Controls on agricultural watershed phosphorus export: Lessons from 2019

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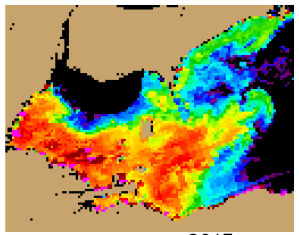
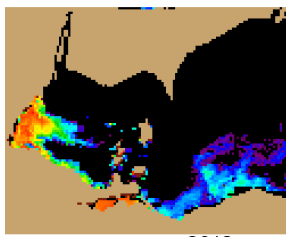
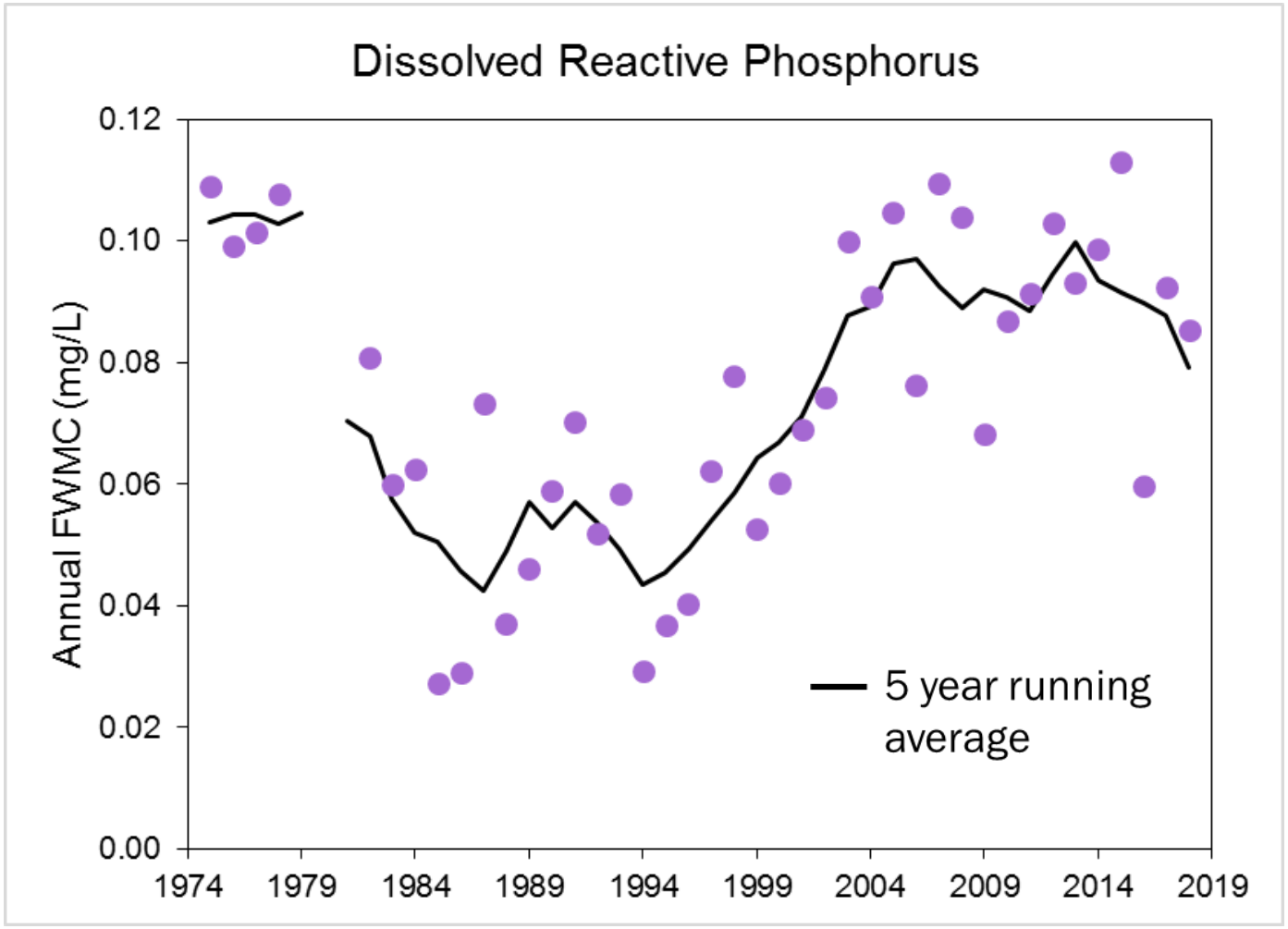


2015



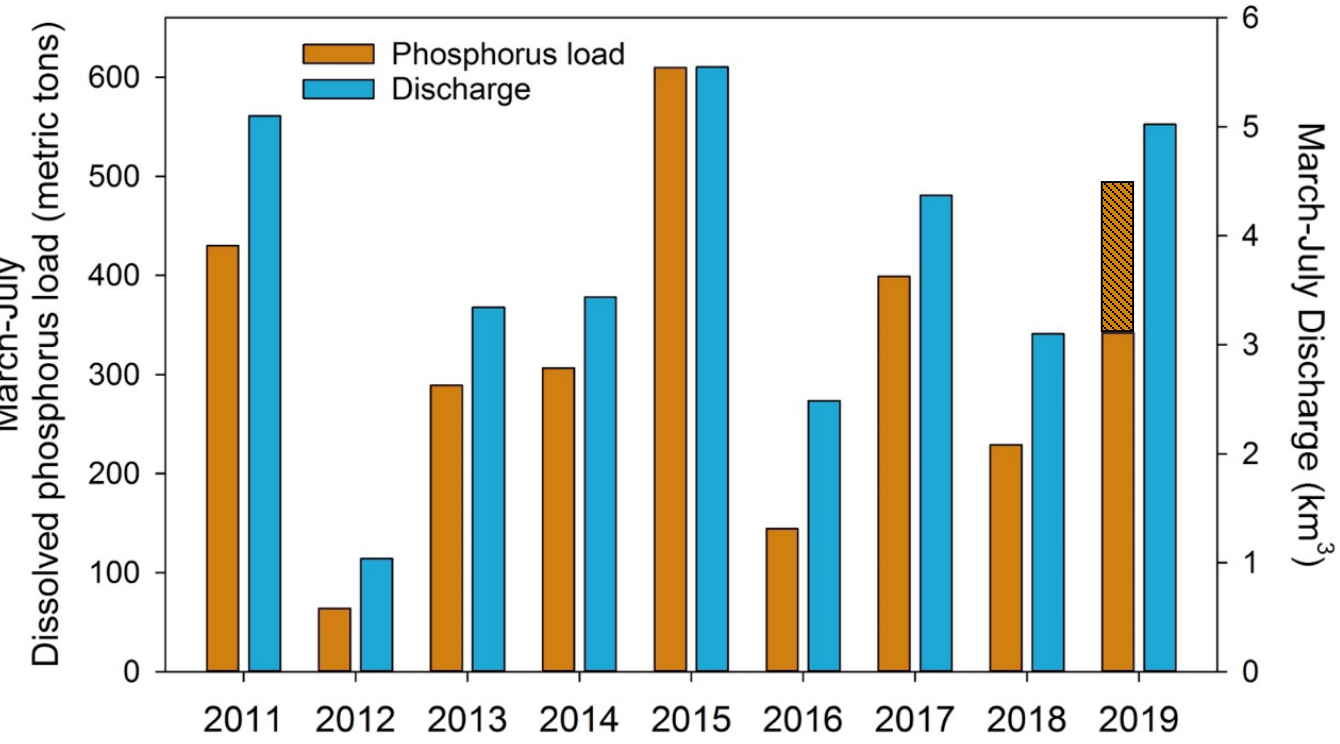
2012

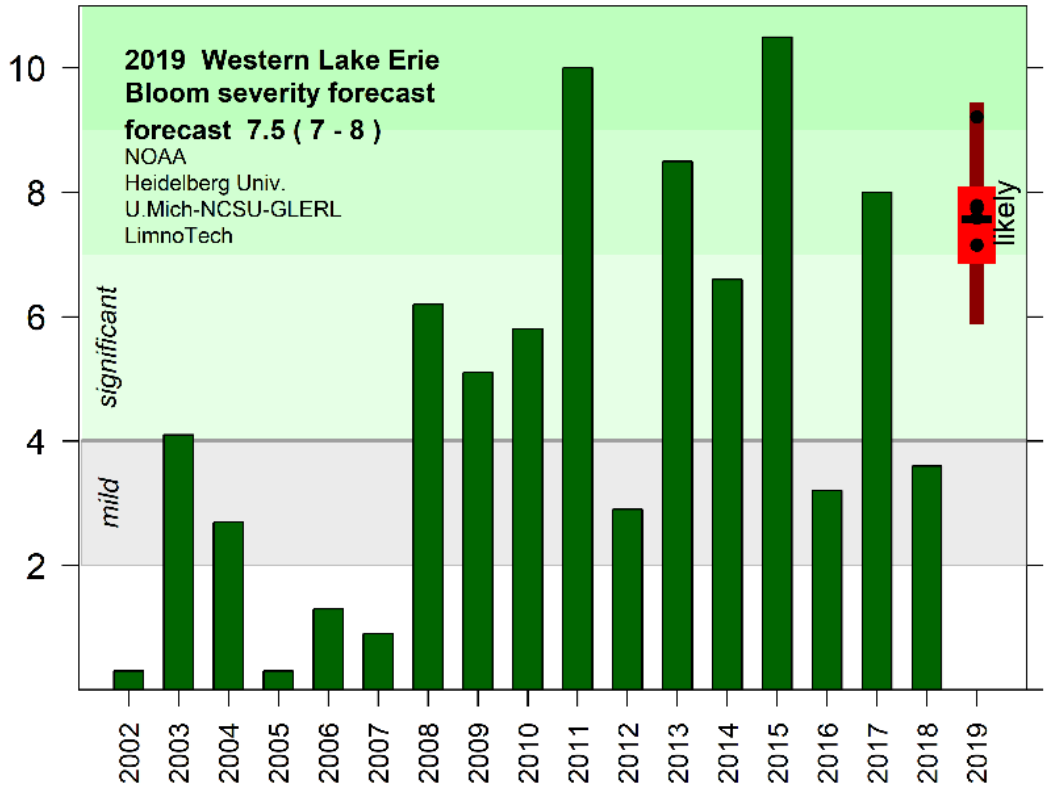


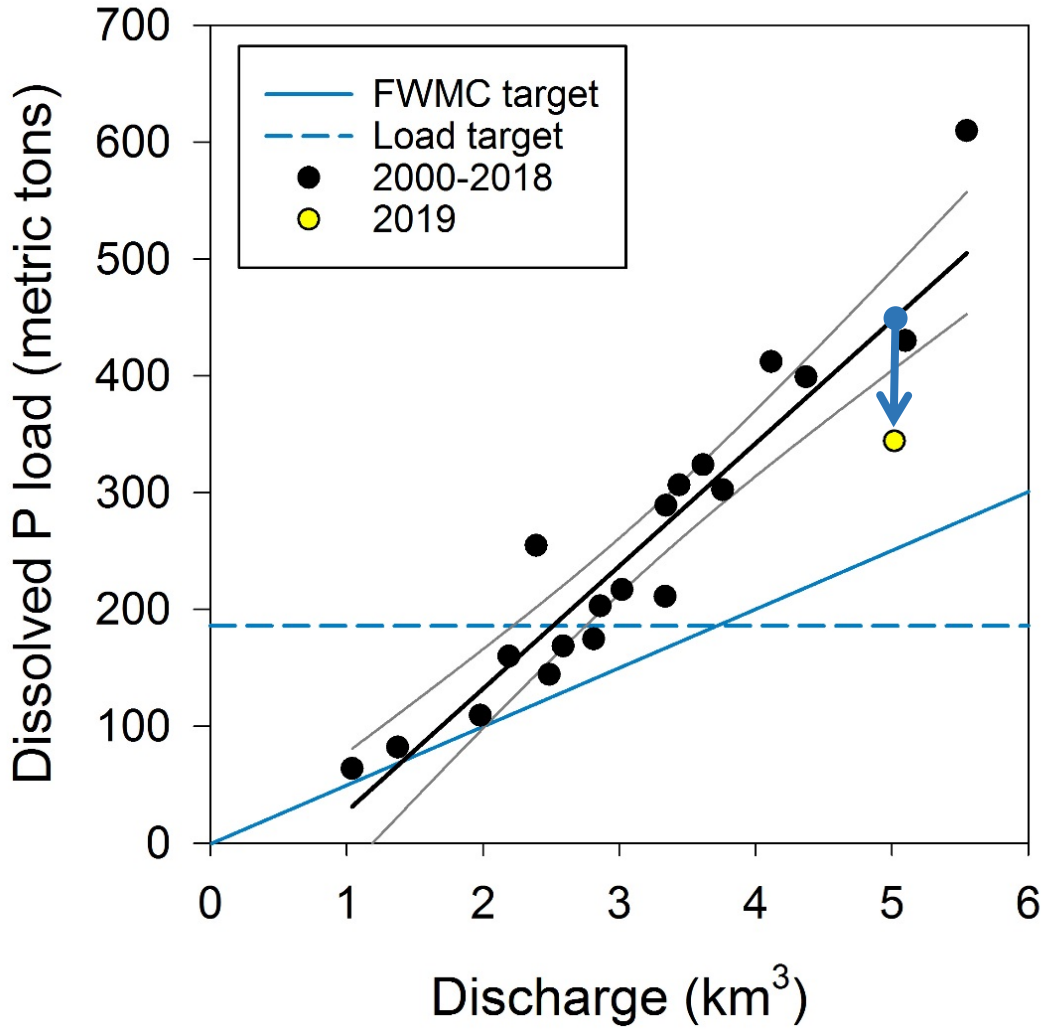
Maumee River dissolved P has increased ~2x since 1994

Goal: reduce phosphorus loads by 40% based on 2008 loads

2019 had a very wet spring, but 30% lower than expected DRP loads







DRP loads can be tracked relative to flow

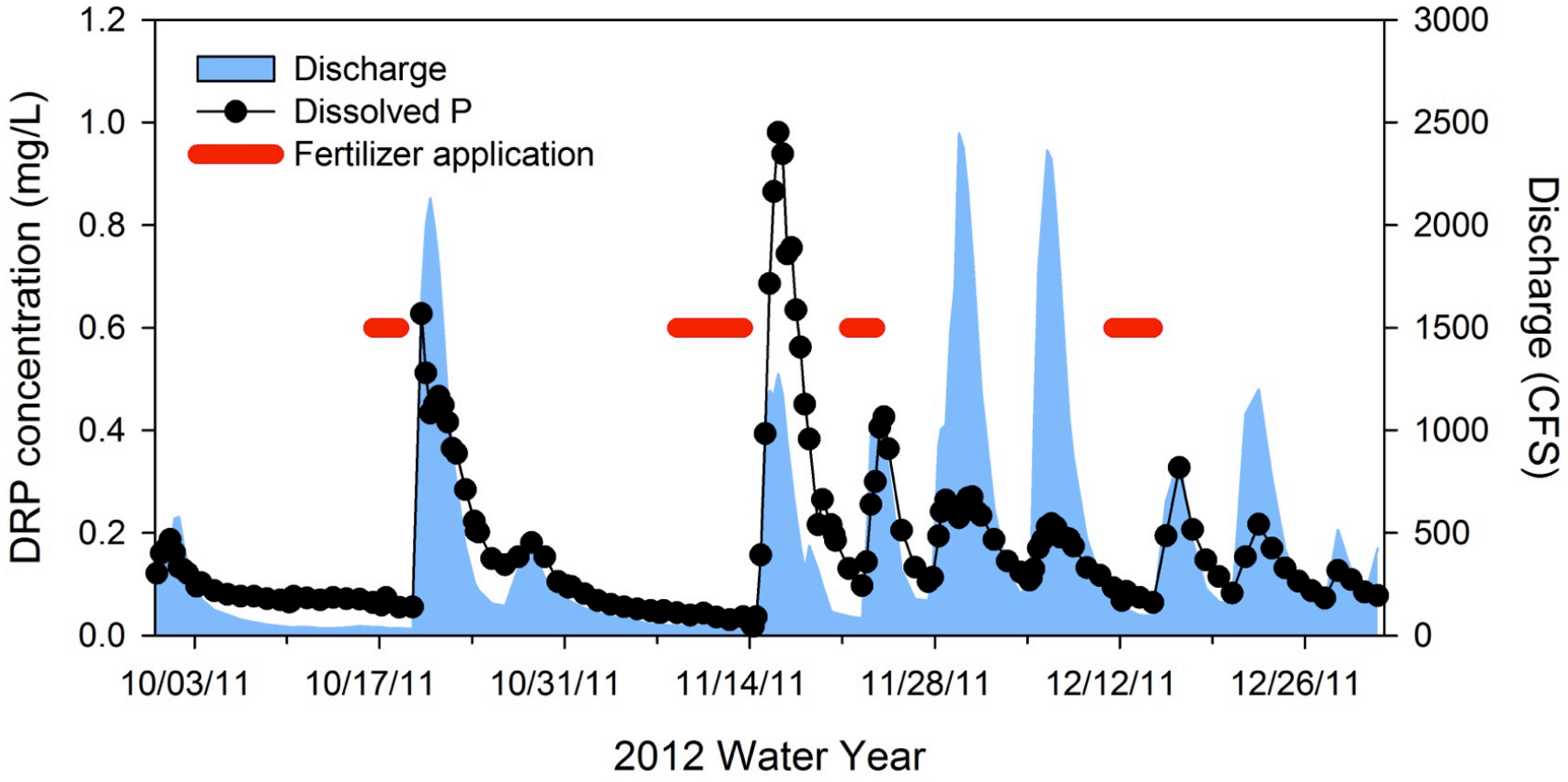
- Lack of P fertilizer application last fall through this spring due to wet conditions
- 40% of the acres in Ohio counties from the Maumee Watershed were prevent plant according to USDA FSA

What can we learn from this year?

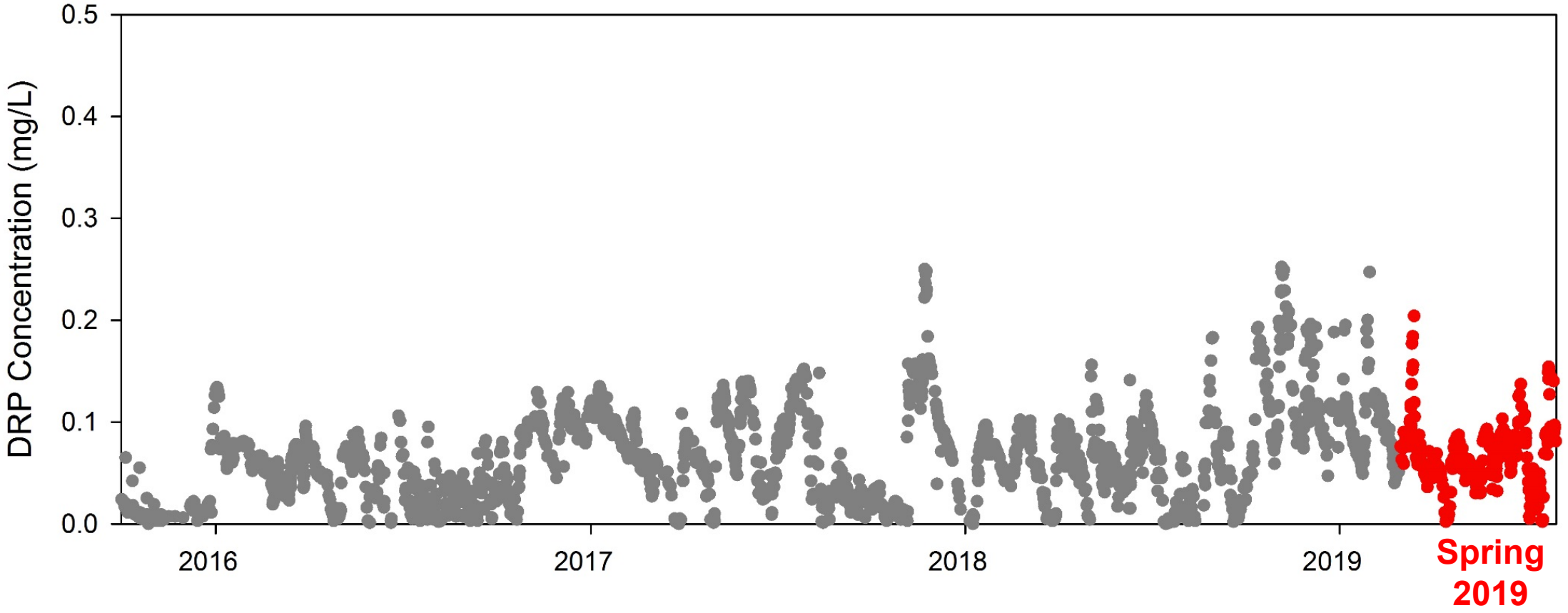
Fertilizer applied within the water year has a large influence on spring and summer DRP load

There are instances of acute runoff

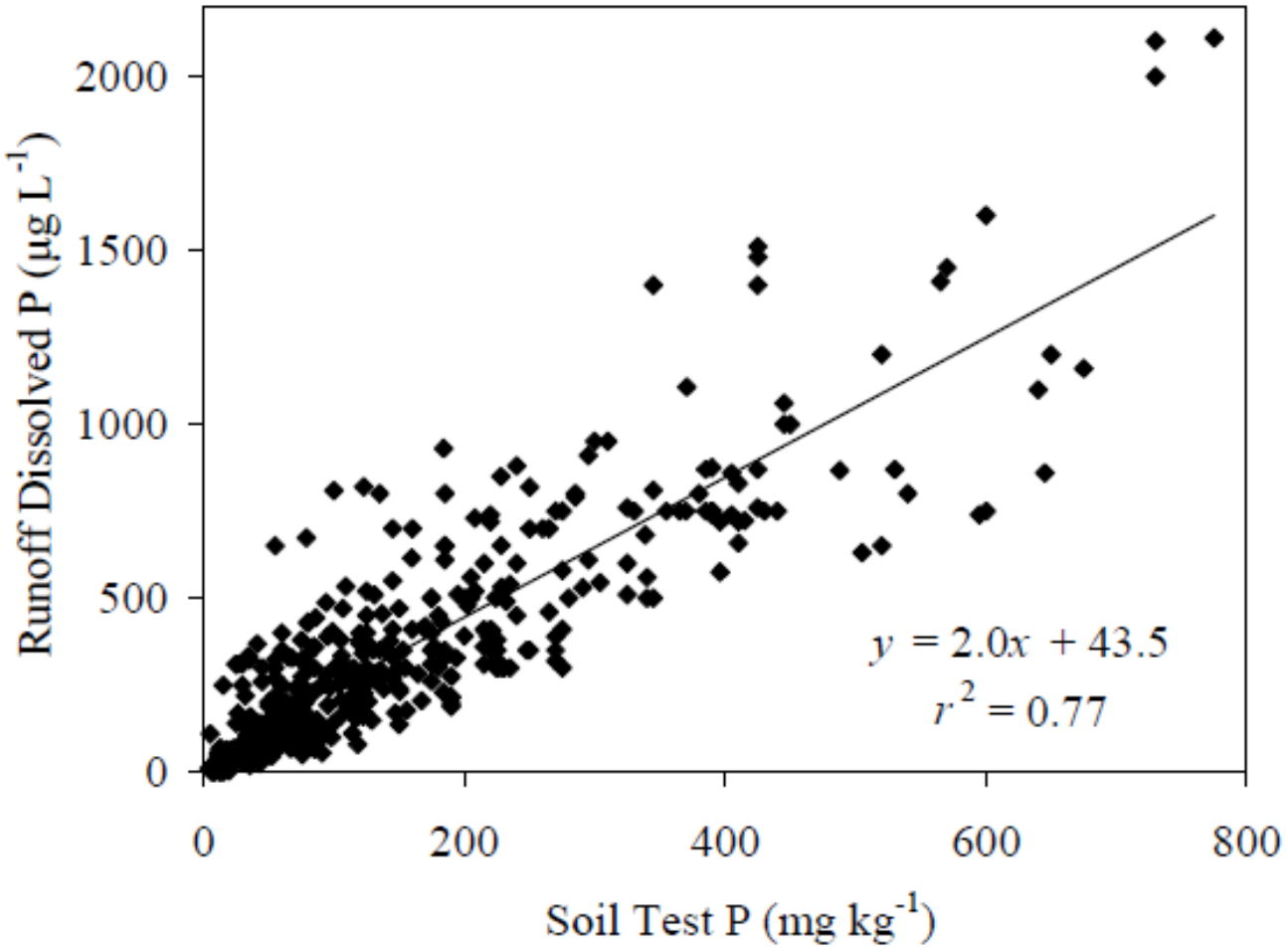
Honey Creek in Fall 2011



Maumee River is dominated by chronic loss driven by hydrology, not acute loss

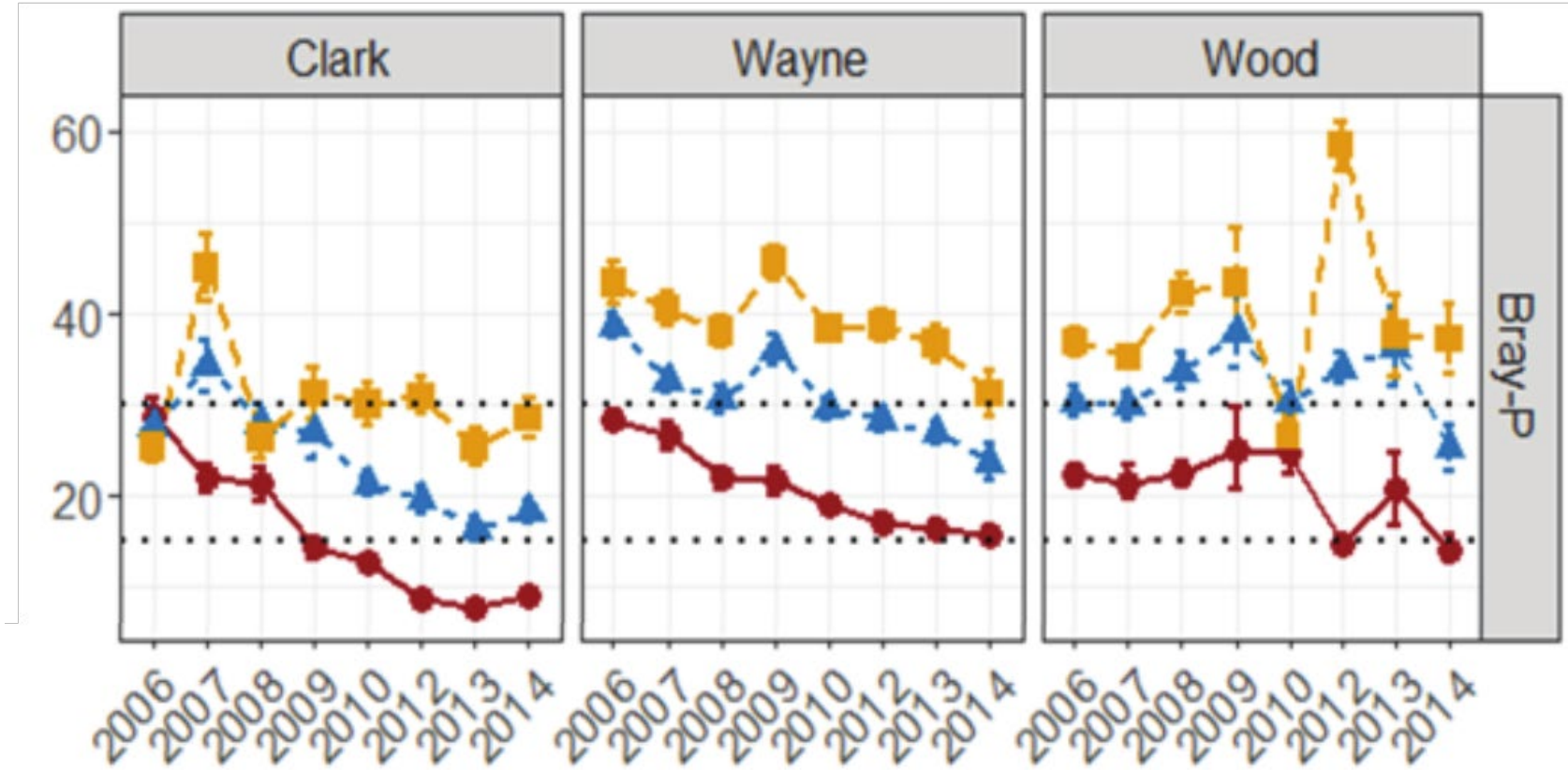


Dissolved P in runoff is often linked to soil test P, but that wouldn't explain this year



From Vadas et al. 2005

It's unlikely that soil test P levels have changed substantially in one year

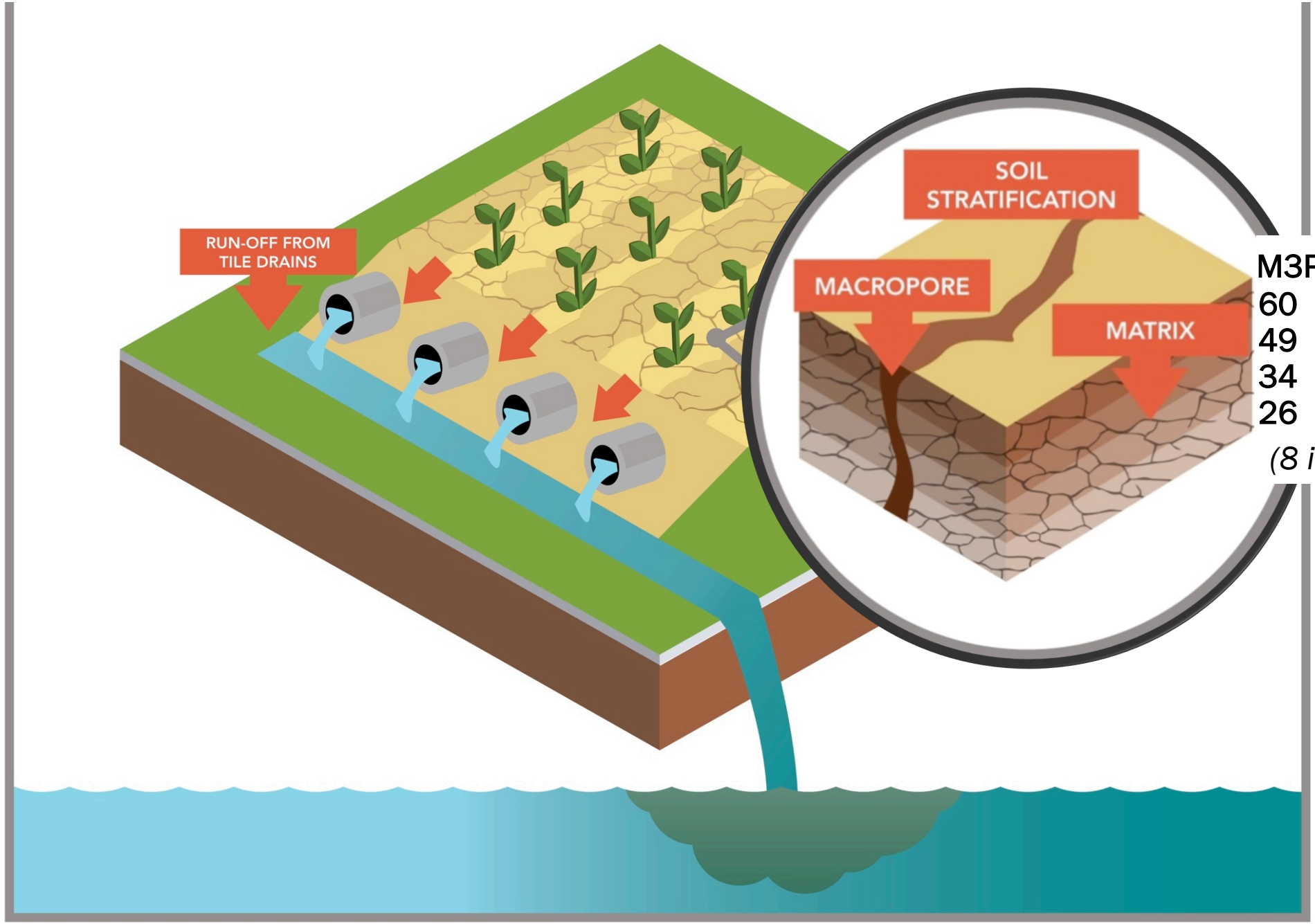


The current strategy is to maintain a bank of crop-available P in the soil such that you don't have a yield loss if you miss one or more years of application

*note, there was no yield differences among these rates

Fulford and Culman 2016, 2018

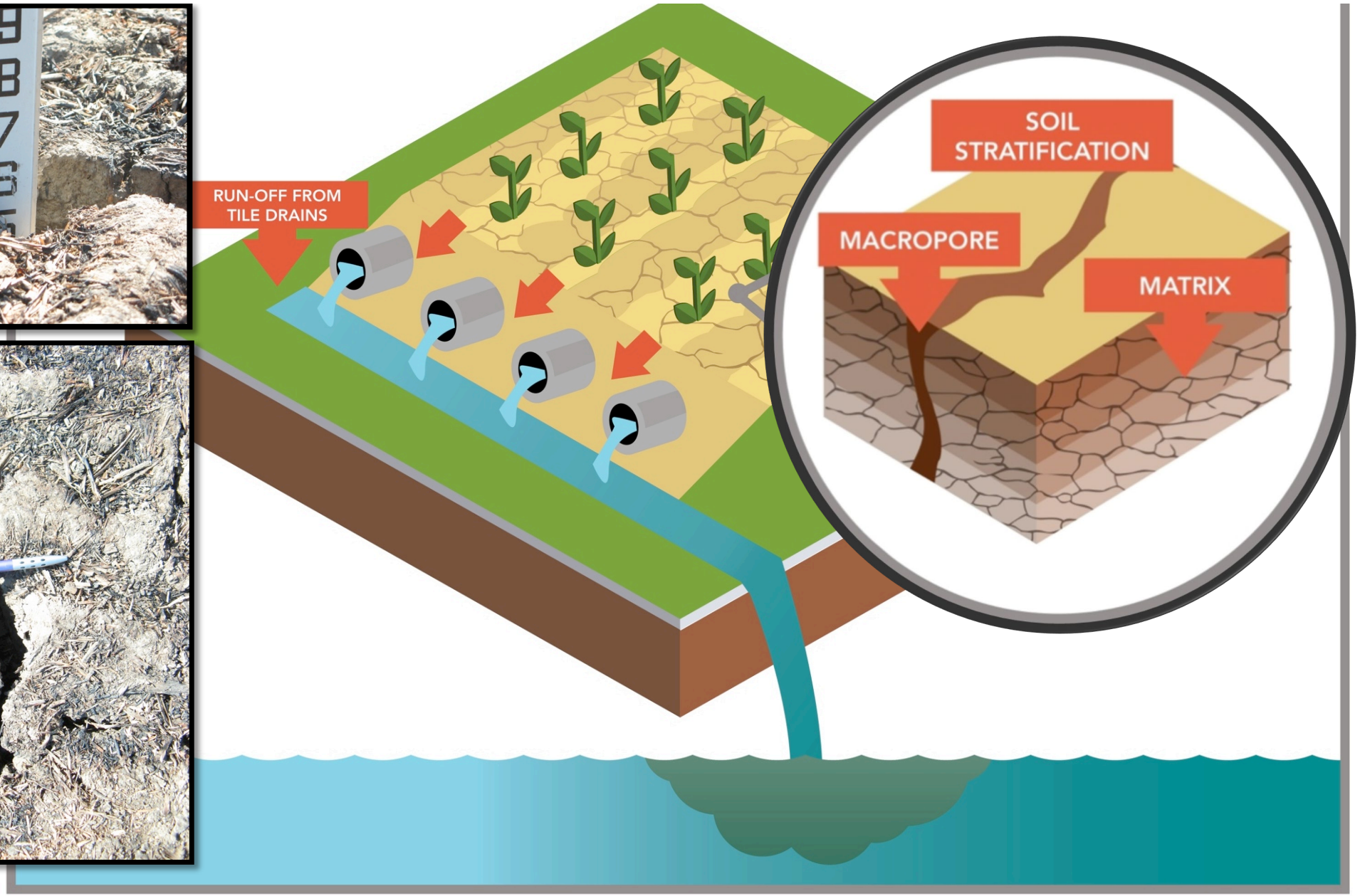
P accumulation on the soil surface appears to be the mechanism for DRP export...



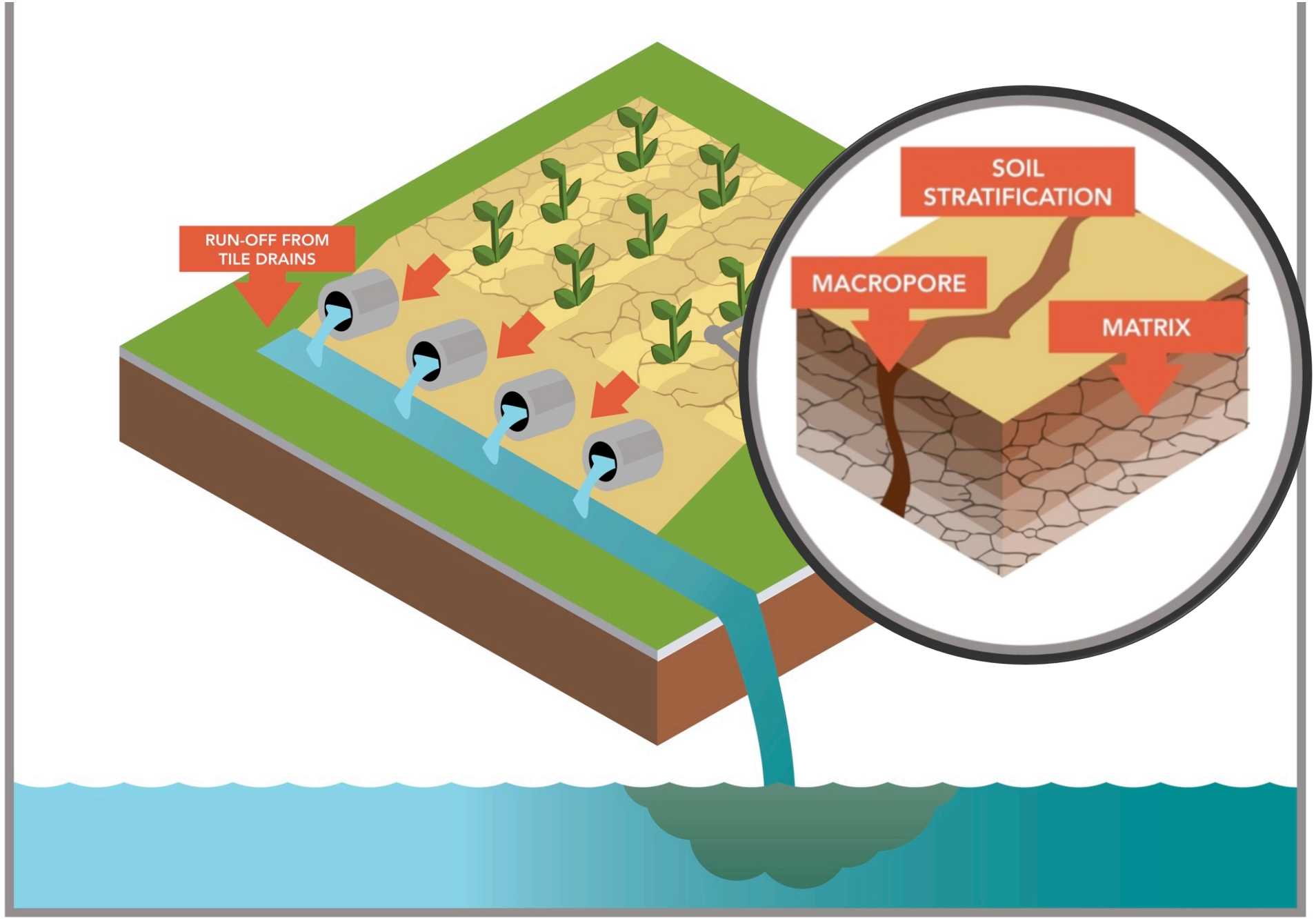
M3P
60
49
34
26

(8 inch depth)

P accumulation on the soil surface appears to be the mechanism for DRP export, which is facilitated by macropore flow



Decreased DRP could imply the soil surface was less enriched due to lack of application



What can we learn from this year?

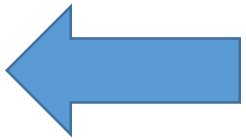
- Fertilizer applied within the water year has a large influence on DRP loads, but losses tend to be chronic and not acute
- We manage soils to bank P and don't expect a drop in soil test P- so a big reduction in DRP is surprising
- We've documented a prevalence of P stratification
- Perhaps a combination of surface placement and loosely sorbed P contribute 30% of DRP loads
- Working with edge-of-field researchers and modeling teams to better identify a management response

- All sources of fertilizer are accounted for in the nutrient recommendation.

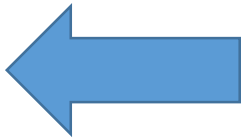
- Soil tests, used to make nutrient recommendations are less than four years old.
- Nutrient application equipment is calibrated annually.

- The timing of phosphorus and nitrogen application avoids spreading on frozen or snow-covered fields.
- Nutrients are not broadcast applied prior to a predicted heavy rainfall.

- Phosphorus is applied below the soil surface whenever possible.
- Nutrient application setbacks are followed in sensitive areas.



- Assess if application is really needed that year
- Maintain a slightly lower STP level, closer to the critical level



- Inject P below 2” depth in the soil to prevent P stratification

Special thanks to all our support!

Thanks!

Aerial Associates Photography

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