OBJECTIVE

Overview

Trend Results 2020

- Summary of short-term trends in TN and TP
- Detailed look at each basin level
- Full summary at % change across TN, N, TP, DIP, SS

Sharing Results

Summary of trends in load through 2020

Total Nitrogen

Since ~1985, 52% of stations improved

- Trends Since 2011 -

- 37% of stations improved
- 4/9 River Input stations improved: the Susquehanna, Potomac, James, and Patuxent; representing three of the largest RIM watersheds
- About 35% of Susquehanna stations improved, mostly located in lower portion of the watershed
- 4/6 Western Shore stations improved while 4/5 Eastern Shore stations degraded
- About the same number Potomac stations improved as degraded
- Most Virginia watershed stations had no trend

Total Phosphorus

Since ~1985, 67% of stations improved

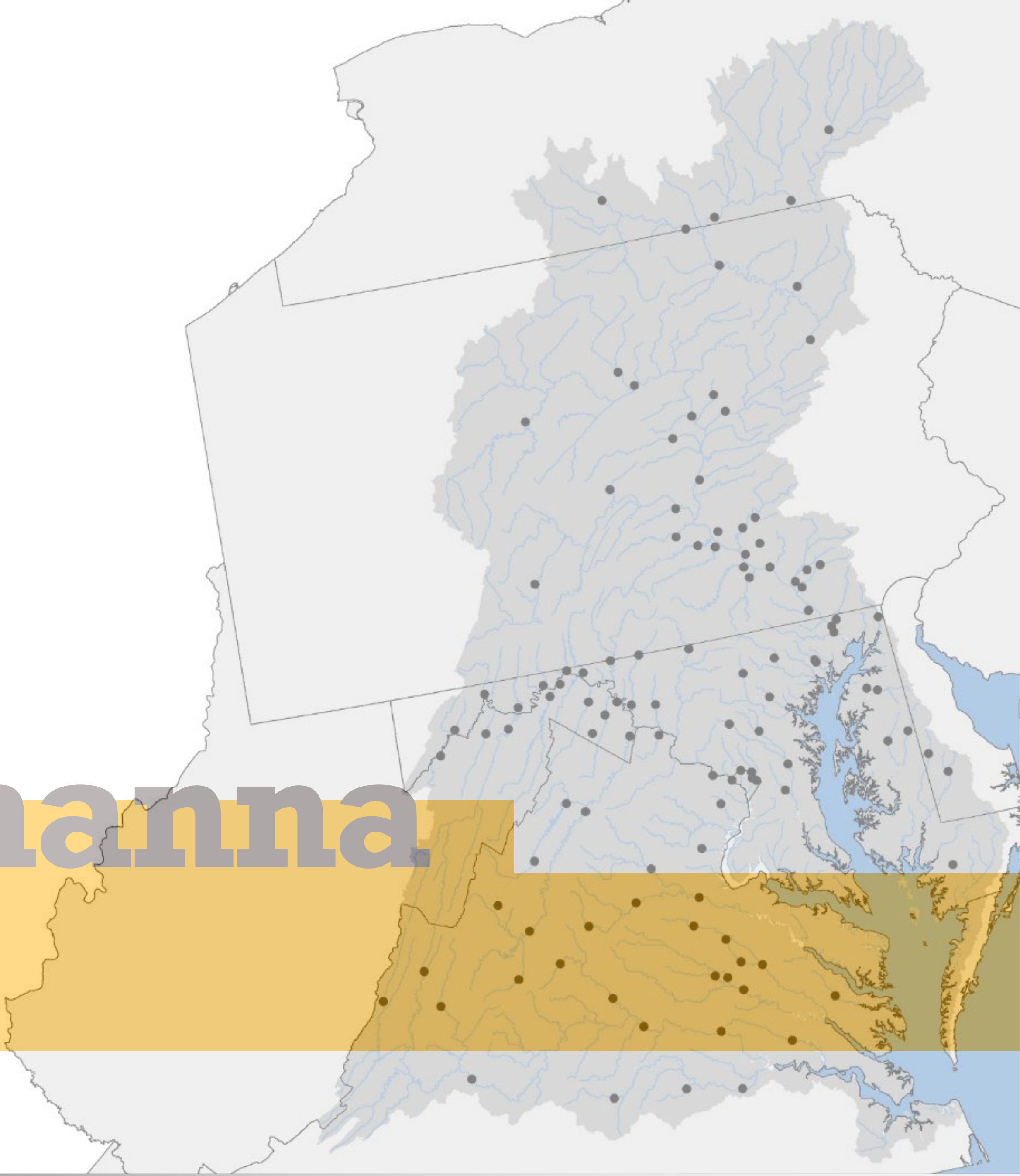
- Trends Since 2011 -

- 44% of stations improved
- 4/9 River Input stations improved: the Susquehanna, James, Patuxent, and Pamunkey
- About 42% of Susquehanna stations improved, located in the upper and lower portion of the watershed
- 3/6 Western Shore stations improved while 4/5 Eastern Shore stations degraded
- 50% of Potomac stations improved
- 54% of Virginia watershed stations improved

Trends in total nitrogen and phosphorus are influenced by changes in dissolved and particulate material

- Since 2011, nitrate degraded at 69% of stations while orthophosphate improved at 66% of stations
- Since 2011, suspended sediment improved at only 18% of stations

Susquehanna Basin



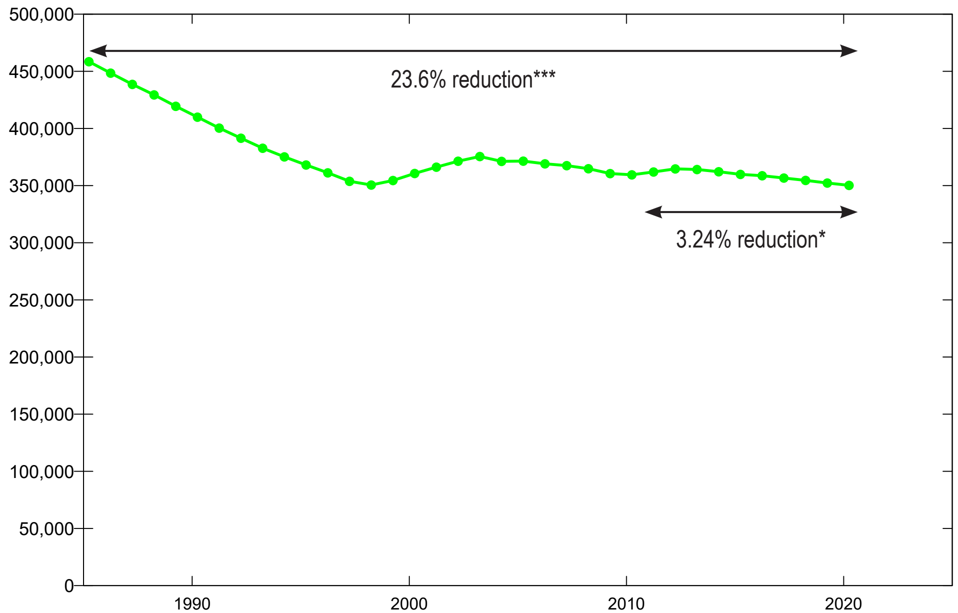
Trends in nitrogen loads result from changing nitrogen inputs or transport

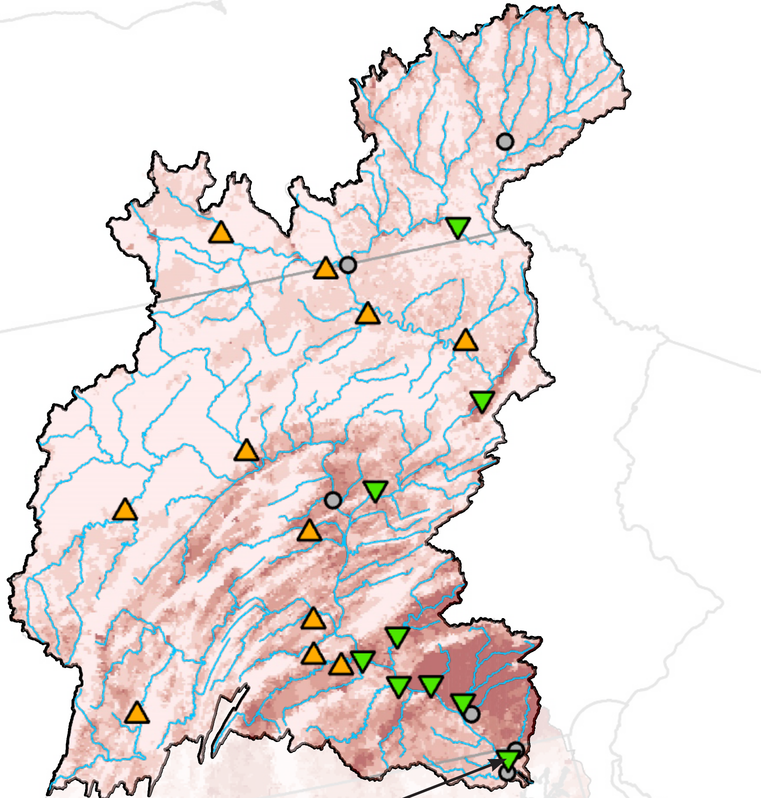
The most recent ten year period in the Susquehanna Basin, 2011-2020[2]

Nitrogen Per-acre Load[1]
Low → High

Trend Direction[2]
Degrading
Improving
No Trend

River Input Monitoring station
Susquehanna River at Conowingo, MD
Flow-normalized Load (lbs/day)





[1] Ator, S.W., Brakebill, J.W., and Blomquist, J.D., 2011, Sources, fate, and transport of nitrogen and phosphorus in the Chesapeake Bay watershed: An empirical model: U.S. Geological Survey Scientific Investigations Report 2011-5167, p. 27.

[2] Mason and others, 2022

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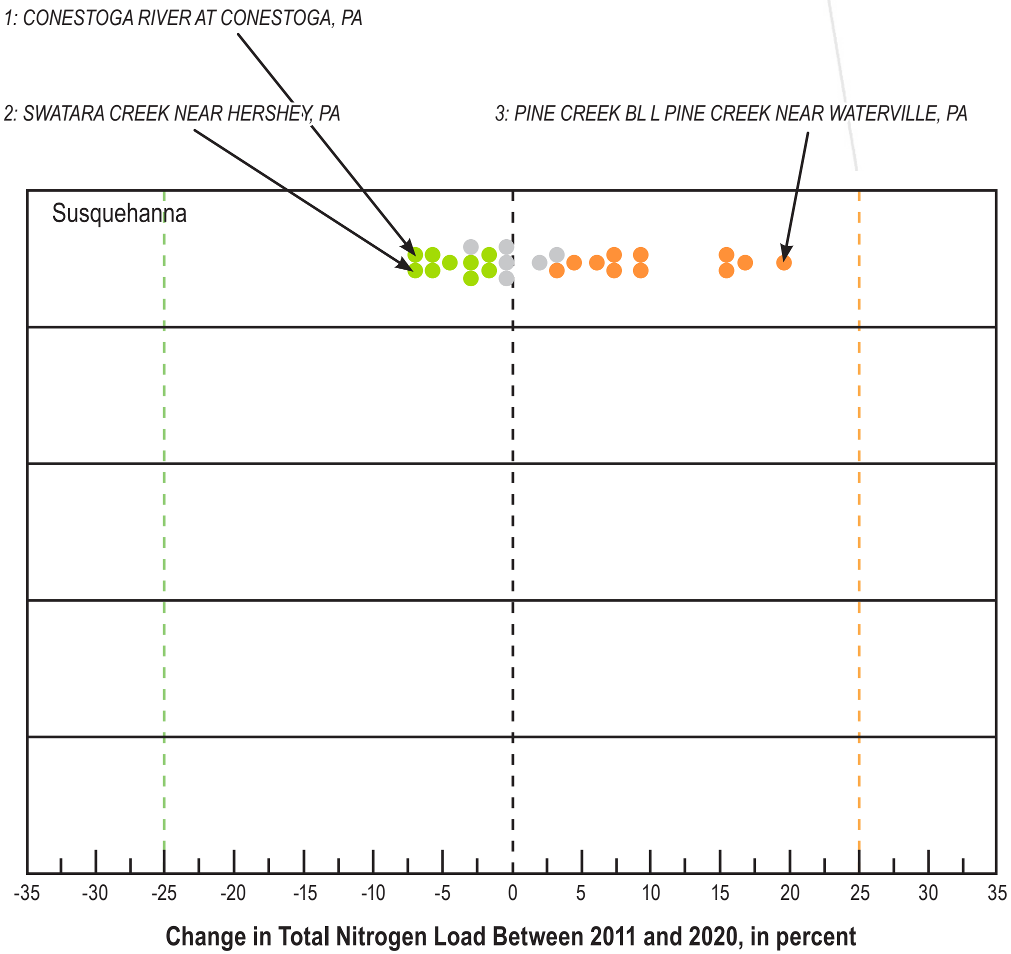
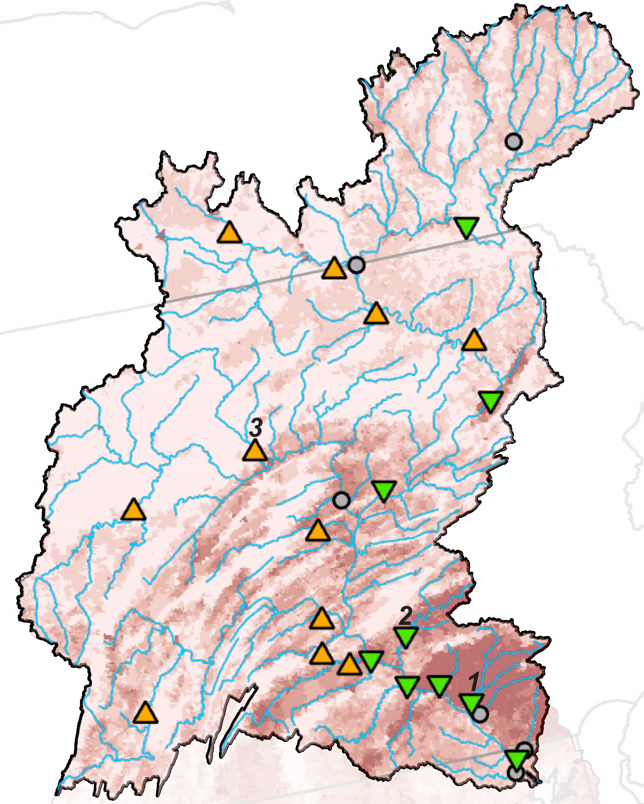
Trends in nitrogen loads result from changing nitrogen inputs or transport

The most recent ten year period in the Susquehanna Basin, 2011-2020



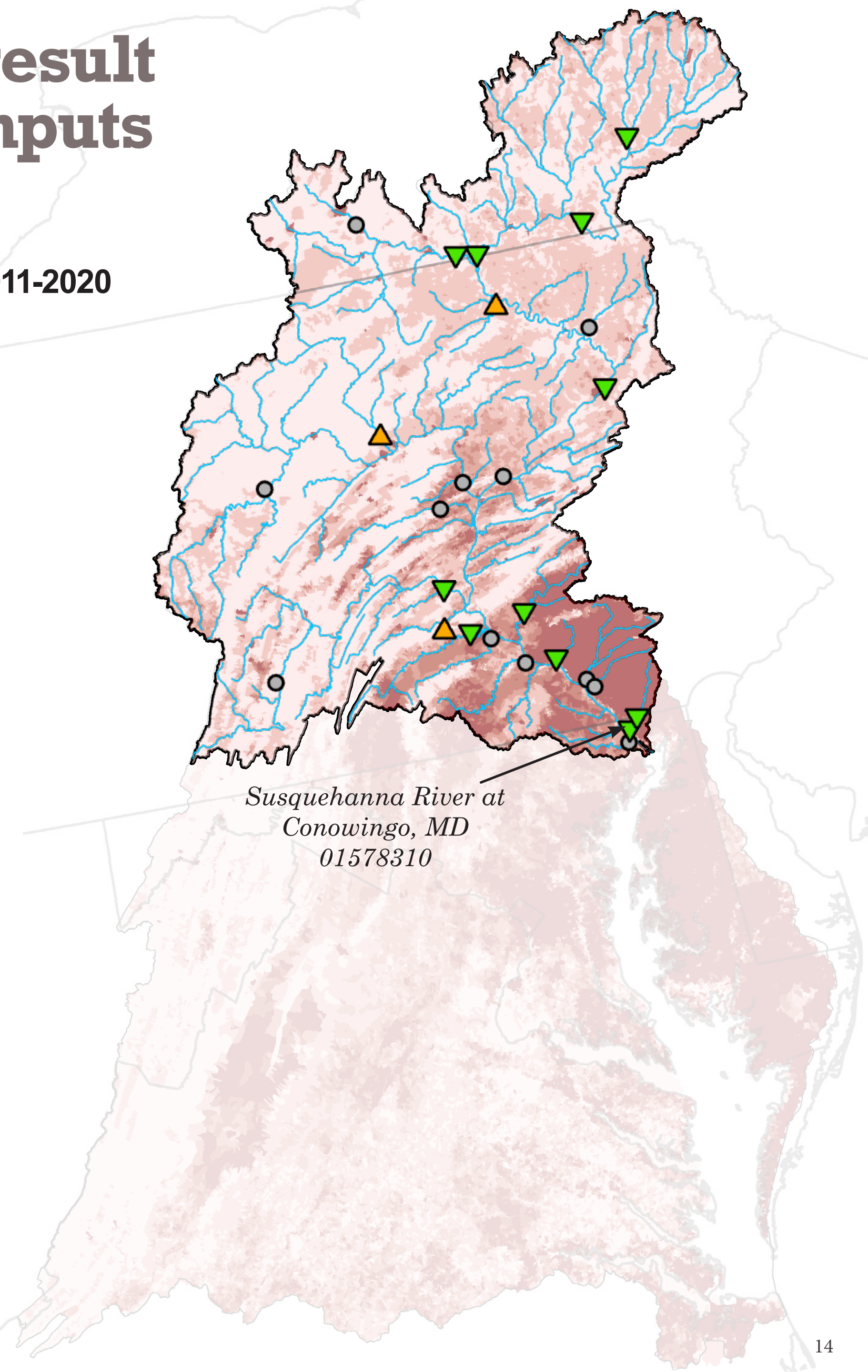


Nitrogen loads (n=26) have improved at 9, degraded at 11, and have no trend at 6 stations.

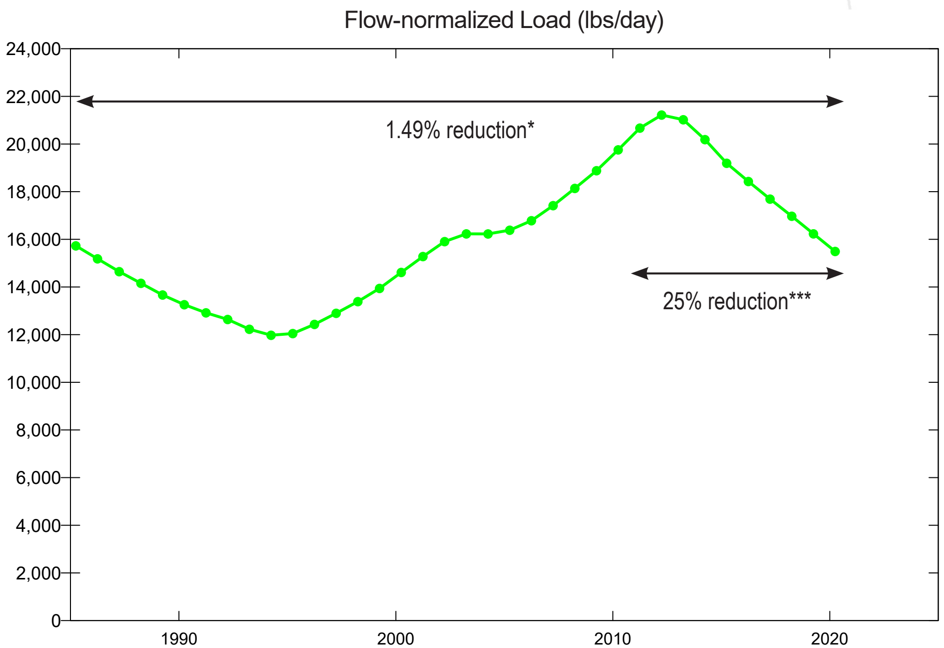
Across the Susquehanna, the median N improvement is 4.5% and the median degradation is 9%.

Trends in phosphorus loads result from changing phosphorus inputs or transport

The most recent ten year period in the Susquehanna Basin, 2011-2020

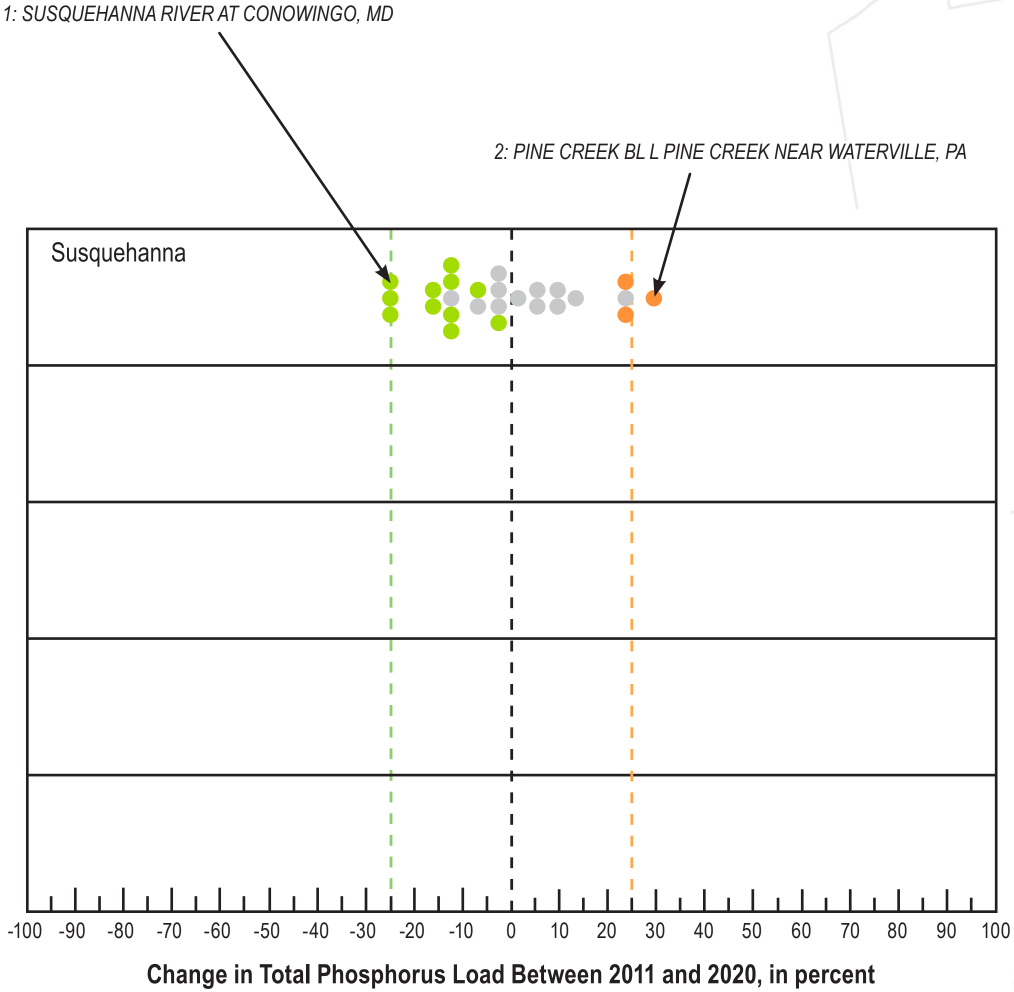


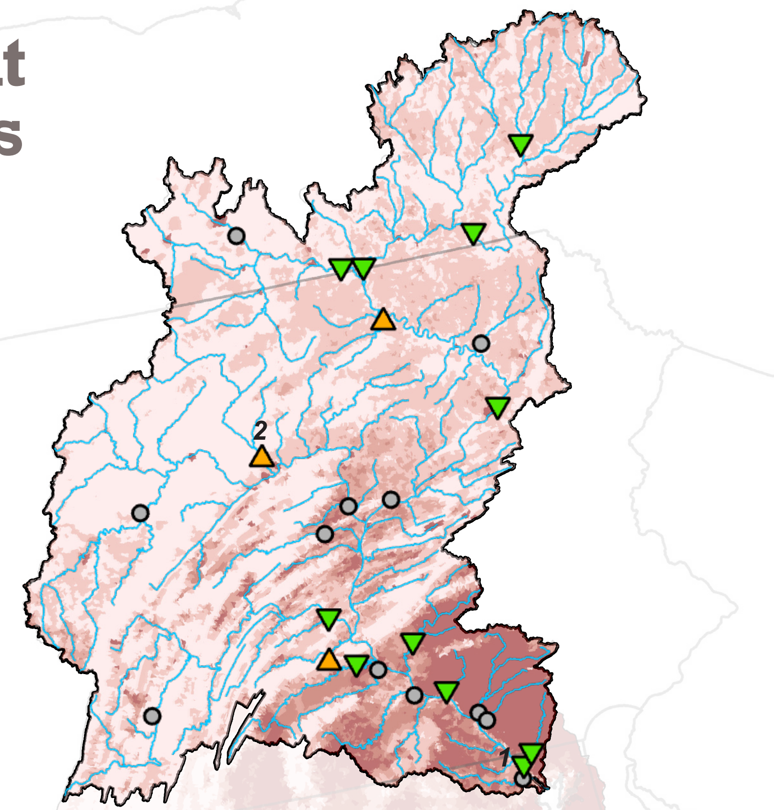
River Input Monitoring station
Susquehanna River at Conowingo, MD



Trends in phosphorus loads result from changing phosphorus inputs or transport

The most recent ten year period in the Susquehanna Basin, 2011-2020

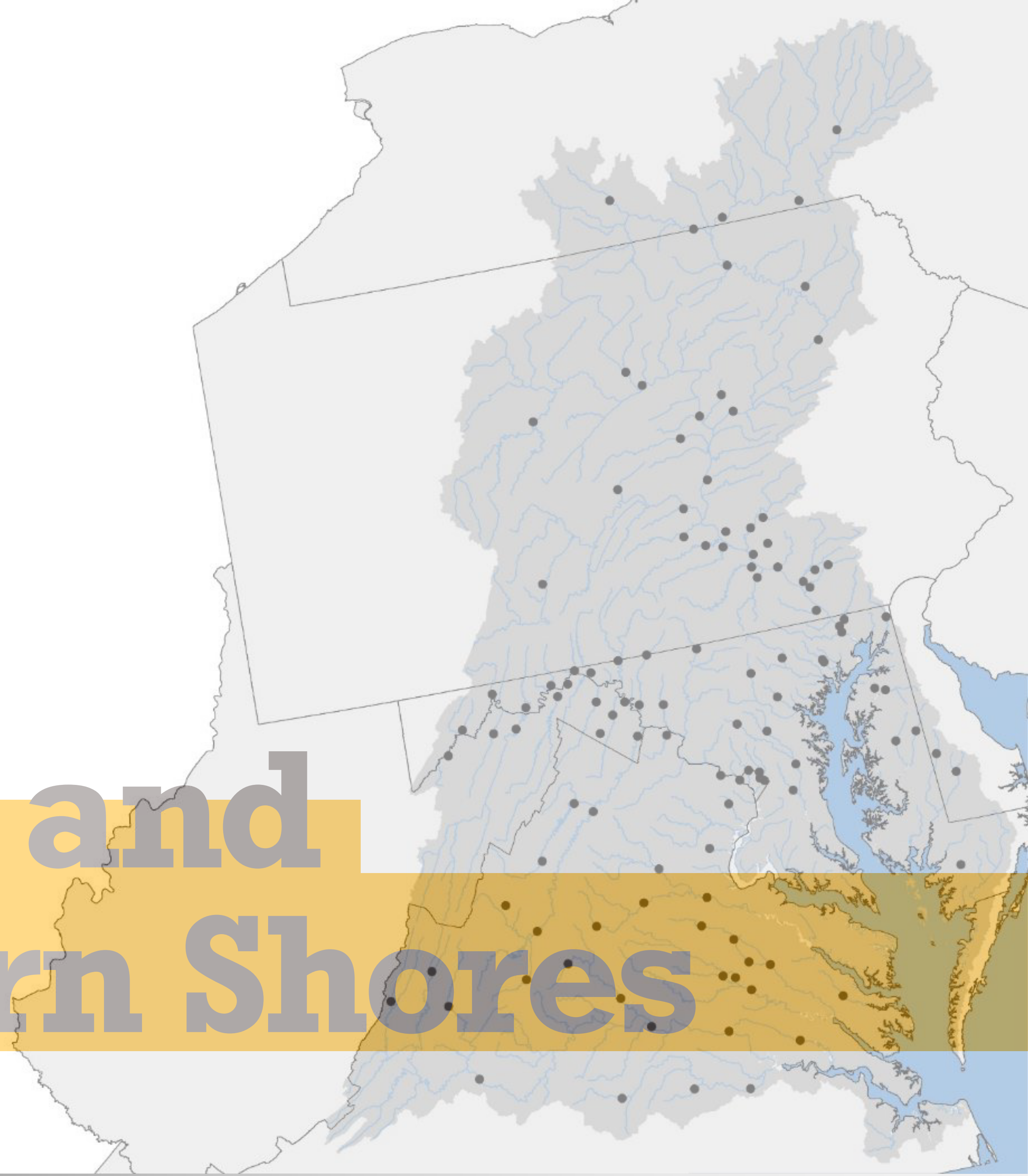




Phosphorus loads (n=26) have improved at 11, degraded at 3, and have no trend at 12 stations.

Across the Susquehanna, the median P improvement is 13% and the median degradation is 26%.

Eastern and Western Shores



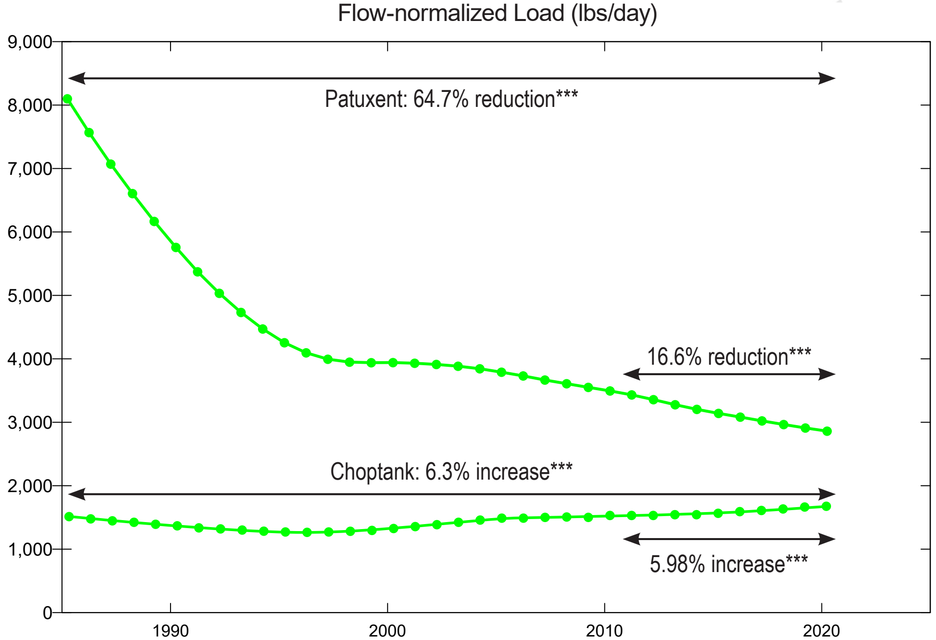
Trends in nitrogen loads result from changing nitrogen inputs or transport

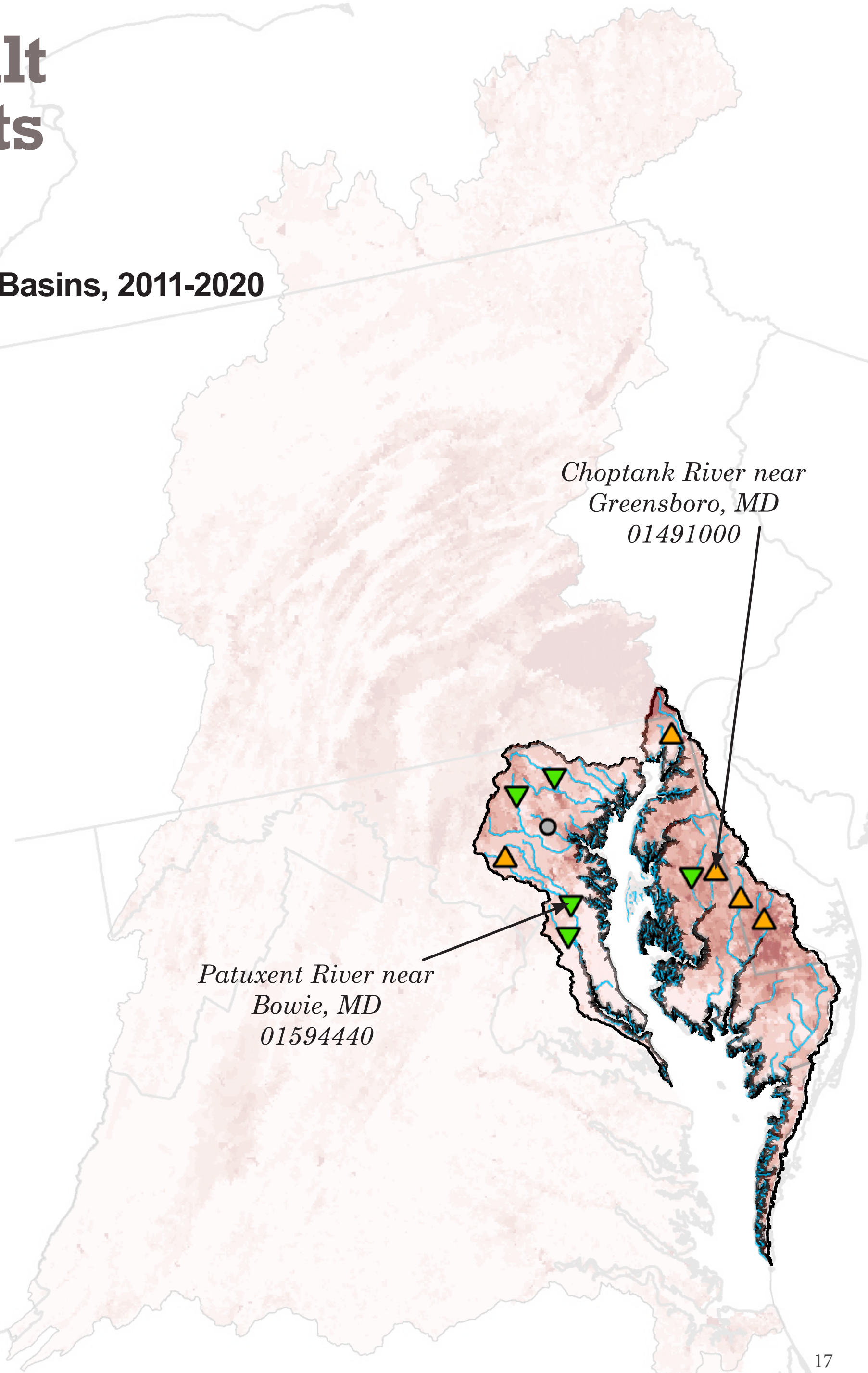
The most recent ten year period in the Eastern/Western Shore Basins, 2011-2020

Nitrogen Per-acre Load
Low → High

Trend Direction
Degrading
Improving
No Trend

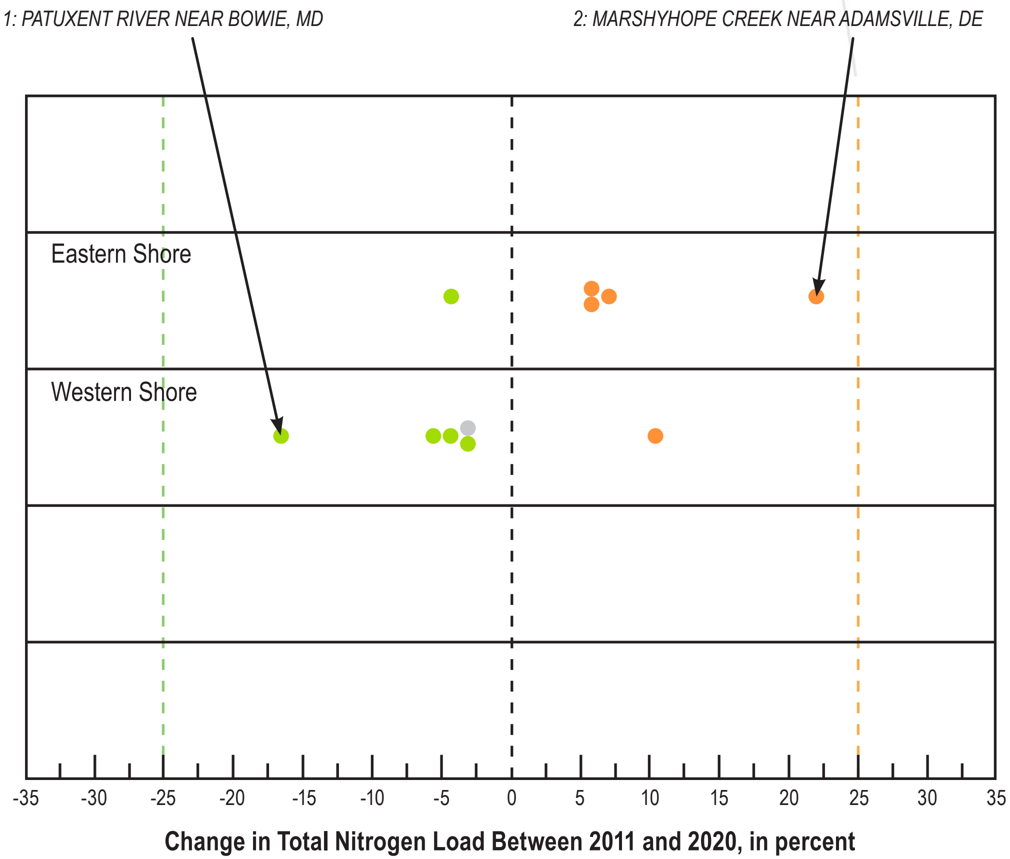
River Input Monitoring stations
Patuxent River near Bowie, MD and Choptank River near Greensboro, MD



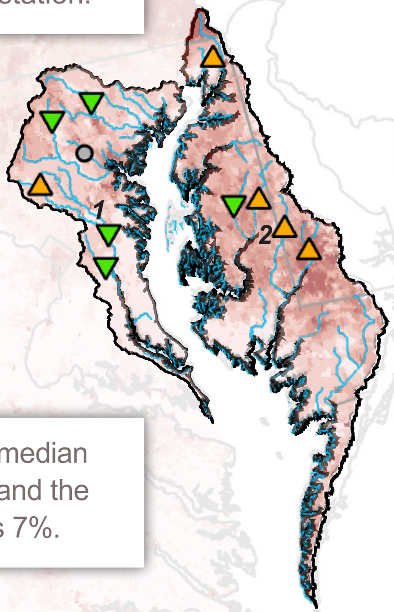


Trends in nitrogen loads result from changing nitrogen inputs or transport

The most recent ten year period in the Eastern/Western Shore Basins, 2011-2020



Nitrogen loads (n=11) have improved at 5, degraded at 5, and have no trend at 1 station.



Across the ES/WS, the median N improvement is 4.4% and the median degradation is 7%.

Trends in phosphorus loads result from changing phosphorus inputs or transport

The most recent ten year period in the Eastern/Western Shore Basins, 2011-2020

Phosphorus Per-acre Load

Low → High

Trend Direction

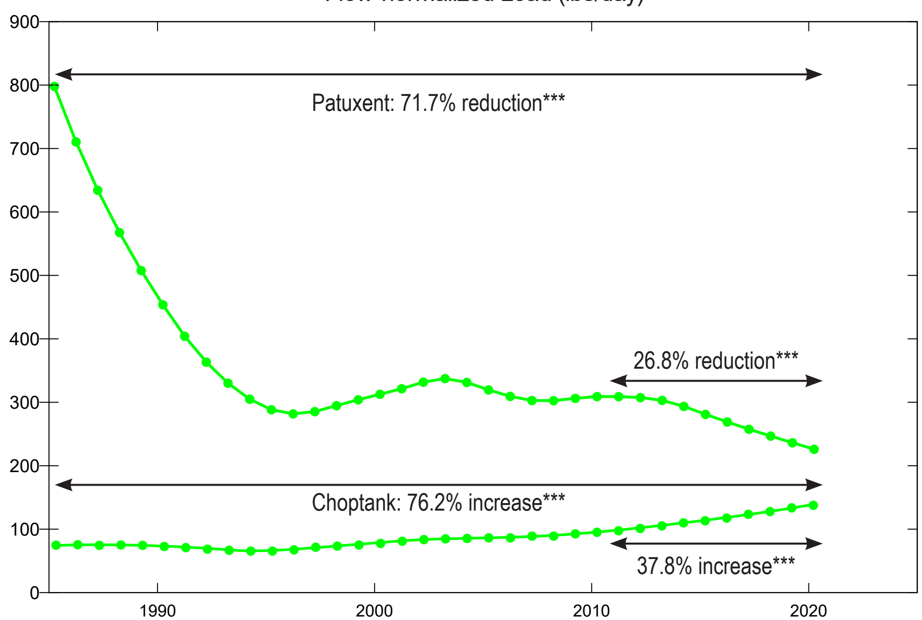
Degrading

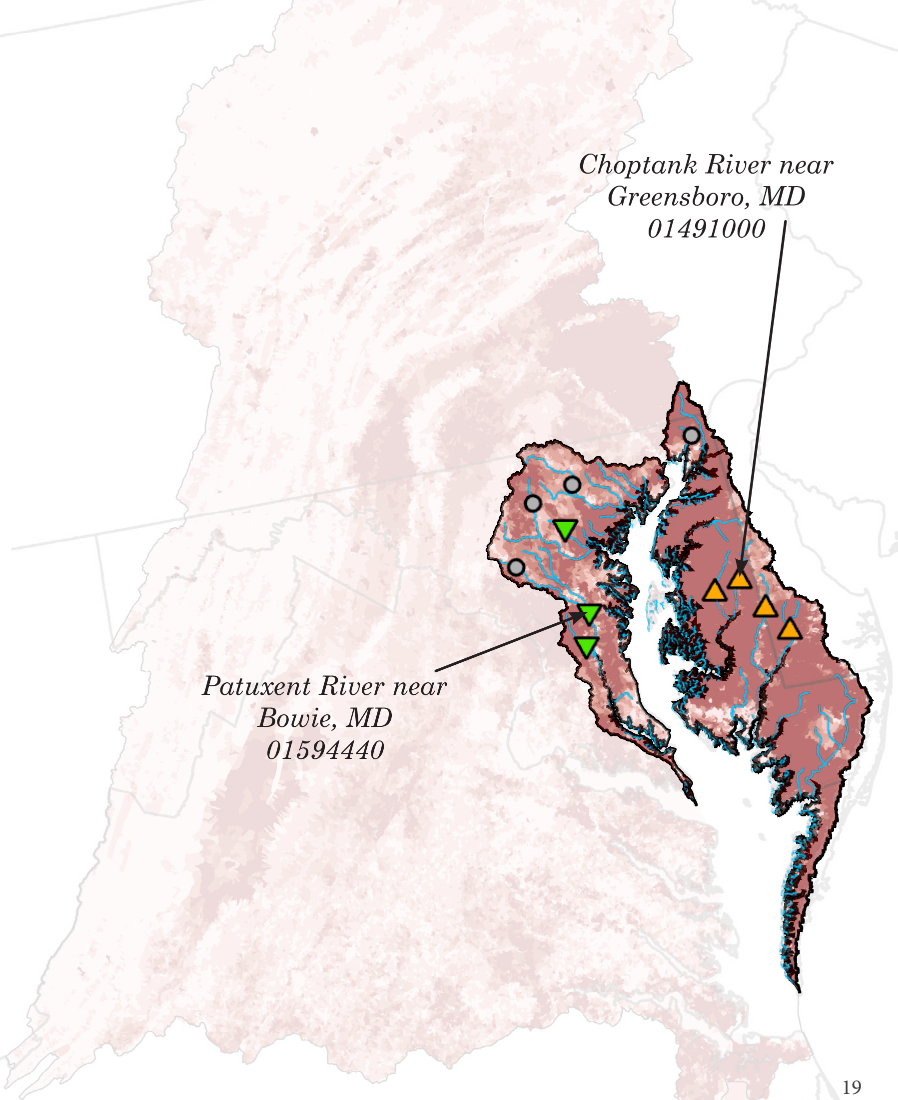
Improving

No Trend

River Input Monitoring stations
Patuxent River near Bowie, MD and Choptank River near Greensboro, MD

Flow-normalized Load (lbs/day)





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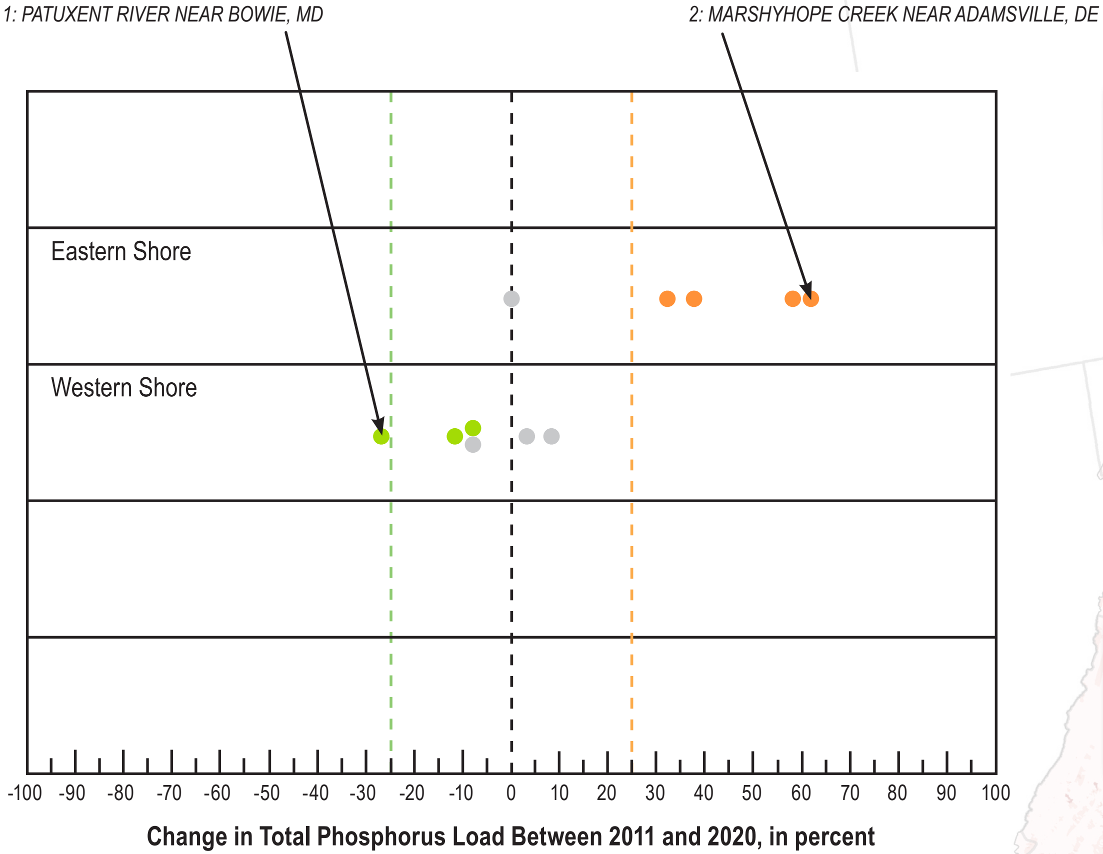
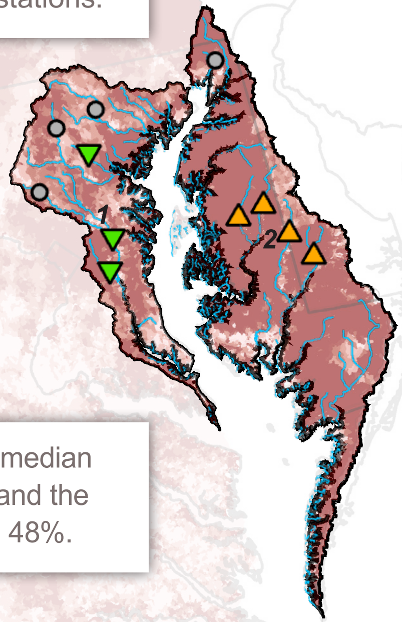
Trends in phosphorus loads result from changing phosphorus inputs or transport

The most recent ten year period in the Eastern/Western Shore Basins, 2011-2020



Phosphorus loads (n=11) have improved at 3, degraded at 4, and have no trend at 4 stations.



Across the ES/WS, the median P improvement is 12% and the median degradation is 48%.

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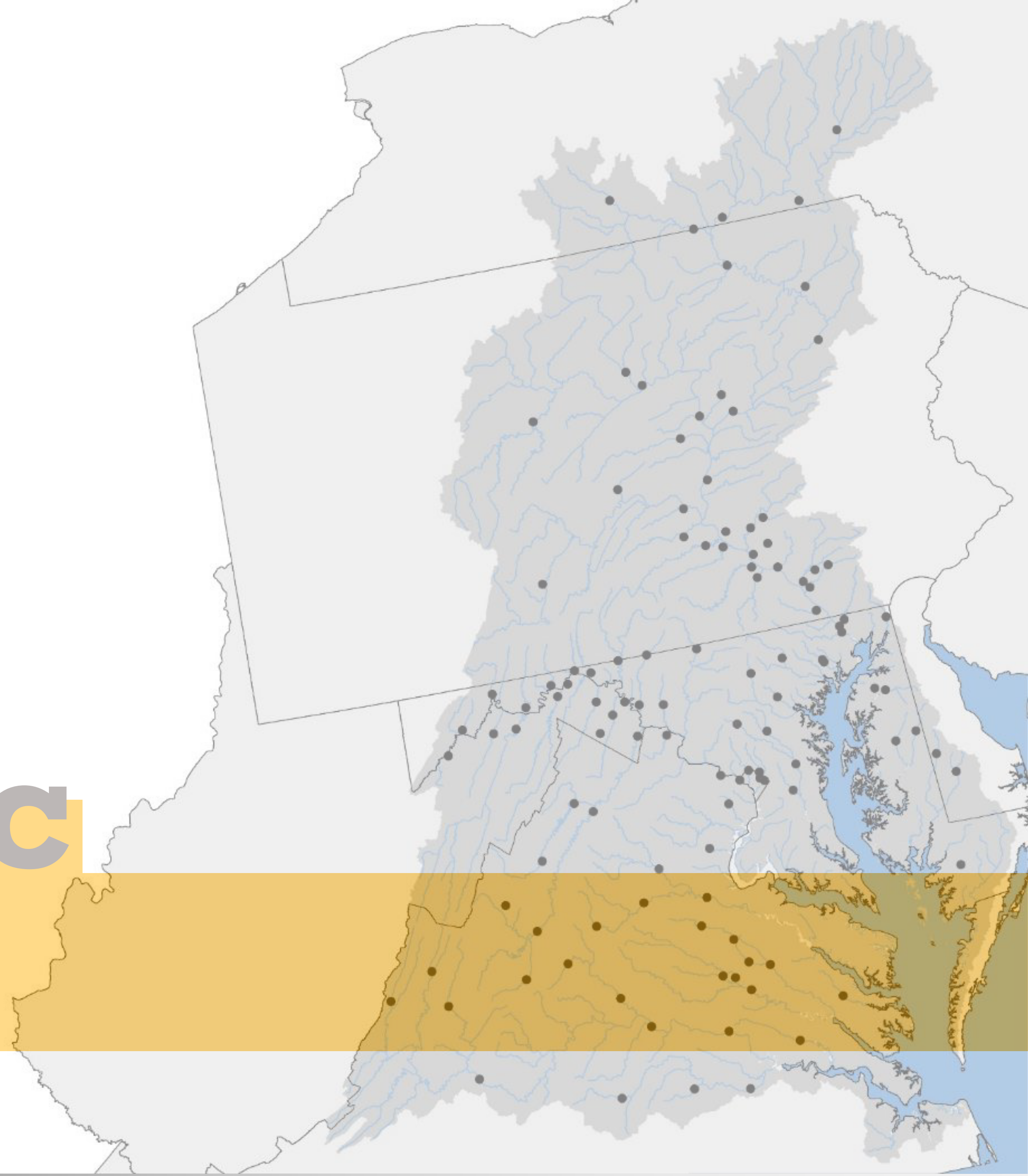
Potomac Basin



Trends in nitrogen loads result from changing nitrogen inputs or transport

The most recent ten year period in the Potomac Basin, 2011-2020

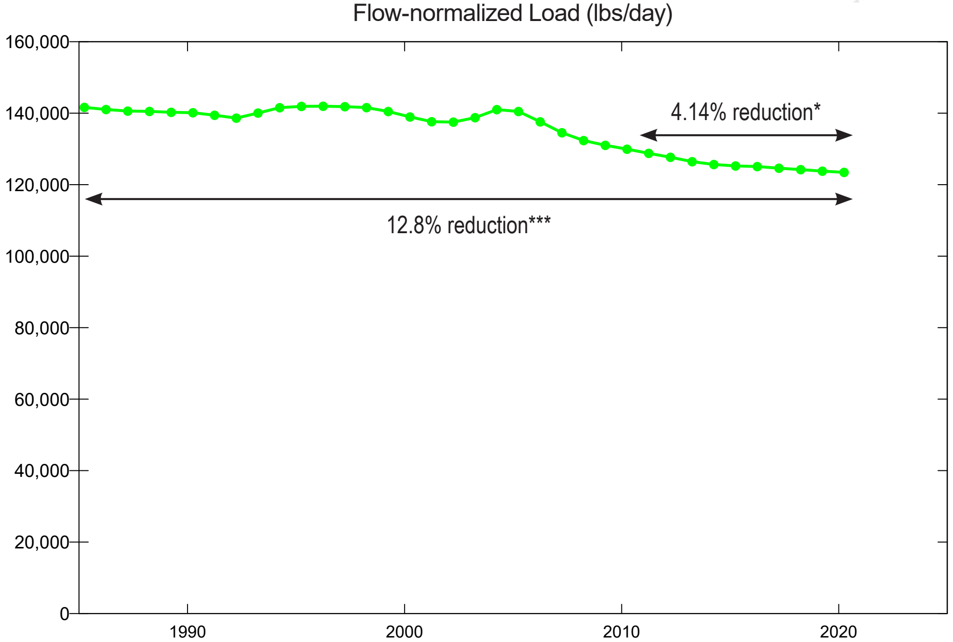
Nitrogen Per-acre Load

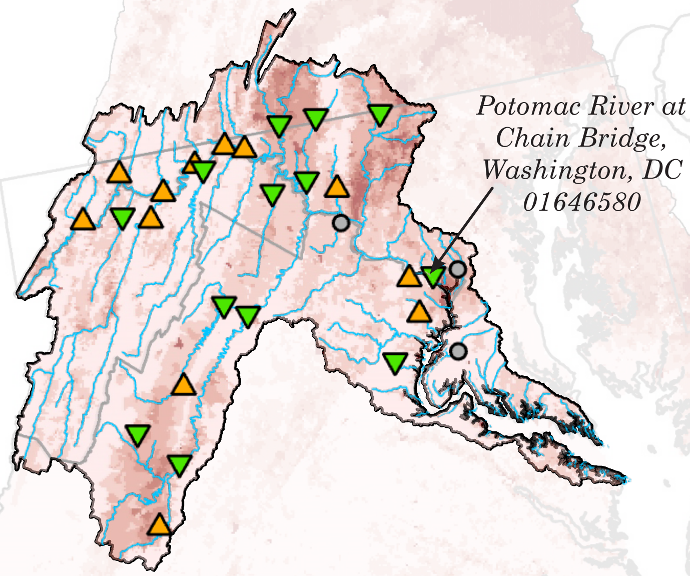
Low → High

Trend Direction

- Degrading
- Improving
- No Trend

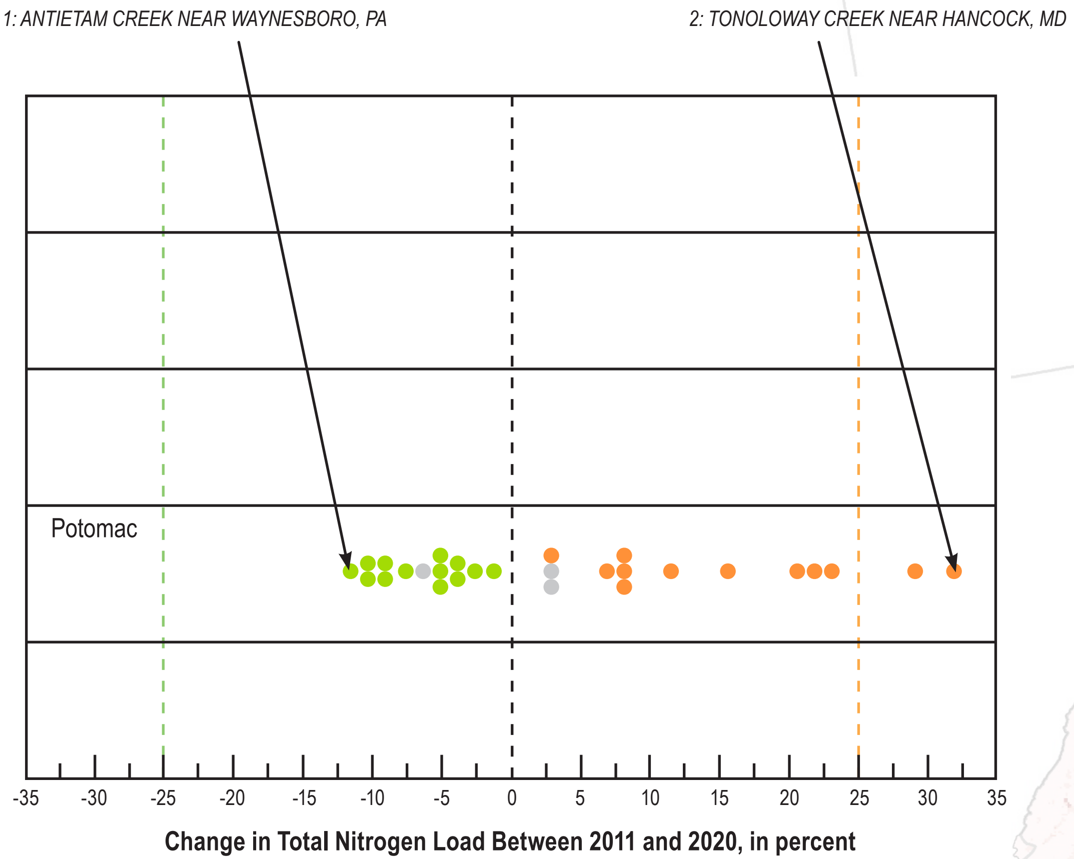
River Input Monitoring station
Potomac River at Chain Bridge, Washington, DC





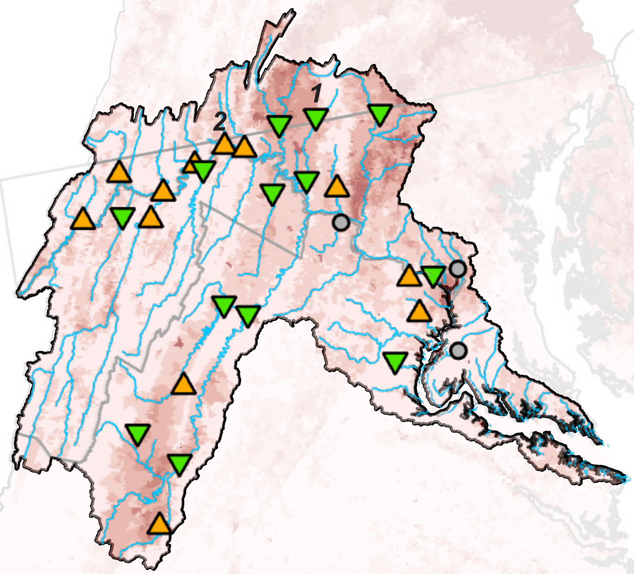
Trends in nitrogen loads result from changing nitrogen inputs or transport

The most recent ten year period in the Potomac Basin, 2011-2020



Nitrogen loads (n=28) have improved at 13, degraded at 12, and have no trend at 3 stations.

Across the Potomac, the median N improvement is 5.5% and the median degradation is 14%.



Trends in phosphorus loads result from changing phosphorus inputs or transport

The most recent ten year period in the Potomac Basin, 2011-2020

Phosphorus Per-acre Load

Low → High

Trend Direction

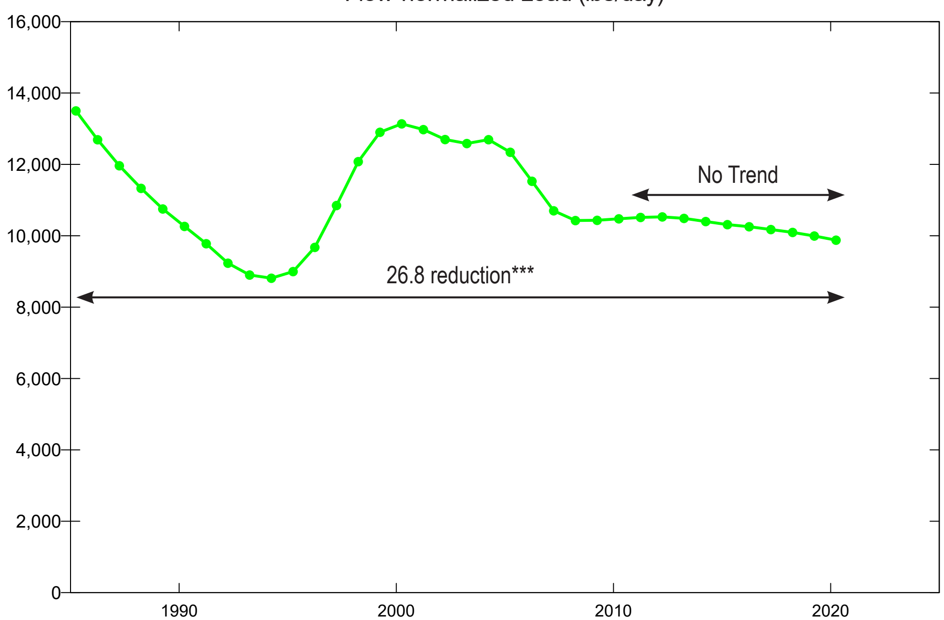
Degrading

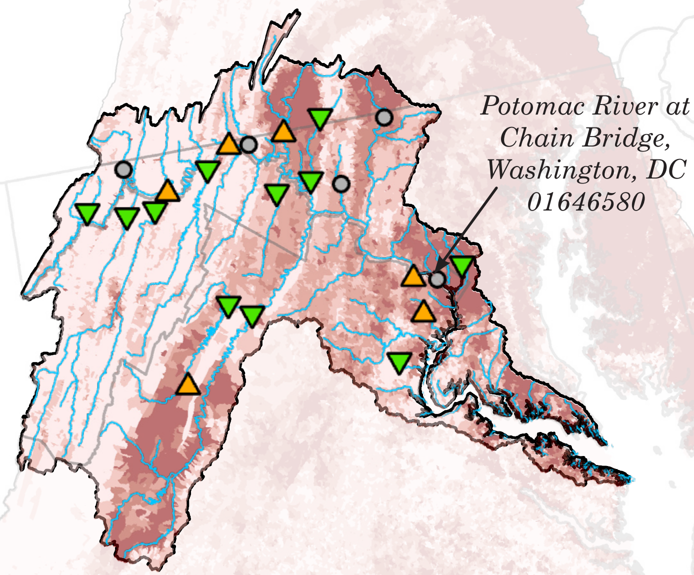
Improving

No Trend

River Input Monitoring station
Potomac River at Chain Bridge, Washington, DC

Flow-normalized Load (lbs/day)





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Trends in phosphorus loads result from changing phosphorus inputs or transport

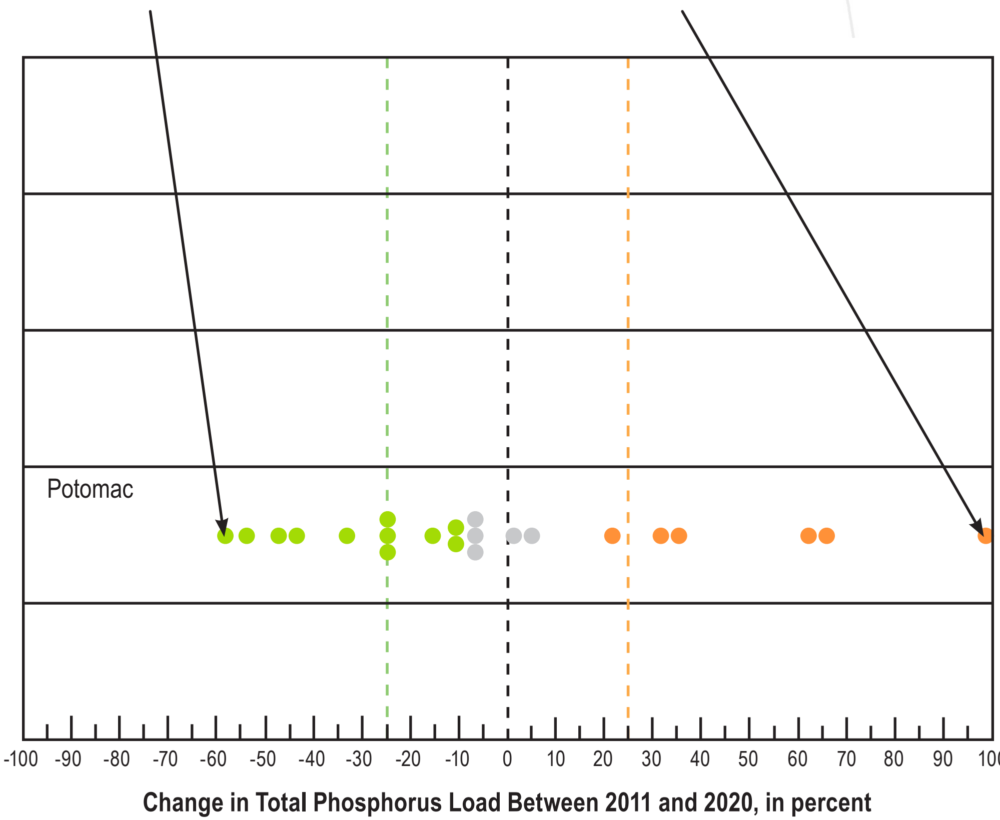
The most recent ten year period in the Potomac Basin, 2011-2020

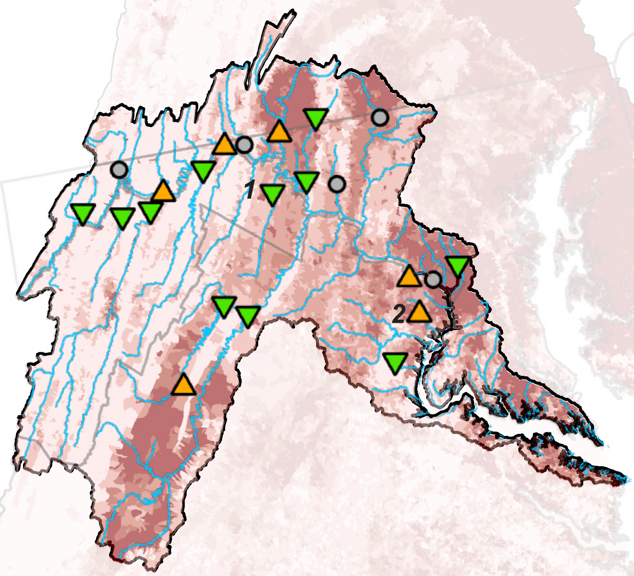
Phosphorus loads (n=22) have improved at 11, degraded at 6, and have no trend at 5 stations.

Across the Potomac, the median P improvement is 26% and the median degradation is 48%.

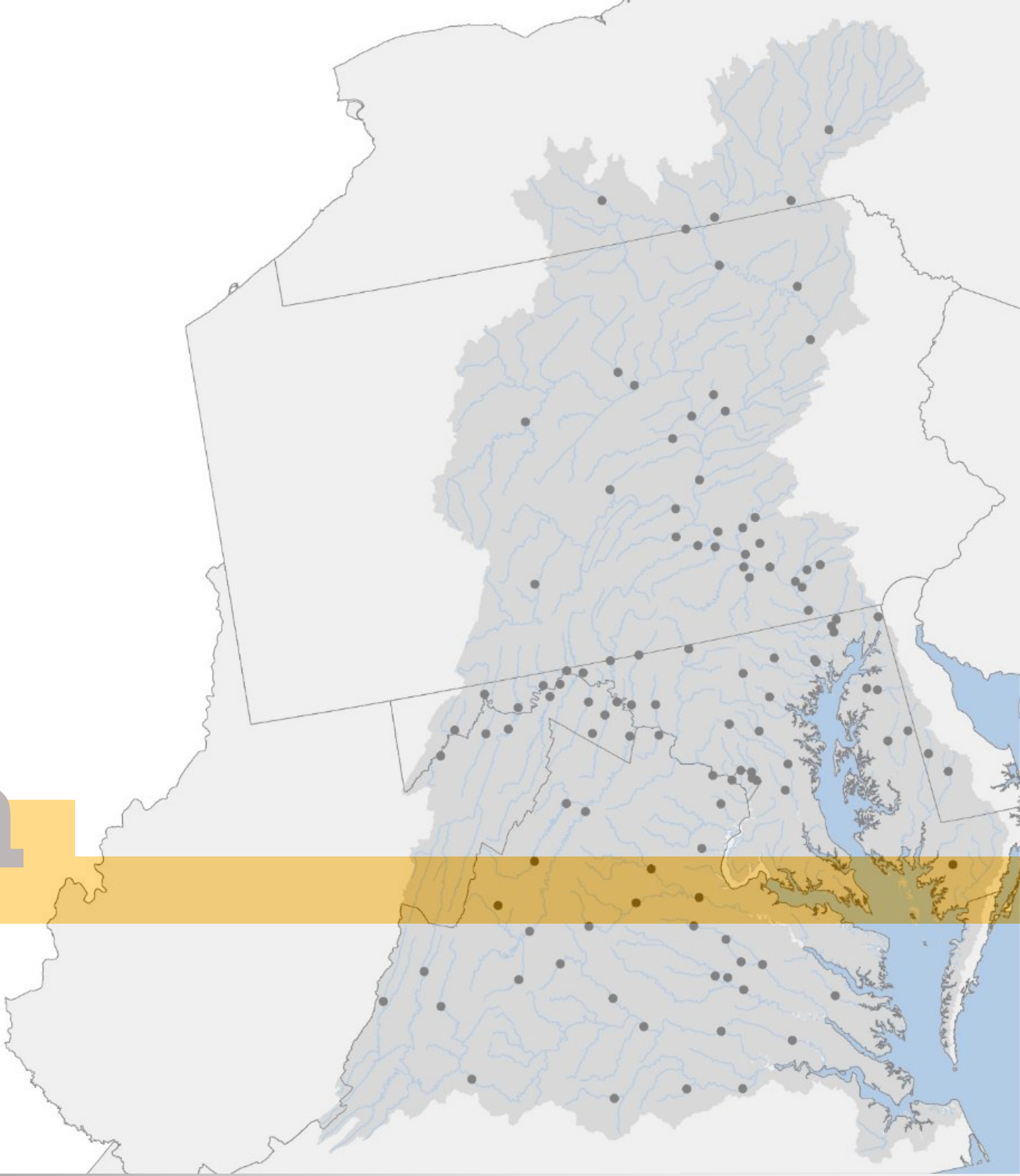
1: OPEQUON CREEK NEAR MARTINSBURG, WV

2: ACCOTINK CREEK NEAR ANNANDALE, VA





Virginia



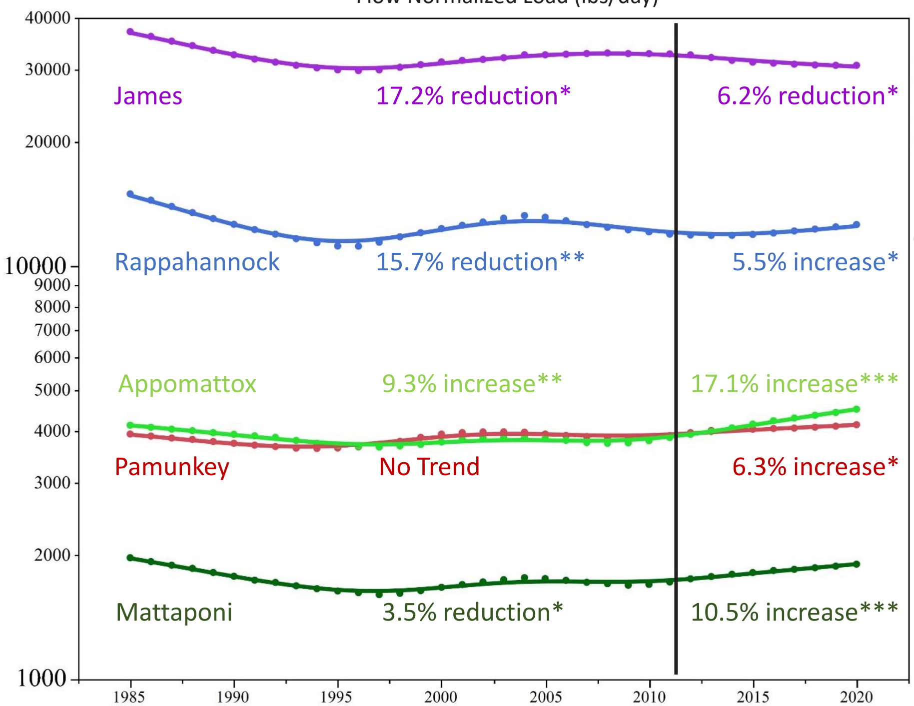
Trends in nitrogen loads result from changing nitrogen inputs or transport

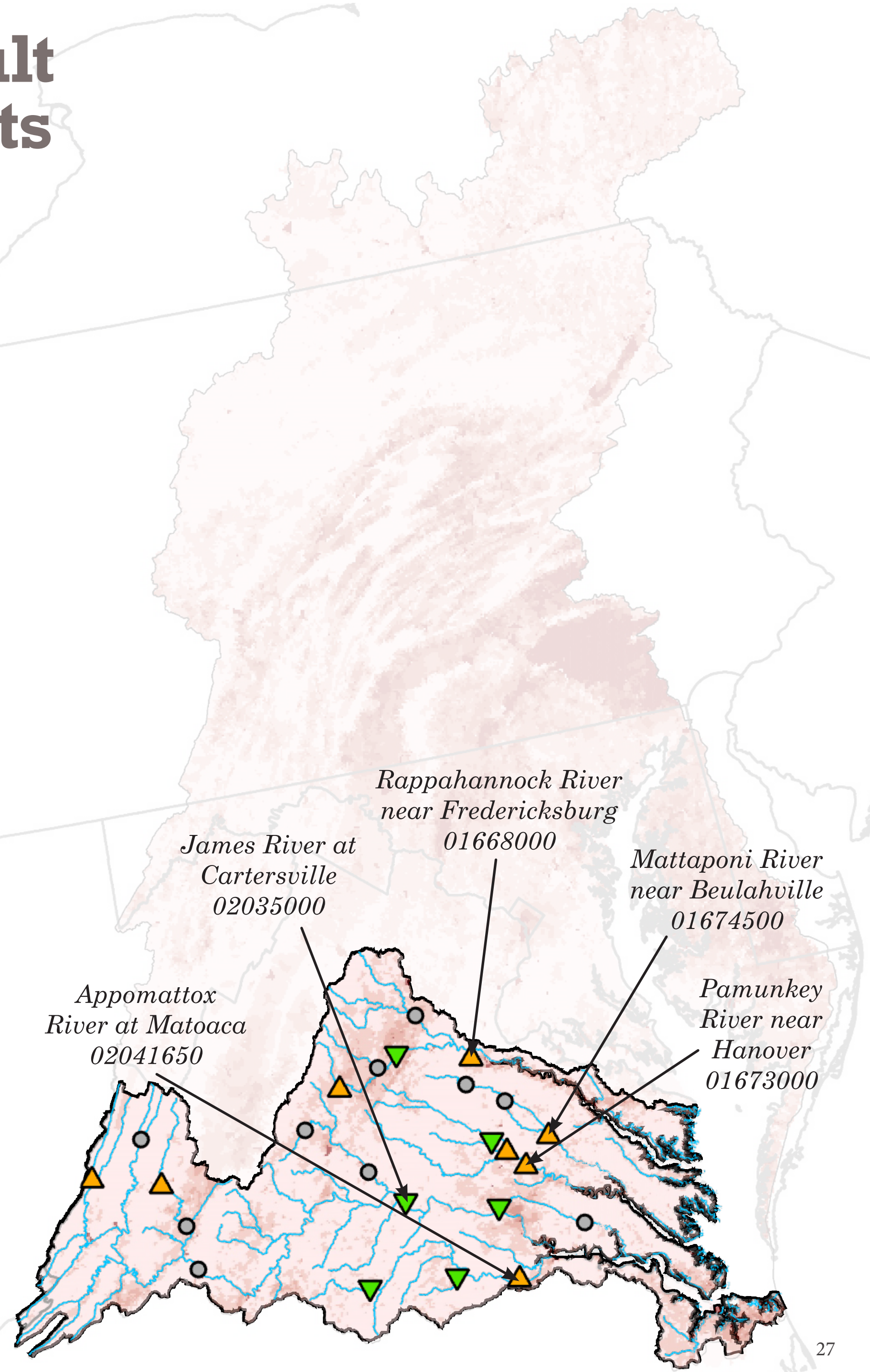
The most recent ten year period in Virginia, 2011-2020

Nitrogen Per-acre Load
Low → High

Trend Direction
Degrading
Improving
No Trend

Five River Input Monitoring stations in Virginia



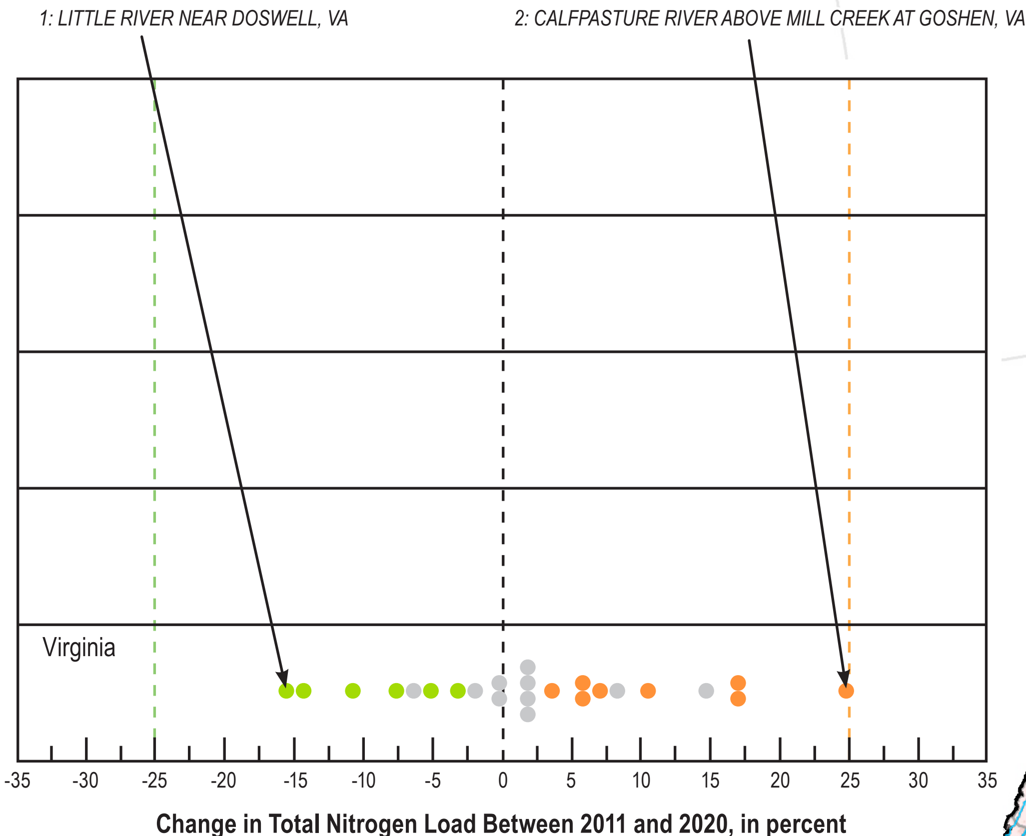


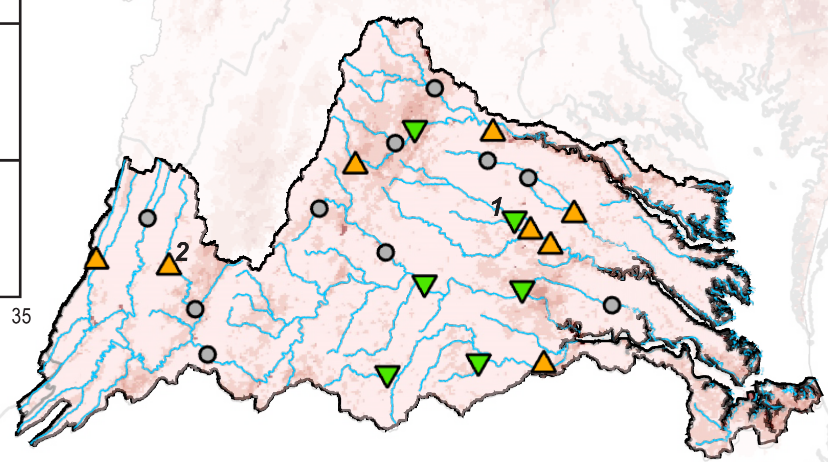
Trends in nitrogen loads result from changing nitrogen inputs or transport

The most recent ten year period in Virginia, 2011-2020

Nitrogen loads (n=24) have improved at 7, degraded at 8, and have no trend at 10 stations.

Across Virginia, the median N improvement is 9% and the median degradation is 8%.





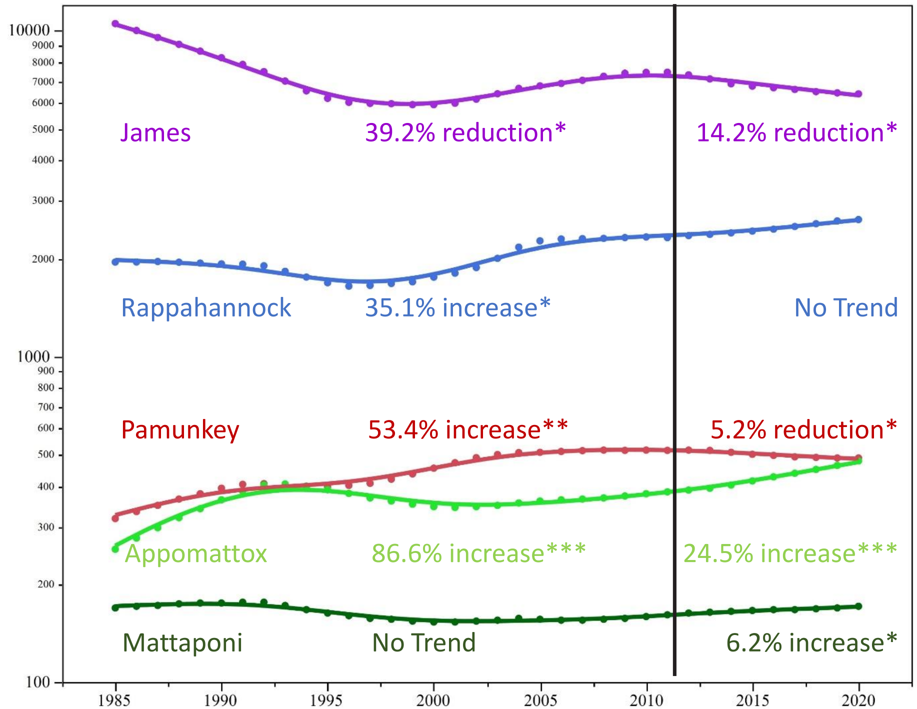
Trends in phosphorus loads result from changing phosphorus inputs or transport

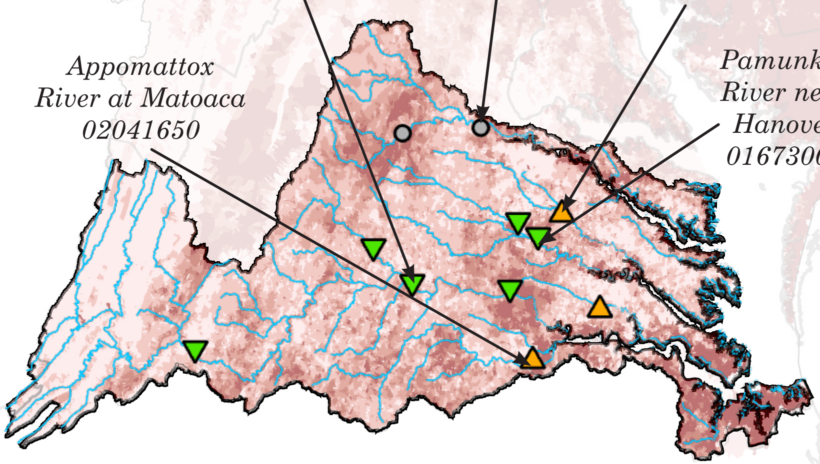
The most recent ten year period in Virginia, 2011-2020

Phosphorus Per-acre Load
Low → High

Trend Direction
Degrading
Improving
No Trend

Five River Input Monitoring stations in Virginia



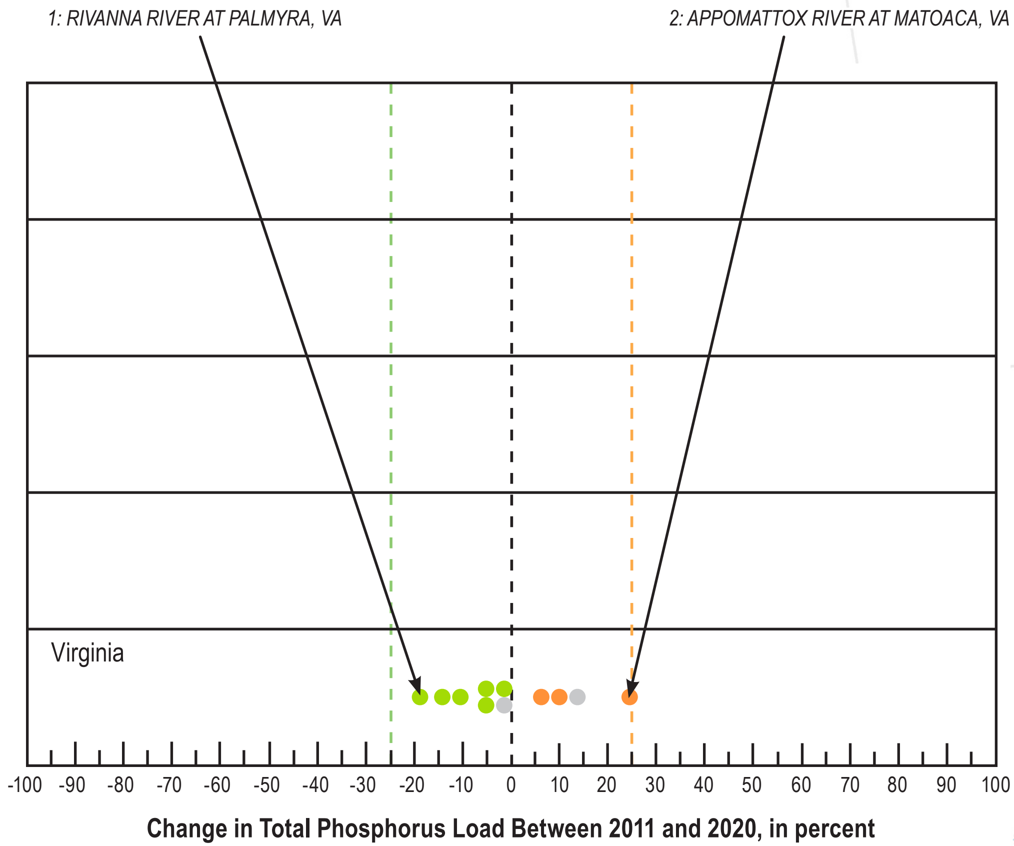


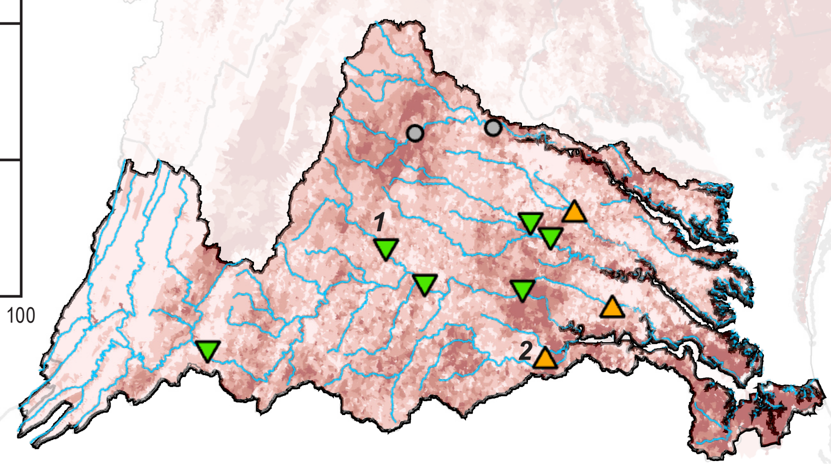
Trends in phosphorus loads result from changing phosphorus inputs or transport

The most recent ten year period in Virginia, 2011-2020

Phosphorus loads (n=11) have improved at 6, degraded at 3, and have no trend at 2 stations.

Across Virginia, the median P improvement is 8% and the median degradation is 9%.





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Trend Direction, 2011-2020

Degrading

Improving

No Trend

Percent change in flow-normalized load (numbers) at the nontidal network

Constituents from left-to-right: TN (total nitrogen), N+N (nitrate plus nitrite), TP (total phosphorus), DIP (orthophosphate), SS (suspended sediment)

EASTERN SHORE

	TN	N+N	TP	DIP	SS
01487000	7.05	21.9	58.2	-11.8	80.8
01488500	22	26.5	61.7	62.6	63.6
01491000	5.98	1.7	37.8	51	24
01491500	-4.33	-7.64	32.3	38.9	36.2
01495000	5.6	3.98	0.112	-16.8	24.7

WESTERN SHORE

	TN	N+N	TP	DIP	SS
01582500	-2.97	-2.46	8.36	-26.1	49.5
01586000	-5.62	-4.17	-8.61	-12.8	8.42
01589300	-3.4	9.24	-11.6	-27.9	9.72
01591000	10.4	9.83	3.26	17.2	33.1
01594440	-16.6	-18.8	-26.8	-20.4	-27.4
01594526	-4.43	9.34	-9.17	-6.51	-0.887

SUSQUEHANNA

	TN	N+N	TP	DIP	SS
01502500	1.97	13.1	-25	-38.5	-1.55
01503000	-2.81	1.31	-2.19	-54.5	98.2
01515000	2.88	5.13	-16	-41.8	104
01529500	6.16	21.5	-14.6	-49.9	8.94
01531000	9.12	13.2	-24.8	-60.1	70.8
01531500	4.05	5.49	25.6	-53.3	90.4
01534000	16.8	21.4	22.3	25.7	91.7
01536500	-1.36	5.07	-7.64	-42.2	12.2
01540500	-4.54	0.516	-0.901	-54	31
01542500	6.1	17.3	-6.02		-1.49
01549700	19.6	43	29.5		72.2
01553500	-0.754	5.03	-3.97	-34	25.3
01555000	7.33	11	1.47	12.1	-17.5
01562000	15.1	19.6	12.1	2.08	28.7
01567000	9.41	15.6	-16.2	-19.6	-1.89
01568000	15.8	18.6	23.1	22.8	32.8
01570000	3.45	2.96	-11.8	-12	-13.9
01571500	-5.65	-8.92	10.1	16	31.6
01573560	-6.9	-9.61	-13.2	-18.6	-15
01574000	-1.97	-7.3	5.67	9.52	16.1
01576000	-6.01	-1.64	-13.4	-13.2	0.774
01576754	-7.09	-9.25	-3.17	-13.3	18.7
01576787	-2.9	-5.45	9.15	-10.4	20
01578310	-3.24	7.64	-25	-14.1	-34.4
01578475	-0.357	0.929	-13.2	-23	5.87
01580520	-0.173	0.934	5.19	-29	40.2

POTOMAC

	TN	N+N	TP	DIP	SS
01599000	3.46	16.3	-23	-42.6	-10.3
01601500	29.1	33.9	4.03	-33.1	33
01604500	-5.39	-0.852	-53.8	-34.5	-16.4
01608500	8.52	3.26	-47.2	-83.5	41.5
01609000	23	34.1	62.2		24.8
01610155	7.94	36.2			
01611500	-10.2	-14.2	-33.1		4.36
01613095	31.9	41.1	21.7		8.43
01613525	20.6	18.4	-6.51	-38.8	-55.7
01614500	-3.56	-8.07	34.4	-1.34	15.6
01616500	-9.42	-7.05	-58.2	-78.5	39.5
01619000	-11.6	-14.8	-24.9	-43.7	-5.16
01619500	-8.86	-14.1	-10.5	-41.6	67.4
01621050	-7.62	-9.76			
01626000	21.7	29.7			
01628500	-4.45	4.2			
01631000	-5.28	9.98	-26.2	-23.9	-23.6
01632900	6.88	8.11	31.7	-22.4	73.9
01634000	-1.27	10.4	-43.5	-38.4	-49.7
01637500	15.6	21.6	1.33	-13.3	29.6
01638480	2.49	13.7			
01639000	-5.49	5.45	-7.23	2.34	-9.79
01646000	11.5	21.2	65	43.6	128
01646580	-4.14	3.64	-6.06	-30.6	6
01651000	-7.09	12.9	-15.4	-1.26	19.1
01654000	7.76	-7.64	99.9	37.9	267
01658000	2.66	-8.19			
01658500	-11.3	-6.14	-10.7	27.5	-6.94

VIRGINIA

	TN	N+N	TP	DIP	SS
01664000	-0.294	7.25			
01665500	6.08	21.7			
01666500	8.11	21.8			
01667500	-10.8	5.15	-2.21	14.2	0.557
01668000	5.5	14.8	13.7	6.77	16.1
01671020	3.57	48.2	-5.08		-13.1
01671100	-15.6	5.19			
01673000	6.29	22.7	-5.22	-10.3	-16.4
01673800	2.36	16.7			
01674000	1.68	28.3			
01674500	10.5	45.7	6.24	-0.538	25
02011500	16.9	28.1			
02015700	14.7	28.7			
02020500	24.8	39.8			
02024000	1.55	18.5			
02024752	-2.53	19.4	-10.5	-12.2	-12.6
02031000	1.7	22.4			
02034000	-6.7	-14.7	-18.8	-19.2	-22.1
02035000	-6.17	3.86	-14.2	-11.1	-11
02037500	-14.9	6.41	-4.01		4.49
02039500	-7.66	23.2			
02041000	-3.22	12.8			
02041650	17.1	28.4	24.5	48.3	29.7
02042500	-0.175	144	8.75		25.5