The Chesapeake Bay Nontidal Monitoring Network

An overview of the network and the most recent water-quality monitoring results

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Ken Hyer

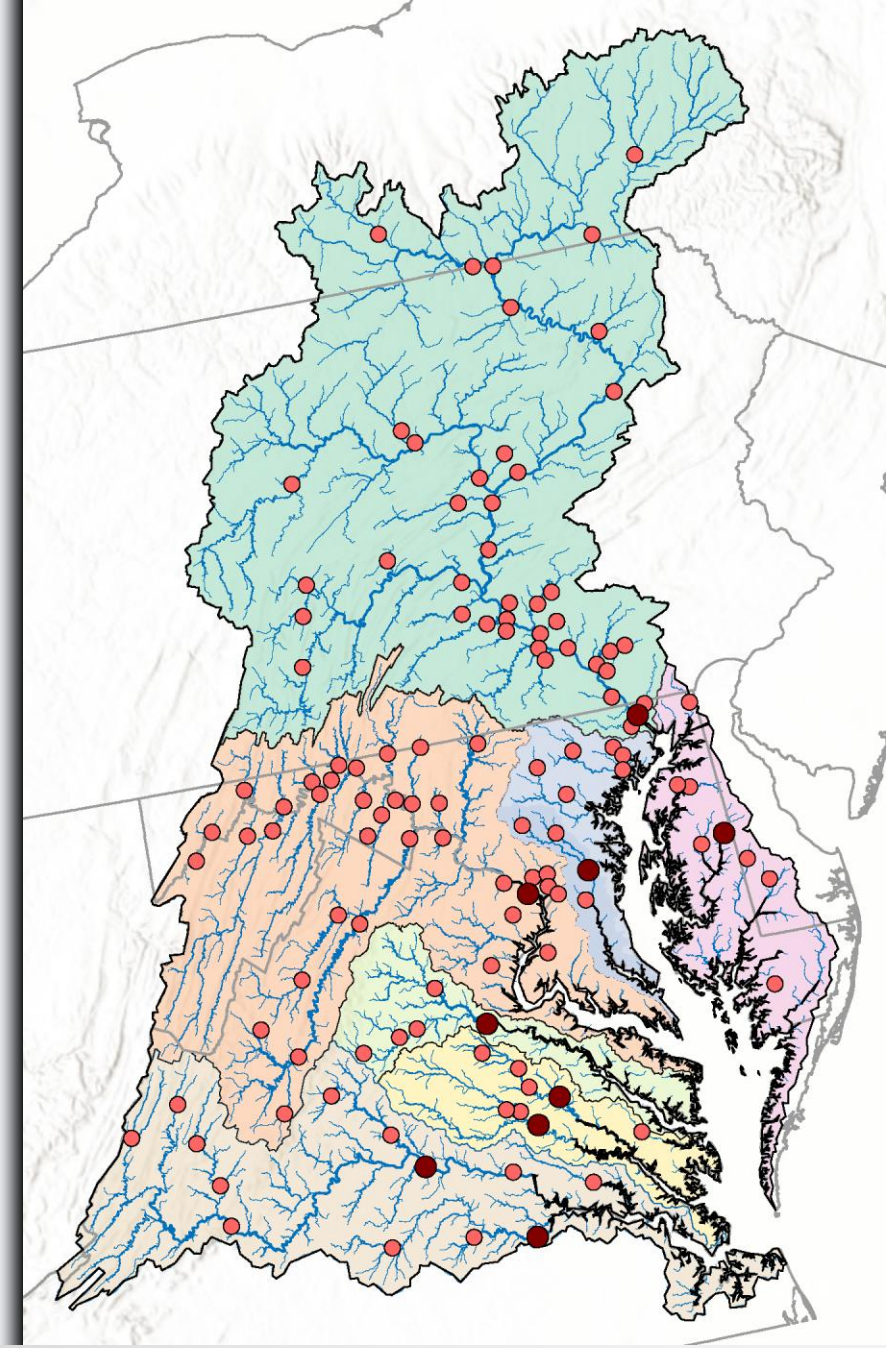
Coordinator of USGS Chesapeake Bay studies
kenhyer@usgs.gov

Jimmy Webber

Associate Coordinator of USGS Chesapeake Bay studies
kenhyer@usgs.gov

Learn more about the Nontidal Monitoring Network:
usgs.gov/CB-wq-loads-trends

Learn more about USGS Chesapeake Bay science:
usgs.gov/cba



Map of NTN monitoring stations.

Information to Guide Decision Making

The objective of the nontidal monitoring network (NTN) is to compute monitoring-based **loads** and **trends** of nitrogen, phosphorus, and sediment in Chesapeake Bay rivers.

- **Load:** An amount of material delivered over time

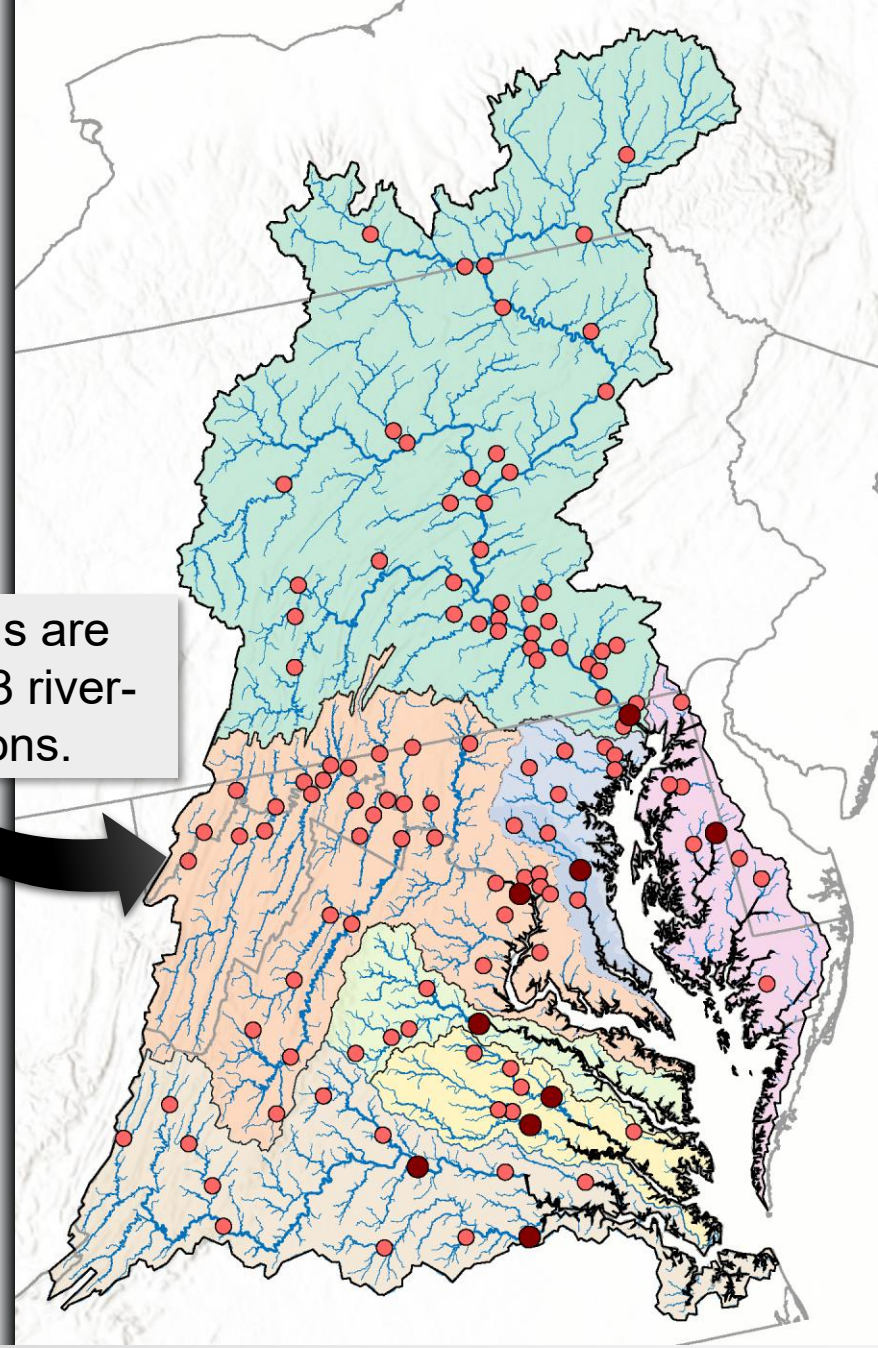
  *Load = Concentration * Streamflow*

- **Trend:** A change in load over time.

Monitoring-based loads and trends provide critical information used to:

- ✓ Assess progress toward water-quality goals
- ✓ Evaluate the effects of management actions
- ✓ Calibrate and improve water-quality models

Loads and trends are computed at 123 river-monitoring stations.

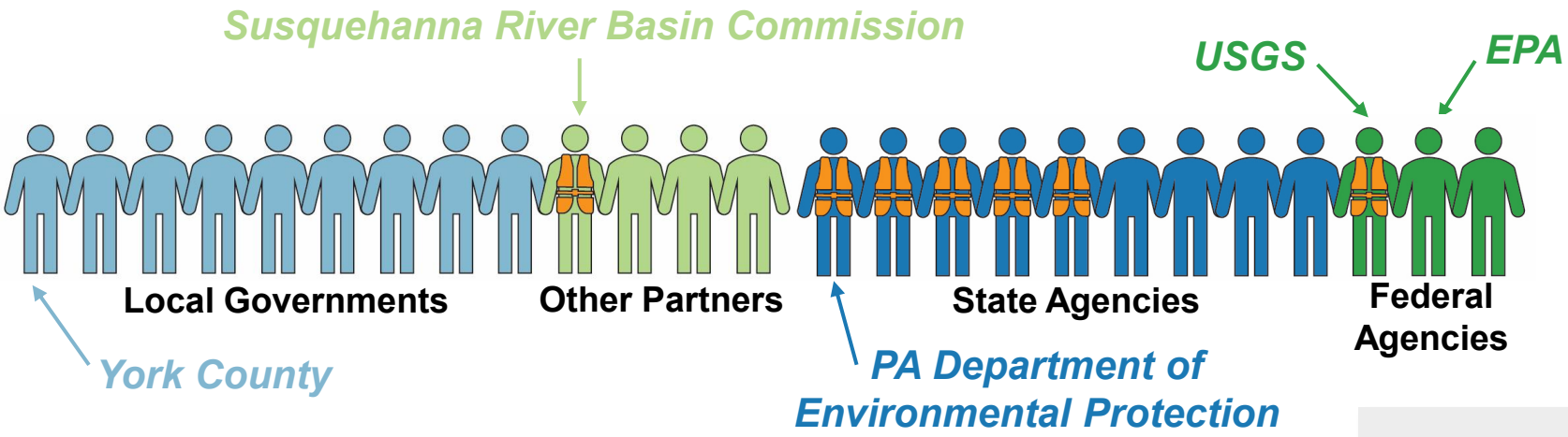


Map of NTN monitoring stations.

A Partnership Approach

The NTN was established in 2004 to provide timely and accurate information about water-quality conditions in the Chesapeake Bay watershed.

Today, 25 different groups support the NTN by funding operations and / or collecting monitoring data



A visual representation of the 25 partners who support the NTN. Orange vests represent agencies that collect monitoring data.

USGS collects monitoring data throughout the watershed and leads the computation and communication of load and trend results.

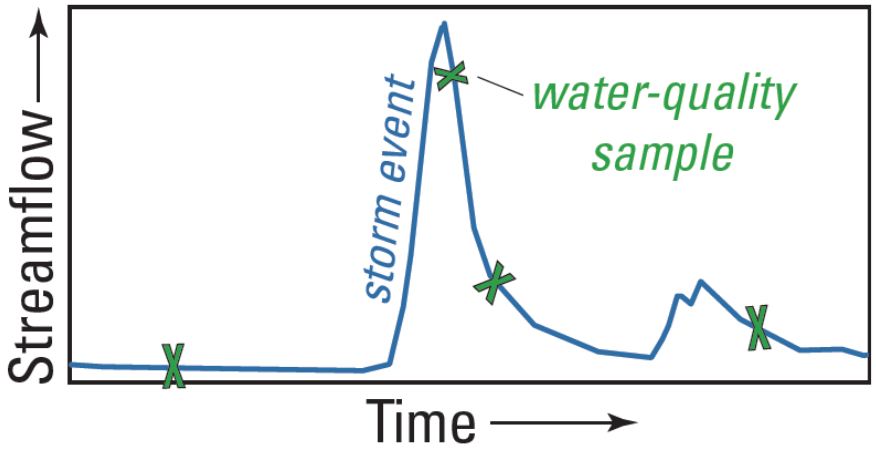
Monitoring-Based Insights

Loads and trends are computed by measuring streamflow and collecting water-quality samples.

Streamflow, the amount of water moving past a station, is reported online every hour.

Water-quality samples of nitrogen, phosphorus, and sediment are collected every month and during storms.

- Each year, more than 2,000 water-quality samples are collected from the NTN!



Graphic representing NTN monitoring data.

World-class monitoring methods, developed by the USGS, are applied consistently across the NTN.

Photos of USGS measuring streamflow and collecting water-quality samples.

A Watershed-Wide Network

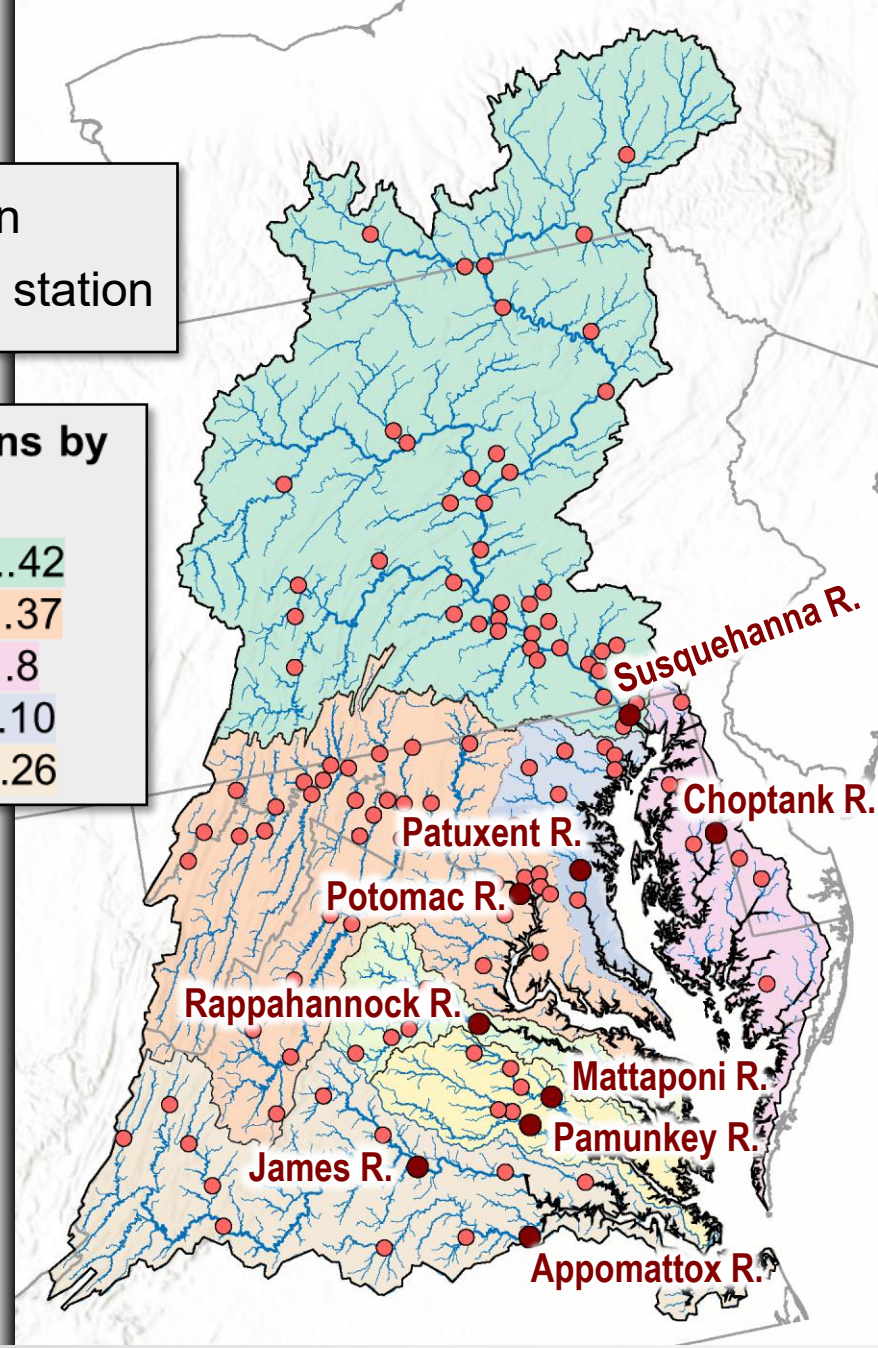
Loads and trends are computed at 123 stations

Stations range in size from less than 1 mi^2 to about 27,000 mi^2. Most stations are more than 100 mi^2.

Water-quality samples have been collected since 1985 at 41 stations, including **9 River Input Monitoring (RIM) stations**.

- **RIM stations** are located near the tidal boundary on 9 of the largest Chesapeake Bay rivers.

NTN stations have been added over time to meet state and local needs – today, all 123 stations have at least 10 years of data.



Map of NTN monitoring stations with 9 RIM stations labeled.

Timely Information About Loads and Trends

Loads and trends are computed annually at the 9 RIM stations and every-other-year at all NTN stations.

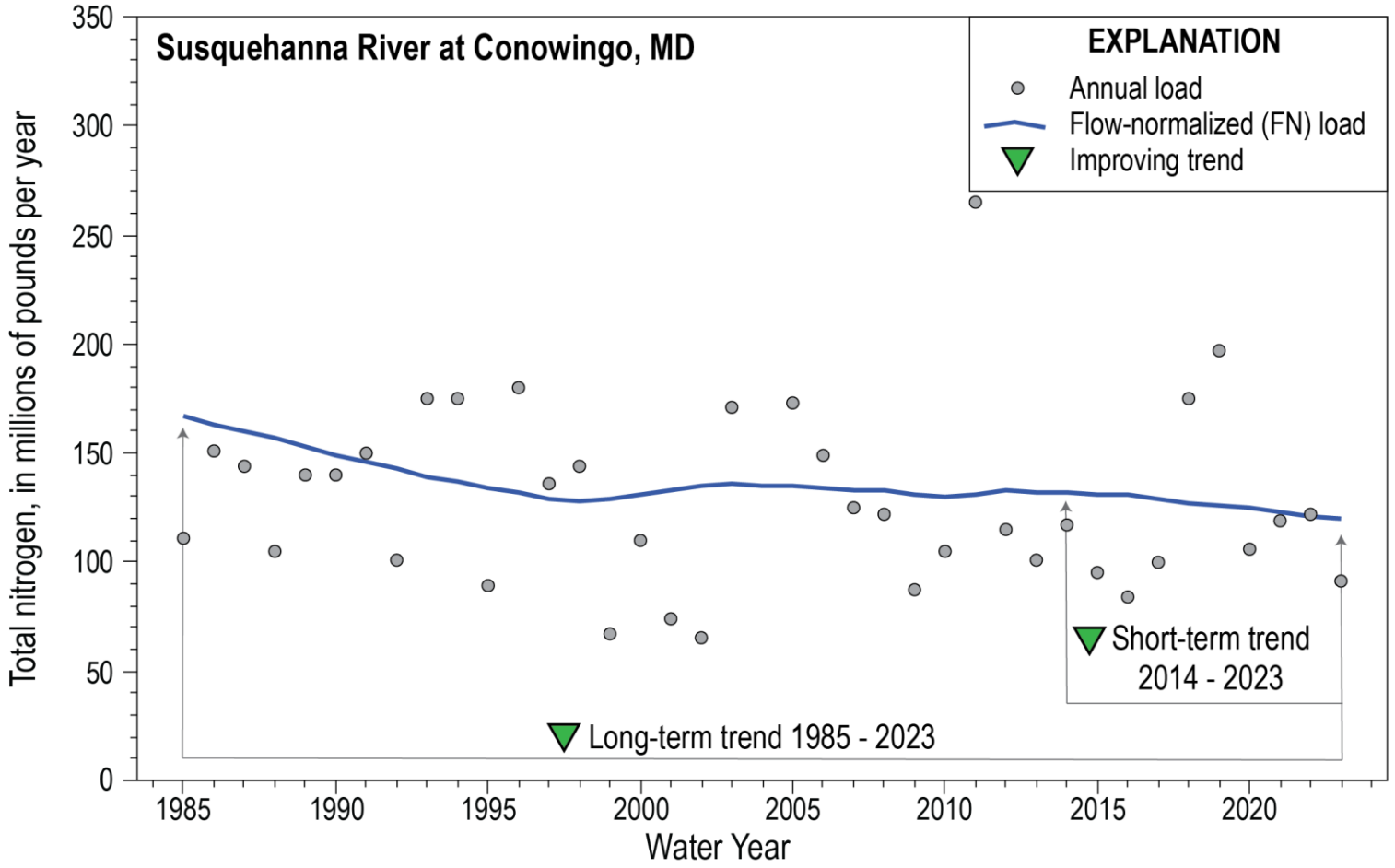
The most recent results are computed through 2024 at RIM stations and 2023 at all NTN stations.

Loads are strongly affected by annual amounts of streamflow.

Flow-normalized (FN) loads remove most year-to-year variability in load associated with streamflow.

Trends are changes in FN load over time.

- **Improving** = a decrease over time
- **Degrading** = an increase over time
- **No trend** = no meaningful change over time



Time-series plot of TN loads and FN loads from 1985 through 2023 at the Susquehanna River RIM station.

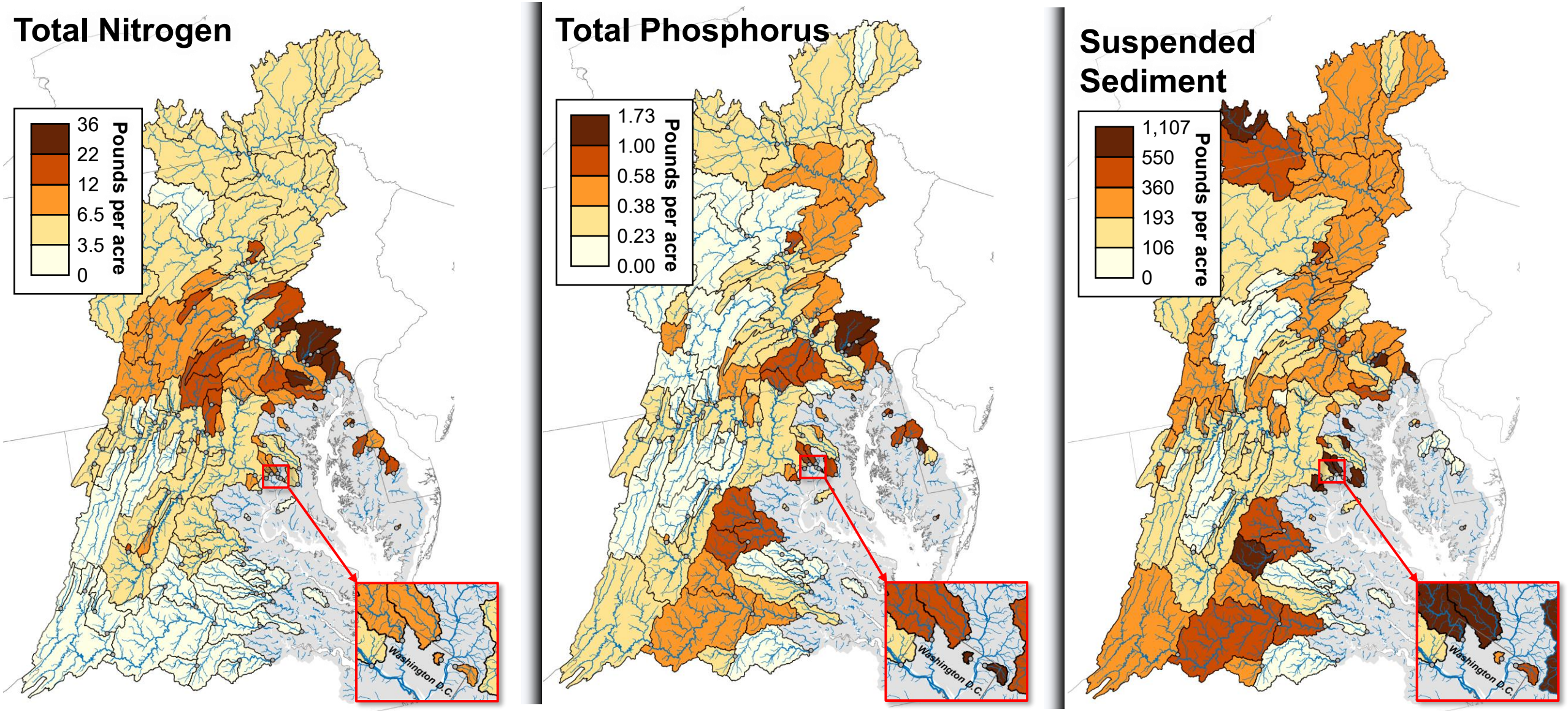
Recent Results

All NTN load and trend results are published online:

Mason, C.A., Colgin, J.E., Webber, J.S., and Soroka, A.M., 2025, Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay Nontidal Network stations: Water years 1985-2023: U.S. Geological Survey data release, https://doi.org/10.5066/P13P4TWR

Mason, C.A., and Soroka, A.M., 2025, Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay River Input Monitoring stations: Water years 1985-2024: U.S. Geological Survey data release, https://doi.org/10.5066/P14CG4D8

Area-Normalized Loads

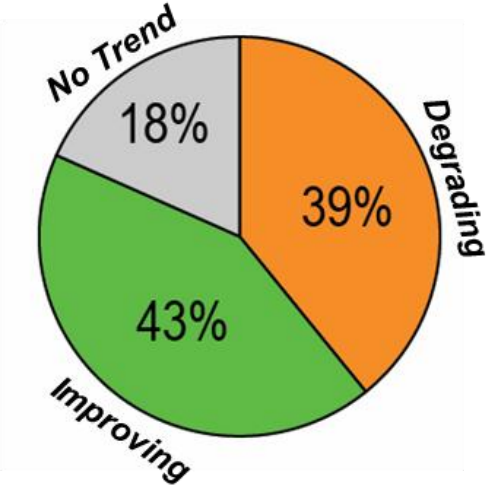


Maps showing area-normalized loads, averaged from 2019 through 2023.

Trends in FN Load: 2014 – 2023

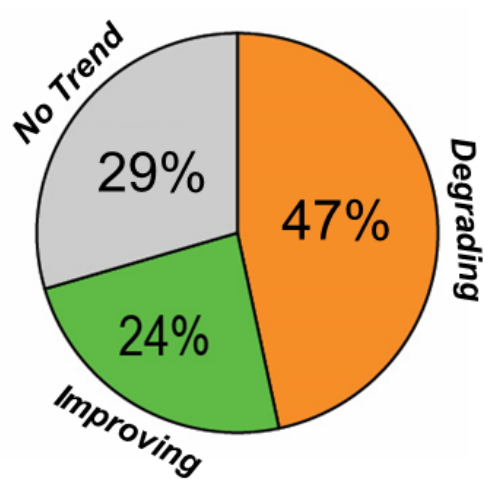
Improving short-term trends of total nitrogen, total phosphorus, and suspended sediment were detected at less than half of all stations.

Total Nitrogen (n=120)



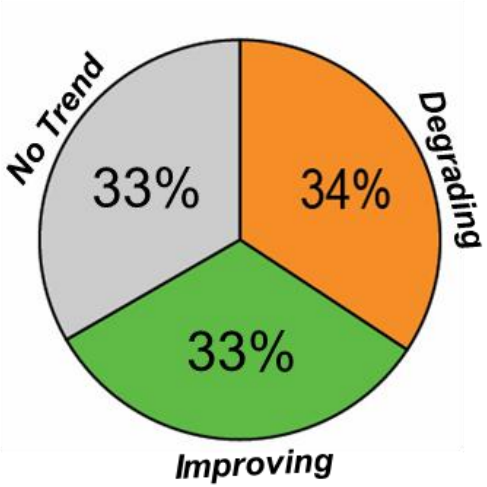
Median percent change = -0.6%

Total Phosphorus (n=105)



Median percent change = +4.3%

Suspended Sediment (n=105)

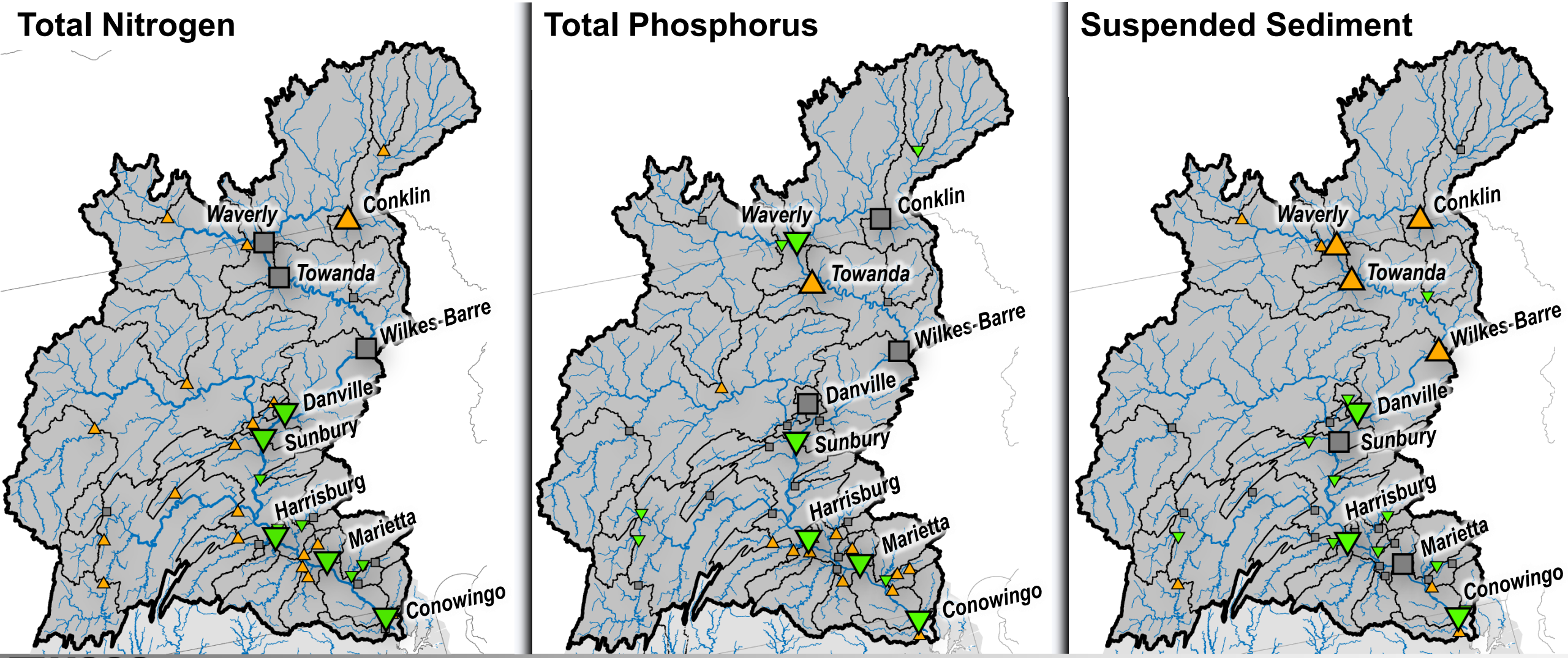


Median percent change = +0.8%

Pie charts representing the percentage of NTN stations with degrading, improving, or no trend conditions from 2014 through 2023.

Trends in FN Load: 2014 – 2023

Susquehanna River Basin

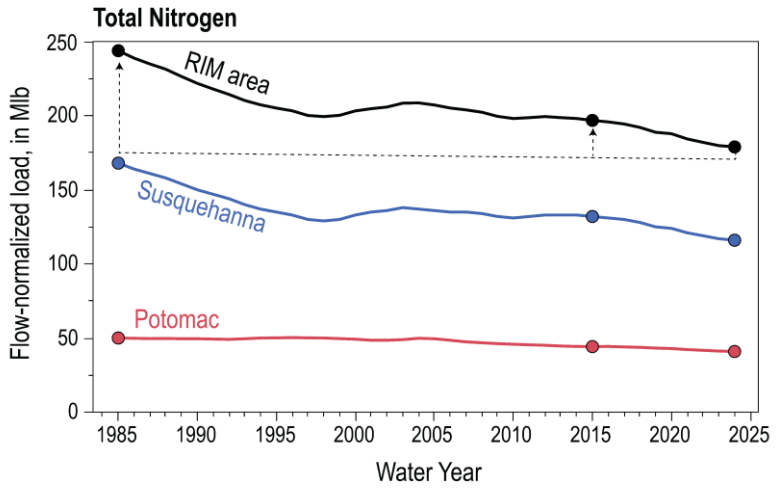


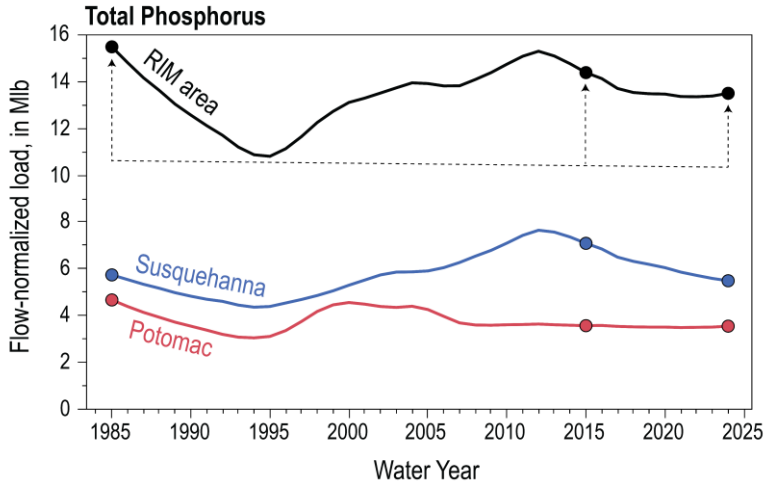
USGS science for a changing world

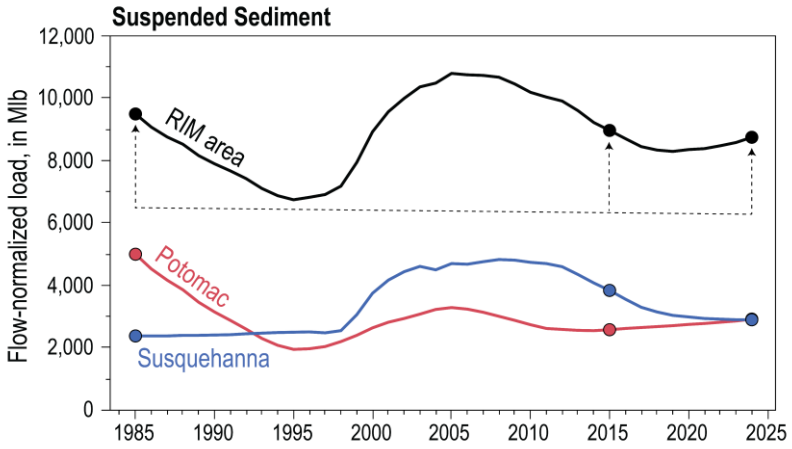
Maps of trends in FN load from 2014 - 2023, with NTN stations on the Susquehanna River labeled.

Long-Term Trends in FN Load

FN nutrient and sediment loads decreased since 1985 from the RIM watershed area (n = 9 stations).

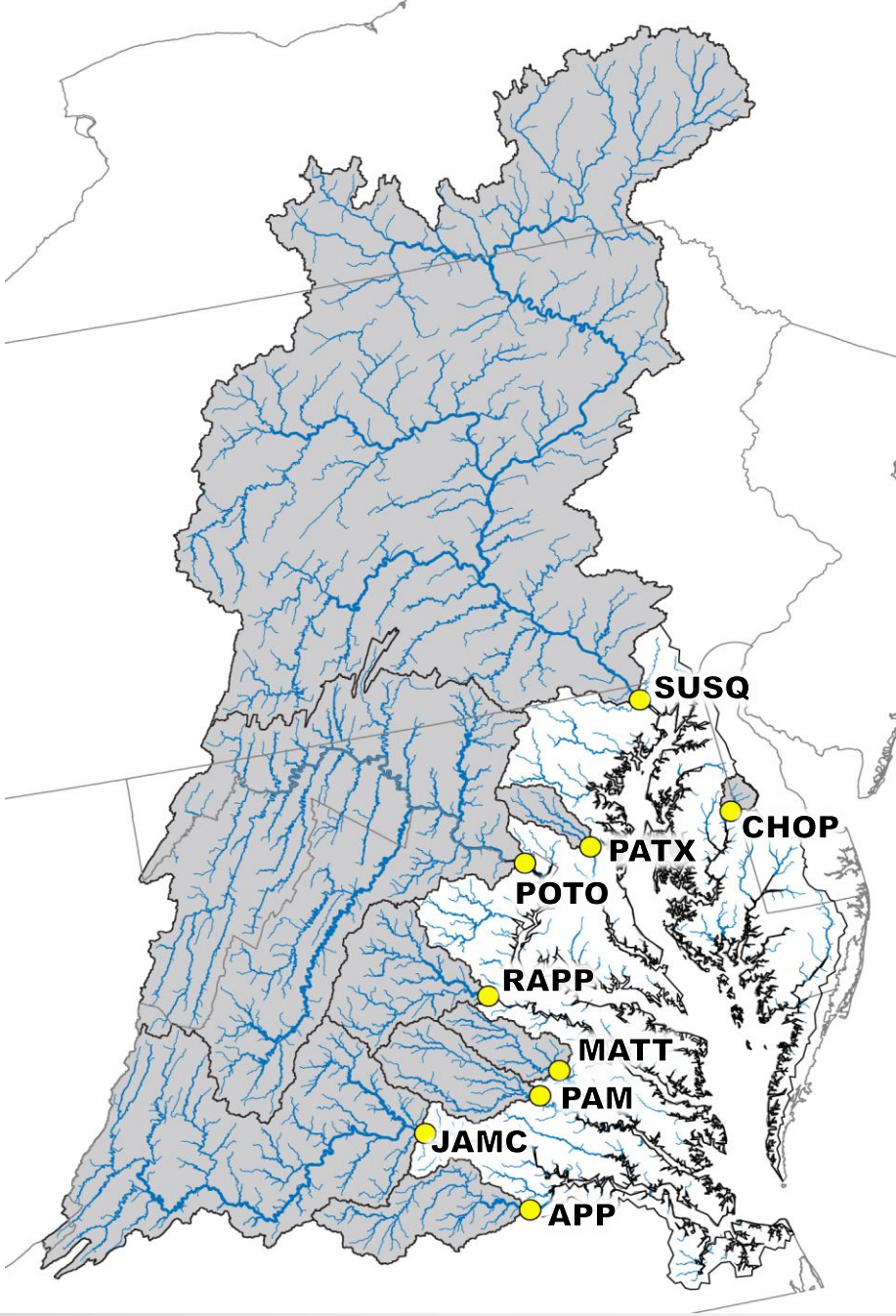






RIM Change in FN load, 1985 - 2024:

- Total Nitrogen: -33%
- Total Phosphorus: -14%
- Suspended Sediment: -8%



USGS science for a changing world

The Susquehanna and Potomac are the largest RIM watersheds. FN loads from these two stations typically represent 70 – 90% of the total RIM FN load.

The RIM network has a similar number of improving and degrading trend results

Trend Summary

- 13 trends have improved and 11 have degraded since 1985.
- 8 trends have improved and 12 have degraded since 2015.

Good News

- All trends improved at Susquehanna since 2015.
- TN trends improved at all MD RIM stations since 2015.

Concerns

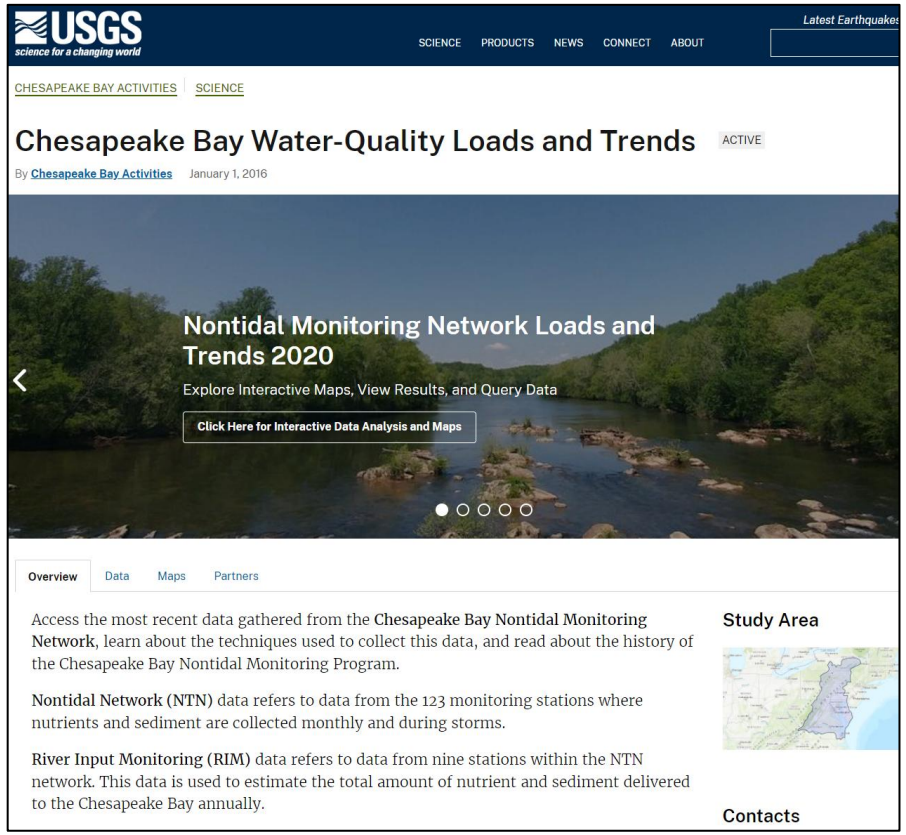
- The Choptank has the highest TP per-acre load and a large TP increase since 2015.
- Other than the Pamunkey, loads were higher in 2024 than 2015 at all Virginia RIM stations.

	RIM Monitoring Station	Long term: 1985 - 2024			Short term: 2015 - 2024		
		TN	TP	SS	TN	TP	SS
Maryland RIM stations	SUSQ	-31.2%	-4.6%	+21.5%	-12.4%	-22.8%	-24.8%
	CHOP	-2.5%	+77.4%	-34.3%	-4.5%	+20.2%	-7.5%
	PATX	-69.5%	-66.8%	-44.0%	-21.0%	-5.5%	-4.5%
	POTO	-18.4%	-24.3%	-41.7%	-7.6%	-1.0%	+13.1%
Virginia RIM stations	RAPP	-15.6%	+31.2%	+50.0%	+7.3%	+7.6%	+1.7%
	MATT	-6.4%	+6.4%	+8.6%	+1.7%	+8.9%	+26.9%
	PAM	-1.3%	+59.2%	+36.3%	-3.9%	+1.0%	-9.9%
	JAMC	-8.0%	-22.1%	+40.3%	+11.2%	+25.8%	+20.9%
	APPO	+6.4%	+99.5%	+44.2%	+5.4%	+23.4%	+38.9%

Trend Direction Improving Degrading No trend

Communication to Inform Chesapeake Bay Partners

We maintain a project website that provides access to the most recent data, and an interactive summary of results: usgs.gov/CB-wq-loads-trends



We present findings to the Chesapeake Bay Program and at local, state, and regional conferences.

We host field events to discuss results and information about individual NTN stations with local partners.

Monitoring Rivers and the Bay

River loads affect water-quality conditions in the Bay.

Watershed Area

- RIM Watershed
- Chesapeake Bay

River Trend: Load
2015 – 2024
Flow Normalized

- Increase
- Decrease
- No Trend

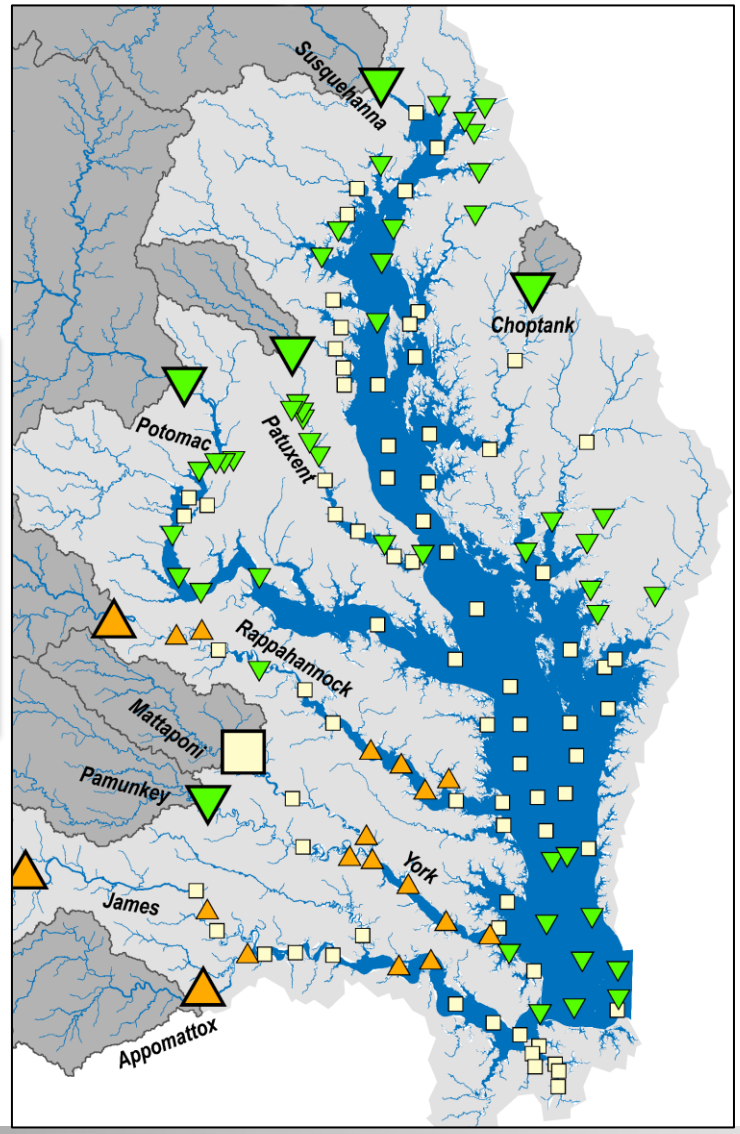
The tidal trends team:

Rebecca Murphy (UMCES/CBP), Renee Karrh (MDDNR), Mike Lane (ODU), Cindy Johnson (DEQ), Efeturi Oghenekaro, Blessing Edje and George Onyullo (DOEE); Mukhtar Ibrahim (MWCOG), Breck Sullivan (USGS), Kaylyn Gootman (EPA), and Gabriel Duran (CRC)

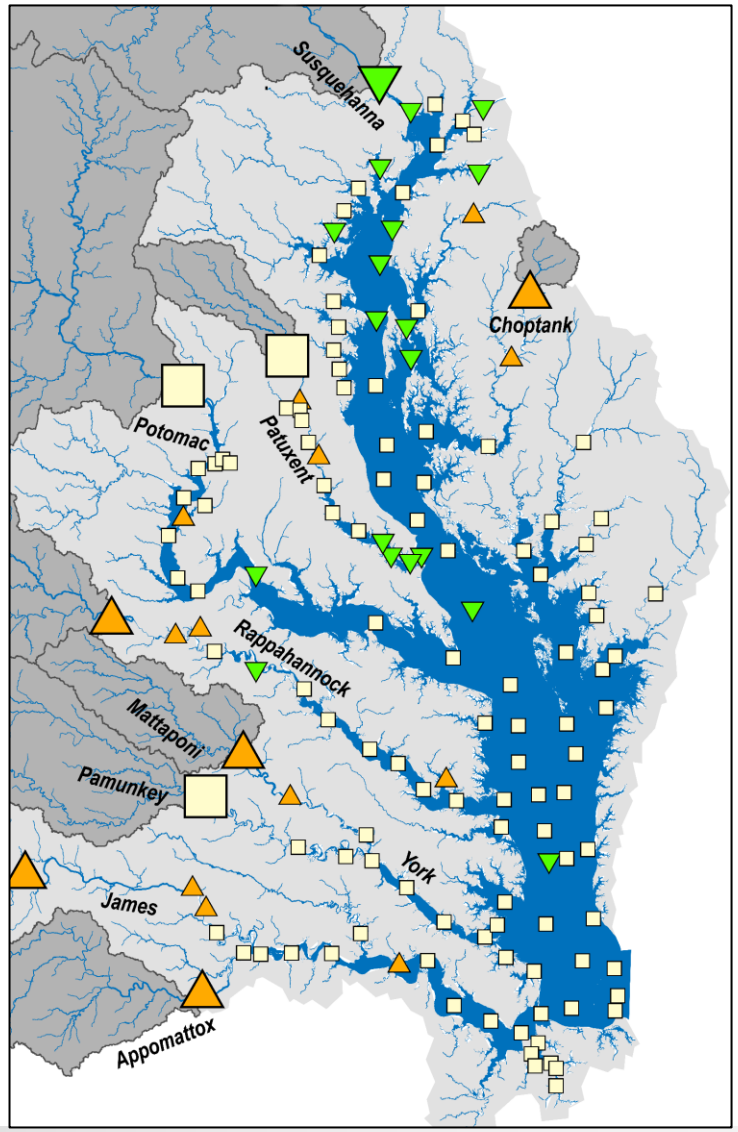
Tidal Trend[1]: Surface Concentration
2015/16 – 2023/24
Non-linear with Flow Adjustment

- Significant increase
- Significant decrease
- Possible or unlikely change

Total Nitrogen



Total Phosphorus



Maps showing trends in total nitrogen (left) and phosphorus (right) at river and tidal monitoring stations from 2015 through 2024.