Water Quality Trends and Shifts in the Pollutant Source Sectors: Policy Implications for the Partnership

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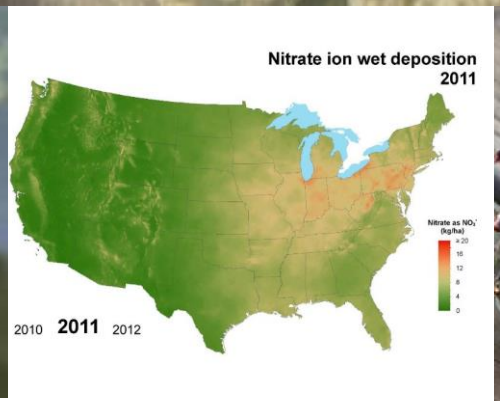
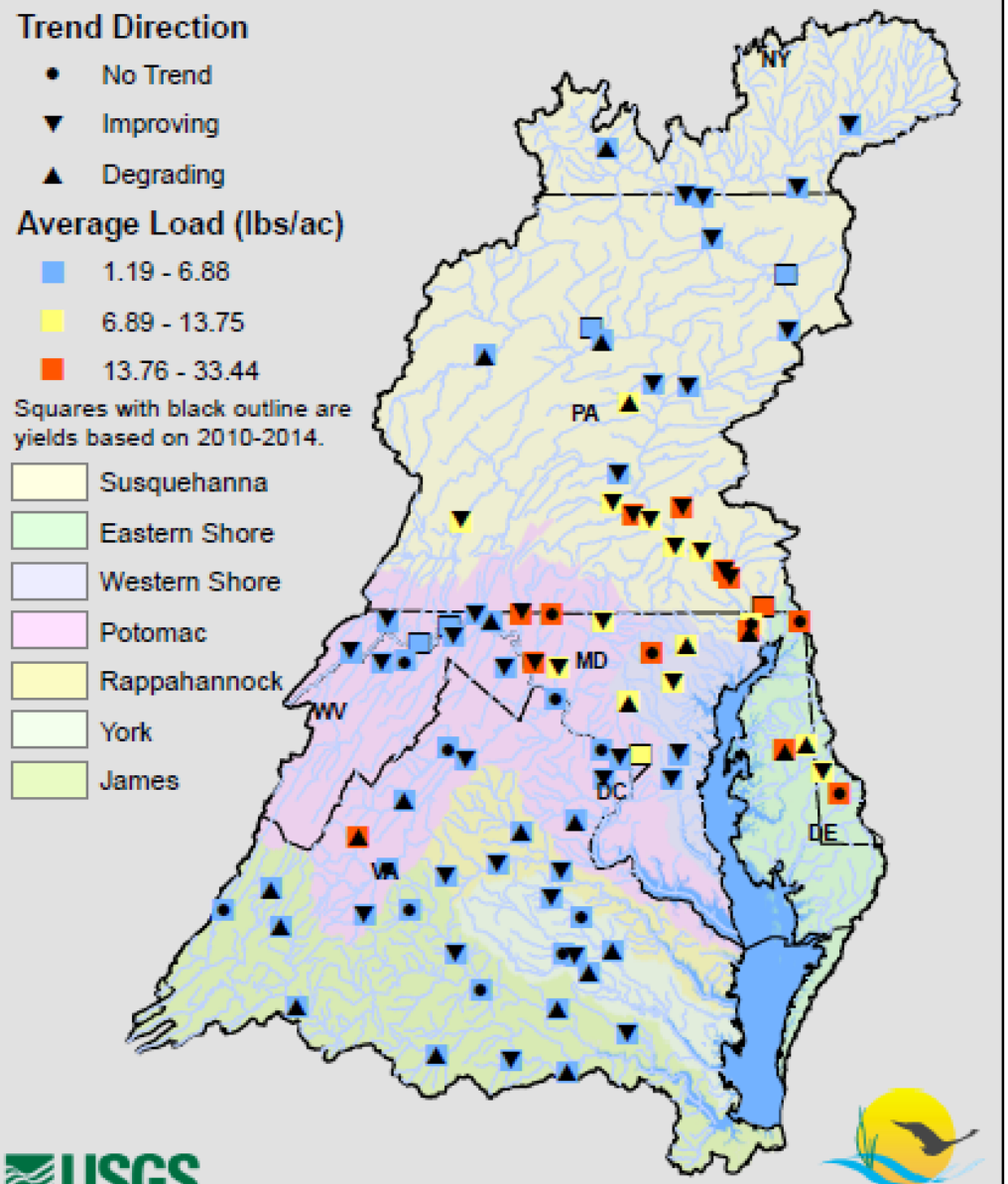
Associate Director for Science, Analysis and Implementation
Chesapeake Bay Program Office
U.S. Environmental Protection Agency
Annapolis, Maryland

SUCCESSES—SEEING REAL BAY AND WATERSHED RESPONSES



Chesapeake Bay Watershed Water Quality Trends

Total Nitrogen per Acre Loads and Trends: 2005-2014



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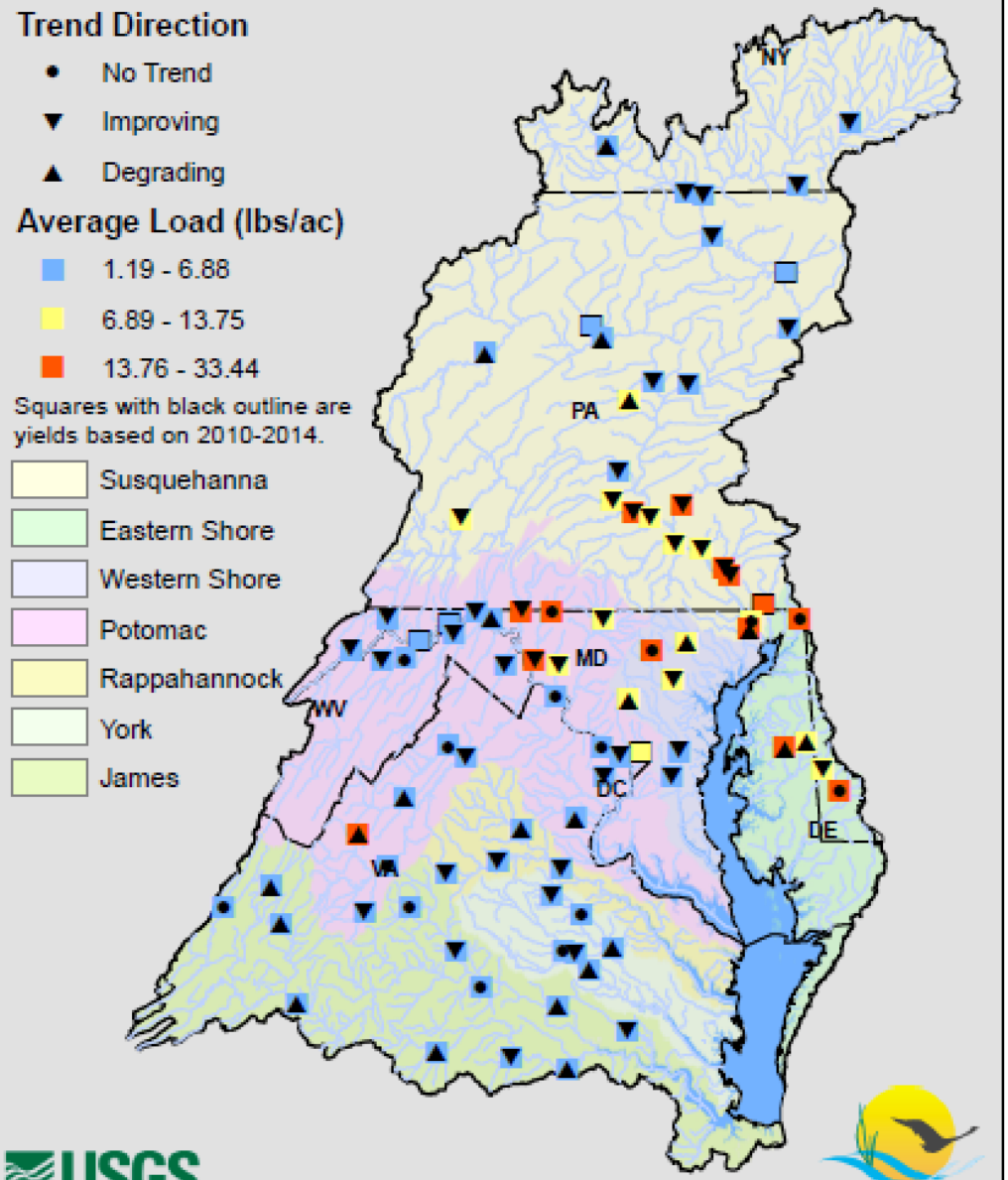

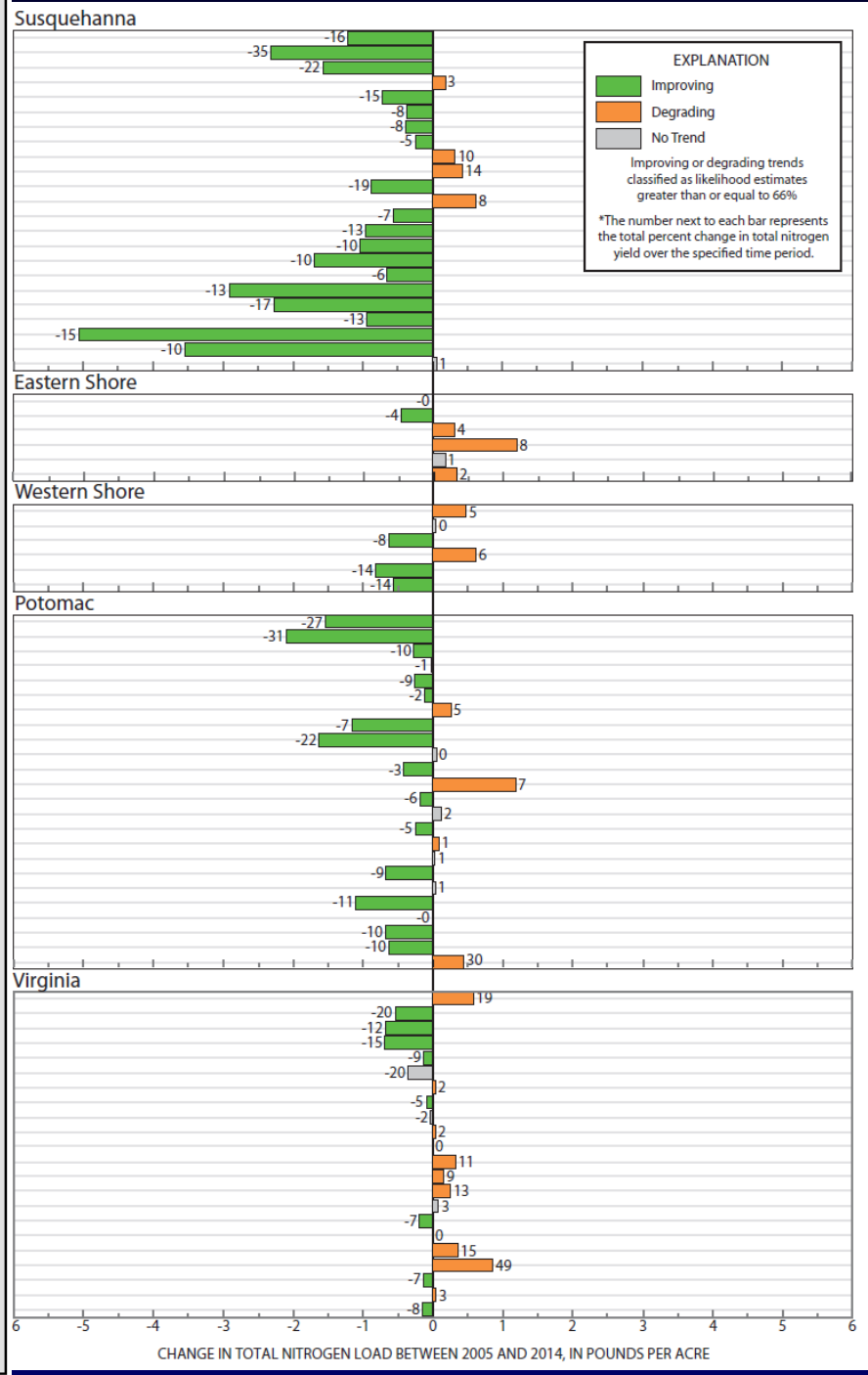

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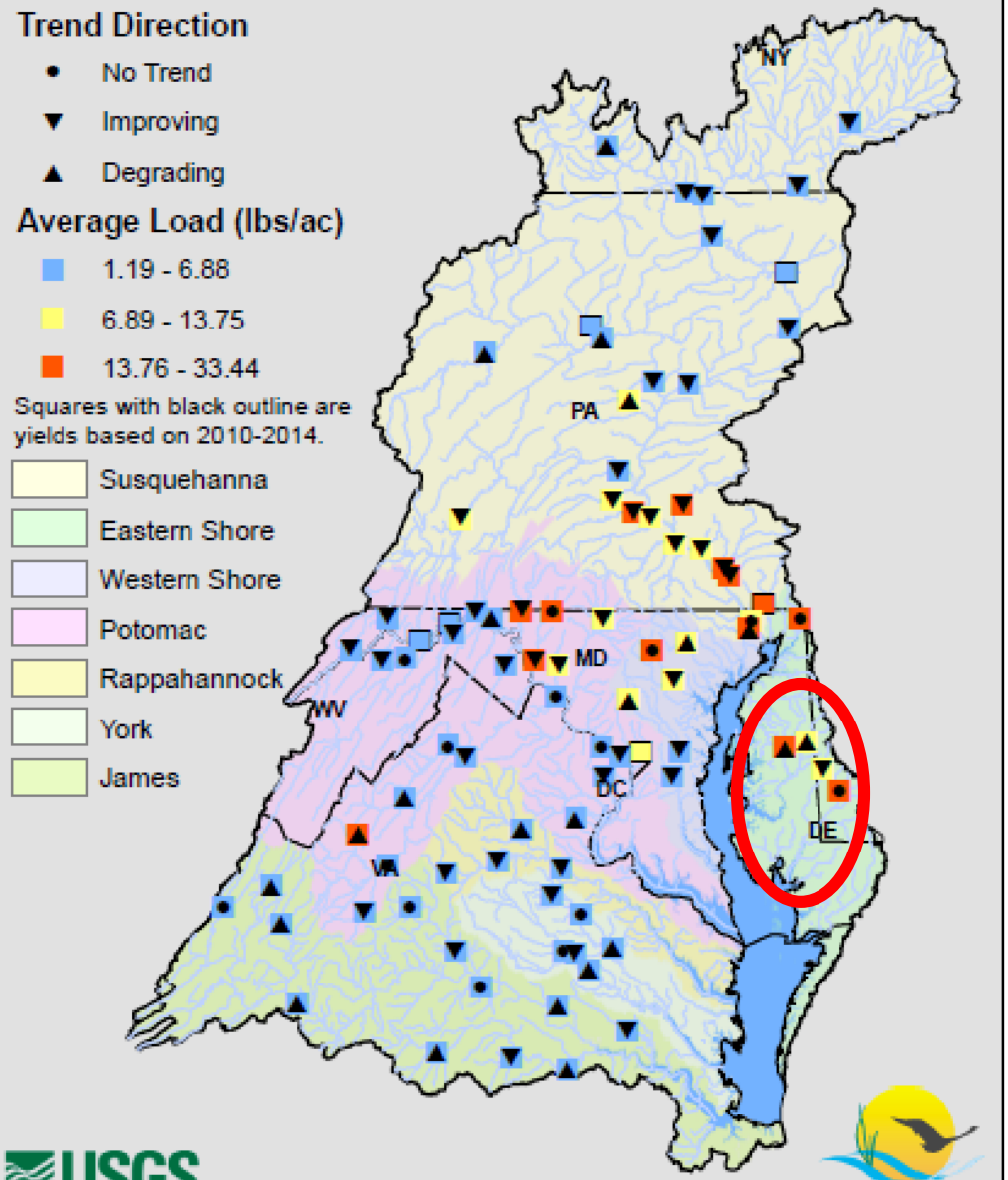

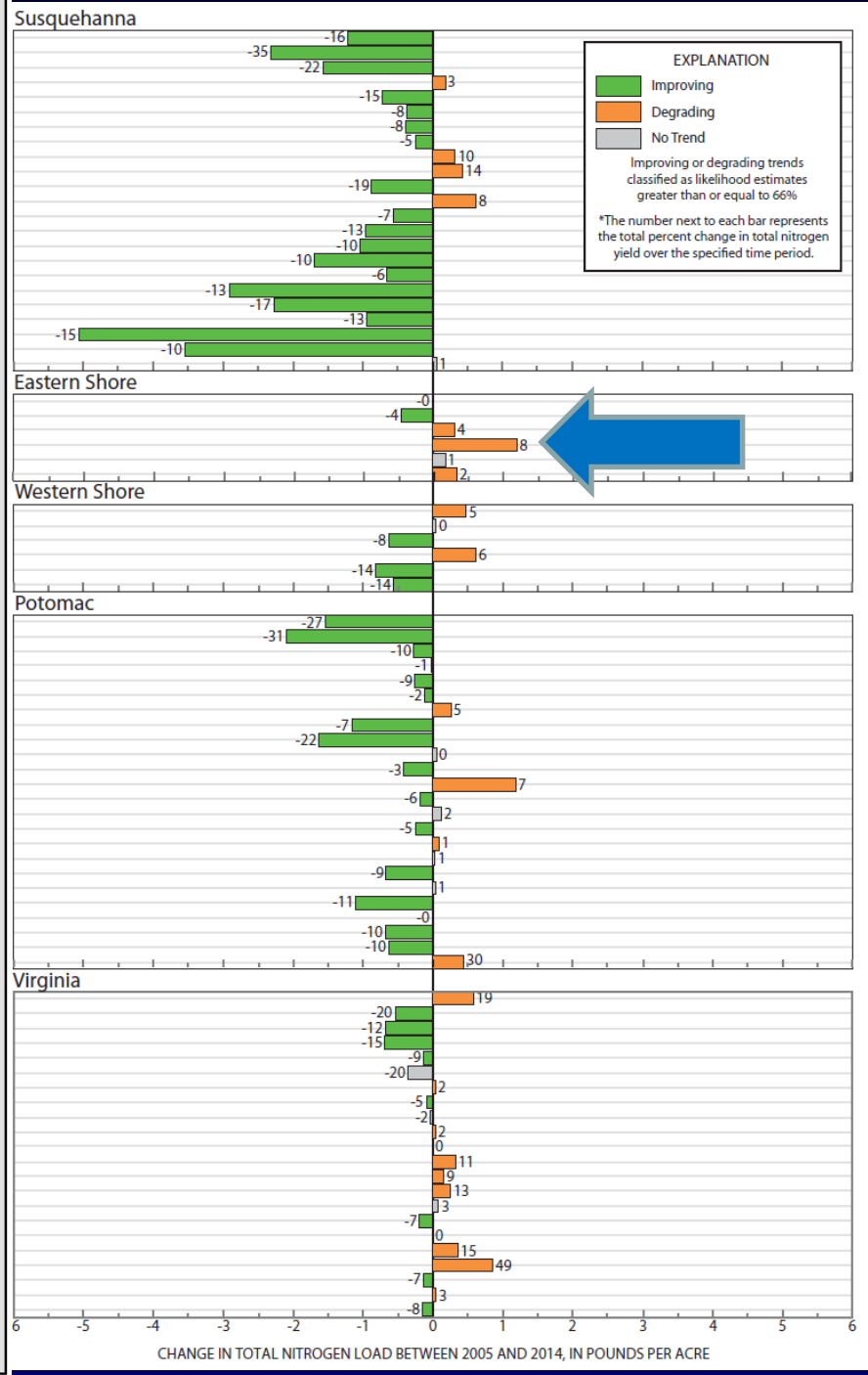

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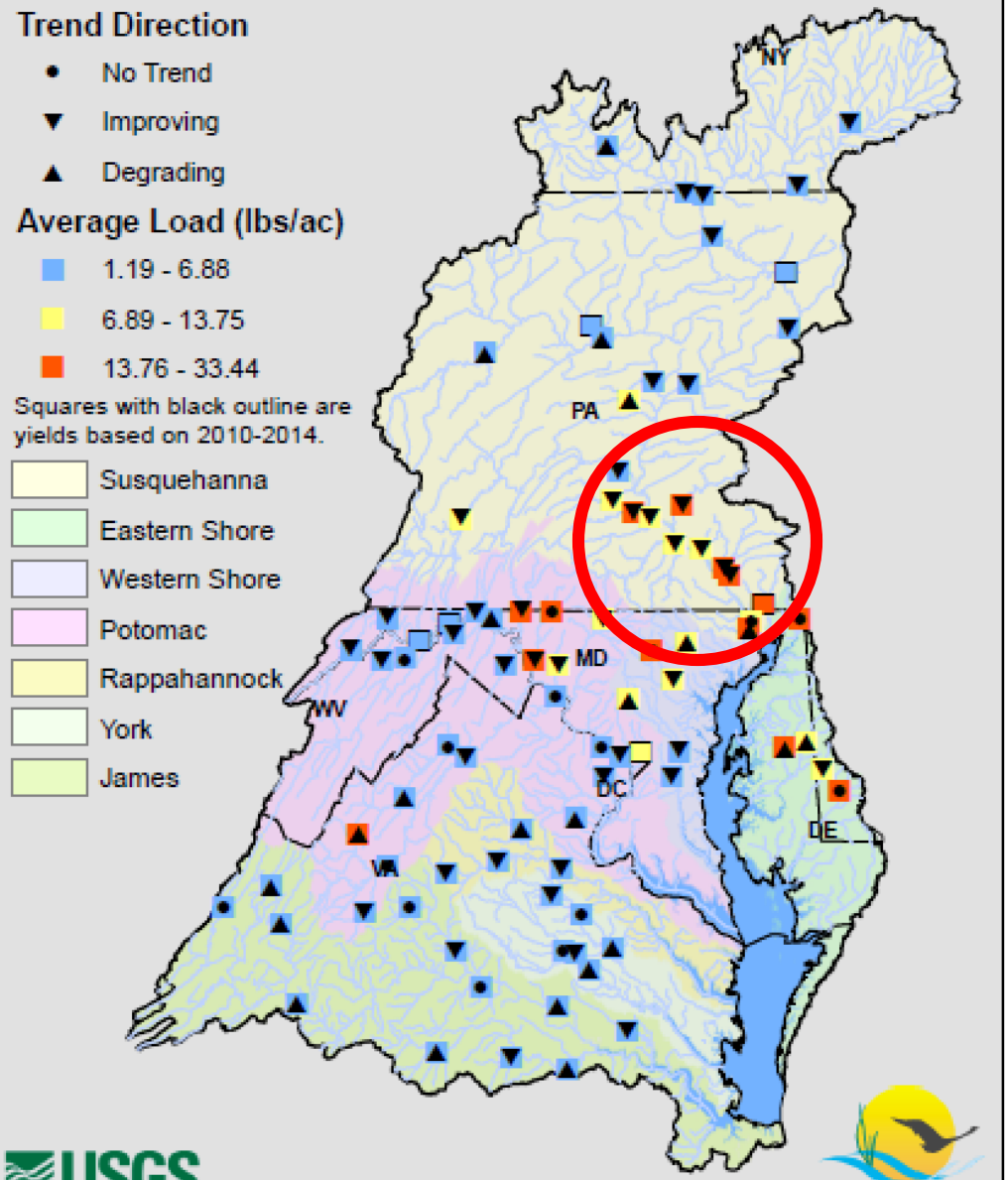

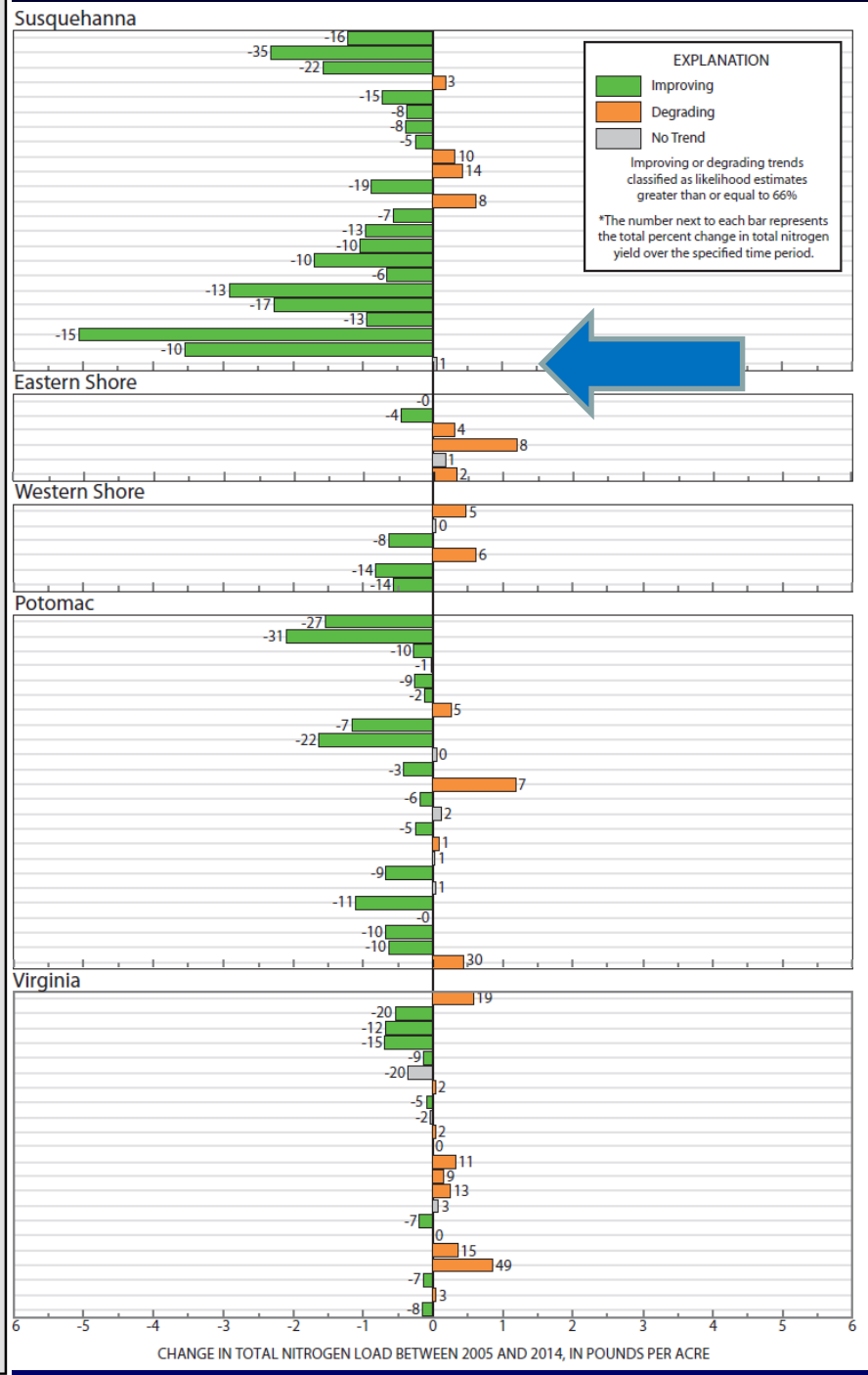

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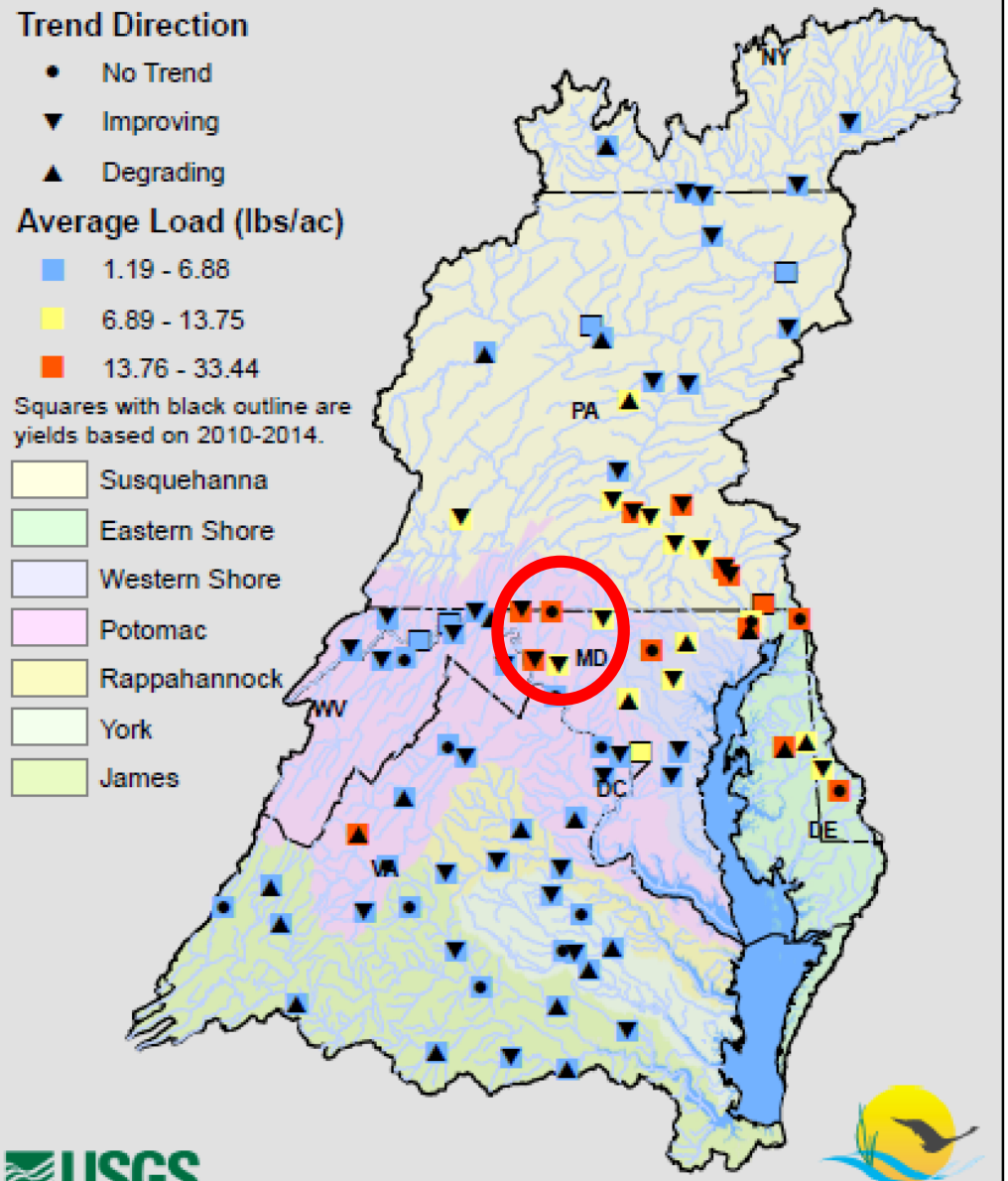
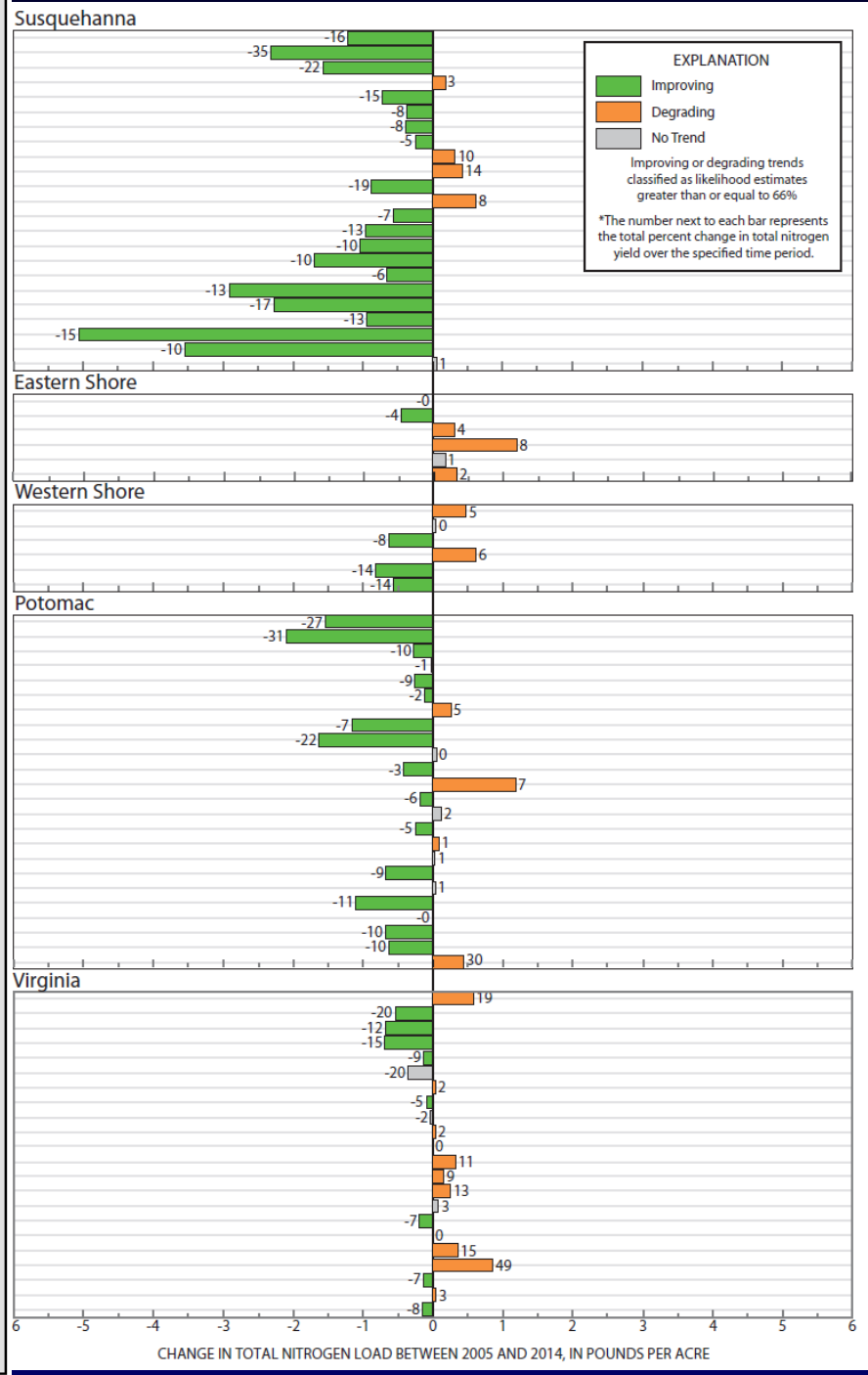
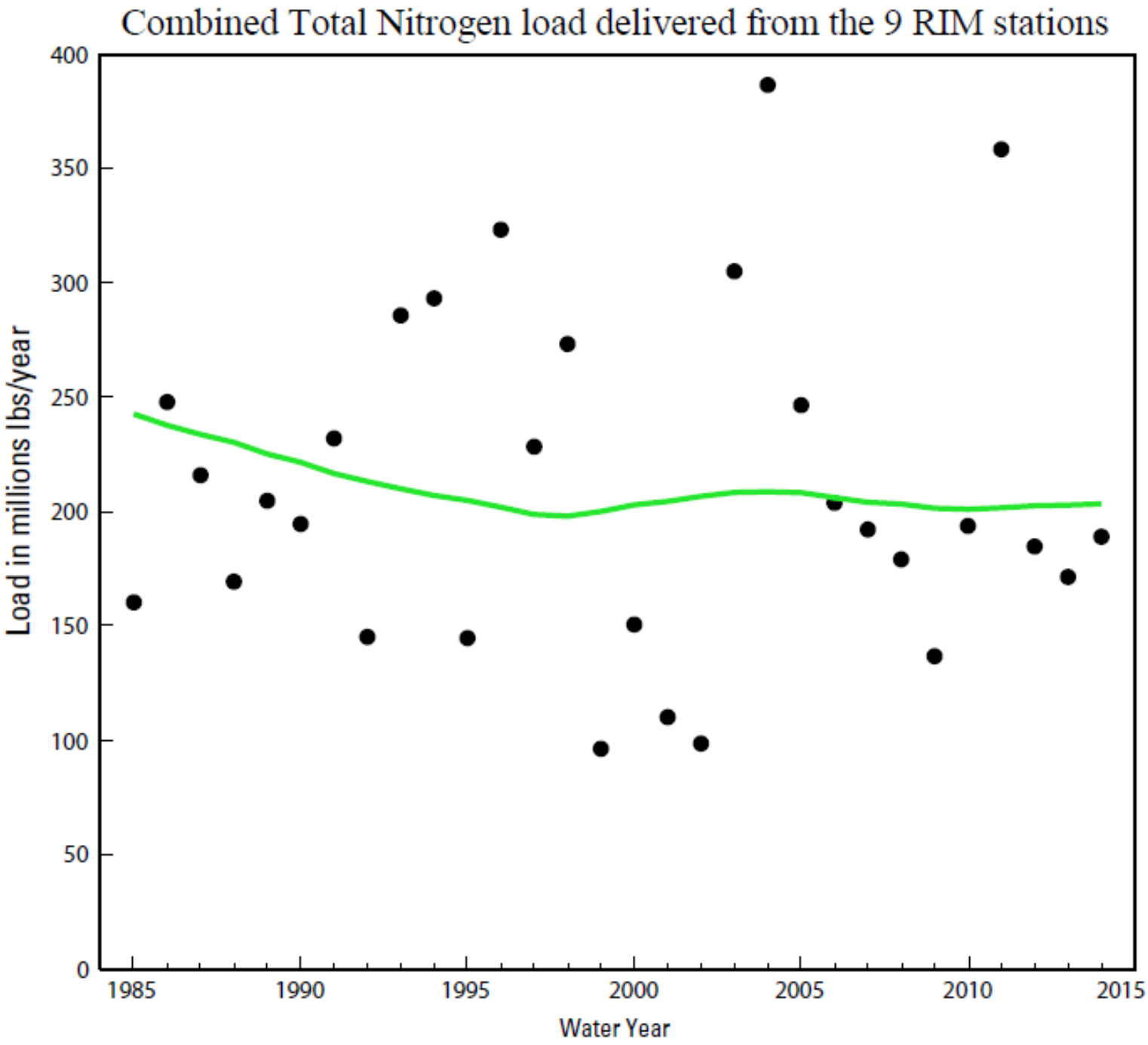
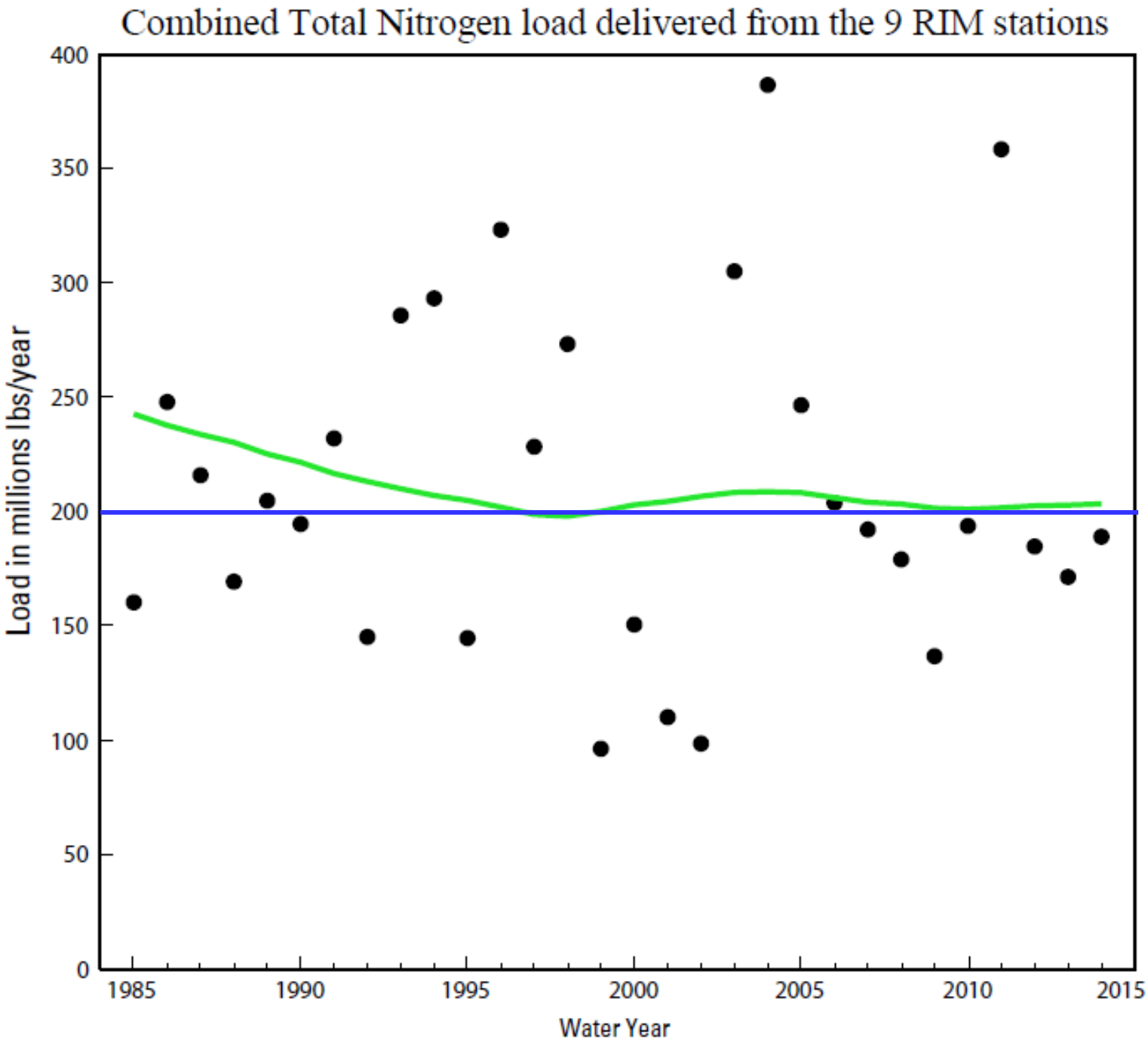
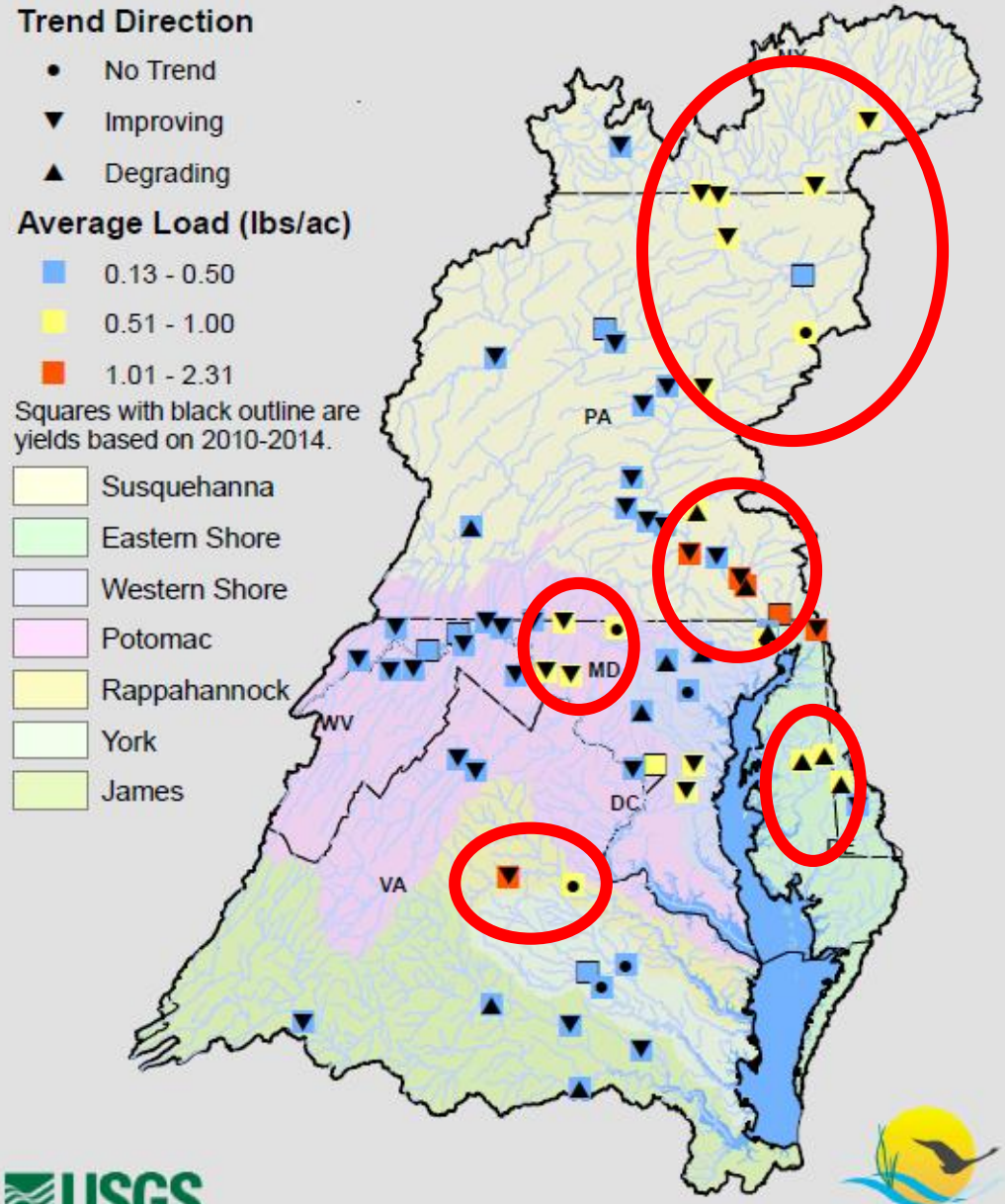


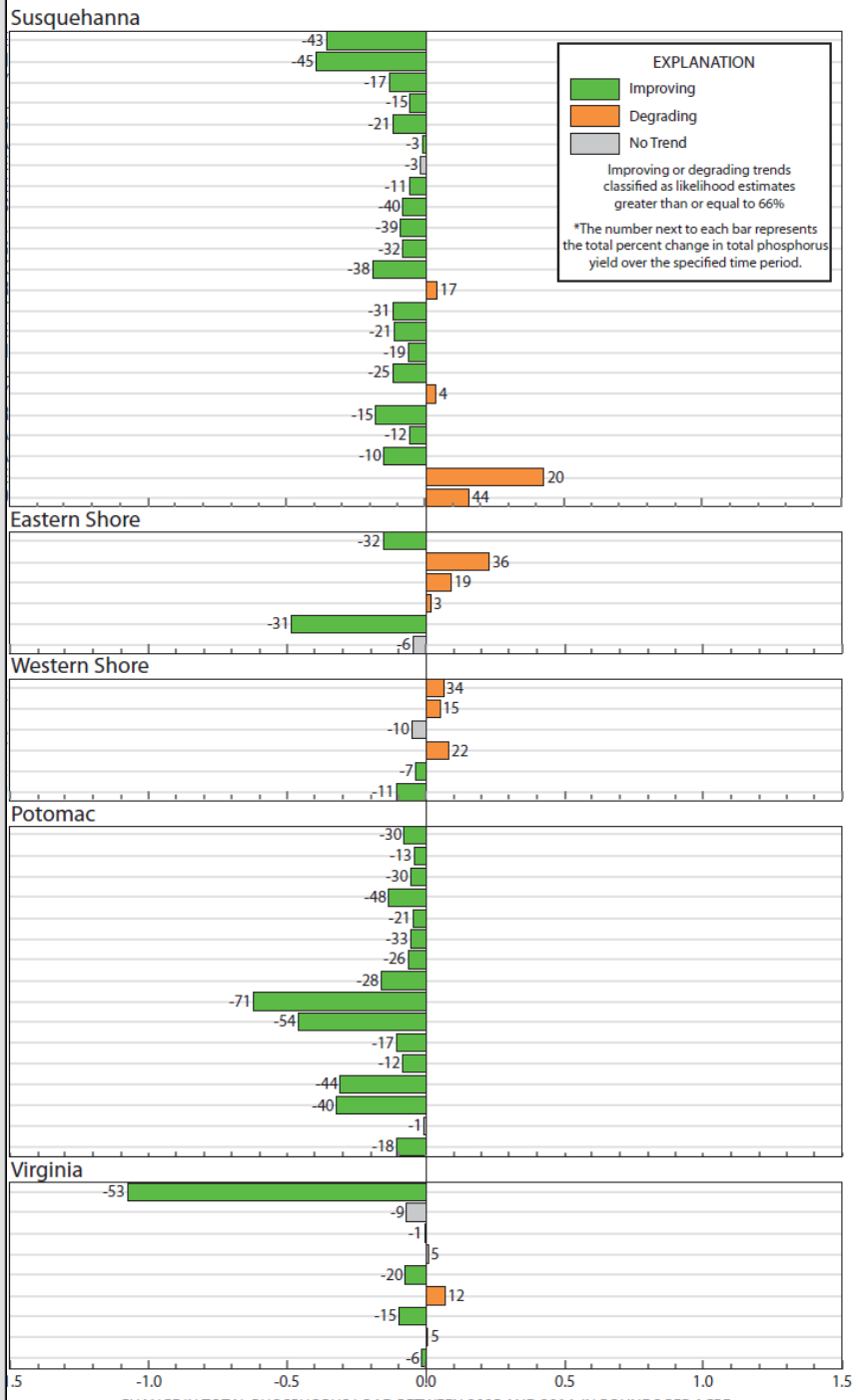



Combined Total Nitrogen load delivered from the 9 RIM stations
Load in millions lbs/year
400
350
300
250
200
150
100
50
0
1985
1990
1995
2000
2005
2010
2015
Water Year


Combined Total Nitrogen load delivered from the 9 RIM stations
Load in millions lbs/year
400
350
300
250
200
150
100
50
0
1985
1990
1995
2000
2005
2010
2015
Water Year

Total Phosphorus per Acre Loads and Trends: 2005-2014

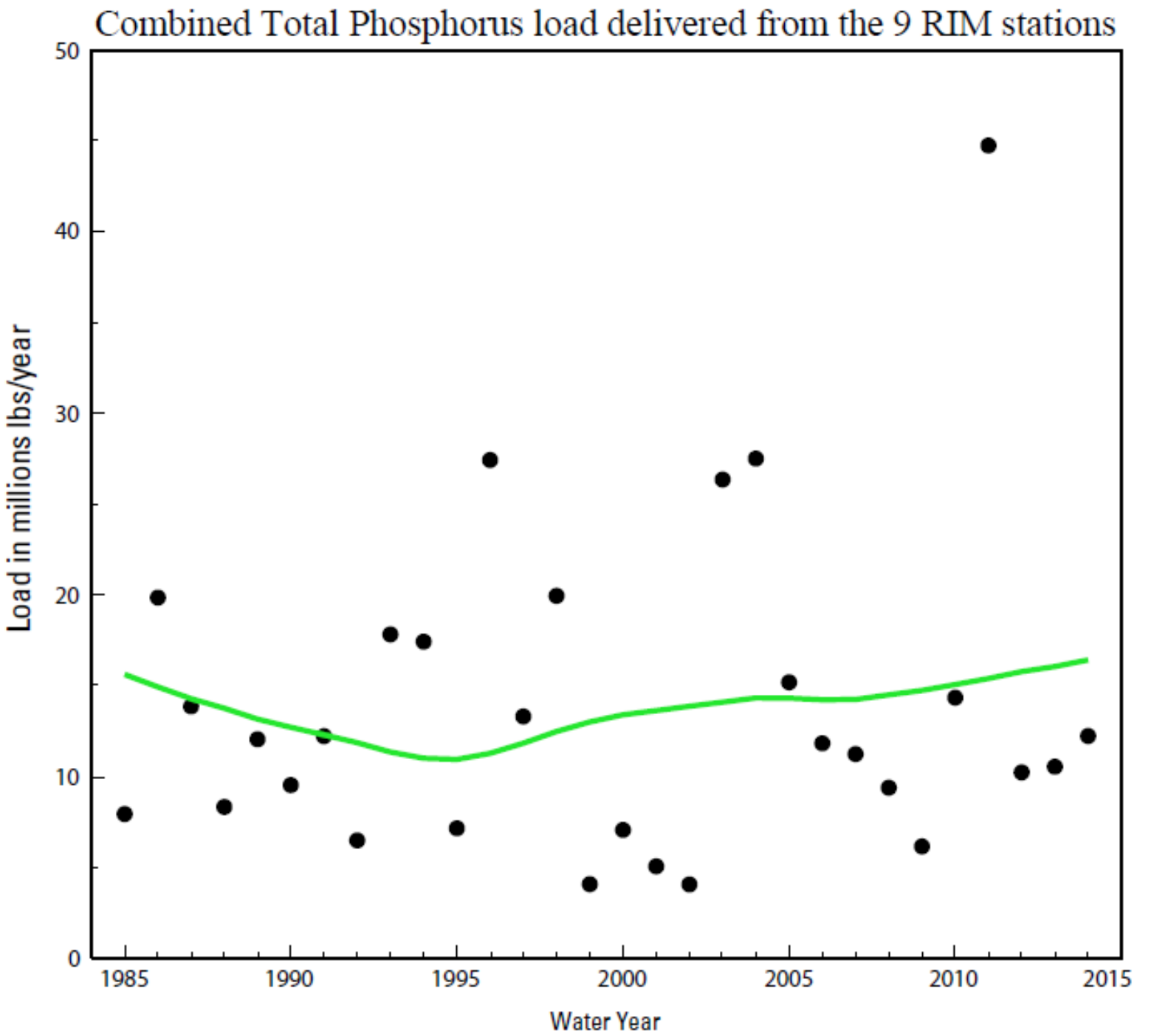


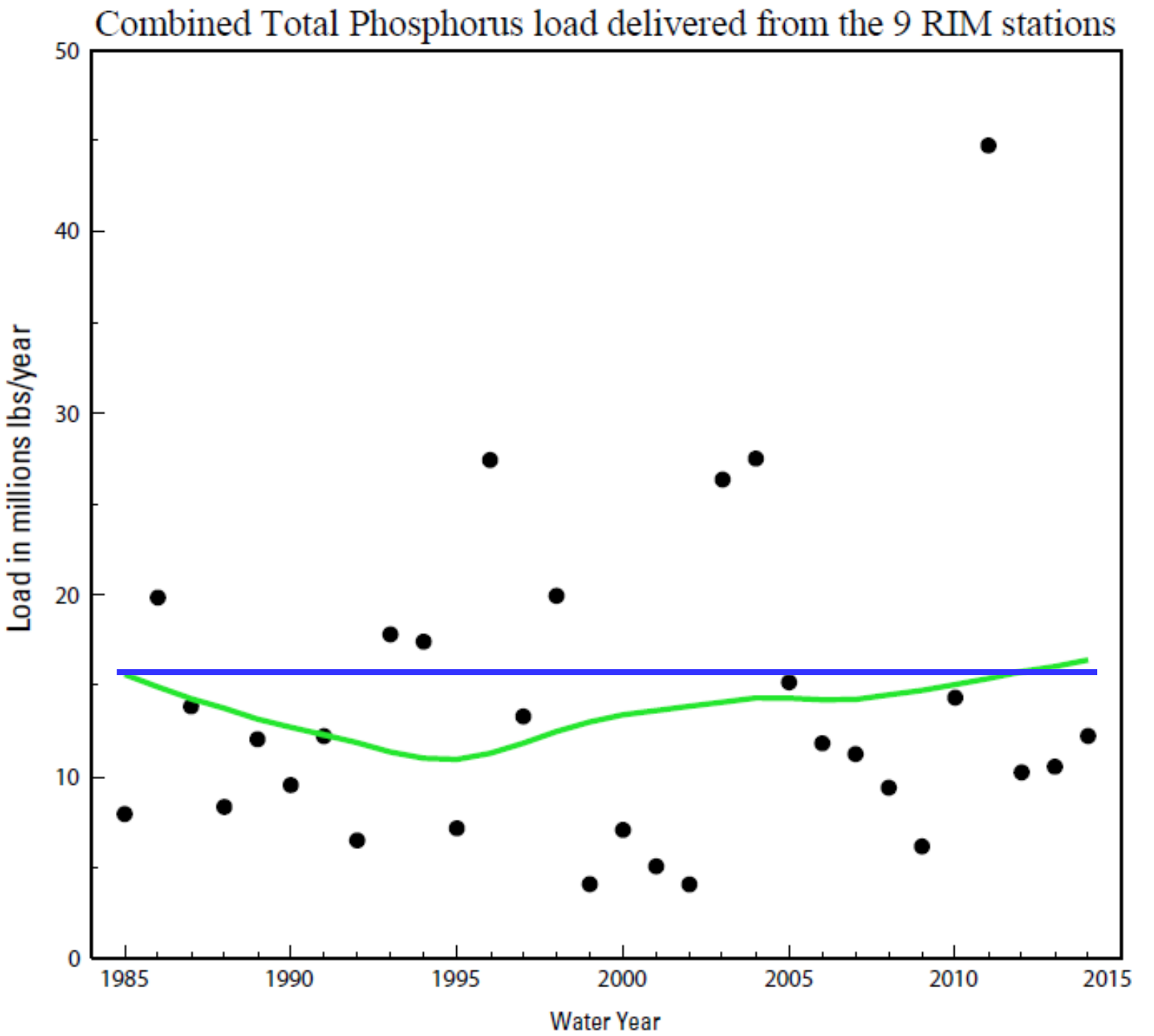


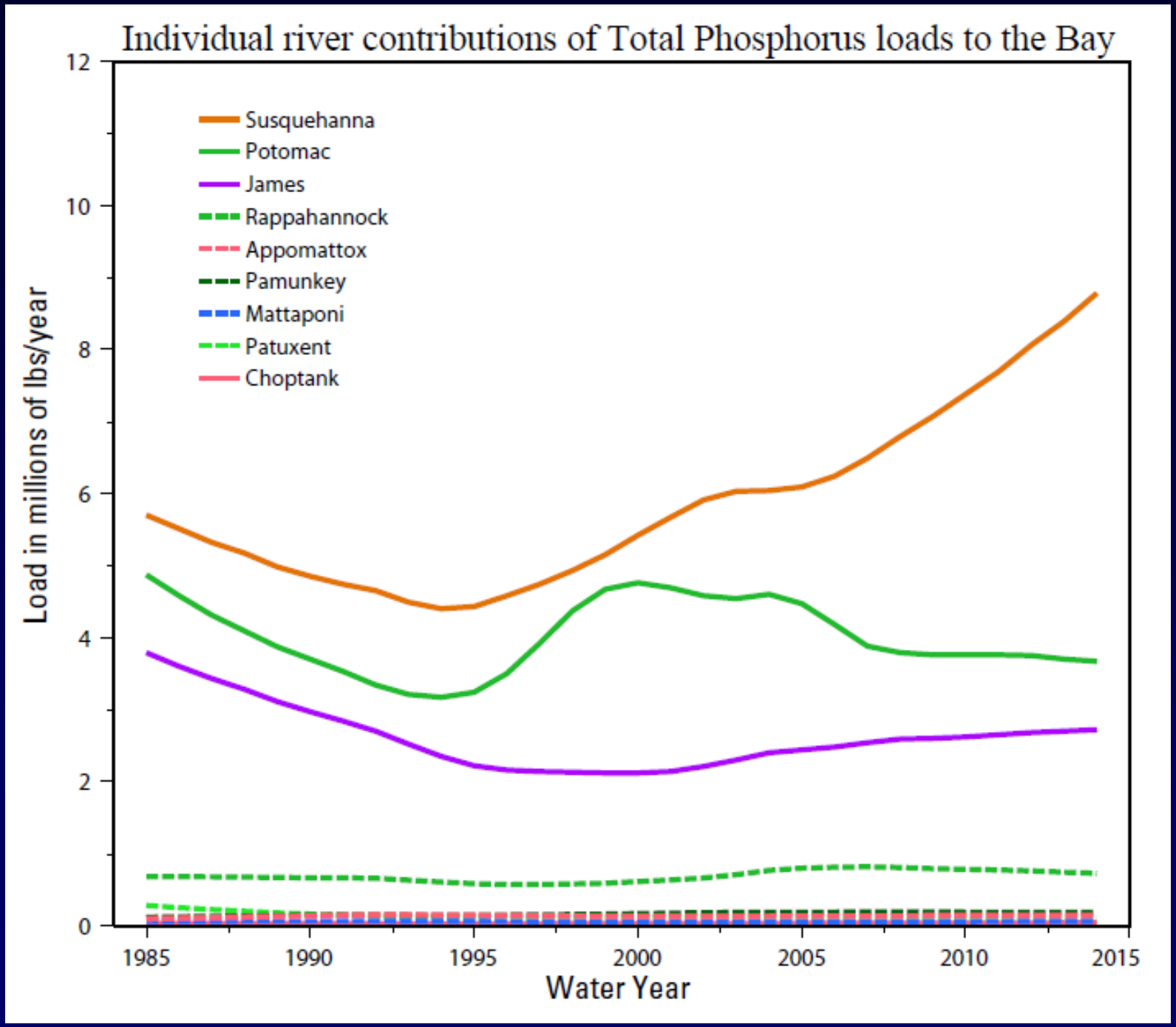
USGS science for a changing world

Prepared on 10/20/15

Chesapeake Bay Program
A Watershed Partnership


Combined Total Phosphorus load delivered from the 9 RIM stations
Load in millions lbs/year
50
40
30
20
10
0
1985
1990
1995
2000
2005
2010
2015
Water Year


Combined Total Phosphorus load delivered from the 9 RIM stations
Load in millions lbs/year
50
40
30
20
10
0
1985
1990
1995
2000
2005
2010
2015
Water Year

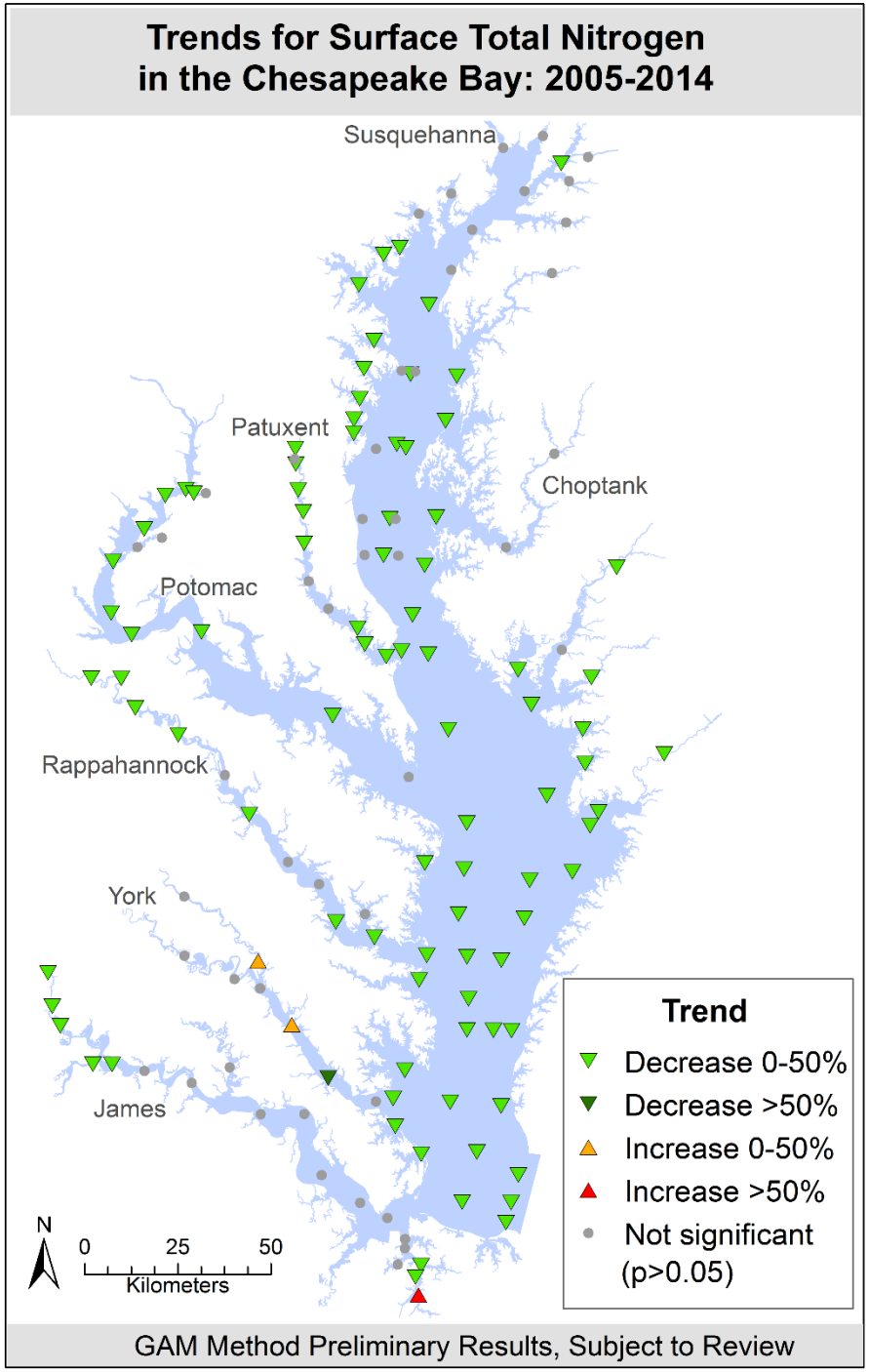

Individual river contributions of Total Phosphorus loads to the Bay
Susquehanna
Potomac
James
Rappahannock
Appomattox
Pamunkey
Mattaponi
Patuxent
Choptank
Load in millions of lbs/year
0
2
4
6
8
10
12
1985
1990
1995
2000
2005
2010
2015
Water Year

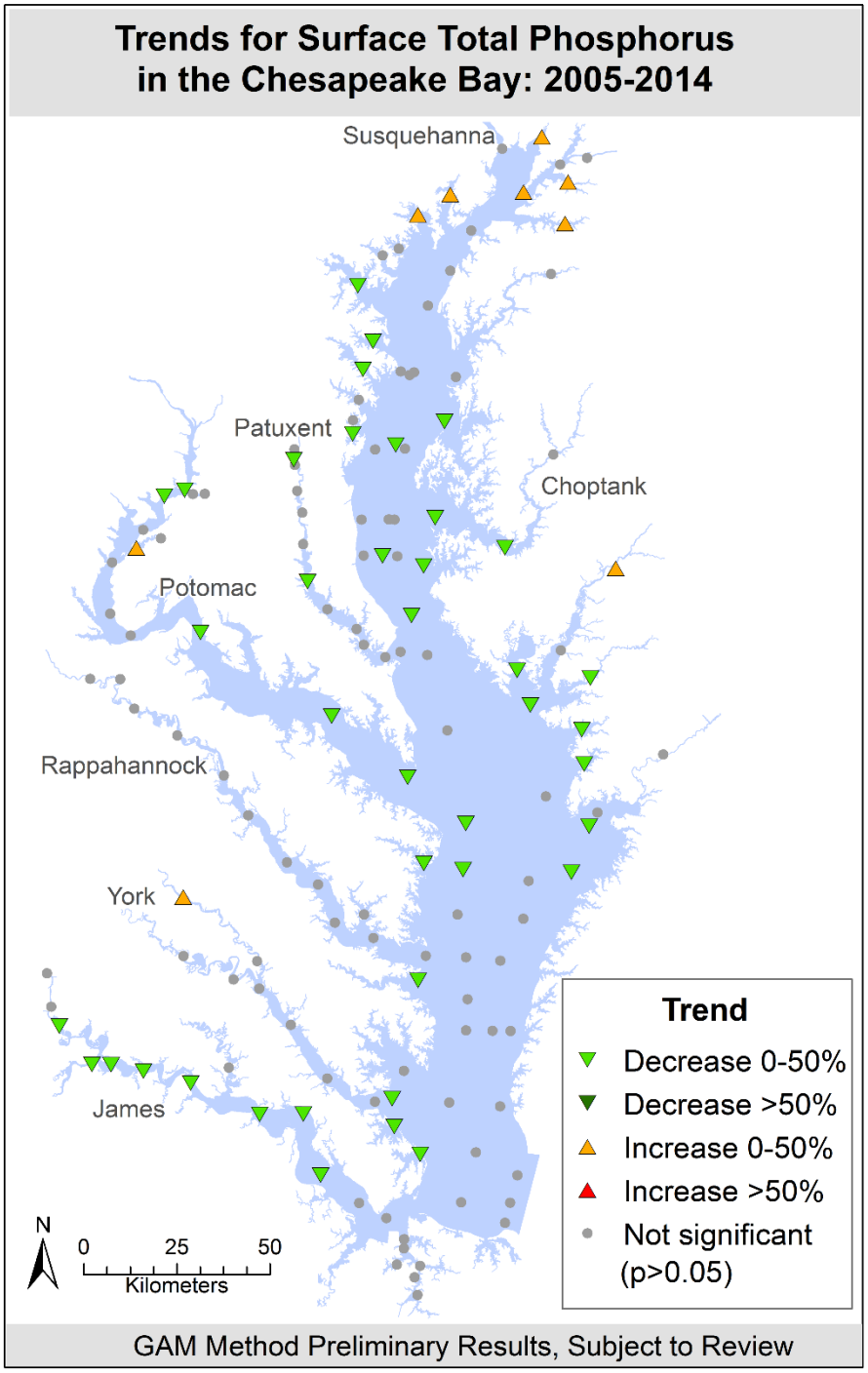
Watershed Trends:
Feedback/Direction from PSC

What additional information would you like to see on the following:

- Trends for specific watersheds or locations
- Why the more recent river input trends in nitrogen and phosphorus loads are either flattening out or increasing
- Causes of the increasing trend in phosphorus at Conowingo Dam when upstream stations are showing downward trends
- Other additional information

Chesapeake Bay Tidal Water Quality Trends


Trends for Surface Total Nitrogen
in the Chesapeake Bay: 2005-2014
Susquehanna
Patuxent
Choptank
Potomac
Rappahannock
York
James
N
0
25
50
Kilometers
Trend
Decrease 0-50%
Decrease >50%
Increase 0-50%
Increase >50%
Not significant
(p>0.05)
GAM Method Preliminary Results, Subject to Review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Choptank
Potomac
Rappahannock
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James
N
0
25
50
Kilometers
Trend
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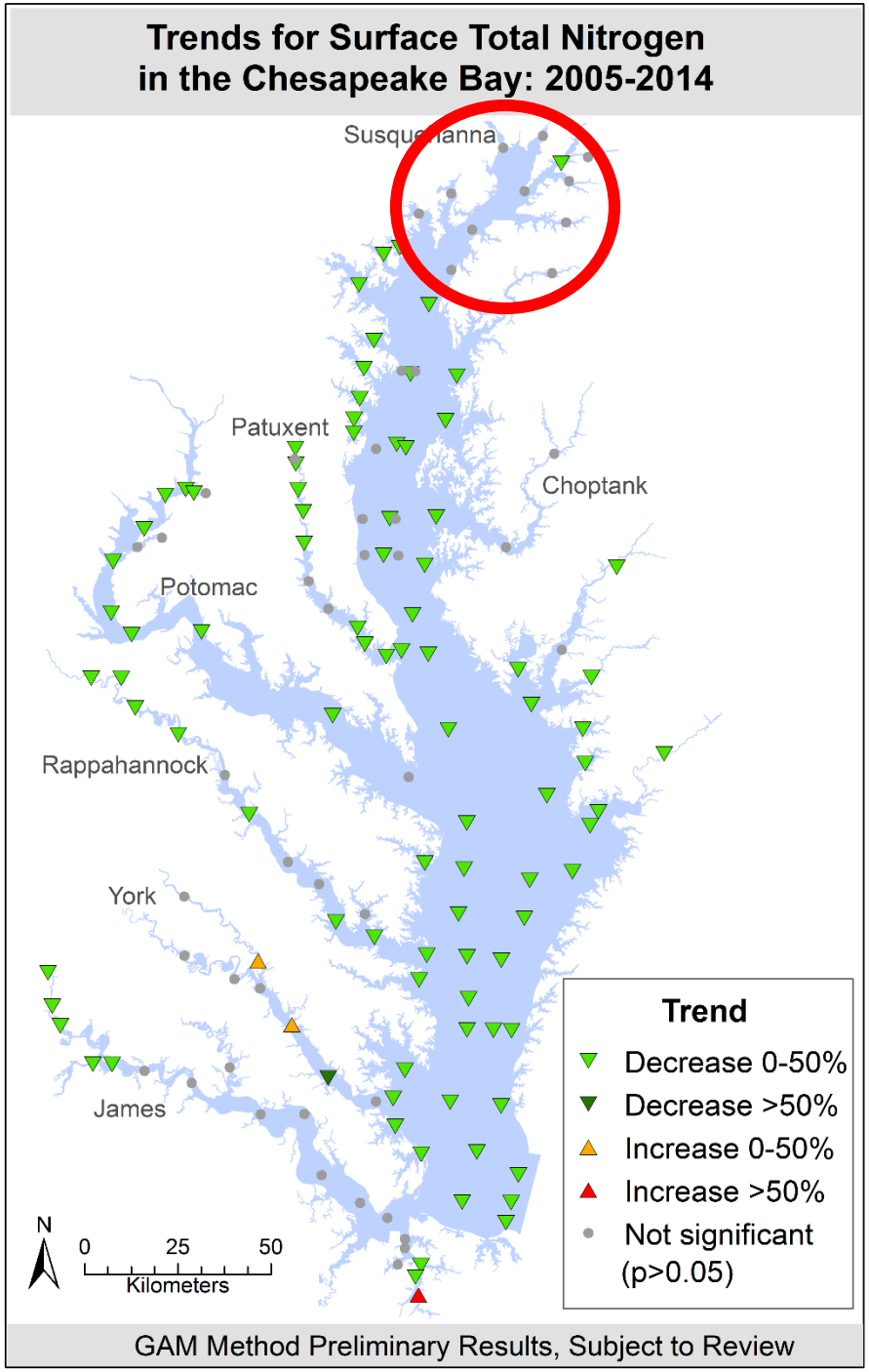
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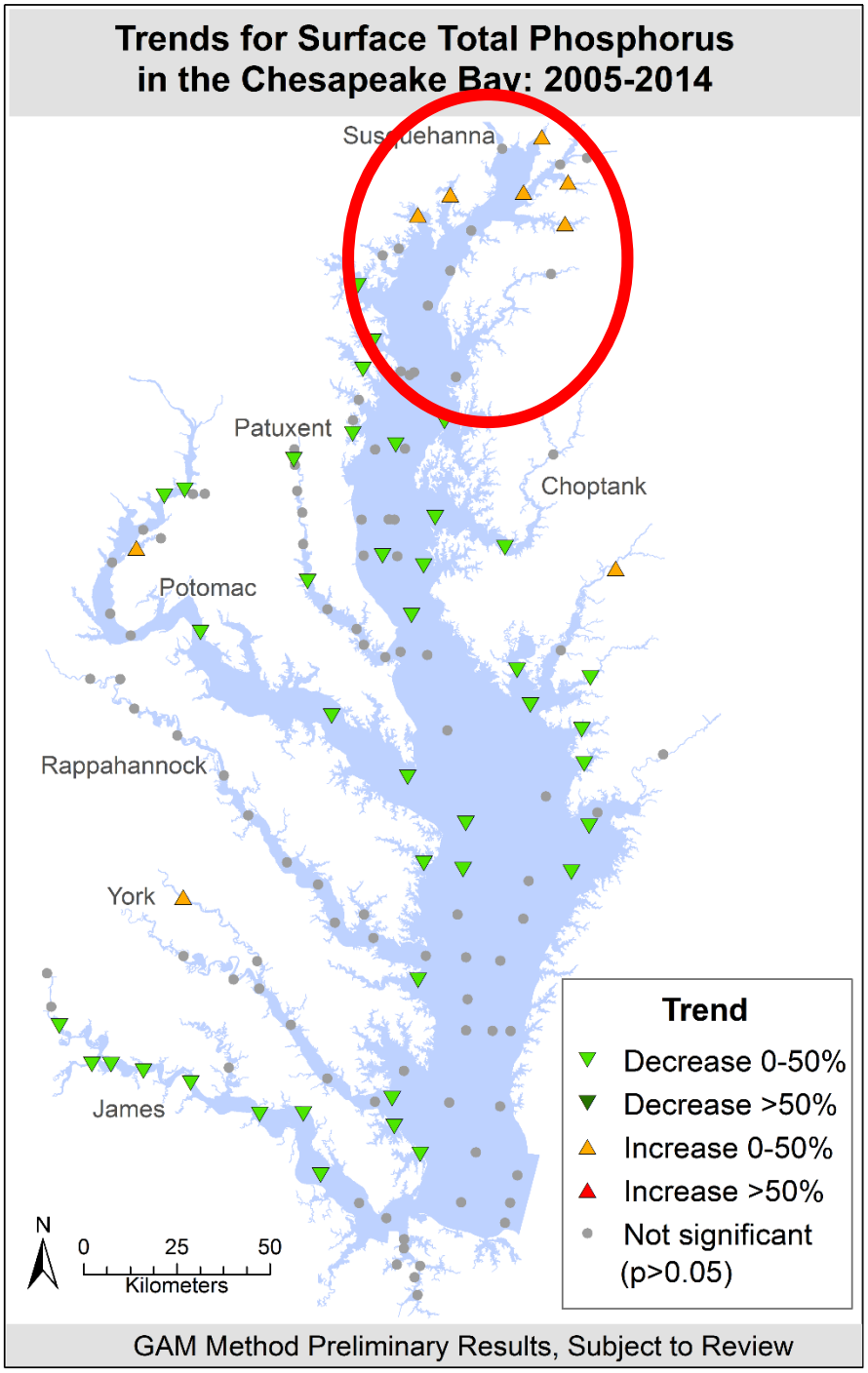
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Potomac
Rappahannock
York
James
N
0
25
50
Kilometers
Trend
Decrease 0-50%
Decrease >50%
Increase 0-50%
Increase >50%
Not significant
(p>0.05)
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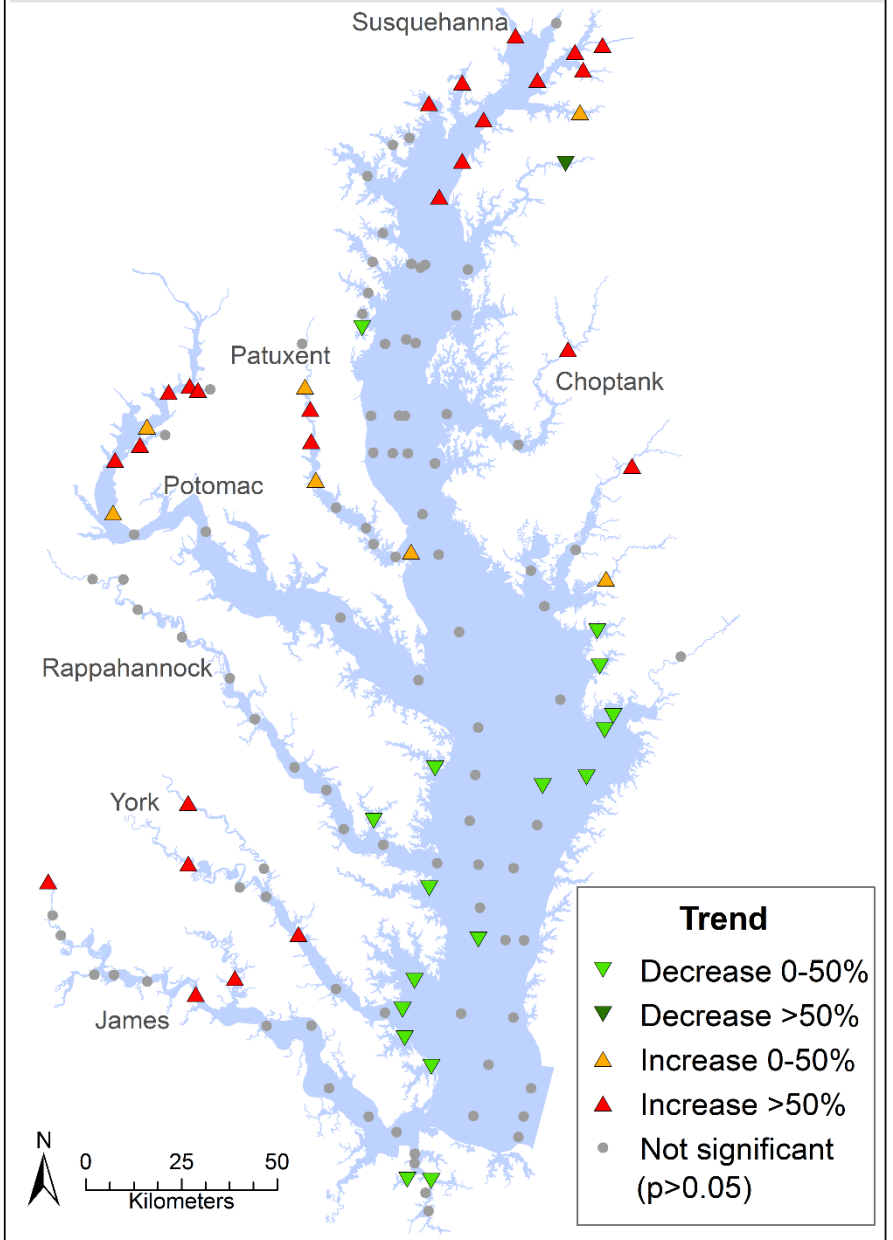
Trends for Surface Chlorophyll-a in the Chesapeake Bay: 2005-2014



GAM Method Preliminary Results, Subject to Review

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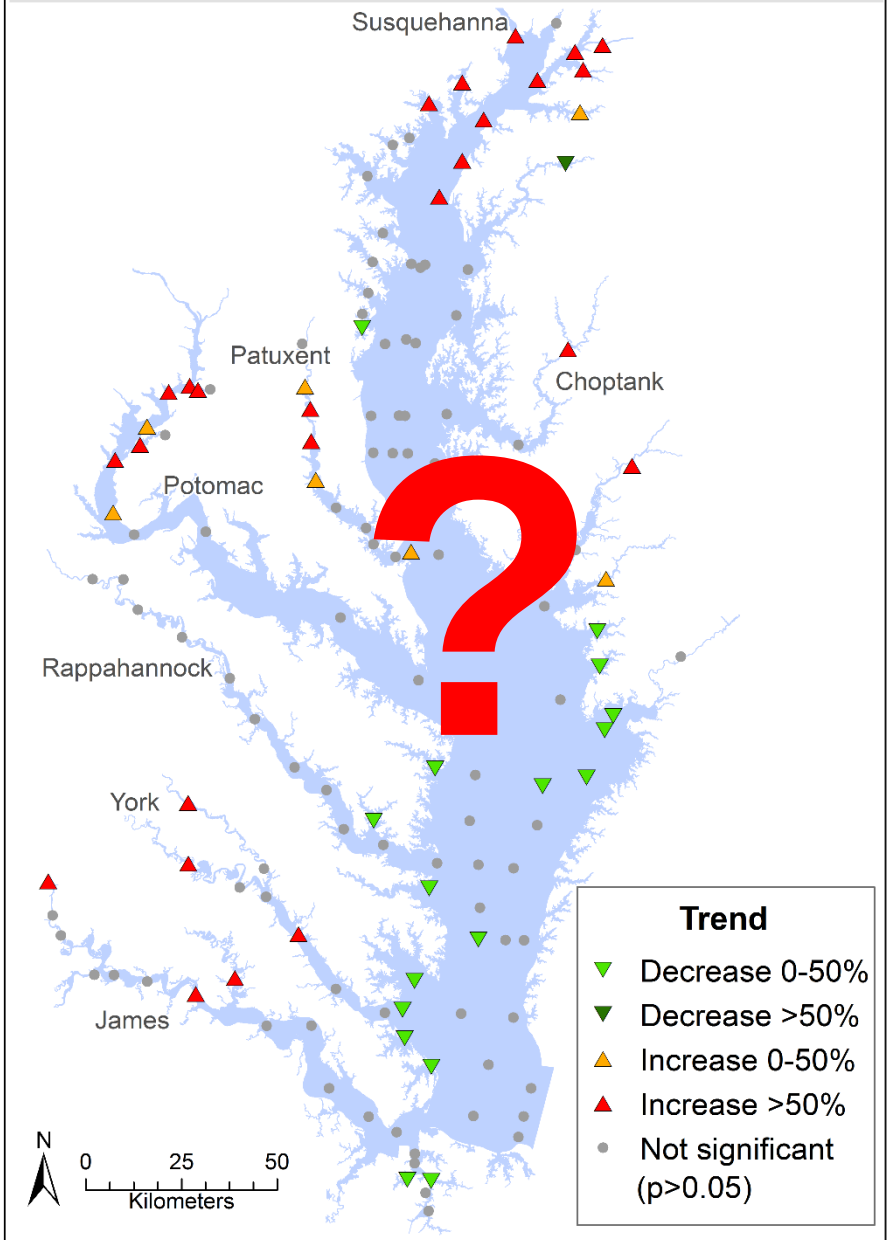
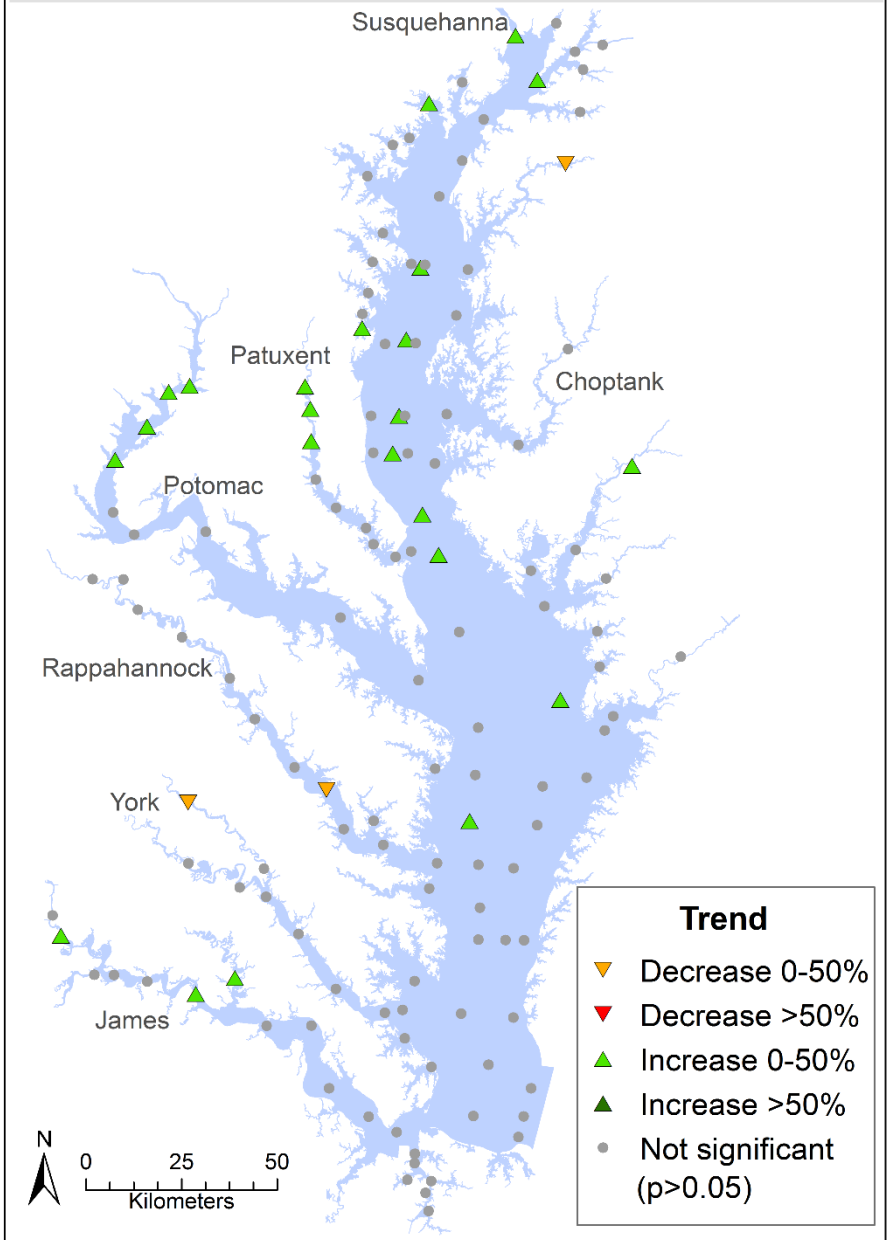


GAM Method Preliminary Results, Subject to Review

Trends for Bottom Dissolved Oxygen in the Chesapeake Bay: 2005-2014



GAM Method Preliminary Results, Subject to Review

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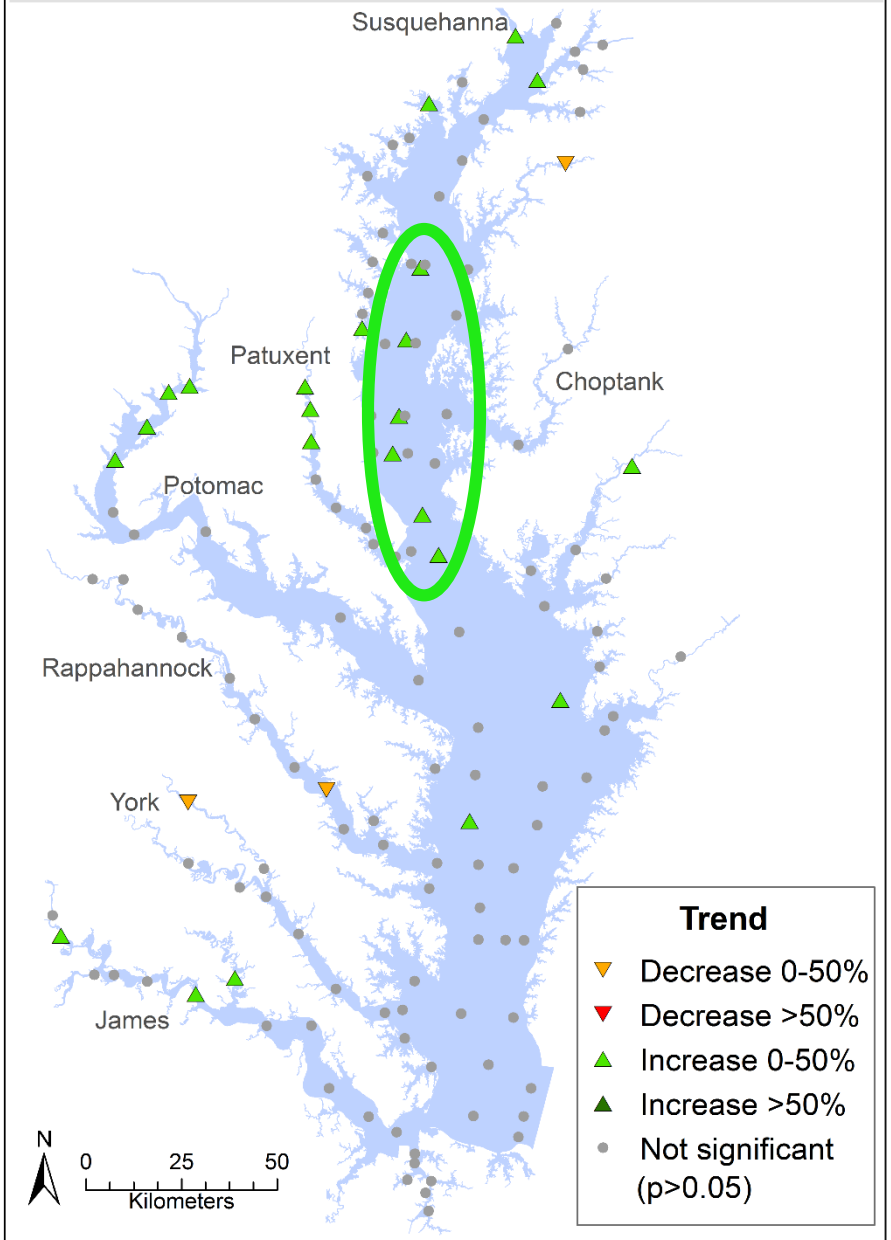
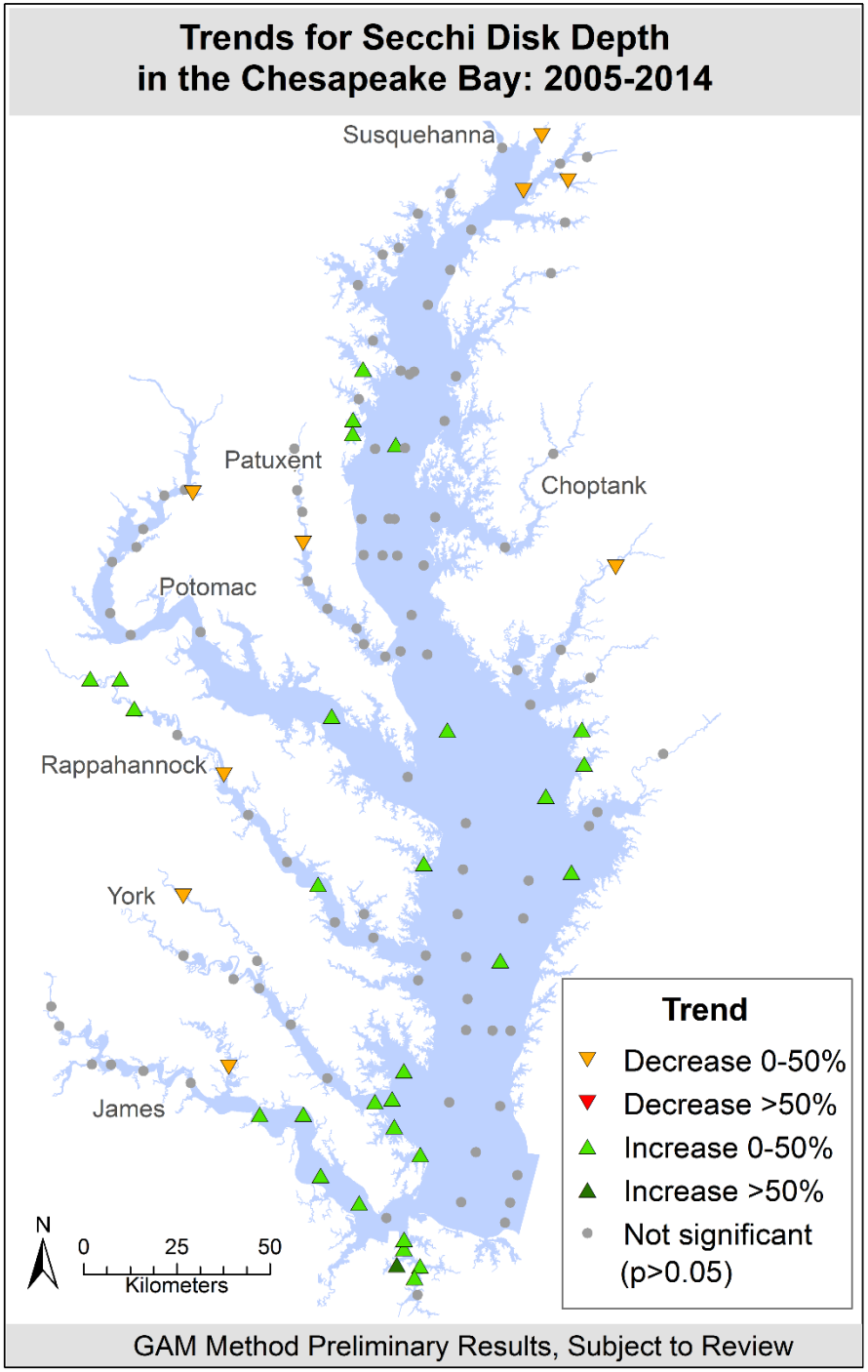
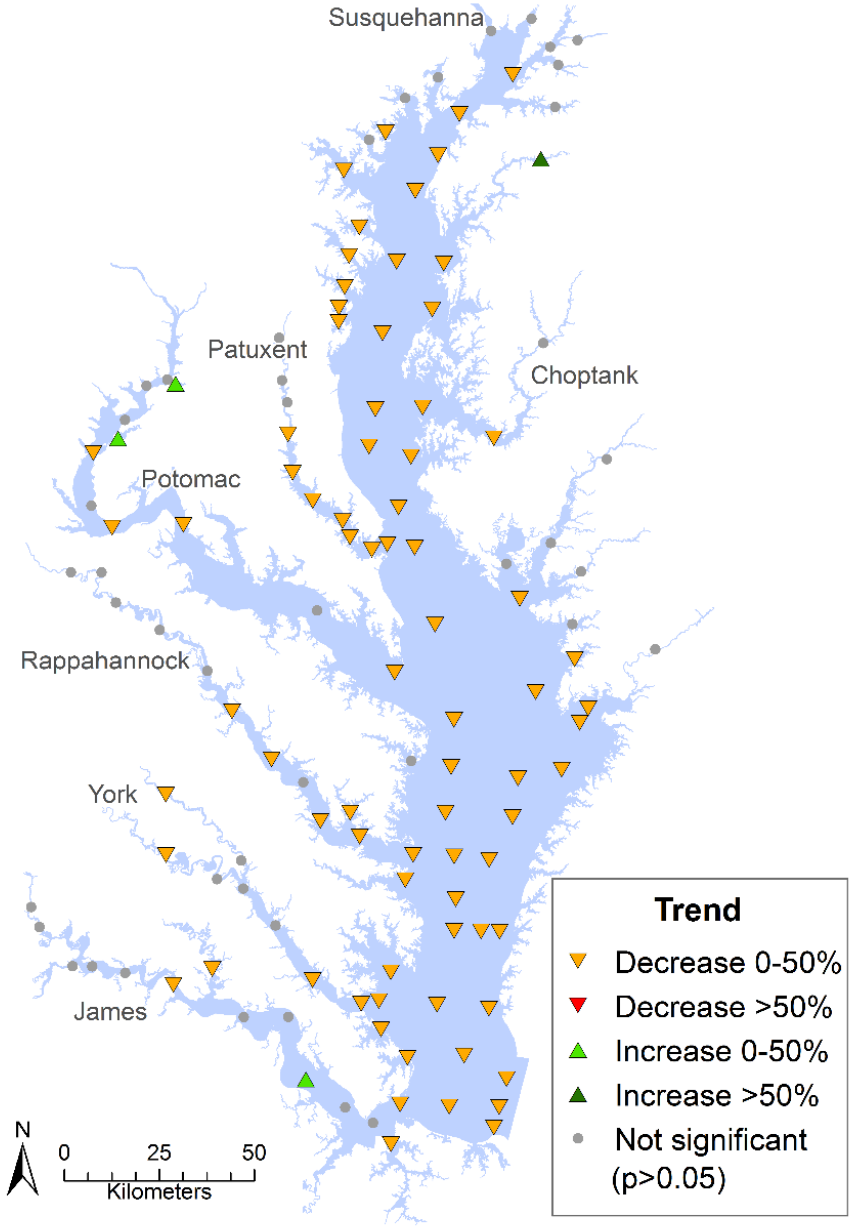


GAM Method Preliminary Results, Subject to Review

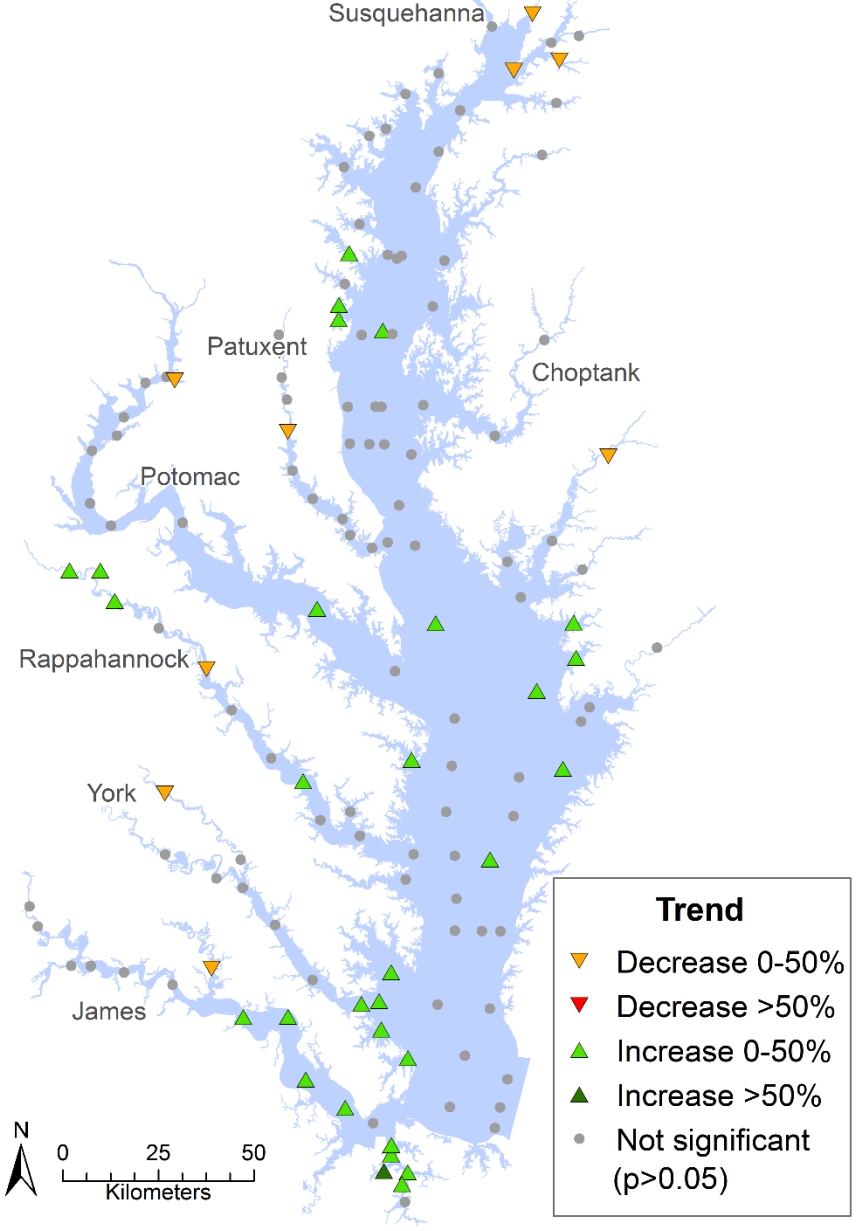

Trends for Secchi Disk Depth
in the Chesapeake Bay: 2005-2014
Susquehanna
Patuxent
Choptank
Potomac
Rappahannock
York
James
N
0
25
50
Kilometers
Trend
Decrease 0-50%
Decrease >50%
Increase 0-50%
Increase >50%
Not significant
(p>0.05)
GAM Method Preliminary Results, Subject to Review

Trends for Secchi Disk Depth in the Chesapeake Bay: 1985-2013



SK Method Results, Subject to Change with GAM Method

Trends for Secchi Disk Depth in the Chesapeake Bay: 2005-2014



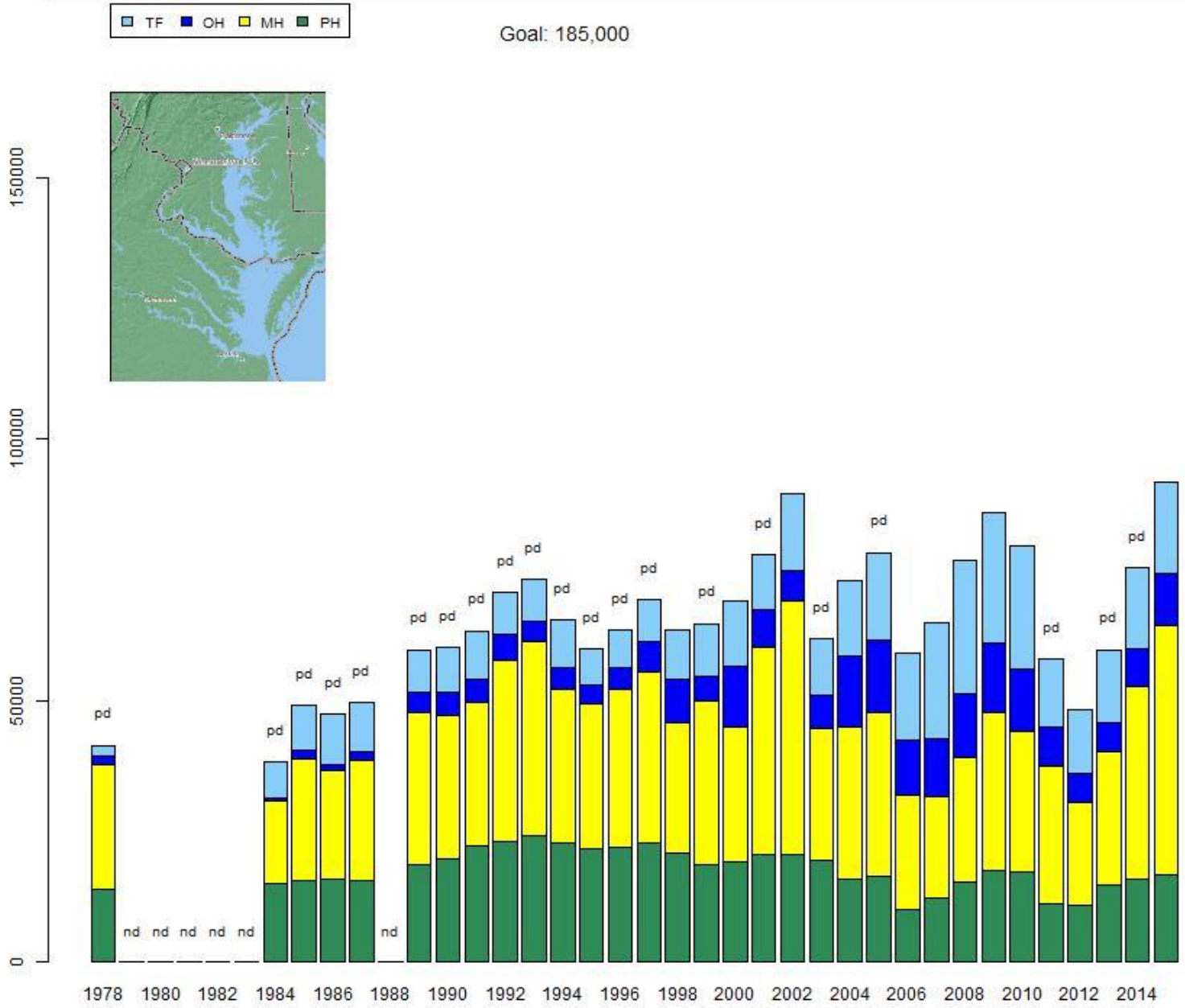
GAM Method Preliminary Results, Subject to Review

Tidal Water Trends:
Feedback/Direction from PSC

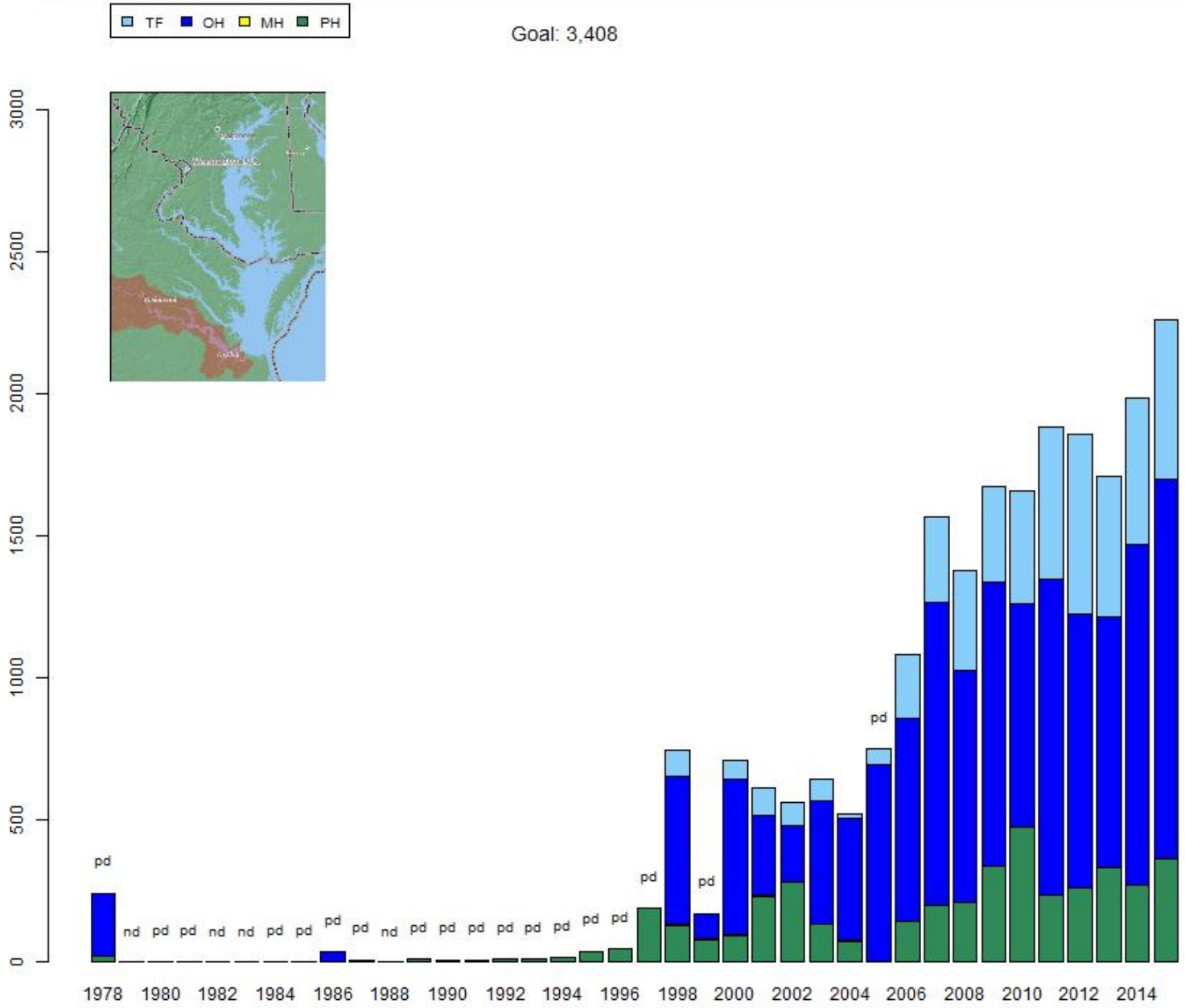
What additional information would you like to see on the following:

- What additional pollutant loads are needed before we see more tidal water quality responses
- What are the time lags for tidal water quality responses to pollutant load reductions from the watershed
- Other questions

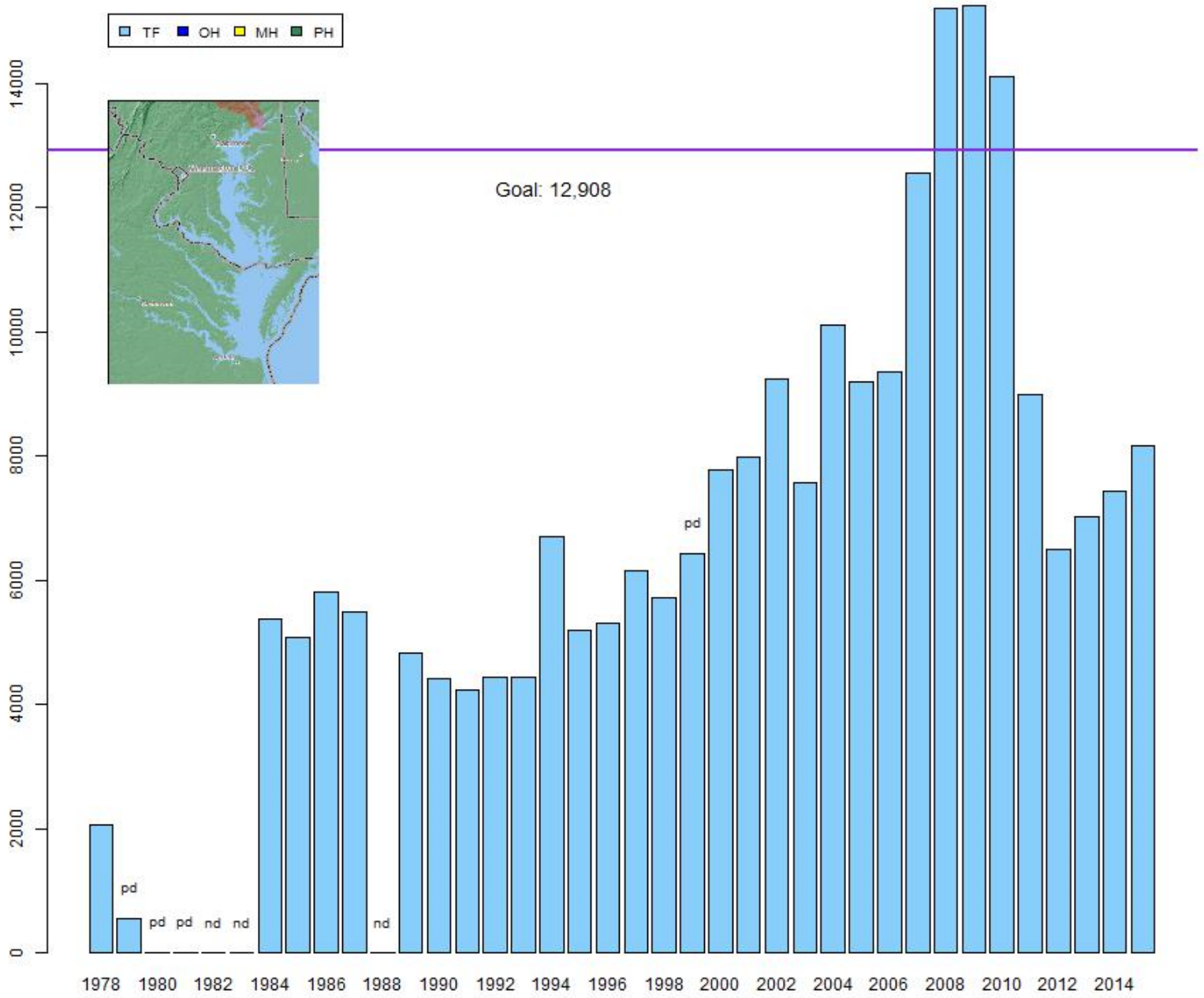
Chesapeake Bay SAV Trends: 1978-2015



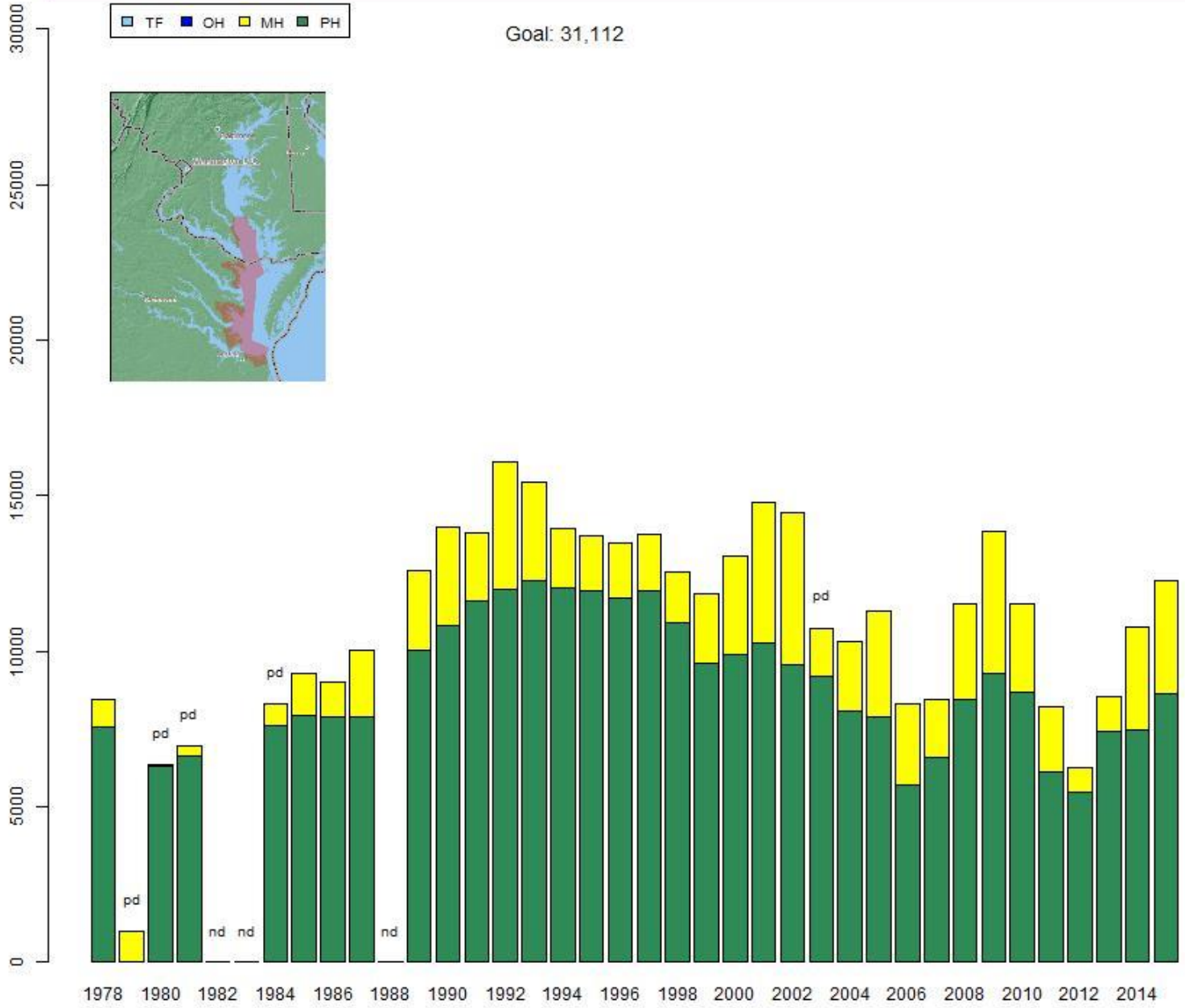
James River SAV Trends: 1978-2015



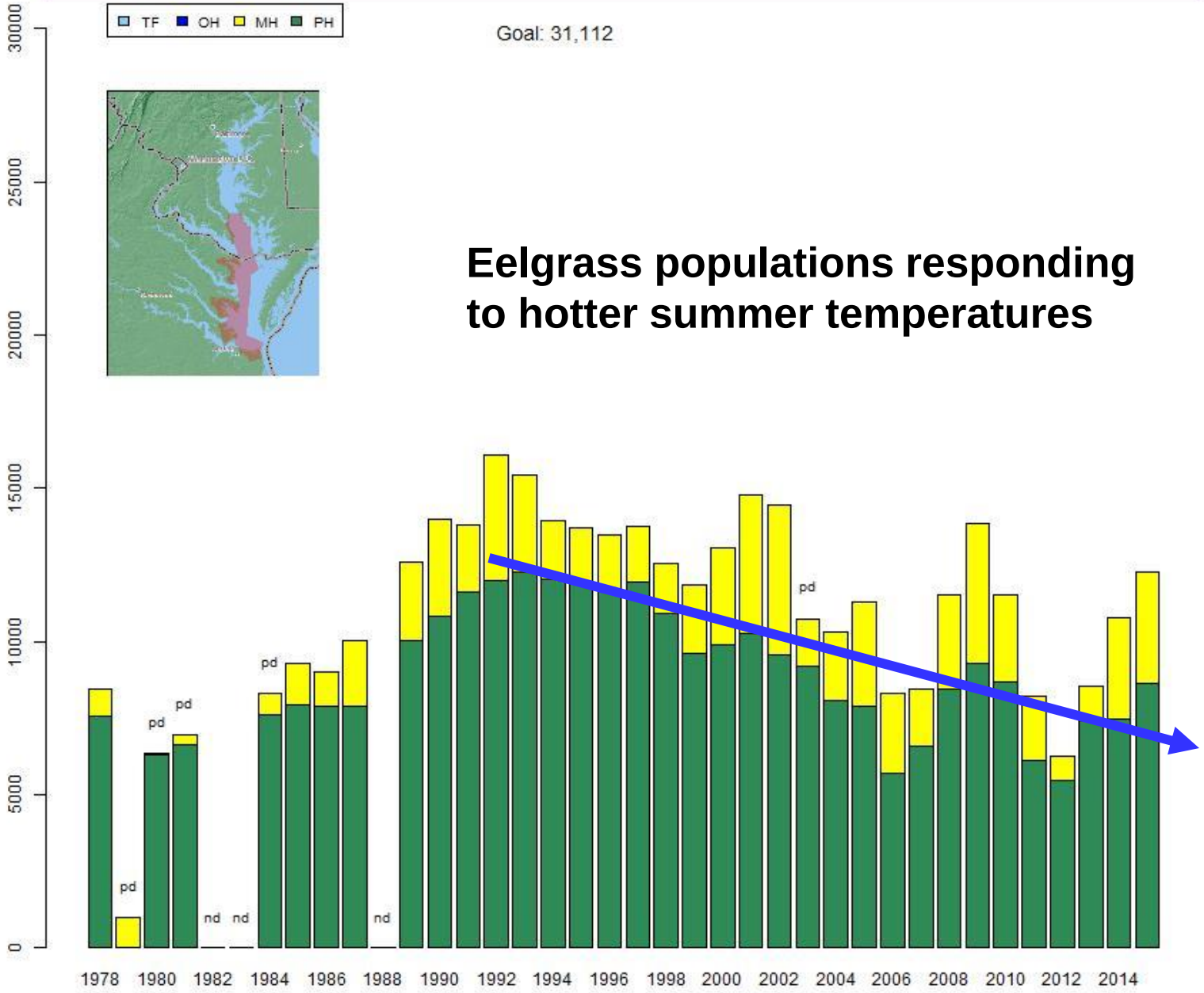
Susquehanna Flats SAV Trends: 1978-2015



Lower Western Shore SAV Trends: 1978-2015



Lower Western Shore SAV Trends: 1978-2015



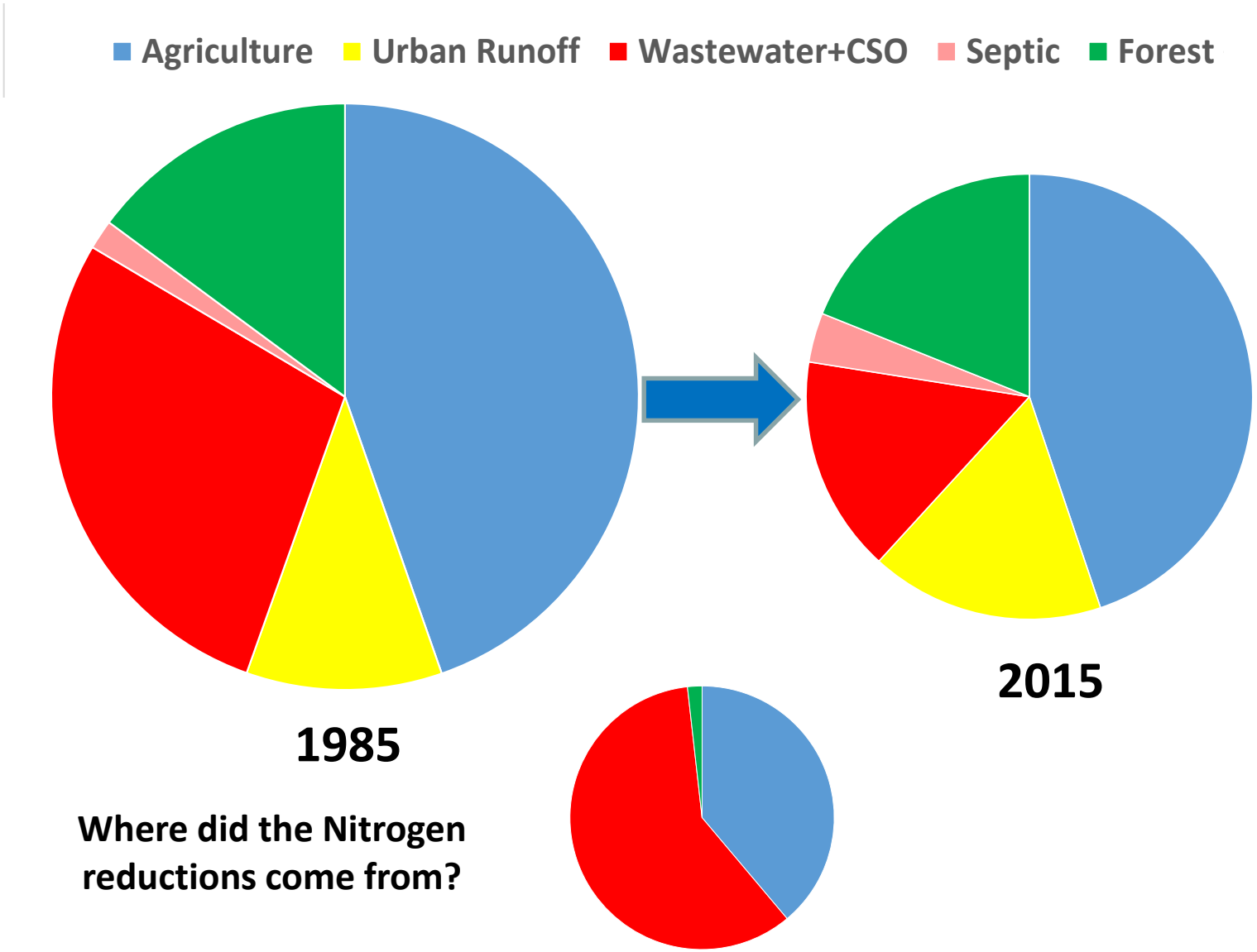
SAV Trends:
Feedback/Direction from PSC

What additional information would you like to see on the following:

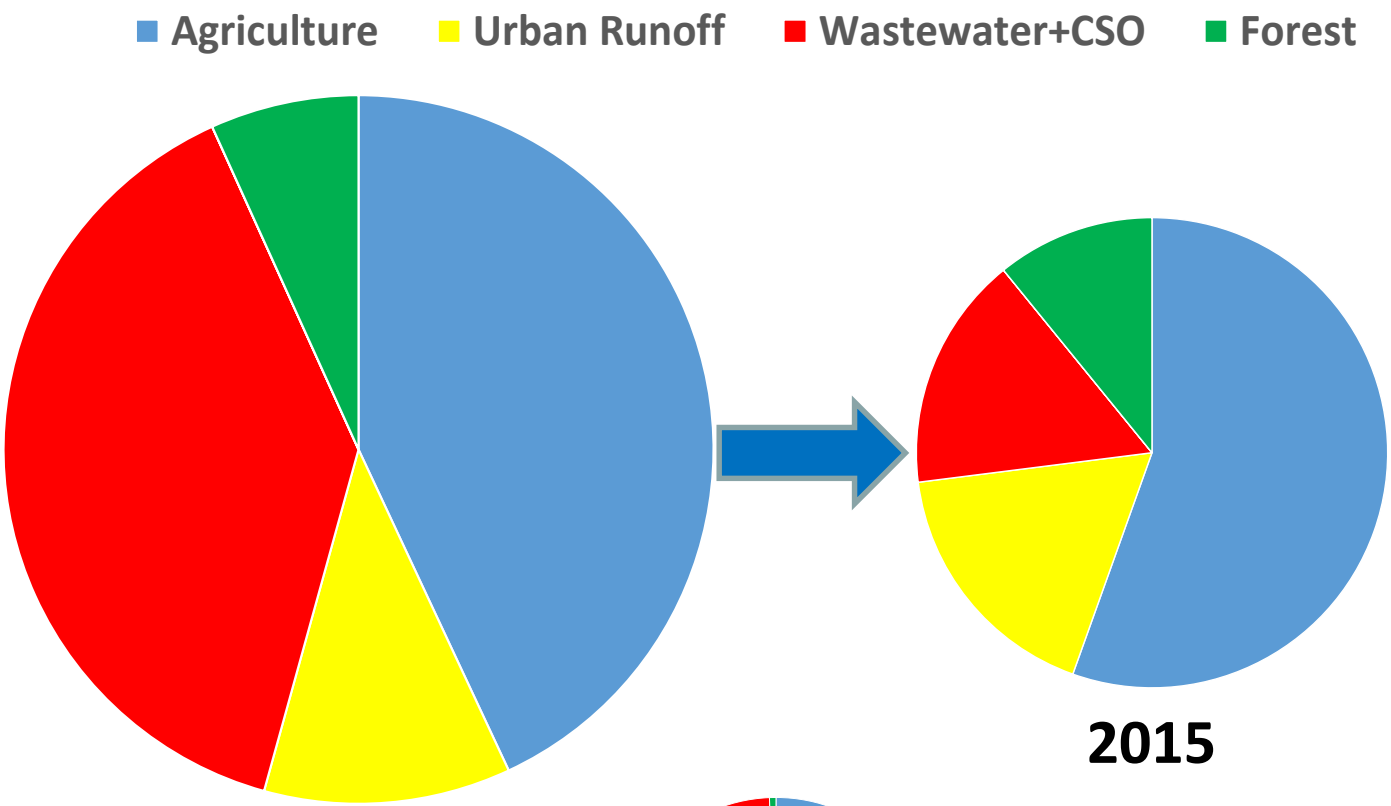
- Local and regional SAV trends over the past 40 years
- Challenge we are facing with fully restoring eelgrass to the Bay
- What additional improvements in water clarity are needed to see the next significant increase in SAV acreages
- Other findings described here

The Changing Shape of Our Watershed Pollutant Sources

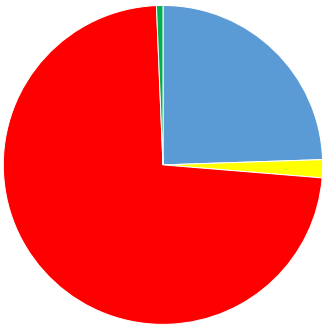
Chesapeake Bay Watershed Nitrogen Loads: 1985-2015



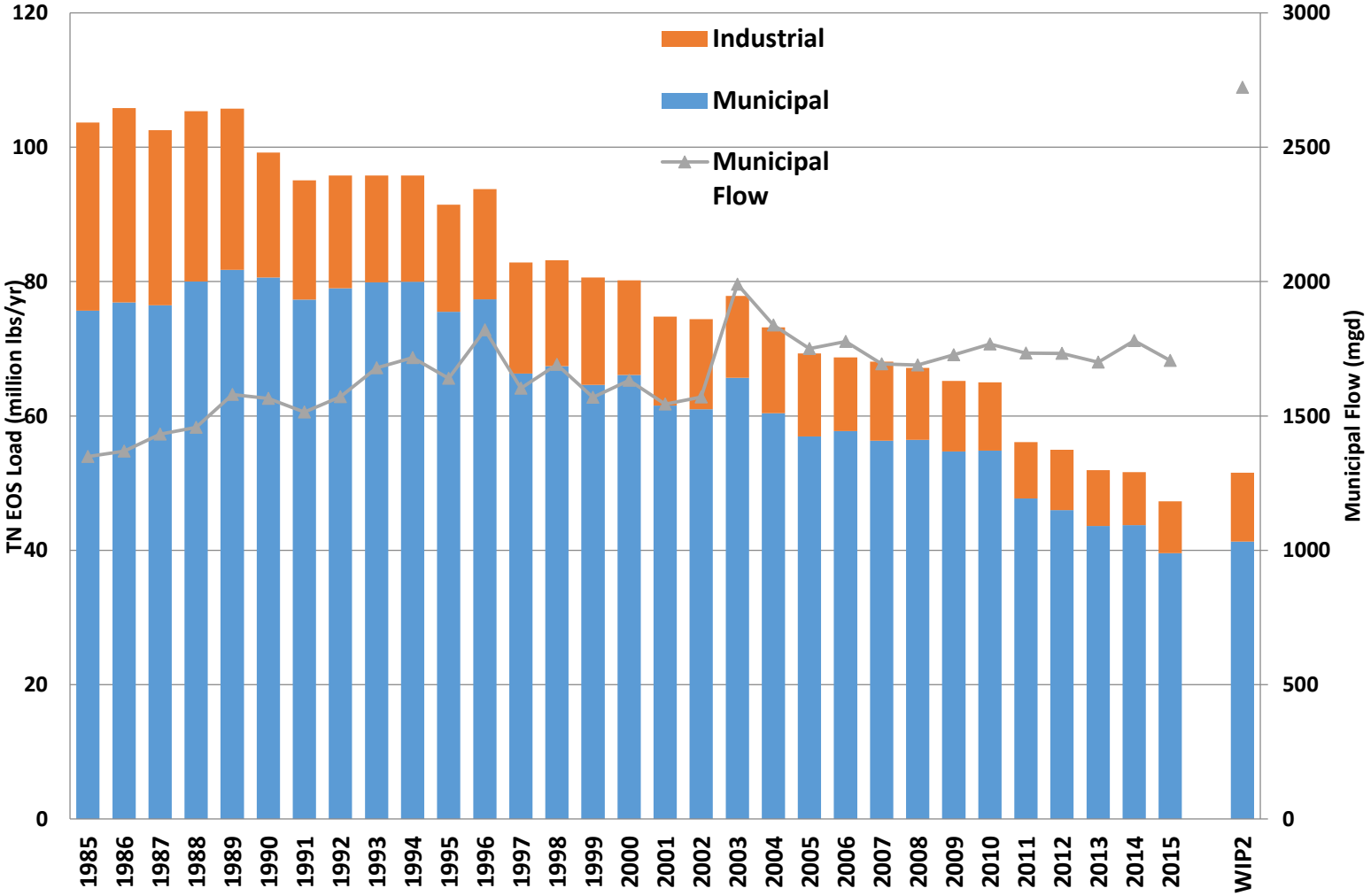
Chesapeake Bay Watershed Phosphorus Loads: 1985-2015

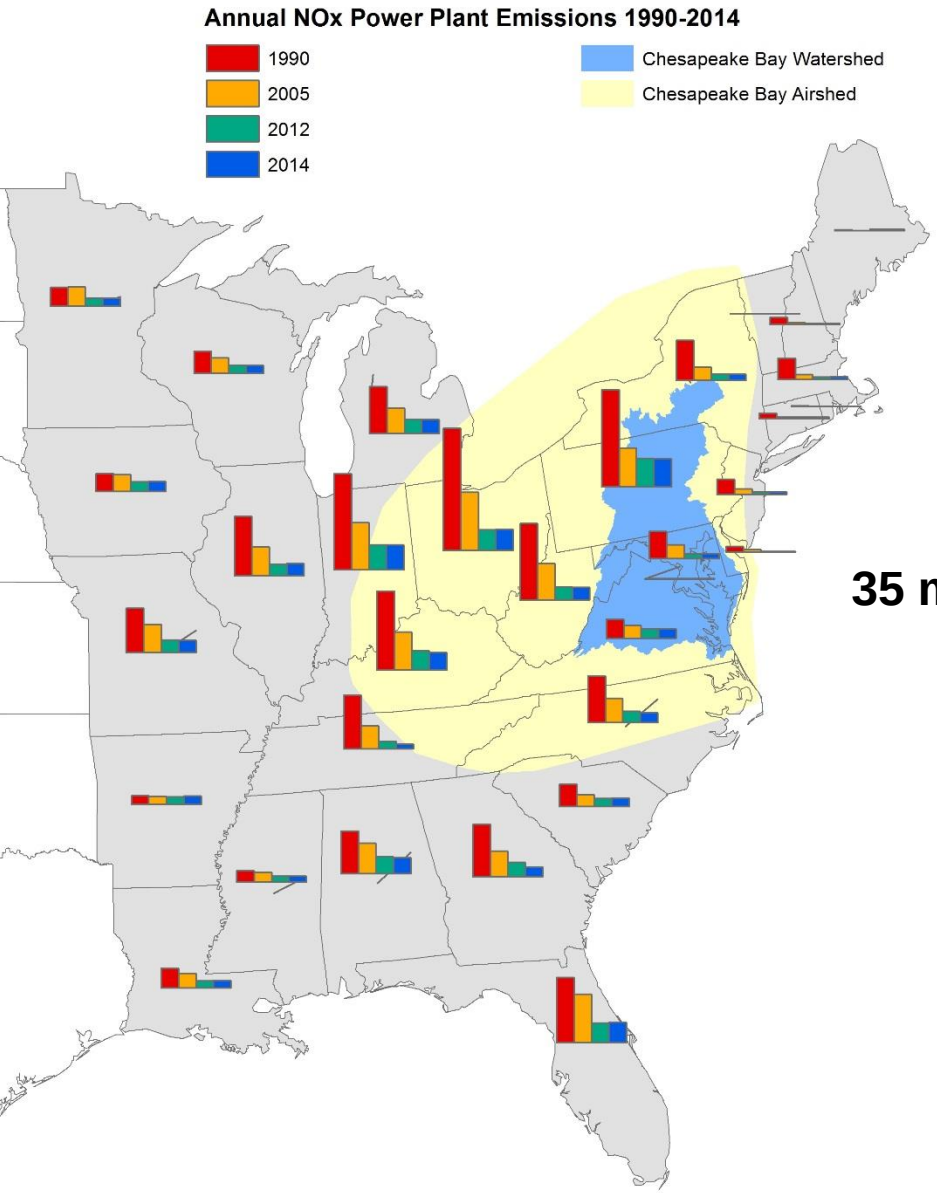


Where did the phosphorus reductions come from?

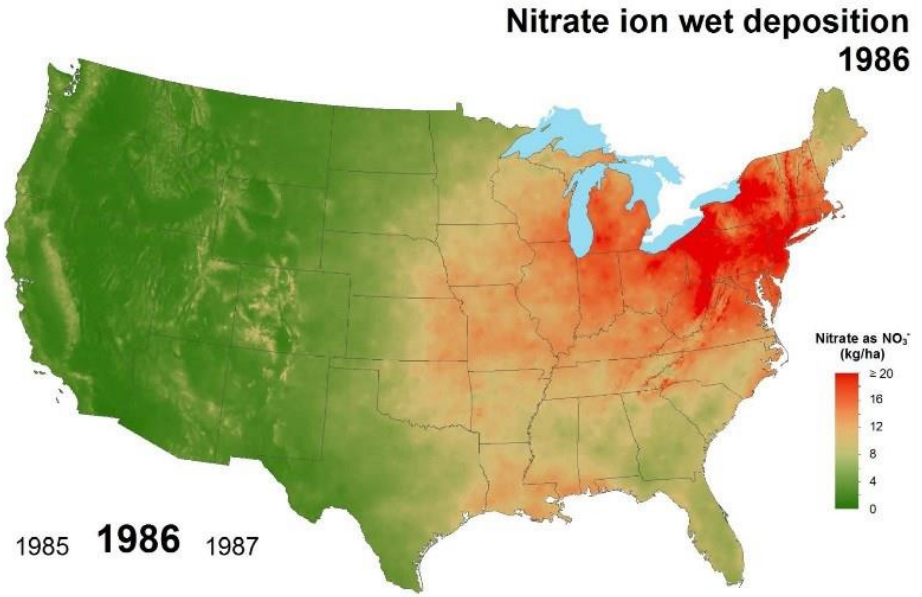


Chesapeake Bay Watershed Municipal and Industrial Wastewater Treatment Facilities Discharged Nitrogen Loads: 1985-2015

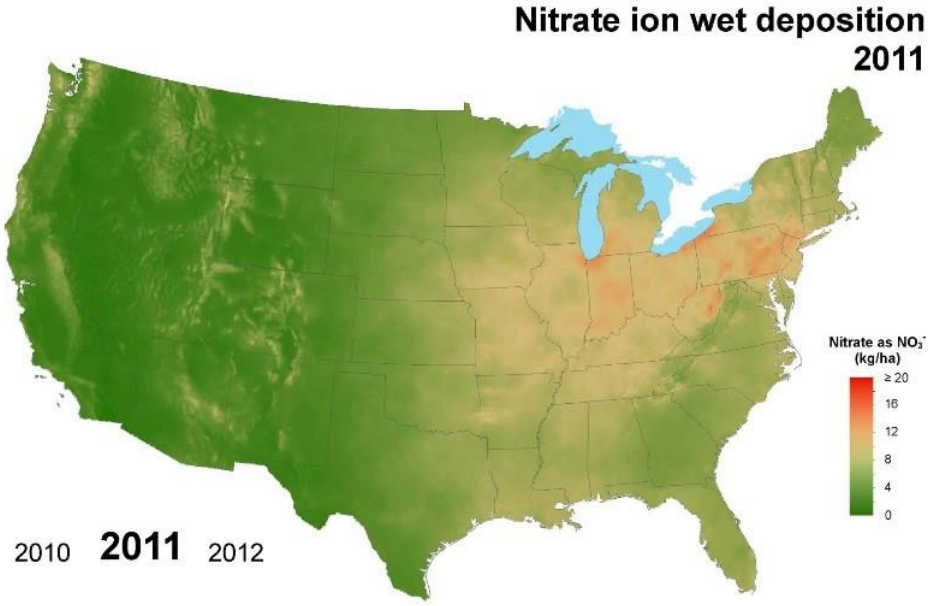




http://gis.chesapeakebay.net/air



35 million lbs. reduction to Bay: 1985-2015



Remaining Source Sectors

- Basinwide, still need to reduce:
  - 49 million lbs of nitrogen
  - 0.9 million lbs of phosphorus
- Based on the Phase II WIPs, agriculture will be responsible for 71 percent of remaining nitrogen load reductions by 2025
- Stormwater currently responsible for 24 percent
- Septic systems responsible for 5 percent

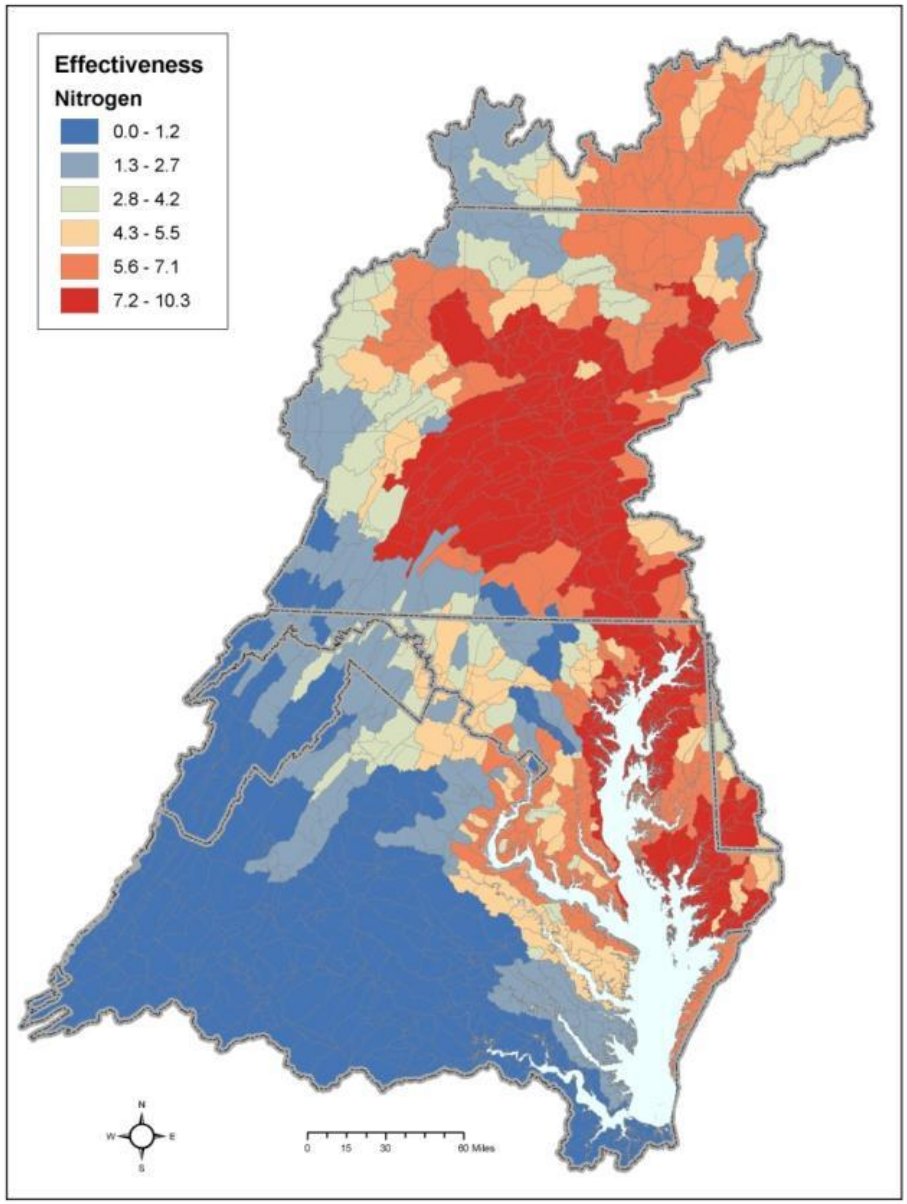
Source Sector Trends:
Feedback/Direction from PSC

What additional information would you like to see on the following:

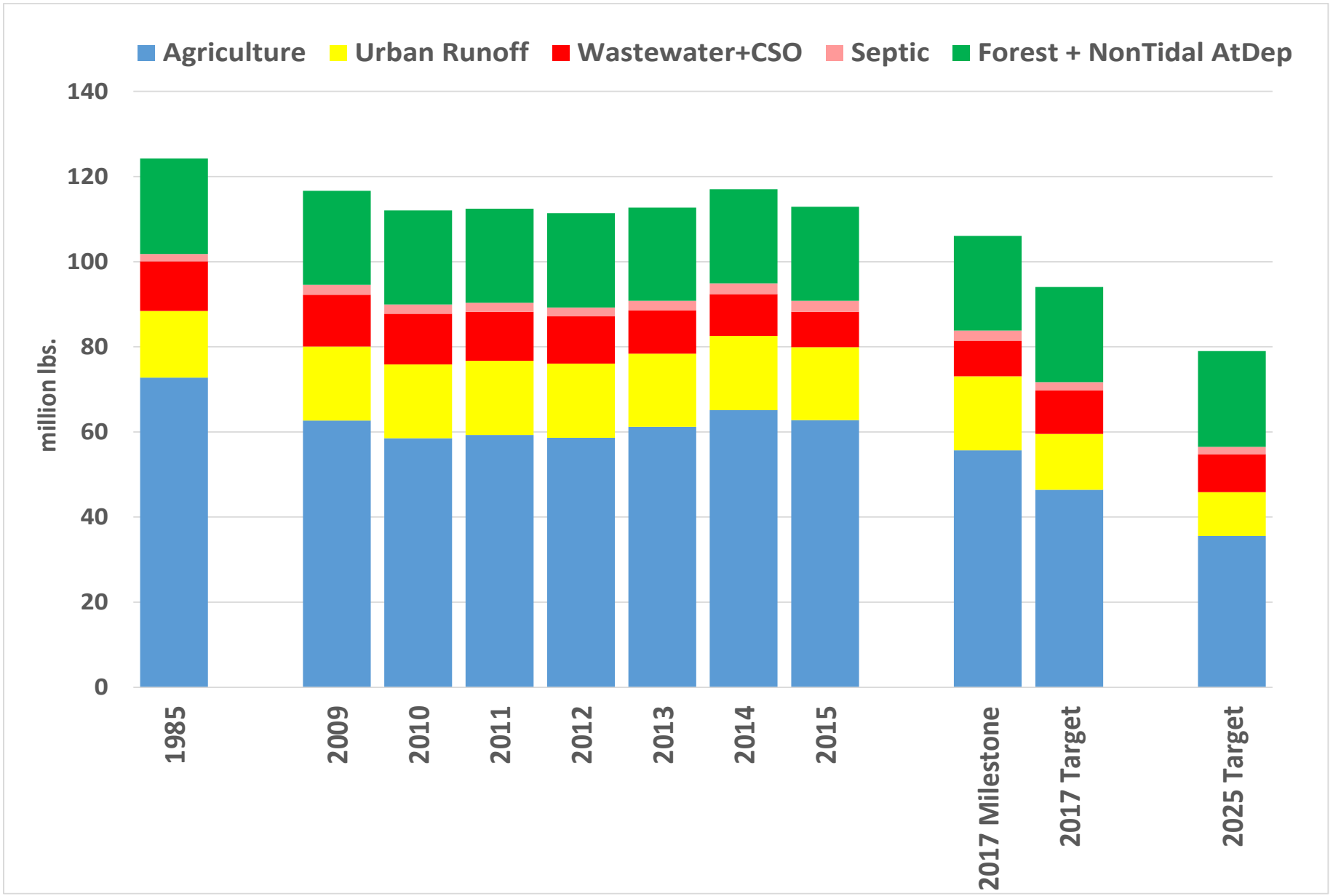
- What additional reductions are coming from the Clean Air Act
- What more is possible from the wastewater sector/from septics
- What further reductions from agriculture are likely by 2025
- What further reductions from urban stormwater are likely by 2025
- Other questions

Resulting Policy Challenges

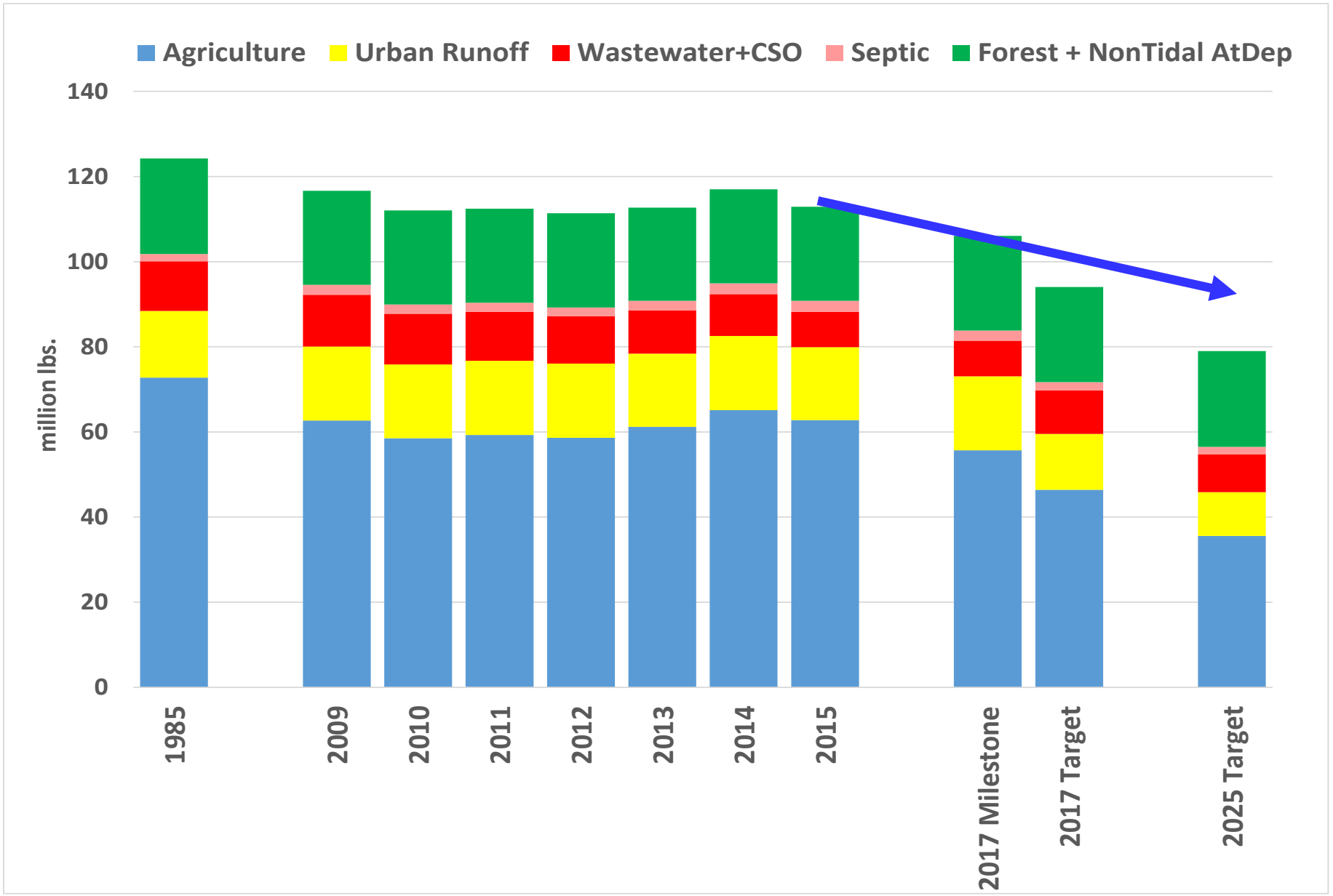
Where Load Reductions Occur Matters



Pennsylvania Nitrogen Loads and Goals: 1985-2025



Pennsylvania Nitrogen Loads and Goals: 1985-2025



Pennsylvania's Challenges

- Needs to reduce 19 million lbs nitrogen by 2017 and 34 by 2025
- Responsible for 69 percent of remaining basinwide nitrogen load reductions by 2025
- Agriculture will likely be responsible for more than 80 percent of these nitrogen reductions given more realistic reductions expected from stormwater and septic systems by 2025

Summary of Challenges

- River input loads flattening out, increasing in the past decade
- Highest yielding areas are in the lower Susquehanna, Eastern Shore, and middle Potomac
- Wastewater, atmospheric dep close to tapped out
- Agriculture being asked for most of the remaining reductions
- Pennsylvania agriculture on the hook for a significant portion of all the remaining reductions
- Phosphorus saturated soils, groundwater lags hinder timely water quality responses