

Chesapeake Bay Nontidal Network Nitrogen and Phosphorus Loads and Trends: An Update of Results through 2018

May 14, 2020

Doug Moyer

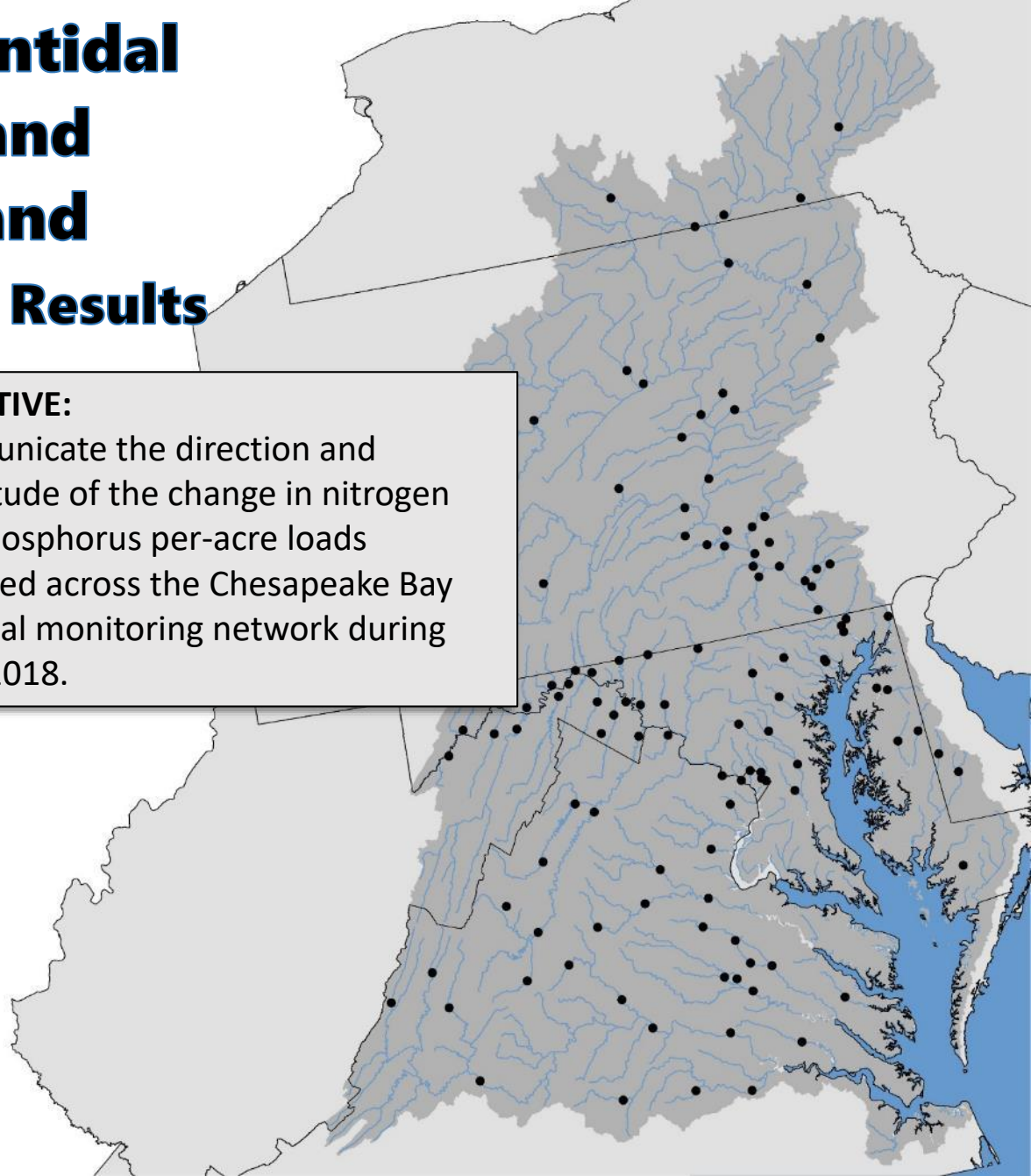
dlmoyer@usgs.gov

Scott Phillips

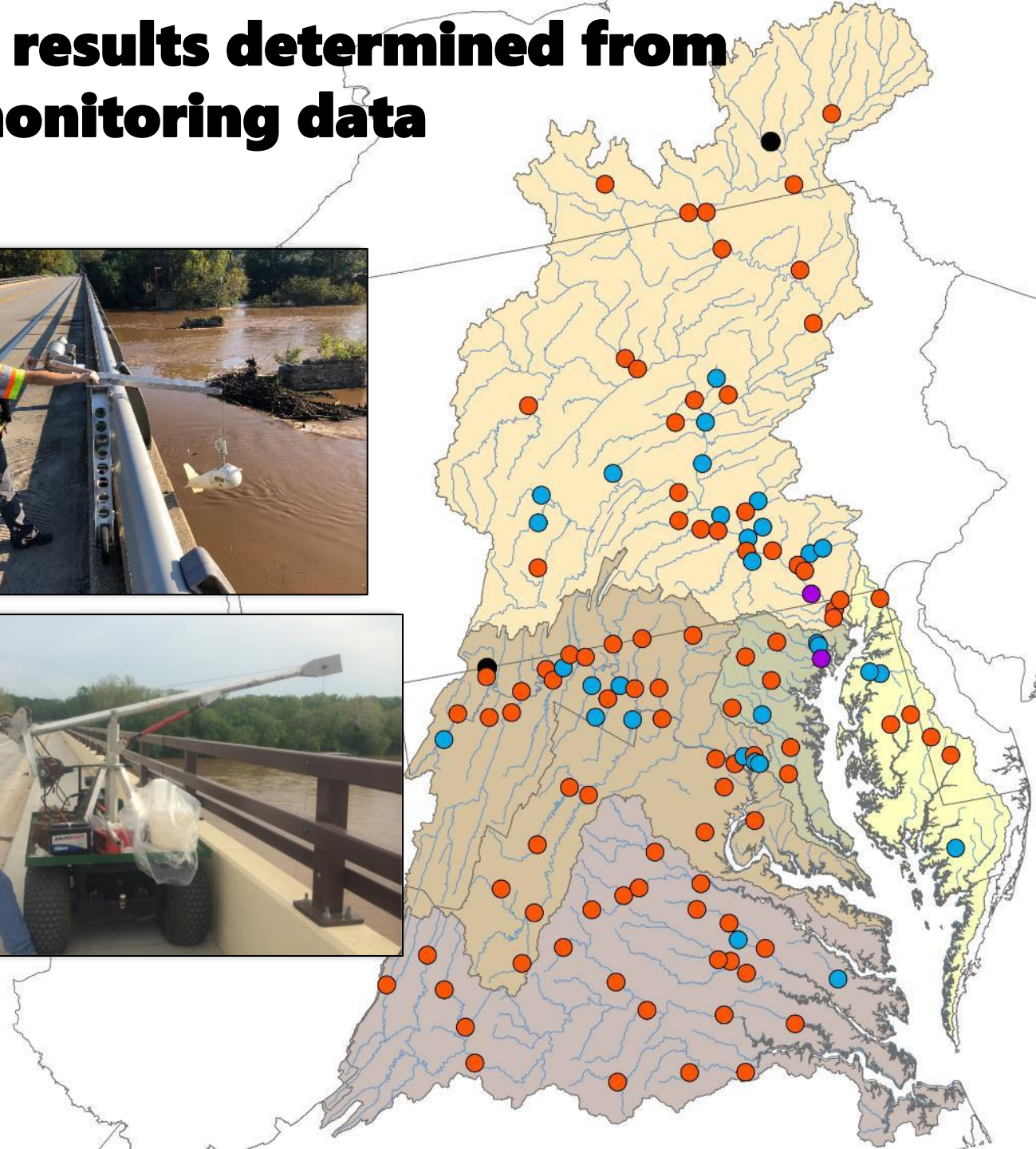
swphilli@usgs.gov

OBJECTIVE:

Communicate the direction and magnitude of the change in nitrogen and phosphorus per-acre loads observed across the Chesapeake Bay Nontidal monitoring network during 2009-2018.



Loads and trend results determined from foundation of monitoring data



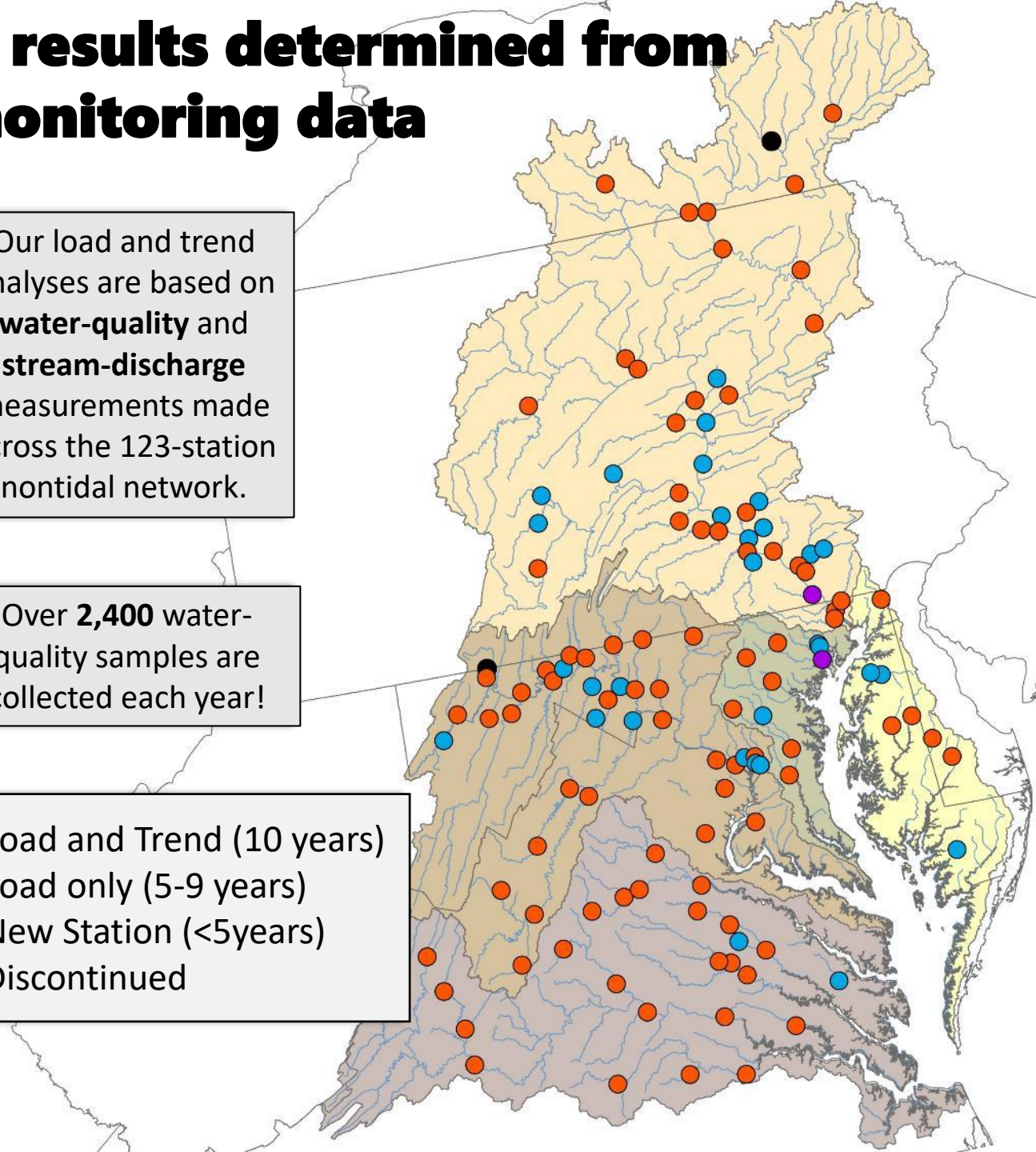
Loads and trend results determined from foundation of monitoring data



Our load and trend analyses are based on **water-quality** and **stream-discharge** measurements made across the 123-station nontidal network.

Over **2,400** water-quality samples are collected each year!

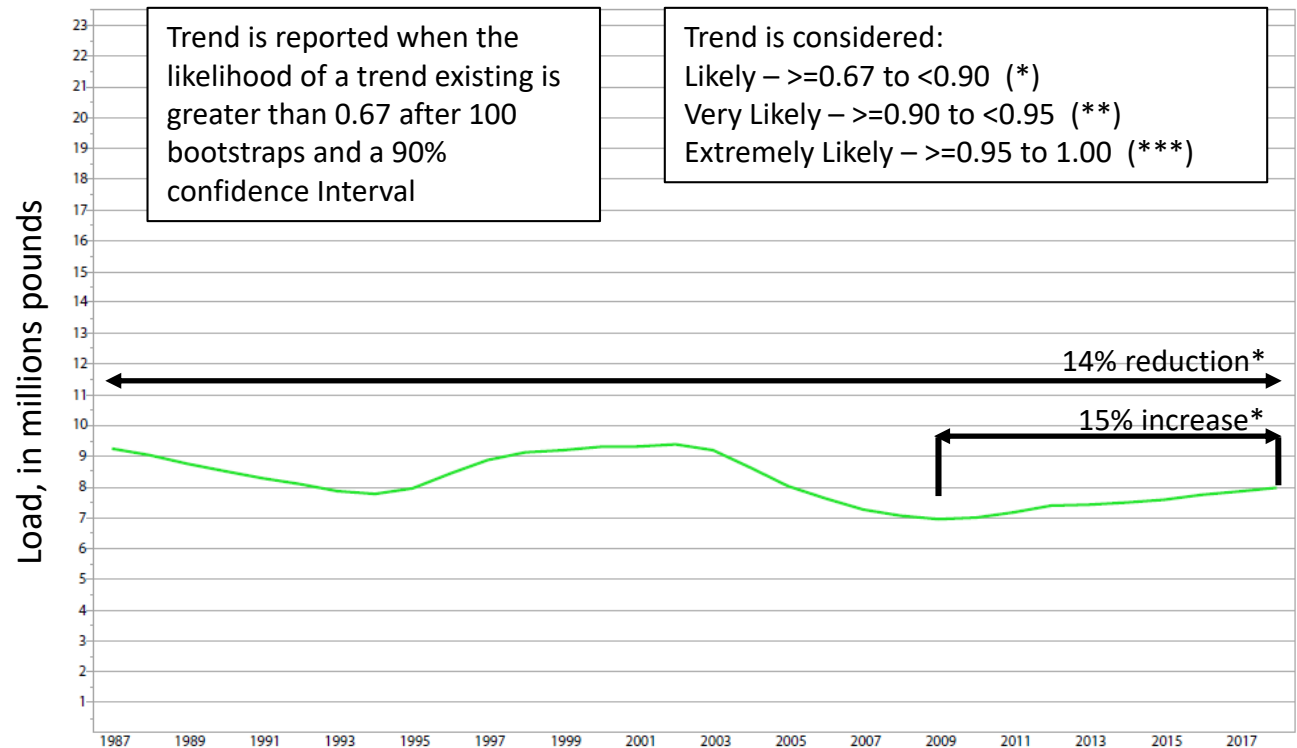
- Load and Trend (10 years)
- Load only (5-9 years)
- New Station (<5years)
- Discontinued



Load and trend results have been computed through 2018 to provide timely information available for decision making

Flow-normalized loads results by removing most of the hydrologic variability associated with loads. Important for understanding water-quality responses to watershed changes response.

Susquehanna River at Marietta: Total Phosphorus



Summary of nitrogen and phosphorous trends: 2009-2018²

Trends in total nitrogen

- 41% of NTN stations showing reductions in nitrogen loading (median change 7%)
- 40% of the NTN stations showing degradation in nitrogen loading (median change 10%)
- Good news – Majority of improvements occur in agricultural areas of the lower Susquehanna and Potomac.

Trends in total phosphorus

- 44% of NTN stations showing reductions in phosphorus loading (median change 15%)
- 32% of the NTN stations showing degradation in phosphorus loading (median change 28%)
- 12 of 18 stations in the Potomac watershed are showing significant reductions; no stations are showing degradation
- Continued degradation in the high loading areas of the lower Susquehanna and Eastern Shore

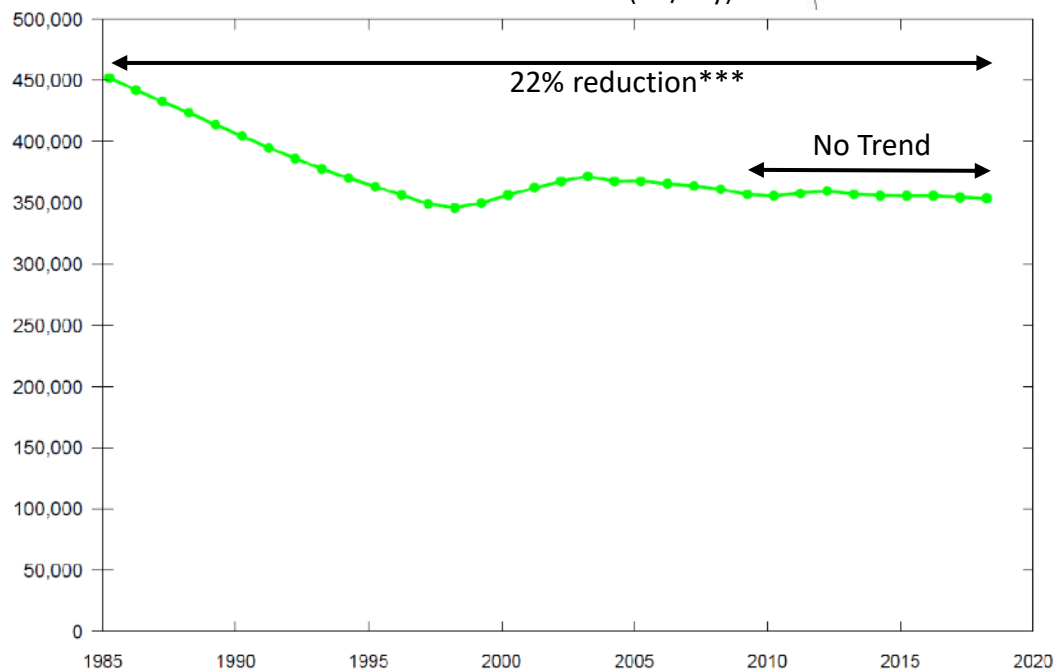


Trends in nitrogen loads result from changing nitrogen inputs or transport

River Input Monitoring Station:

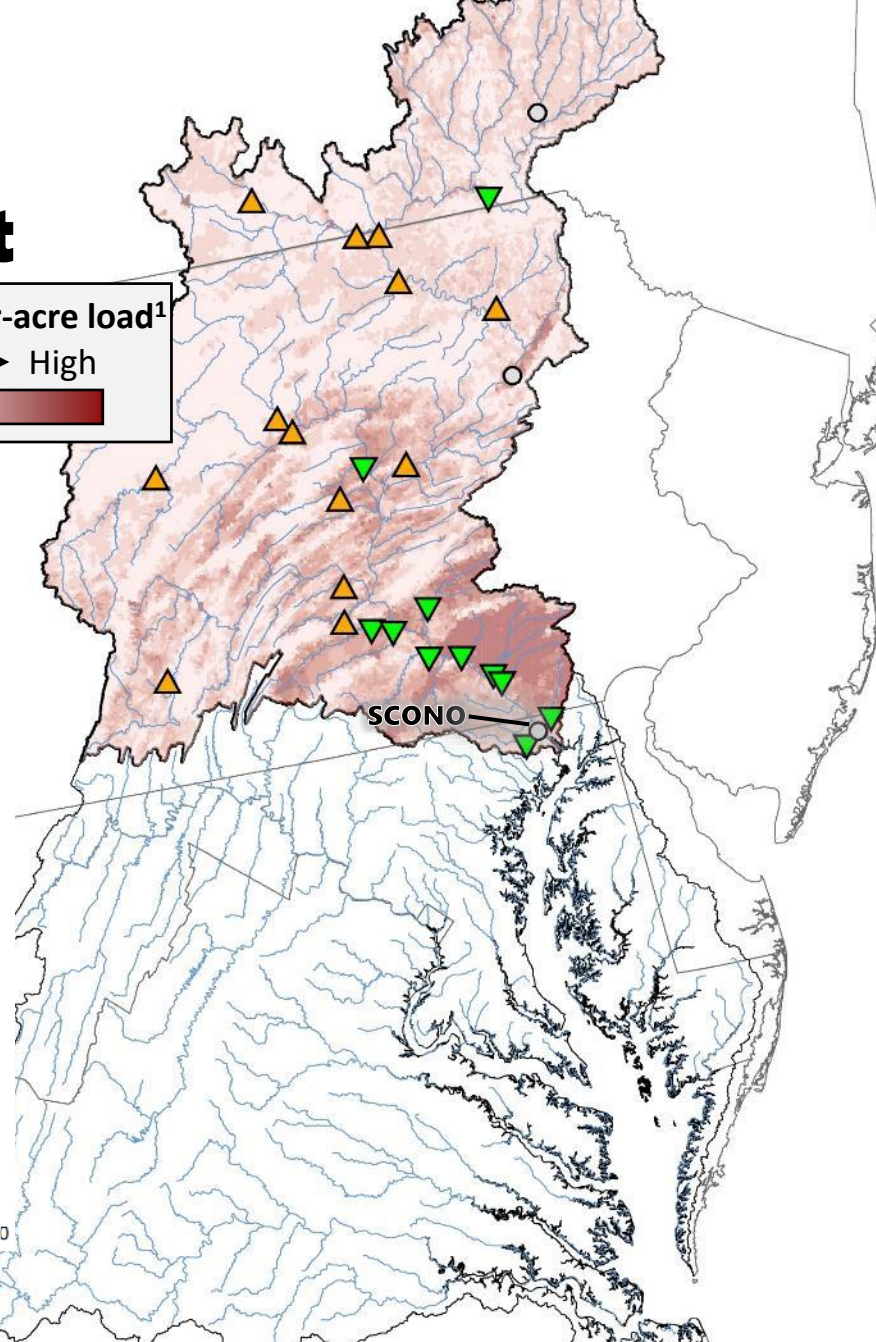
Susquehanna River at Conowingo

Flow Normalized Load (lbs/day)



Nitrogen per-acre load¹

Low → High

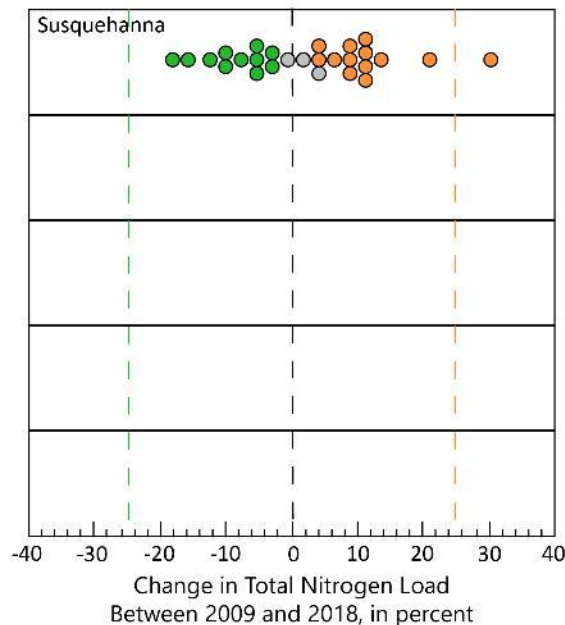


Trends in nitrogen loads result from changing nitrogen inputs or transport

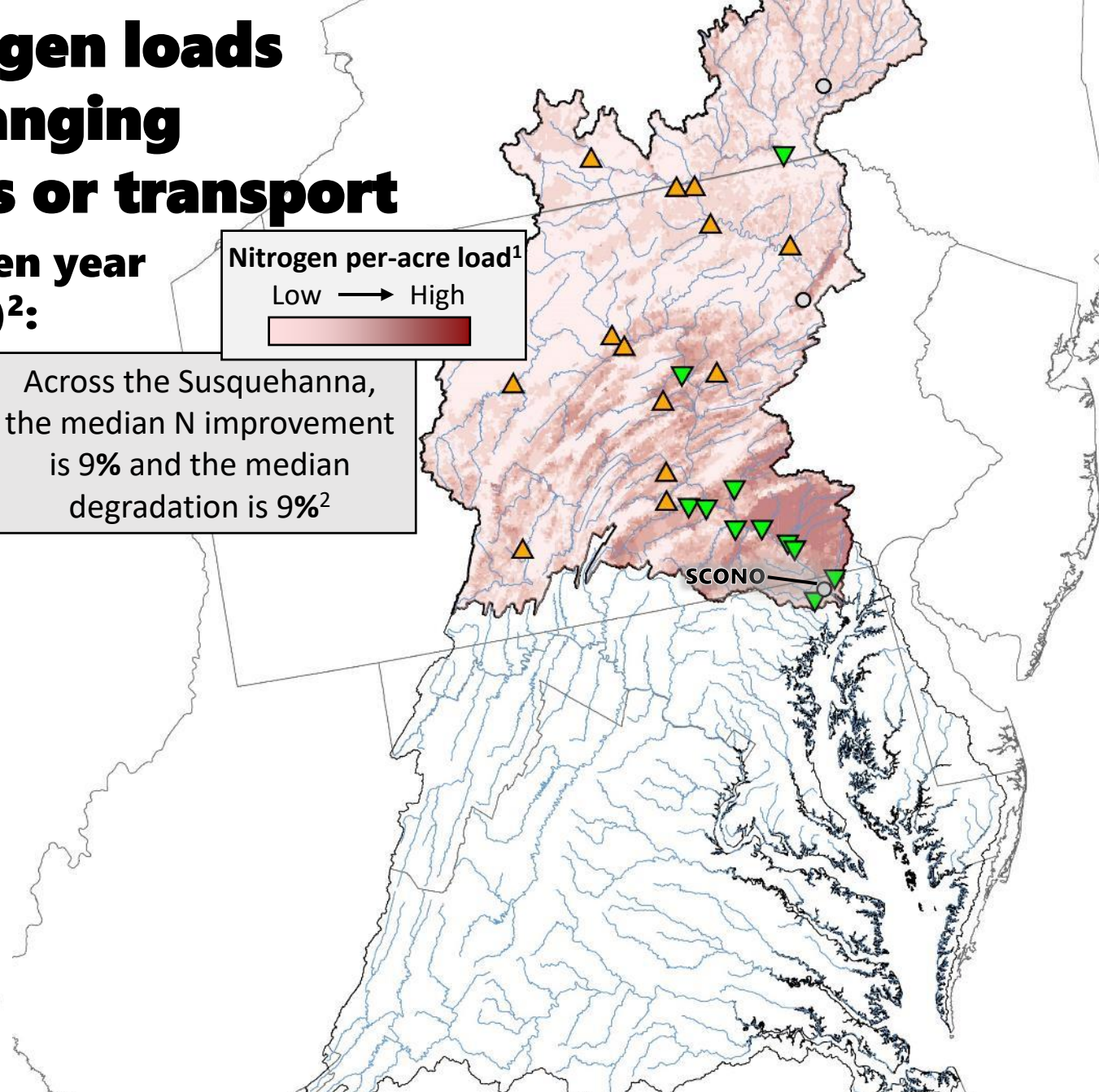
In the most recent ten year period (2009 – 2018)²:

Nitrogen loads (**n=27**) have improved at **11**, degraded at **13**, and have no trend at **3** stations².

Across the Susquehanna, the median N improvement is 9% and the median degradation is 9%²



Nitrogen per-acre load¹
Low → High

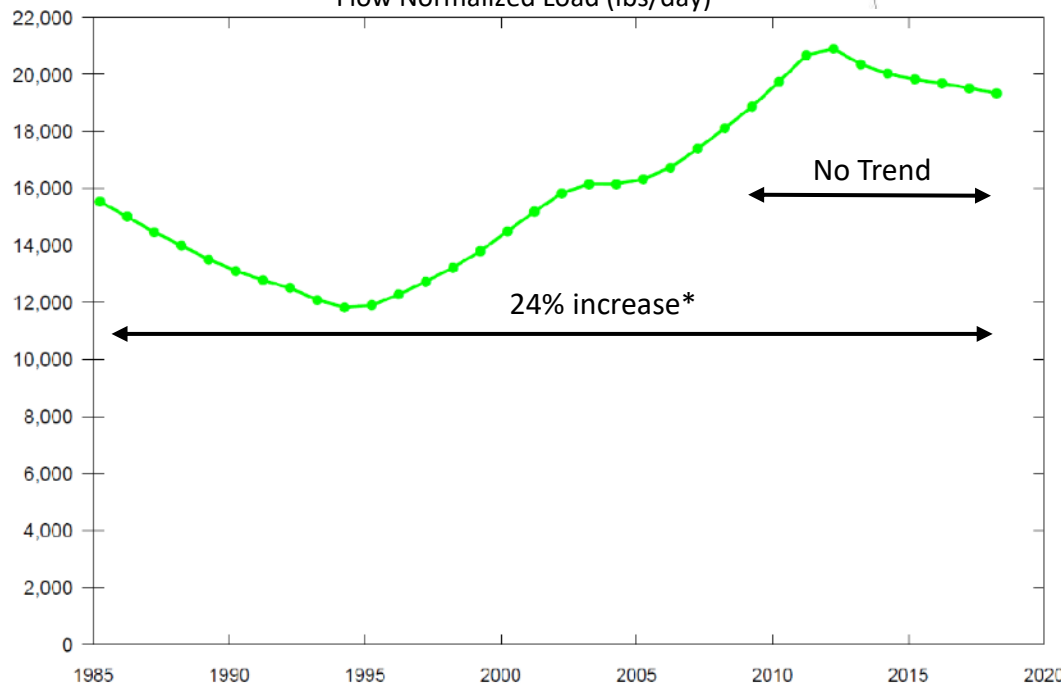


Trends in phosphorus loads result from changing phosphorus inputs or transport

River Input Monitoring Station:

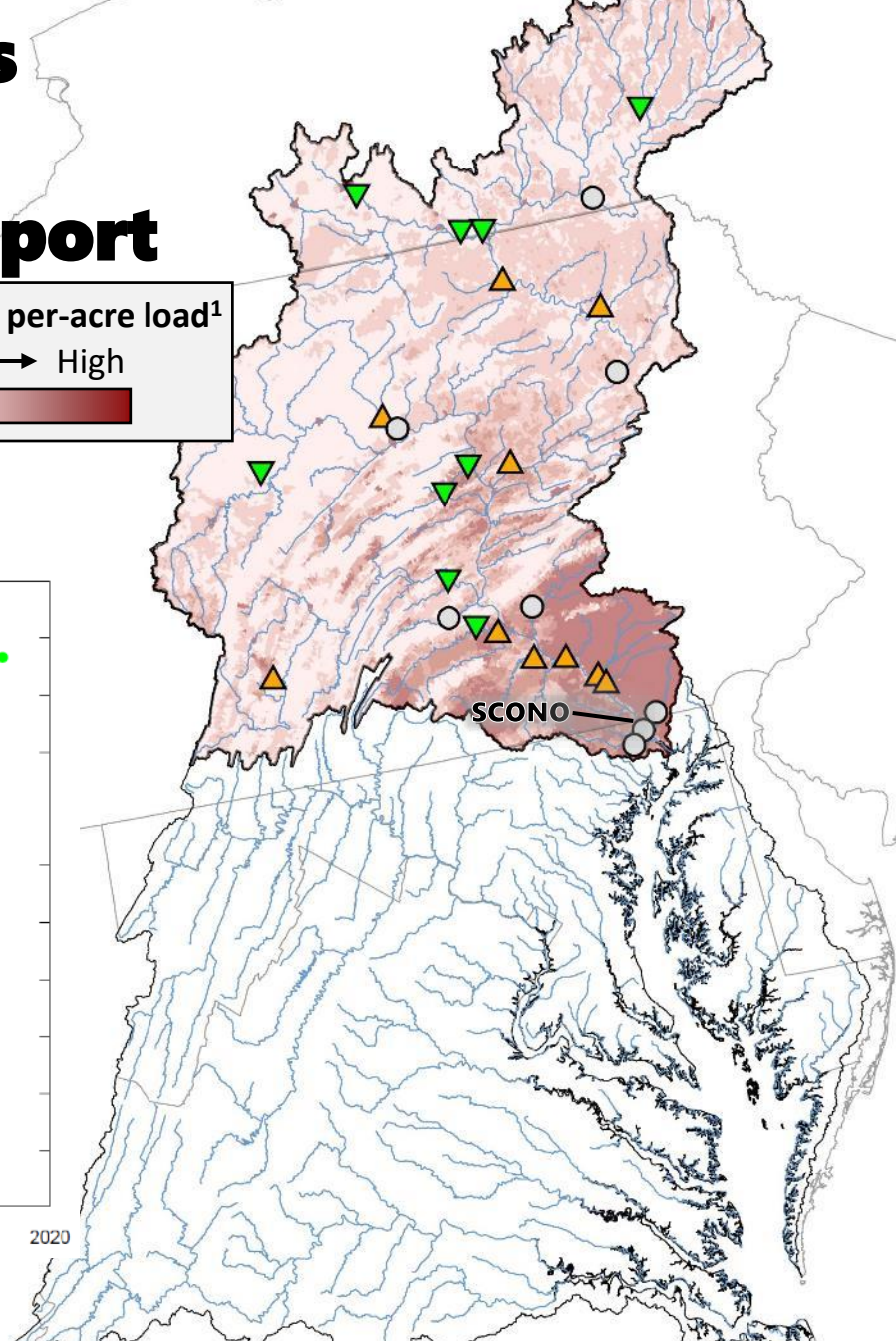
Susquehanna River at Conowingo

Flow Normalized Load (lbs/day)



Phosphorus per-acre load¹

Low → High



Trends in phosphorus loads result from changing phosphorus inputs or transport

In the most recent ten year period (2009 – 2018)²:

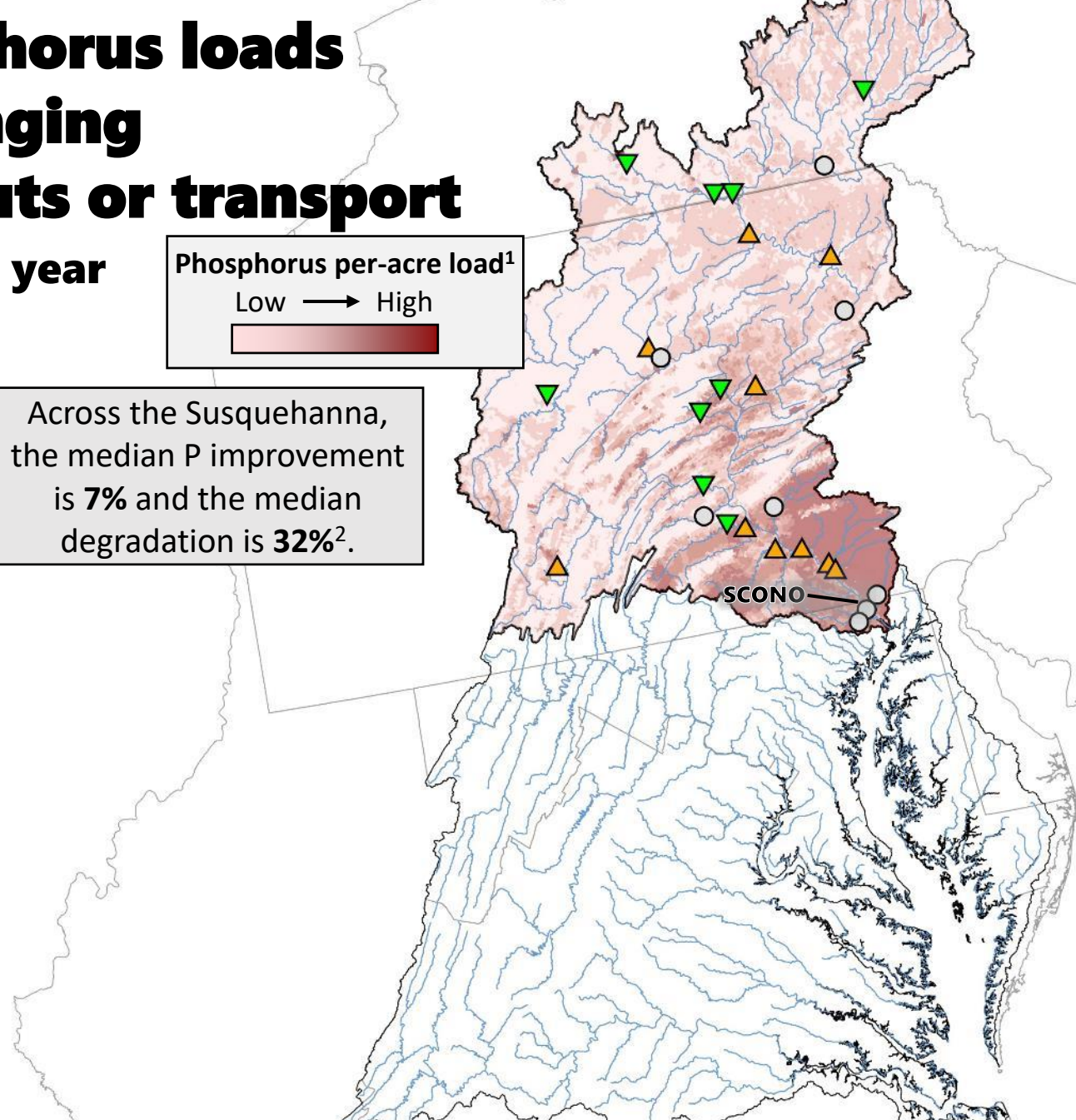
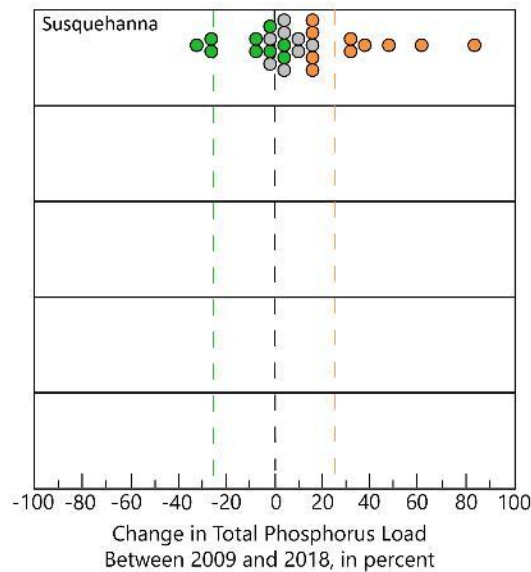
Phosphorus per-acre load¹

Low → High



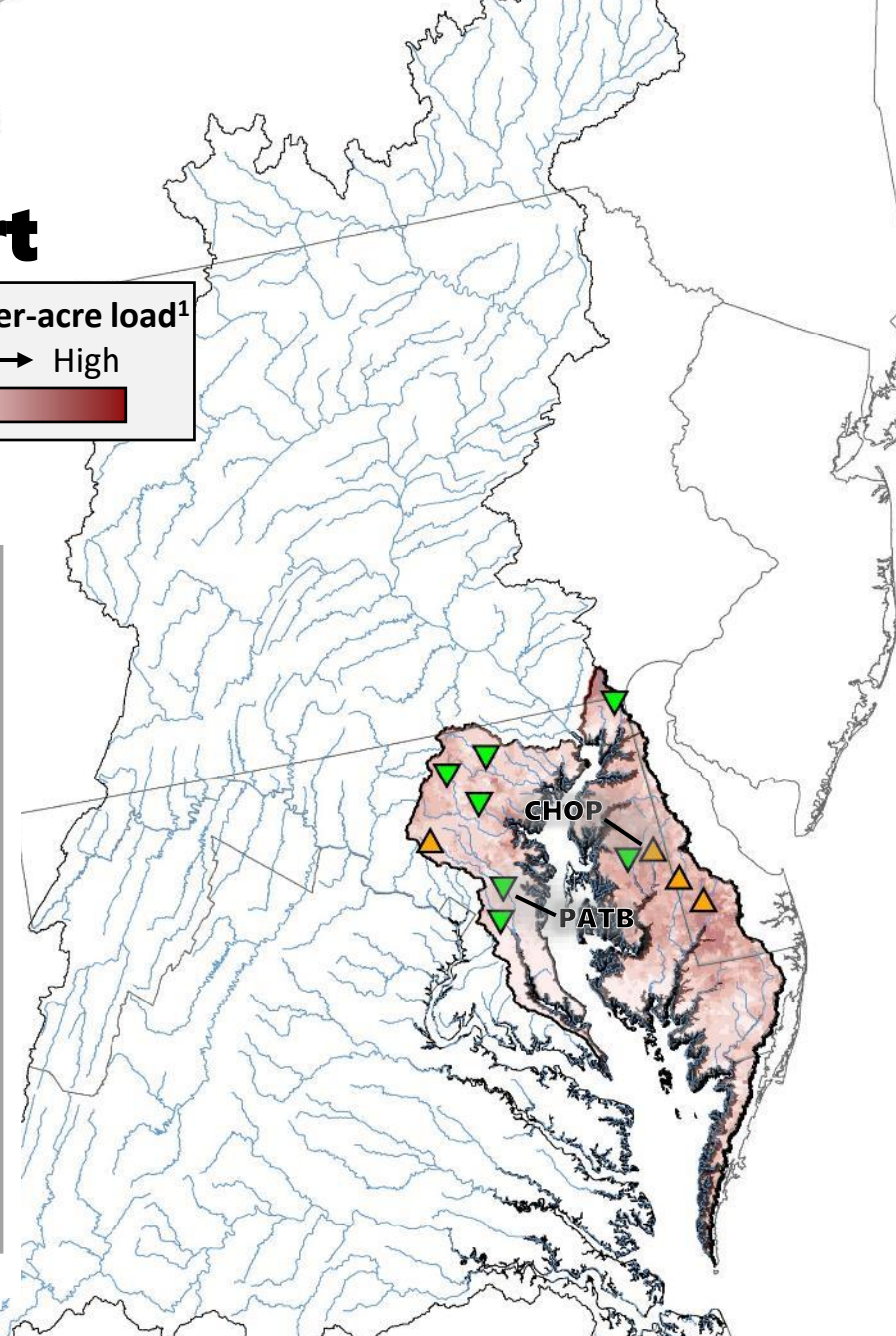
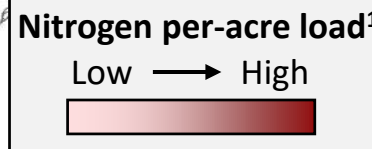
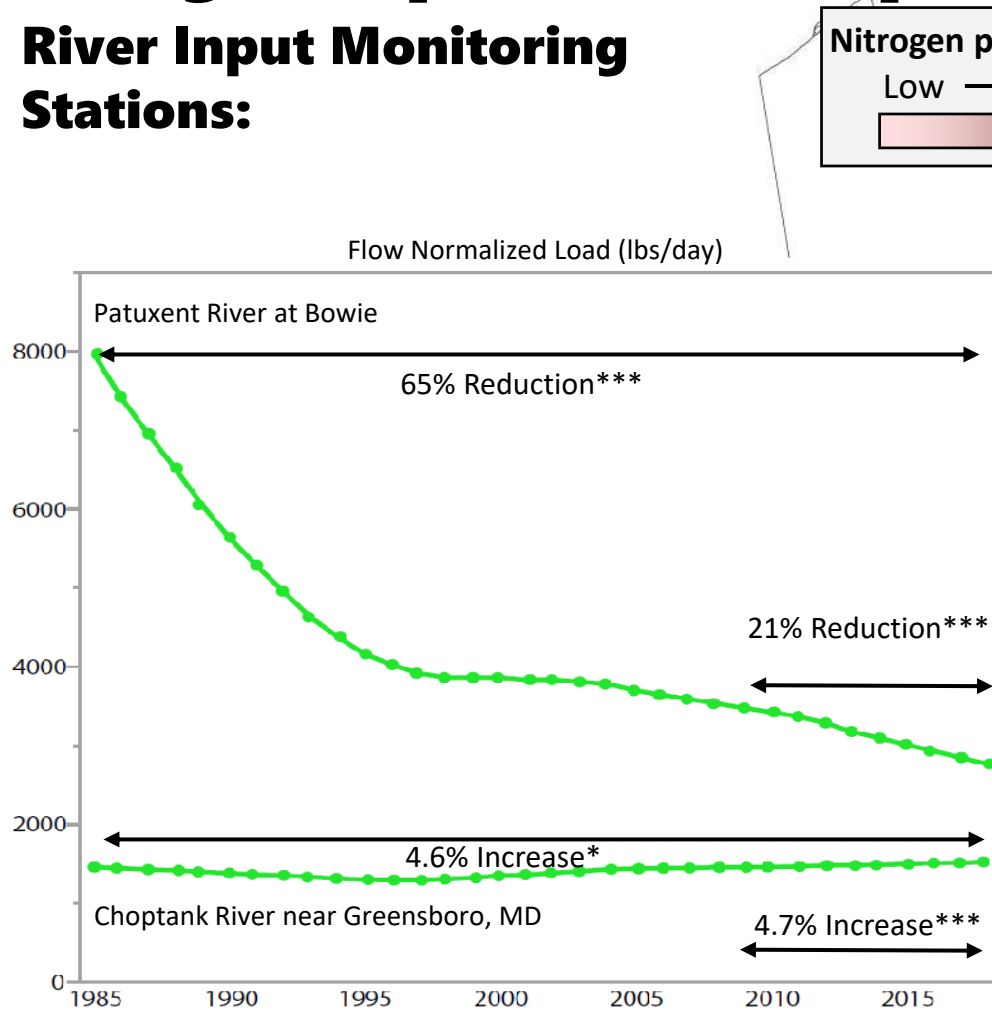
Phosphorus loads (n=27) have improved at 9, degraded at 10, and have no trend at 8 stations².

Across the Susquehanna, the median P improvement is 7% and the median degradation is 32%².



Trends in nitrogen loads result from changing nitrogen inputs or transport

River Input Monitoring Stations:



Trends in nitrogen loads result from changing nitrogen inputs or transport

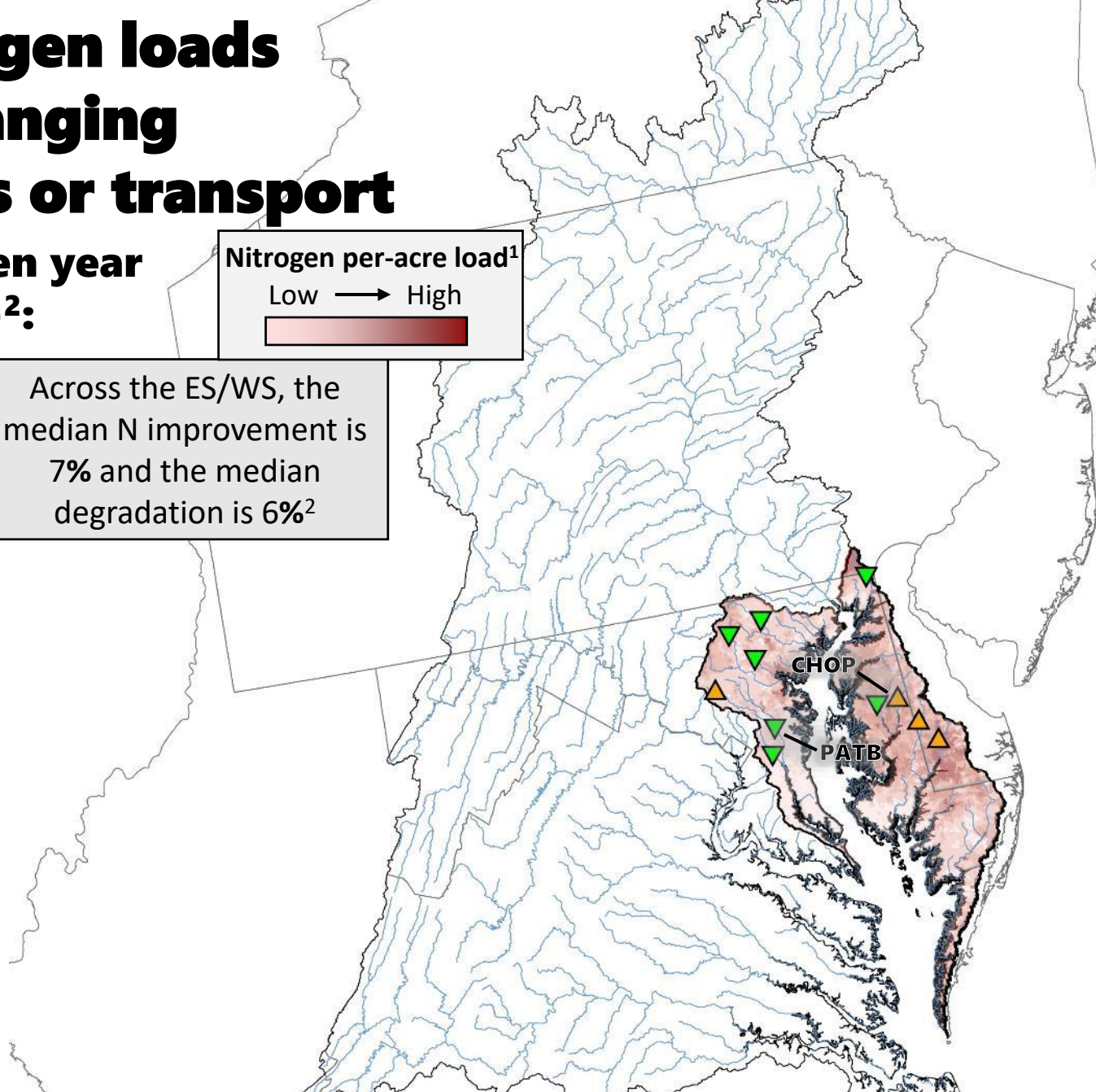
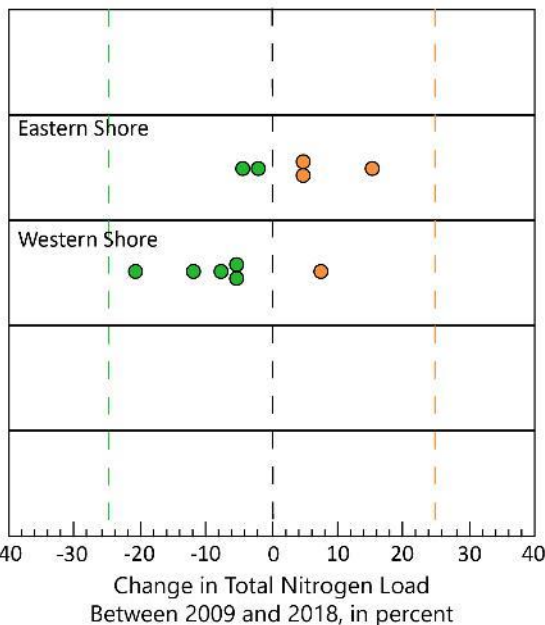
In the most recent ten year period (2009 – 2018)²:

Nitrogen loads (**n=11**) have improved at **7** and degraded at **4** stations².

Across the ES/WS, the median N improvement is 7% and the median degradation is 6%²

Nitrogen per-acre load¹

Low → High

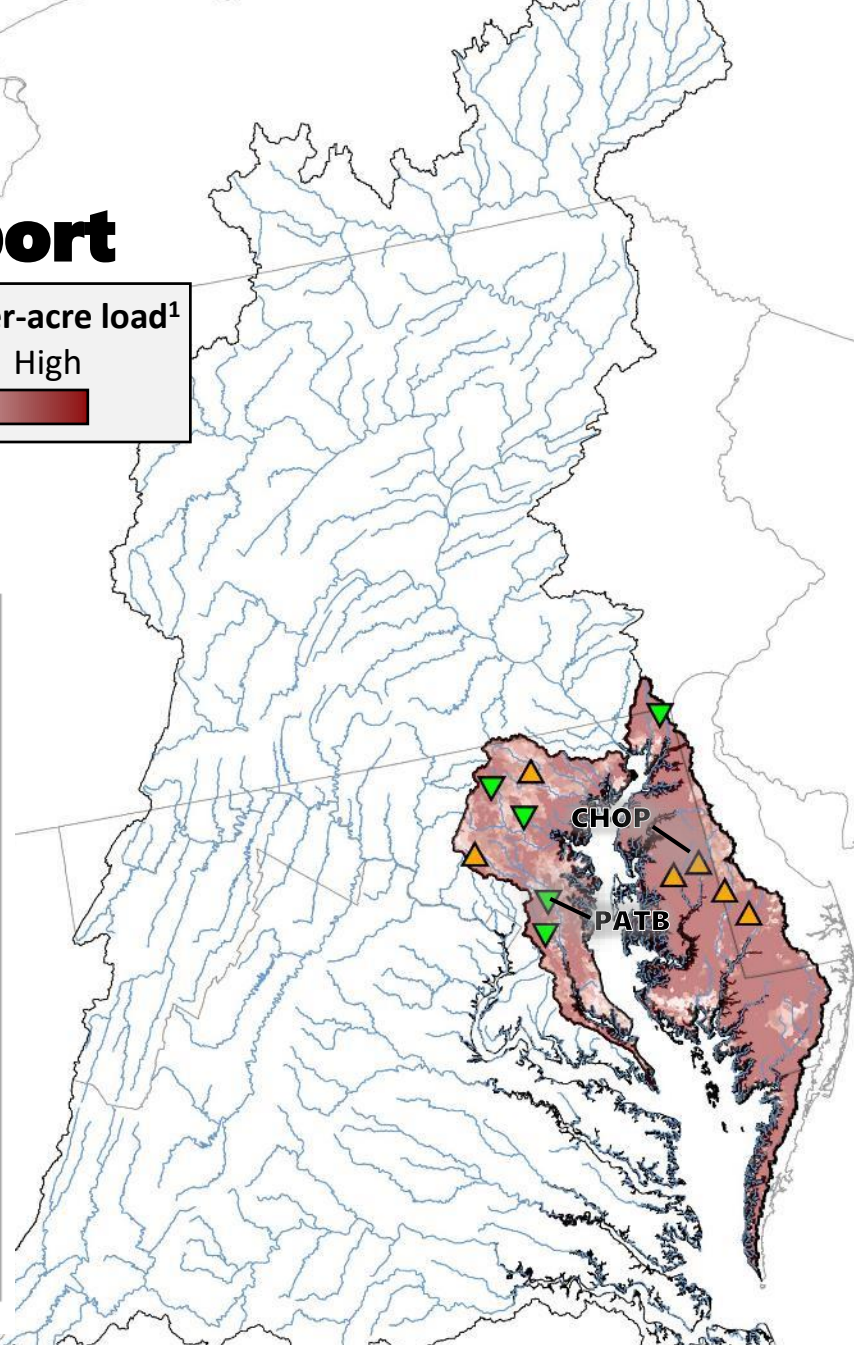
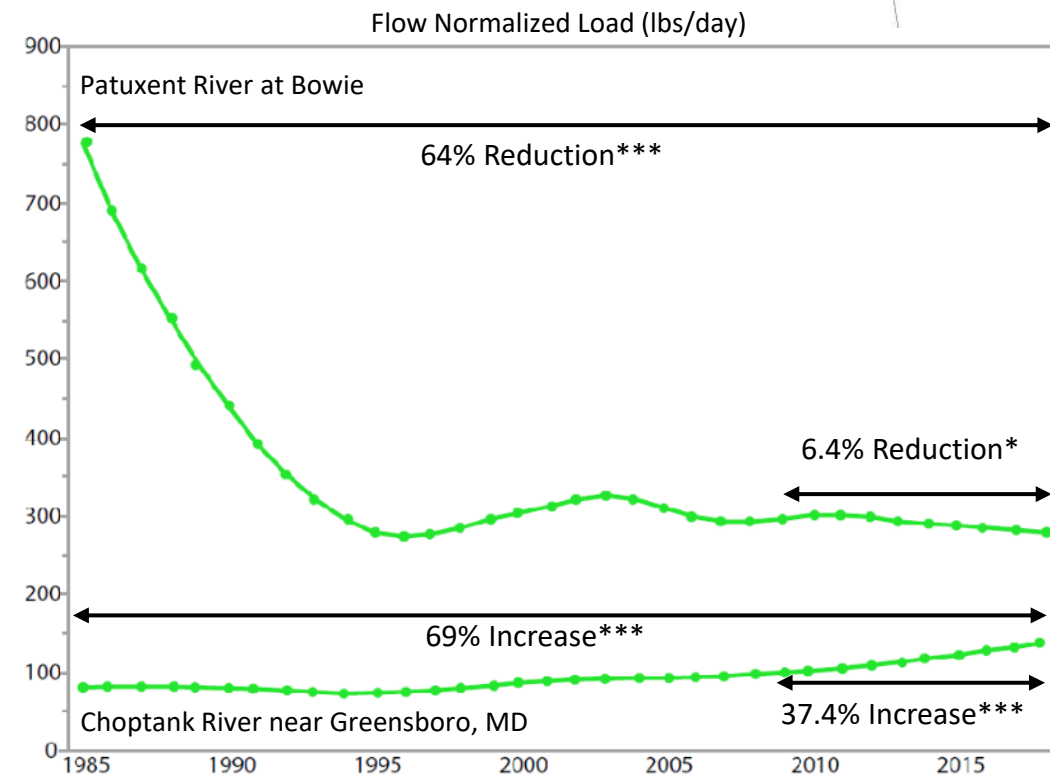


Trends in phosphorus loads result from changing phosphorus inputs or transport

River Input Monitoring Stations:

Phosphorus per-acre load¹

Low → High



Trends in phosphorus loads result from changing phosphorus inputs or transport

In the most recent ten year period (2009 – 2018)²:

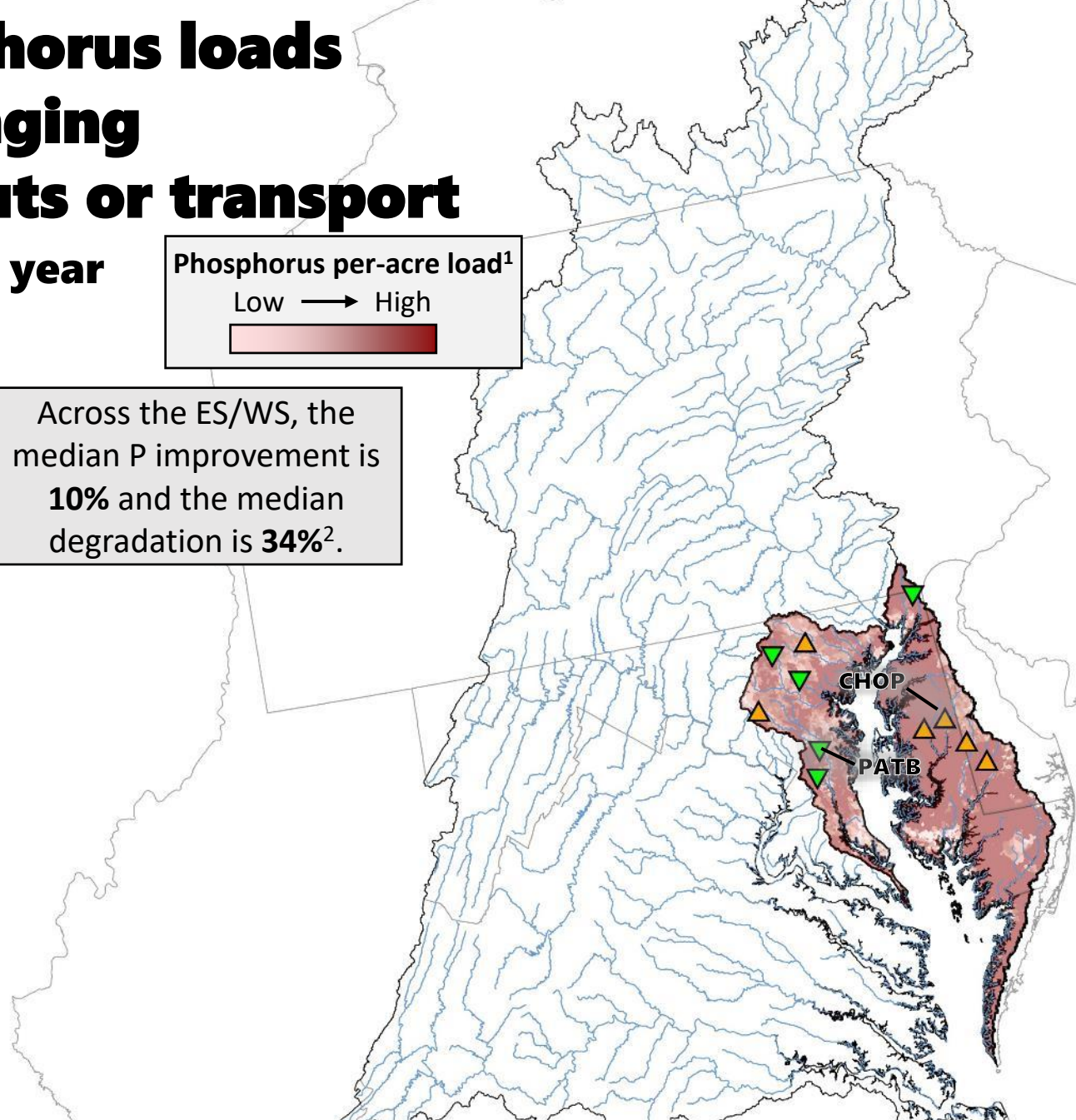
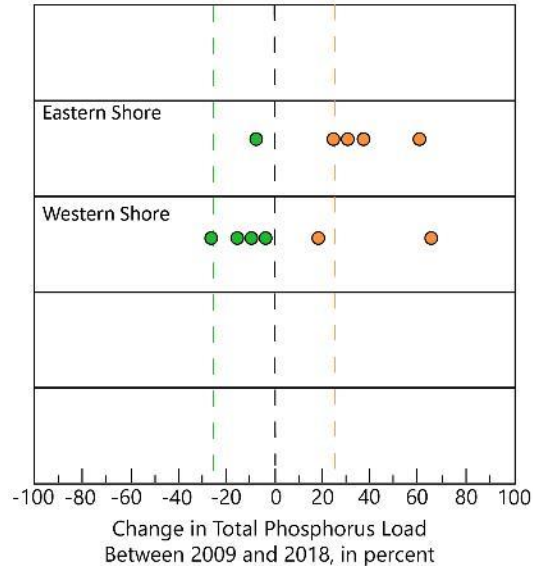
Phosphorus per-acre load¹

Low → High



Phosphorus loads (n=11) have improved at **5** and have degraded at **6** stations².

Across the ES/WS, the median P improvement is **10%** and the median degradation is **34%**².



Trends in nitrogen loads result from changing nitrogen inputs or transport

River Input Monitoring Station:

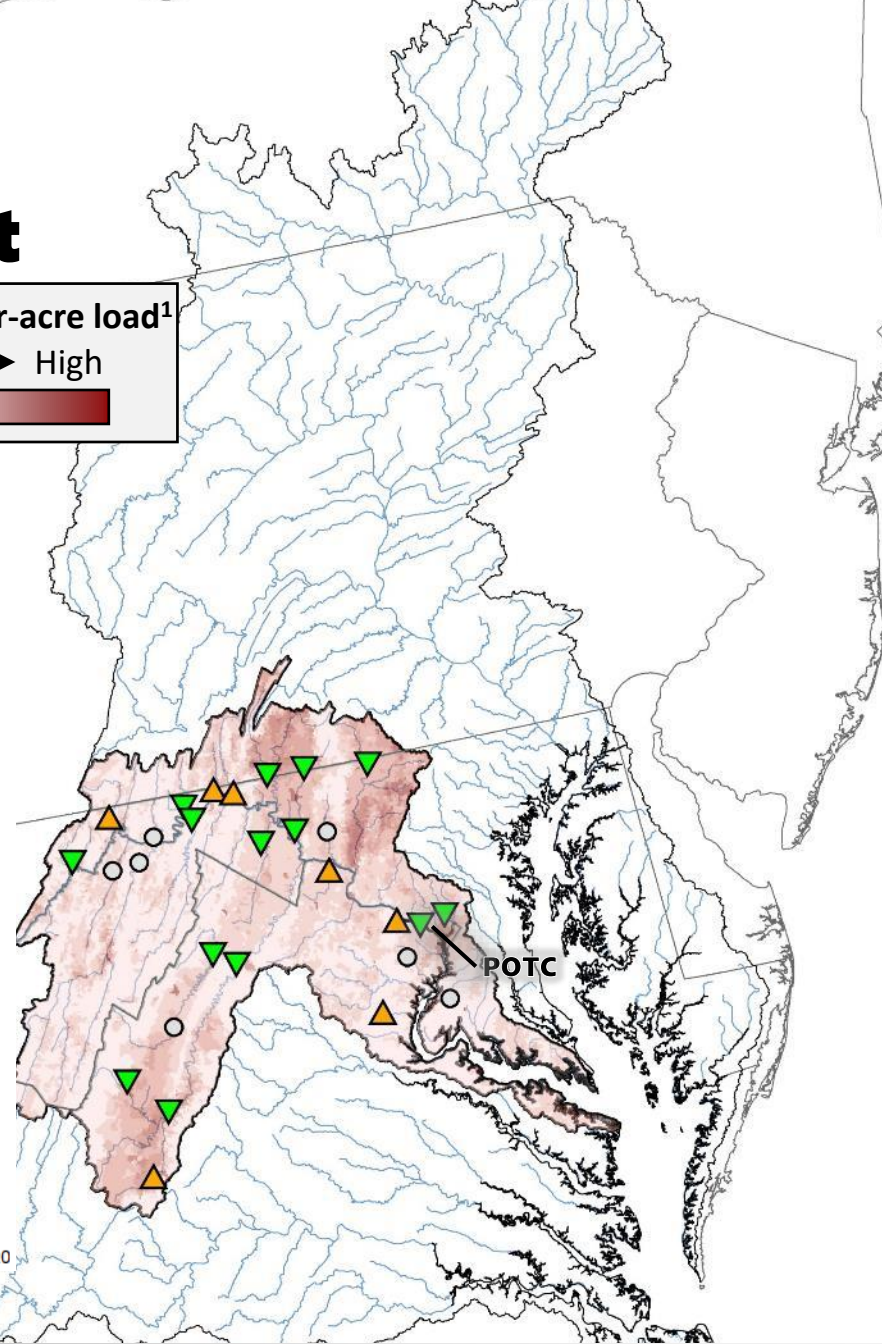
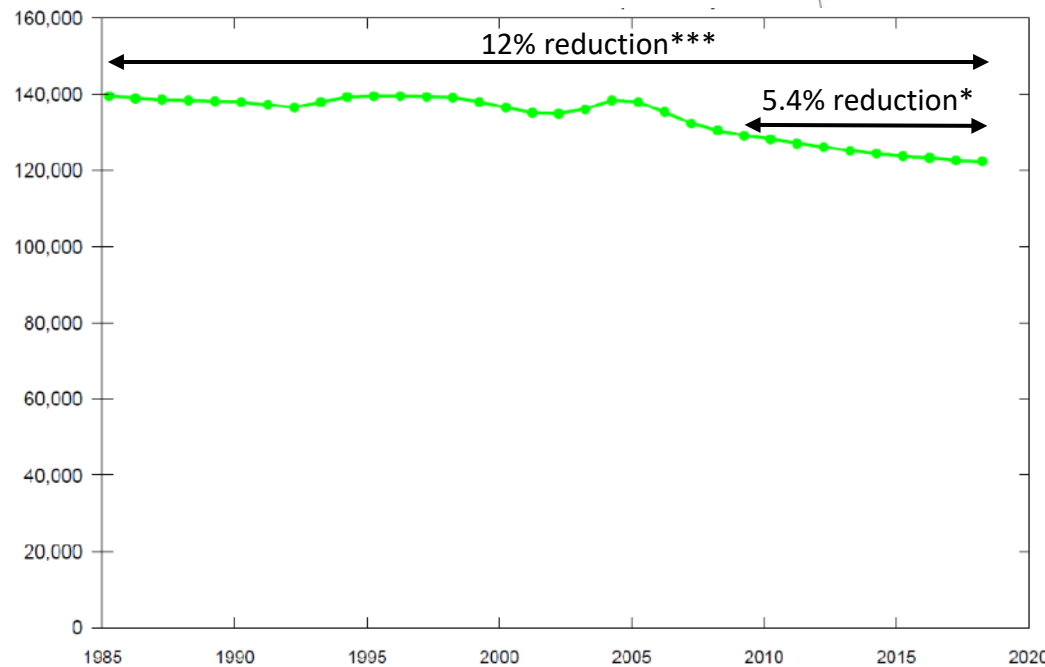
Nitrogen per-acre load¹

Low → High



Potomac River at Chain Bridge, Washington, DC

Flow Normalized Load (lbs/day)

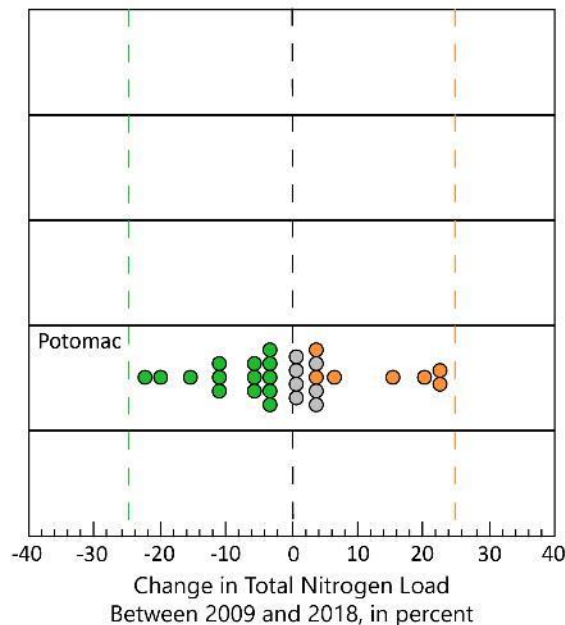


Trends in nitrogen loads result from changing nitrogen inputs or transport

In the most recent ten year period (2009 – 2018)²:

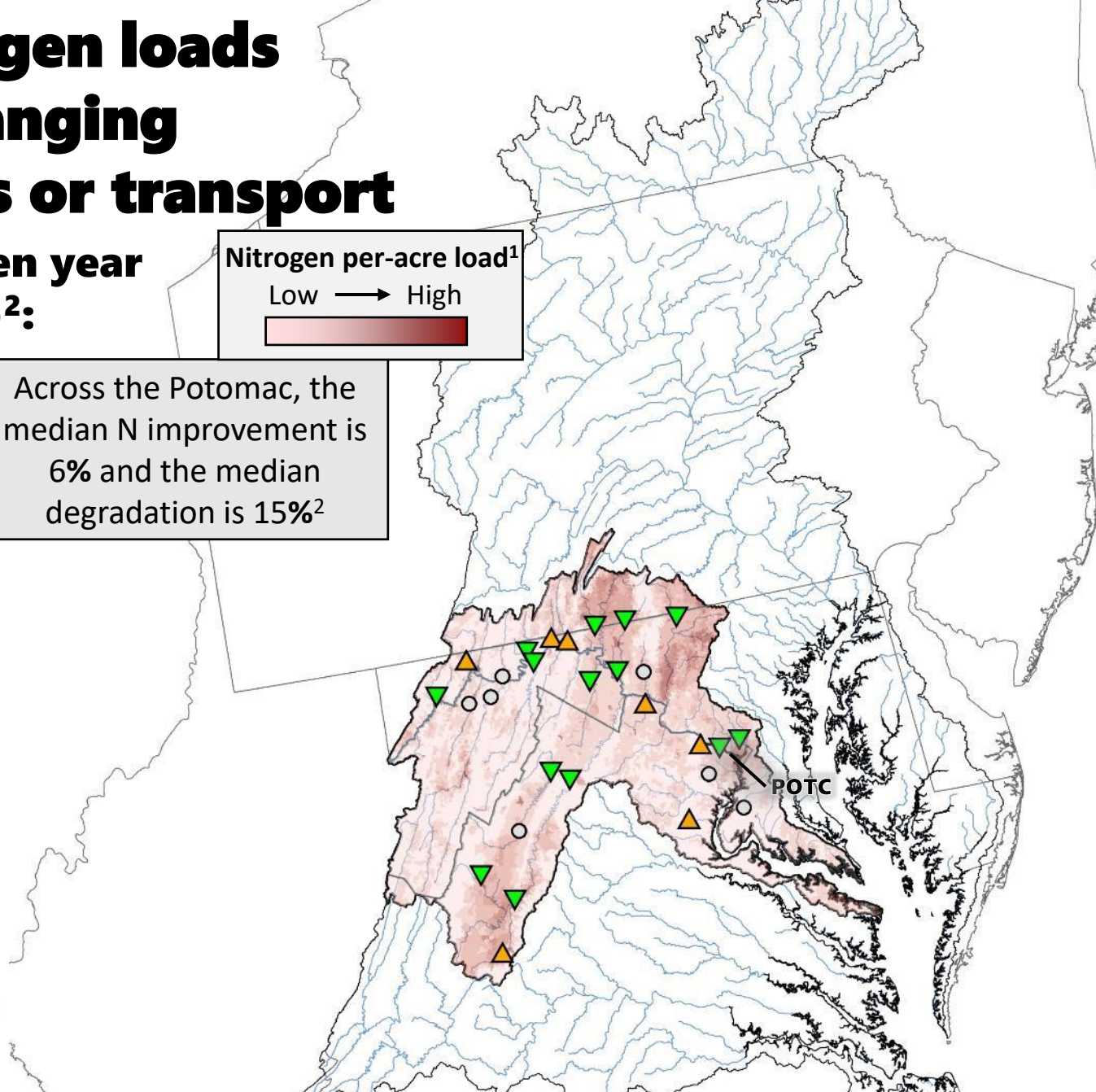
Nitrogen loads (**n=28**) have improved at **14**, degraded at **7**, and have no trend at **7** stations².

Across the Potomac, the median N improvement is 6% and the median degradation is 15%²



Nitrogen per-acre load¹

Low → High



Trends in phosphorus loads result from changing phosphorus inputs or transport

River Input Monitoring Station:

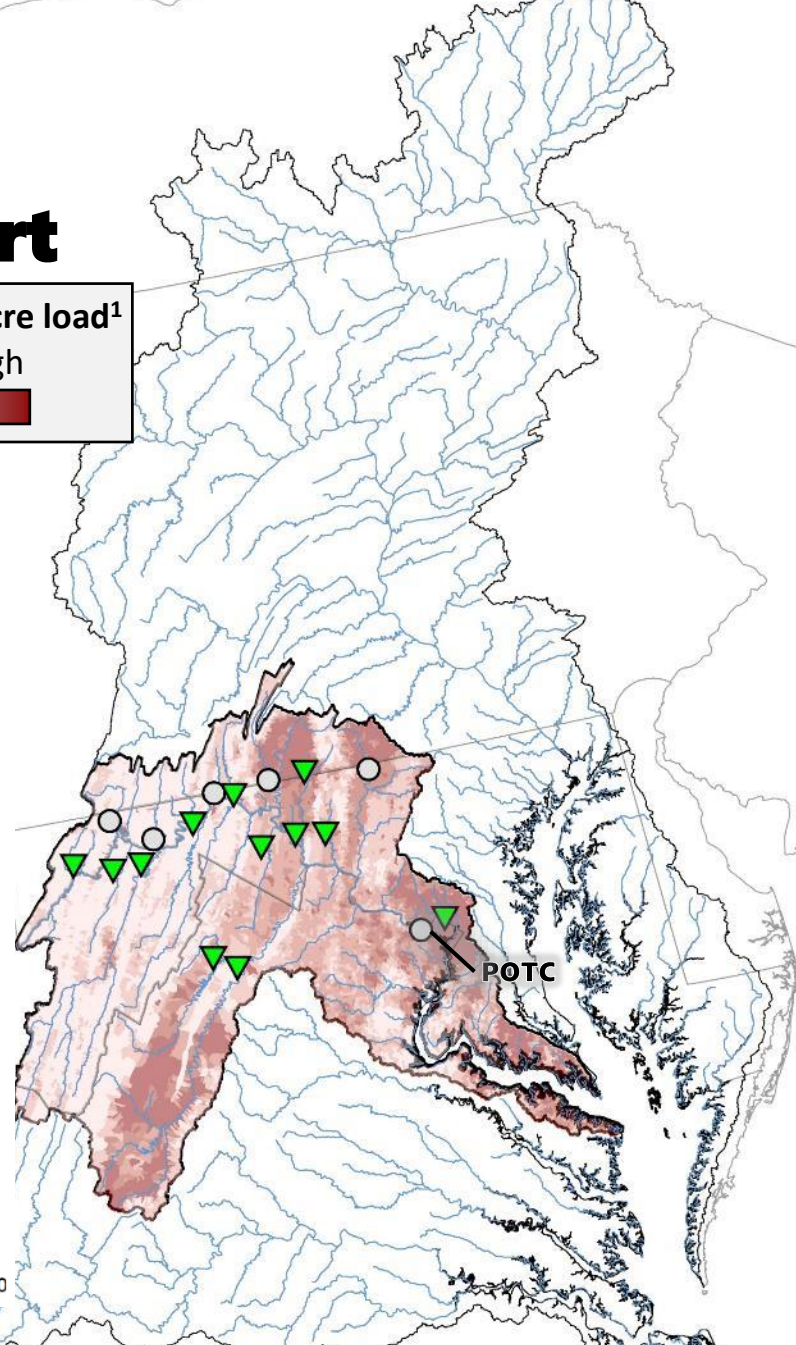
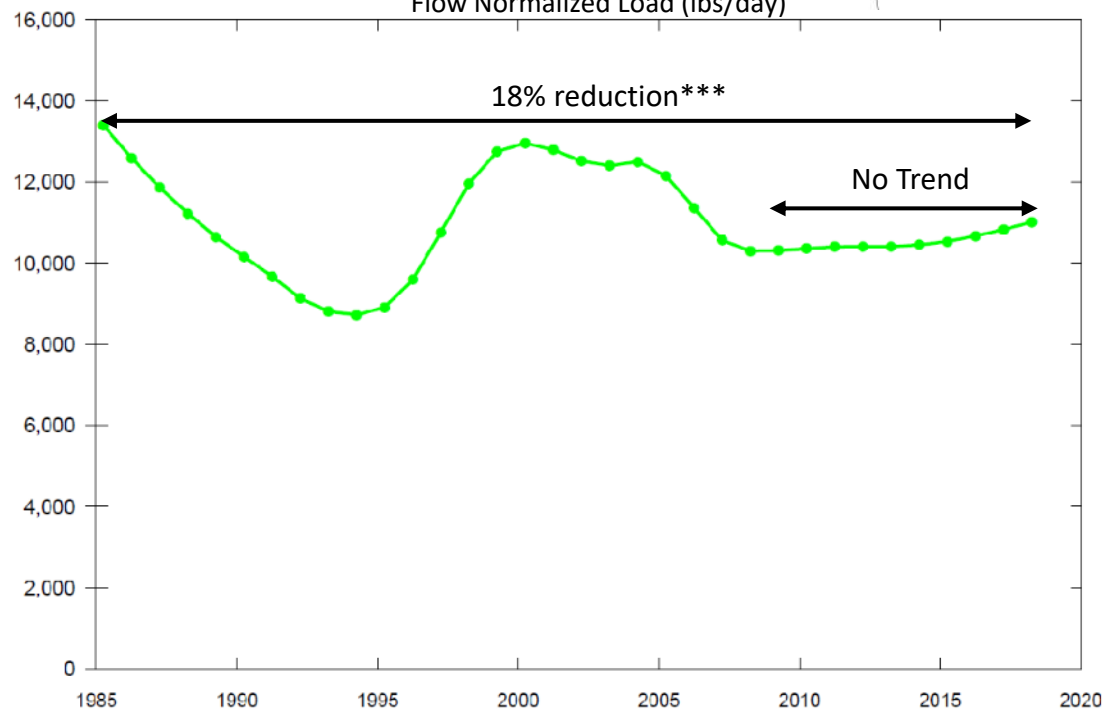
Phosphorus per-acre load¹

Low → High



Potomac River at Chain Bridge, Washington, DC

Flow Normalized Load (lbs/day)



Trends in phosphorus loads result from changing phosphorus inputs or transport

In the most recent ten year period (2009 – 2018)²:

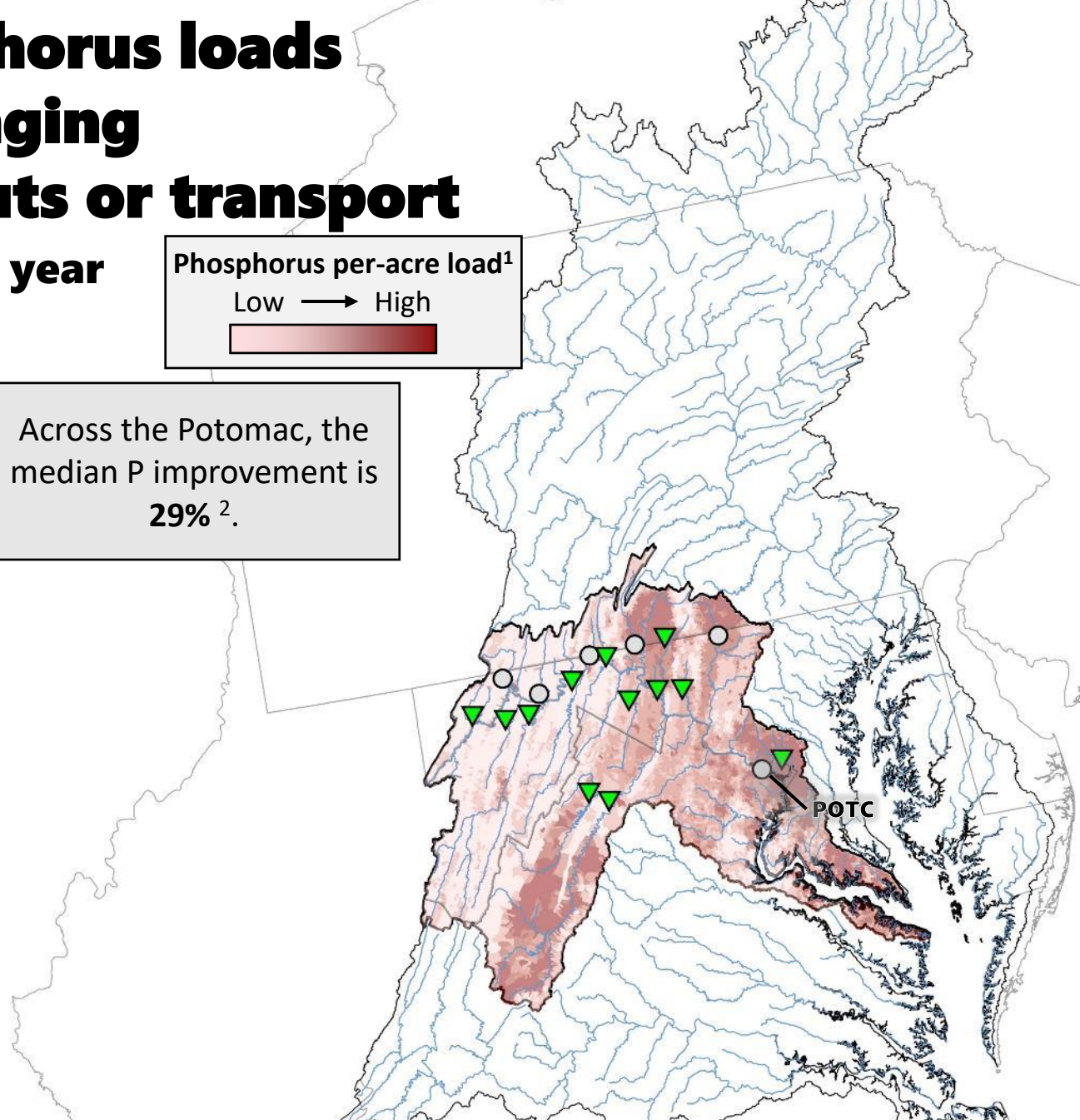
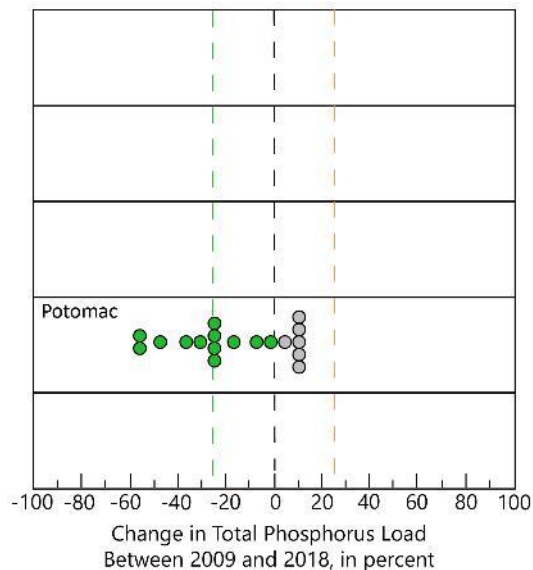
Phosphorus per-acre load¹

Low → High



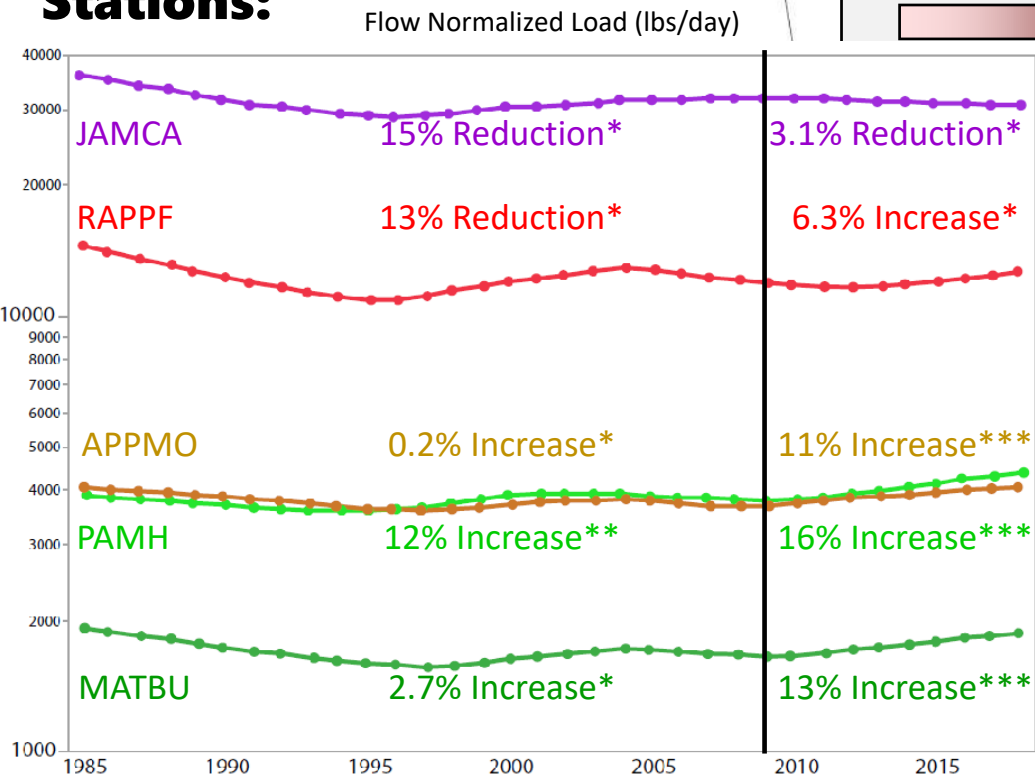
Phosphorus loads (n=18) have improved at 12 and have no trend at 6 stations².

Across the Potomac, the median P improvement is 29%².



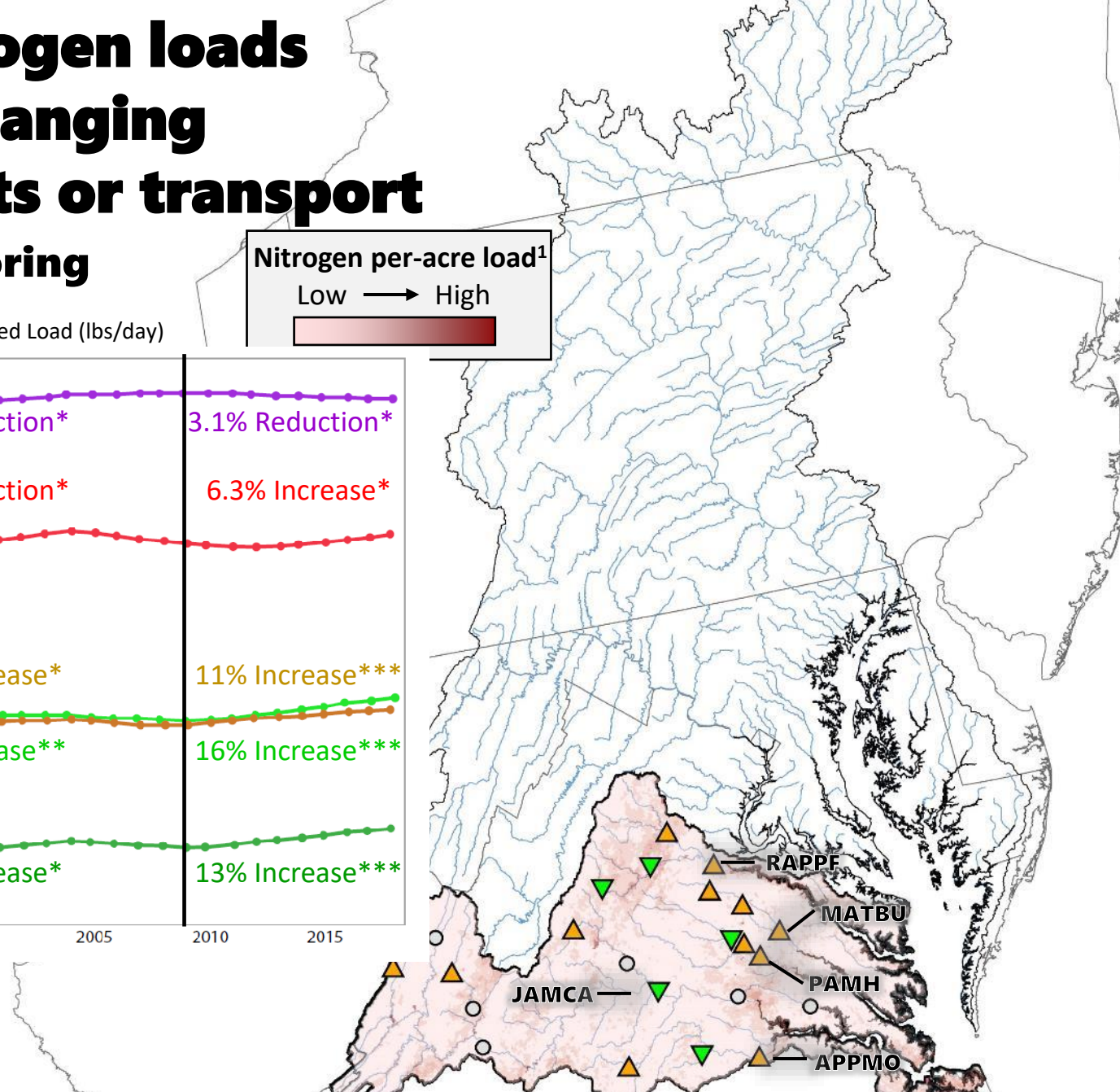
Trends in nitrogen loads result from changing nitrogen inputs or transport

River Input Monitoring Stations:



Nitrogen per-acre load¹

Low → High

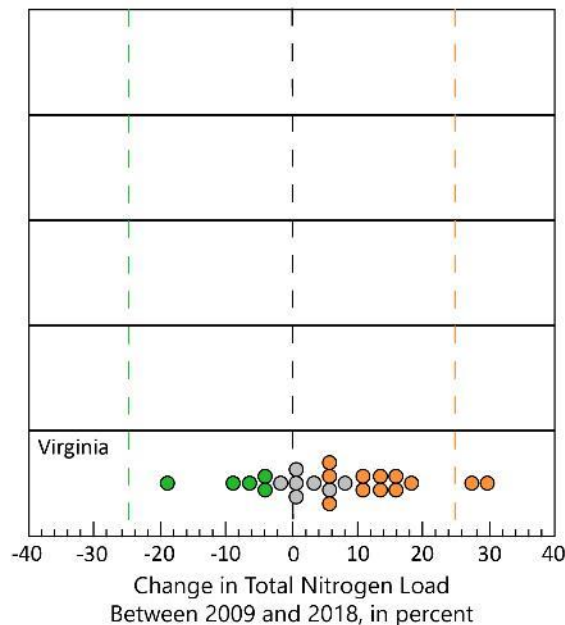


Trends in nitrogen loads result from changing nitrogen inputs or transport

In the most recent ten year period (2009 – 2018)²:

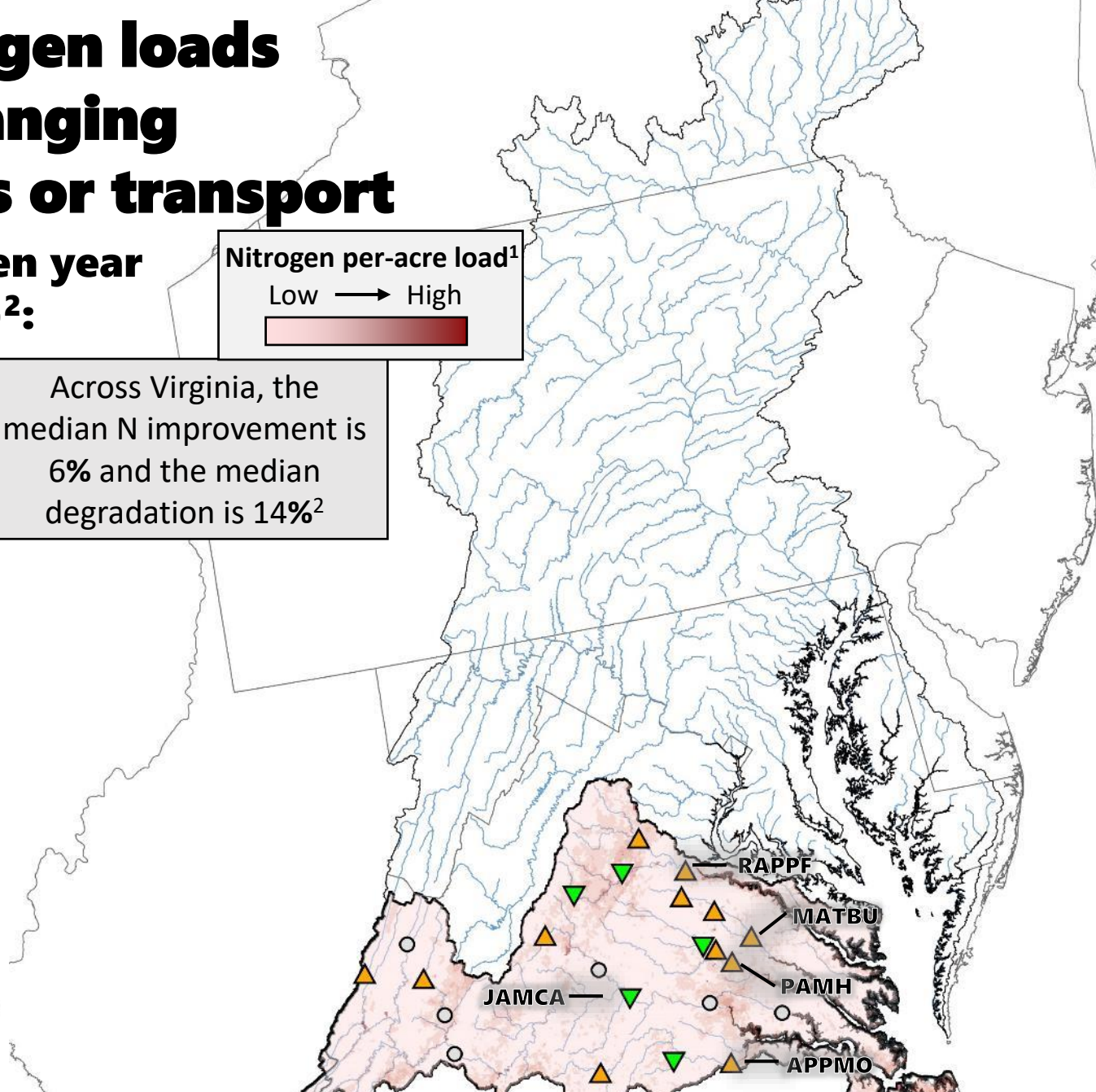
Nitrogen loads (**n=24**) have improved at **5**, degraded at **12**, and have no trend at **7** stations².

Across Virginia, the median N improvement is 6% and the median degradation is 14%²



Nitrogen per-acre load¹

Low → High



Trends in phosphorus loads result from changing phosphorus inputs or transport

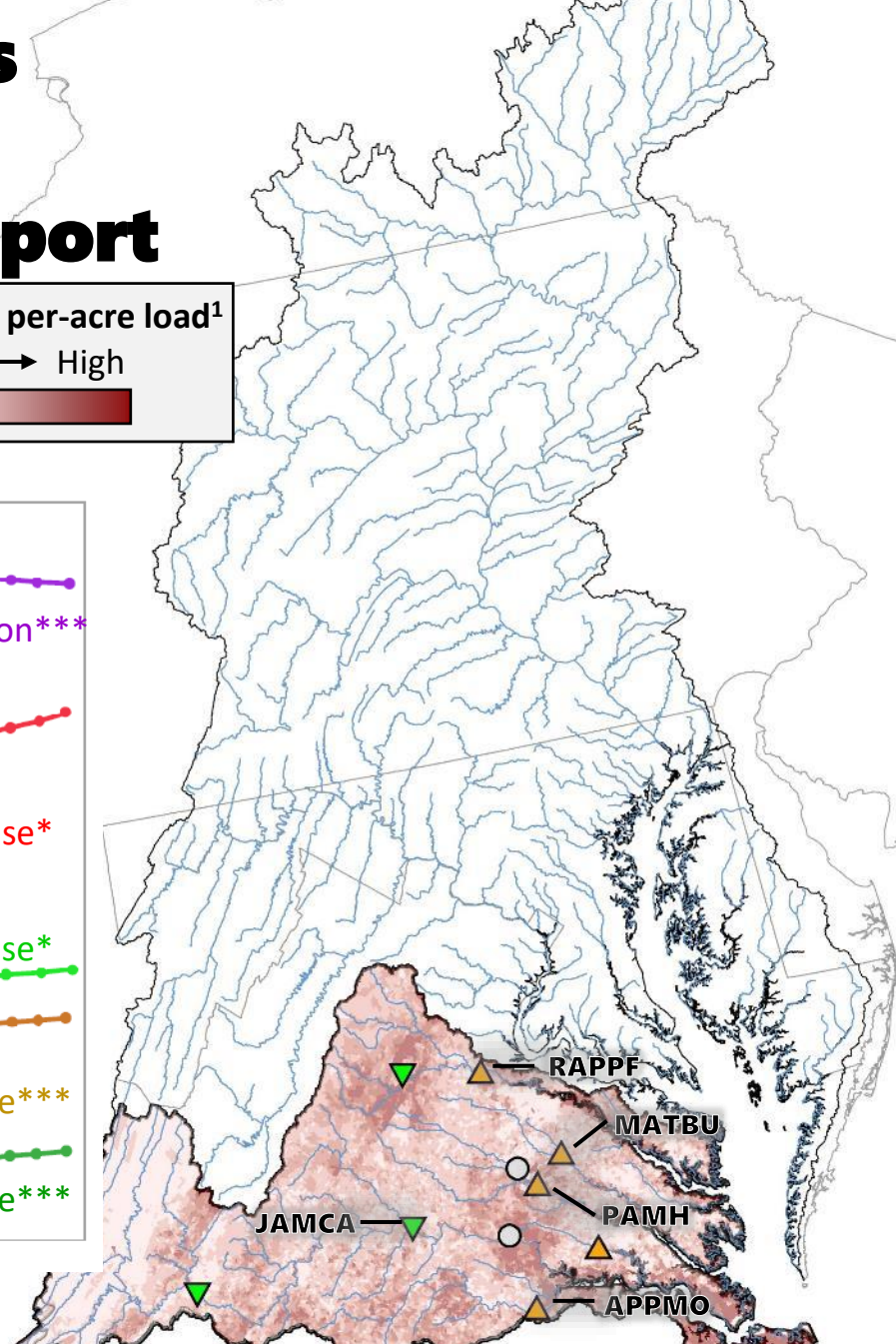
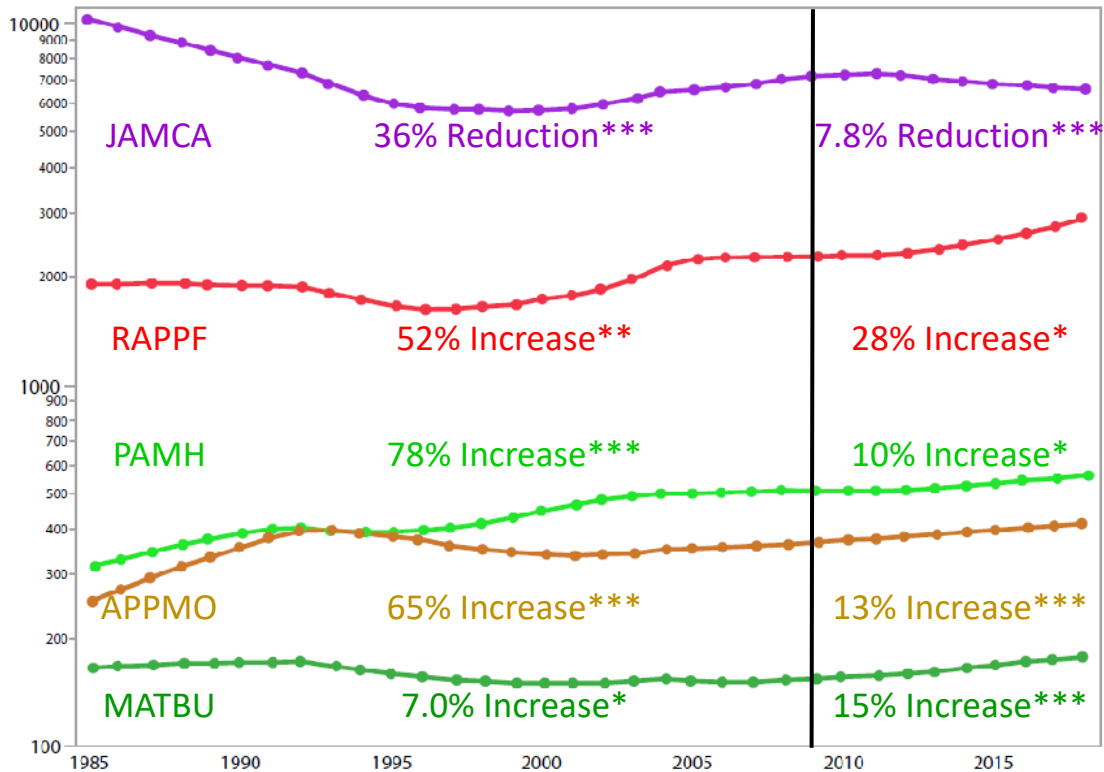
River Input Monitoring Stations:

Phosphorus per-acre load¹

Low → High



Flow Normalized Load (lbs/day)



Trends in phosphorus loads result from changing phosphorus inputs or transport

In the most recent ten year period (2009 – 2018)²:

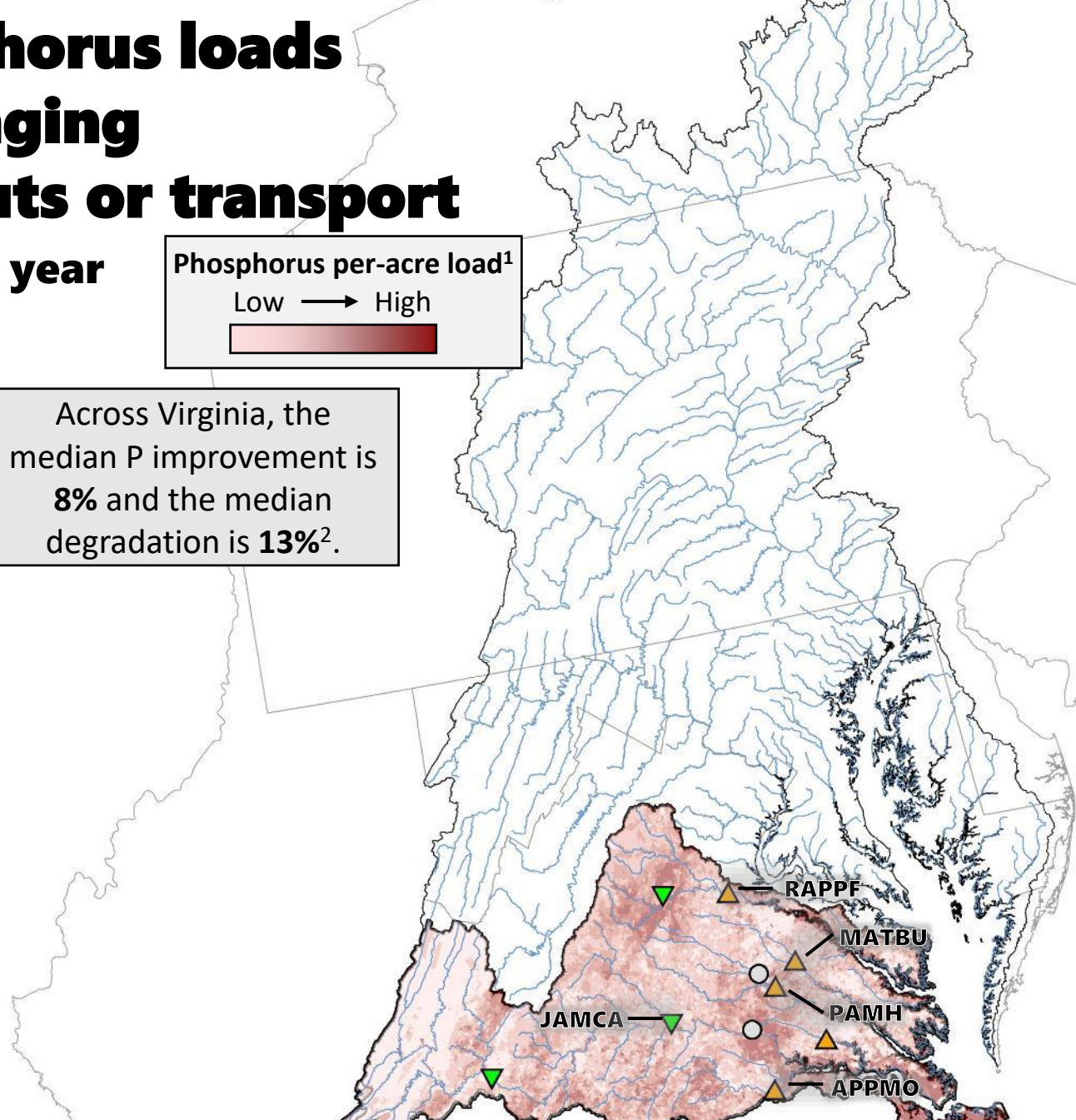
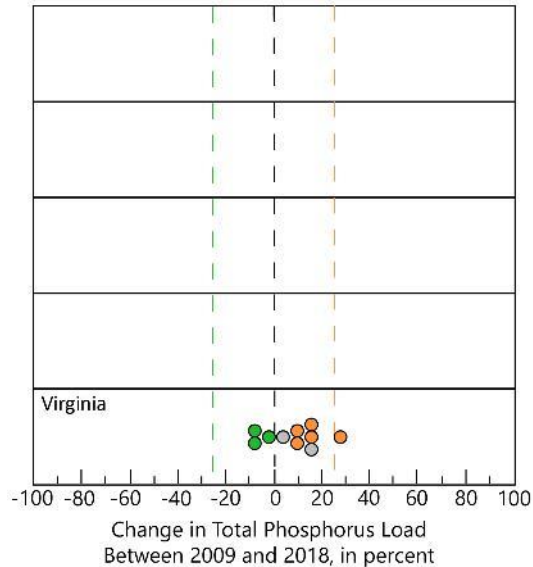
Phosphorus per-acre load¹

Low → High

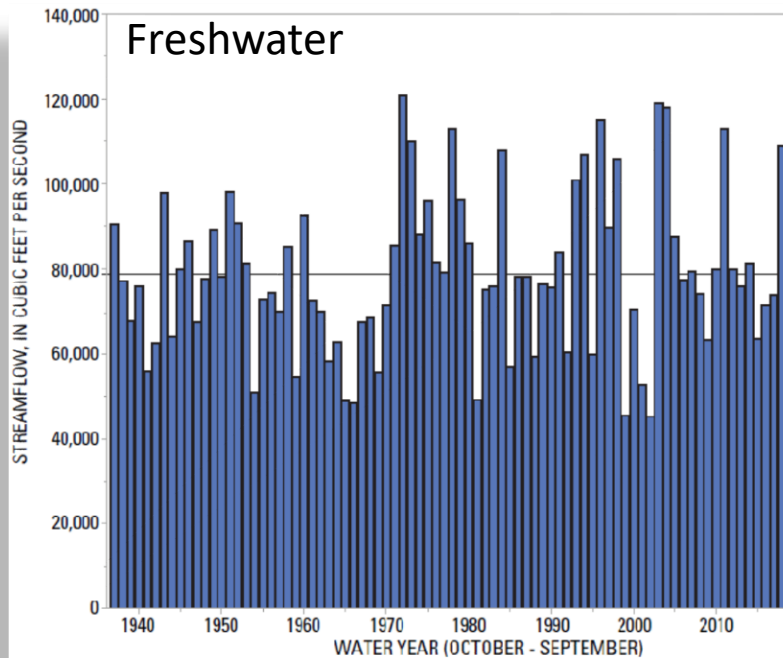


Phosphorus loads (n=10) have improved at 3, degraded at 5, and have no trend at 2 stations².

Across Virginia, the median P improvement is 8% and the median degradation is 13%².

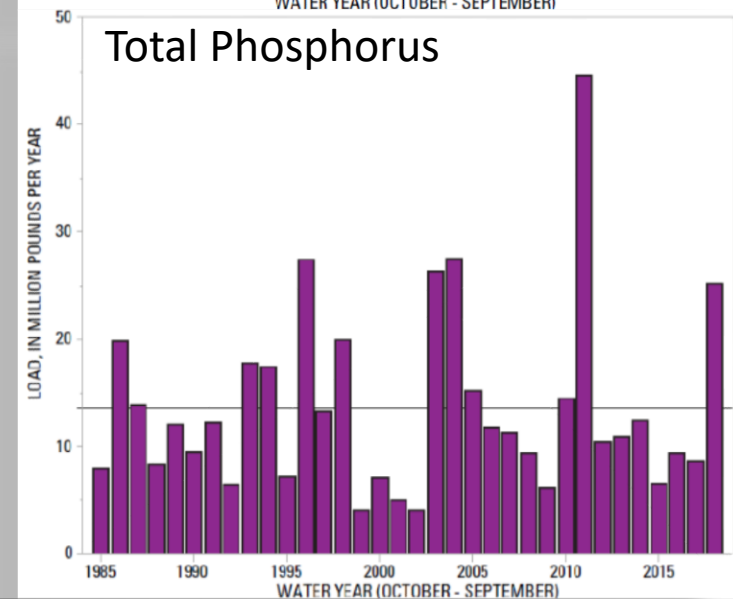
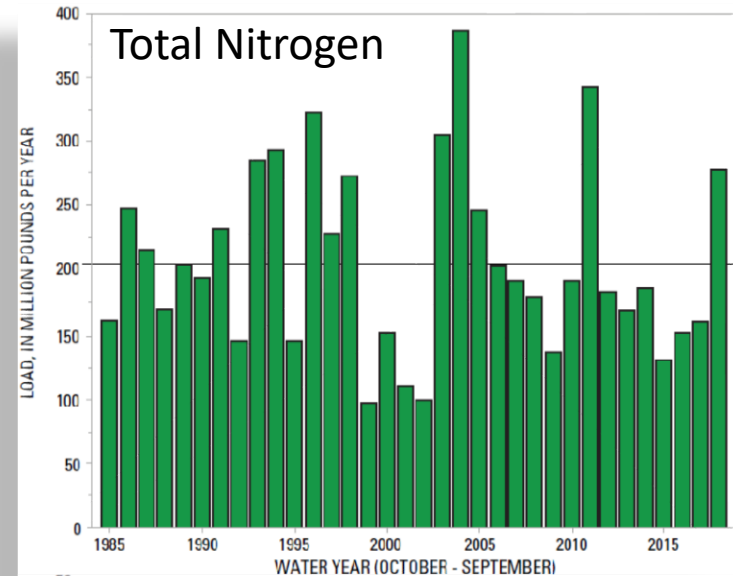


2018 delivery of freshwater flow and total nitrogen and phosphorus loads



2018 Stats

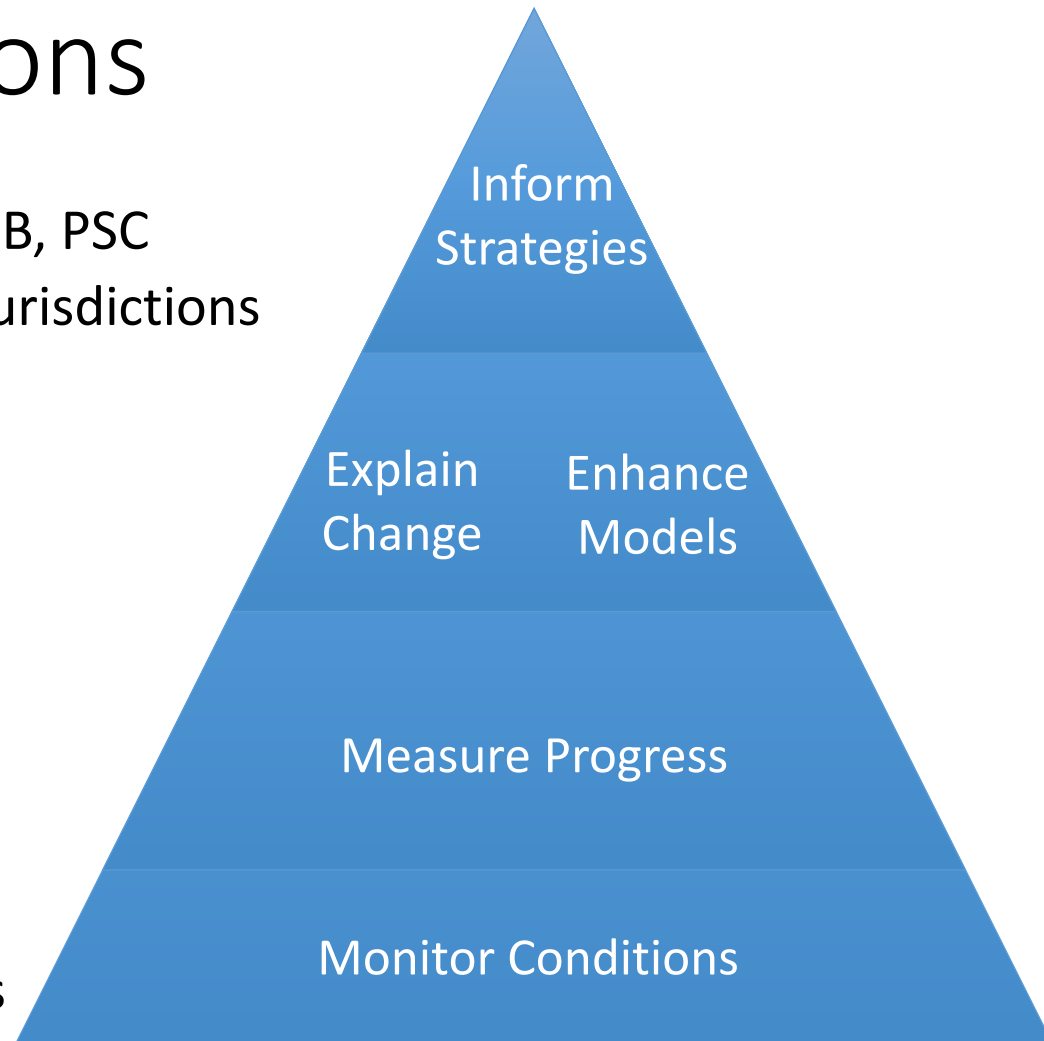
- 5th largest freshwater flow to the bay since 1985 (8th since 1937).
- TN load for 2018 was the 7th largest since 1985.
- TP load for 2018 was the 5th largest since 1985.



Communicating results and informing decisions

- Results to WQ GIT & WGs, MB, PSC
- Meetings/interactions with jurisdictions
- Inform 2-year milestones

- Fact Sheets
- Press Releases
- Web summaries
- Story Maps
- Tributary summaries
- Data Dashboard
- Technical reports and articles



More information

- USGS Chesapeake Bay Website:
<https://www.usgs.gov/centers/cba>
 - Science summaries
 - Nutrient and sediment trends
 - Explaining water-quality changes
 - Nontidal Trends Webpage
<https://cbrim.er.usgs.gov/index.html>
- Chesapeake Progress: Clean Water
<https://www.chesapeakeprogress.com/>
- CBP Watershed Data Dashboard



The nontidal monitoring webpage has been updated with 2018 results

<https://cbrim.er.usgs.gov/index.html>

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science for a changing world

Water Quality Loads and Trends at Nontidal Monitoring Stations in the Chesapeake Bay Watershed

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Water Quality Loads and Trends at Nontidal Monitoring Stations in the Chesapeake Bay Watershed

Welcome

This web site is dedicated to providing water quality load and trend results for the nontidal rivers of the Chesapeake Bay watershed.

What are the Objectives of the Chesapeake Bay Nontidal Monitoring Program?

- Quantify nutrient and sediment loads in the nontidal rivers of the Chesapeake Bay watershed. These loads are defined as the mass of nutrient or sediment passing a monitoring location per unit time.
- Estimate changes over time (trends) in sediment and nutrient loads. In a manner that compensates for any measured trend in stream discharge, trends estimated in this manner can indicate changes in the watershed, such as the effects of land management practices, that cannot be attributed primarily to climatic fluctuation.

How the Program Works

- Monitoring data are collected by numerous agencies through the nontidal monitoring network.
- Results are updated on even numbered water years for the network of water quality monitoring stations distributed throughout the Chesapeake Bay watershed.

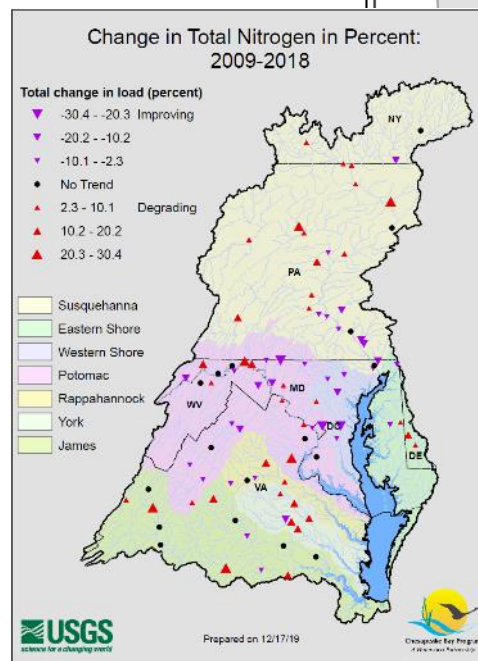
What Data and Related Information Are Available?

Methods, data, results, and interpretations are available for:

- Sediment and nutrient loads and trends (see area codes)
- Water temperature and dissolved oxygen

Click on the image above to access the interactive map.

The website contains load and trend results for Total Nitrogen, Nitrate, Total Phosphorus, Orthophosphorus, and Suspended Sediment at individual monitoring stations in graphical or tabular formats.



Download Entire Annual Loads Table

Select Station: 01491000 - CHOPTANK RIVER NEAR GREENSBORO, MD

Select Parameter: P00600 - Total nitrogen (mg/L as N)

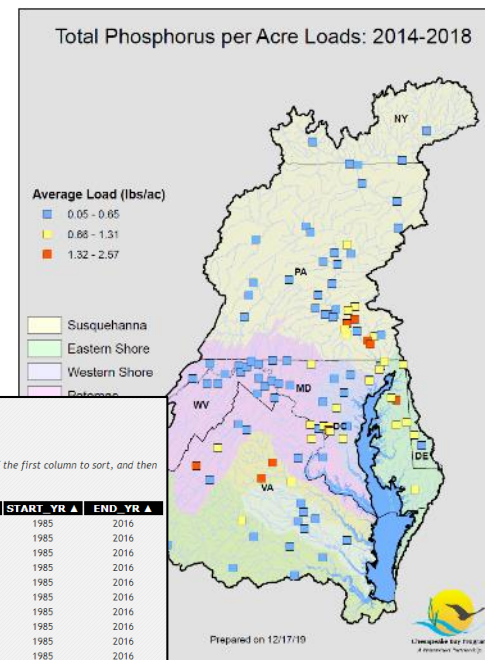
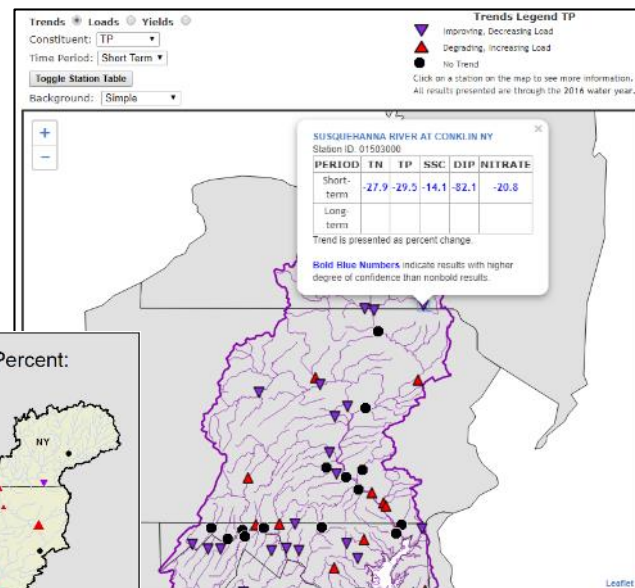
Columns default to ascending sort order going from left to right. To change the sort order, click the column name of the first column to sort, and then Ctrl-click each subsequent column to sort. Columns can be sorted ascending, descending, or not at all.

Show: 10

STATION	PCODE	Year	Q	Conc	Load	FNConc	FNLoad	START_YR	END_YR
01491000	P00600	1985	53.6	1.58	177000	1.71	529000	1985	2016
01491000	P00600	1986	92.7	1.66	338000	1.71	524000	1985	2016
01491000	P00600	1987	119.1	1.68	441000	1.7	519000	1985	2016
01491000	P00600	1988	66	1.63	227000	1.7	515000	1985	2016
01491000	P00600	1989	198.2	1.72	672000	1.69	507000	1985	2016
01491000	P00600	1990	141.5	1.72	487000	1.69	502000	1985	2016
01491000	P00600	1991	97	1.66	331000	1.68	496000	1985	2016
01491000	P00600	1992	77.2	1.65	256000	1.67	492000	1985	2016
01491000	P00600	1993	131.8	1.69	442000	1.66	483000	1985	2016
01491000	P00600	1994	193.6	1.62	609000	1.65	477000	1985	2016

Showing 1 to 10 of 32 records

Pages: Previous 1 2 3 4 Next



The Chesapeake Bay Watershed Data Dashboard (Rivers & Streams) page is being updated.

Chesapeake Bay Watershed Data Dashboard (Beta)

Need Help?



Start Here!

Rivers & Streams

Tidal Waters

Targeting Restoration

Management Practices

Planning for Change

Get started here...

Water Quality Trends

[Click here to open this section separately in its own window.](#)

This section displays water quality monitoring data for freshwater rivers and streams in the [Chesapeake Bay Program Non-tidal Monitoring Network](#).



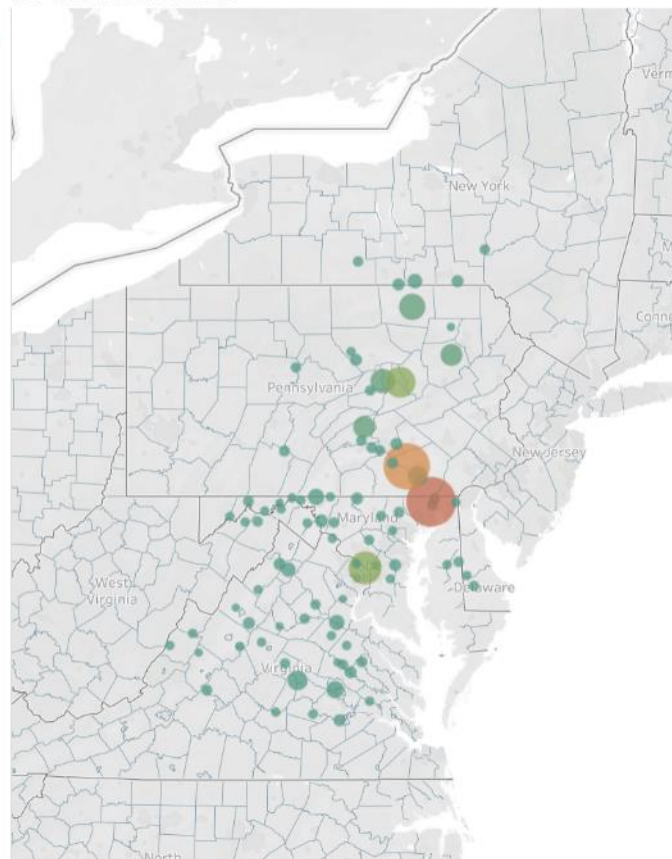
Streams and rivers with high amounts of nutrients and sediment, especially relative to their size, are some of the most effective places to focus restoration efforts.



Watersheds with more developed, agricultural, and urban land tend to have higher nutrients and sediment levels in streams than more natural or forested watersheds.

Water Quality in Streams and Rivers

Non-Tidal Network Stations



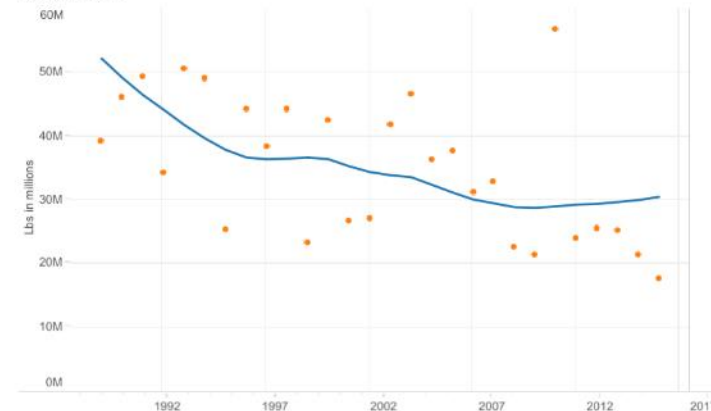
Station: 01536500

SUSQUEHANNA RIVER AT WILKES-BARRE, PA

Parameter: Total nitrogen

Station ID: (All)

Annual Load



Trends (Long Term)



Trends (Short Term)



5-Year mean Yield (2012-2016)



10-Year mean Yield (2007-2016)



Yield Color: (yields in pounds per acre)

Lower Yields Medium Yields Higher Yields

Catchment Total Area (square miles): 9,960

Catchment Area Land Cover