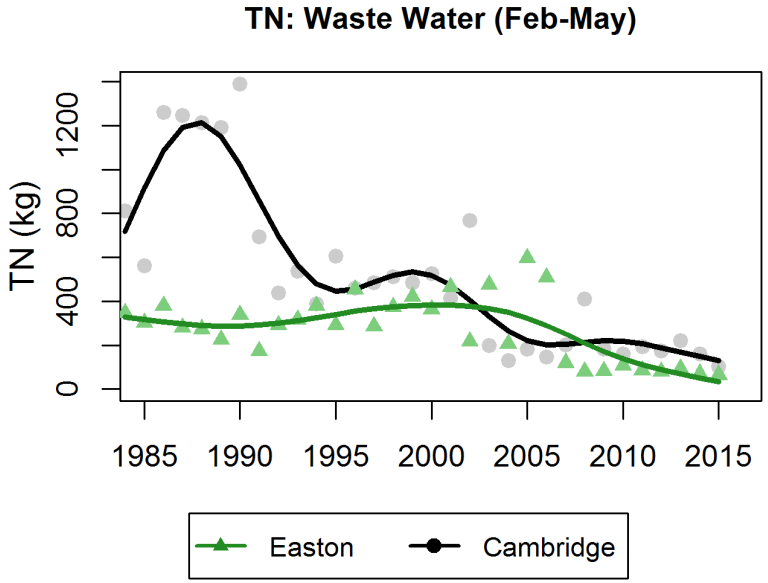


From trends run by Renee Karrh, MDDNR

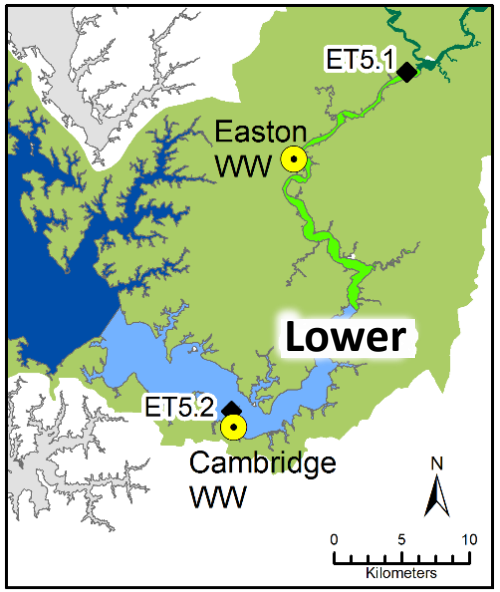
GAMs: Rebecca Murphy, UMCES; Renee Karrh, MDDNR

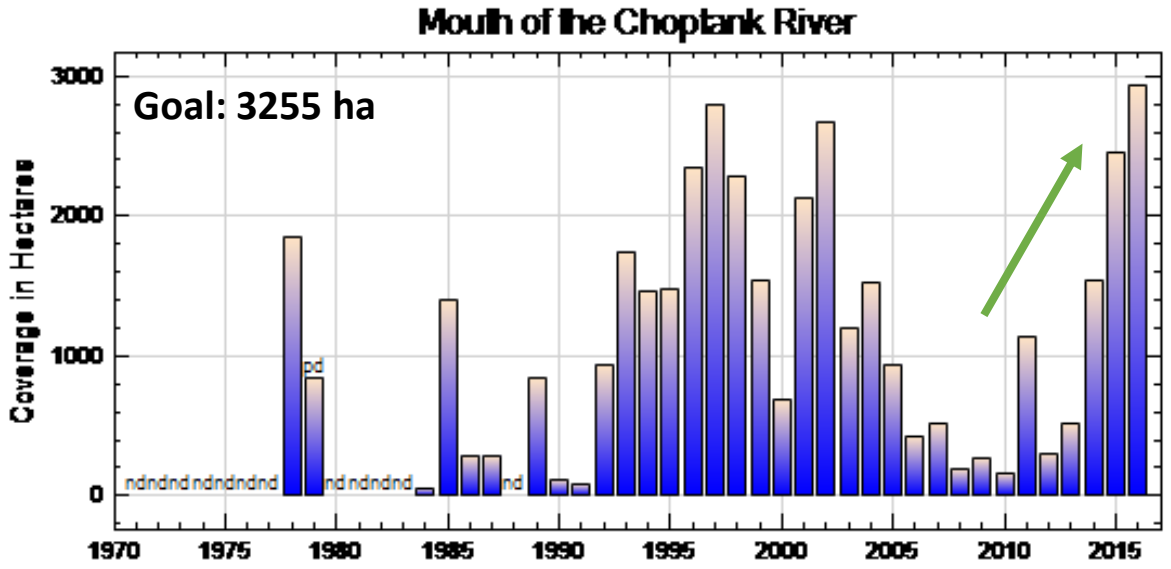
Water quality drivers of attainment

- Wastewater upgrades have contributed to decrease in nutrients
- SAV has shown recovery in recent years



Wastewater treatment plants



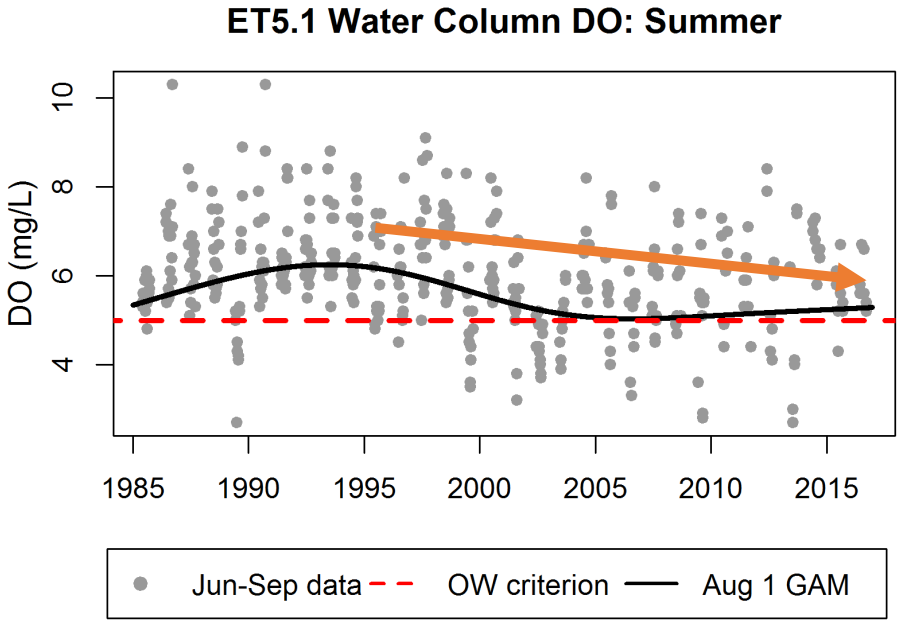


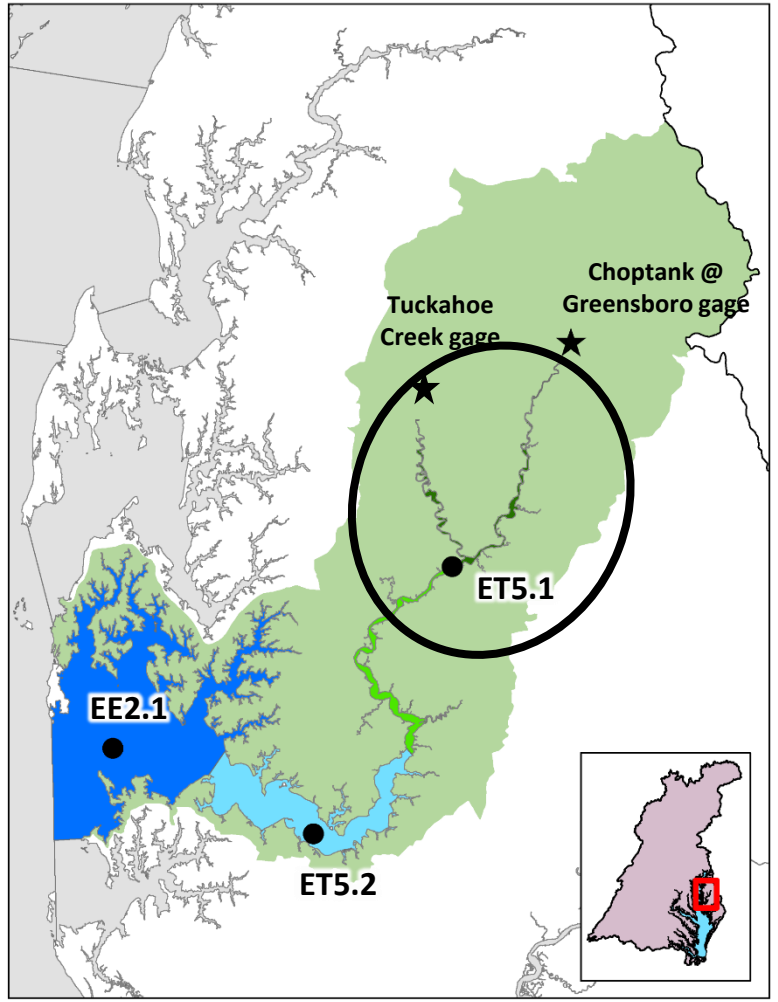
SAV coverage 2016

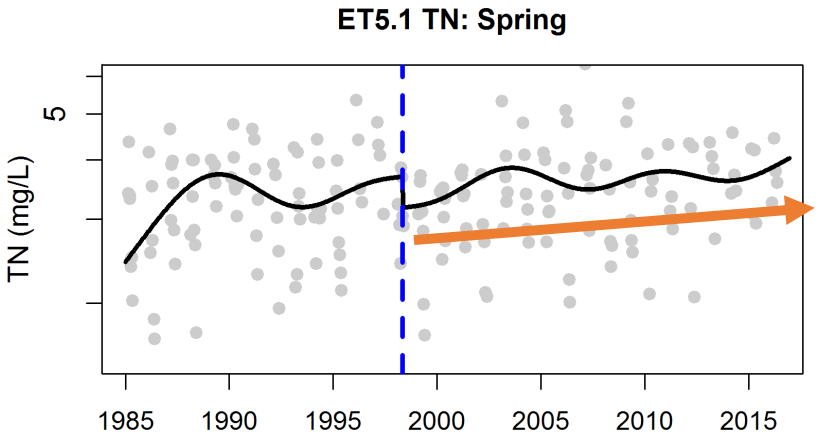
WW: CBP Point Source Database, graph and map by Rebecca Murphy, UMCES; SAV graph: http://web.vims.edu/bio/sav/index.html

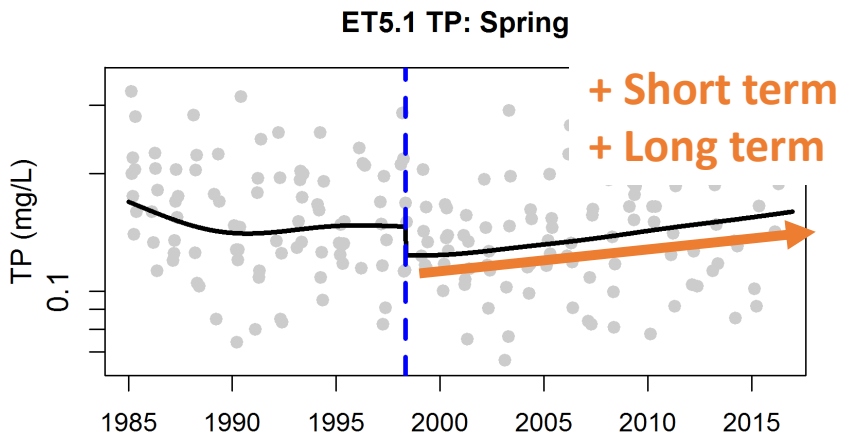
Water quality drivers of attainment

- Upper river has shown long-term decline of summer dissolved oxygen and clarity
- Tidal nutrient concentrations influence dissolved oxygen
- Research has connected decline in water quality to increased nutrients from watershed





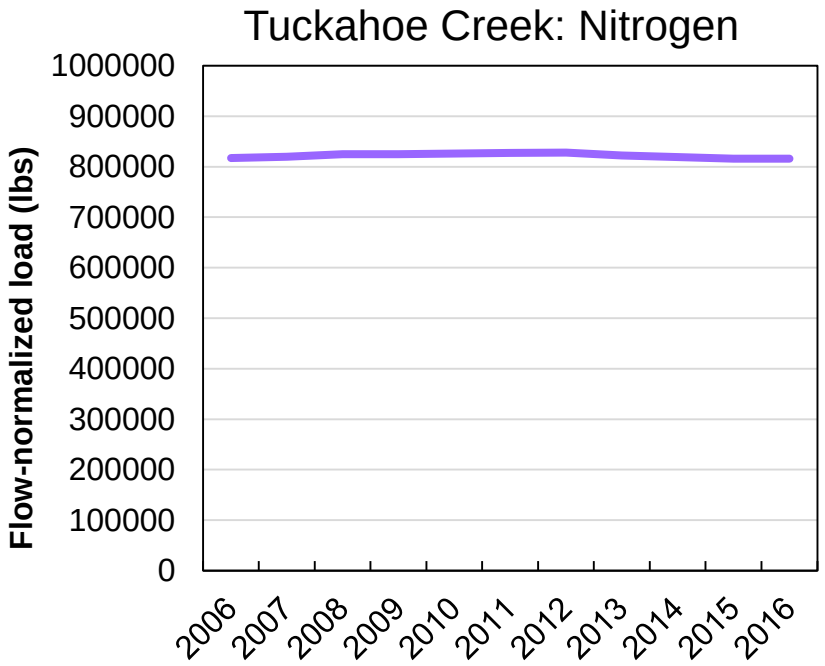


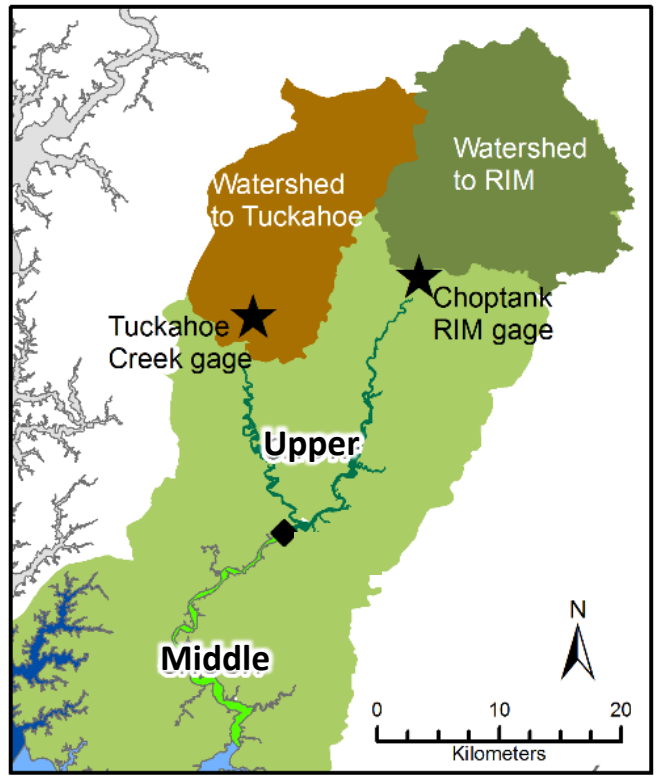


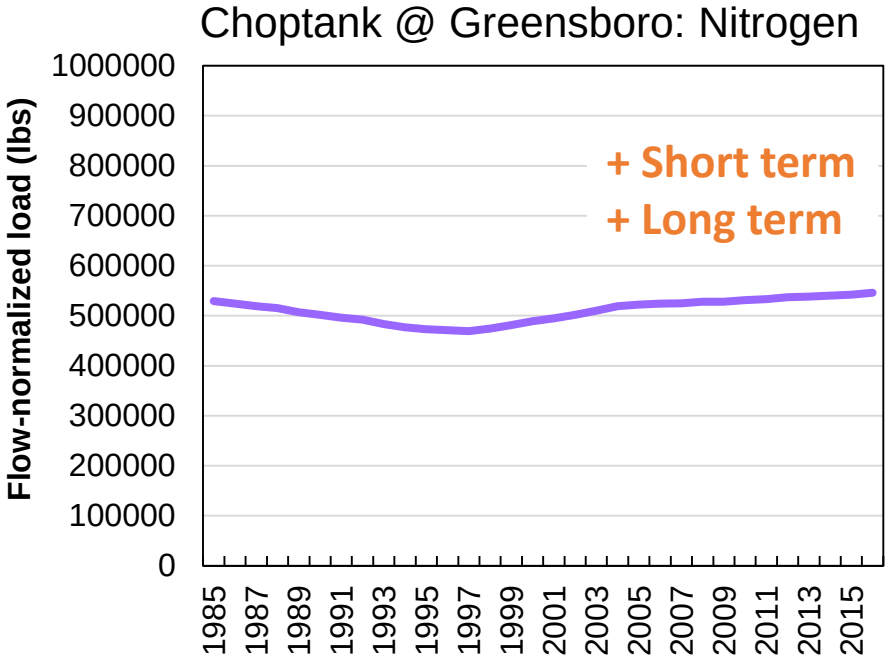
+ Short term
+ Long term

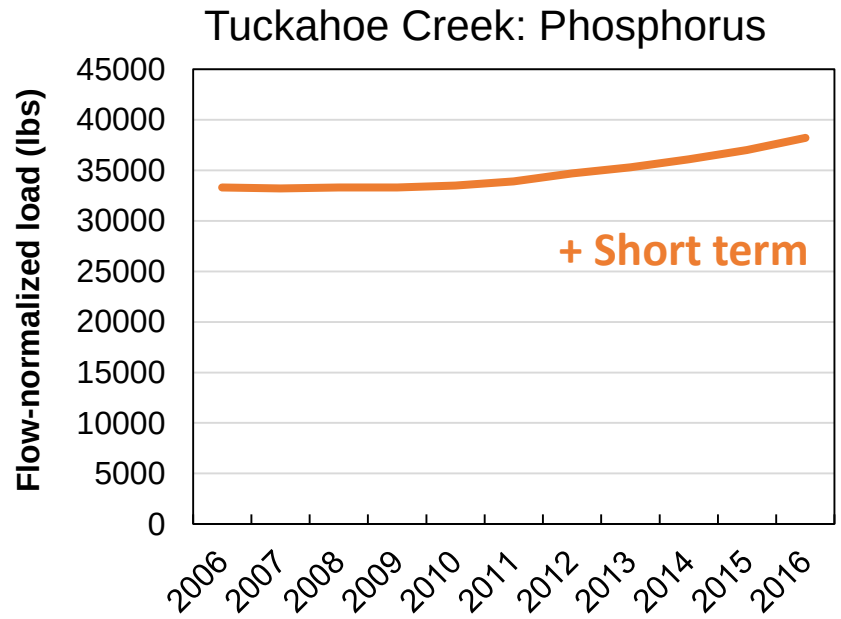
GAMs: Rebecca Murphy, UMCES; Renee Karrh, MDDNR

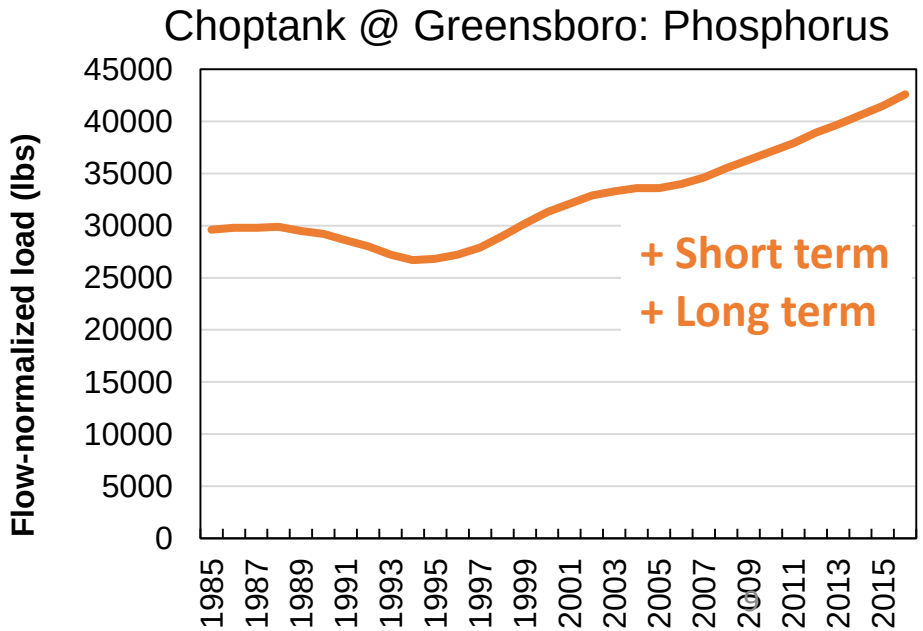
Watershed trends
(flow-normalized)







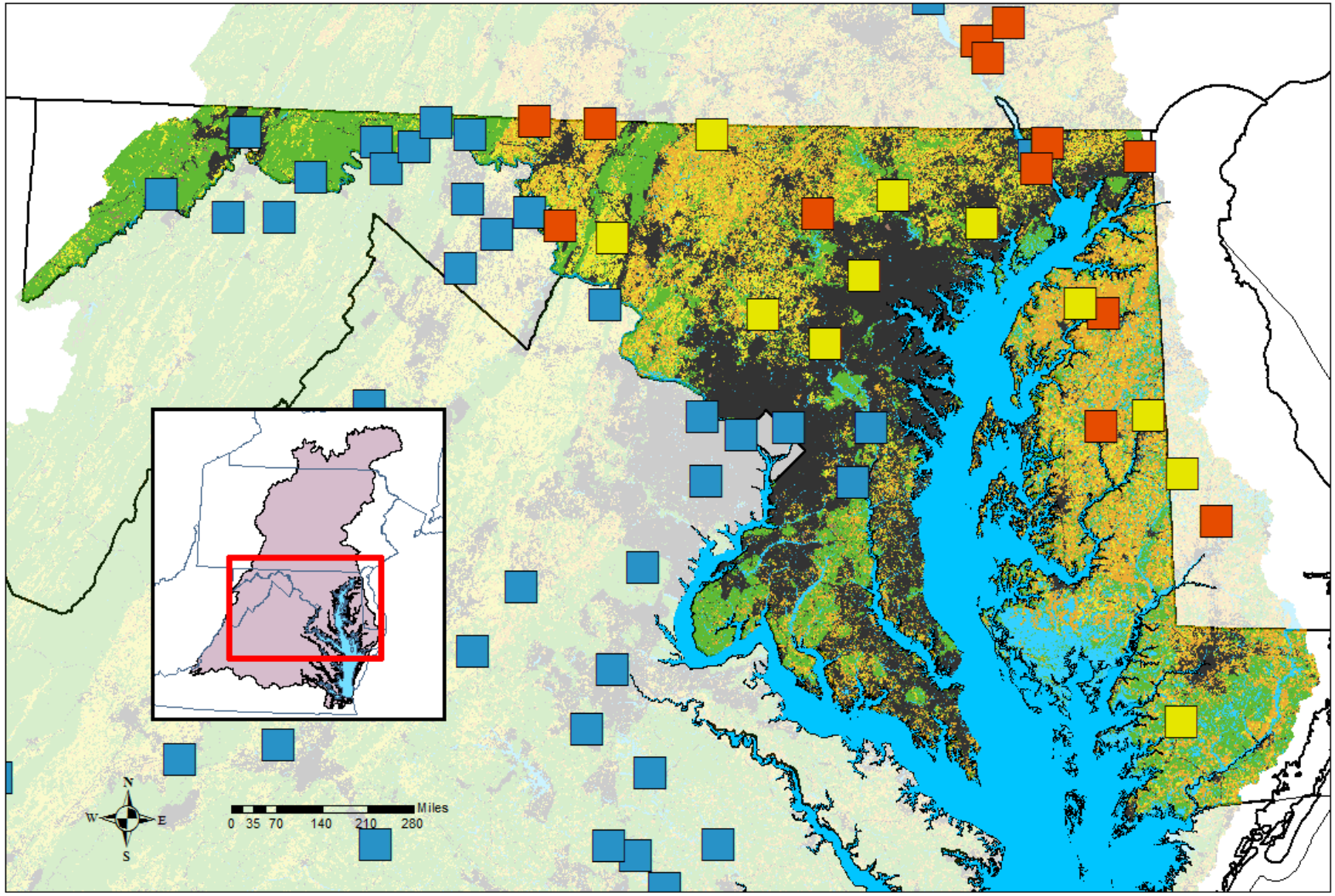




USGS Chesapeake Bay Non-tidal Network:
https://cbrim.er.usgs.gov/

We can’t monitor everywhere under all conditions

Monitored nitrogen in pounds per acre of watershed



Falcone, 2015. USGS. https://cbrim.er.usgs.gov/

Models can fill in gaps in water quality monitoring

Estimated and monitored nitrogen

Water quality monitoring

Nitrogen lbs/acre

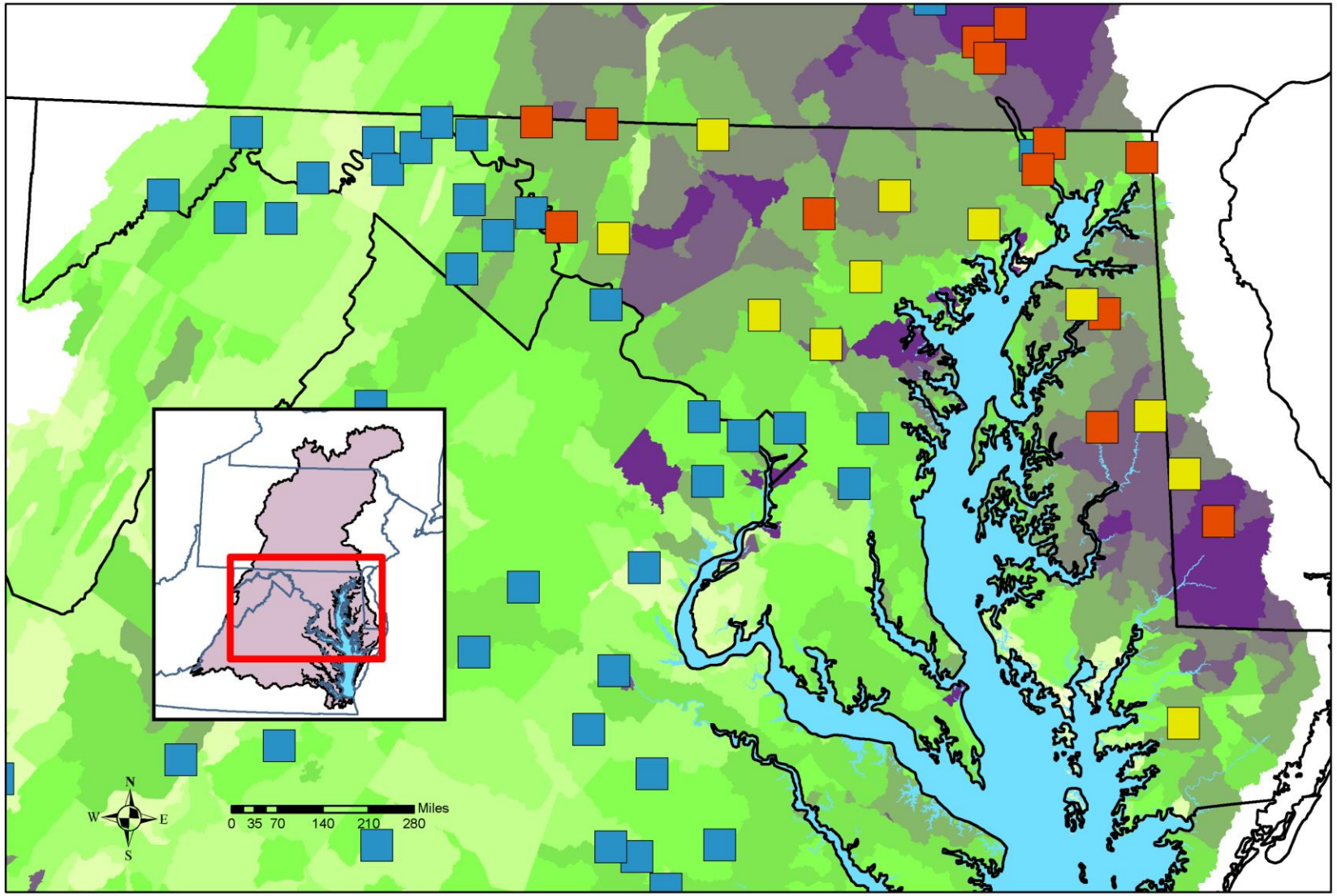
- Low
- Medium
- High

Bay Program Watershed Model

Estimated annual yield to local streams (lbs/acre)

Nitrogen

- < 2
- 2 to 3
- 3 to 4
- 4 to 5
- 5 to 7
- 7 to 10
- 10 to 14
- 14 to 17
- 17 to 22
- >22

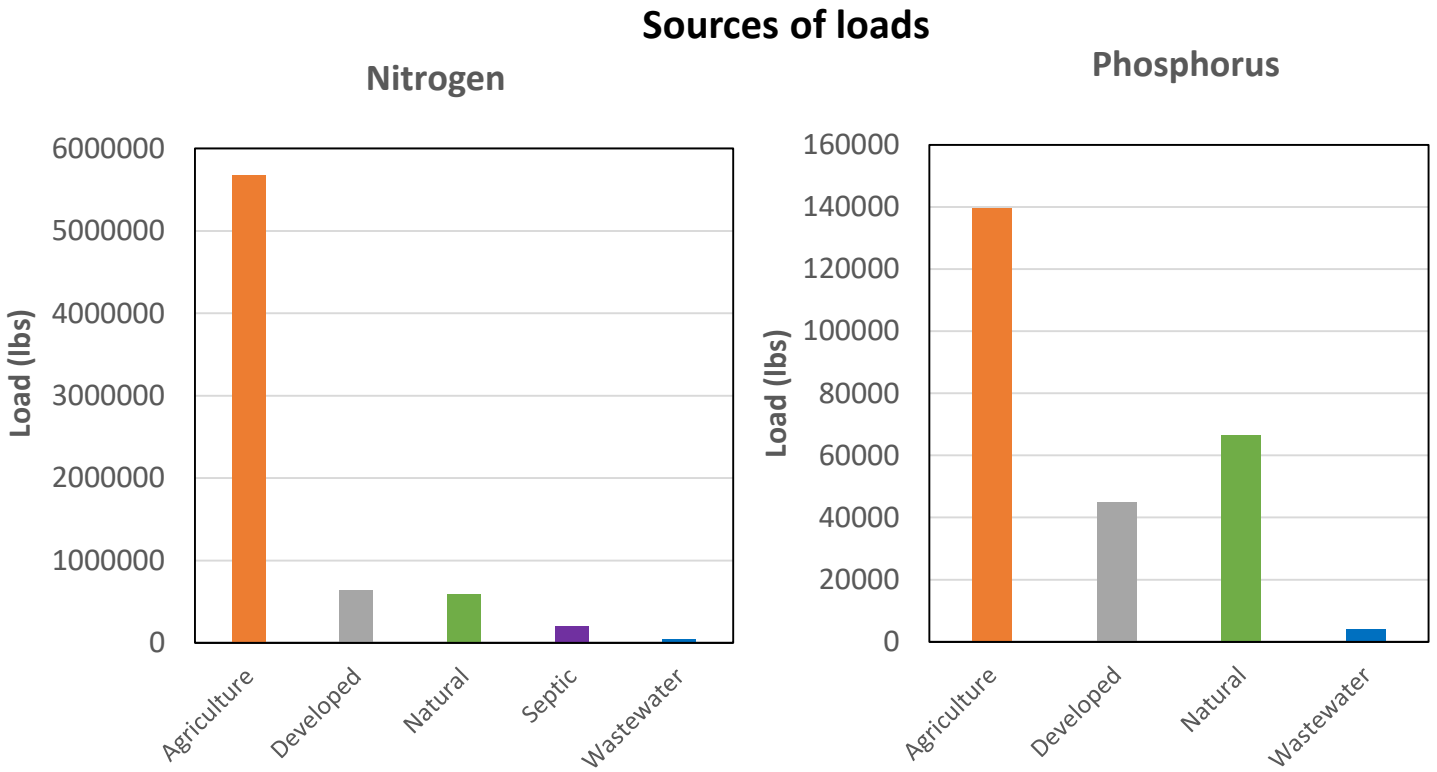


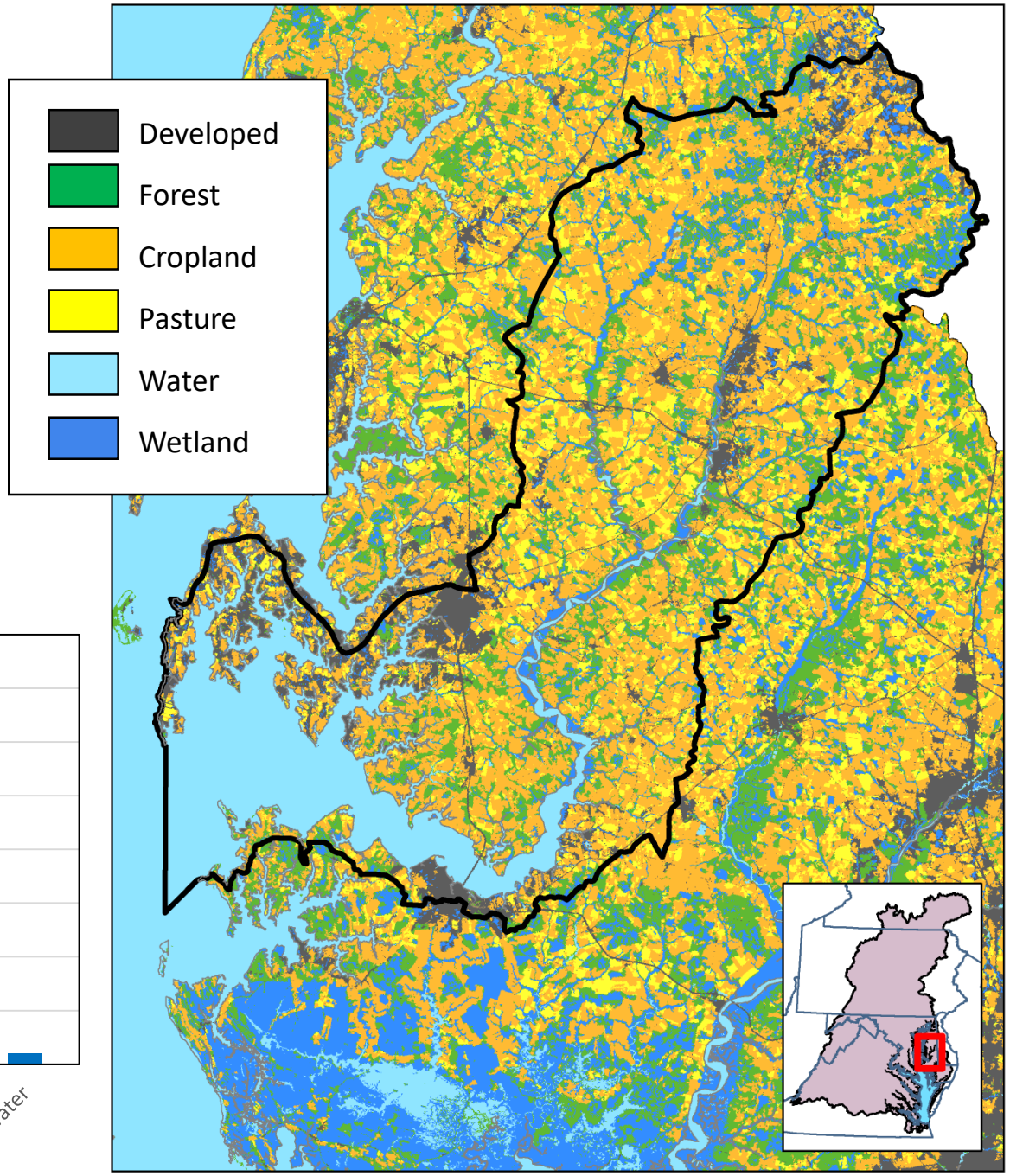
Chesapeake Bay Program Phase 6 Watershed Model. http://cast.chesapeakebay.net

USGS. https://cbrim.er.usgs.gov/

Where do nutrients come from in the watershed?

- Nutrient and sediment loads come primarily from agriculture, specifically cropland
- Different localities can have unique issues



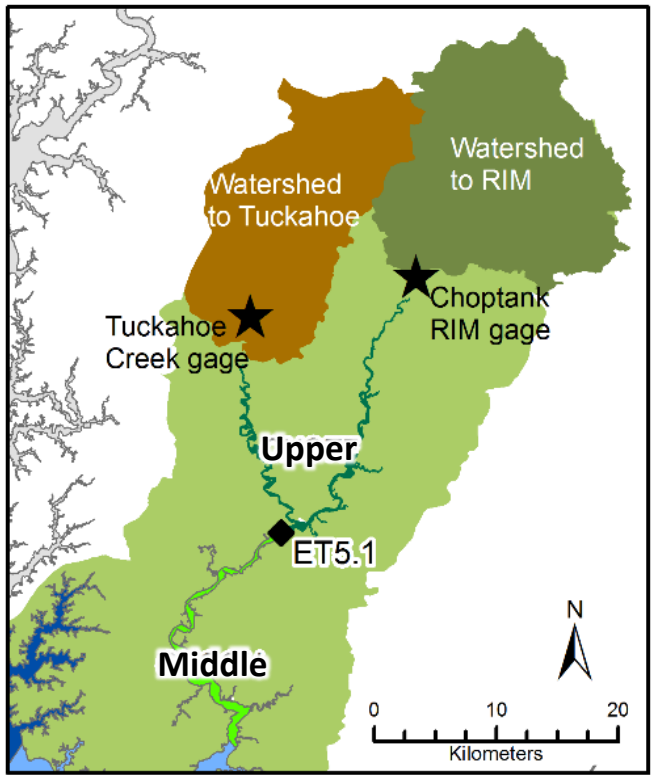


Chesapeake Bay Phase 6 Program Watershed Model. Draft 2016 Progress.

Map data from Falcone, J.A., 2015.

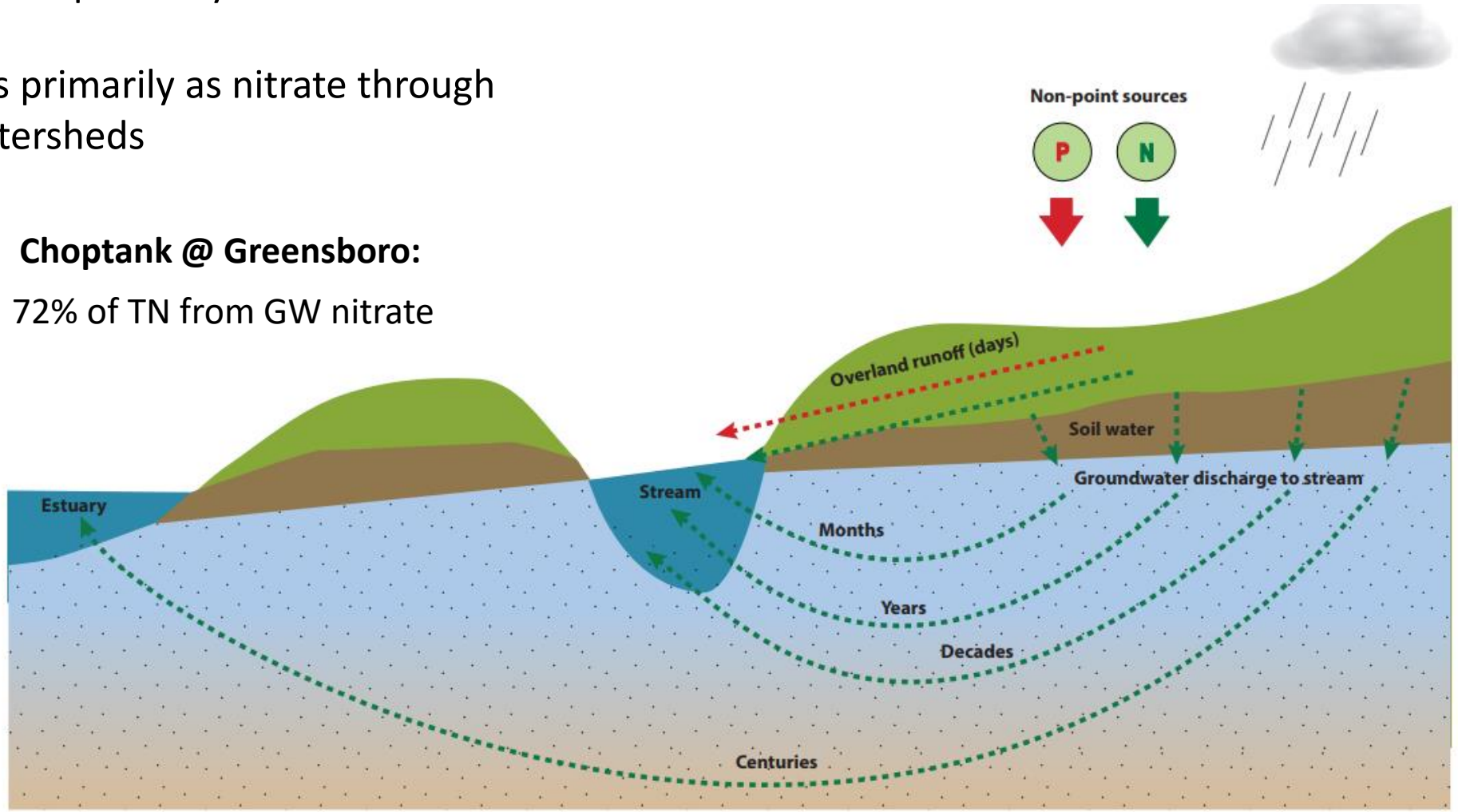
The transport of nutrients matters

- Phosphorus reaches streams primarily from overland runoff during storms
- Nitrogen reaches streams primarily as nitrate through groundwater in some watersheds



Choptank @ Greensboro:

72% of TN from GW nitrate



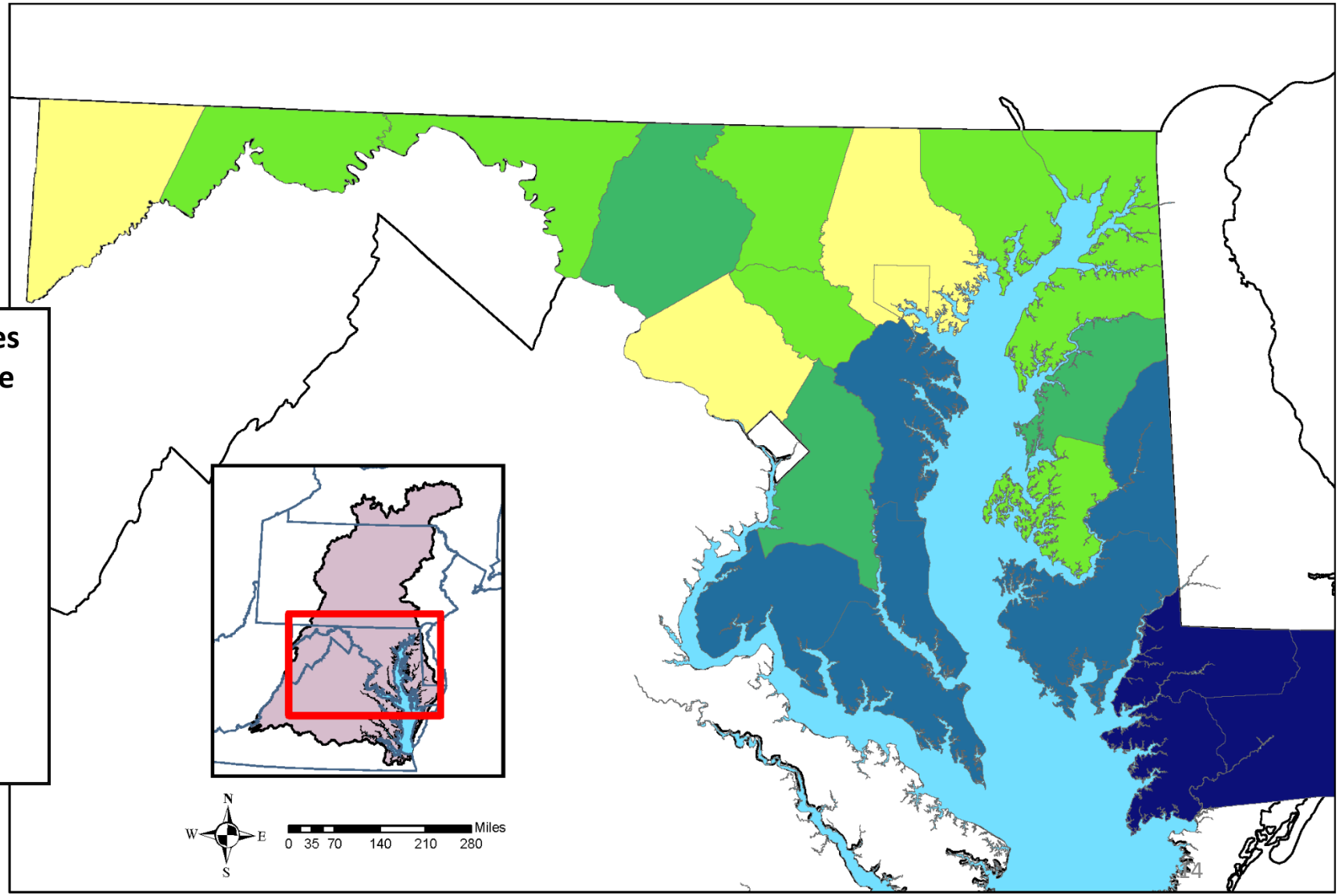
Ator, S.W. & Denver, J.M., 2015.
Bachman, L.J., et al., 1998.

Diagram from Lyerly, A.L. et al., 2014.

Soil phosphorus and water quality are linked

- High soil phosphorus levels can lead to increased loads of phosphorus into streams

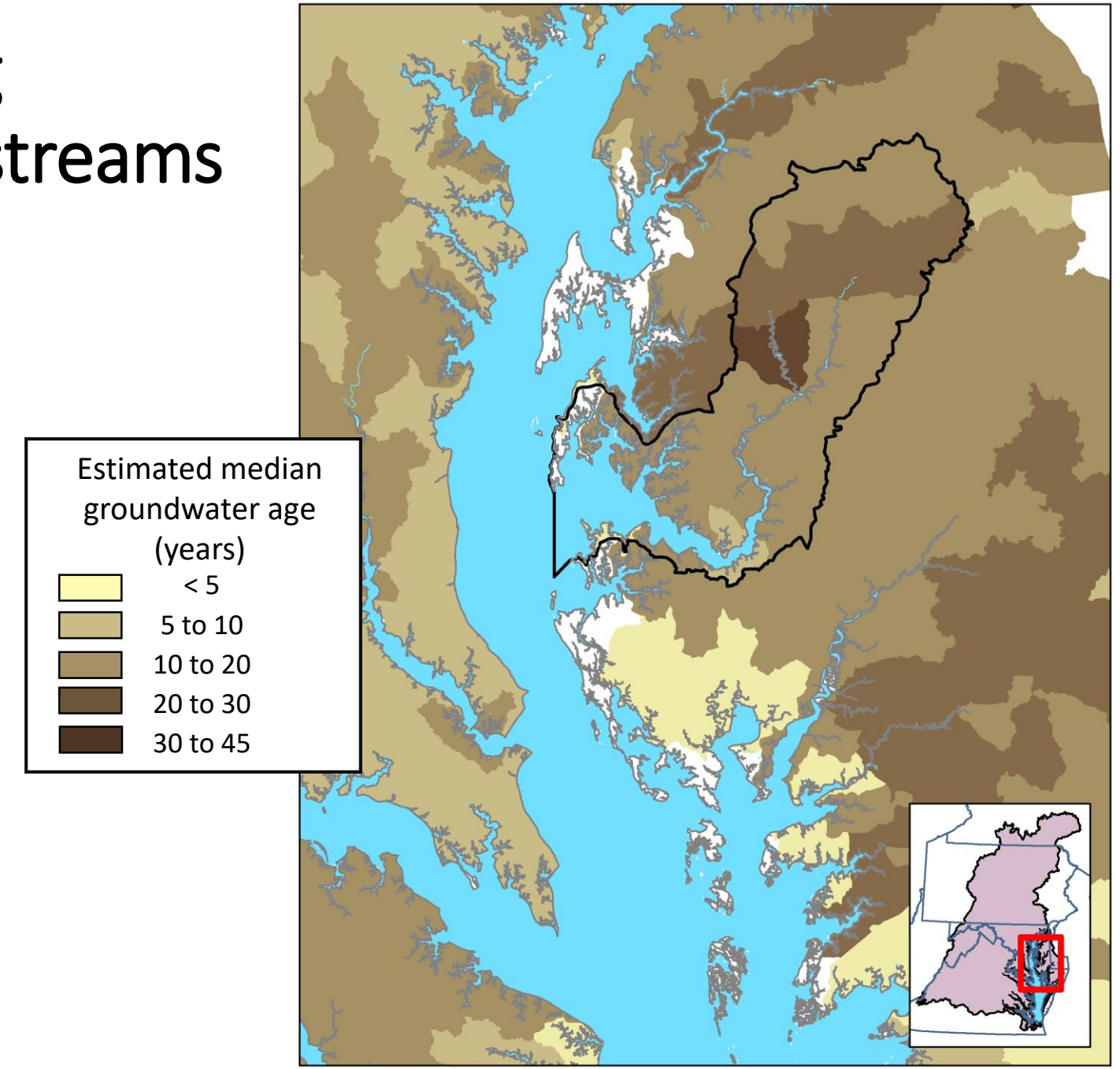
Fertility Index Value of Maryland Counties



Maryland Department of Agriculture
Phosphorus Management Tool

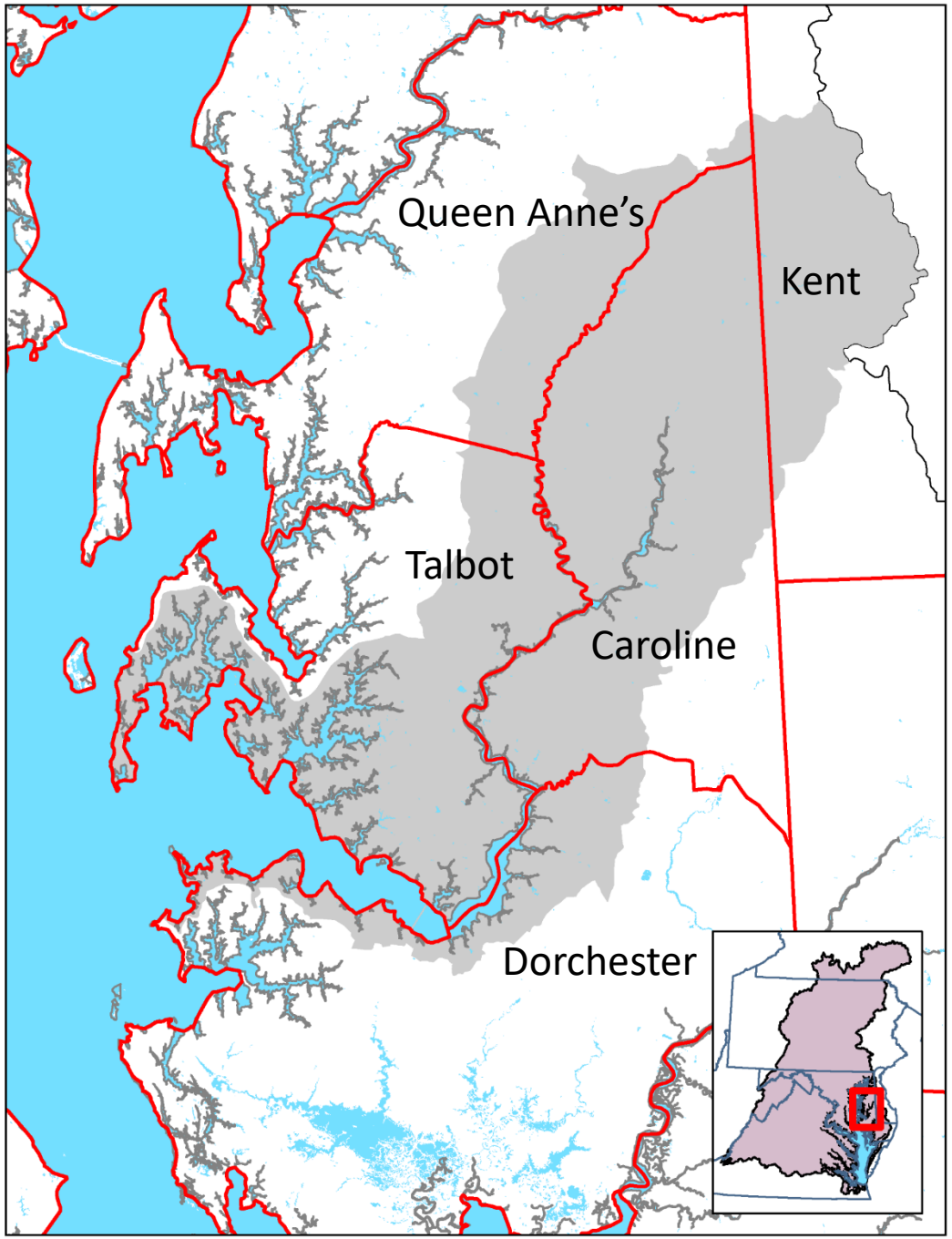
Groundwater takes varying amounts of time to reach streams depending on location

- Nitrate in groundwater represents a range of ages from recent to decades old
- Benefits from management actions will manifest immediately as well as into the future



Phase 6 Watershed Model groundwater age estimates. Data from Ghopal Batt, Chesapeake Bay Program. Map modified from Jimmy Webber, USGS..

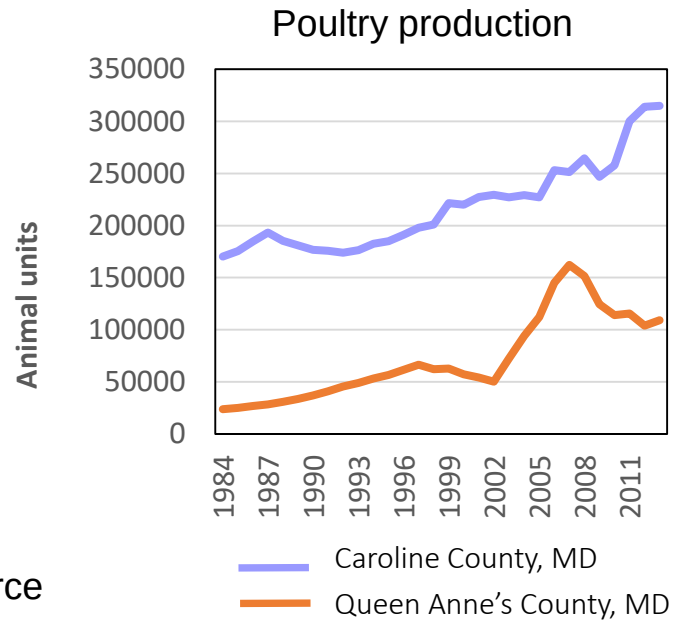
Sources, drivers, and impacts can differ over political boundaries

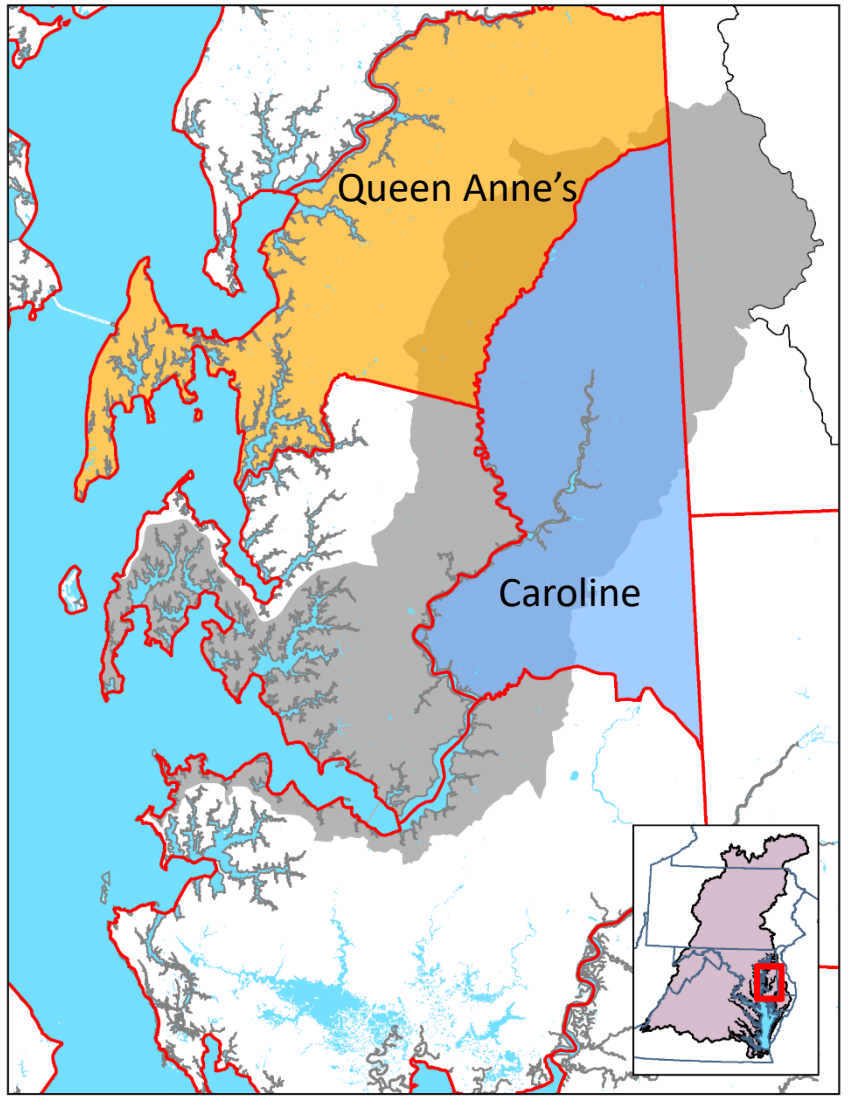


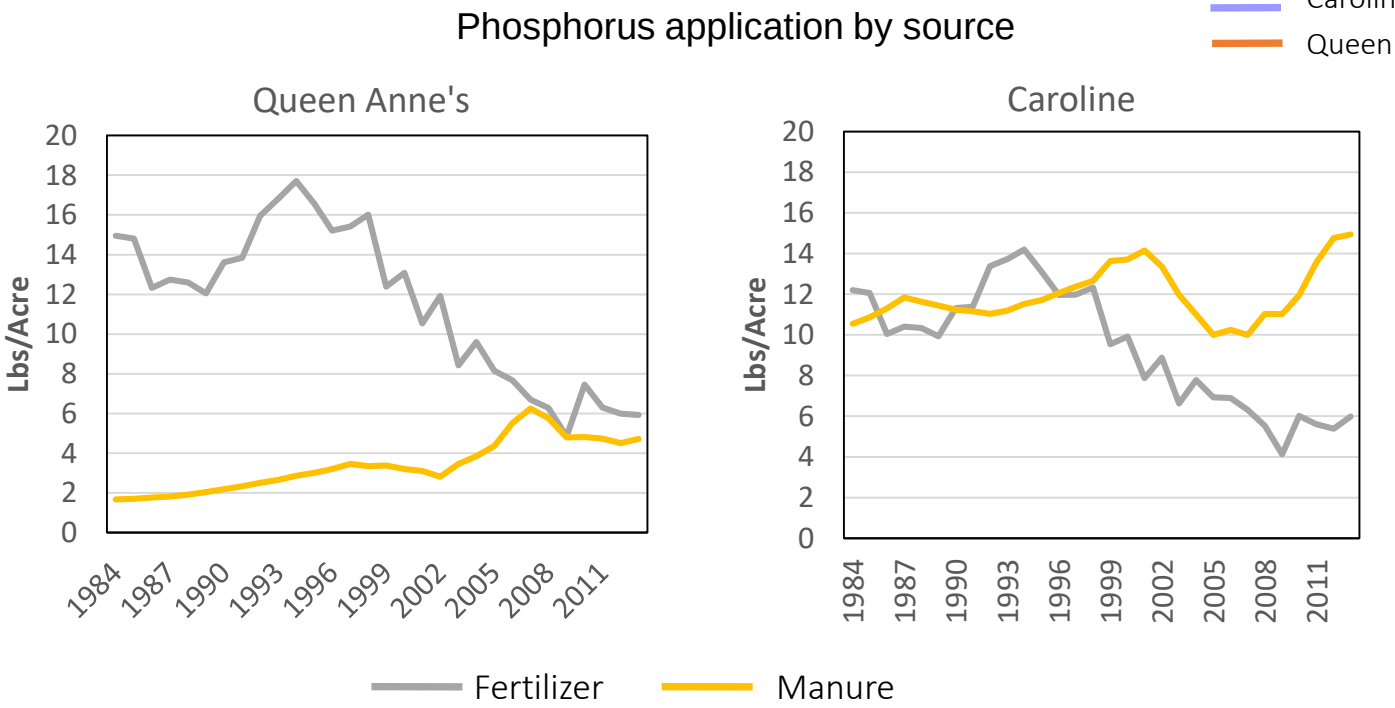
Sources, drivers, and impacts can differ between counties

Example: Queen Anne's & Caroline

- Different agricultural production
- Different application practices
- Different impact on soils & streams







Chesapeake Bay Phase 6 Program Watershed Model Calibration Inputs. http://cast.chesapeakebay.net

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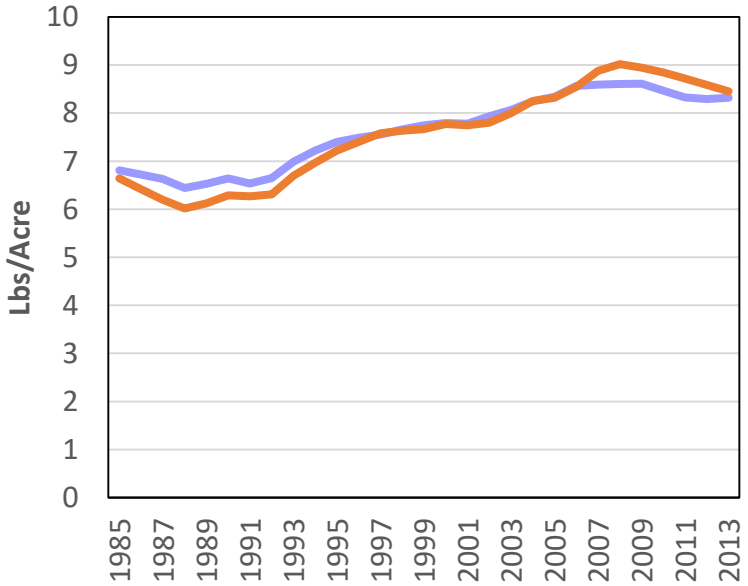
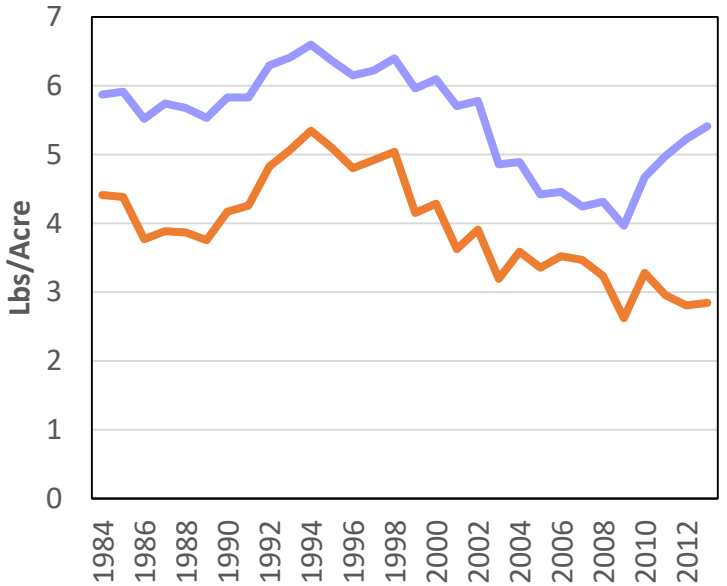
Phosphorus removed in crops

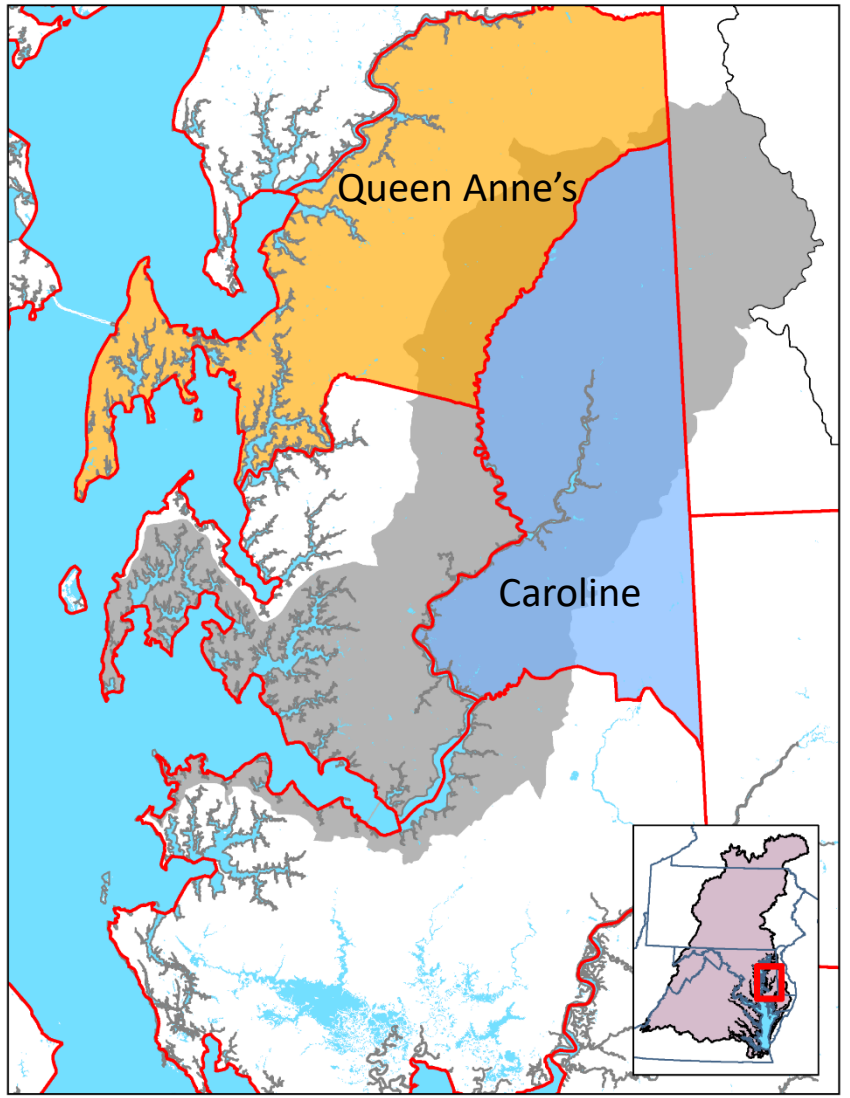


Phosphorus applied to crops



Caroline County, MD

Queen Anne's County, MD



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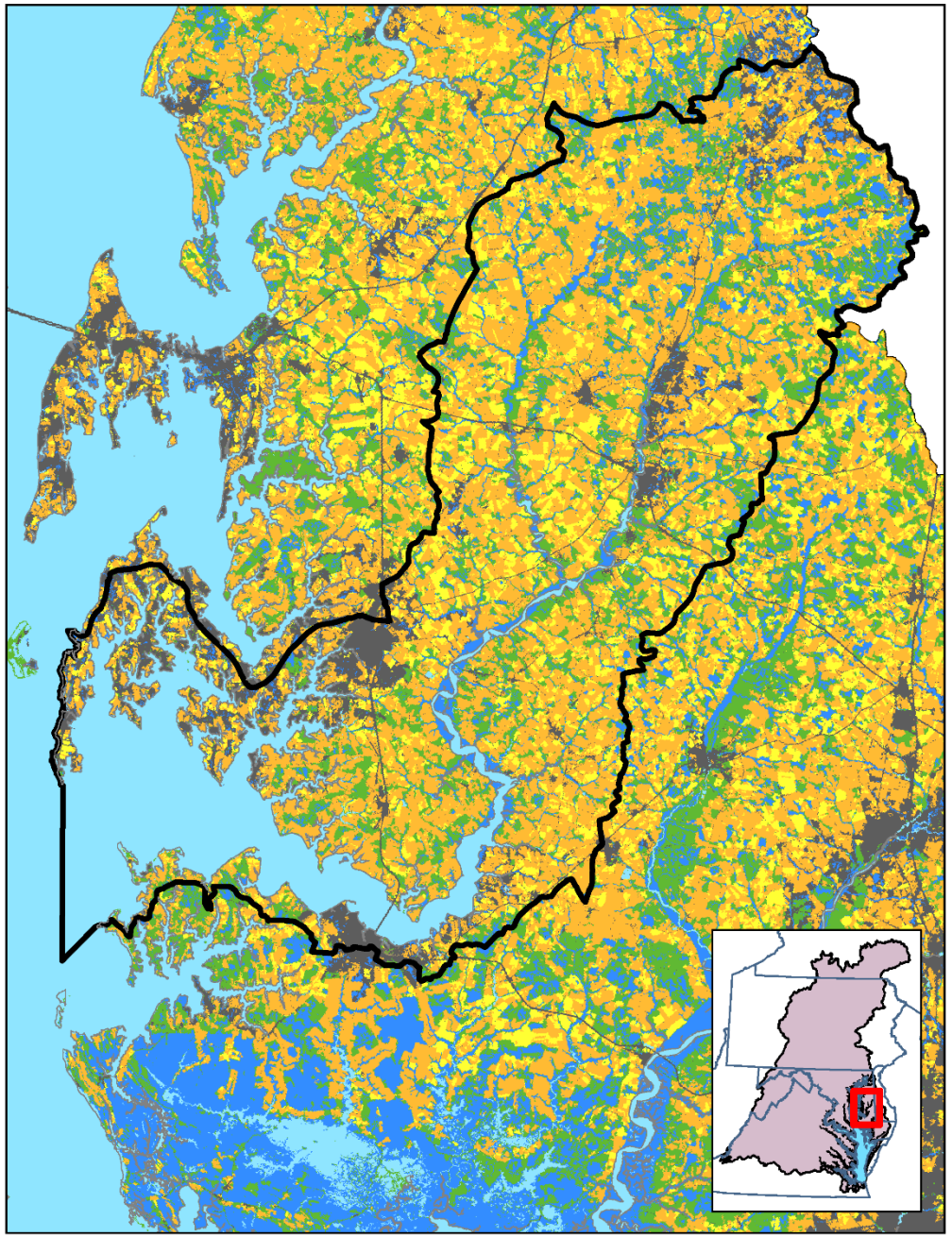
Making the management connection:

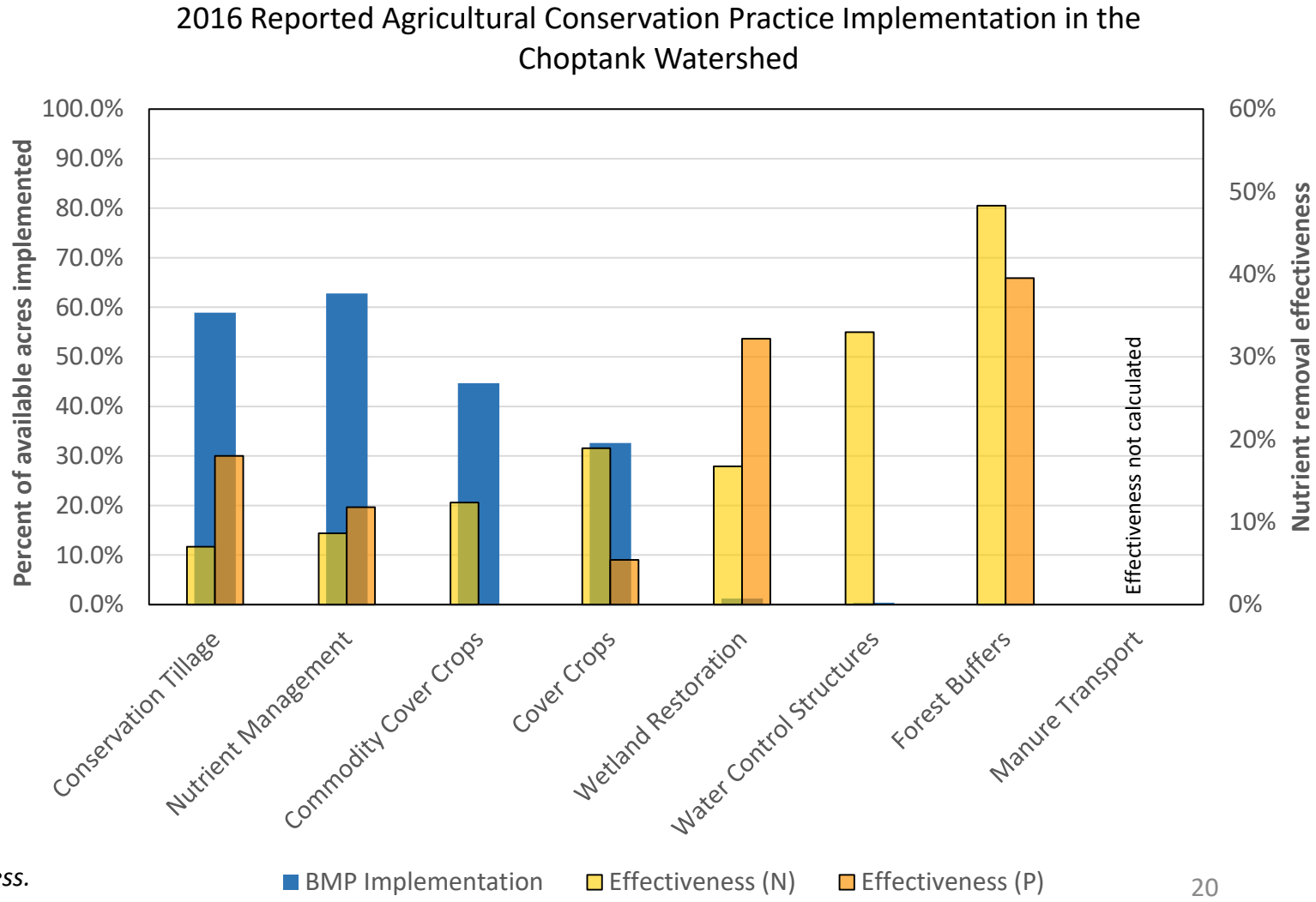
What have we done so far and what are the opportunities moving forward?



Map data from Falcone, J.A., 2015.

What practices address the issues in the Choptank? Have we been implementing them?

- Conservation tillage has been the longest and most widely implemented practice
- Major issues are nitrogen in groundwater, soil phosphorus, and overland runoff of sediment and phosphorus
- Effective practices could be cover crops, forest buffers, water control structures, manure transport, wetland restoration, appropriate nutrient management

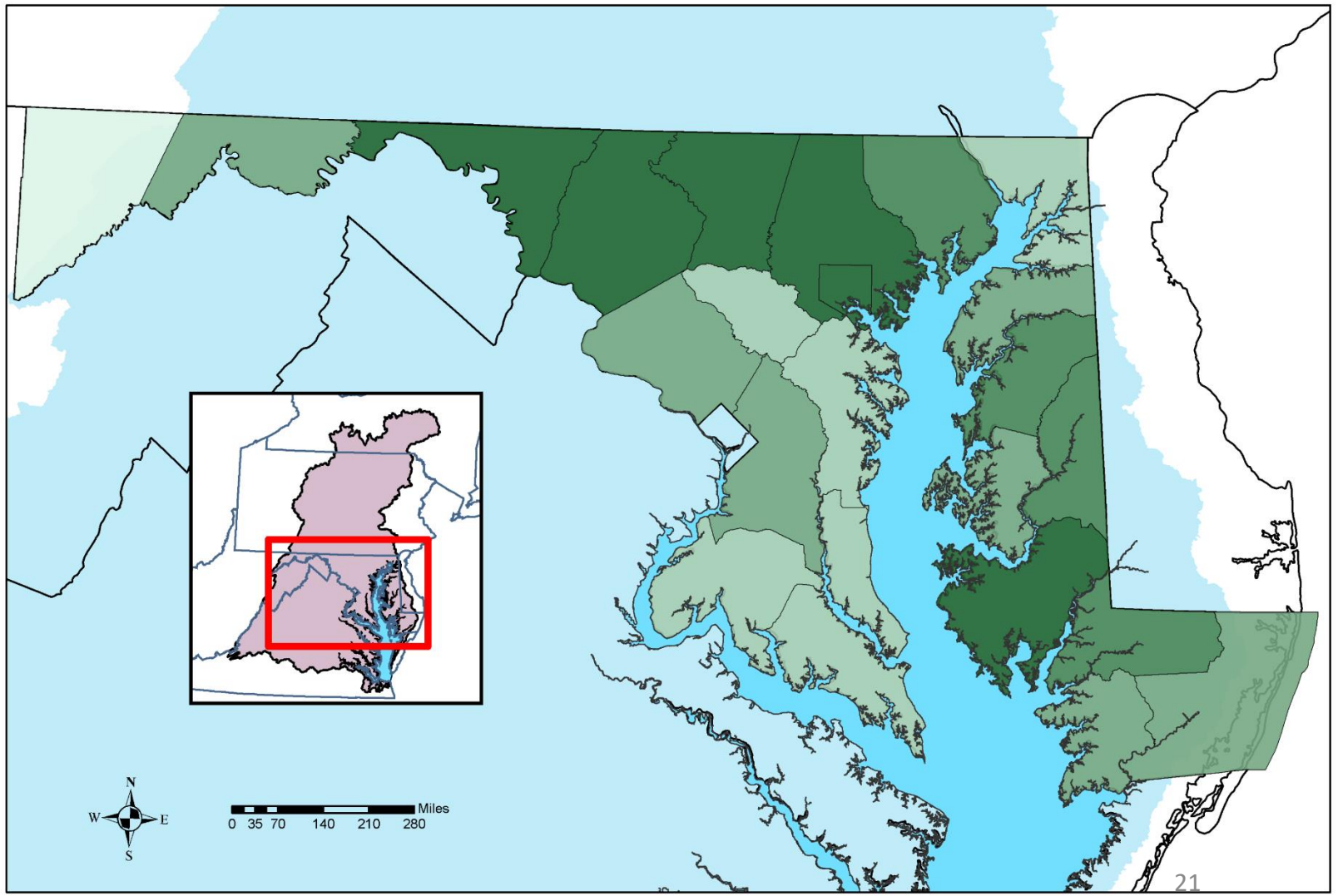


Chesapeake Bay Phase 6 Program Watershed Model Draft 2016 Progress. http://cast.chesapeakebay.net

The low hanging fruit isn't all gone!

- Opportunities exist to focus restoration efforts geographically and by the most cost-effective practices
- We are working with partners to build this information into tools

Acres available for grass or forest buffer implementation



Acres available for buffer implementation

Fewer acres

More acres

Data from Lindsey Gordon, CRC CBP

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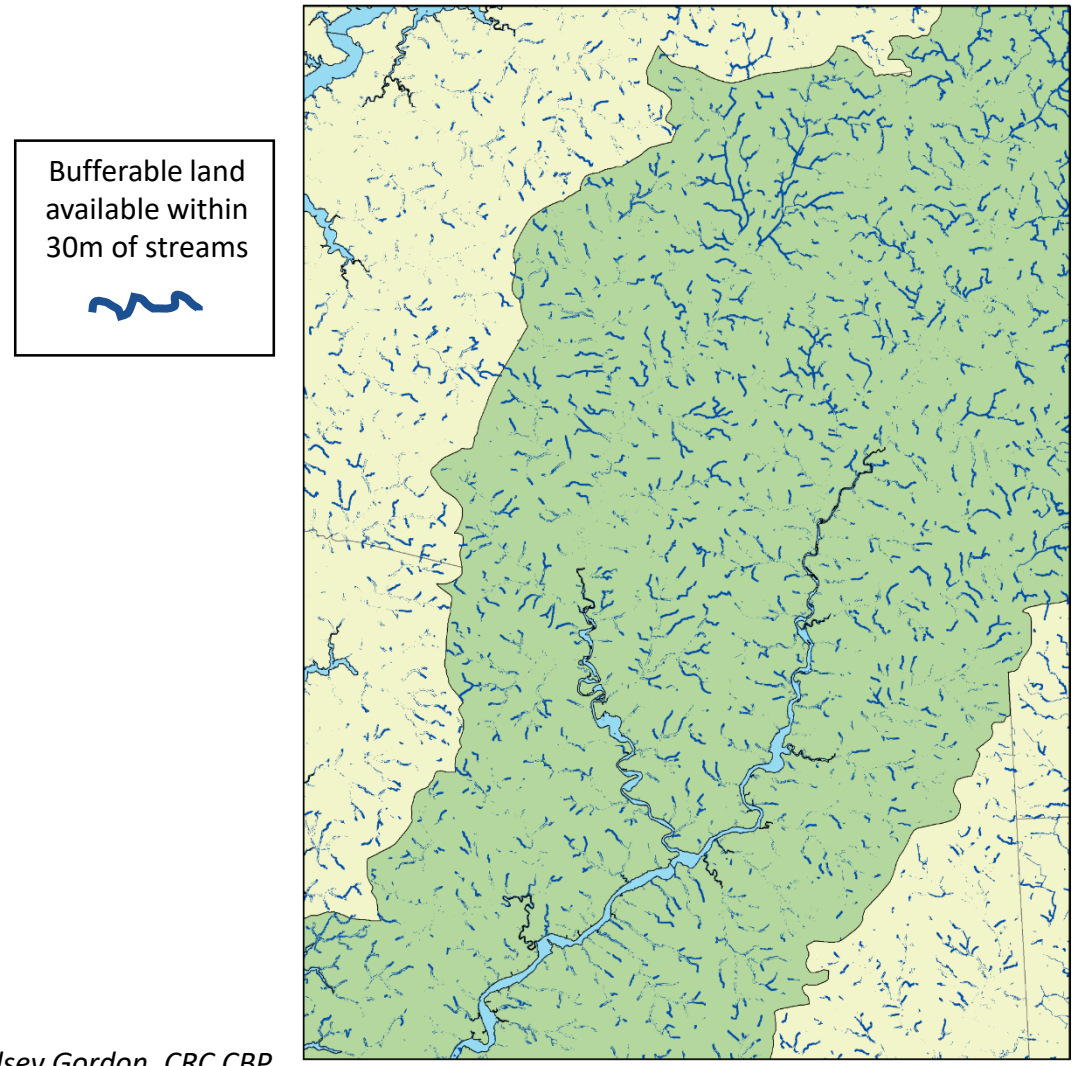

Data from Lindsey Gordon, CRC CBP

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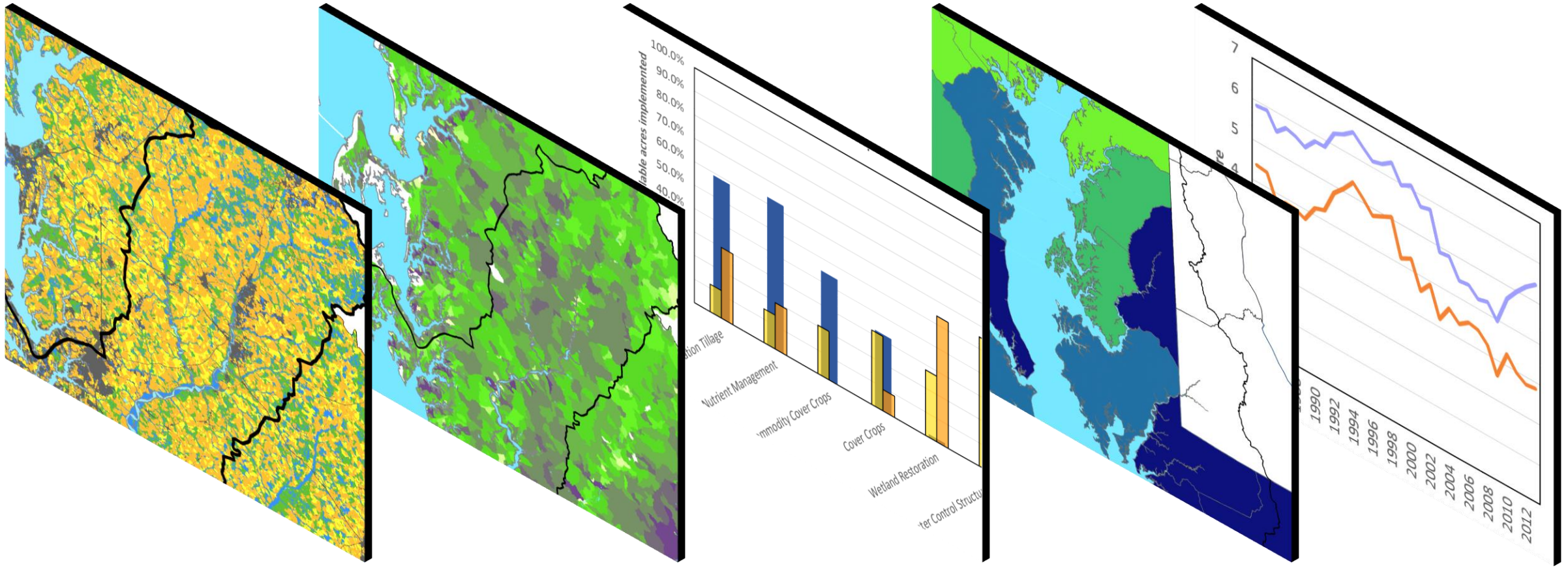

We are currently working with the jurisdictions and local partners to incorporate this information into their planning efforts…

- Technical support to jurisdictions
  - Explaining trends and science building blocks
  - Support with peeling back the layers shown for their local areas
  - Storyline development and training
- Support to local areas
  - Through jurisdictions' local engagement strategies
  - With feedback from LGAC and LGEI
  - Directly with local groups
- Tool development & data accessibility
  - Data layers, guidance and messages being made available
  - Tool development process underway to gather user feedback

Feedback requested from LGAC

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We want to make this relevant to your local planning efforts

- **Does this concept of introducing planning-relevant information through a local story resonate with you?**
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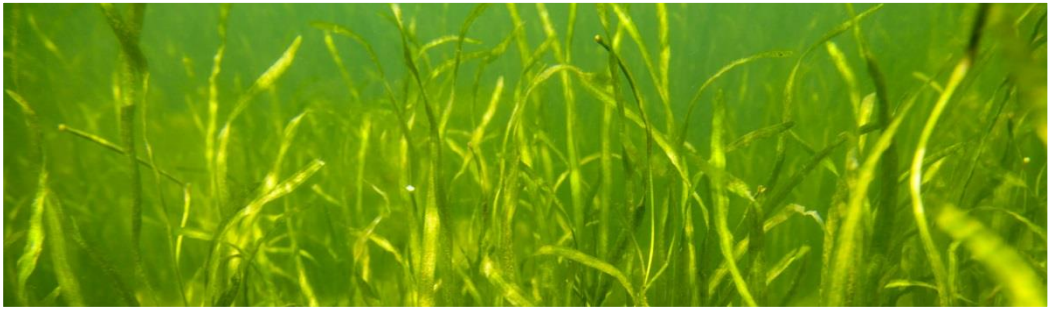


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