

Susquehanna River: The Science, Issues, and Potential Solutions

January 3, 2019

Chesapeake Bay Commission

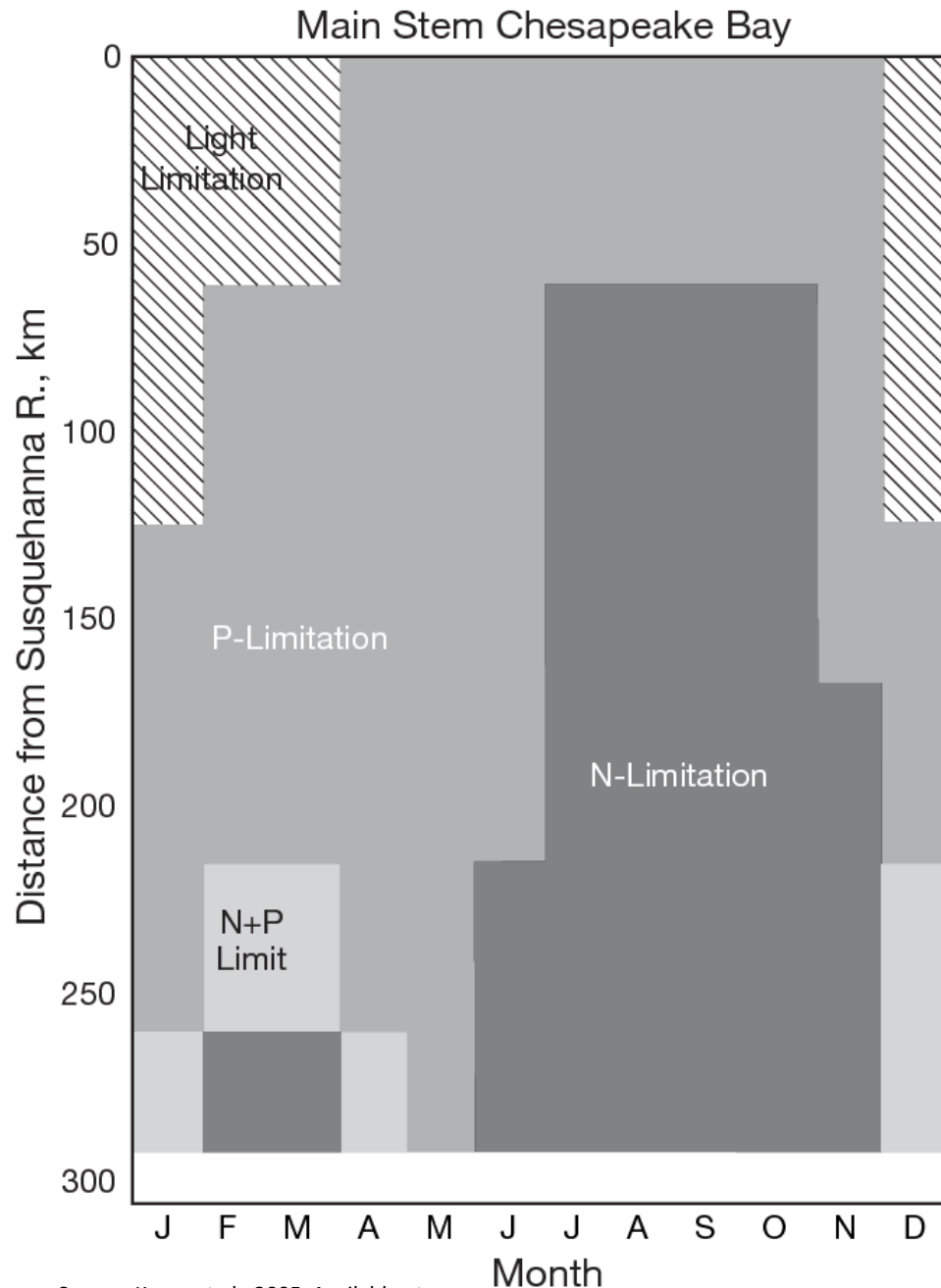
Matthew Johnston

Senior Policy Analyst, Chesapeake Bay Program

University of Maryland

Opinions/recommendations presented are solely those of the author.

The Watershed Issue: Nutrients



“...Reductions in both N and P from rivers and point sources would be required to reduce Bay phytoplankton biomass consistently throughout the year for the whole Bay...”

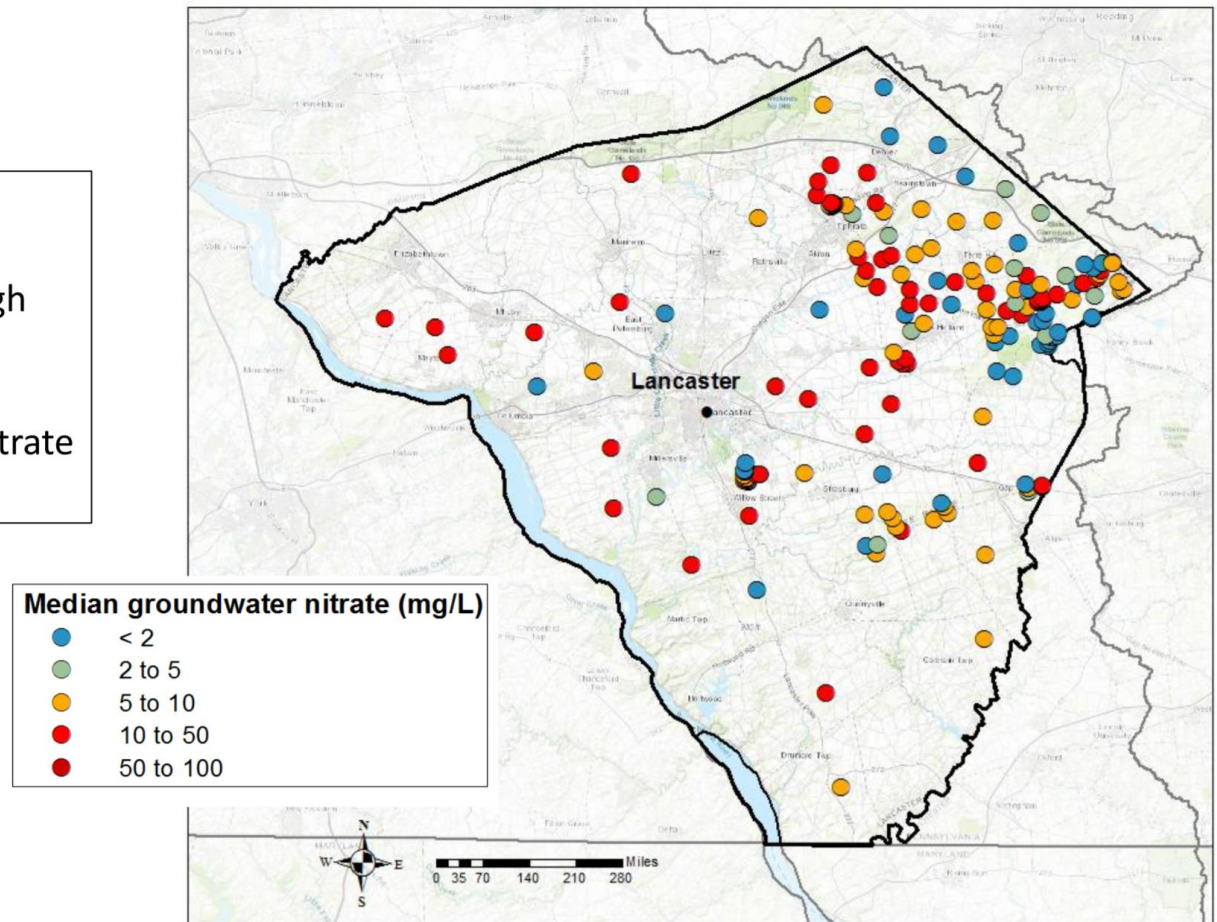
Source: Kemp et al., 2005. Available at:

https://www.researchgate.net/publication/228375141_Eutrophication_of_Chesapeake_Bay_Historical_Trends_and_Ecological_Interactions

The Local Issue: Nutrients

Certain areas of the watershed are more vulnerable

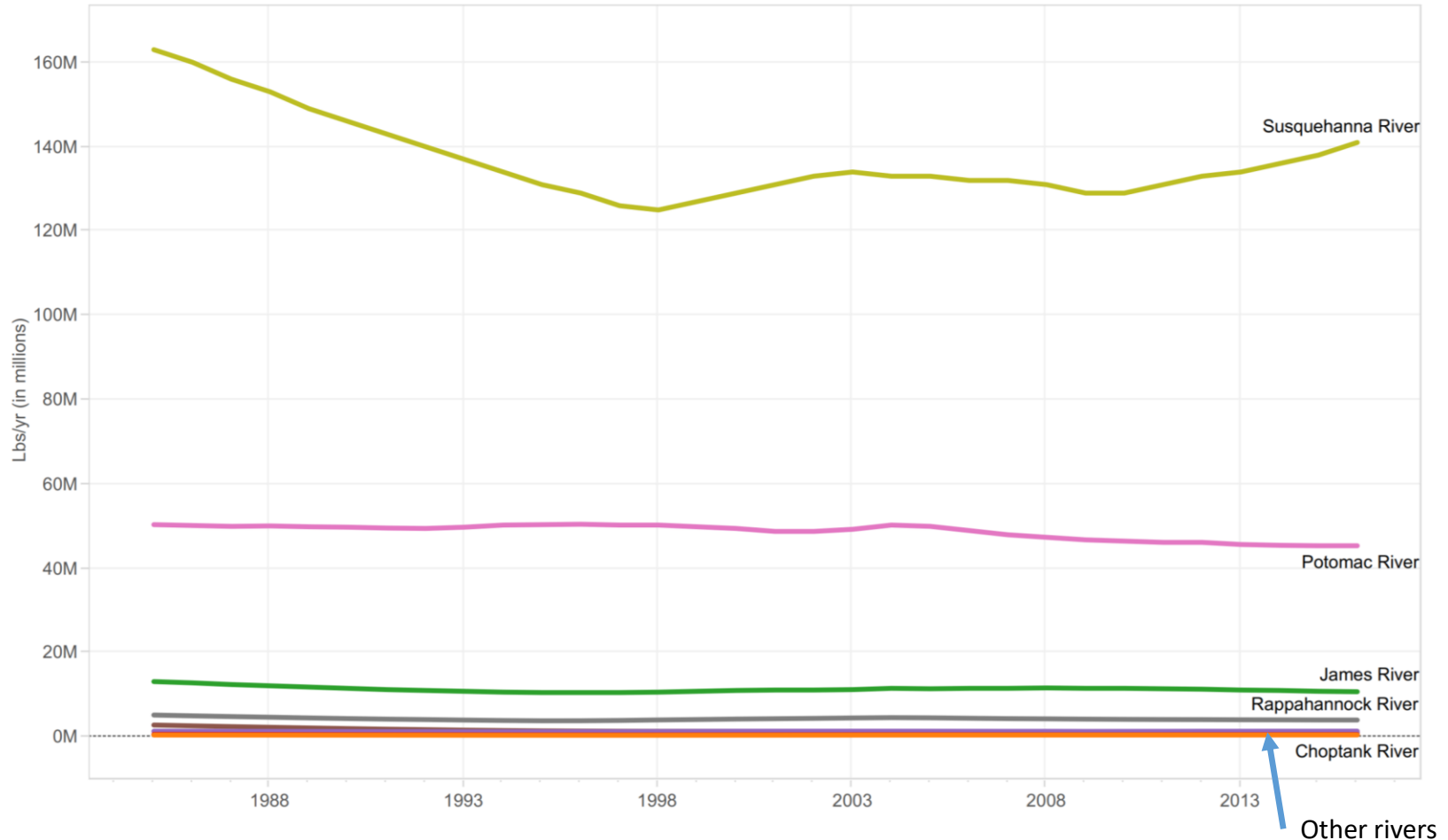
- Geology makes the groundwater (and therefore streams) in some areas especially vulnerable to high nitrogen inputs
- These areas can be the most effective to focus practices for nitrate in groundwater



The Mother of the Bay's Nitrogen

Flow Normalized Annual Nitrogen Load

Click and drag to pan the graph. Click the home button to return to the original view. Hover over the lower lines to identify their names

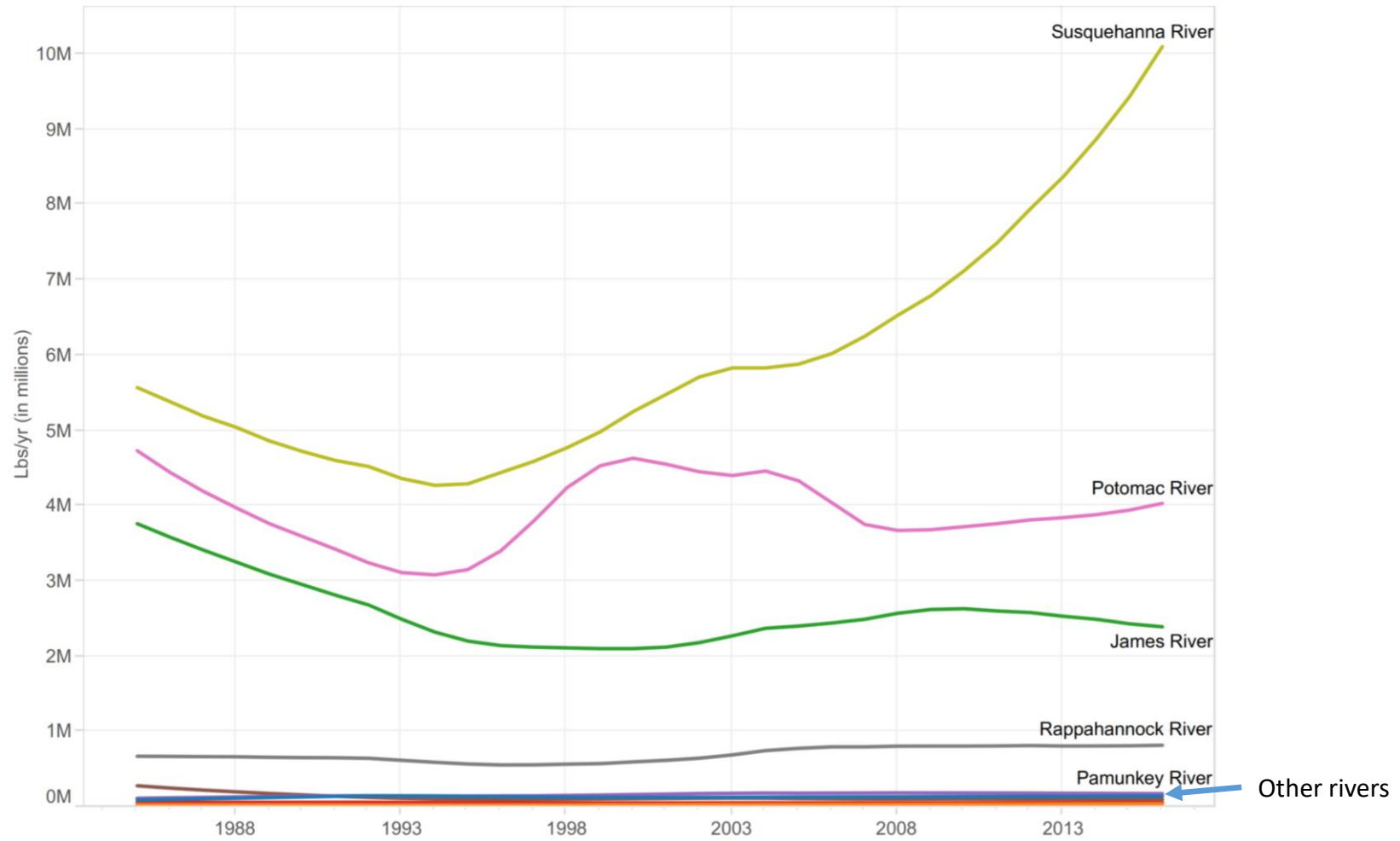


Approximately 69% of Nitrogen inputs came via the Susquehanna in 2016.

The Mother of the Bay's Phosphorus

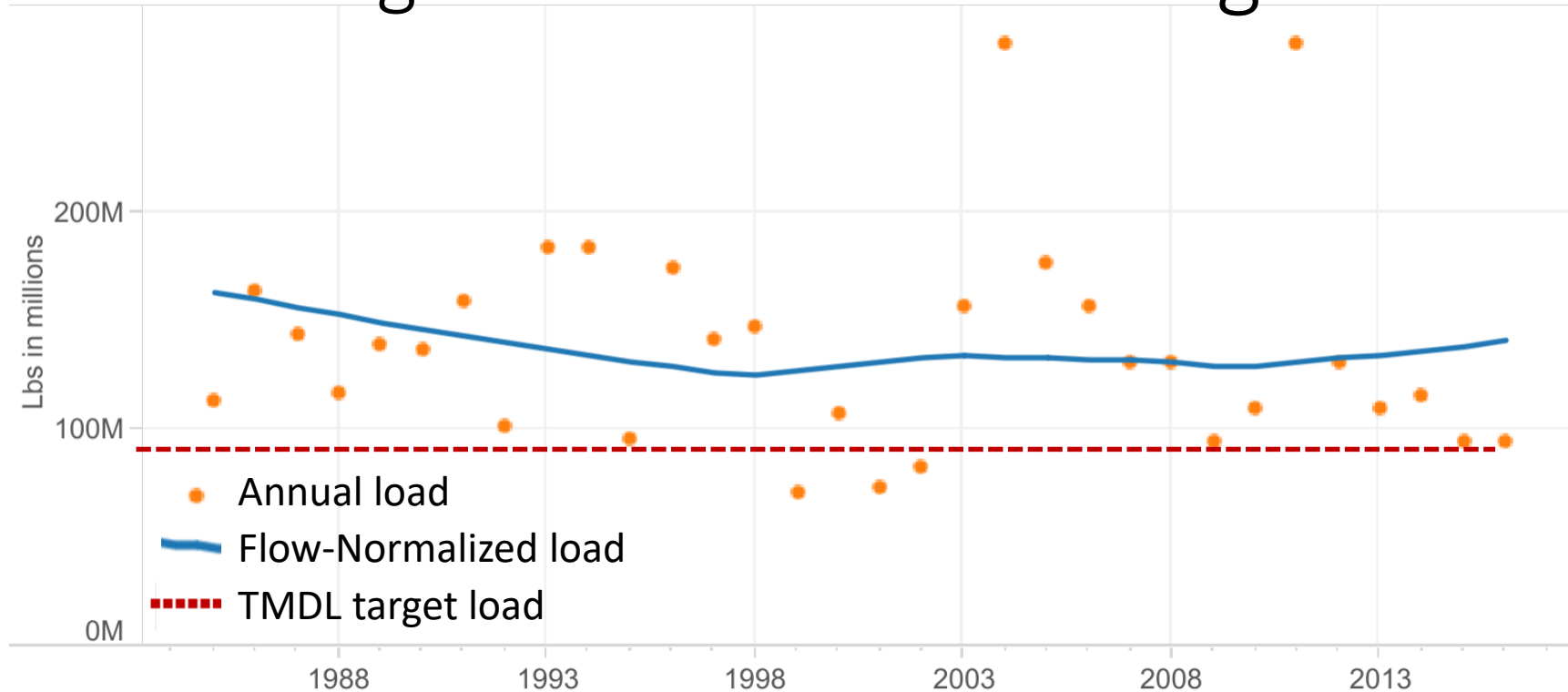
Flow Normalized Annual Phosphorous Load

Click and drag to pan the graph. Click the home button to return to the original view. Hover over the lower lines to identify their names



Approximately 57% of Phosphorus inputs came via the Susquehanna in 2016.

Total Nitrogen Loads at Conowingo



Trends in flow-normalized annual loads, and the likelihood of those trends, are computed for each station with enough years of data. For stations with water quality records prior to 1990, trends are computed for the entire period of record (Long Term) and the most recent 10 years (Short Term). For stations having records beginning after 1990, only the most recent 10-year trends are computed. The likelihood of trends is analyzed according to Hirsch and others, 2015.

Trends (Long Term)

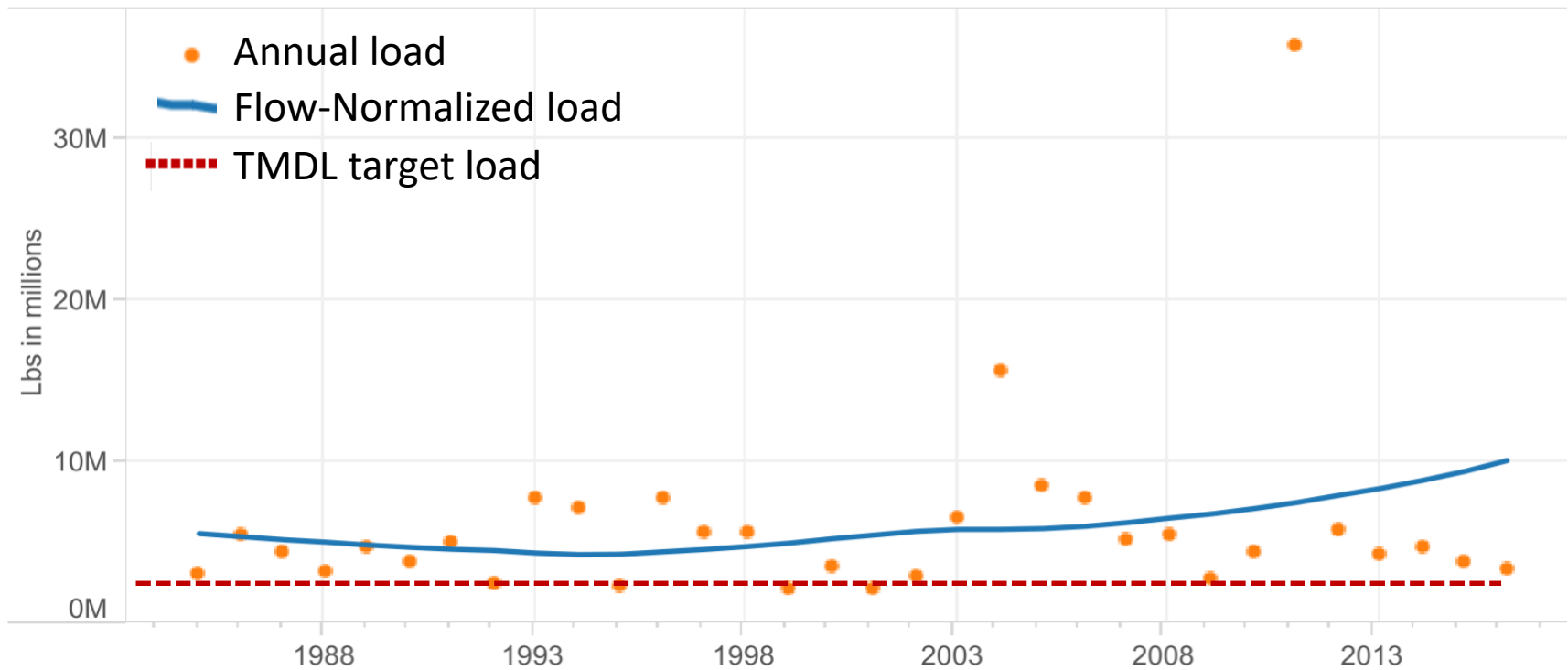
		Long Term
1985	2016	Improving

Trends (Short Term)

		Short Term
2007	2016	Degrading

Data Source: <http://gis.chesapeakebay.net/wip/dashboard/>; <https://cbrim.er.usgs.gov/>

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Trends (Long Term)

		Long Term
1985	2016	Degrading

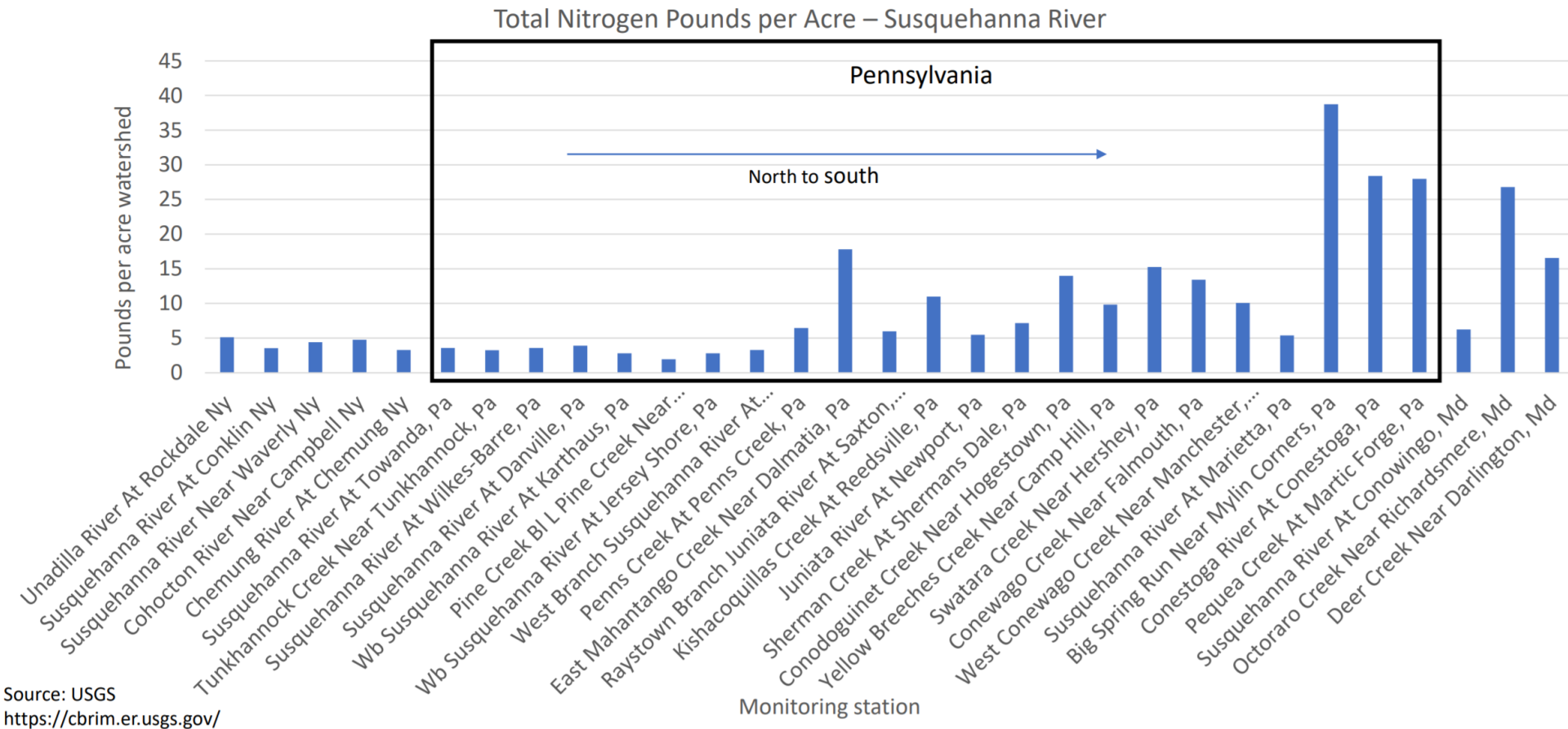
Trends (Short Term)

		Short Term
2007	2016	Degrading

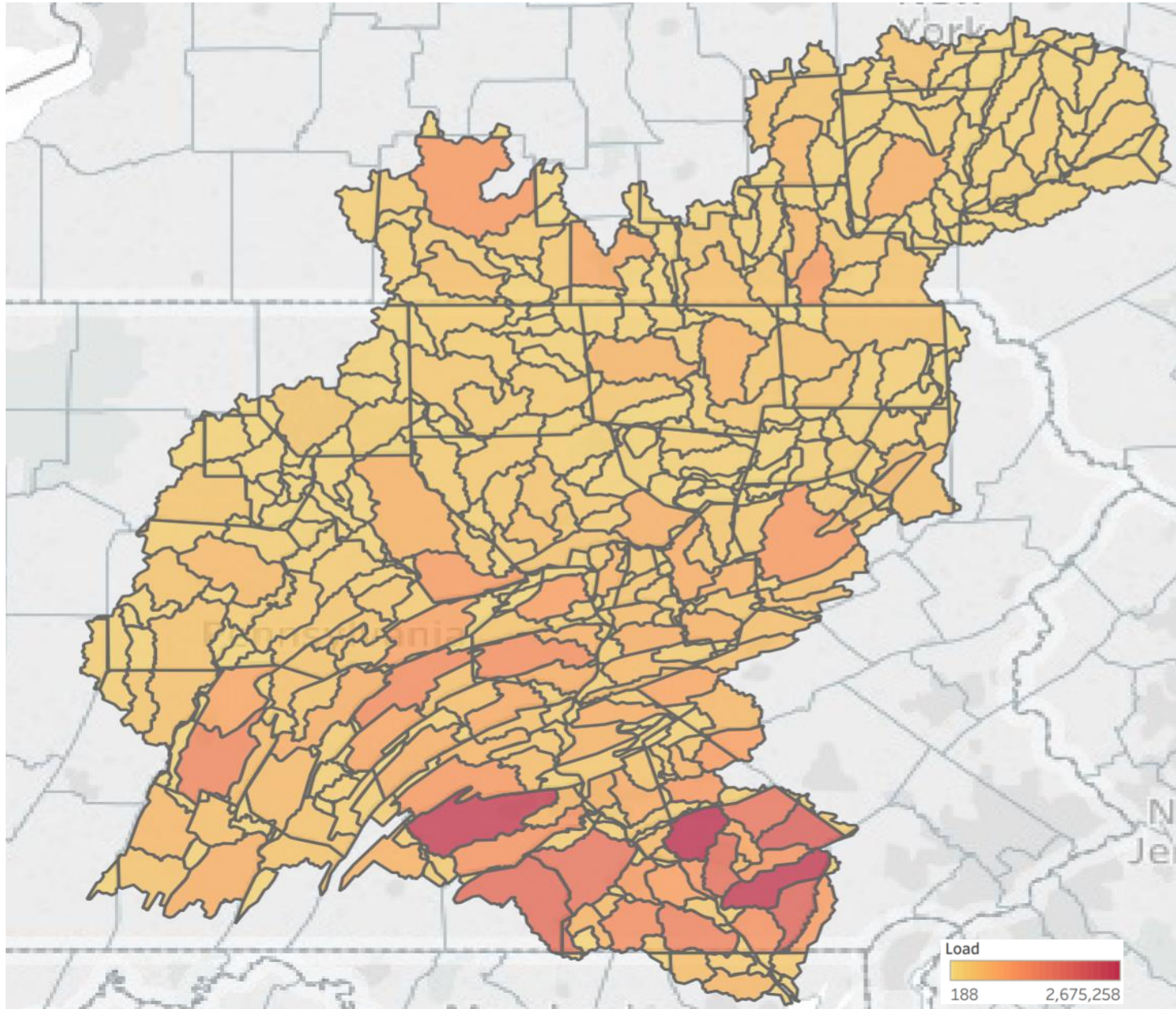
Data Source: <http://gis.chesapeakebay.net/wip/dashboard/>; <https://cbrim.er.usgs.gov/>

Nutrient Runoff Increases Significantly from North to South

Monitoring shows that some Pennsylvania watersheds, especially in the Lower Susquehanna, generate some of the highest amounts of nitrogen, phosphorus and sediment in the Chesapeake Bay watershed.



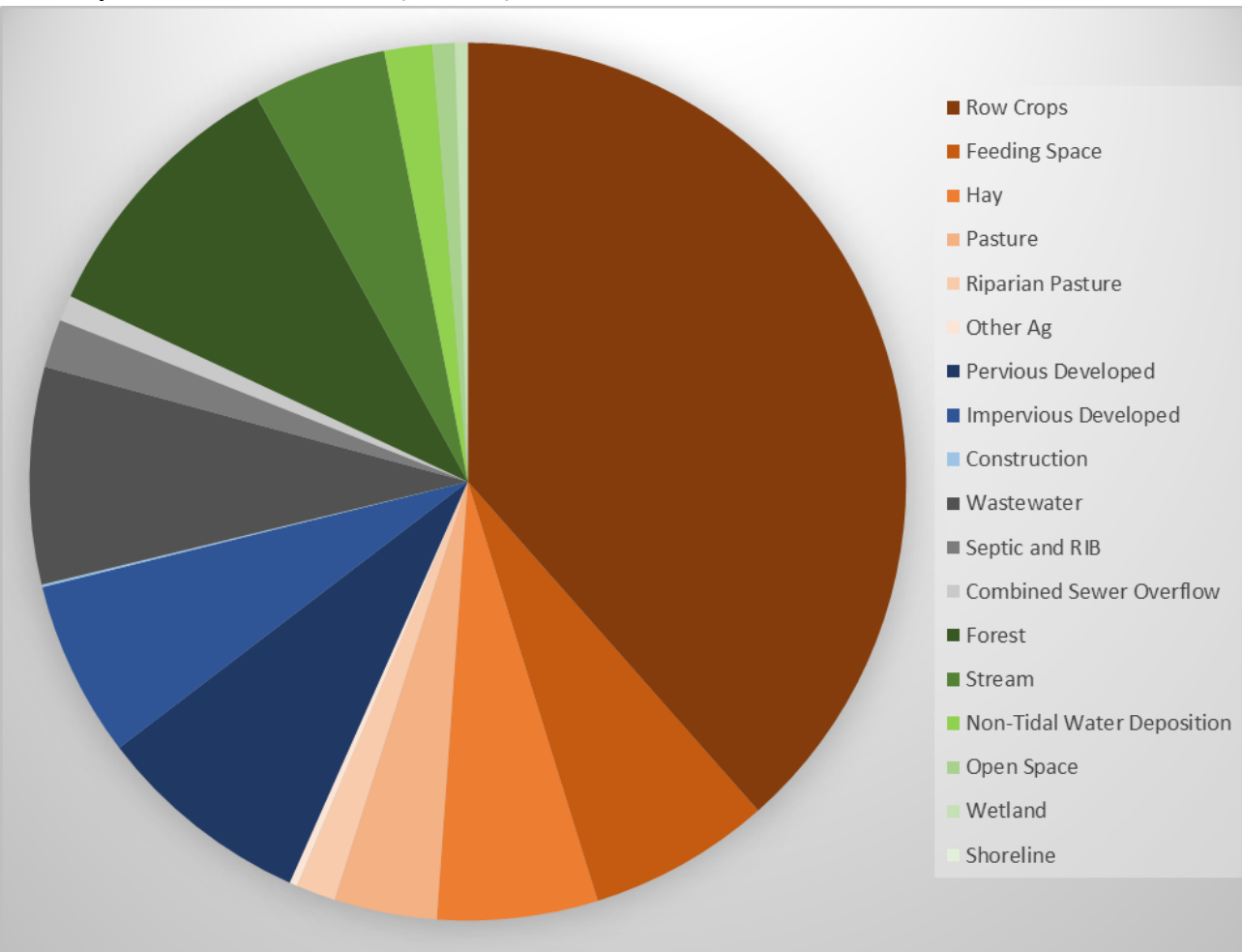
Where are the Nutrients Coming From?



Data Source: <http://gis.chesapeakebay.net/wip/dashboard/>

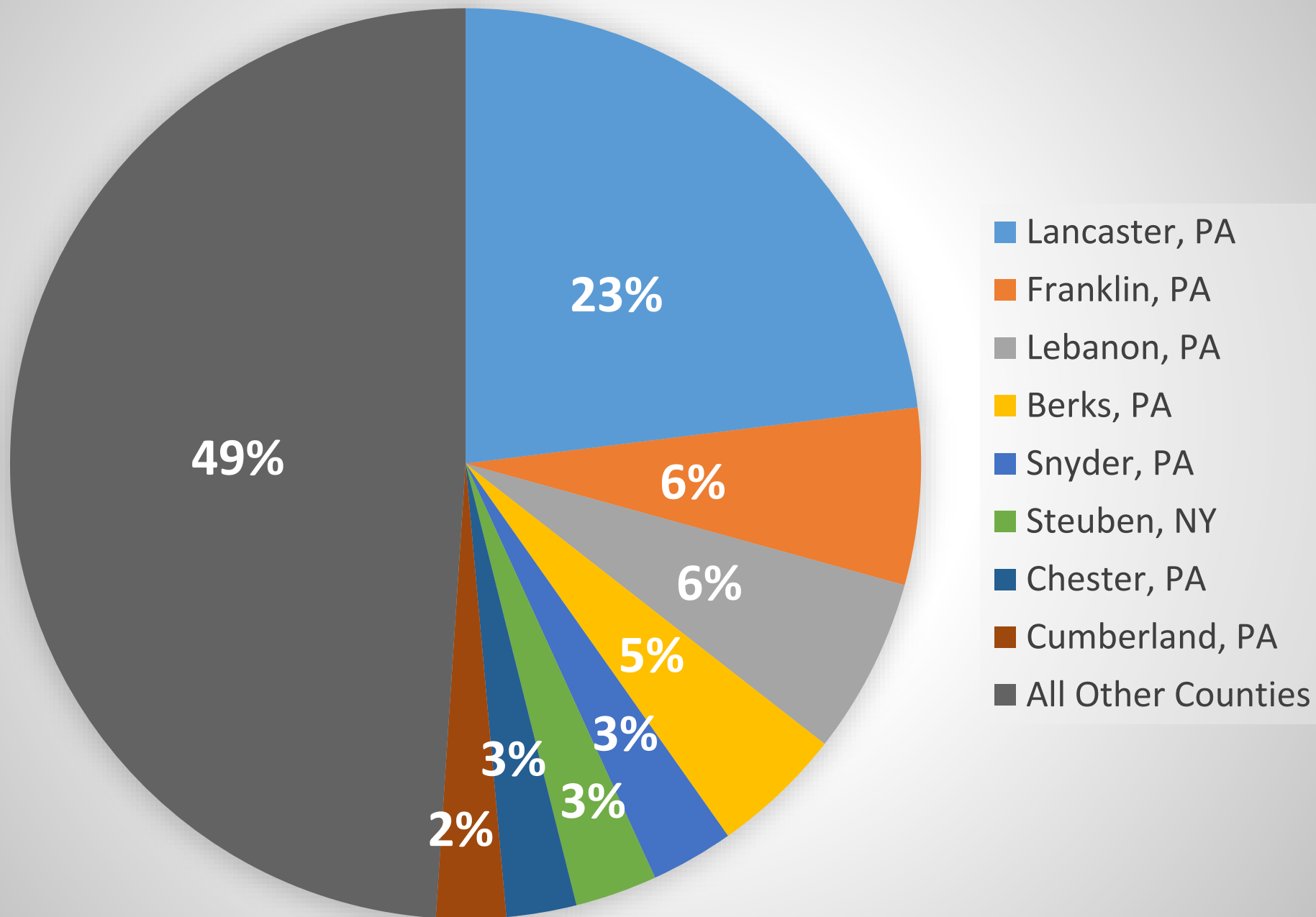
Where are the Nutrients Coming From?

Estimated Nitrogen Loads by Minor Source Across the
Susquehanna Basin (2017)



- **56% of N from Agriculture**
 - **38% alone from Crops**
- **15% from Urban**
- **11% from Wastewater/Septic**
- **18% from Natural**

Estimated Manure Nitrogen Applications (2017)



Solutions

What are the 4Rs



RIGHT SOURCE

Matches fertilizer type to crop needs.



RIGHT RATE

Matches amount of fertilizer type crop needs.



RIGHT TIME

Makes nutrients available when crops need them.



RIGHT PLACE

Keep nutrients where crops can use them.



From top left to right bottom:

Green Infrastructure

Nutrient Management

Forest Buffers and Cattle Exclusion

Soil Health

Significant Improvement is Possible

➤ Reductions from Agricultural Scenarios

Scenario	N	P	Percent N Achieved/ Cumulative N Achieved	Percent P Achieved/ Cumulative P Achieved
Reductions Needed from 2017	52,700,000	2,030,000	NA	NA
Compliance	8,113,000	236,000	15%/15%	12% / 12%
Soil Health	7,689,000	327,300	15% / 30%	16% / 28%
Expanded NM	817,000	44,200	2% / 32%	2% / 30%
Manure Storage	7,058,000	303,900	13% / 45%	15% / 45%
Dairy Feed Management	610,000	61,200	1% / 46%	3% / 48%
Buffers	8,070,000	1,001,400	15% / 61%	49% / 97%
Manure Transport	957,000	181,500	2% / 63%	9% / 106%

Agricultural stakeholders across PA designed scenarios of BMPs that would be feasible if adequate funding and technical support was made available.

These agricultural scenarios alone could achieve 63% of all PA's required N reductions and 106% of its required P reductions.

Presentation available at:

http://files.dep.state.pa.us/Water/ChesapeakeBayOffice/WIP/2018/July10/July10_Handout3_DEP%20Ches%20Bay%20Scenario%20Results.pdf

Policy Needs

Funding

- PA will need a dedicated cost share program similar to MACS or VACS.

Change in Conservation Planning

- PA's Chapter 102 Erosion and Sediment Control requires planning for almost all agricultural operations, but plans rarely call for the types of practices needed: buffers; soil health; and advanced nutrient management.
- New program could learn lessons from VA Resource Management Plan Program (RMP).

Targeted Efforts in South-Central PA

- Lancaster County alone has needs to reduce more nitrogen than all of New York.

Green Infrastructure on Urban Lands

- Most municipalities are emphasizing sediment BMPs over nutrient ones like bioretention.
- 75% of PA's urban lands are not regulated by the MS4 program.

A group of black and white cows are standing in a shallow stream, surrounded by large trees and greenery. The scene is a rural landscape with a fence in the background and a large tree on the left.

Questions

Matthew Johnston

mjohnston@chesapeakebay.net

410-267-5707