



Where are Phosphorus Imbalances in the Chesapeake Bay Watershed?

Chesapeake Bay Goal Line 2025: Opportunities for
Enhancing Agricultural Conservation
Hunt Valley, Maryland
October 6, 2010

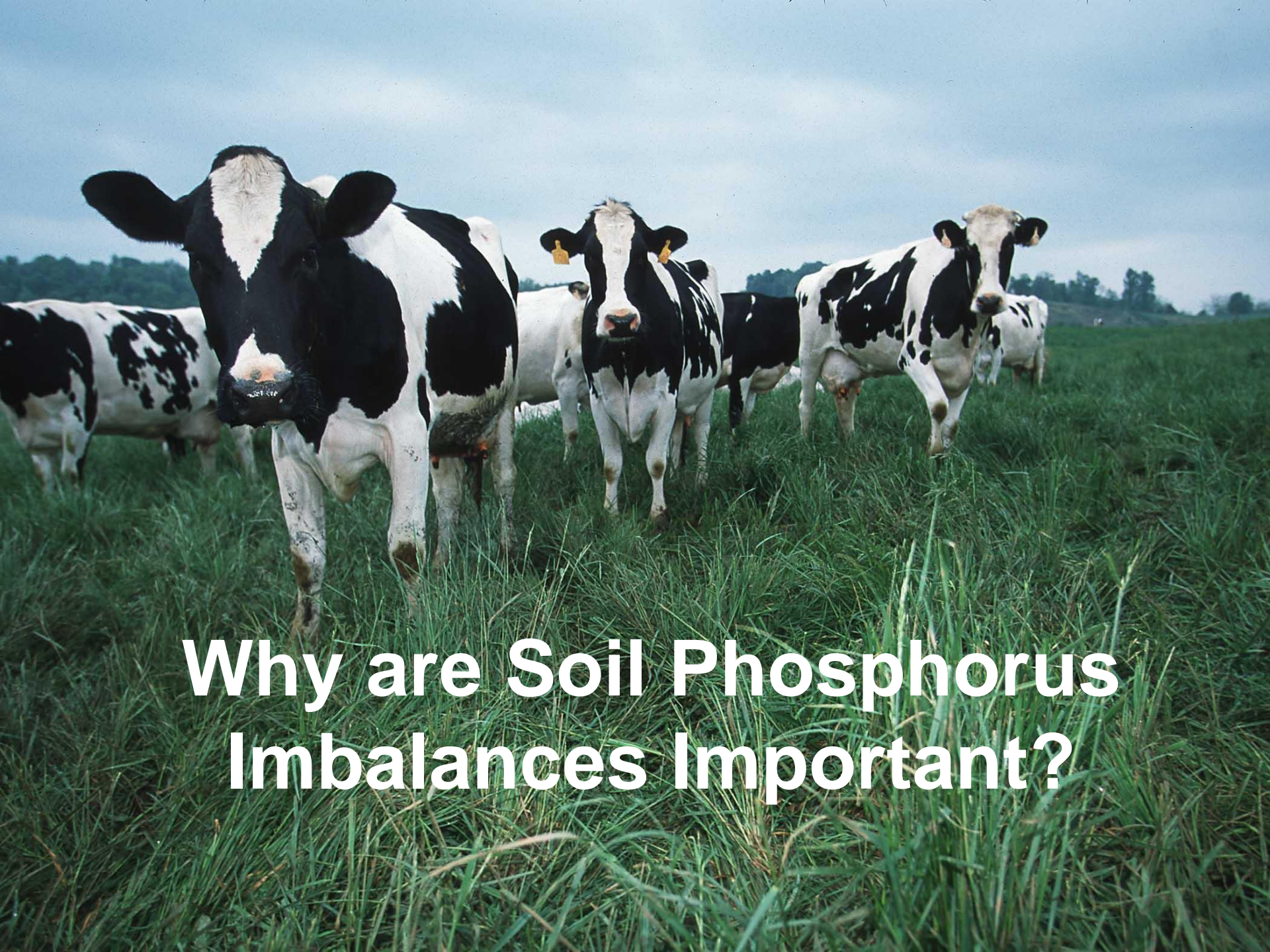


Mark P. Dubin
Agricultural Technical Coordinator
University of Maryland Extension-College Park

USDA-NIFA Mid-Atlantic Water Program
EPA Chesapeake Bay Program Office

mdubin06@umd.edu
mdubin@chesapeakebay.net





**Why are Soil Phosphorus
Imbalances Important?**

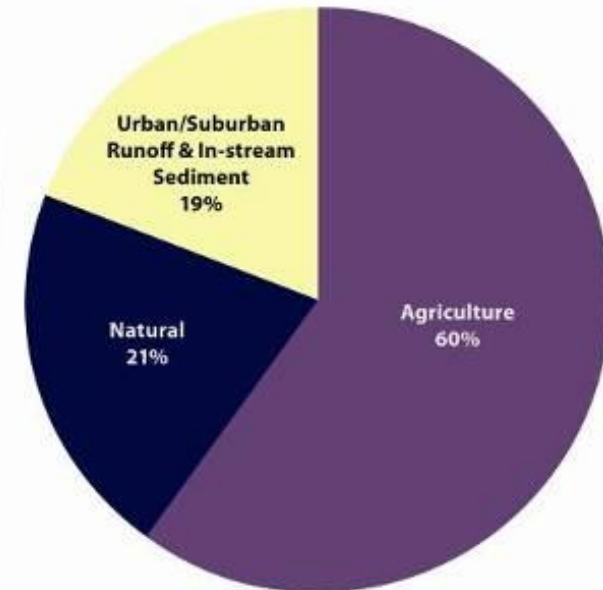
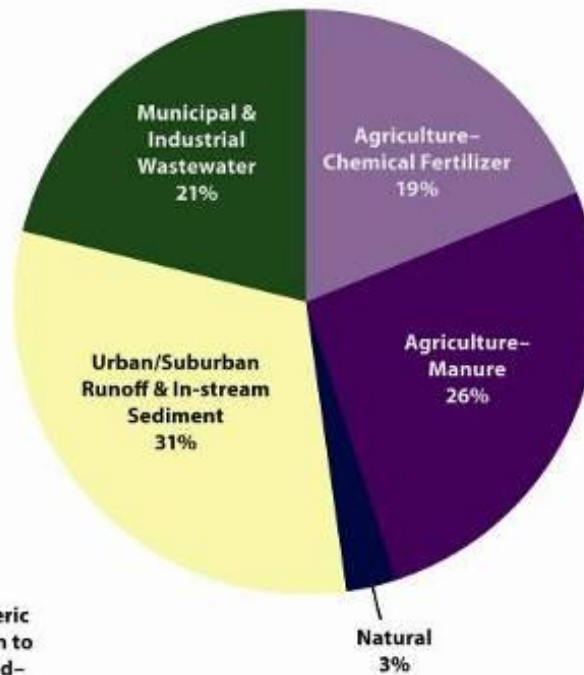
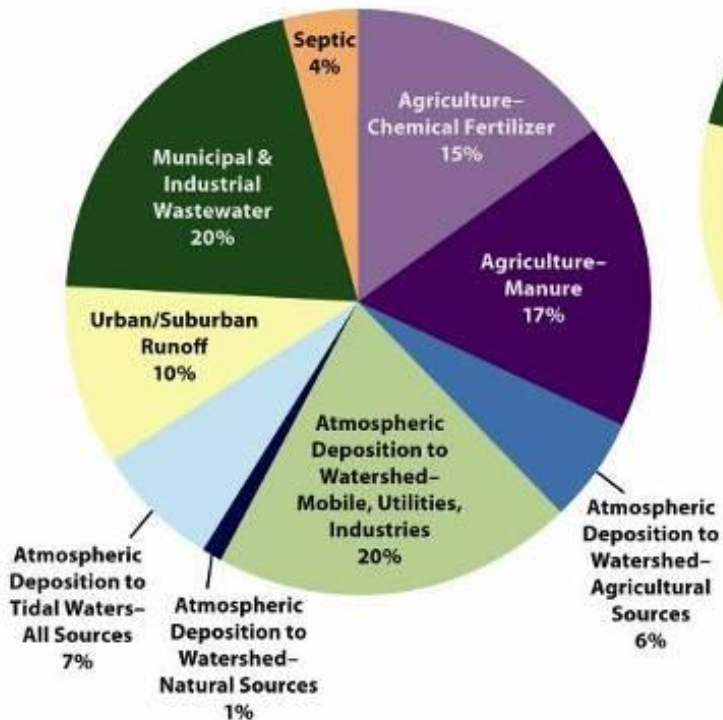
Main Sources of Bay Pollution

- Agriculture – animal manure, commercial fertilizer
- Urban/suburban runoff – a growing problem
- Air pollution – tailpipes, power plants
- Wastewater – sewage treatment plants

Phosphorous

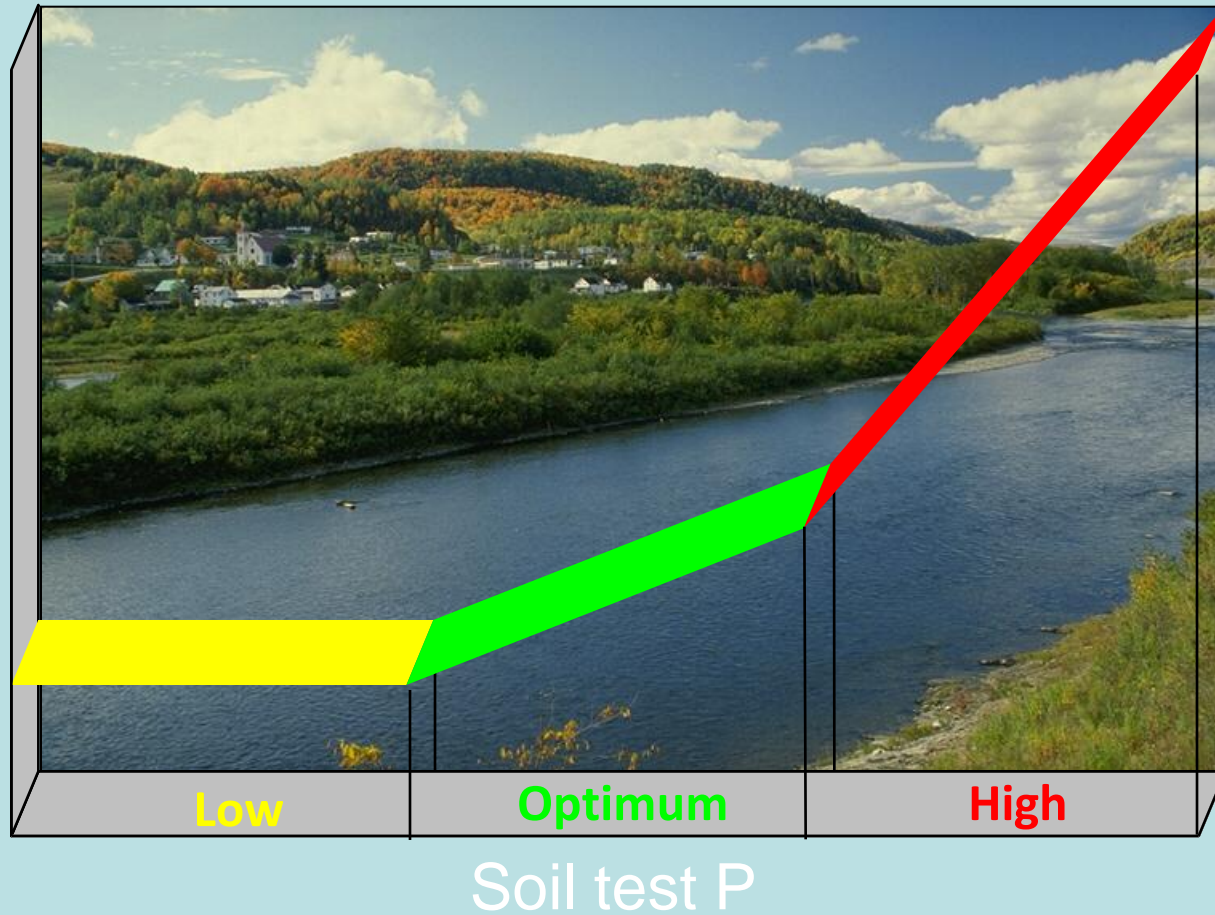
Nitrogen

Sediment

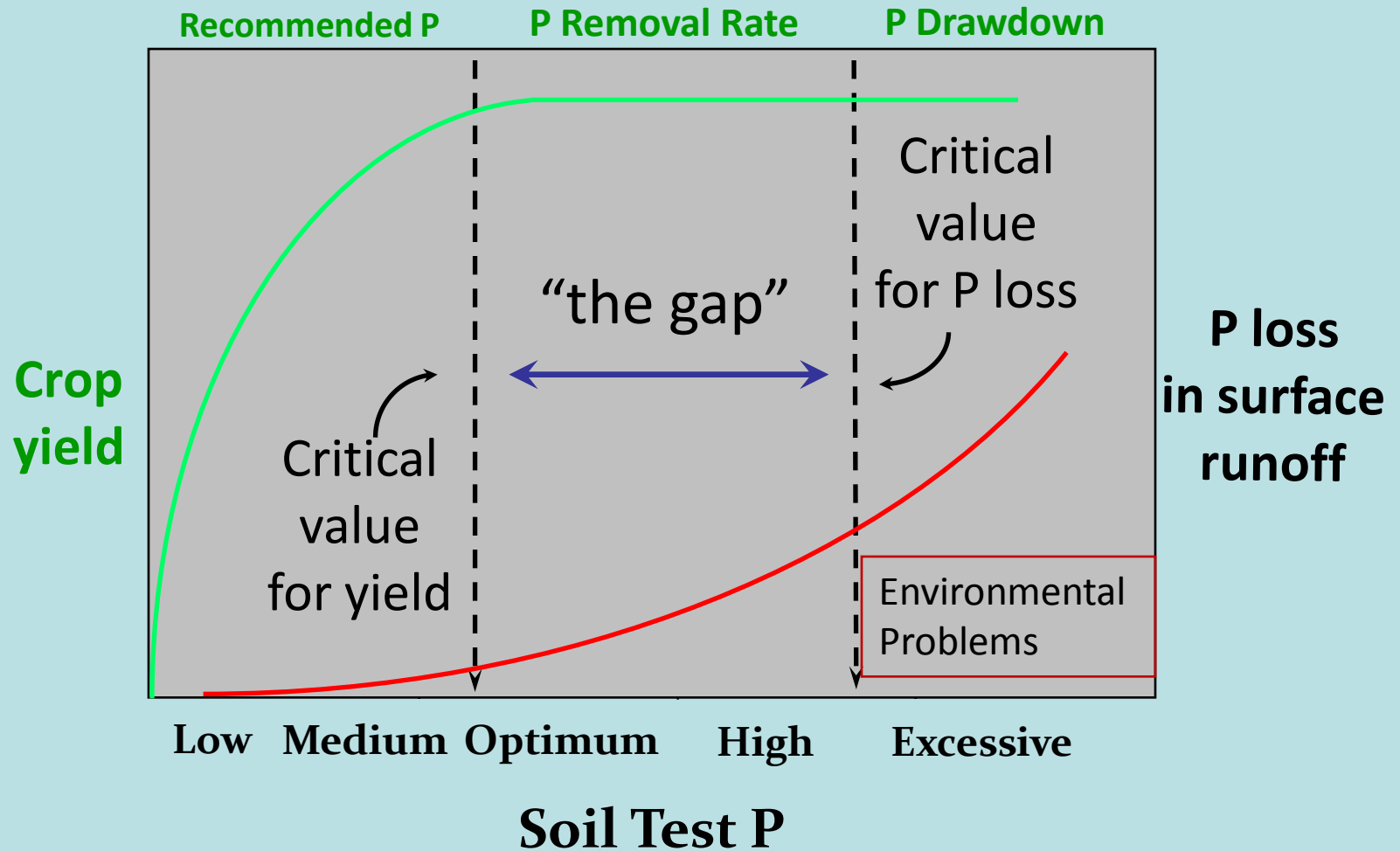


As Soil P Increases, so does Runoff P.

Potential
for P loss



Determining "the Gap"



An aerial photograph of a farm complex. In the center, there is a large red barn with a white roof, surrounded by several tall, cylindrical silos in white and blue. A dirt road winds through the farm. The surrounding landscape is a patchwork of green fields, some with distinct curved patterns, likely from conservation tillage or contour farming. The lighting suggests a bright, sunny day.

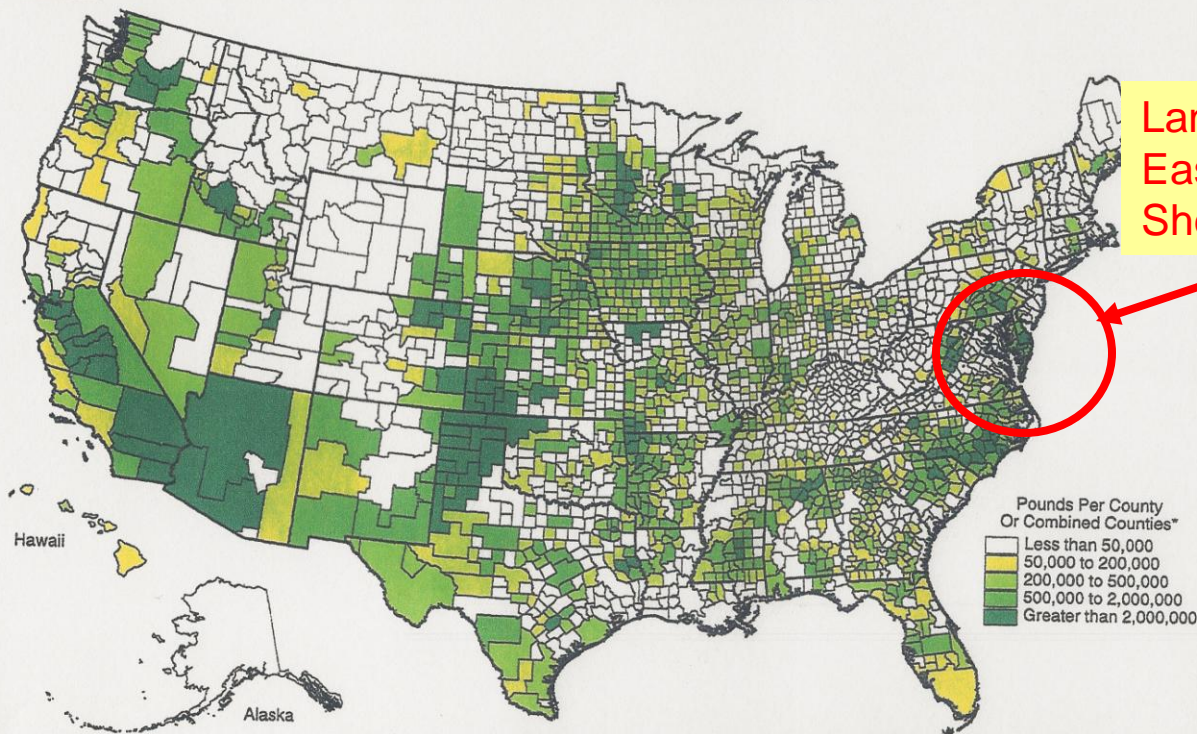
How Significant are Soil Phosphorus Imbalances?

Federal, state, and private studies all document P imbalances in the Chesapeake Bay Watershed.

Significant Manure P Imbalances in Chesapeake Bay Watershed - USDA Study

USDA 2002 Report

Map 30 Excess manure phosphorus assuming no export of manure from farm, 1997



Lancaster region, PA
Eastern shore, MD/VA/DE
Shenandoah Valley, VA

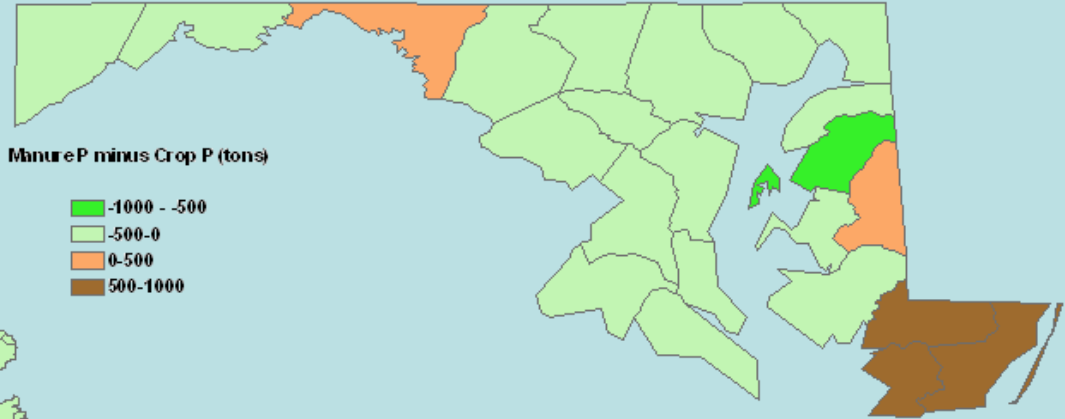
Excess Manure P assuming no export of manure from county, 1997

Chesapeake Bay Watershed is one of the regions nationwide with the highest excess manure P (greater than 2 million lbs/county).

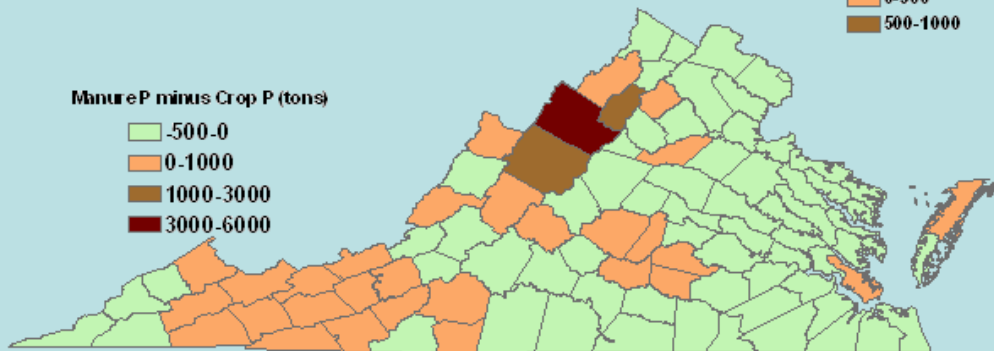


USDA-NIFA Mid-Atlantic Water Program Regional Nutrient Budgets Manure P – 2002

2002



2002



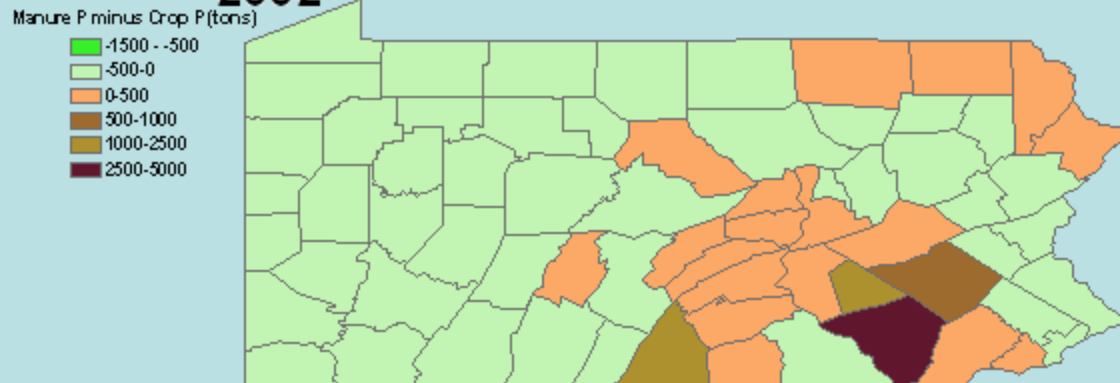
Limitations:

Poor quality commercial fertilizer data.

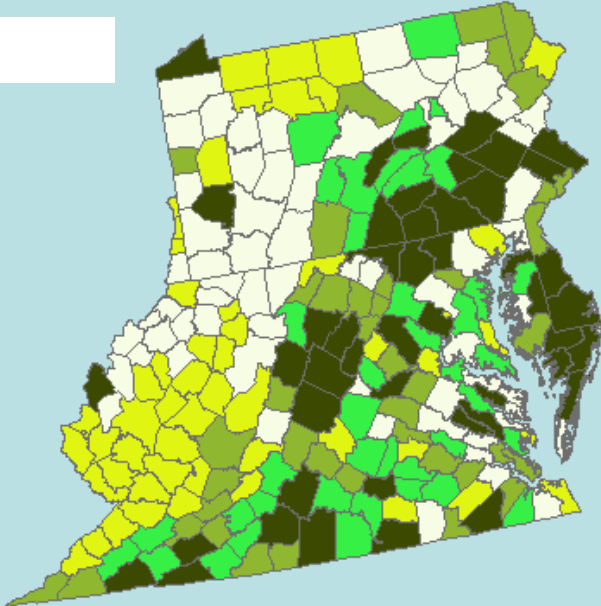
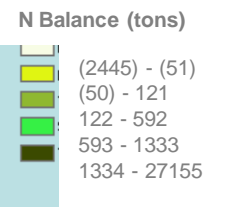
P reserve in soils not considered.

Manure transport not considered.

2002



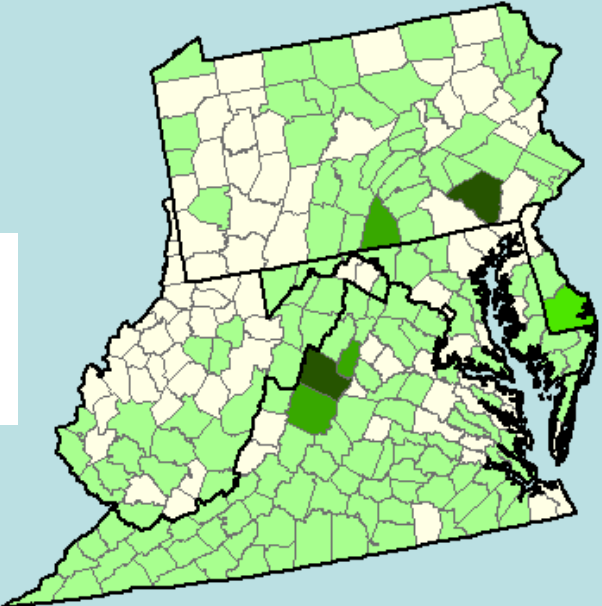
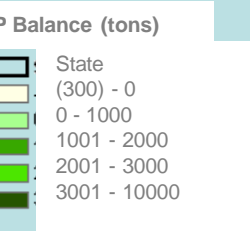
Nutrient Imbalances



N balance for cropland in Mid-Atlantic counties in 2007

Source: MAWP 2007

Note: The darkest color indicates counties with the highest N balances.



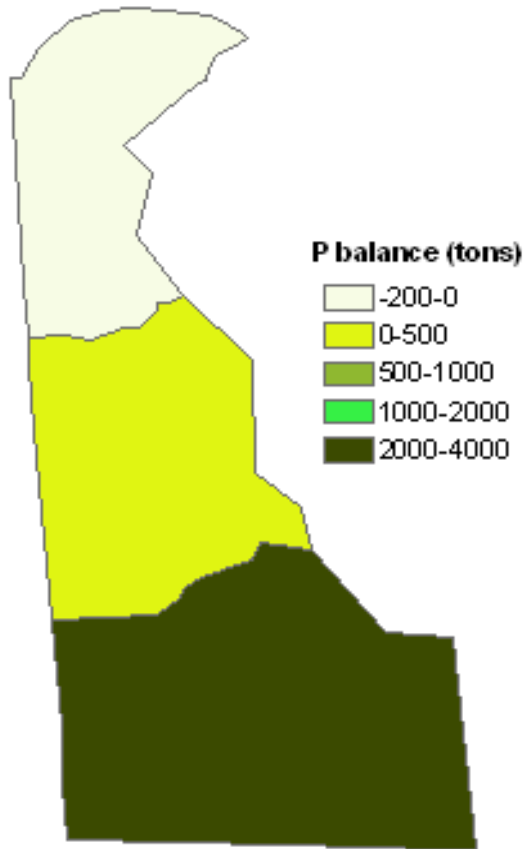
P balance for cropland in Mid-Atlantic counties in 2007

Source: MAWP 2007

Note: The darkest color indicates counties with the highest P balances.

Manure P Imbalances in Chesapeake Bay WS

State-Specific Studies



2007

- “Agricultural nutrient balance analyses...suggest total N and P surpluses have existed in Delaware for many years and continue today, particularly in Sussex County.
- Surpluses are gradually declining due to:
 - Changes in nutrient management
 - Declining livestock
 - Manure relocation

Mid-Atlantic Nutrient Budget, 2007

Delaware Nutrient Mass Balance Report
1996-2006

Mid-Atlantic Soils are Not Hurting for P

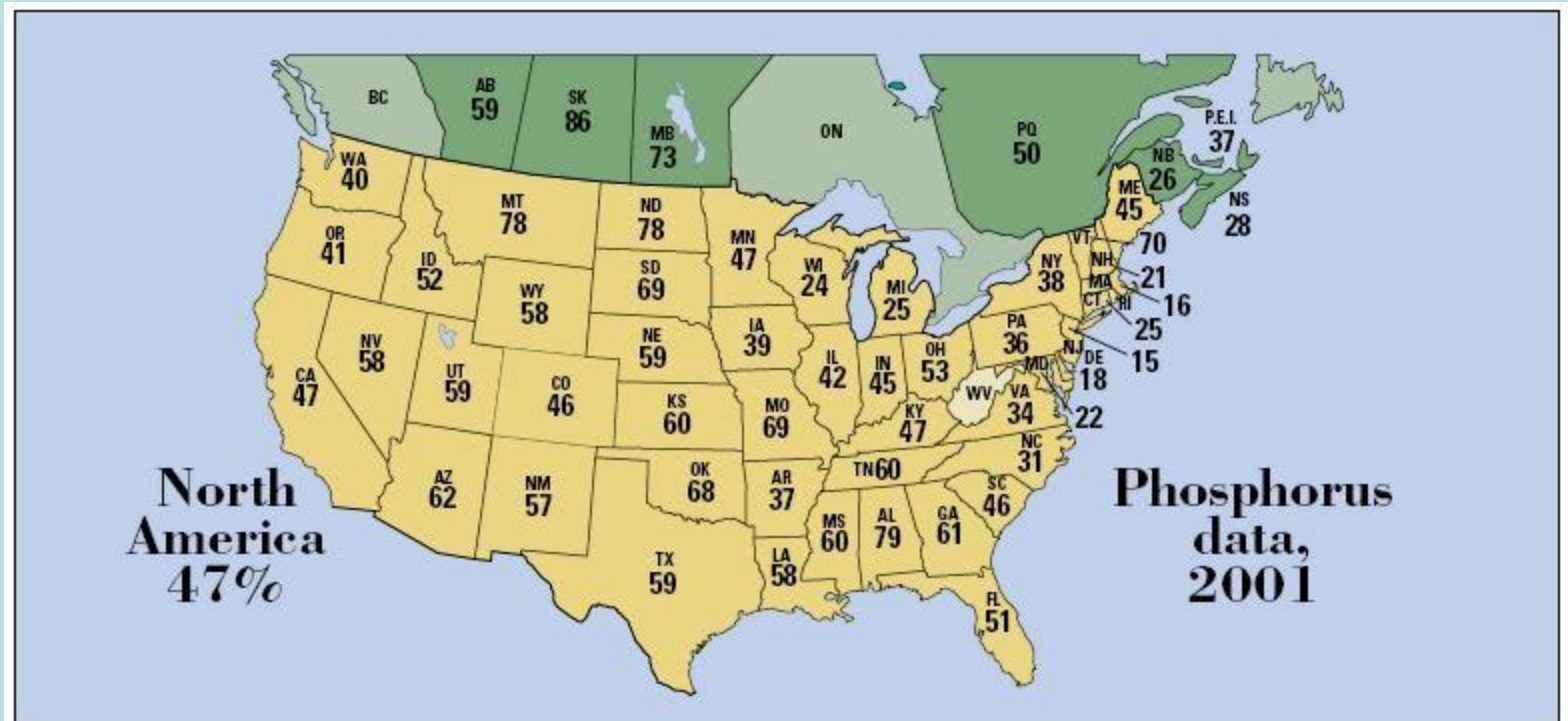


Figure 1. Percent of soils testing medium or lower in P.

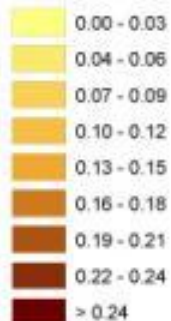
Mid-Atlantic region has a small percentage of low/medium levels of P.
% of Soils with High/very high P levels: MD = 78% (and increasing based on 2001 - 2005 data), DE – 82%, PA = 64%, VA = 66% (Better Crops/Vol.86 (2002, No. 1), P.E. Fixen)

Agricultural Sources of Total Phosphorus

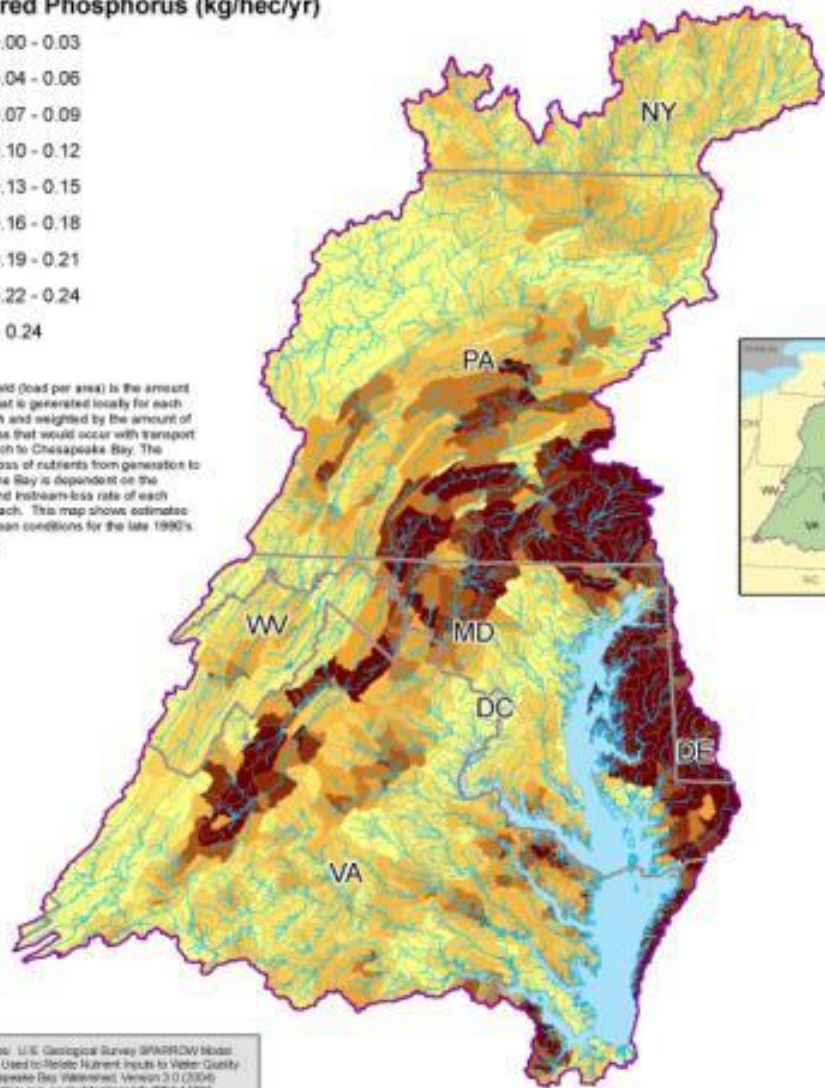
Delivered Yield to the Chesapeake Bay



Delivered Phosphorus (kg/hectare/yr)



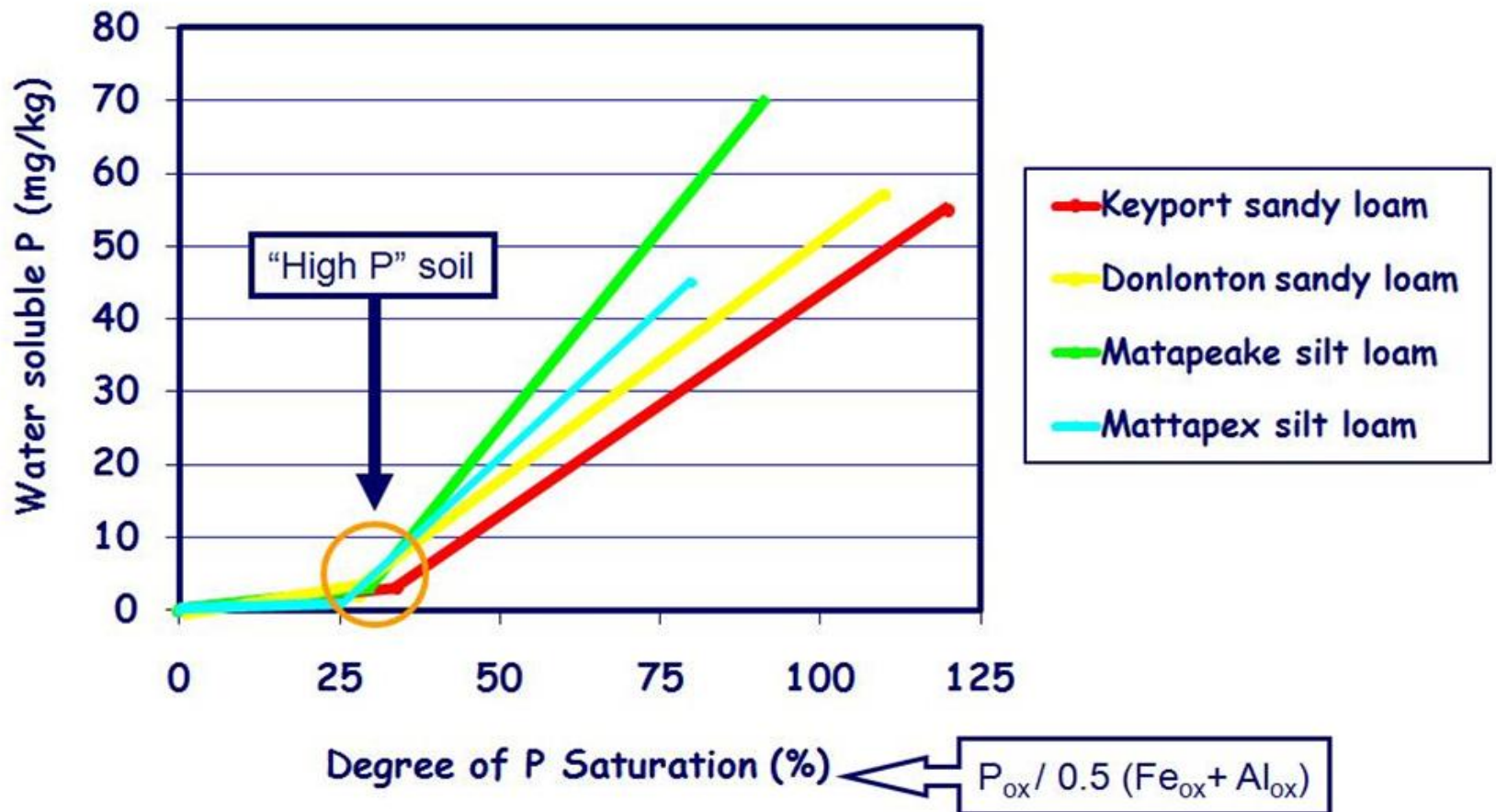
Delivered yield (load per area) is the amount of nutrient that is generated locally for each stream reach and weighted by the amount of in-stream loss that would occur with transport from the reach to Chesapeake Bay. The cumulative loss of nutrients from generation to delivery to the Bay is dependent on the traveltime and in-stream loss rate of each individual reach. This map shows estimates based on stream conditions for the late 1990's time period.



Data Source: U.S. Geological Survey SPARROW Model
Digital Data Used to Relate Nutrient Inputs to Water Quality
in the Chesapeake Bay Watershed, Version 3.0 (2004)
(<http://mid.water.usgs.gov/publications/304-1-2004/>)
For more information, visit www.chesapeakebay.net
Disclaimer: www.chesapeakebay.net/areasofuse.jsp



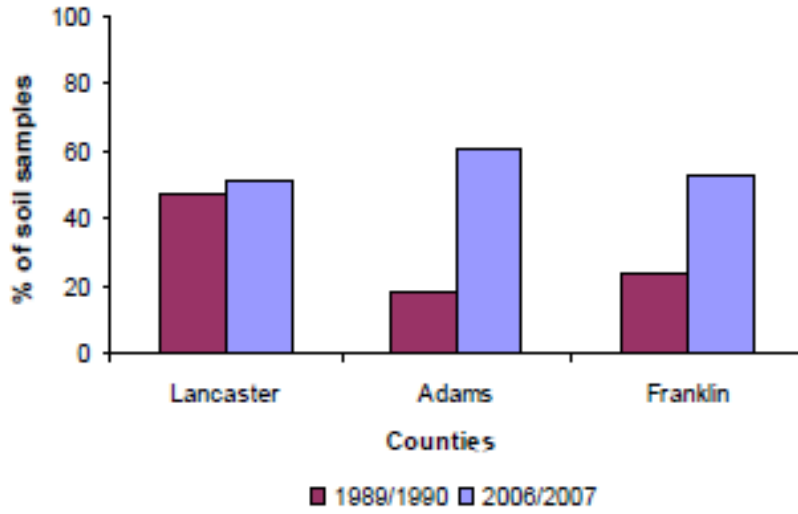
Phosphorus saturation (PSat): The relative proportion of P to iron and aluminum. Numerous research studies on a wide range of soils have shown **P release to water in contact with soil increases significantly between 20 and 25% PSat**



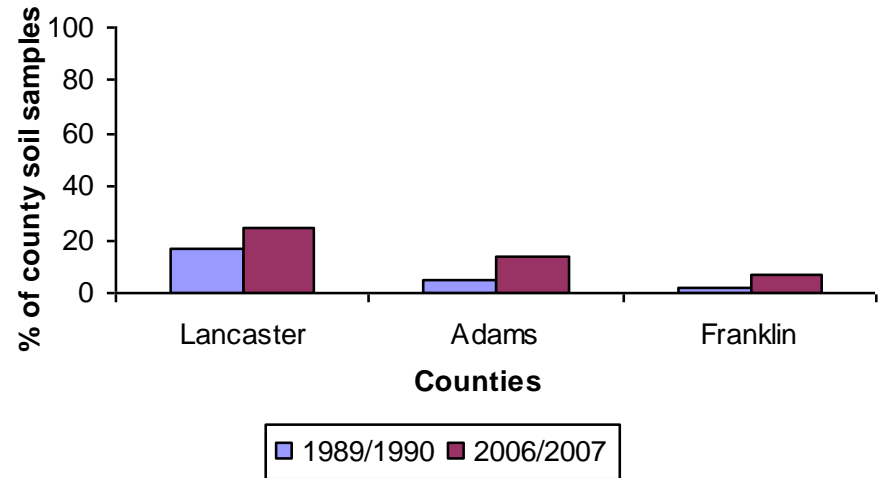
Butler & Coale, 2005

P Saturation Levels in Select PA, MD, and VA Counties - Water Stewardship, Inc.

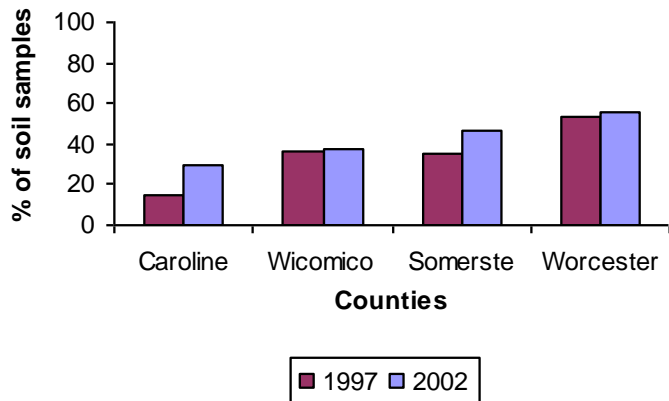
Pennsylvania's Soils that are 15 to 31% P Saturated



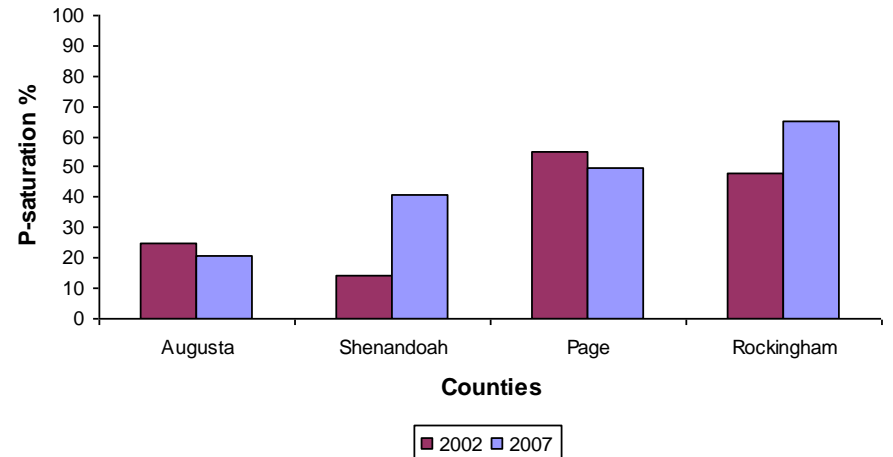
Pennsylvania's Soils that are > 31% P Saturated



Maryland's Soils that are > 31% P-Saturated

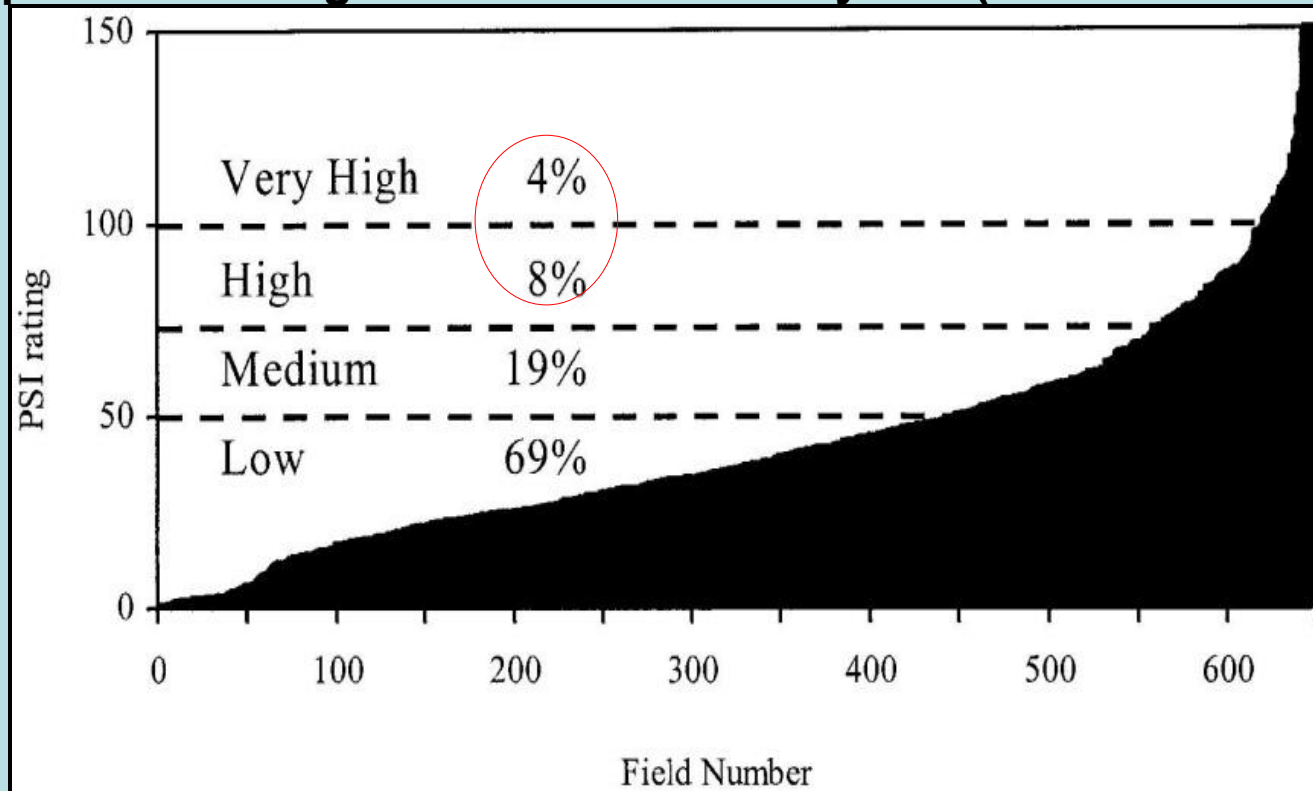


The Percent of Virginia's Soils that are > 18% P-saturated



Phosphorus Site Index Classes for Maryland

Frequency distribution of Maryland PSI ratings for 646 representative agricultural sites in Maryland (Coale et al. 2002)



Class breaks set to assure about a 70-20-10% break between low, medium and high/v high

(As currently used, very few fields are P limited)

Maryland Soil Test Results for Phosphorus (2002)

Maryland 2002	Phosphorus as Fertility Index Value (FIV)						
	L	M	Opt	Excess	Excess	Excess	> Optimum
	0- 25	26-50	51- 100	101- 150	151- 250	250+	
County	% of samples						
Caroline	0	6	20	20	23	29	72
Somerset	6	9	13	7	17	47	71
Wicomico	13	11	11	8	18	37	63
Worcester	2	6	12	10	14	56	80

Additional Studies Underway

- Environmental Working Group: P soil levels in the CB Watershed (September, 2010)
- UMD WREC: P soil trends in Green Run watershed from 2000-2010 (results in early 2011)
- USDA National P Balance Maps updated with 2007 data (early 2011?)
- UMD: MD Nutrient Budget similar to DE analysis (Date TBD)
- USDA CEAP (Nutrient Mgt on cropland) (fall/winter 2010)



For more information visit:

Mid-Atlantic Water Program

Regional Nutrient Budgets:

<http://www.mawaterquality.org/>

Chesapeake Bay Program:

<http://www.chesapeakebay.net>



Mark Dubin
Agricultural Technical Coordinator
University of Maryland Extension-College Park

USDA-NIFA Mid-Atlantic Water Program
EPA Chesapeake Bay Program Office

mdubin@chesapeakebay.net
mdubin06@umd.edu

