

Scientific and Technical Advisory Committee

September 13, 2016

Reconciling findings from field studies
of P loss with monitoring and modeling
results

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University of Maryland
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Wye Research and Education Center
Queenstown, Maryland

Scientific and Technical Advisory Committee

September 14, 2011

Nutrient Transport in Maryland Coastal Plain Watersheds: What We Know and What Next

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College of Agriculture and Natural Resources
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Scientific and Technical Advisory Committee

June 17, 2014

Final report of the STAC ad hoc workgroup
on how P transport from cropland is
simulated in the Bay watershed model

Ken Staver

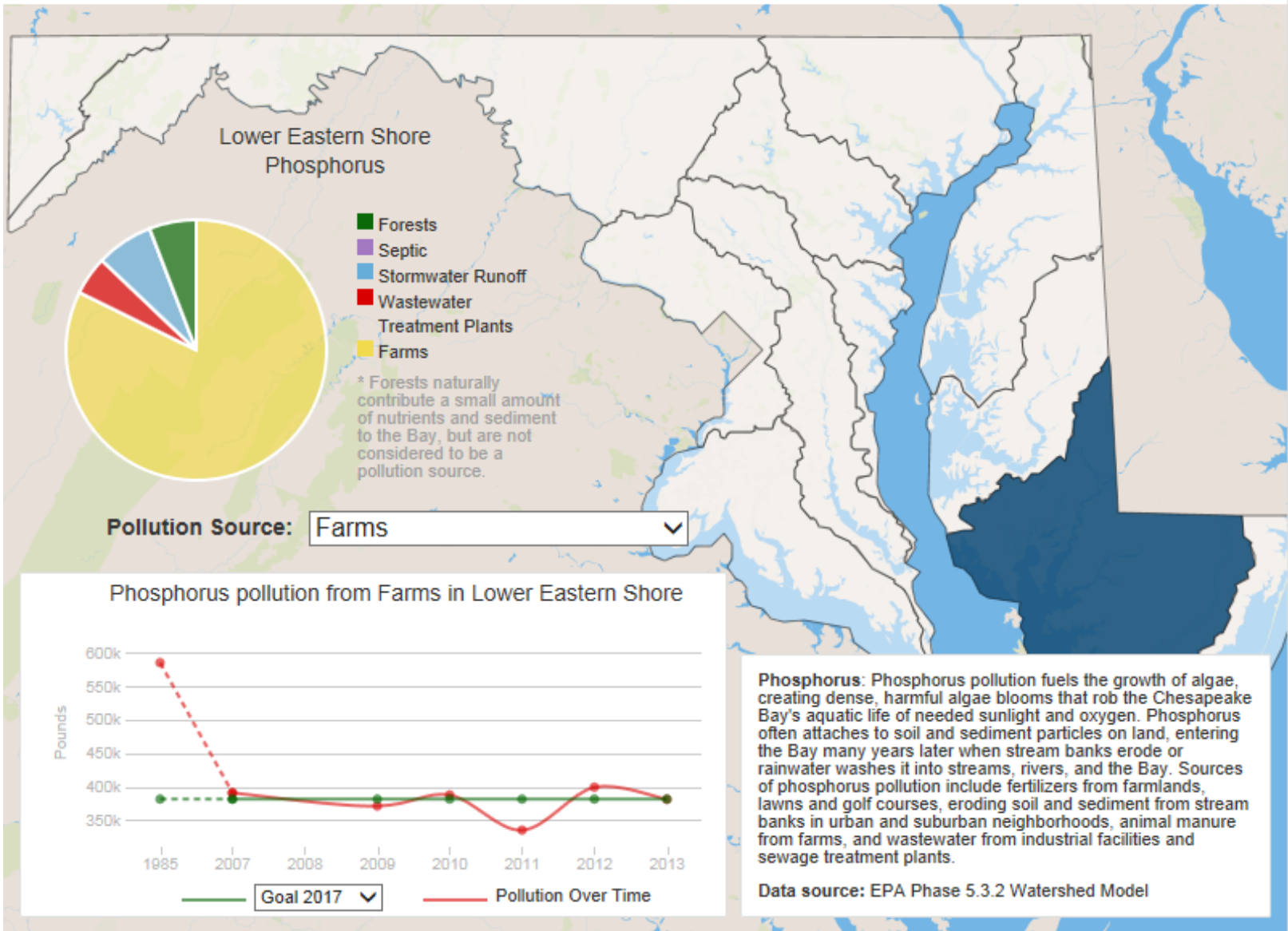
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Causes of Chesapeake Bay Pollution

Click map to select a basin.
Click [here](#) for statewide data.

Nitrogen
 Phosphorus
 Sediment

Tributary Basins



What we did for the last 30 years:

Study nutrient transport patterns across the full spectrum of management scenarios to identify drivers of nutrient loss and options for changing those drivers to reduce nutrient losses.



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662

DeCoursey Island

Wye Island

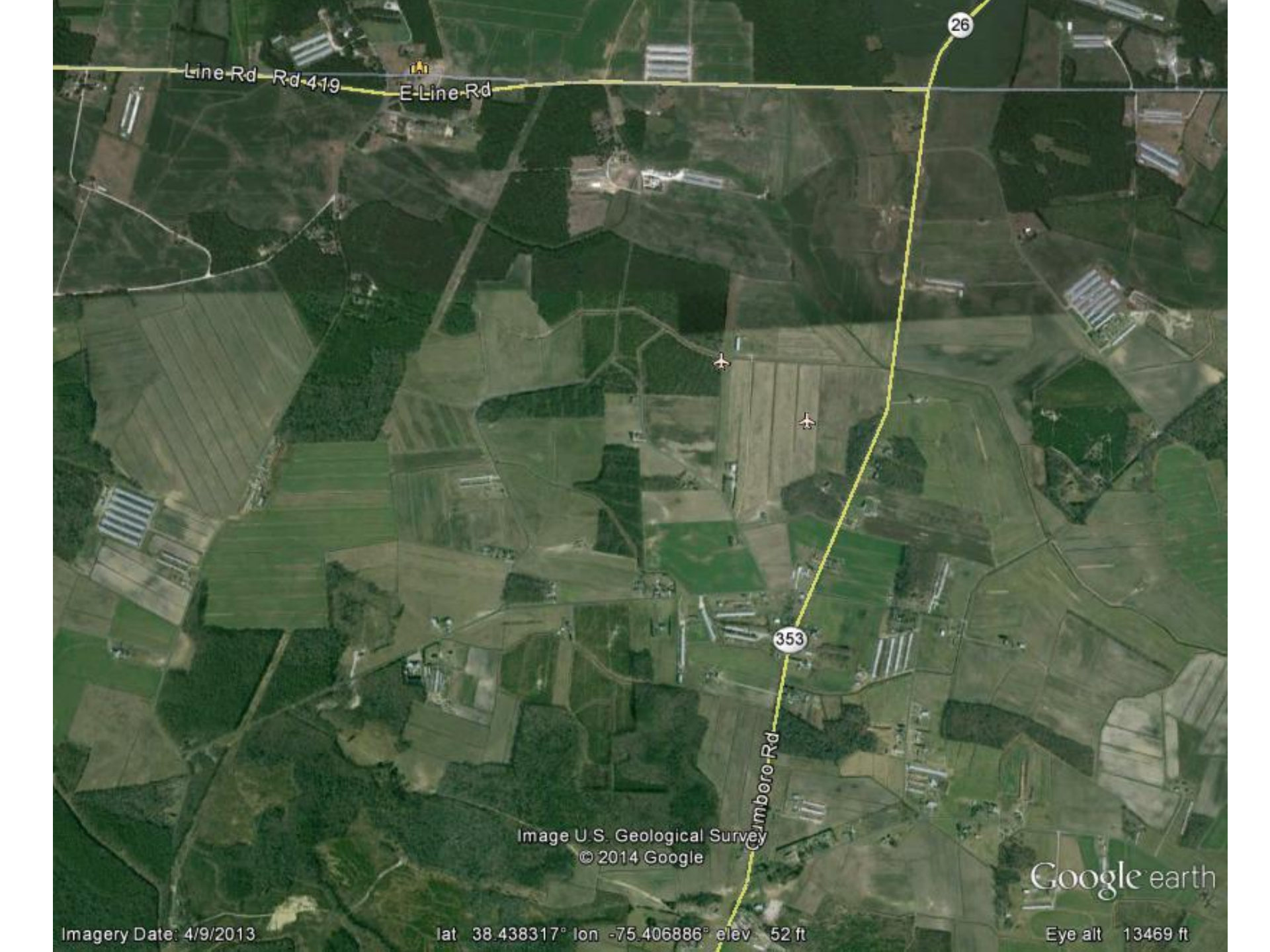
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Imagery Date: 10/19/2013

lat 38.878209° lon -76.119238° elev 3 ft

Eye alt 27619 ft



Line Rd Rd-419
E-Line-Rd

26

353

Cymboro-Rd

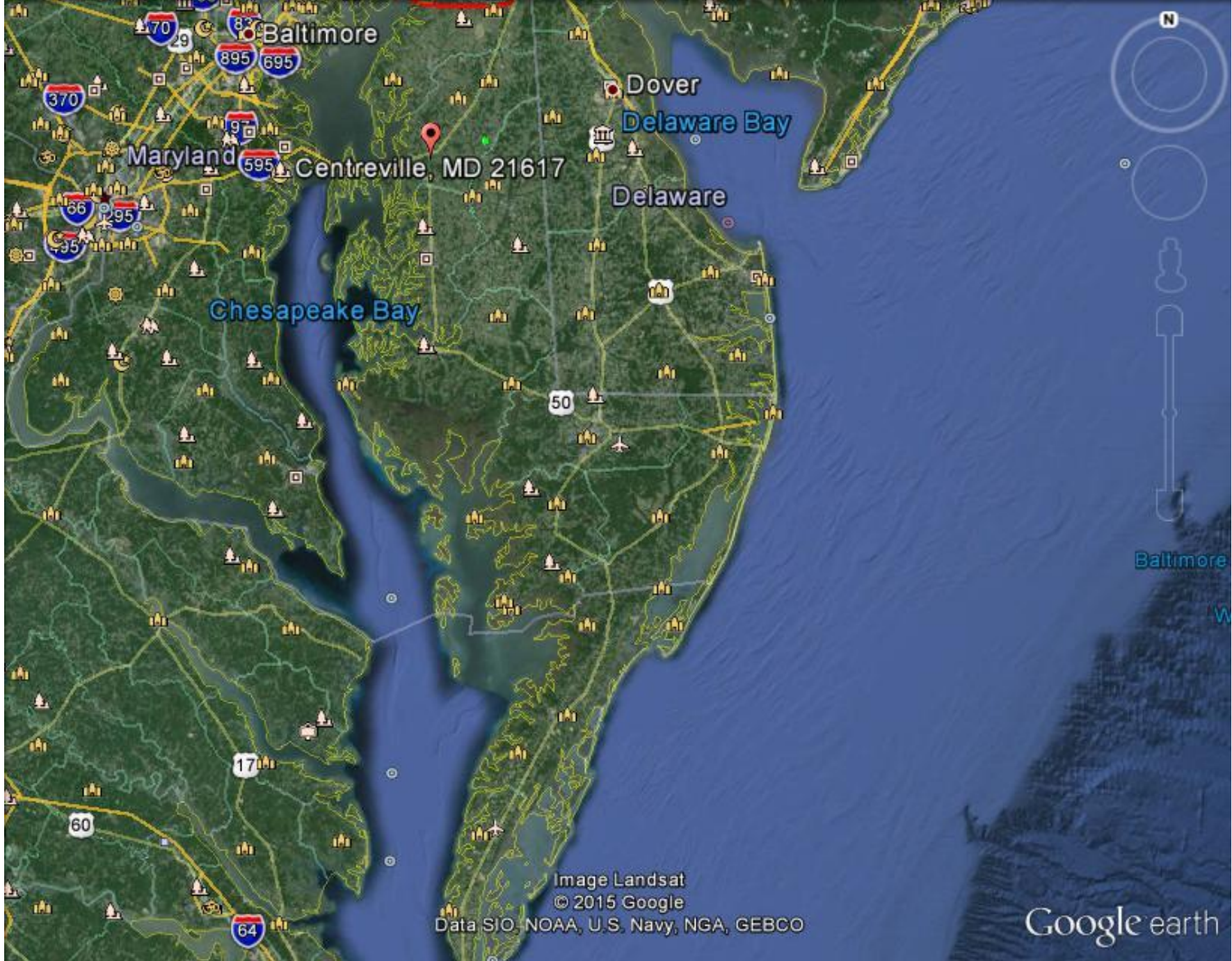
Image U.S. Geological Survey
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Imagery Date: 4/9/2013

lat 38.438317° lon -75.406886° elev 52 ft

Eye alt 13469 ft



Baltimore

Dover
Delaware Bay

Maryland
Centreville, MD 21617

Delaware

Chesapeake Bay

50

17

60

64

Image Landsat
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Baltimore

Google earth

Imagery Date: 4/9/2013
Newport latitude 38.212428° lon -75.511510° elev 28 ft

Eye alt 169.64 mi



Watershed Management

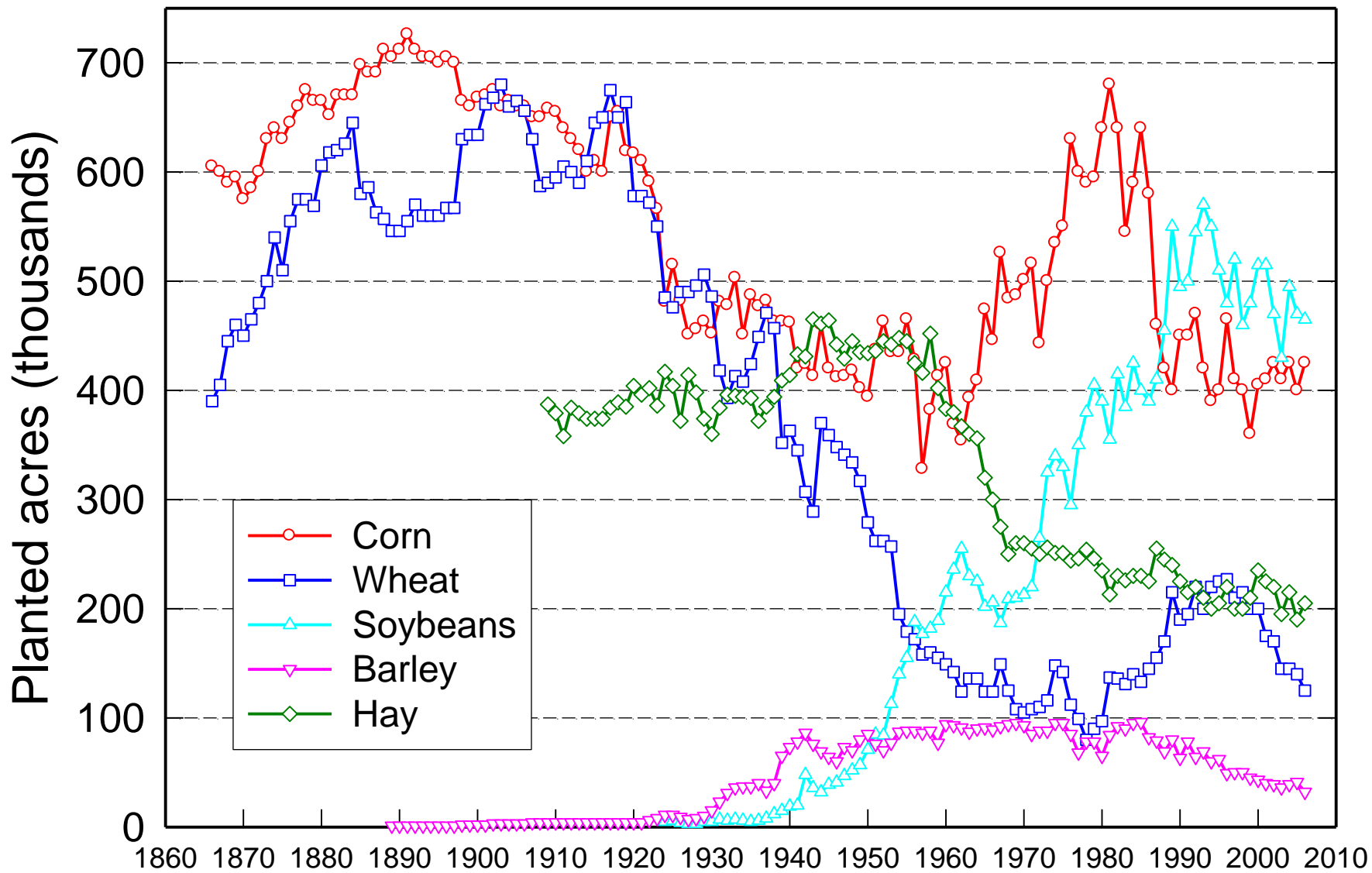
- 1985-97 continuous corn, CT/NT
- 1988-97 rye winter cover crops
- 1990 installed grass waterways
- 1994-97 No P applications
- 1998-2003 corn/wheat/dc soybean
- 1998-2003 CT/NT poultry litter
- 2004-07 surface/subsurface N
- 2008-11 NT/turbotill poultry litter







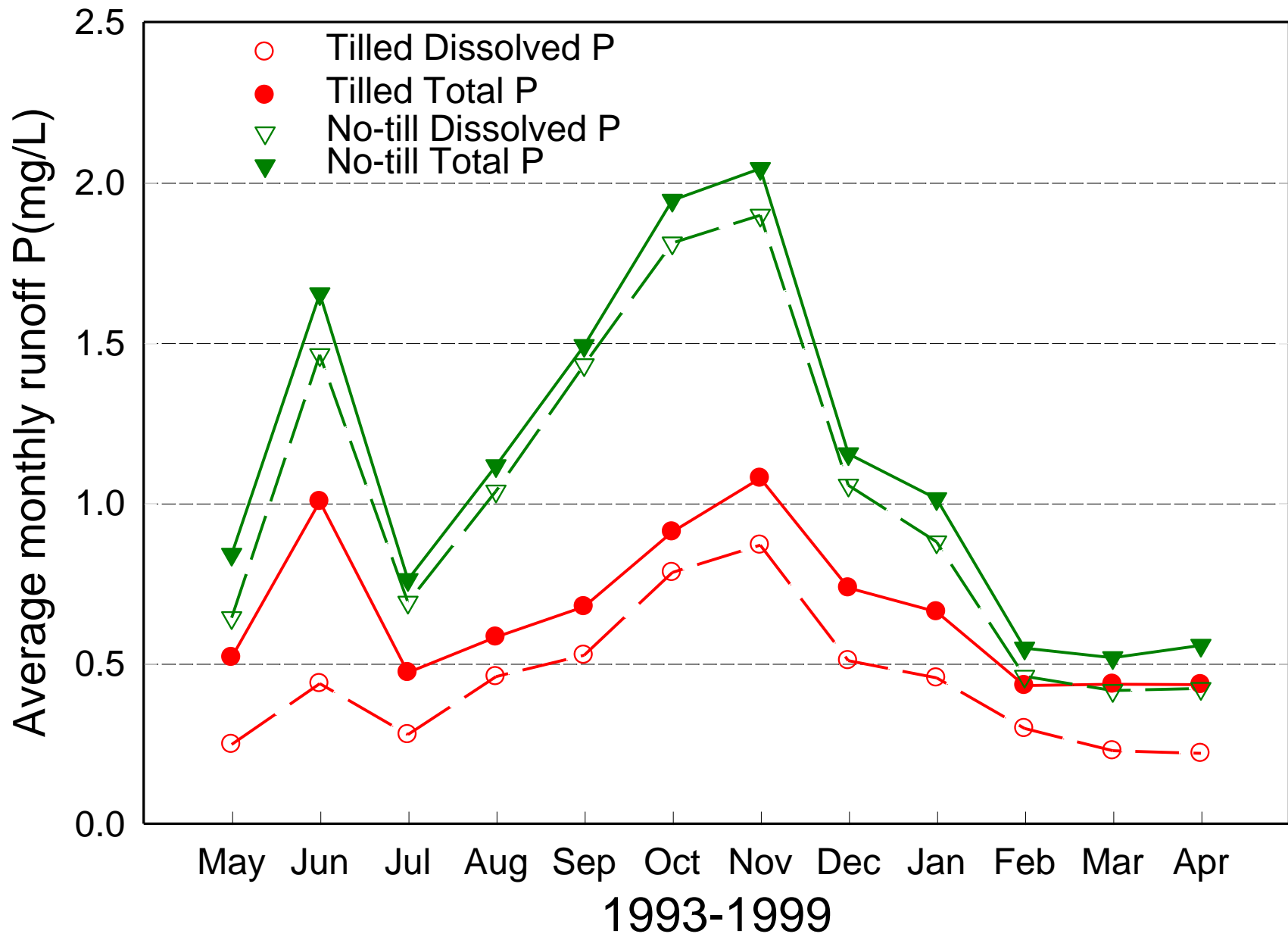


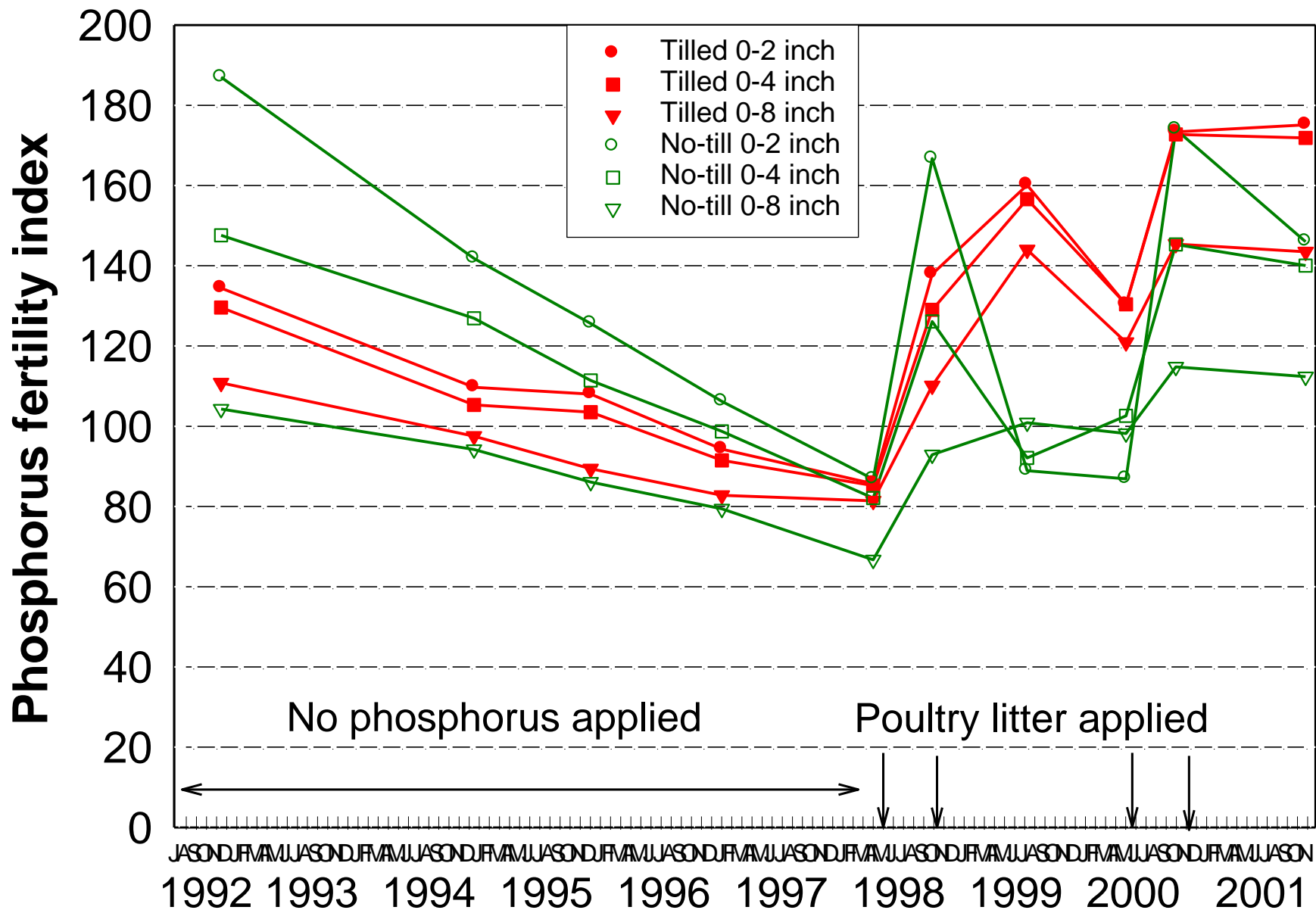


Bottom line on erosion

We have effective methods for minimizing soil erosion (75%) and for reducing the loss of nutrients attached to particles. Particles that are lost from no-till generally have a higher nutrient content so reductions of particle-bound nutrients are less than reductions in erosion.(Soil P)

**Unfortunately, erosion
control did not
translate into
phosphorus control.**

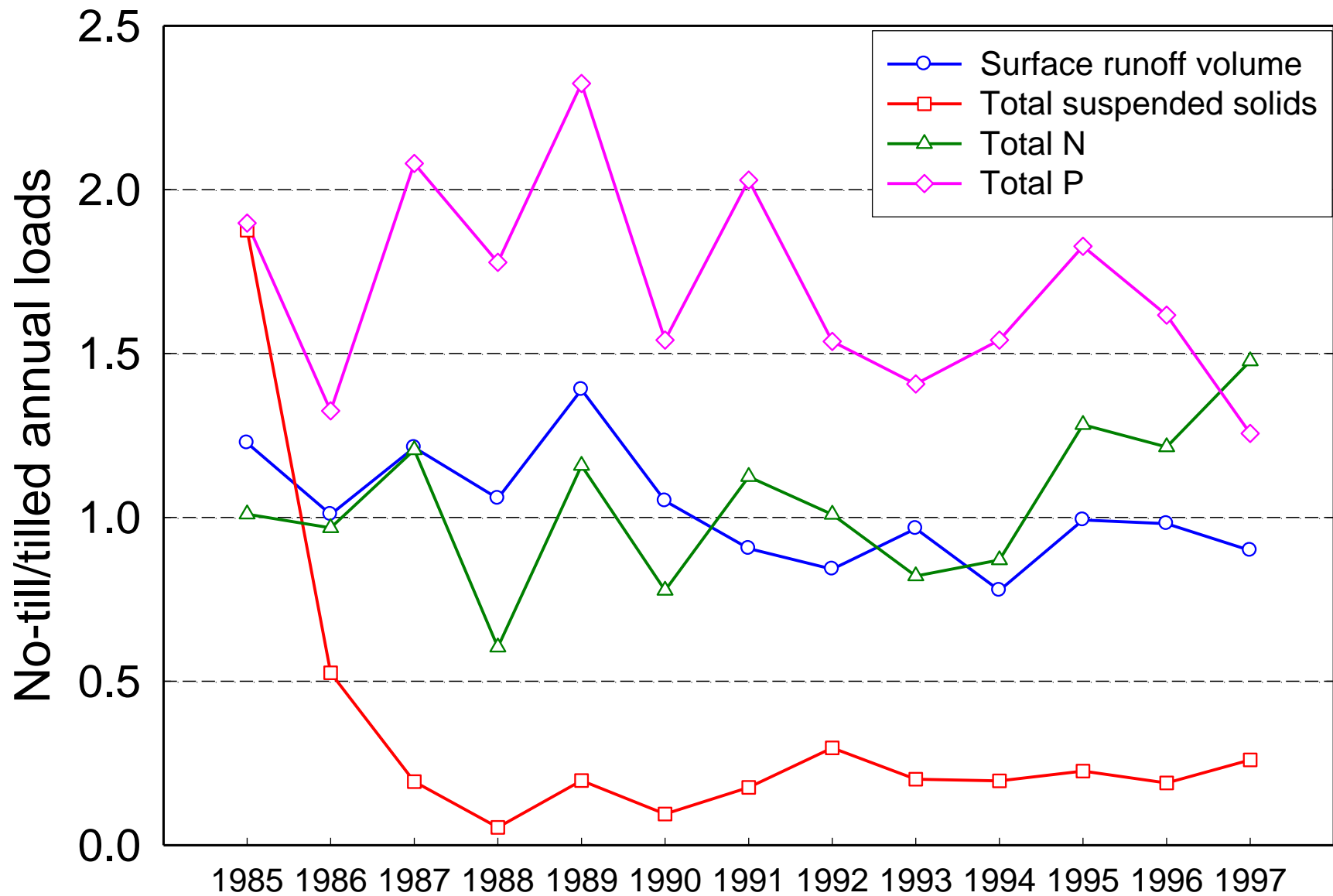






CONTROL 3













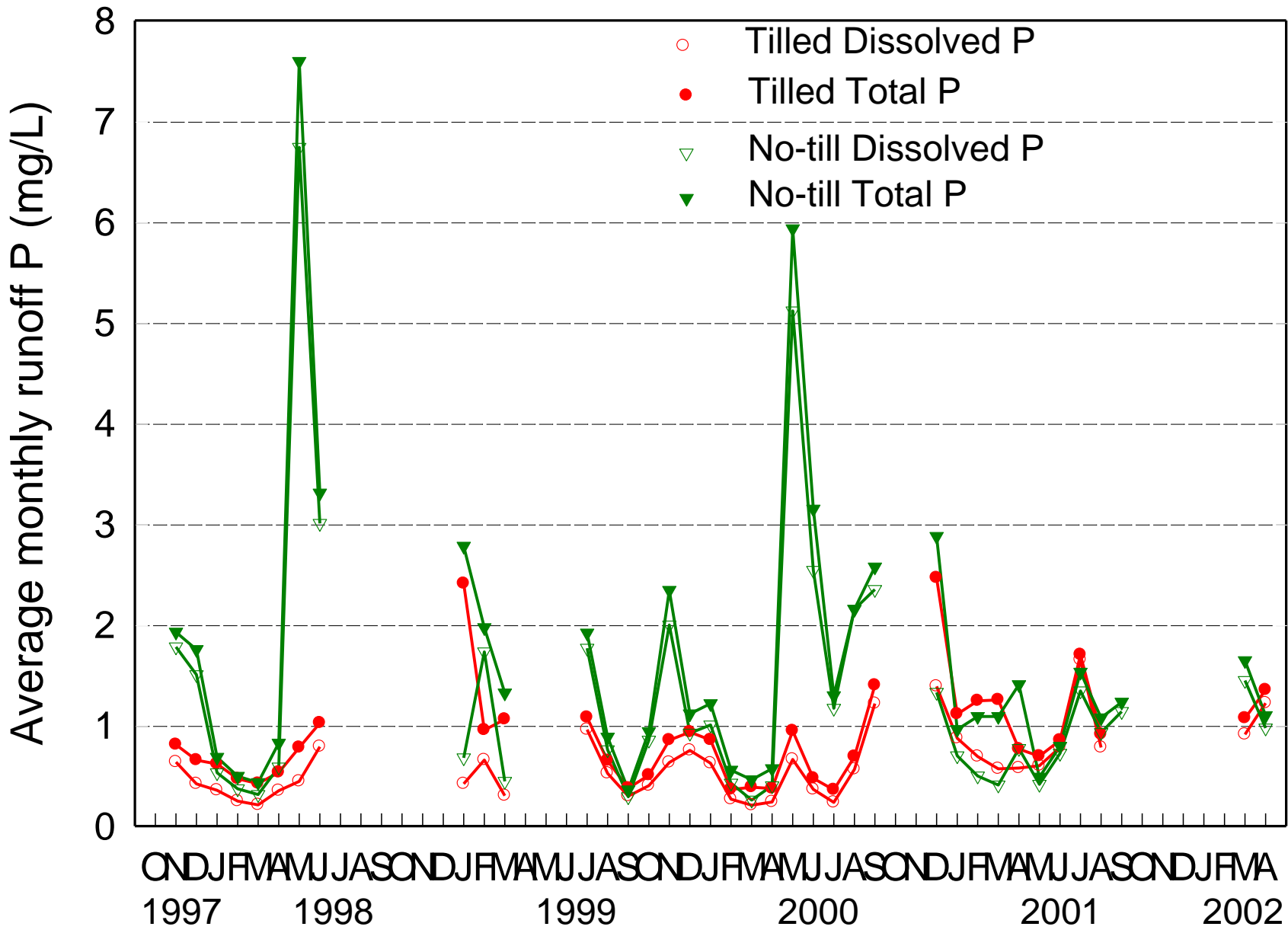


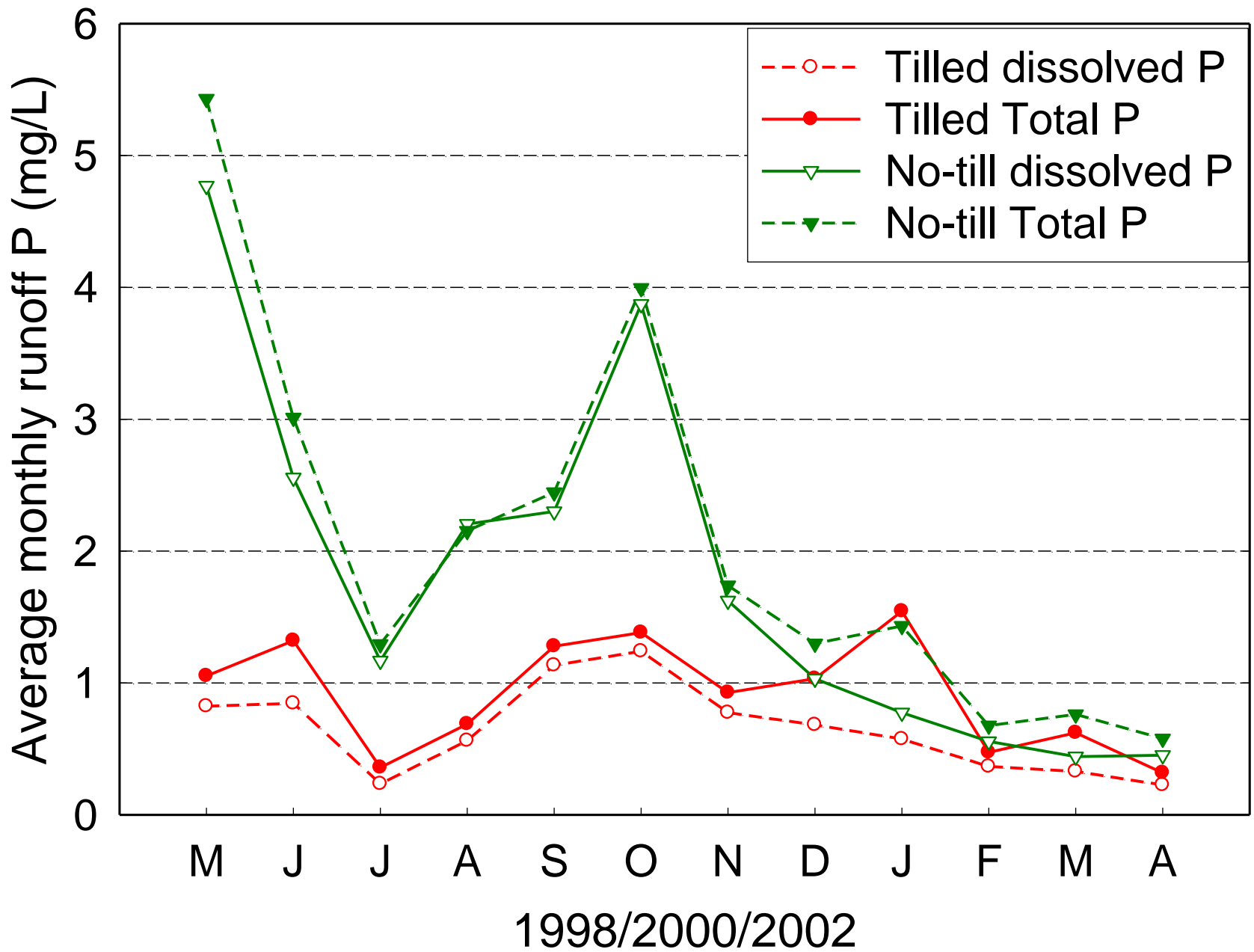


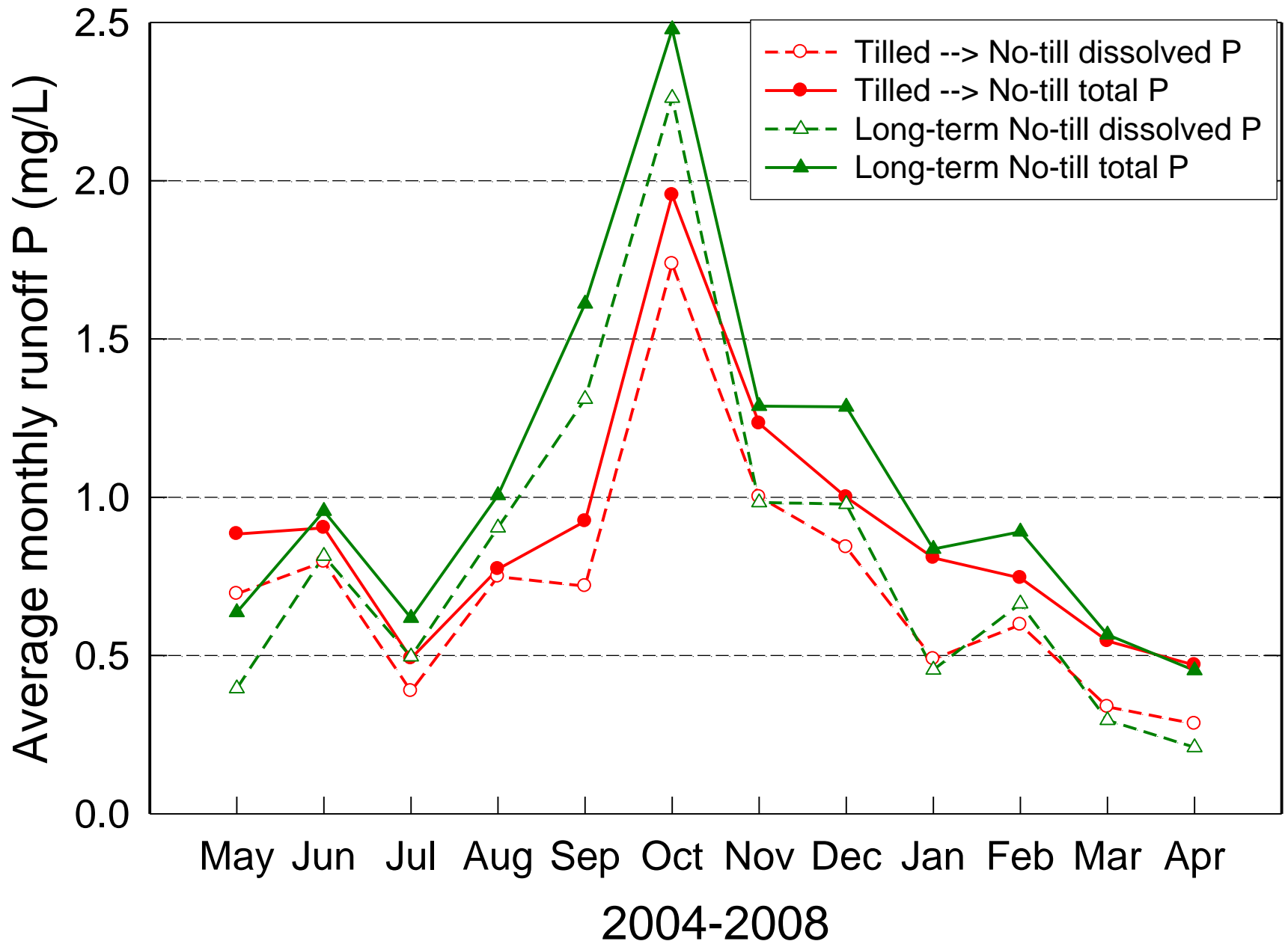
POULTRY LITTER
SUBSURFER

NCS
DAS

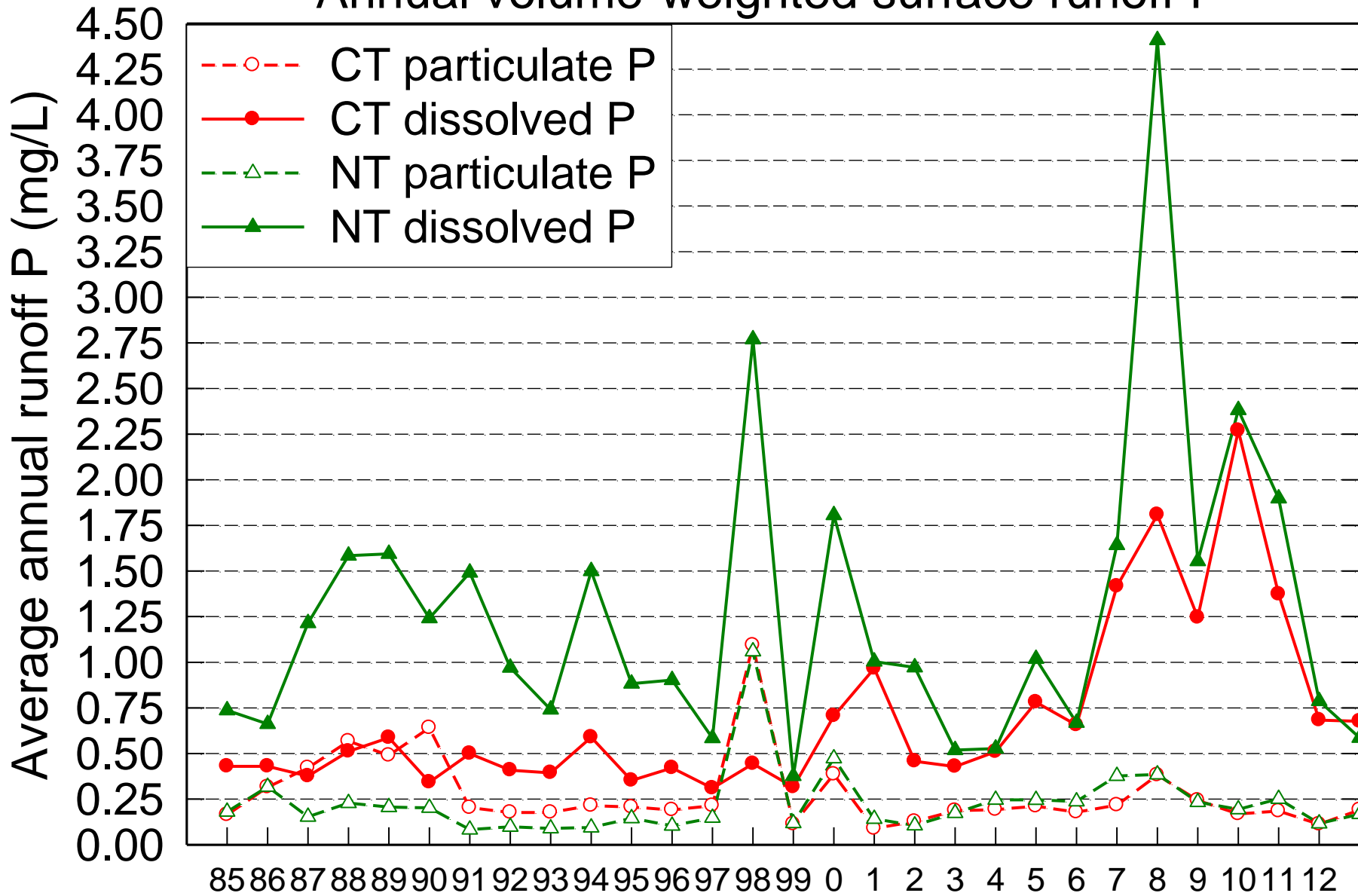


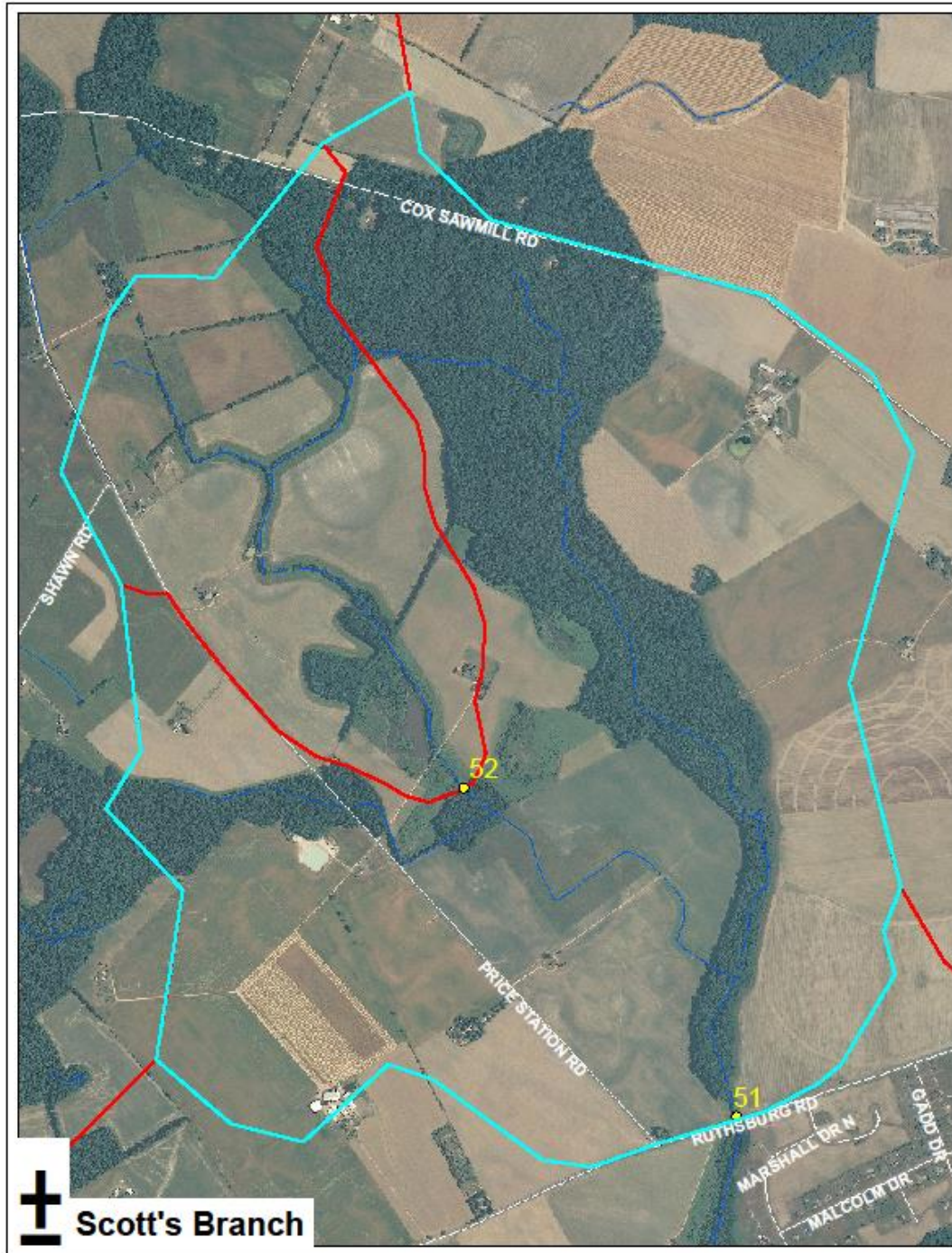




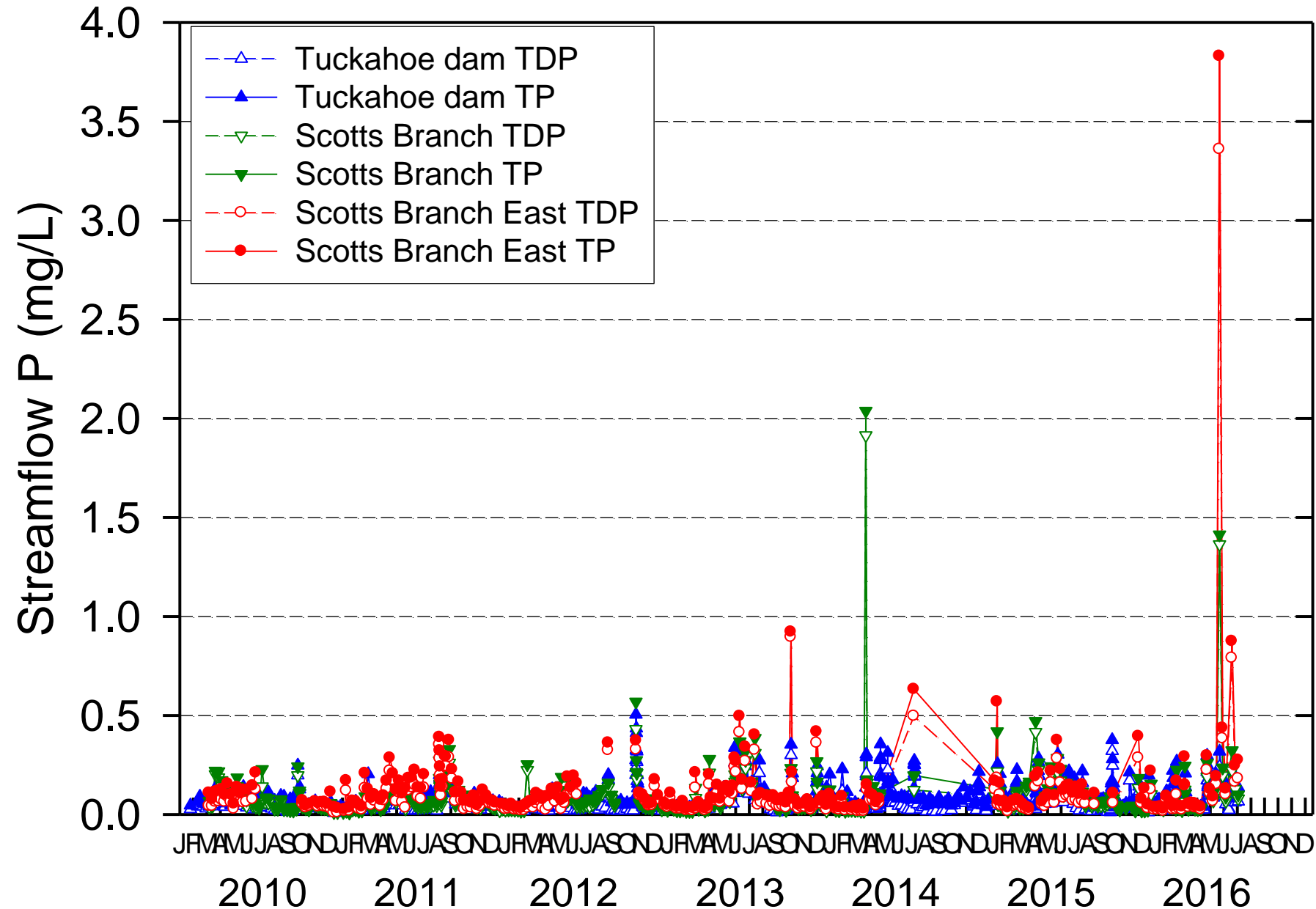


Annual volume-weighted surface runoff P





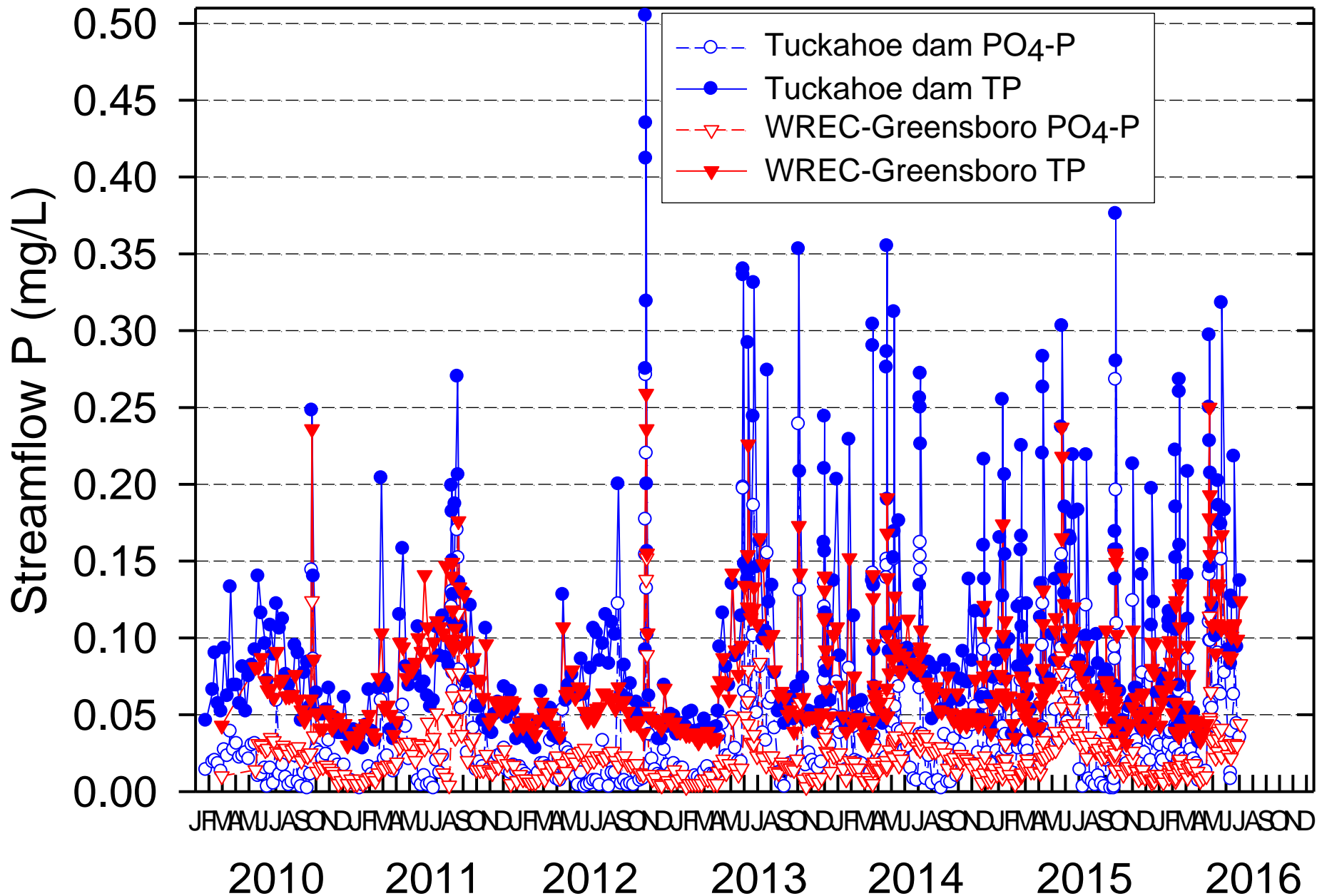
Tuckahoe dam and tributaries P



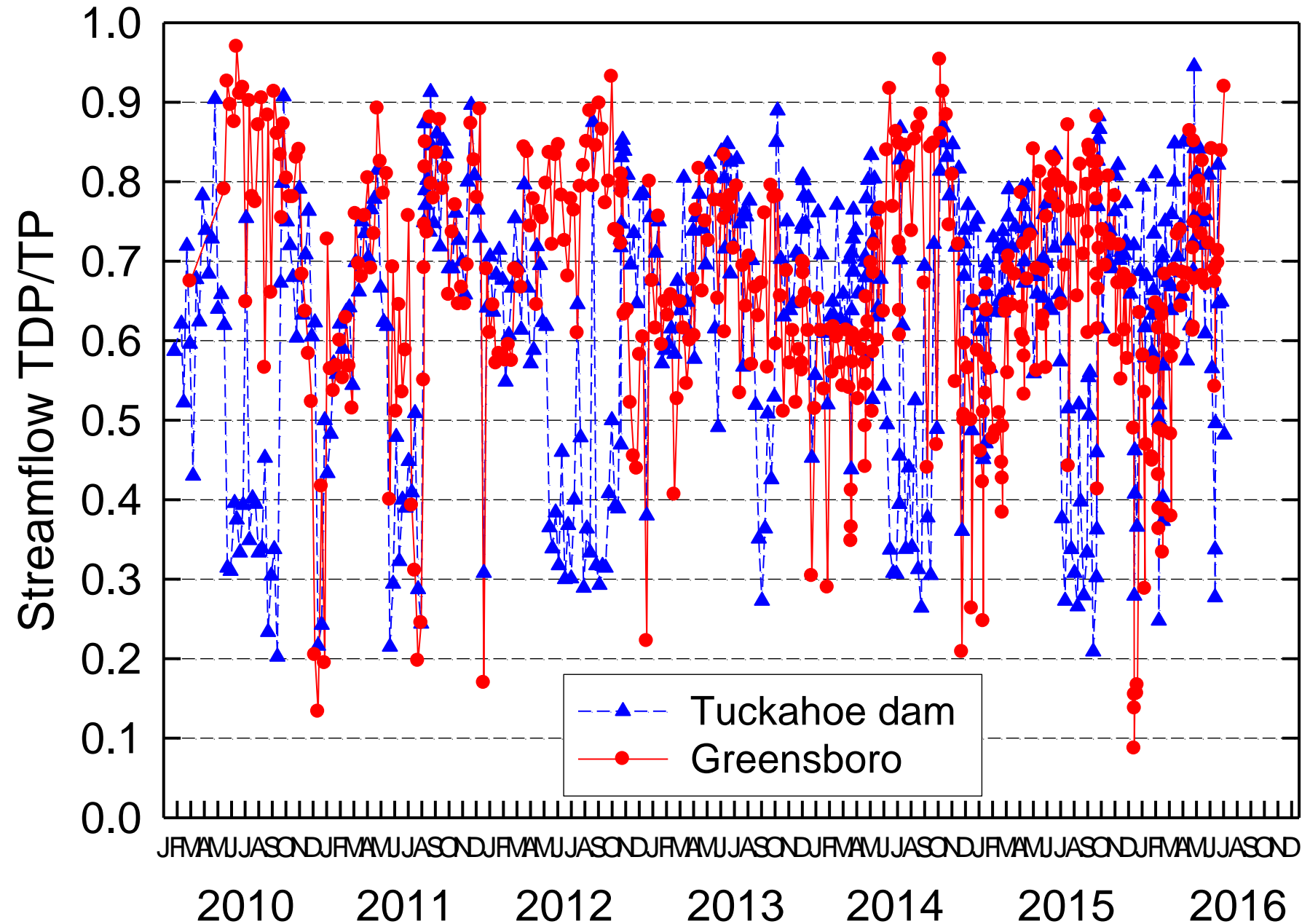


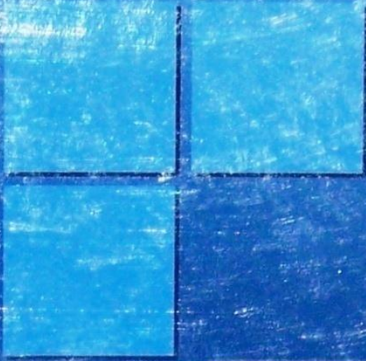


Greensboro and Tuckahoe dam phosphorus



Greensboro and Tuckahoe dam TDP/TP





Agriculture and Phosphorus Management

The Chesapeake Bay



Edited by Andrew N. Sharpley

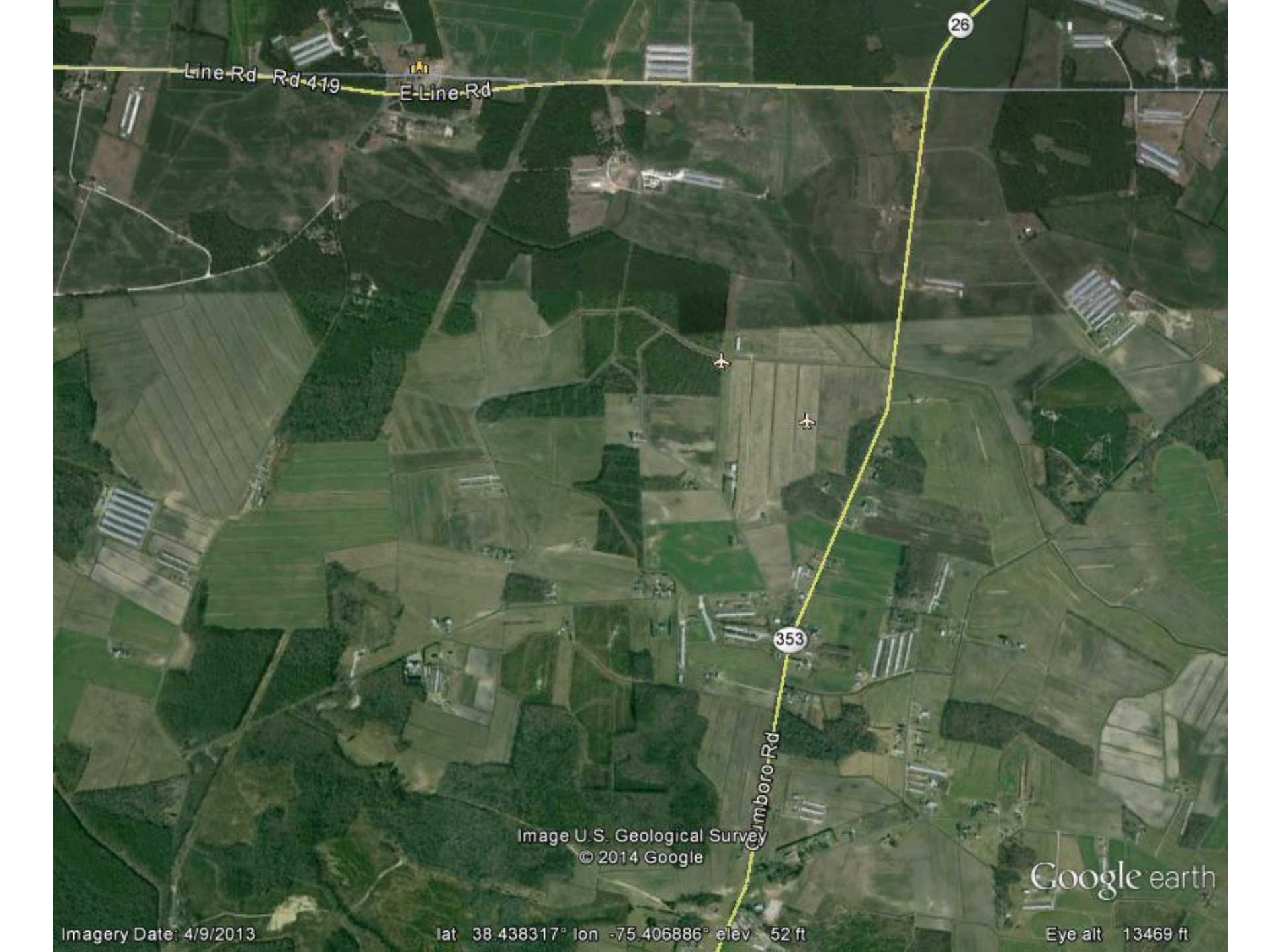
Concluding Remarks

“The overall long-term goal of efforts to reduce P losses from agriculture to surface waters should aim to balance off-farm inputs of P in feed and fertilizer with P outputs as produce, along with managing soils in ways that retain nutrients and applied P resources.”

Concluding Remarks

“The overall long-term goal of efforts to reduce P losses from agriculture to surface waters should aim to balance off-farm inputs of P in feed and fertilizer with P outputs as produce....”,

More simply: Manage soil P



Line Rd Rd-419
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Cymboro-Rd

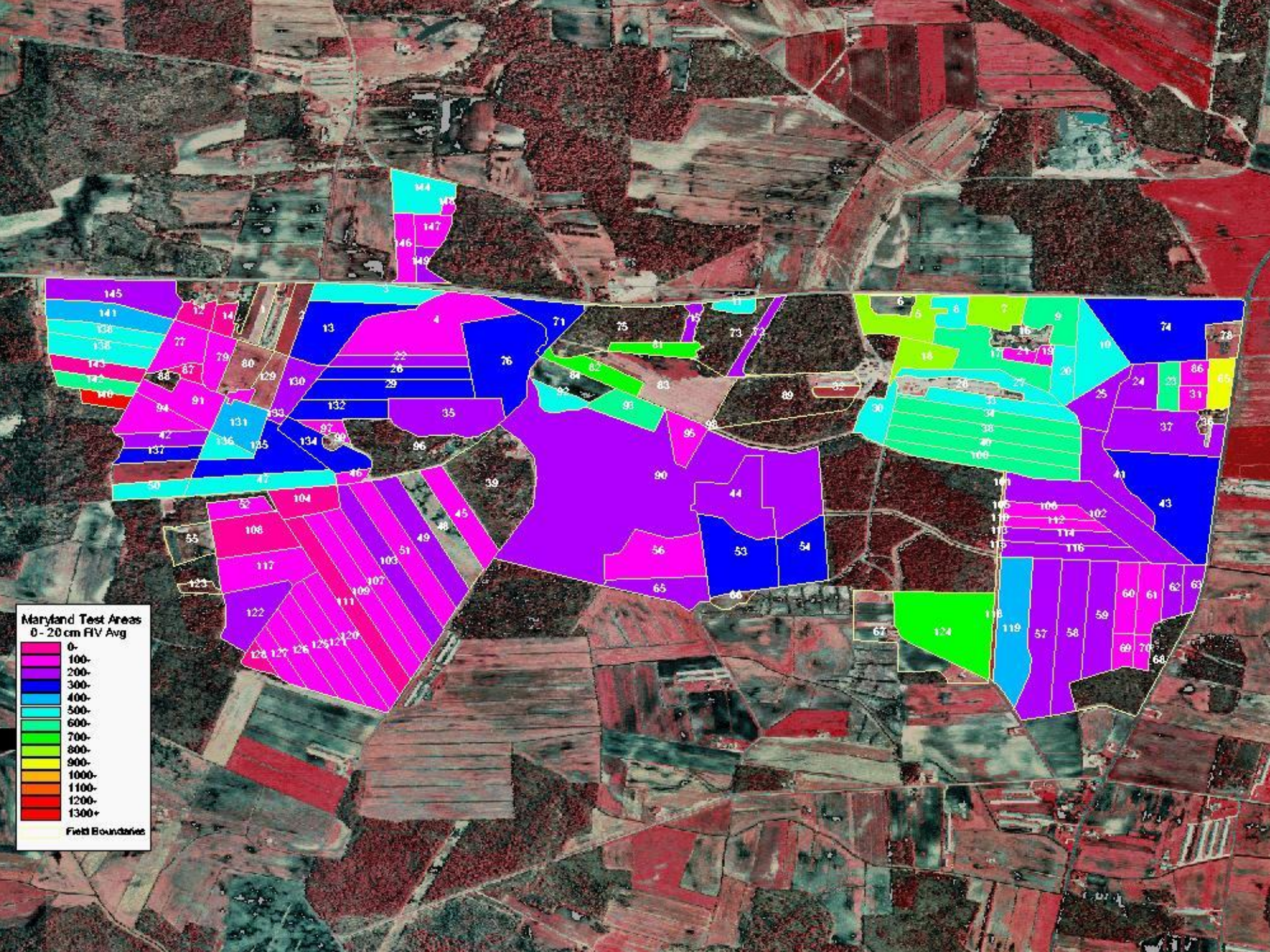
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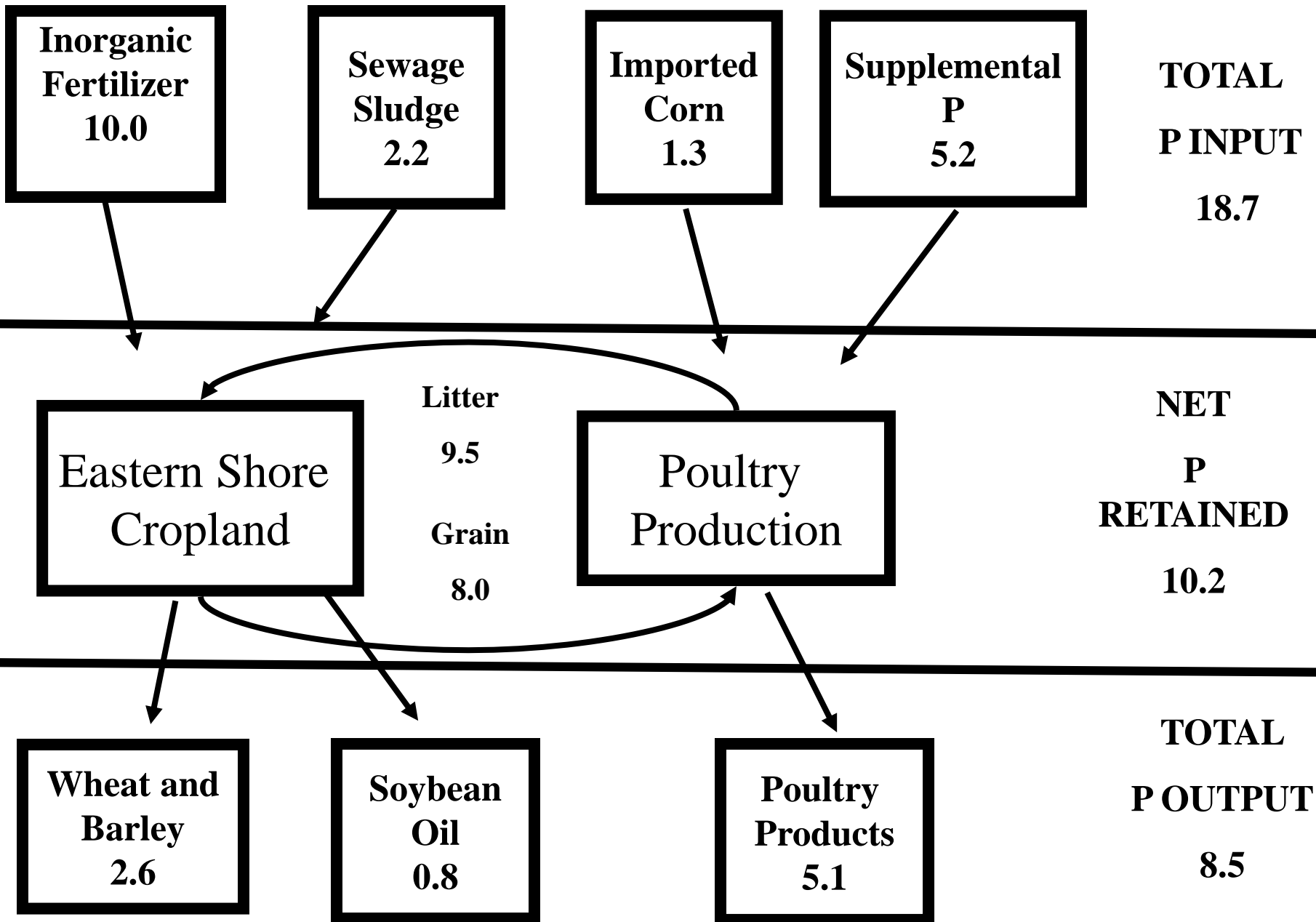
Eye alt 13469 ft



Pocomoke River Watershed

- 4 million lbs poultry litter P/year
- 100,000 acres cropland
- 40 lbs P/acre/year applied
- 20 lbs P/acre/year removed in harvested grain

Since the effort started to reduce nonpoint source nutrient loads in Maryland, the quantity of P stored in cropland in the Pocomoke River drainage basin increased by approximately 25 million pounds.



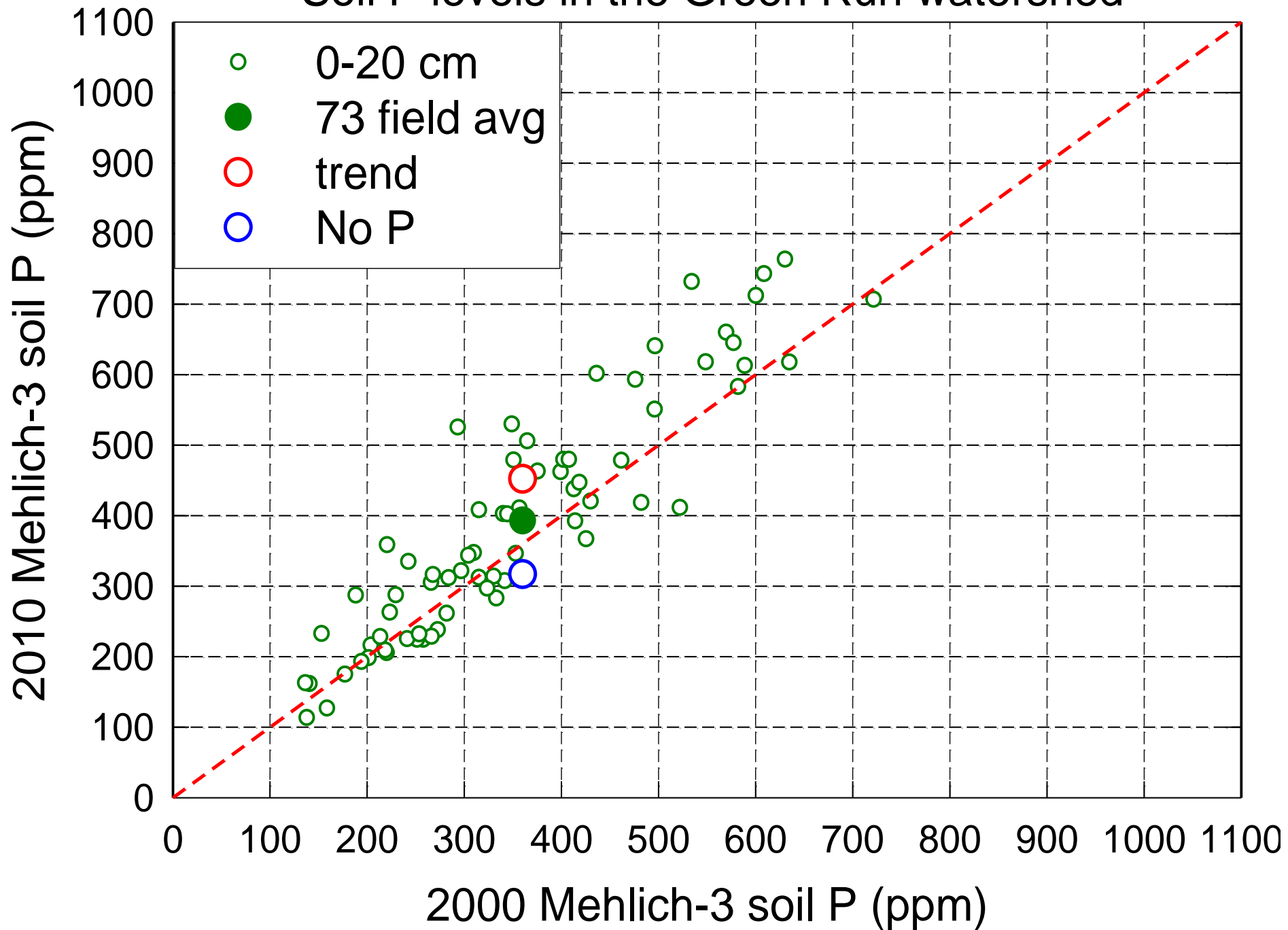
millions of pounds P per year

Source: Kenneth Staver, Wye Research and Education Center

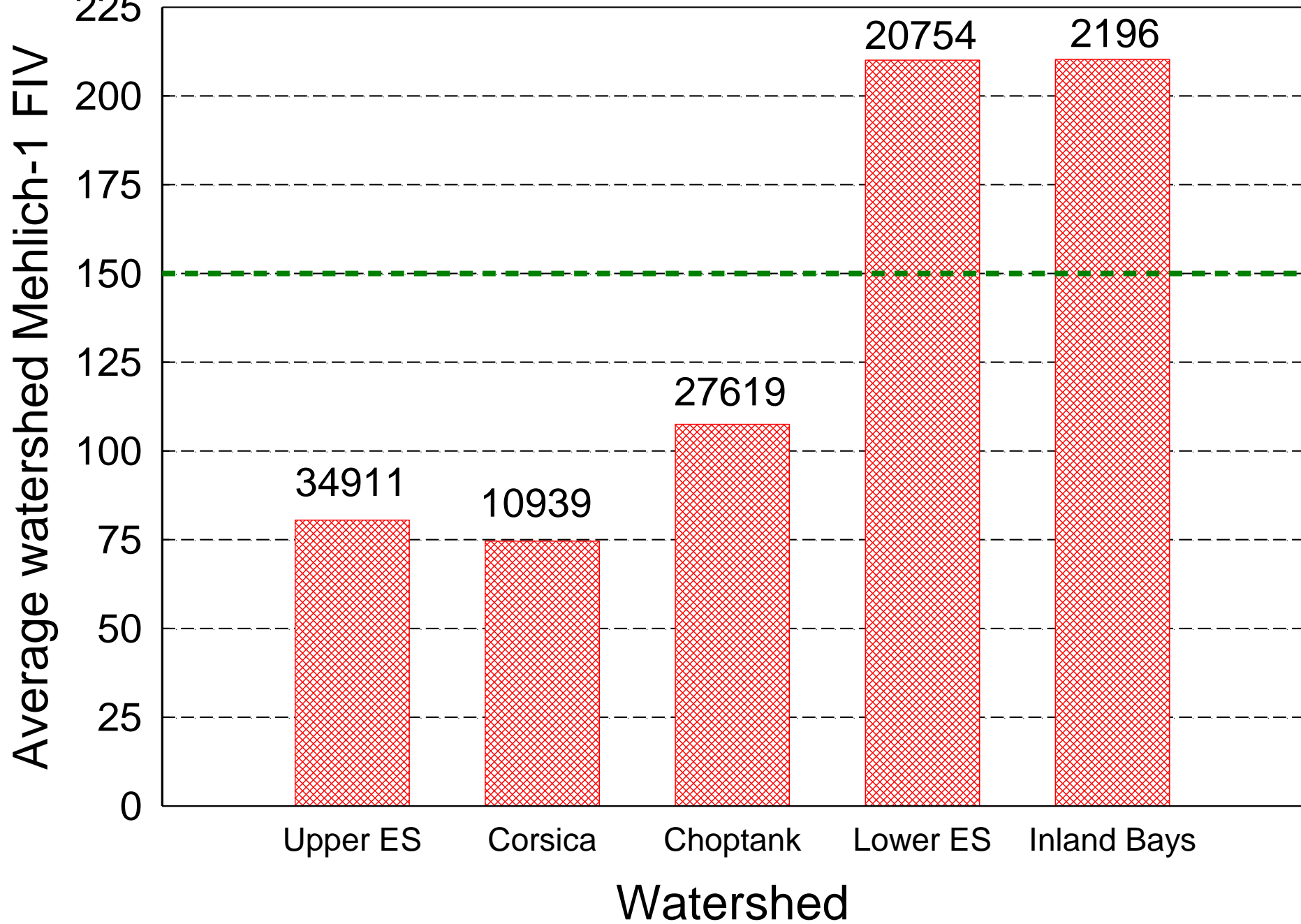
After assumptions, the math is simple!

From 1960-2000 P was being added to cropland in Green Run watershed at a rate of ~ 40 kg/ha/yr, increasing M-3 P ~ 9 units/yr. 2000-2010 average crop harvests in Wicomico County removed ~ 20 kg P/ha, which will reduce M-3 P ~ 4-5 units/year.

Soil P levels in the Green Run watershed



Eastern Shore watershed soil P data from NMPs



Research Bottom Line

1. Soil P concentrations and how we manage P applications are the major drivers for P losses that we can control.
2. Changes in loads only come from changes in drivers. Need high quality pre- and post data sets. Baseline?
3. Small scale monitoring of runoff P losses impractical.

Are reduction strategies
consistent with the science?

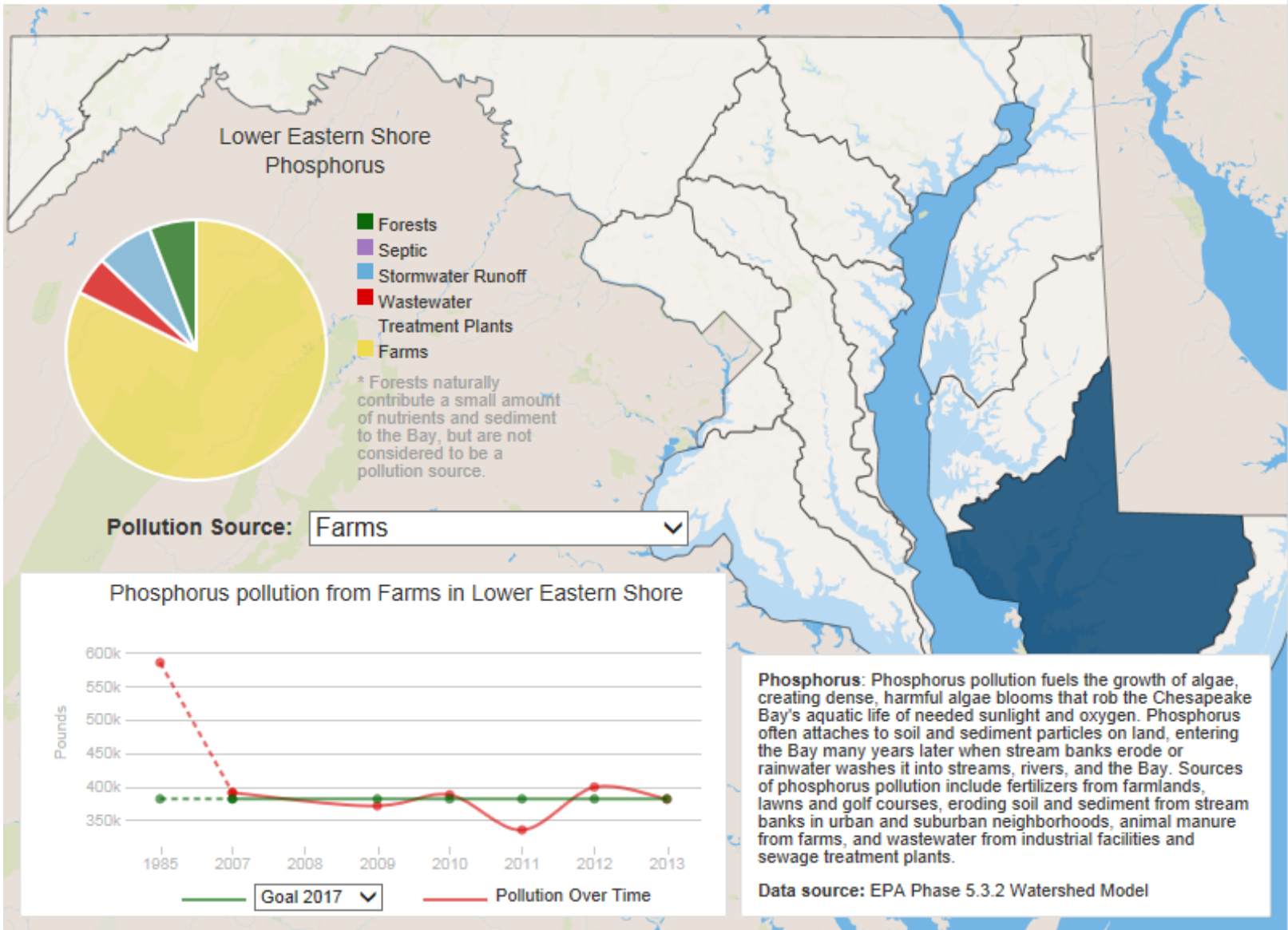
Unfortunately, so far the Bay watershed model has not considered soil P concentration or manure or inorganic fertilizer application methods.

Causes of Chesapeake Bay Pollution

Click map to select a basin.
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 Phosphorus
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Conclusions

1. P losses have short-term and long-term components that are highly variable.
2. Cropland erosion rates are likely near historic lows but don't necessarily translate into lower P losses.
3. Soil P critical as a long term driver. Tracking straightforward, but costly and privacy issues.
4. Dissolved P losses due to increasing soil P and reduced tillage probably the big P hammer on water quality. Past modeling deficient but progress soon??