

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

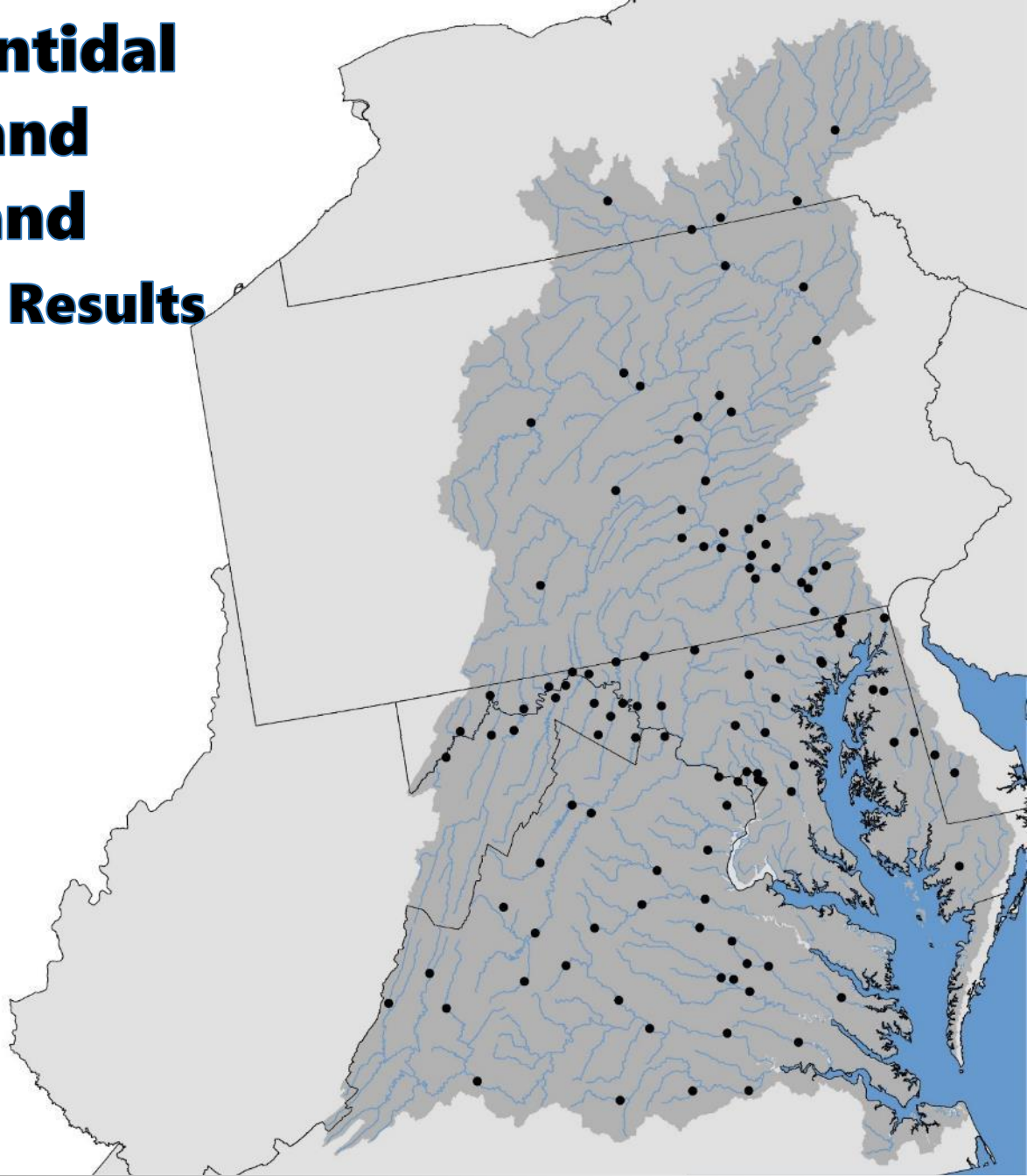
March 23, 2020

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Nutrient Loads and Trends in Chesapeake Bay Nontidal Network Streams: An update and presentation of results

Objectives



Nutrient Loads and Trends in Chesapeake Bay Nontidal Network Streams: An update and presentation of results



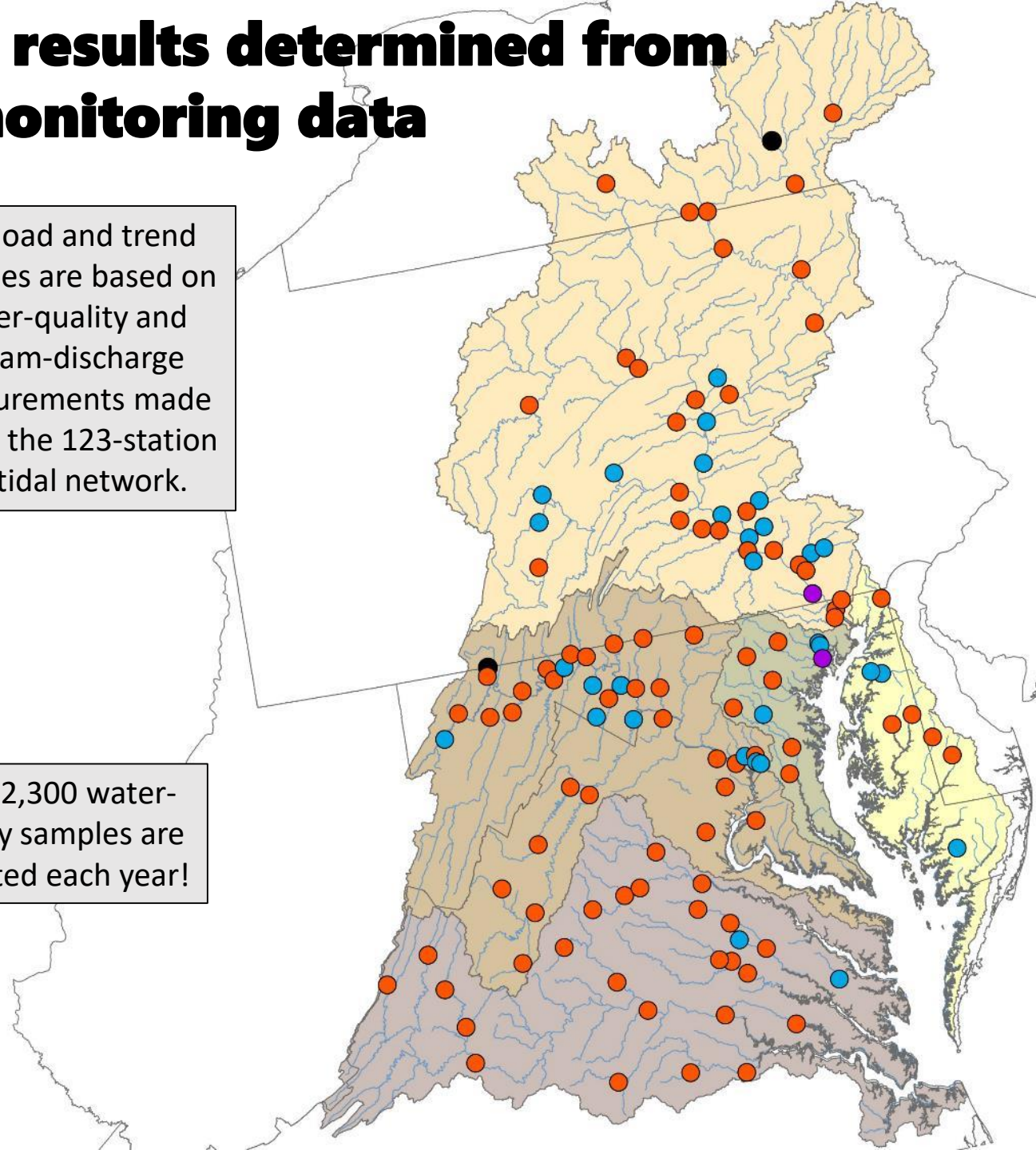
Loads and trend results determined from foundation of monitoring data



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



Over 2,300 water-quality samples are collected each year!



Loads and trends results determined from foundation of monitoring data



Chesapeake Bay NTN – 123 Stations
NY – SRBC (5)
PA – SRBC(20) and USGS(15)
MD – MD DNR (22) and USGS (9)
DE – DN REC (2)
DC – USGS (4)
WV – USGS (10)
VA – VA DEQ (12) and USGS (24)

Monitoring would not be possible
without the funding support
provided by

EPA CBP

USGS

PA DEP, MD DNR, VA DEQ

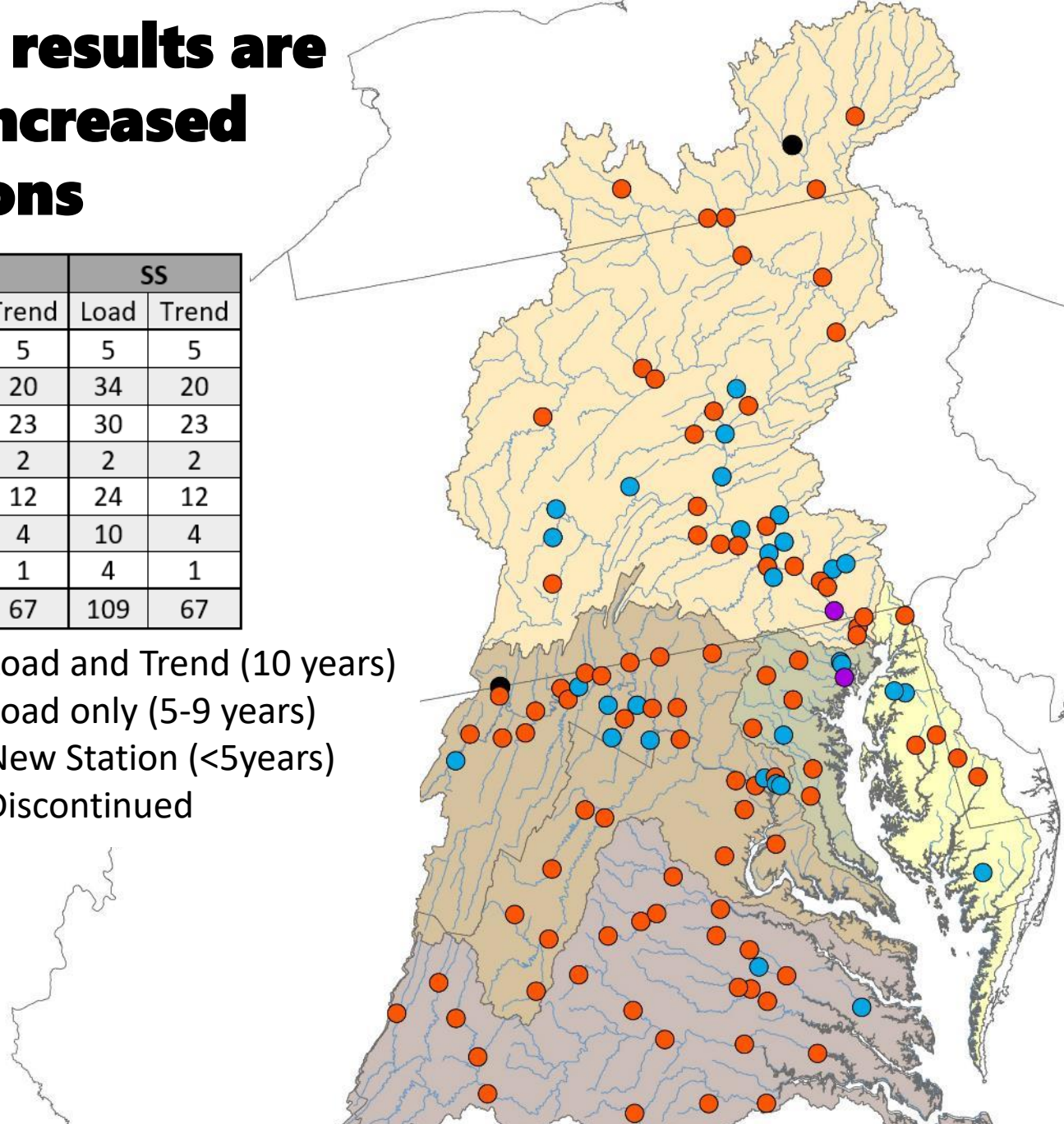
Funding required per station = ~\$50k

Loads and trend results are available at an increased number of stations

Juris.	N Station	TN		TP		SS	
		Load	Trend	Load	Trend	Load	Trend
NY	6	5	5	5	5	5	5
PA	35	34	20	34	20	34	20
MD	32	30	24	30	23	30	23
DE	2	2	2	2	2	2	2
VA	36	36	34	24	12	24	12
WV	10	10	4	9	4	10	4
DC	4	4	1	4	1	4	1
TOTAL	125	121	90	108	67	109	67

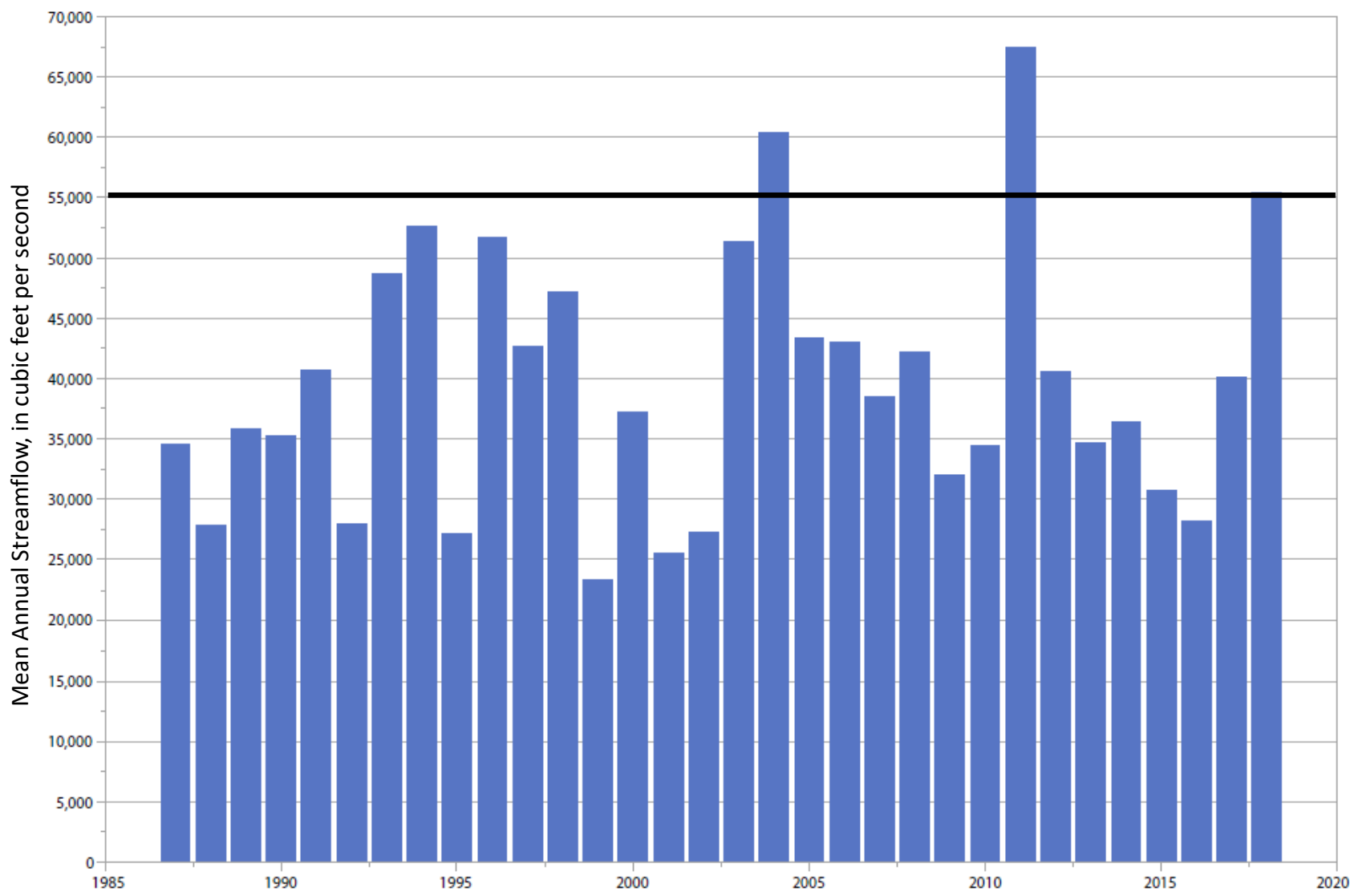
Juris.	Discontinued Stations	New
NY	1	0
PA	0	1
MD	1	1
DE	0	0
VA	0	0
WV	0	0
DC	0	0
TOTAL	2	2

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



Near Record-High Streamflow in 2018 Provides Valuable Information for our Load and Trend Estimation Method

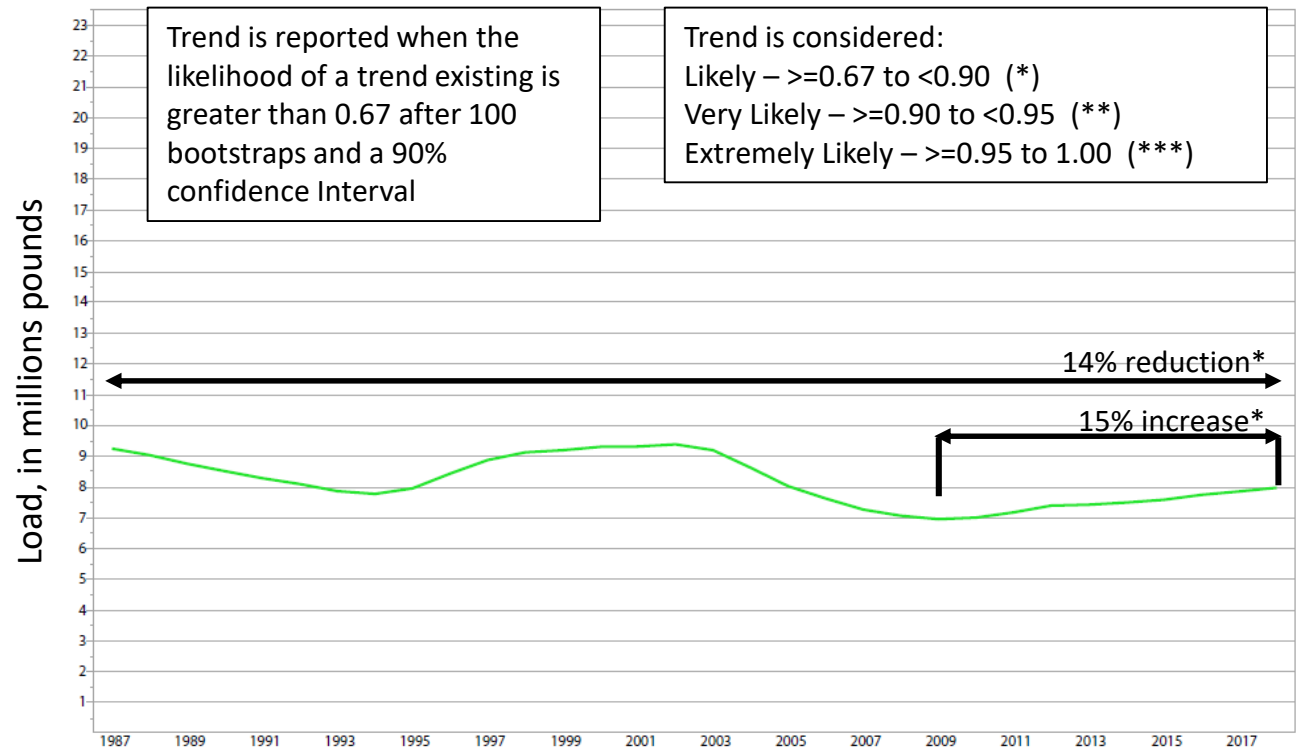
Susquehanna River at Marietta, Pa



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



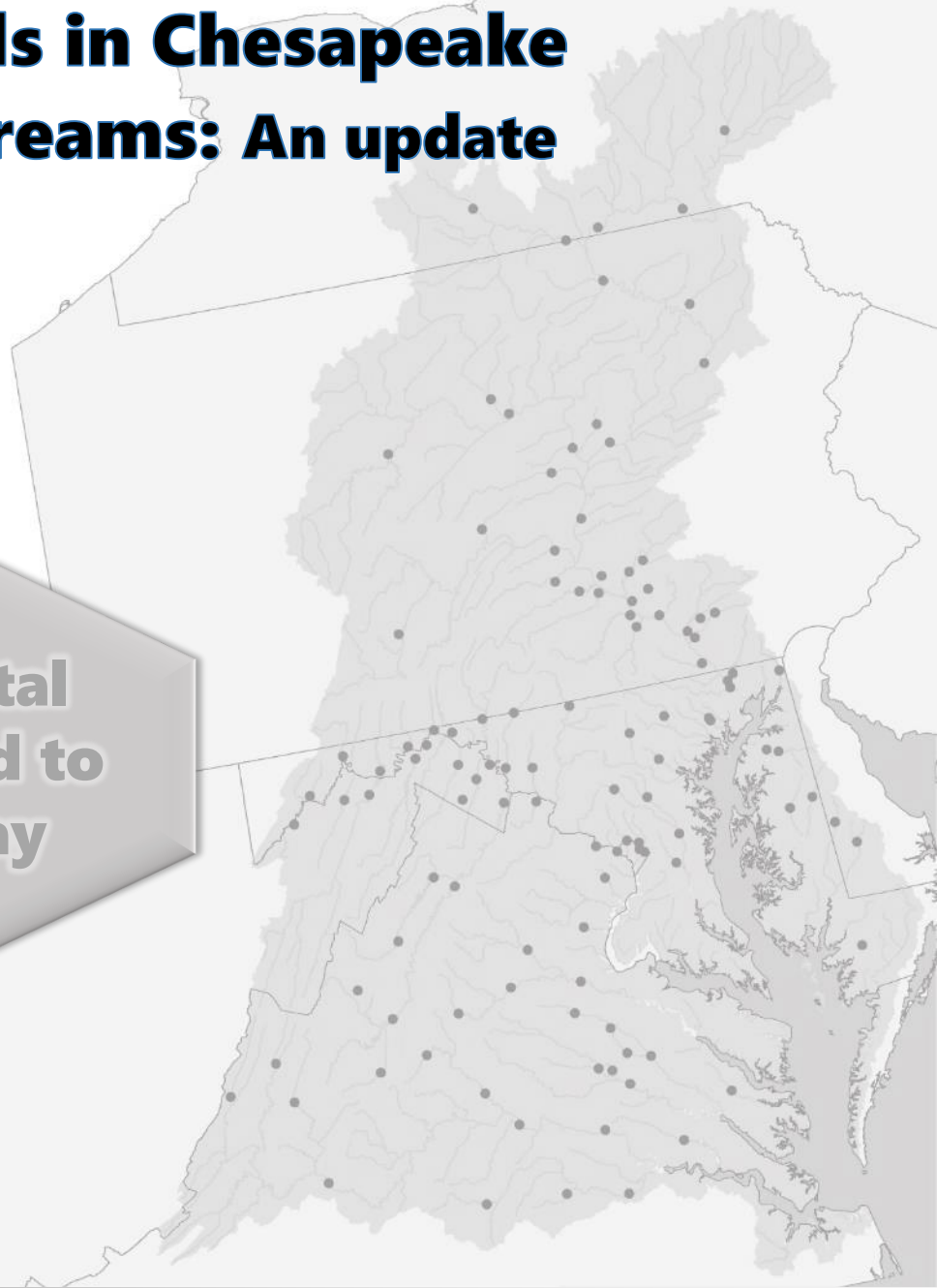
Load and trend results have been computed through 2018 to provide timely information available for decision making

What do we compute/report?

- Trends in flow-normalized load and concentration
 - Long-term - ~1985-2018
 - Short-term – 2009-2018
- Loads and concentration
 - Daily
 - Monthly
 - Annual
- Per-acre Loads (aka. Yields)
 - 10-year average (2009-2018)
 - 5-year average (2014-2018)



Nutrient Loads and Trends in Chesapeake Bay Nontidal Network Streams: An update and presentation of results



Summary of nitrogen and phosphorous trends: 2009-2018²

Trends in total nitrogen

- 41% of NTN stations showing reductions in nitrogen loading (median change 7%)
- Good news – Majority of improvements occur in agricultural areas of the lower Susquehanna and Potomac.
- 3 of 9 River Input stations are showing reductions in nitrogen loading (Potomac, Patuxent, and James)

Trends in total phosphorus

- 44% of NTN stations showing reductions in phosphorus loading (median change 15%)
- 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
- 2 of 9 River Input stations are showing reductions in phosphorus loading (Patuxent and James)
- For trends in suspended-sediment loading, 20 percent of NTN stations are showing reductions
- 2 of 9 River Input stations are showing reductions in suspended-sediment loading (Susquehanna and James)

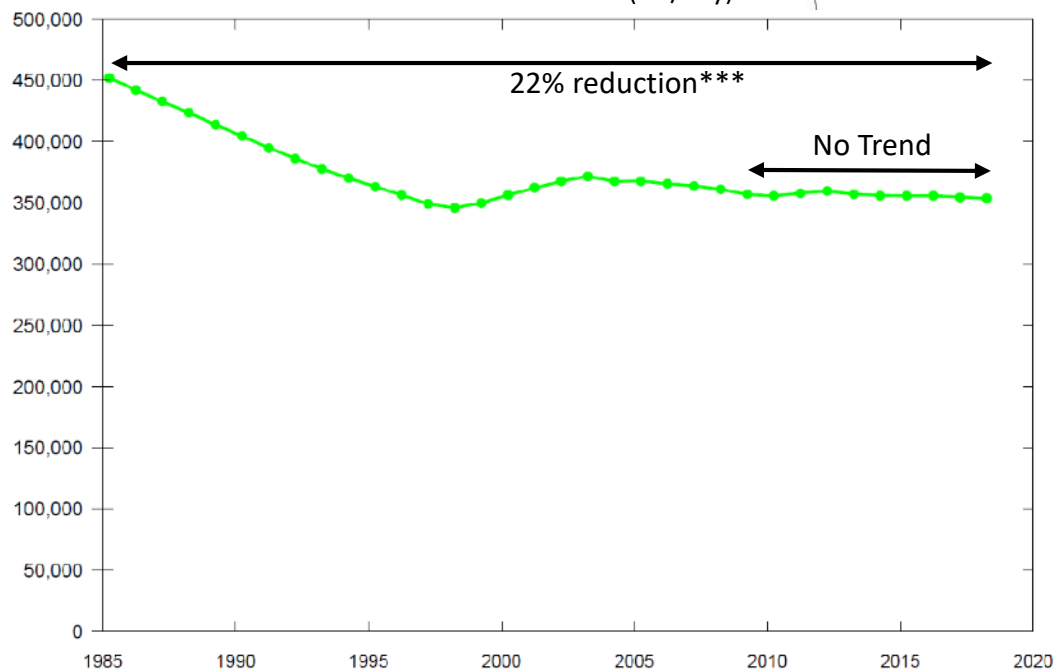


Trends in nitrogen loads result from changing nitrogen inputs or transport

River Input Monitoring Station:

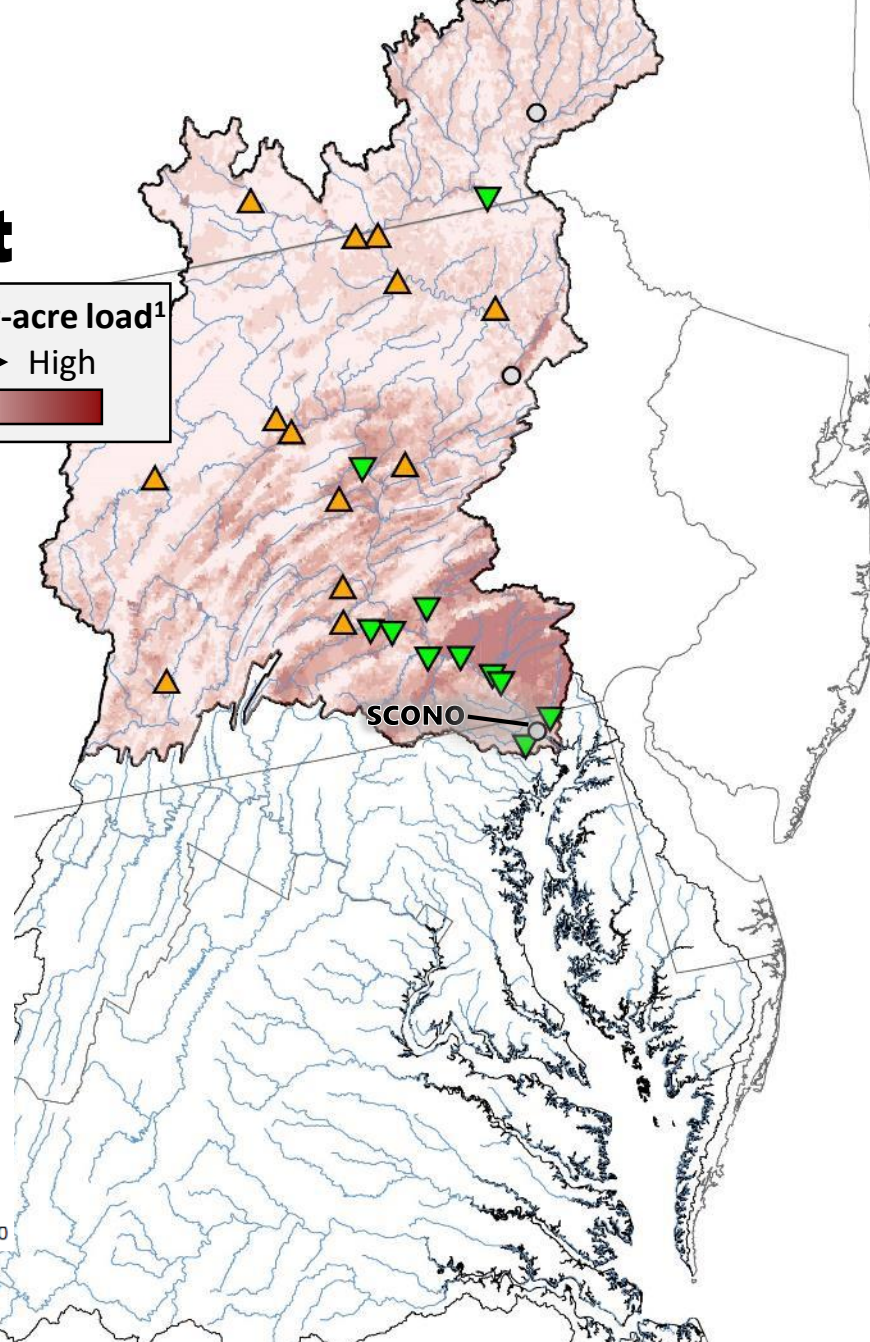
Susquehanna River at Conowingo

Flow Normalized Load (lbs/day)



Nitrogen per-acre load¹

Low → High

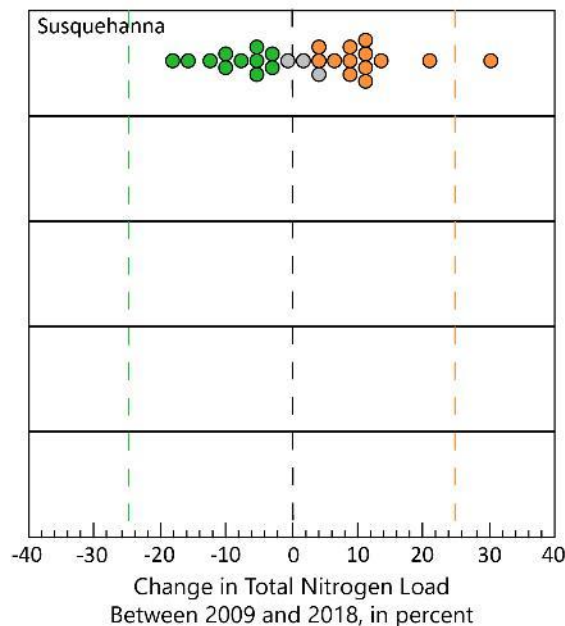


Trends in nitrogen loads result from changing nitrogen inputs or transport

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

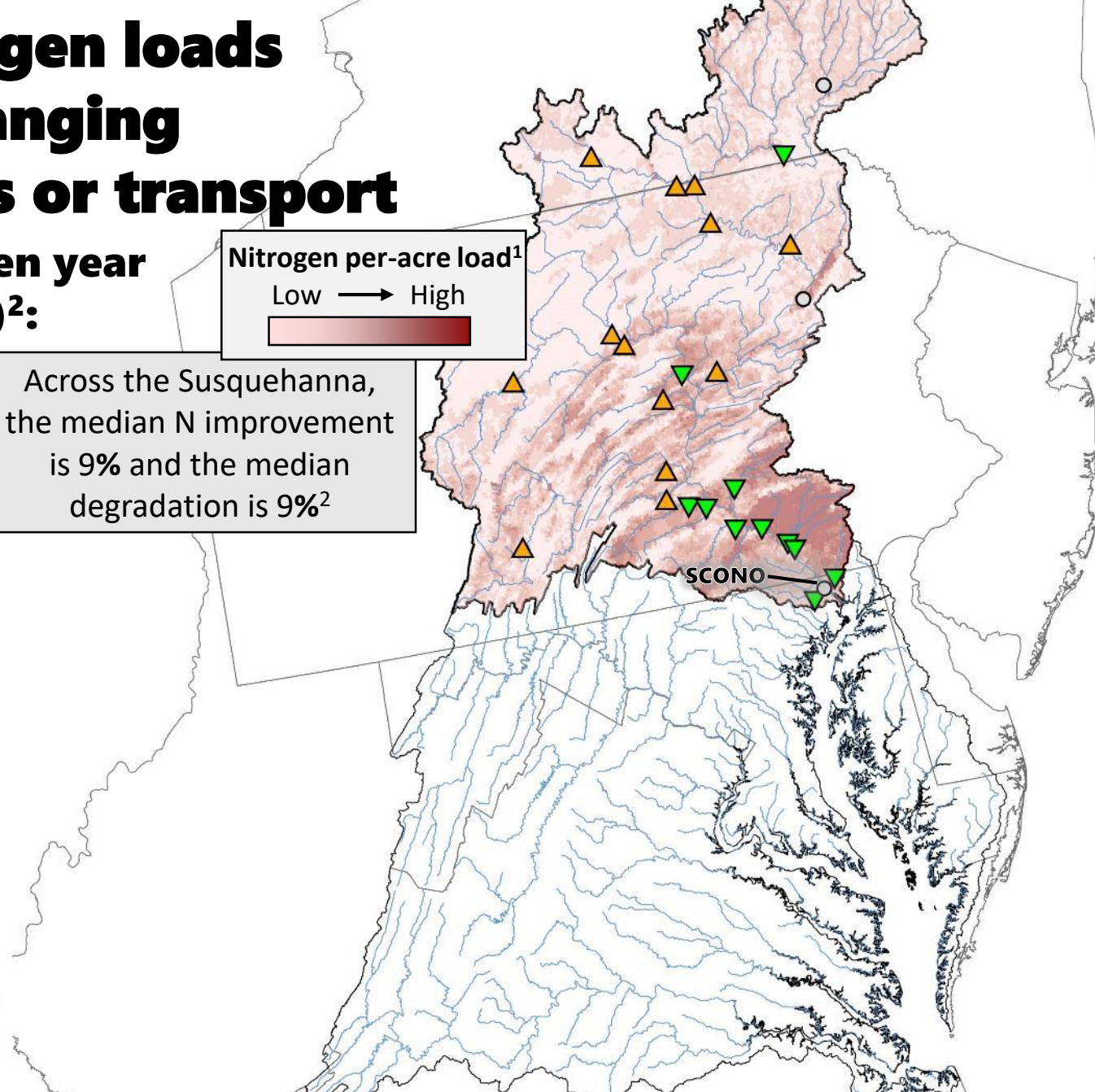
Nitrogen loads (**n=27**) have improved at **11**, degraded at **13**, and have no trend at **3** stations².

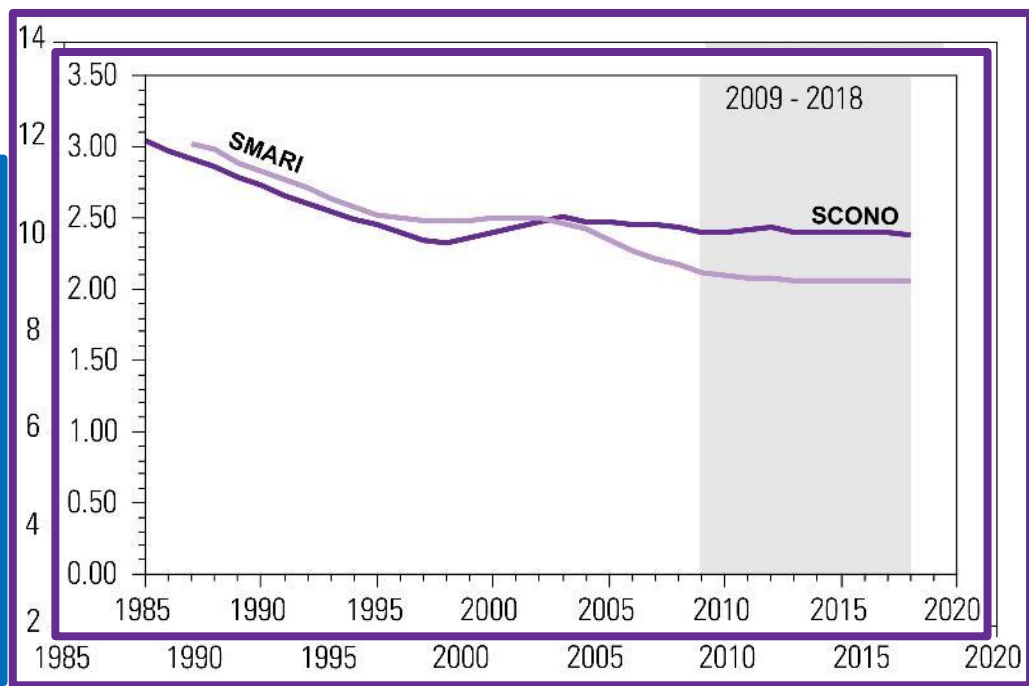
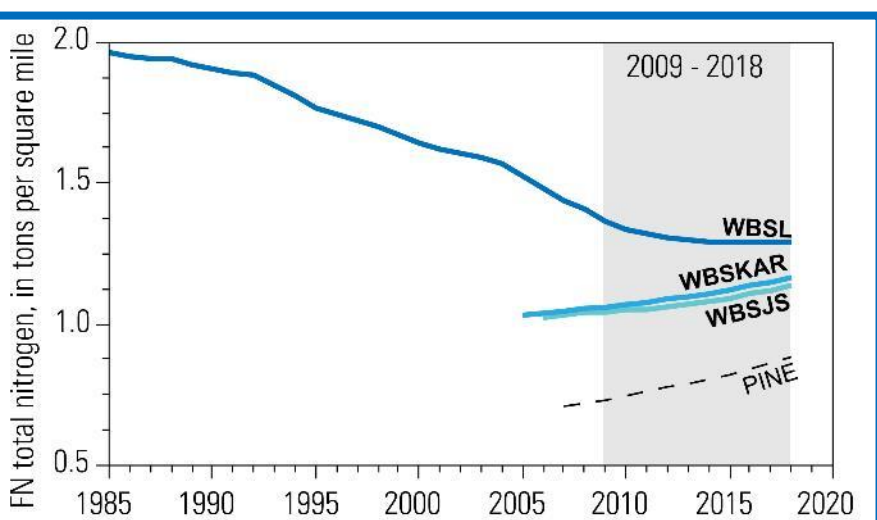
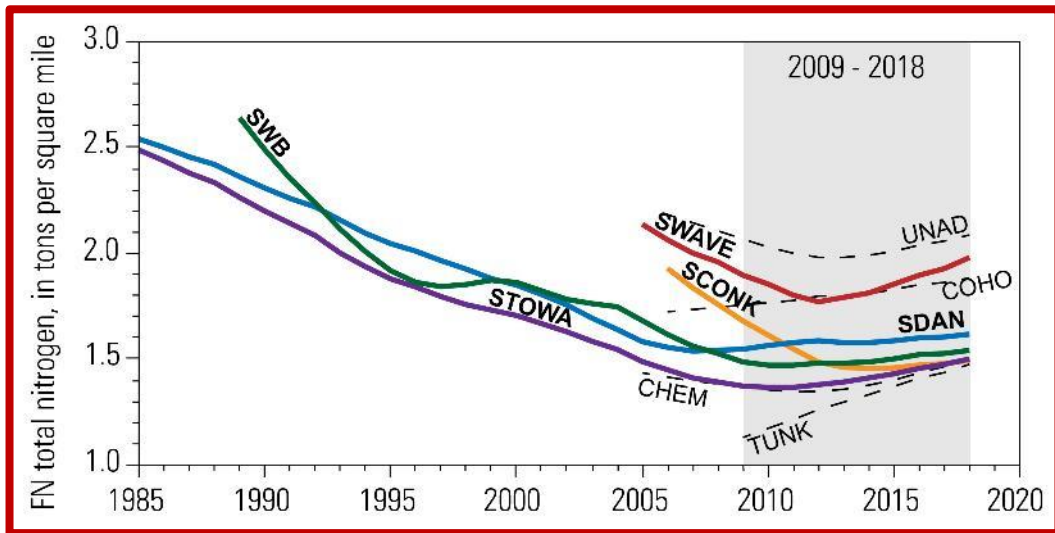
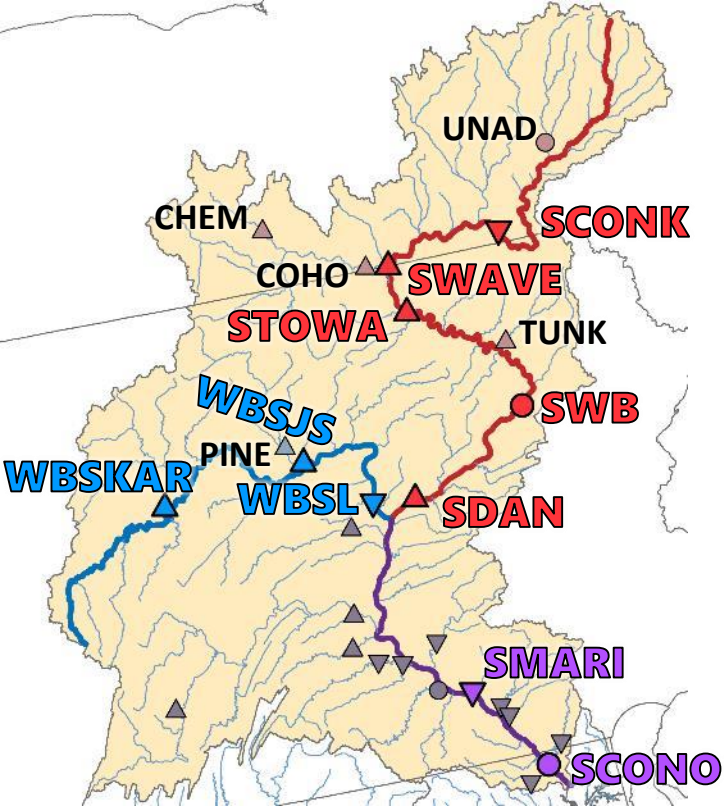
Across the Susquehanna, the median N improvement is 9% and the median degradation is 9%²

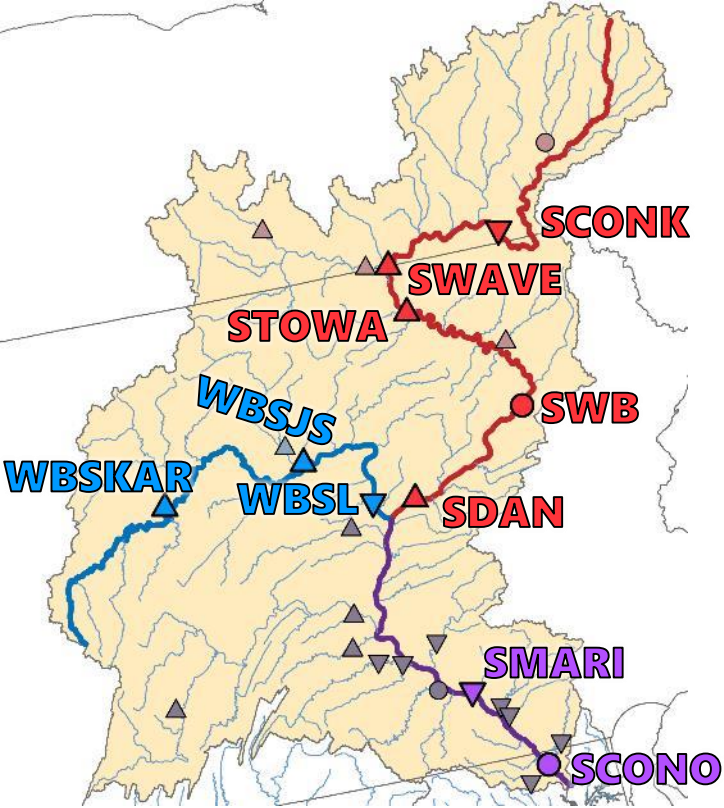


Nitrogen per-acre load¹

Low → High







- What is driving nitrate reductions in lower Susquehanna tributaries?
- How many BMPs are targeting sediment and the retention of particulate nutrients throughout the basin?

- FN yields are decreasing in most lower Susquehanna tributaries
- Yields are typically highest in the lower Susquehanna, with most TN contributed by nitrate
- **SMARI** yields have declined, benefitting from reduced TN contributed by surrounding tributaries.

- FN yields increased in 3/4 WB Susquehanna stations

- FN yields increased in 6/9 Upper Susquehanna stations and have been tracking upward in all stations over the past few years.

- There is evidence of increased particulate N export in many Upper and West Branch Susquehanna stations:
 - High-flow TN concentrations have increased
 - TN/NO₃ ratios have shifted
 - SS export has increased in many stations

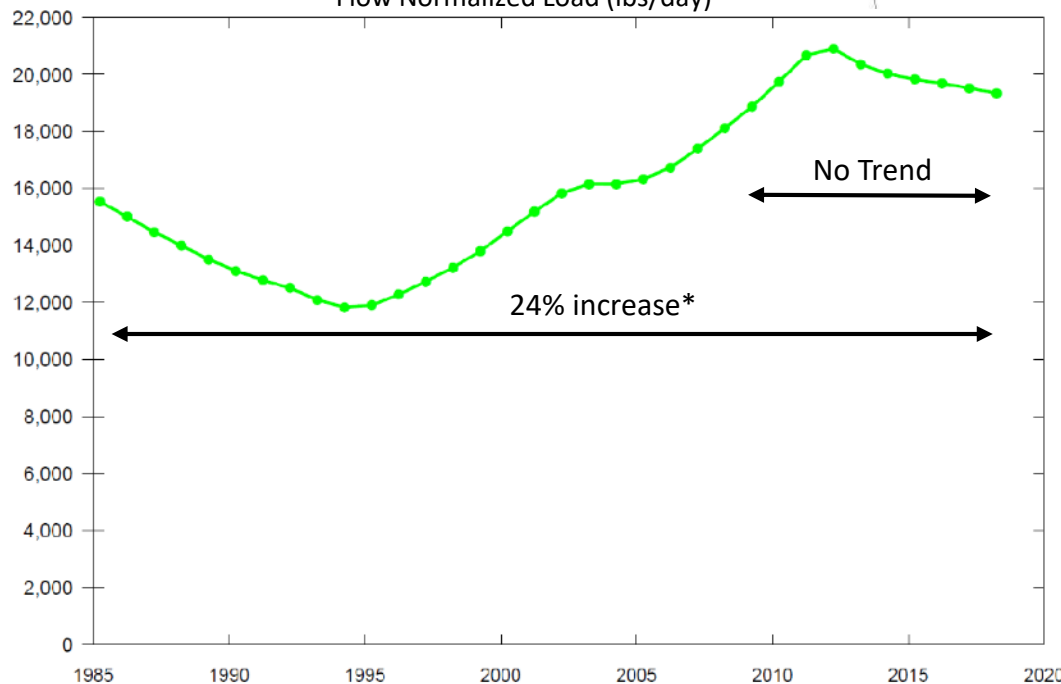
- **SDAN** and **WBSL** trends may increase in coming years as a result of increases from upstream contributing areas.
- About 70% of **SMARI** streamflow is from **WBSL** and **SDAN**; increases in these upstream stations will have negative impact on **SMARI** yields.

Trends in phosphorus loads result from changing phosphorus inputs or transport

River Input Monitoring Station:

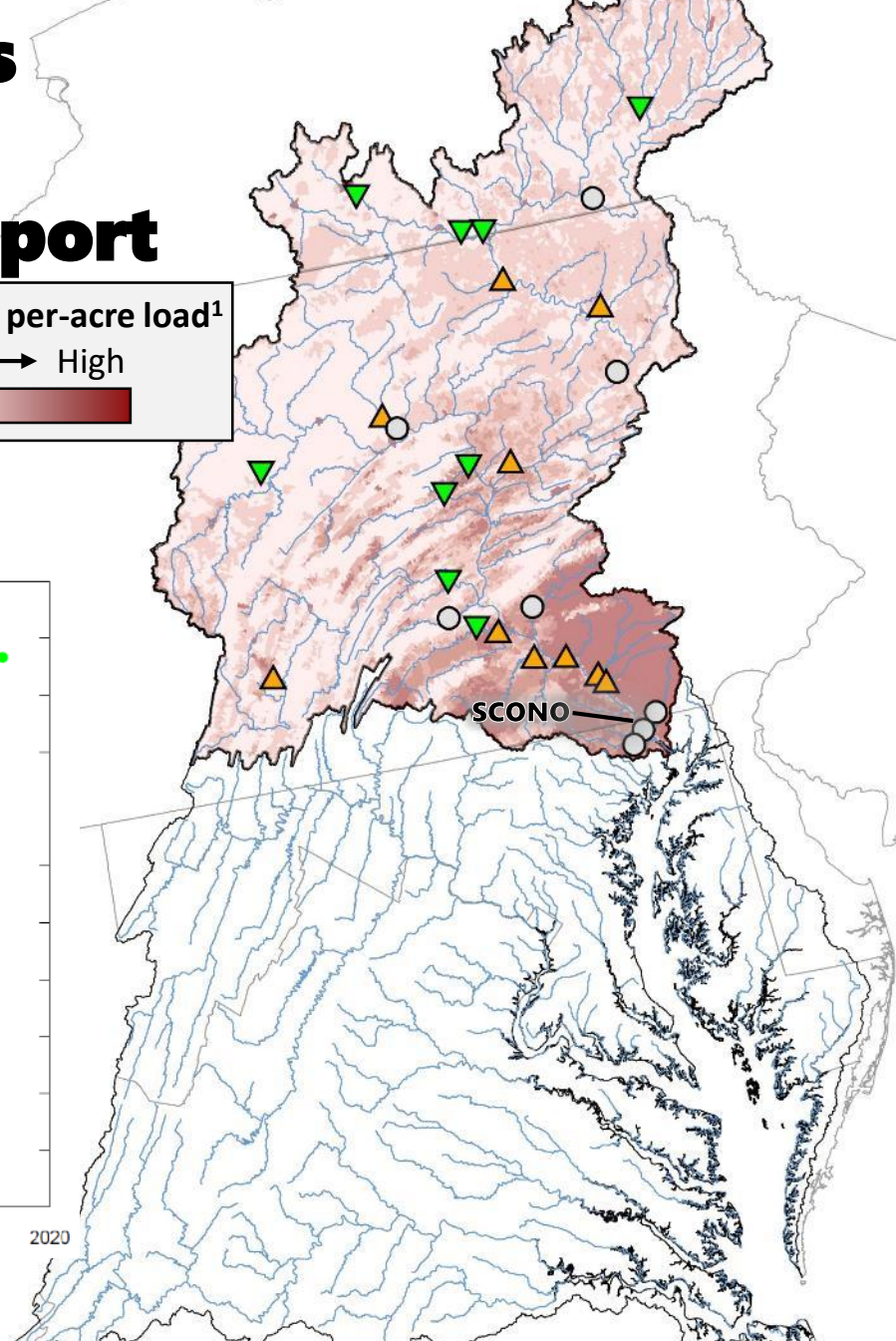
Susquehanna River at Conowingo

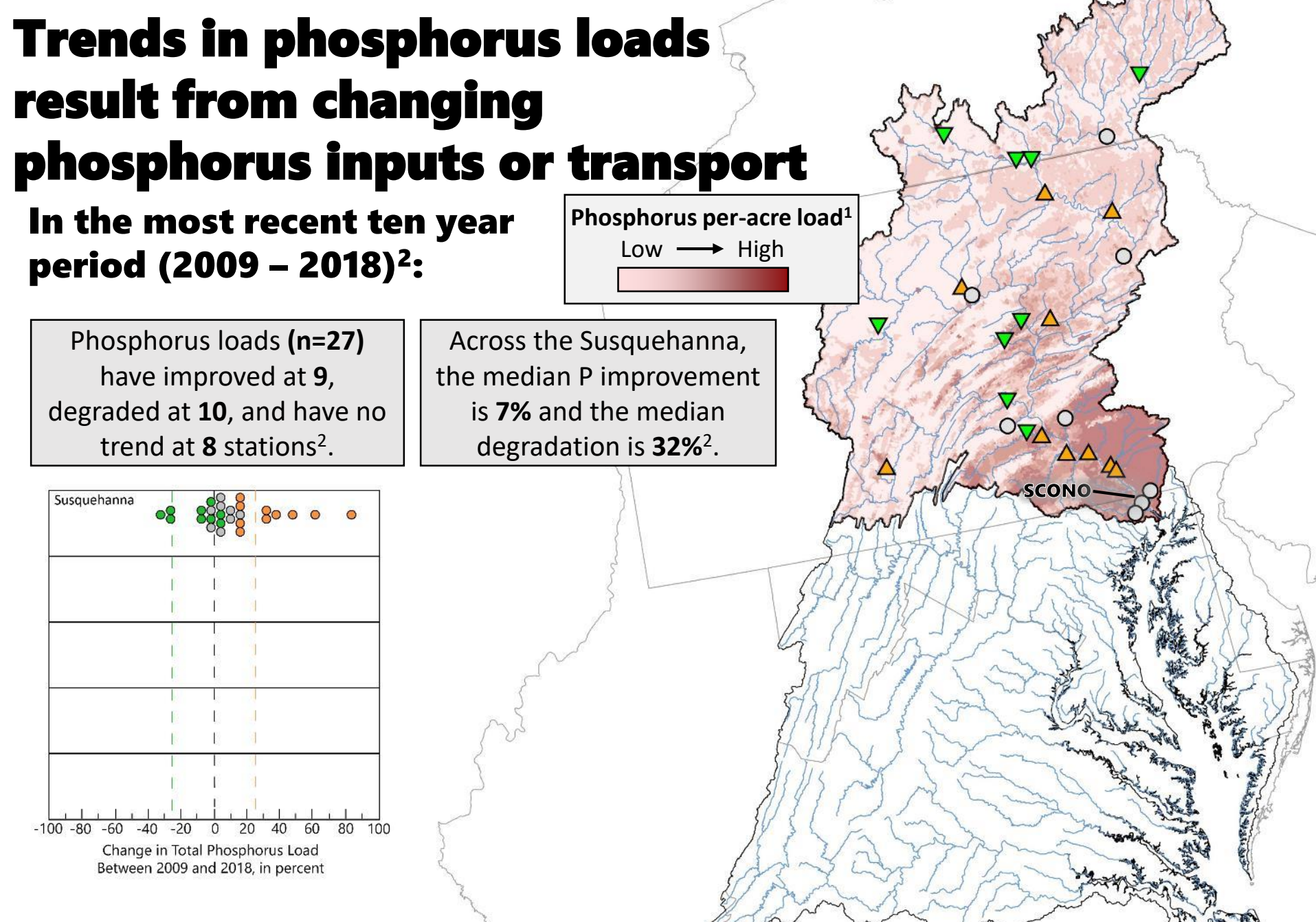
Flow Normalized Load (lbs/day)



Phosphorus per-acre load¹

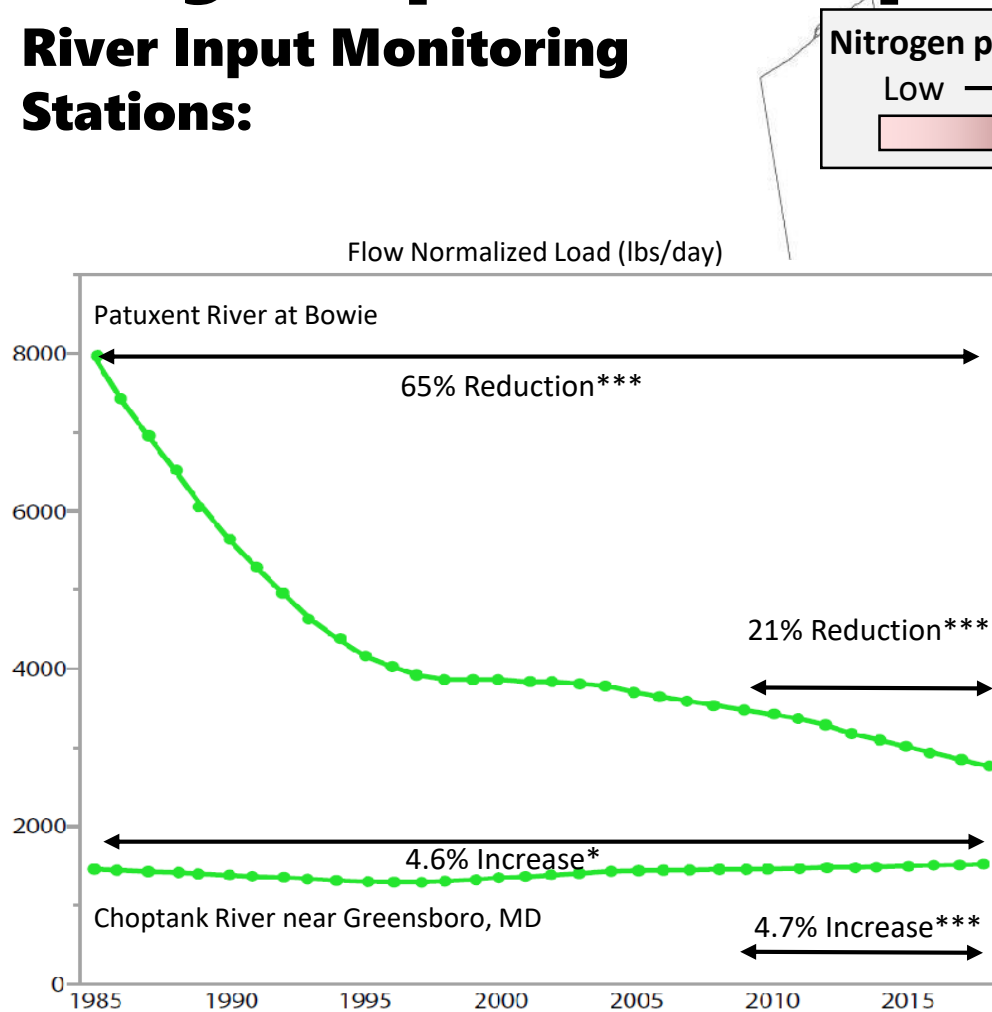
Low → High





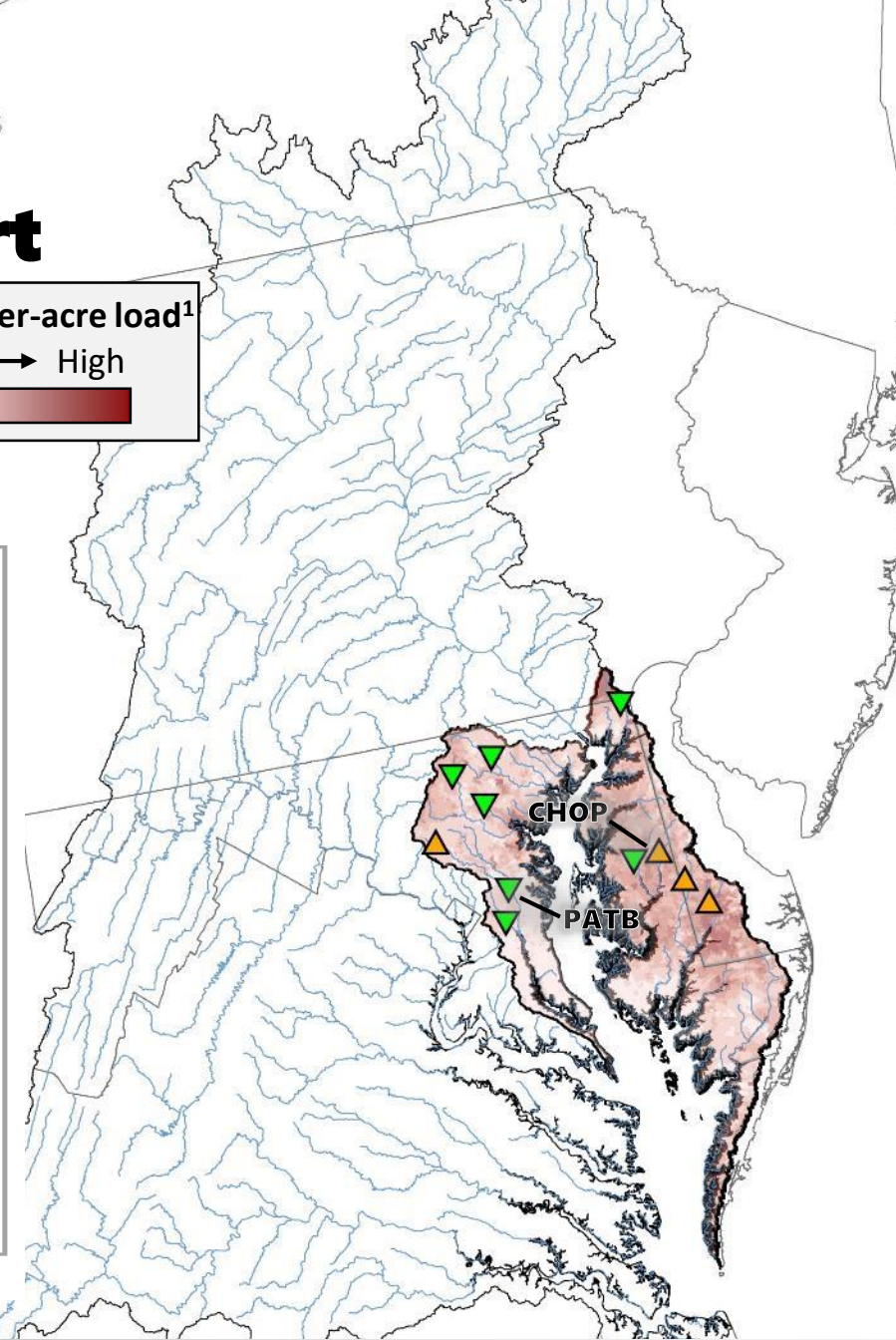
Trends in nitrogen loads result from changing nitrogen inputs or transport

River Input Monitoring Stations:



Nitrogen per-acre load¹

Low → High




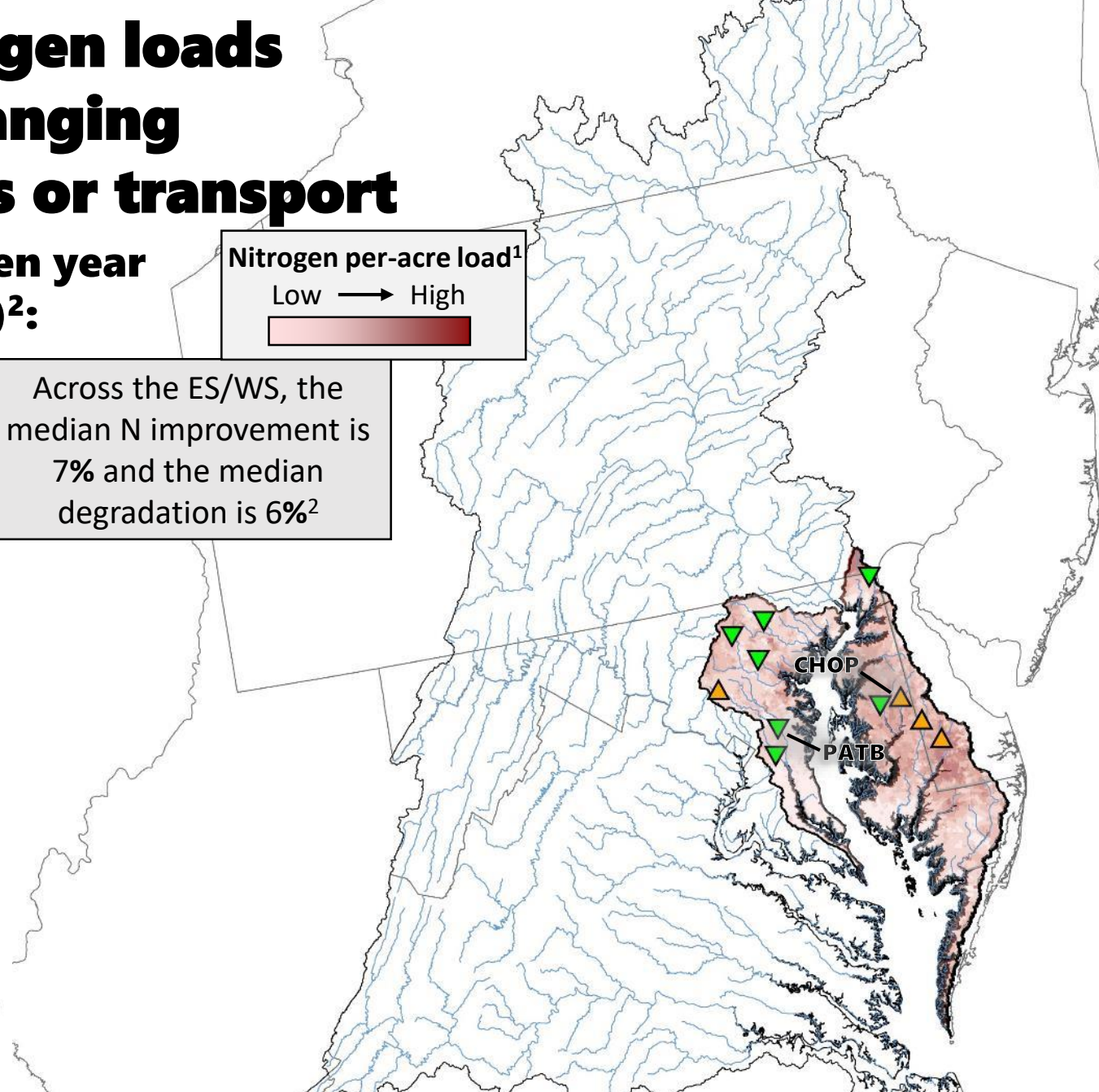
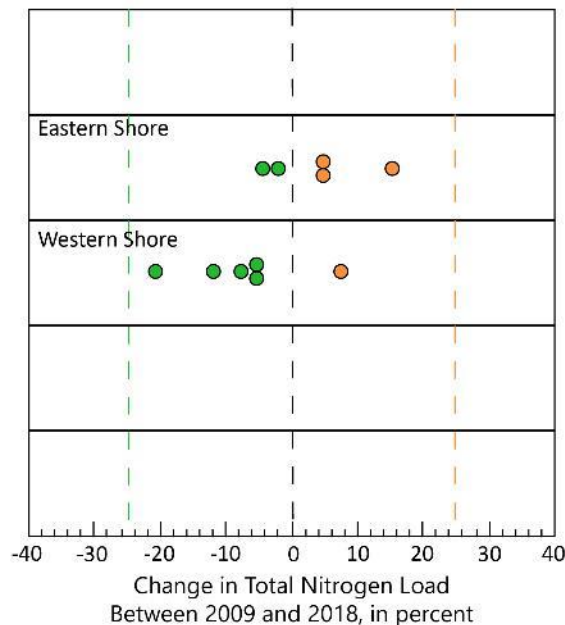
Trends in nitrogen loads result from changing nitrogen inputs or transport

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

Nitrogen loads (**n=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


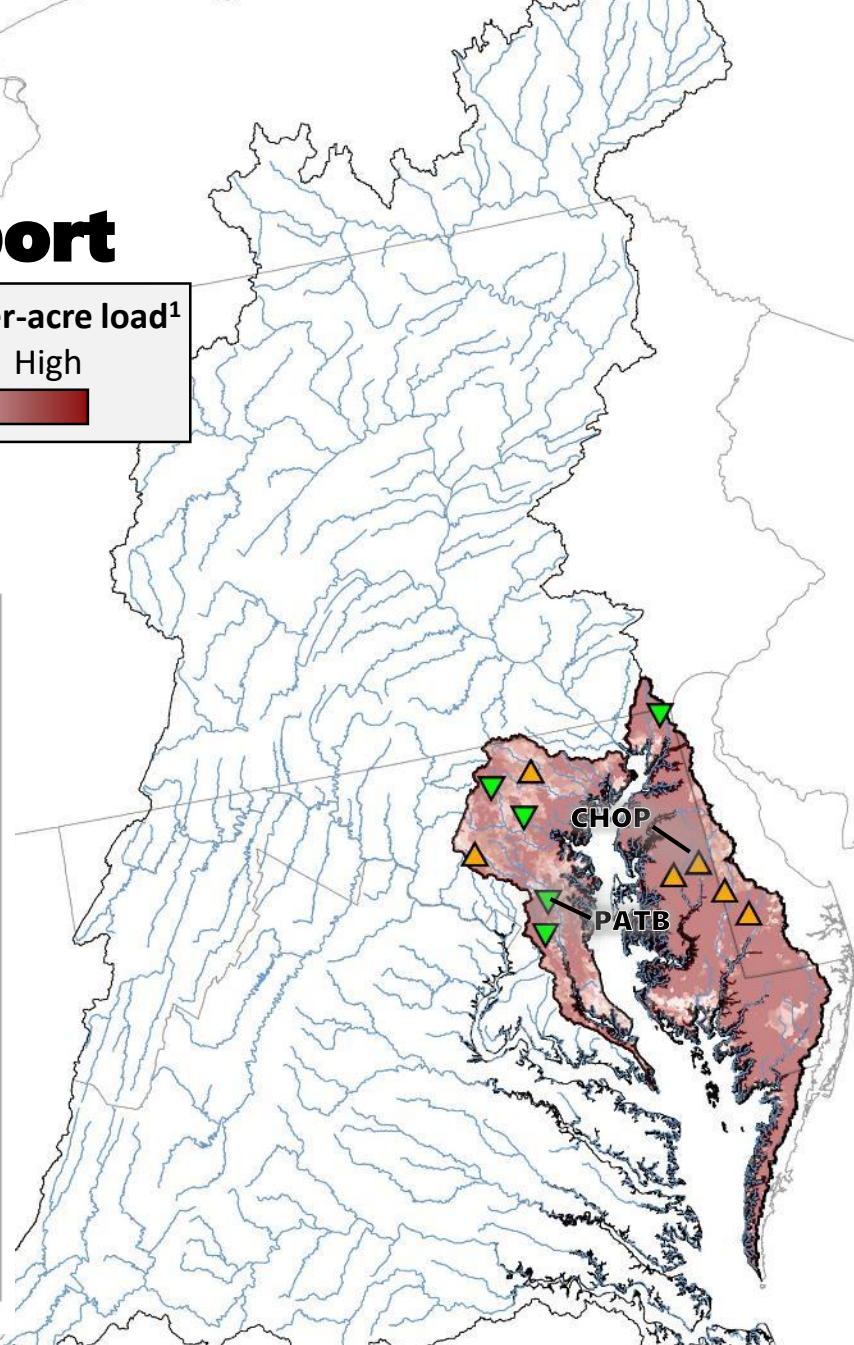
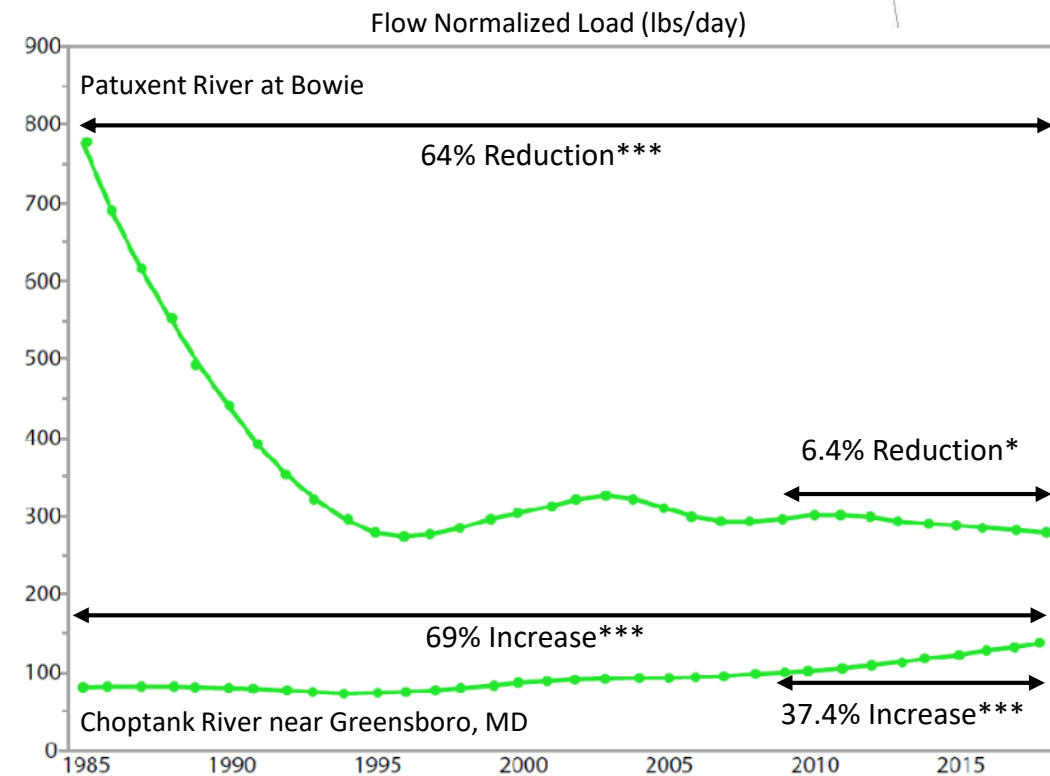


Trends in phosphorus loads result from changing phosphorus inputs or transport

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:

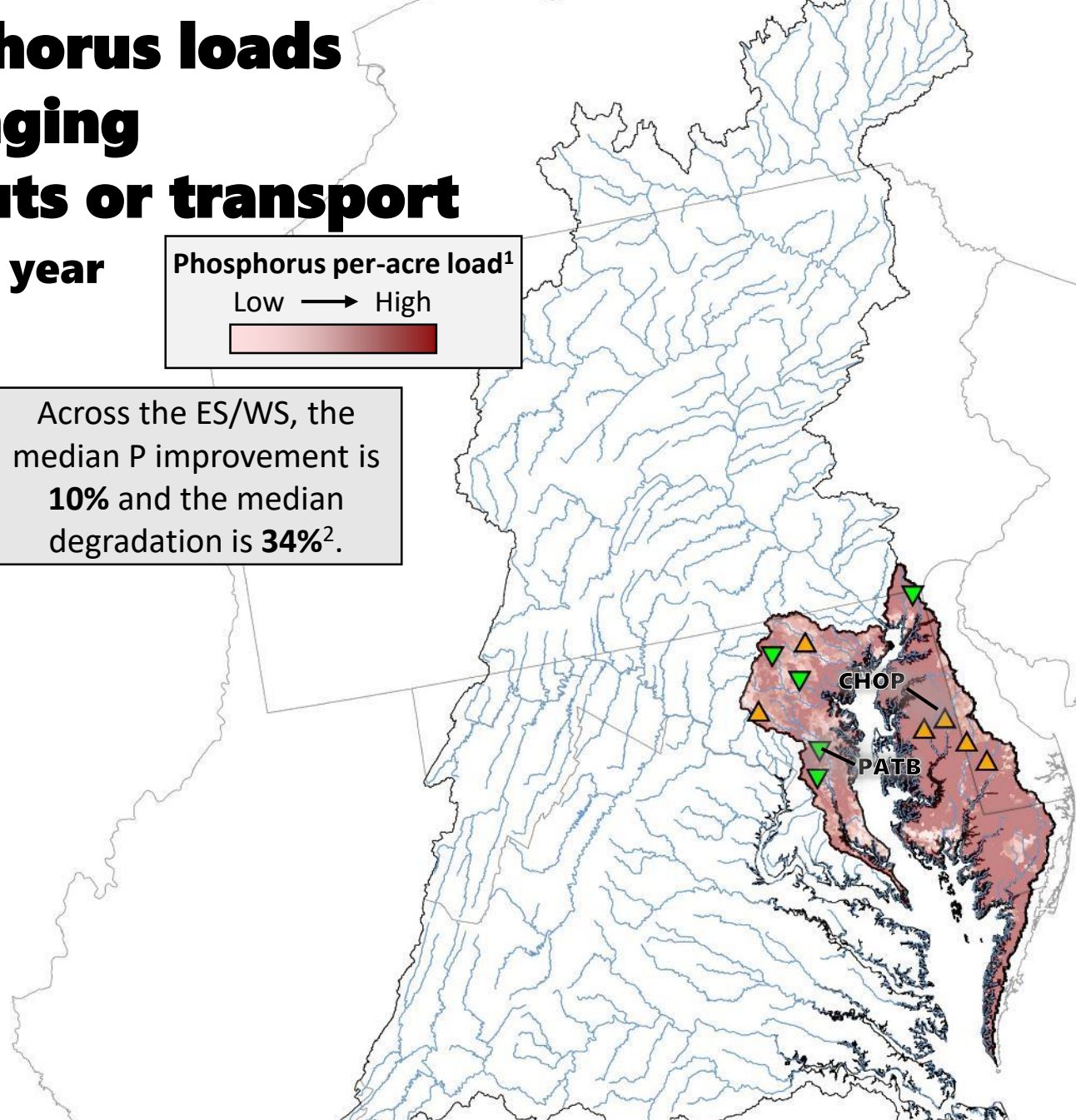
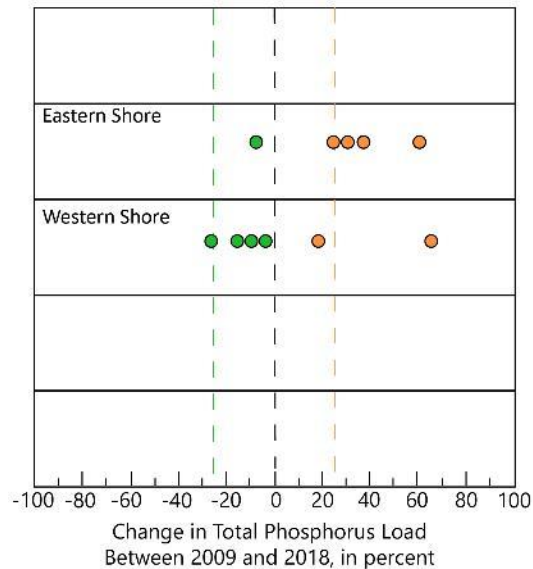
Phosphorus per-acre load¹

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:

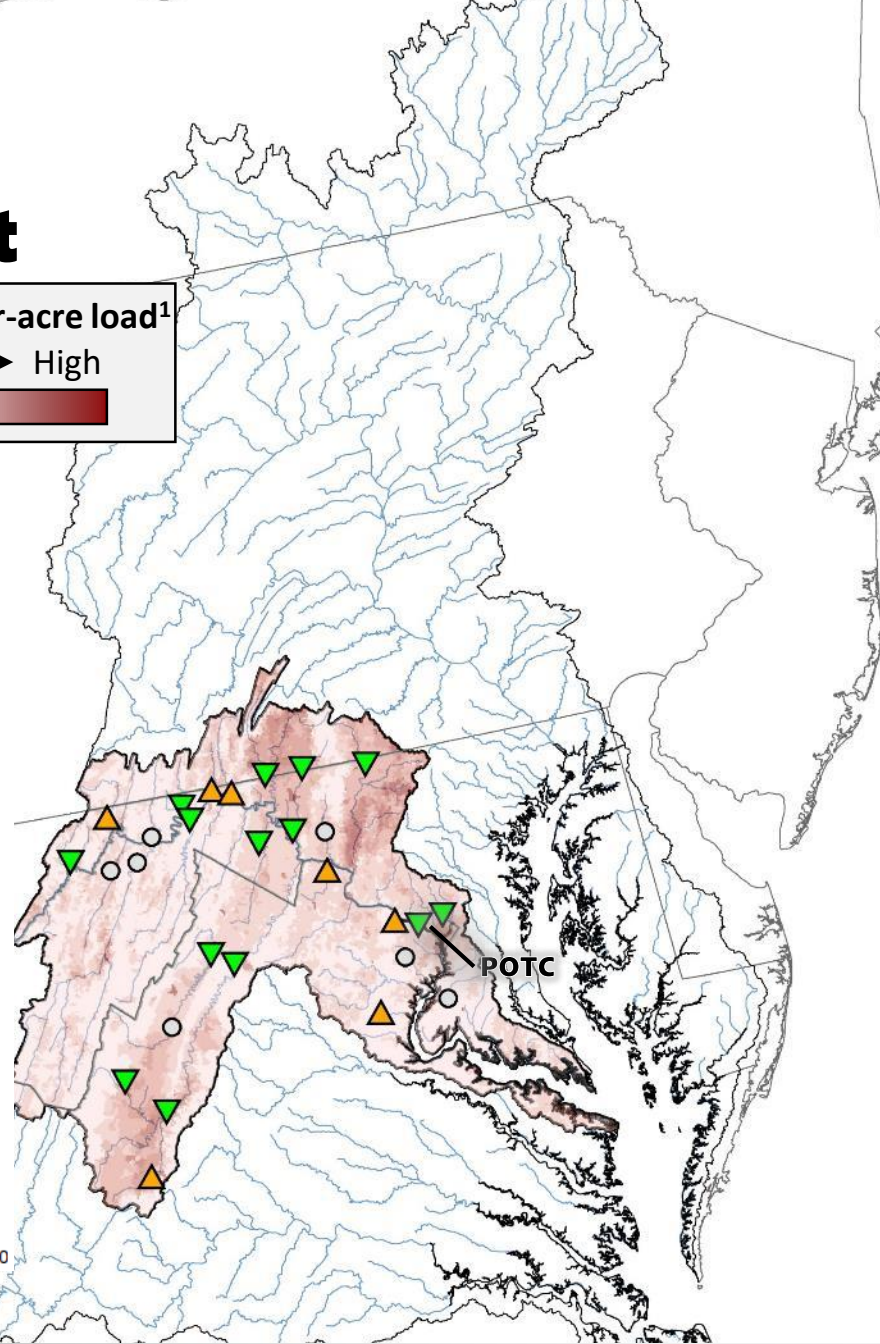
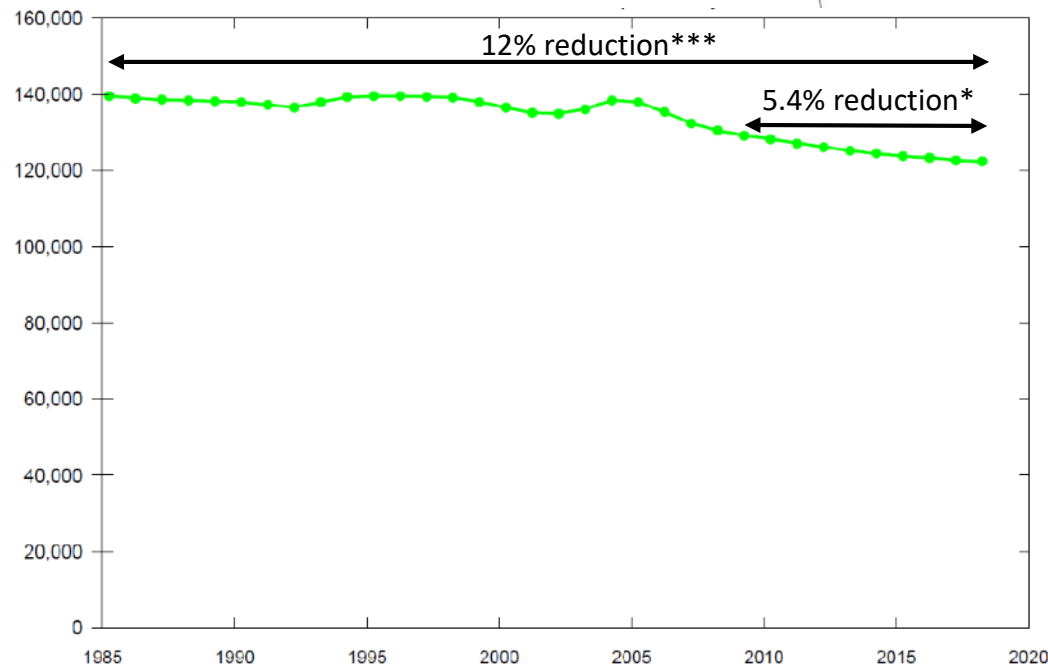
Nitrogen per-acre load¹

Low → High



Potomac River at Chain Bridge, Washington, DC

Flow Normalized Load (lbs/day)

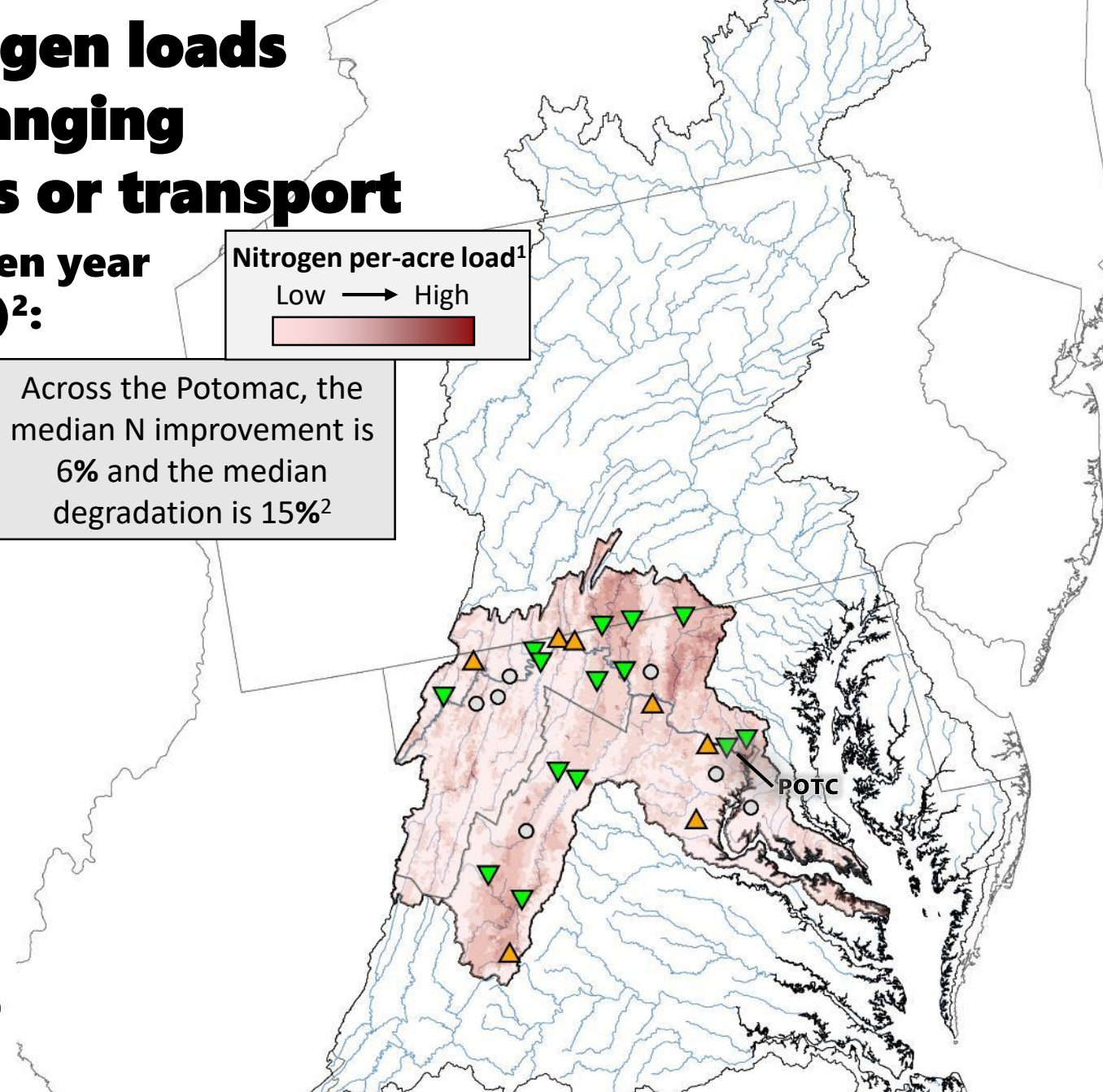
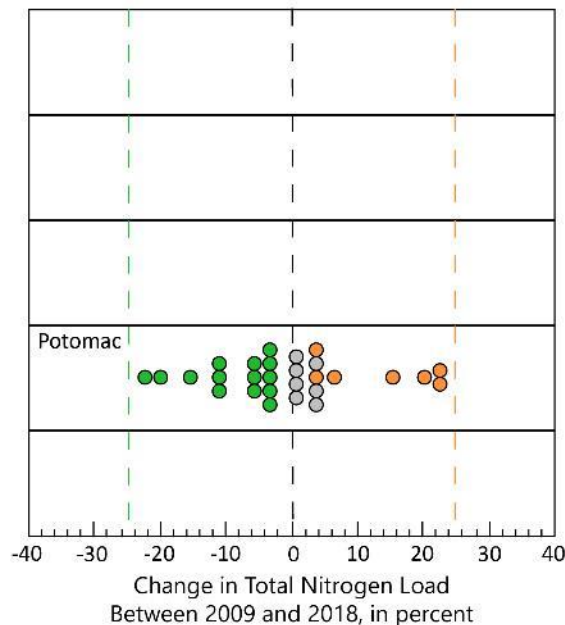


Trends in nitrogen loads result from changing nitrogen inputs or transport

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



Trends in phosphorus loads result from changing phosphorus inputs or transport

River Input Monitoring Station:

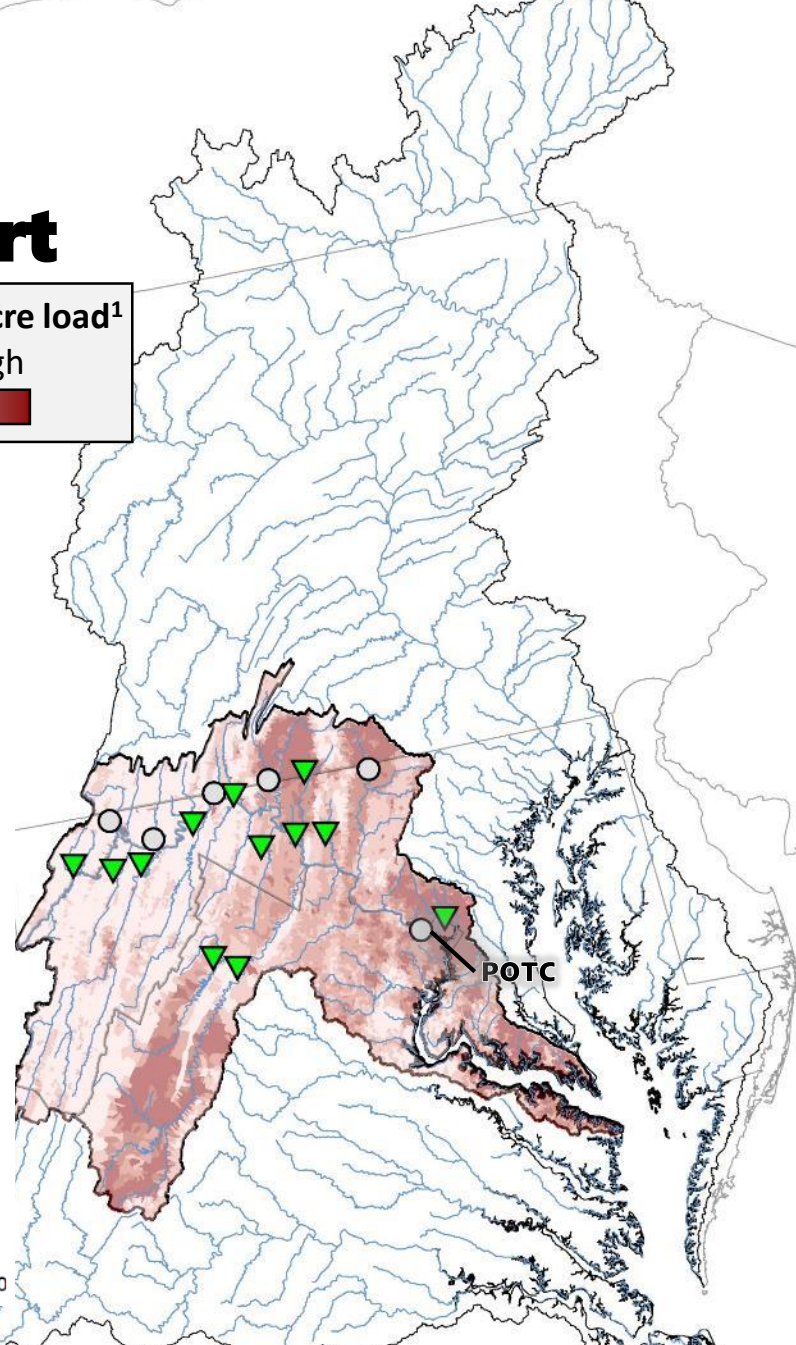
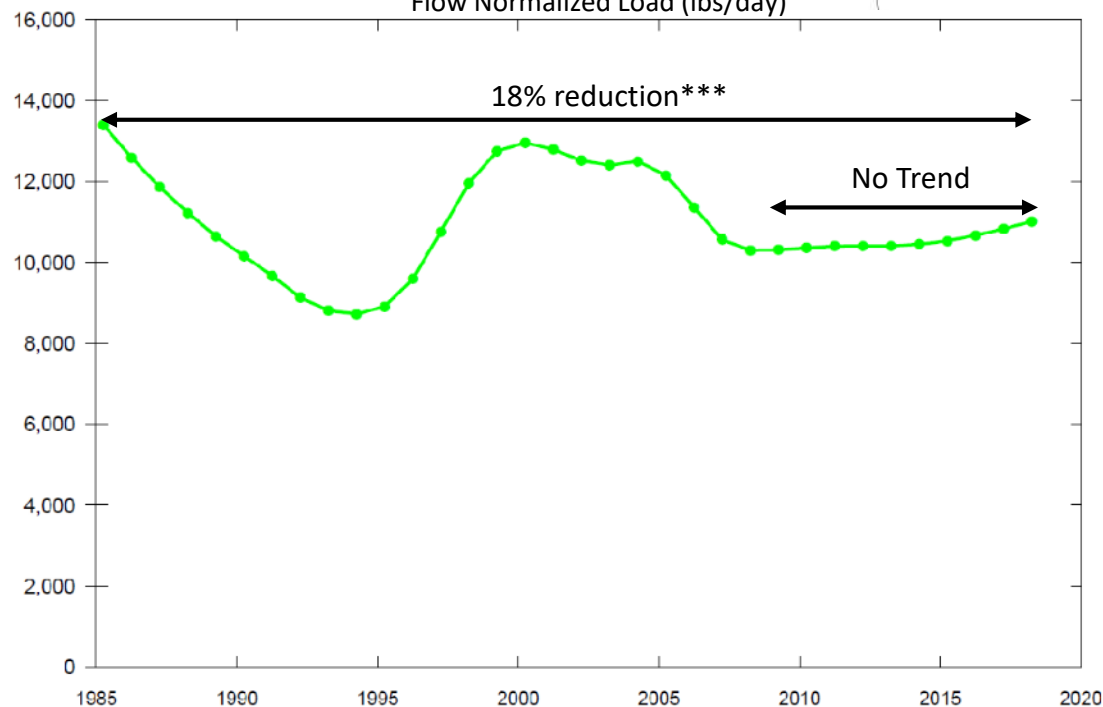
Phosphorus per-acre load¹

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:

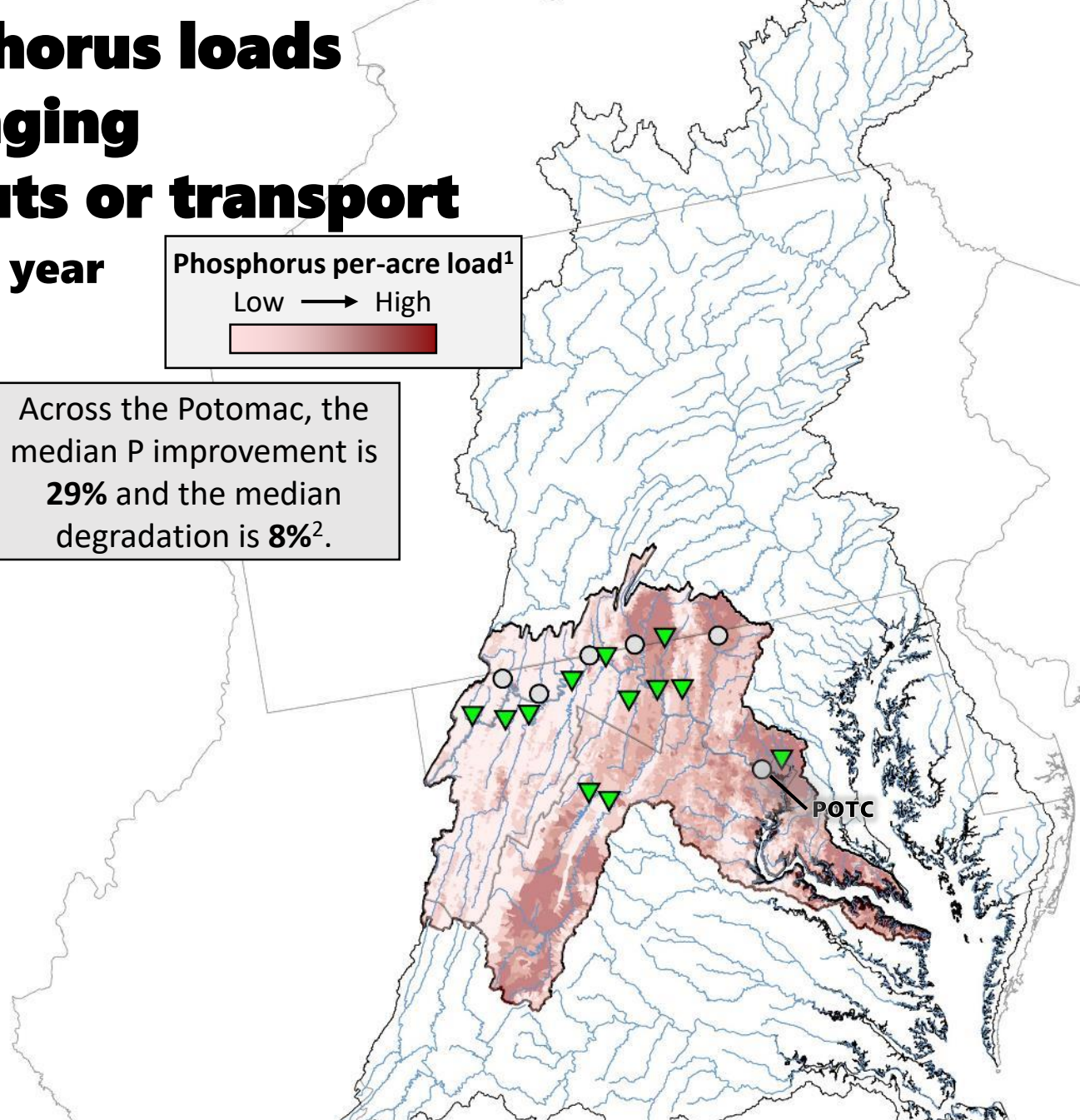
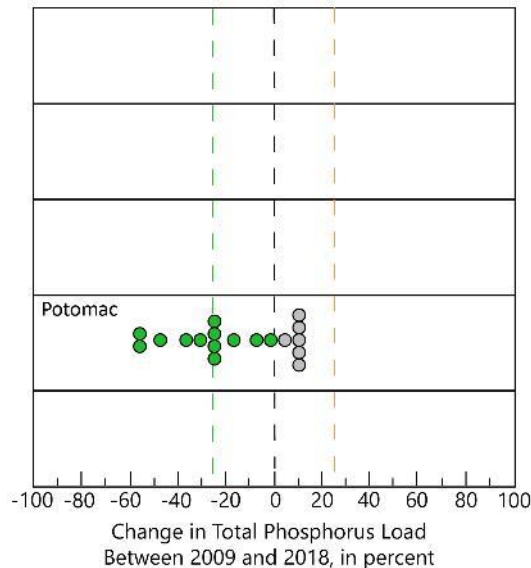
Phosphorus per-acre load¹

Low → High



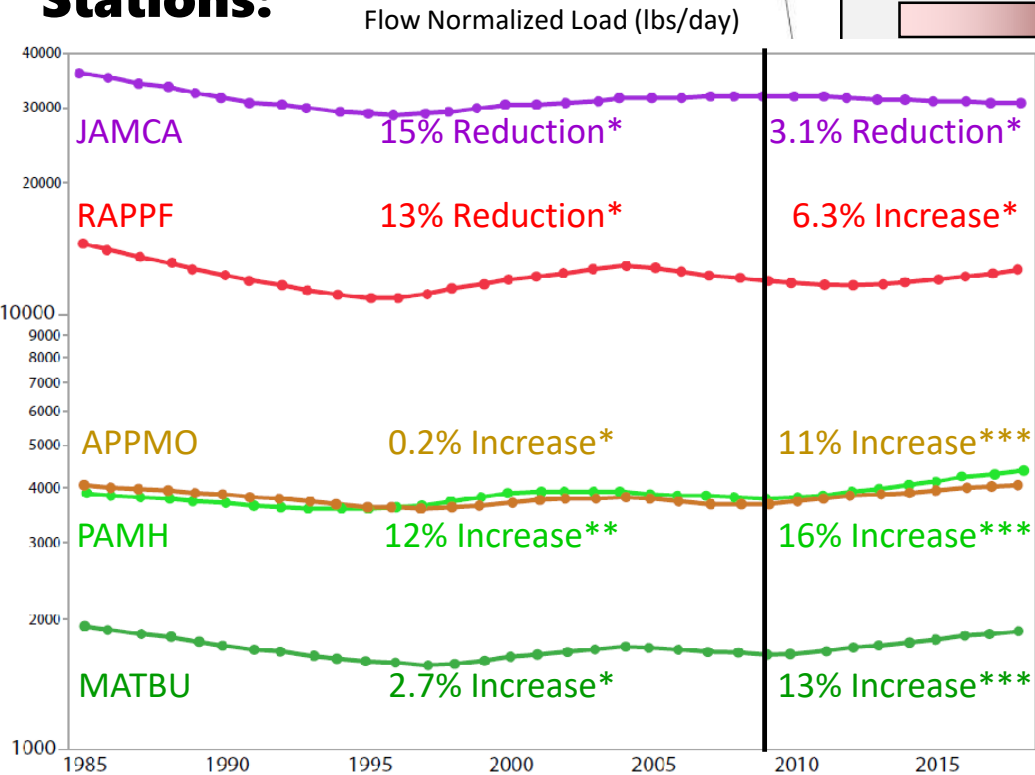
Phosphorus loads (n=18) have improved at 12 and have no trend at 6 stations².

Across the Potomac, the median P improvement is 29% and the median degradation is 8%².



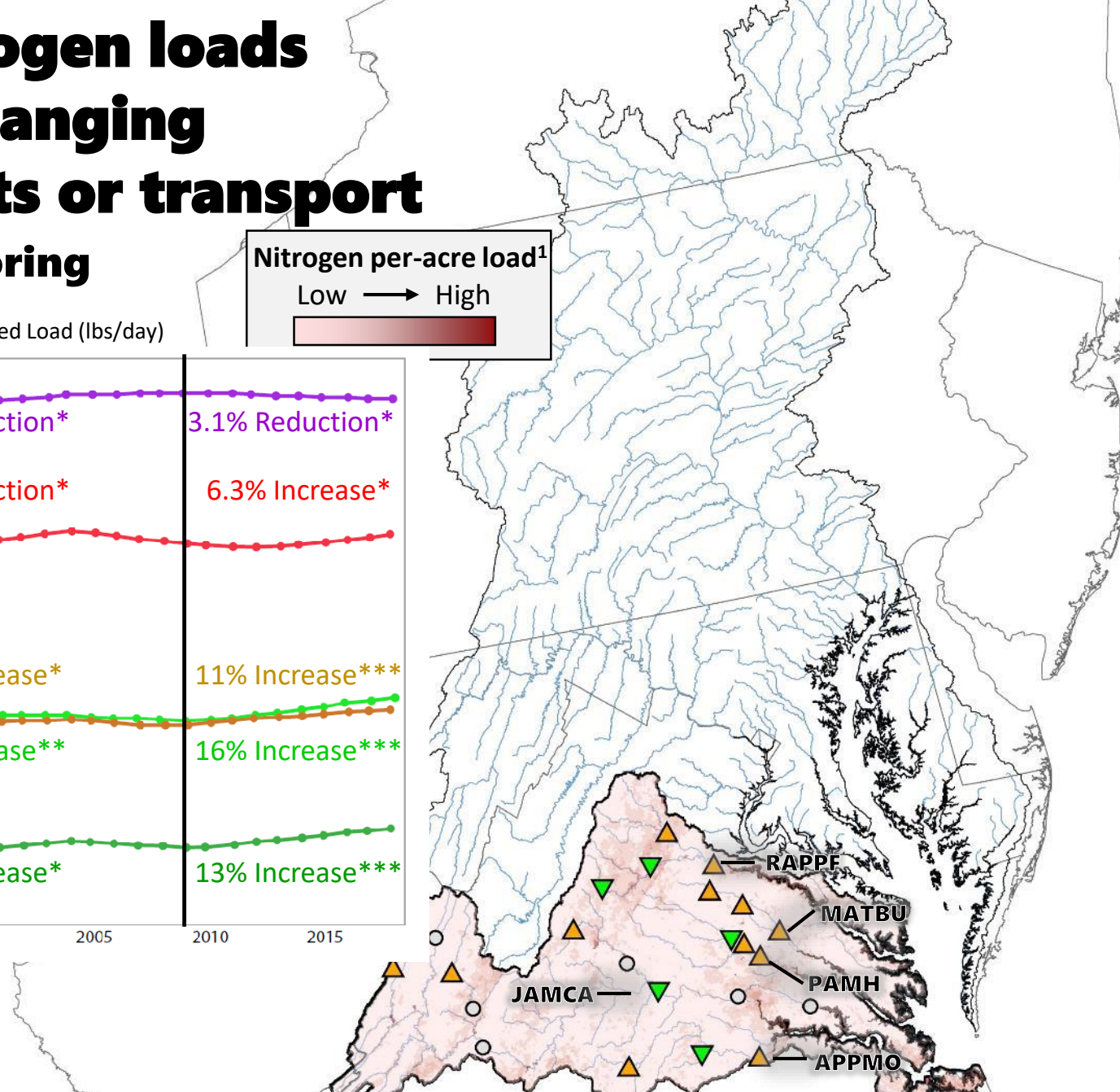
Trends in nitrogen loads result from changing nitrogen inputs or transport

River Input Monitoring Stations:



Nitrogen per-acre load¹

Low → High

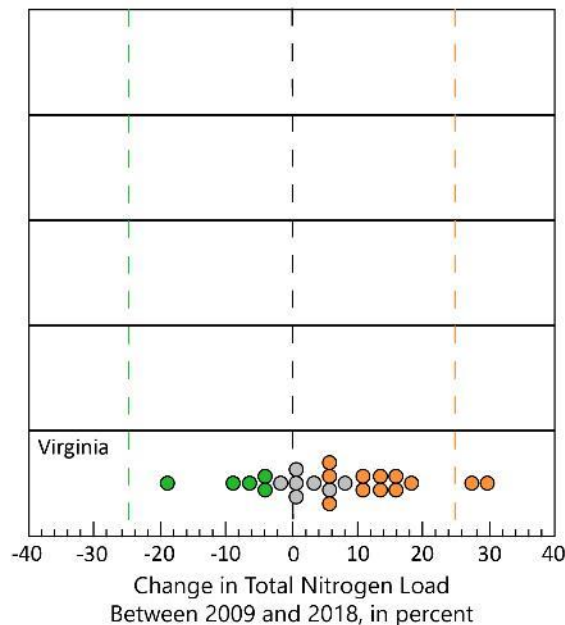


Trends in nitrogen loads result from changing nitrogen inputs or transport

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

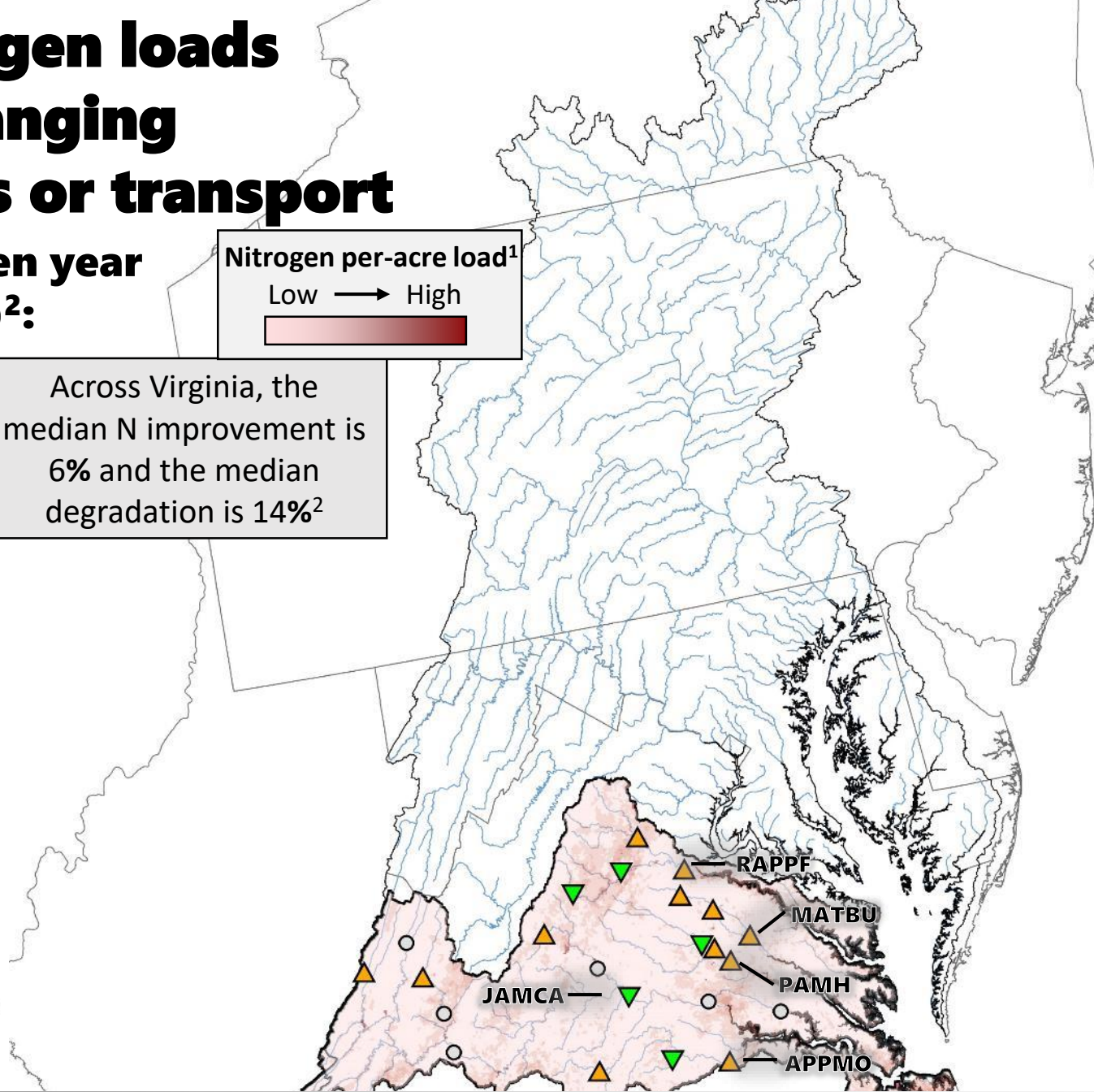
Nitrogen loads (**n=24**) have improved at **5**, degraded at **12**, and have no trend at **7** stations².

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



Nitrogen per-acre load¹

Low → High

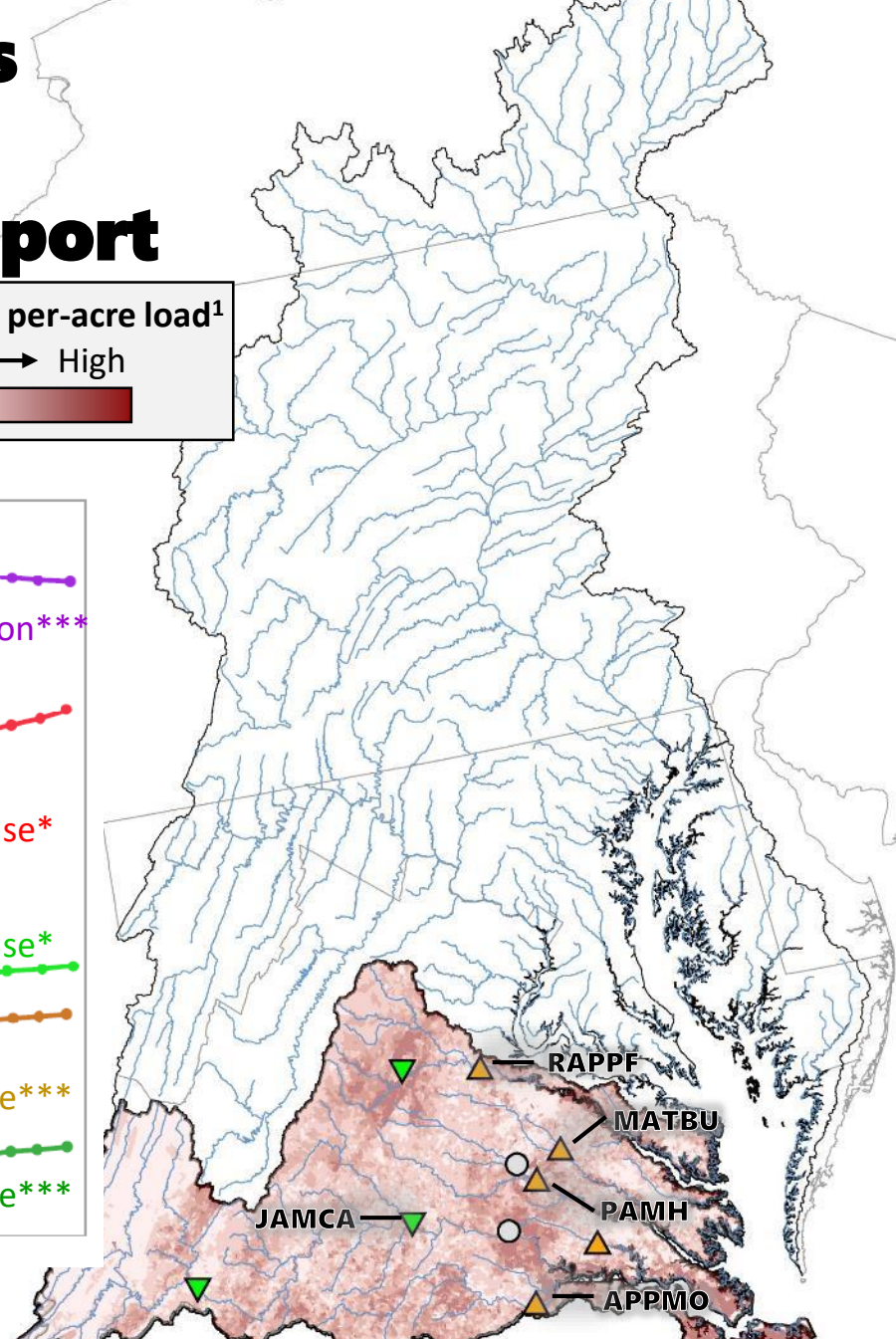
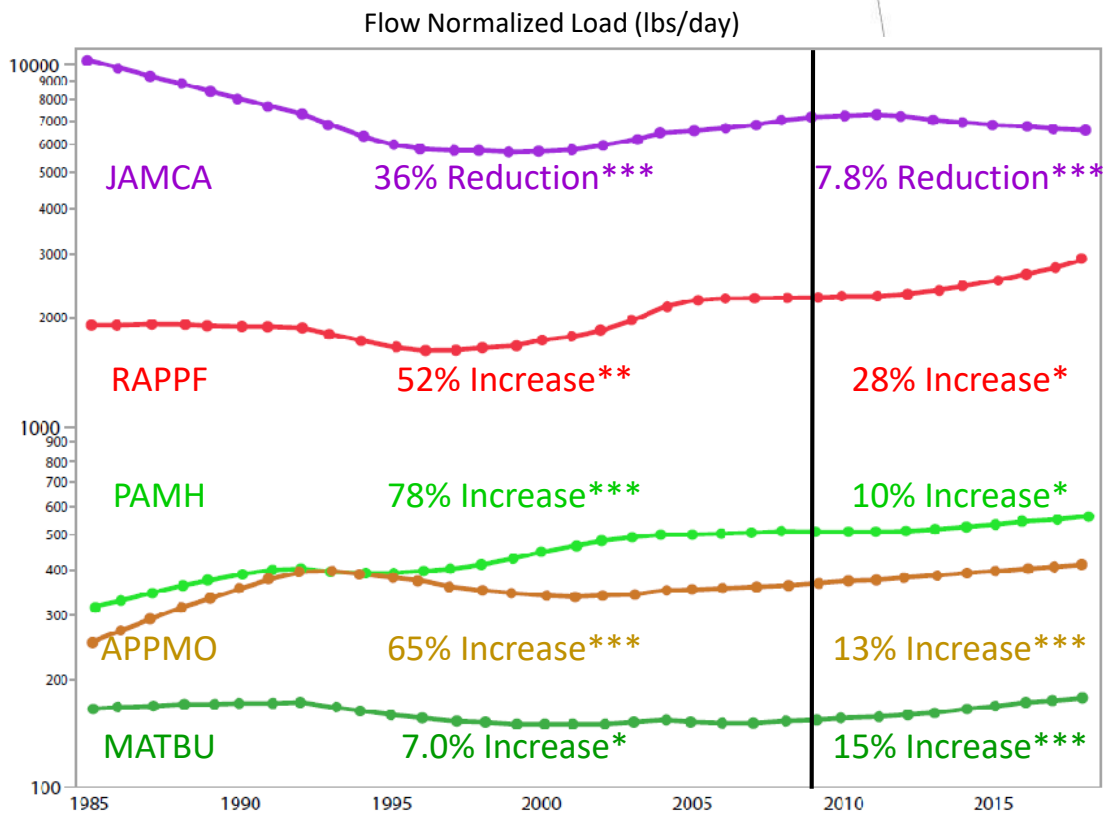


Trends in phosphorus loads result from changing phosphorus inputs or transport

River Input Monitoring Stations:

Phosphorus per-acre load¹

Low → High



Trends in phosphorus loads result from changing phosphorus inputs or transport

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

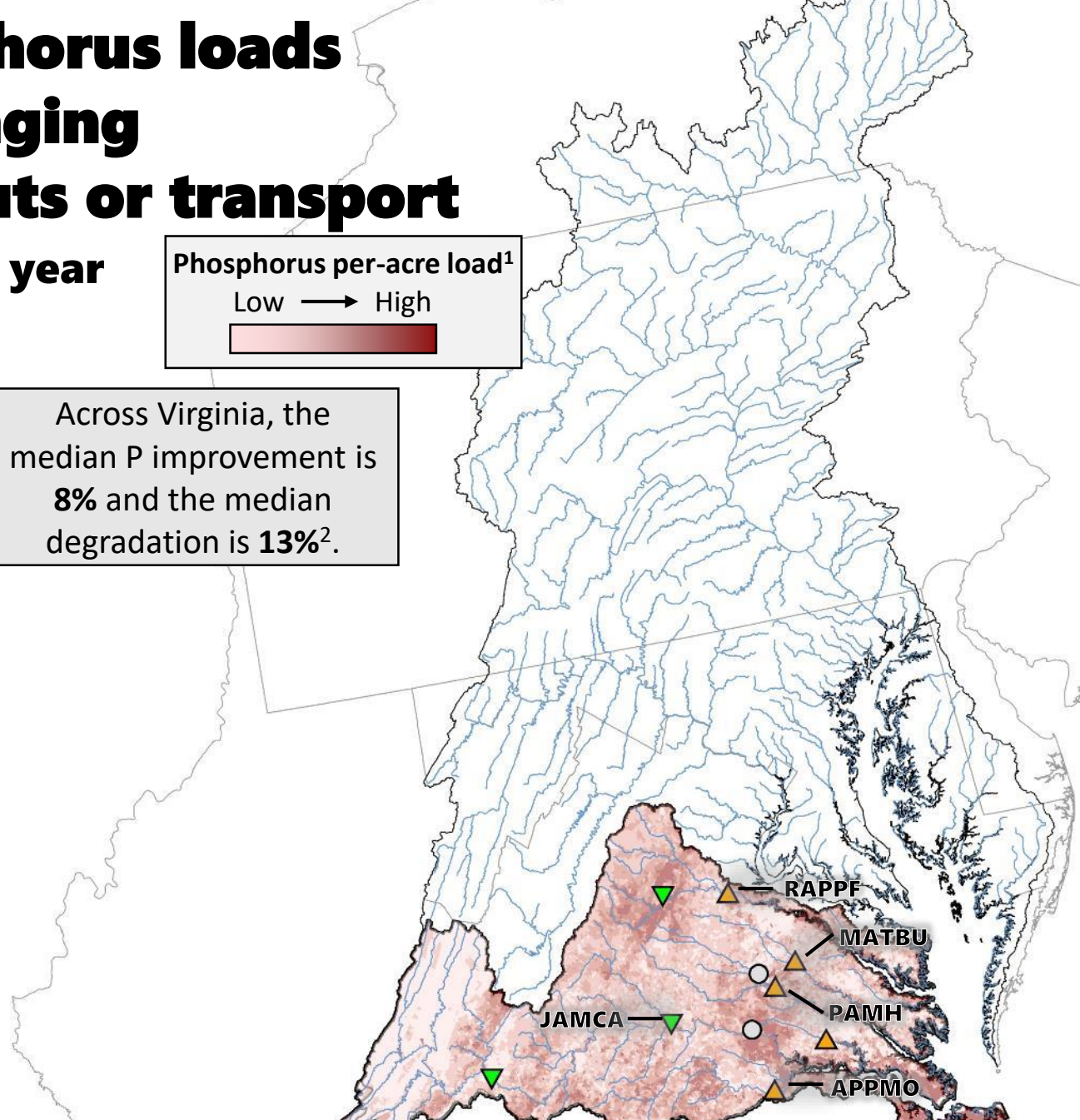
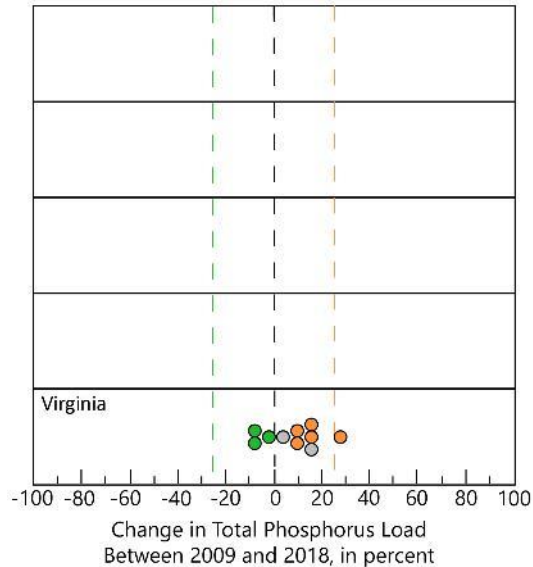
Phosphorus per-acre load¹

Low → High

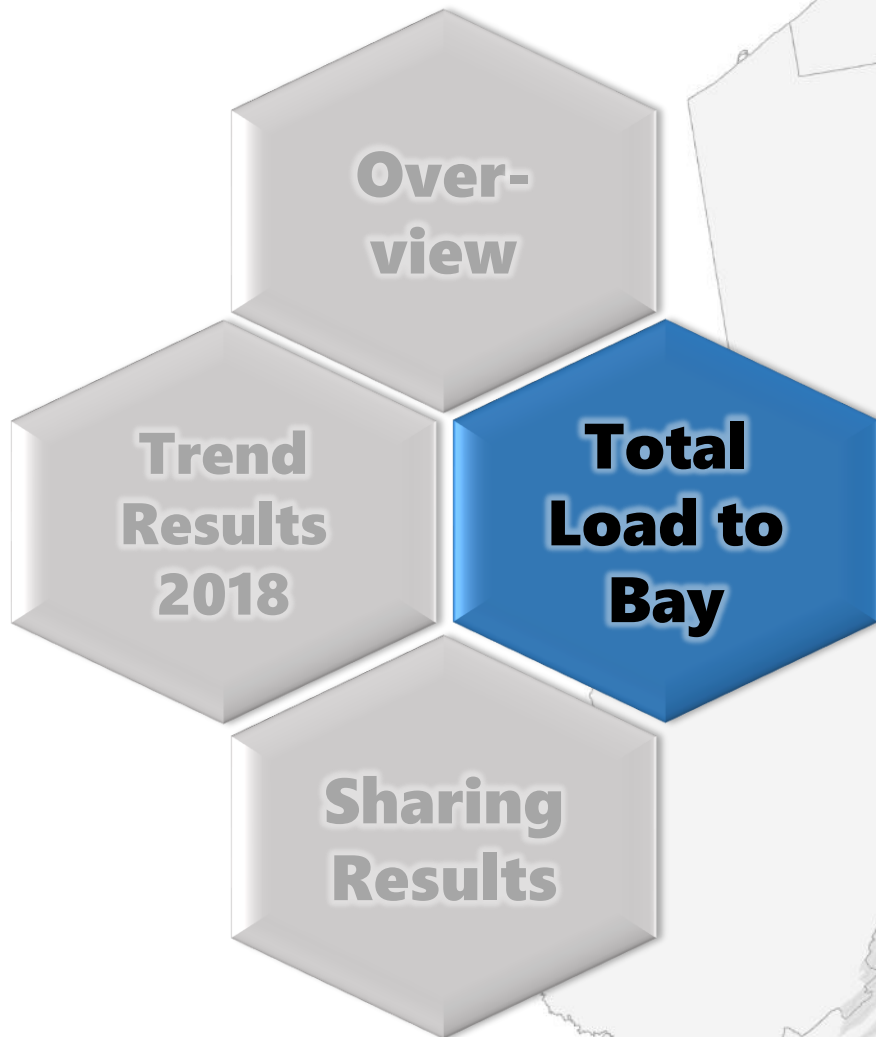


Phosphorus loads (n=10) have improved at 3, degraded at 5, and have no trend at 2 stations².

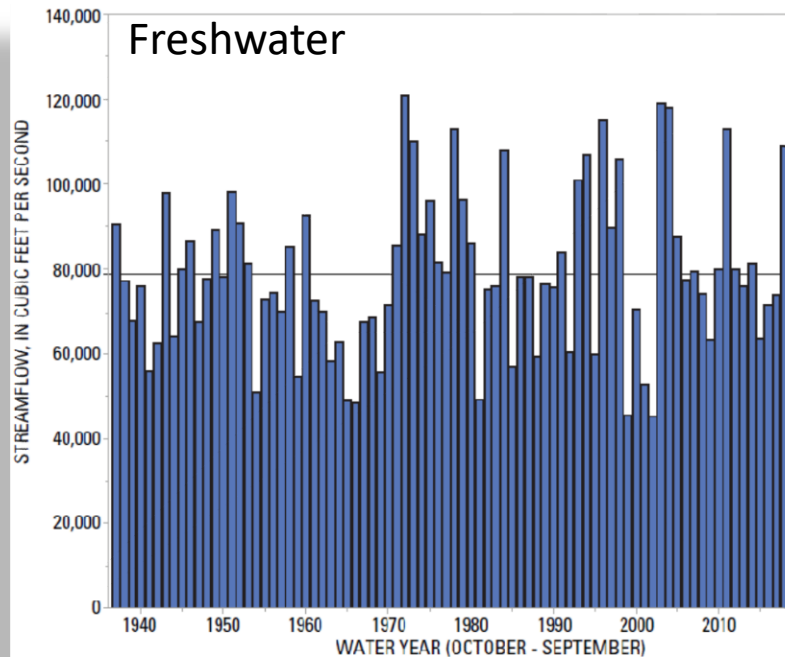
Across Virginia, the median P improvement is 8% and the median degradation is 13%².



Nutrient Loads and Trends in Chesapeake Bay Nontidal Network Streams: An update and presentation of results

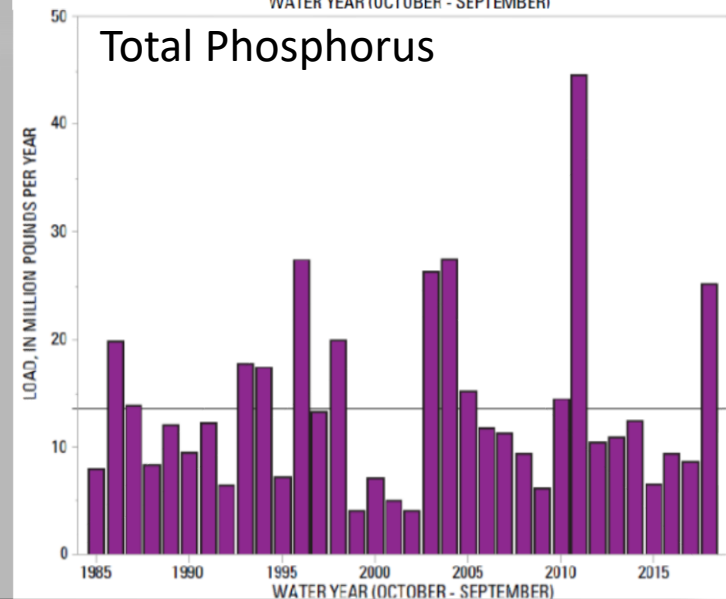
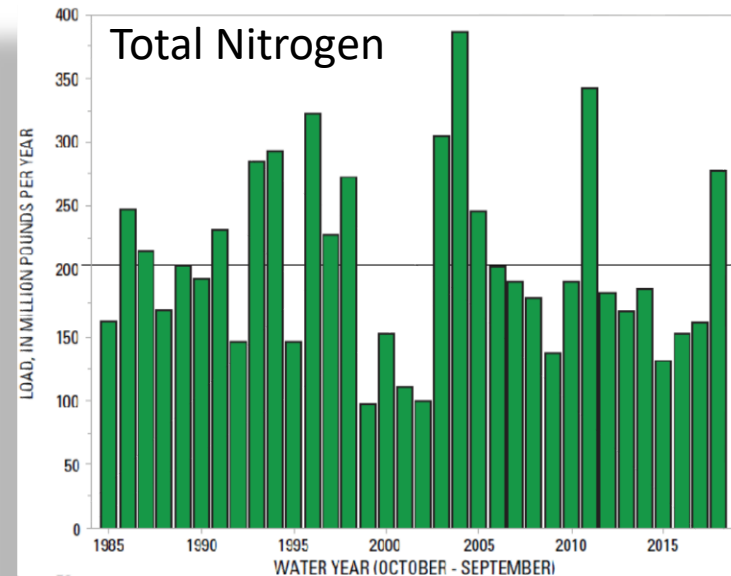


2018 delivery of freshwater flow and total nitrogen and phosphorus loads

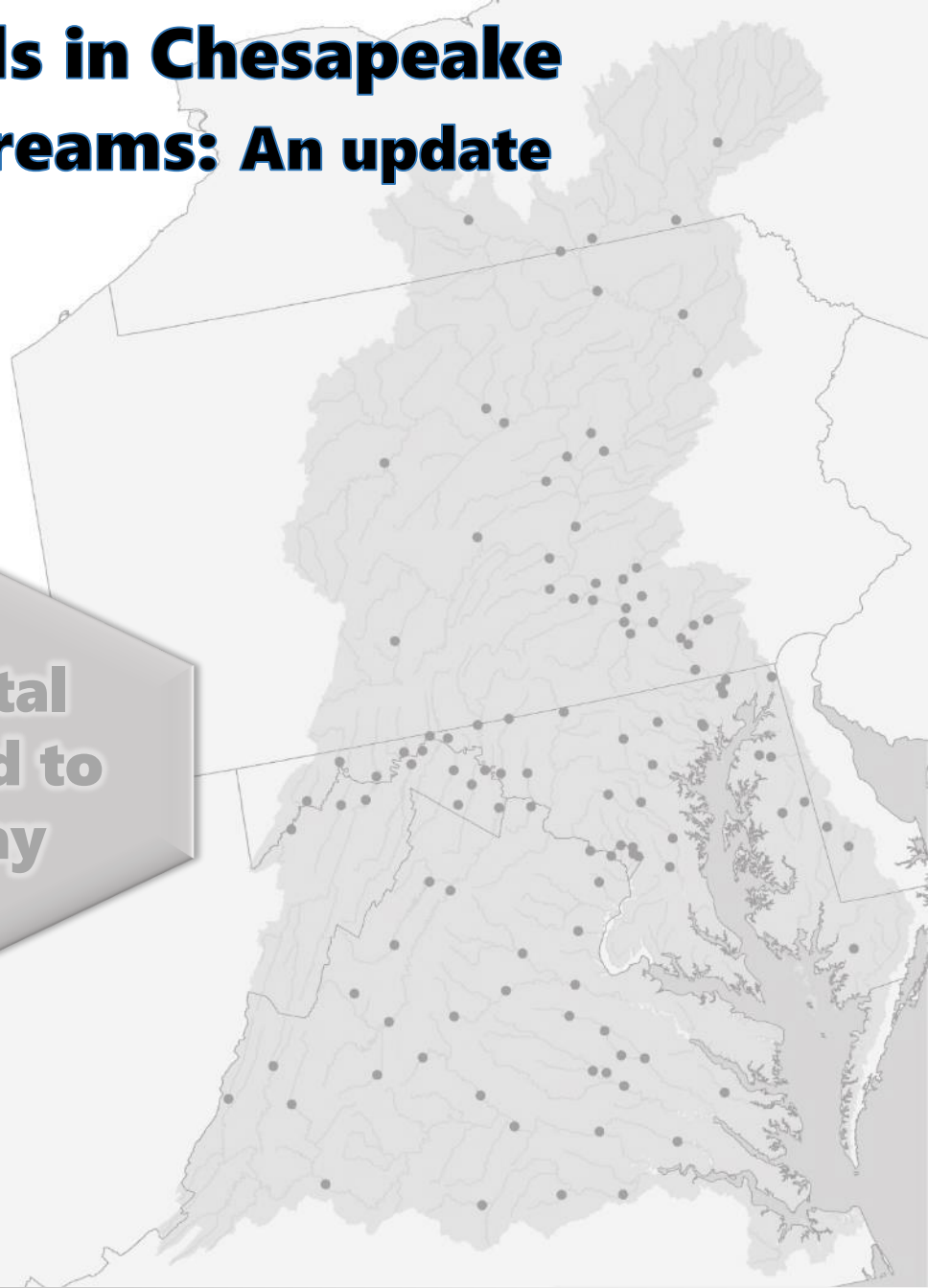


2018 Stats

- 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.



Nutrient Loads and Trends in Chesapeake Bay Nontidal Network Streams: An update and presentation of results



ScienceBase Catalog → USGS Data Release Products → 0. USGS Data Release - IN ... → 000_Data_Release_App_In_... → Nitrogen, phosphorus, and s...

Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay Nontidal Network stations: Water years 1985-2018

Add ▾ View ▾ Manage Item ▾

Dates

Publication Date : 2020
Start Date : 1984-10-01
End Date : 2018-09-30

Citation

Moyer, D.L. and Langland, M.J., 2020, Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay Nontidal Network stations: Water years 1985-2018: U.S. Geological Survey data release, <https://doi.org/10.5066/P931M7FT>.

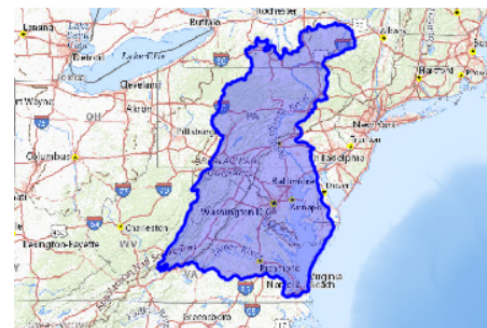
Summary

Nitrogen, phosphorus, and suspended-sediment loads, and changes in loads, in major rivers across the Chesapeake Bay watershed have been calculated using monitoring data from the Chesapeake Bay Nontidal Network (NTN) stations for the period 1985 through 2018. Nutrient and suspended-sediment loads and changes in loads were determined by applying a weighted regression approach called WRTDS (Weighted Regression on Time, Discharge, and Season). The load results represent the total mass of nitrogen, phosphorus, and suspended sediment that was exported from each of the NTN watersheds. To determine the trend in loads, the annual load results are flow normalized to integrate out the year-to-year variability in river discharge. The trend in load is derived from the flow-normalized load timeseries and represents the change in load resulting from changes in sources, delays associated with storage or transport of historical inputs, and (or) implemented management actions. Four data tables are provided that describe nitrogen, phosphorus, and suspended-sediment conditions across the NTN: (1) Annual Loads, (2) Monthly Loads, (3) Trends in Annual Loads, and (4) Average Yield (mass per unit area). Additionally, essential WRTDS Input and Output files are provided. All data tables can be accessed through each respective "Child Item" listed on this page.

Child Items (6)



-  Chesapeake Bay Nontidal Network 1985-2018: Annual loads
-  Chesapeake Bay Nontidal Network 1985-2018: Average annual yields
-  Chesapeake Bay Nontidal Network 1985-2018: Monthly loads
-  Chesapeake Bay Nontidal Network 1985-2018: Short- and long-term trends
-  Chesapeake Bay Nontidal Network 1985-2018: WRTDS input data
-  Chesapeake Bay Nontidal Network 1985-2018: WRTDS output data

Map »



Spatial Services

ScienceBase WMS :

<https://www.sciencebase.gov/catalog>  

Communities

- USGS Data Release Products 

Associated Items

 Associate an Item

Tags

Categories : Data Release - In Progress

Theme : WRTDS, load analysis, nitrogen, nutrients, phosphorus, rivers, suspended sediment, trends, water quality, weighted regression

Place : Chesapeake Bay Watershed, Delaware, Maryland, New York, Pennsylvania, United States, Virginia, Washington DC, West Virginia

Types : Map Service, OGC WFS Layer, OGC WMS

The nontidal monitoring webpage has been updated with 2018 results

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

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

Navigation Menu

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- Nitrate Table
- Sediment Table
- Analysis of Historical Results

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 monitored location per unit time.
- Estimate changes over time (trends) in sediment and nutrient loads. In a manner that compensates for any observed 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.

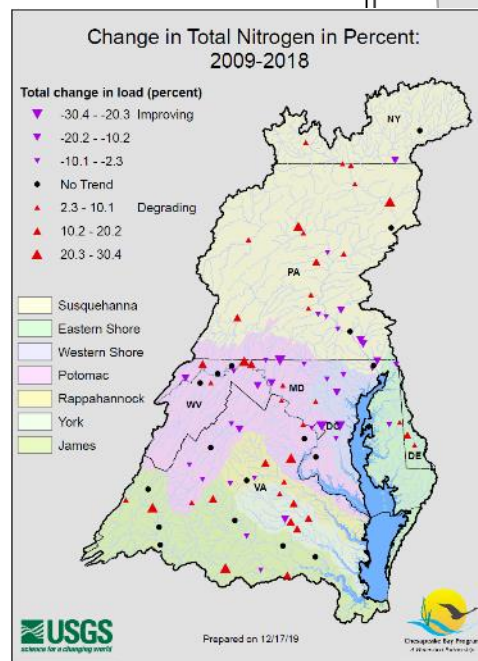
What Data and Related Information Are Available?

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

- Sediment and nutrient loads are provided for each station.
- Results are provided for each station.

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)

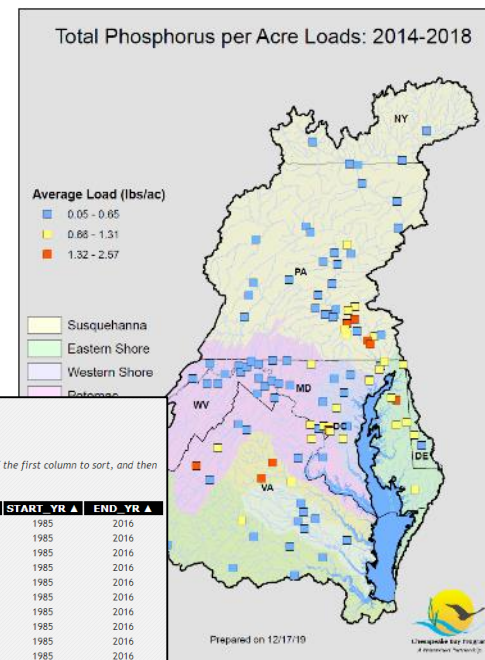
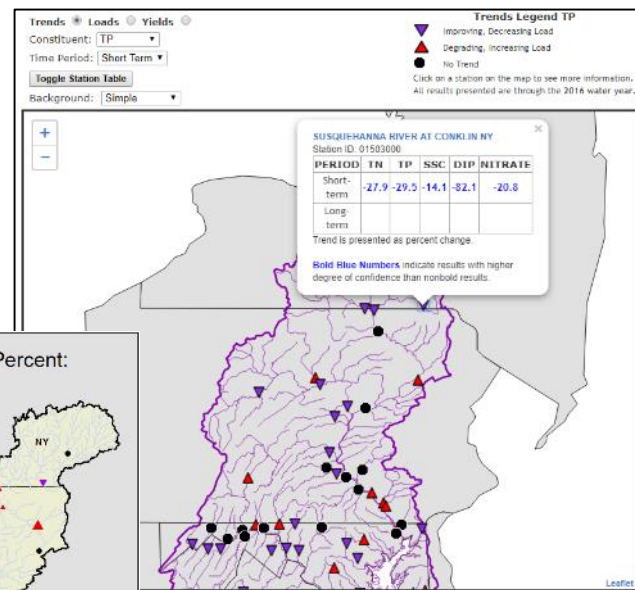
Columns default to ascending sort order going from left to right. To change the sort order, click the column name of the first column to sort, and then Ctrl-click each subsequent column to sort. Columns can be sorted ascending, descending, or not at all.

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

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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](#).



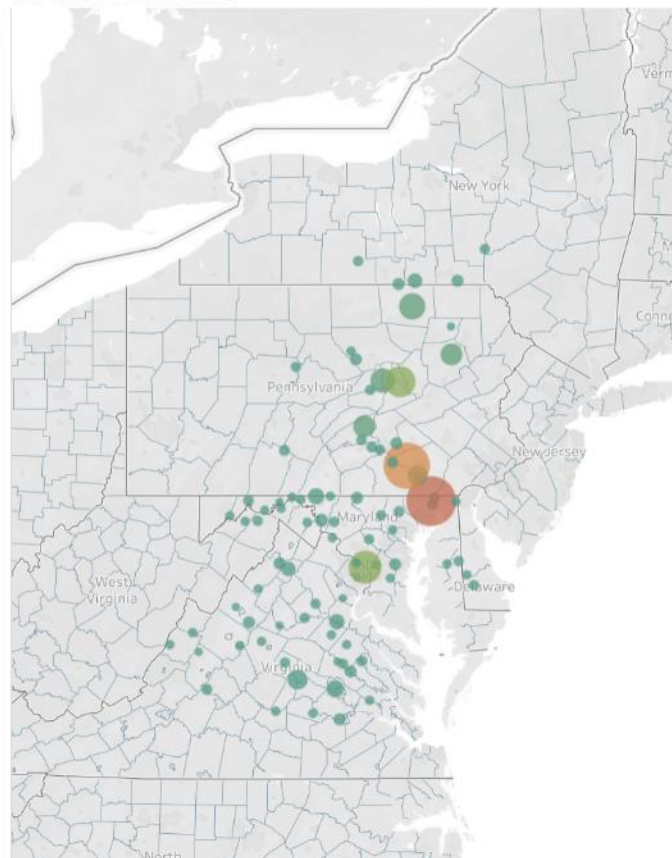
Streams and rivers with high amounts of nutrients and sediment, especially relative to their size, are some of the most effective places to focus restoration efforts.



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



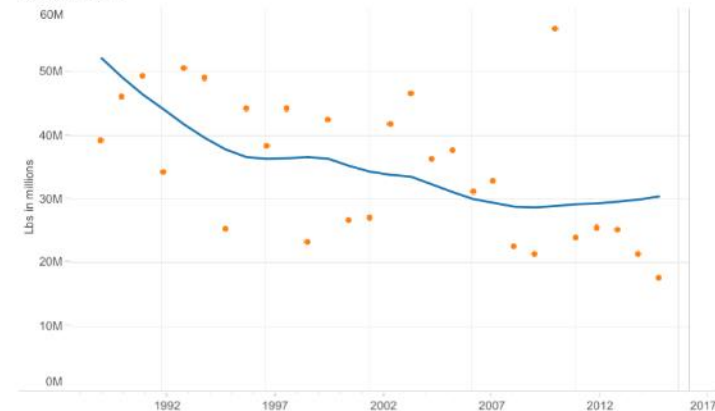
Station: 01536500

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