The Heidelberg Tributary Loading Program and Soil Stratification Sampling: State of the WLEB watersheds

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HEIDELBERG UNIVERSITY

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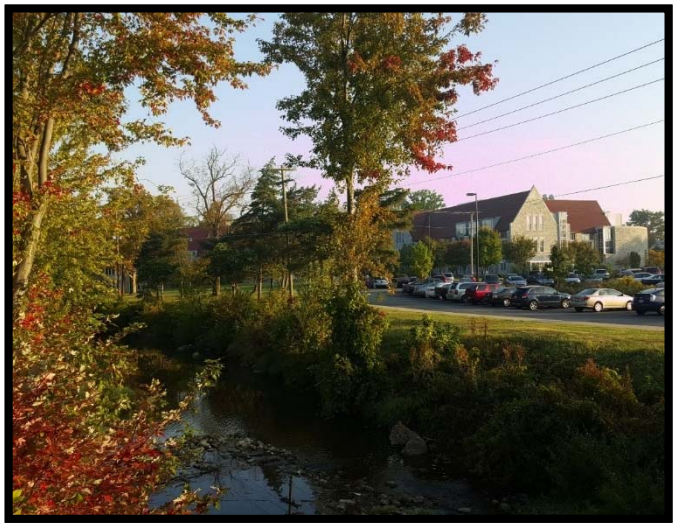
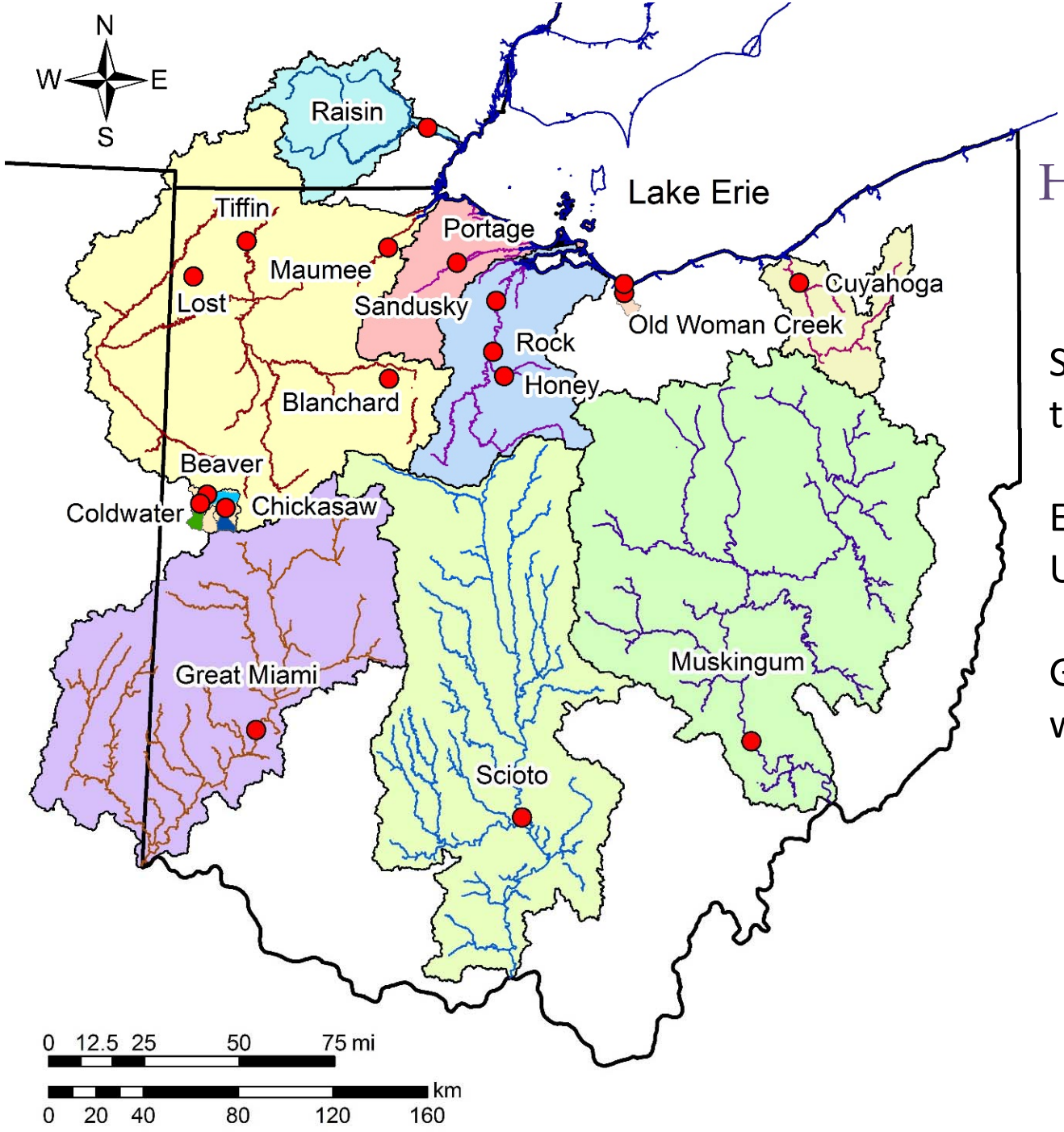




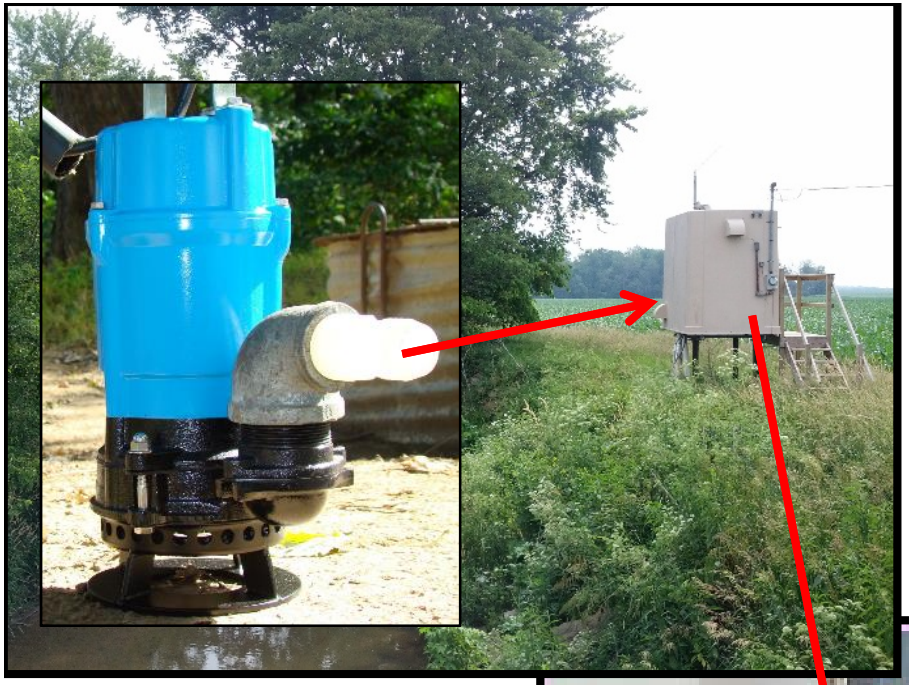
Heidelberg Tributary Loading Program

Sampling began in 1974 in the Maumee and Sandusky

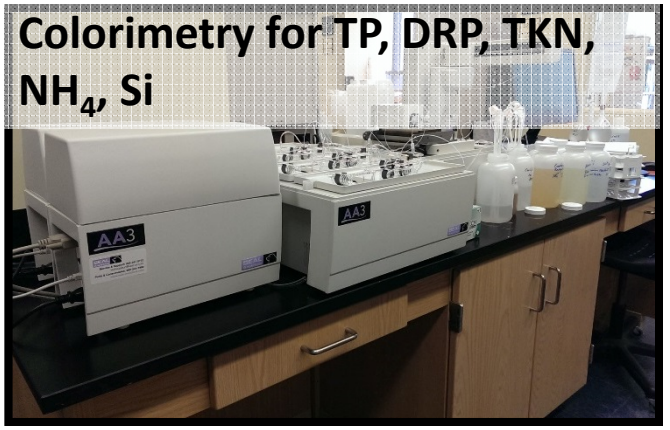
Each station paired with a USGS gage

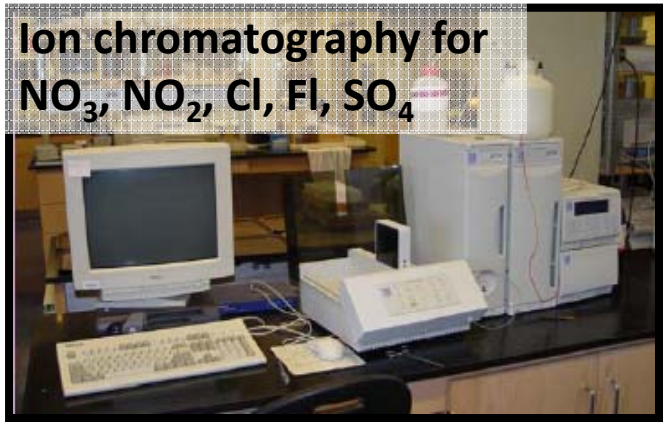
Goal is to quantify watershed loads

USGS
science for a changing world

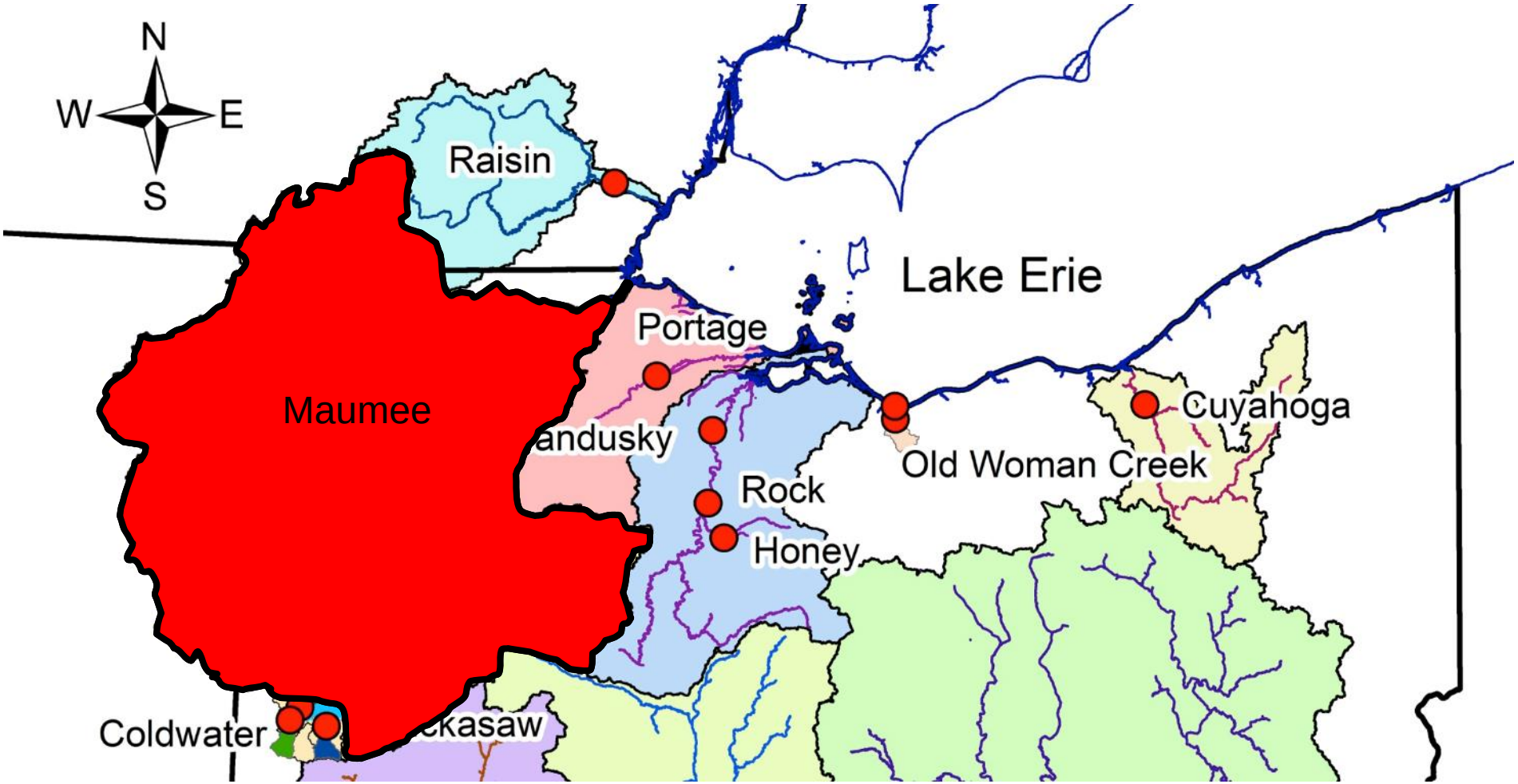


Samples collected 3x a day!



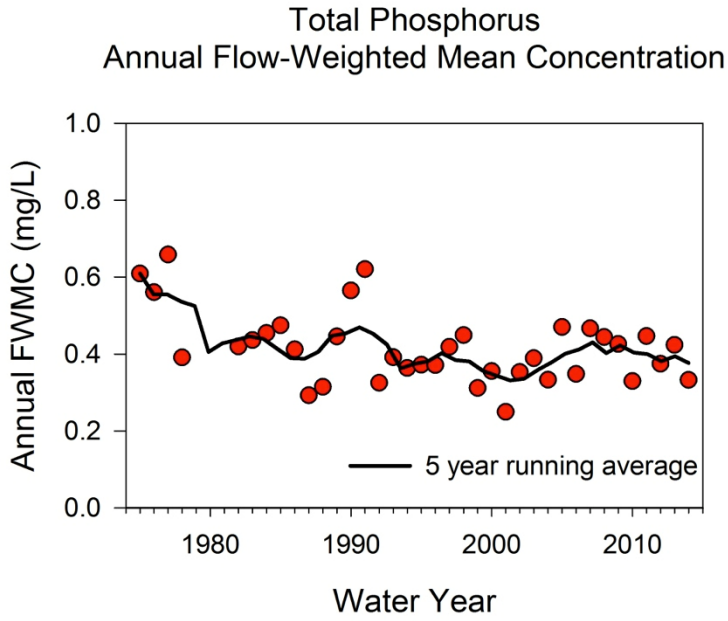


Pesticides measured at select watersheds

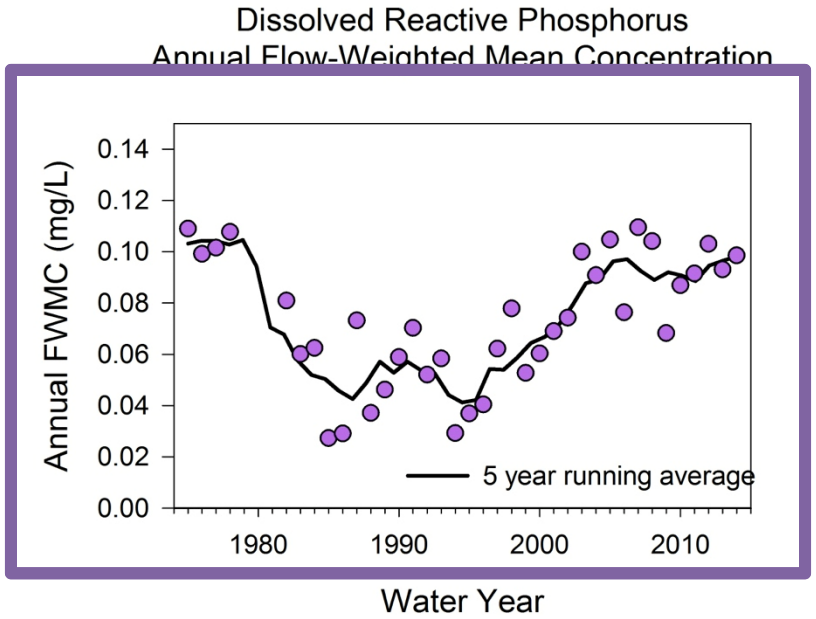


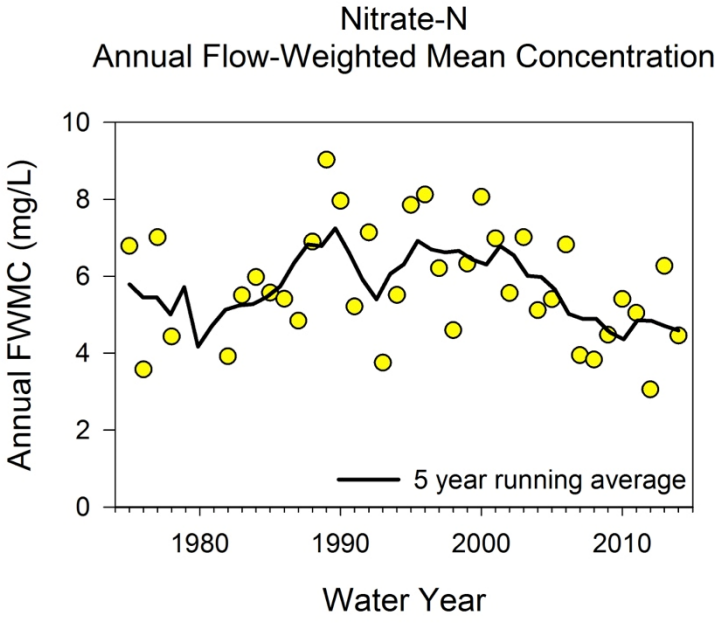
Maumee is the largest tributary to any of the Great Lakes

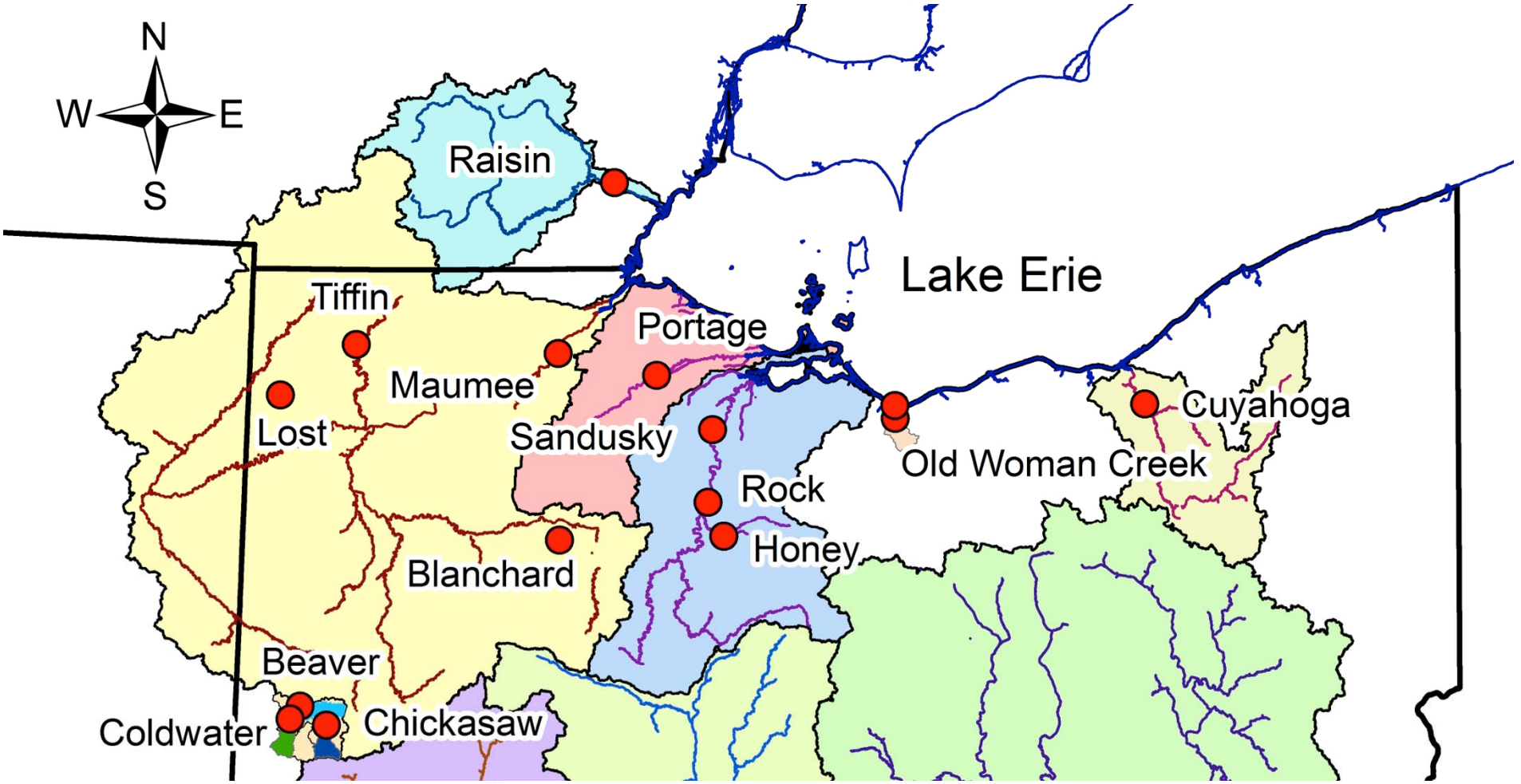
Maumee River trends

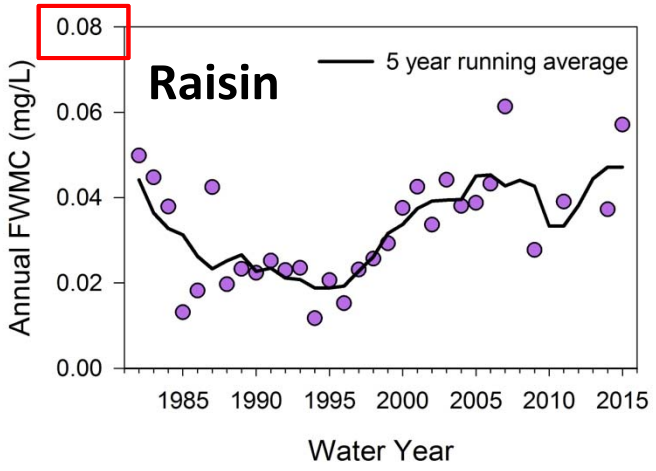


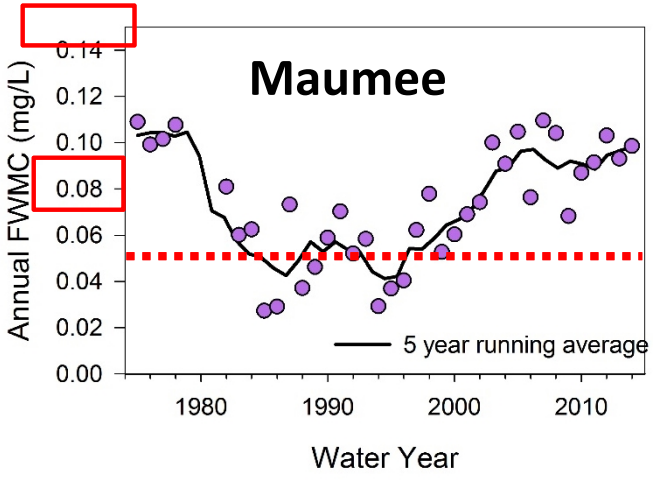
- Total P has decreased slightly over time
- Dissolved P has increased almost 2 fold since the mid-1990s
- Nitrate-nitrogen has decreased since 2000

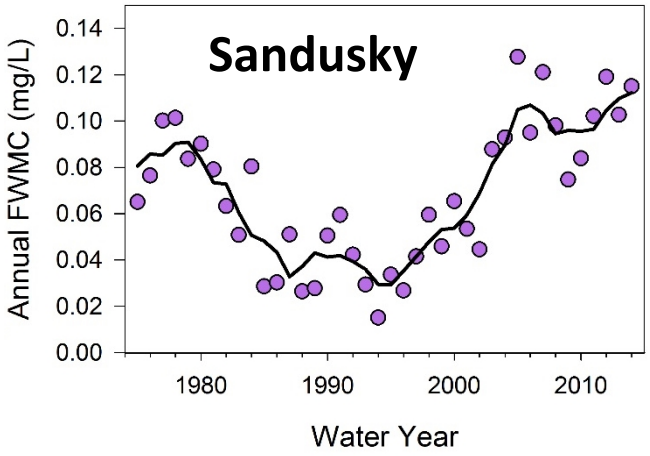


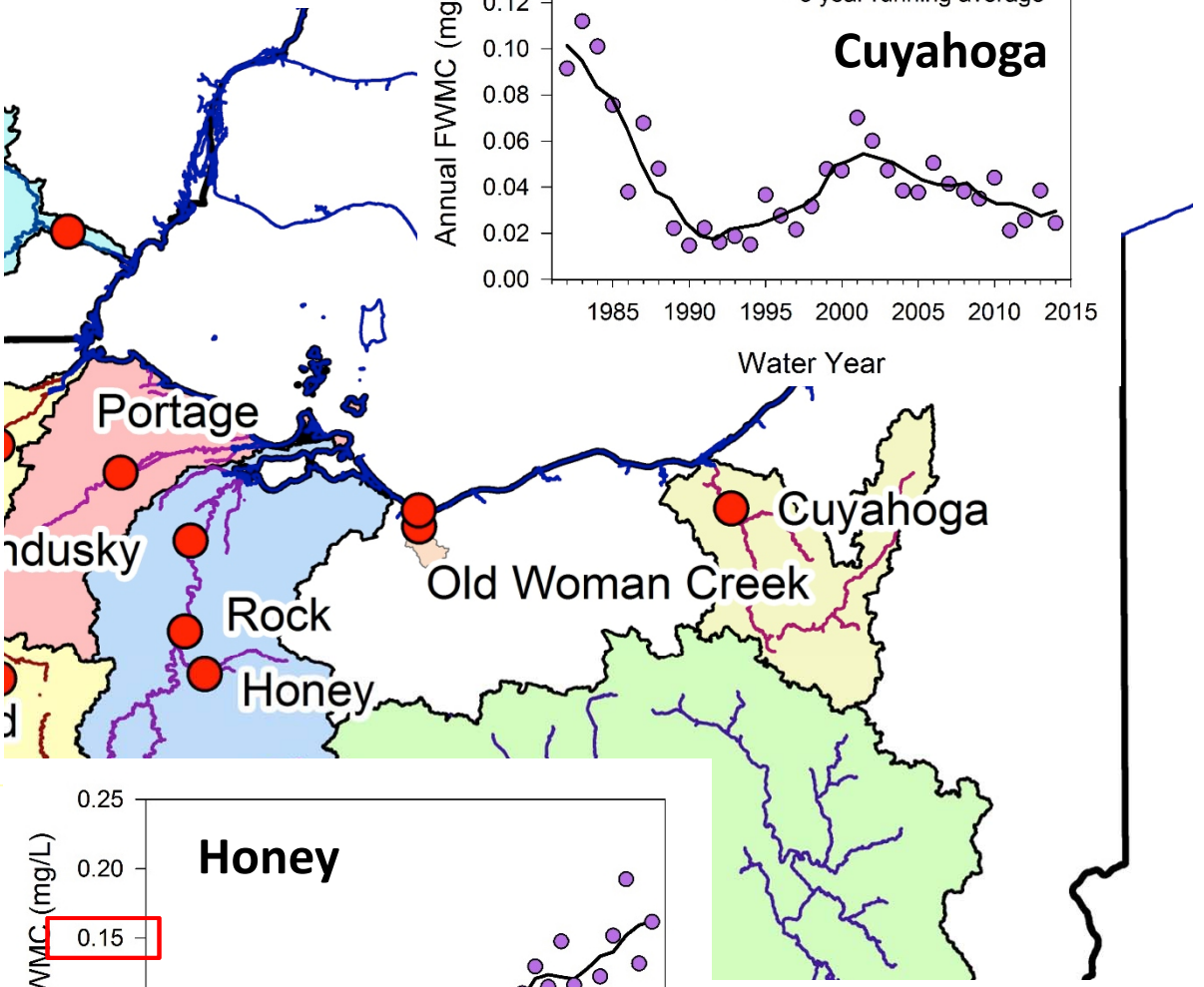



N
W
E
S
Raisin
Lake Erie
Tiffin
Portage
Maumee
Lost
Sandusky
Cuyahoga
Old Woman Creek
Rock
Honey
Blanchard
Beaver
Coldwater
Chickasaw

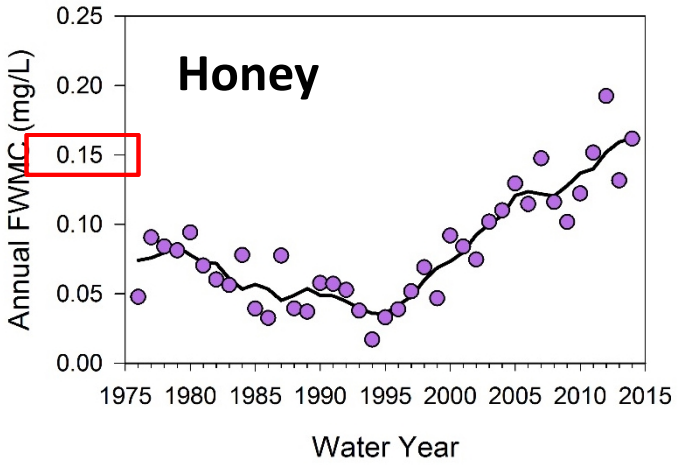

Raisin
5 year running average
Annual FWMC (mg/L)
0.08
0.06
0.04
0.02
0.00
1985 1990 1995 2000 2005 2010 2015
Water Year

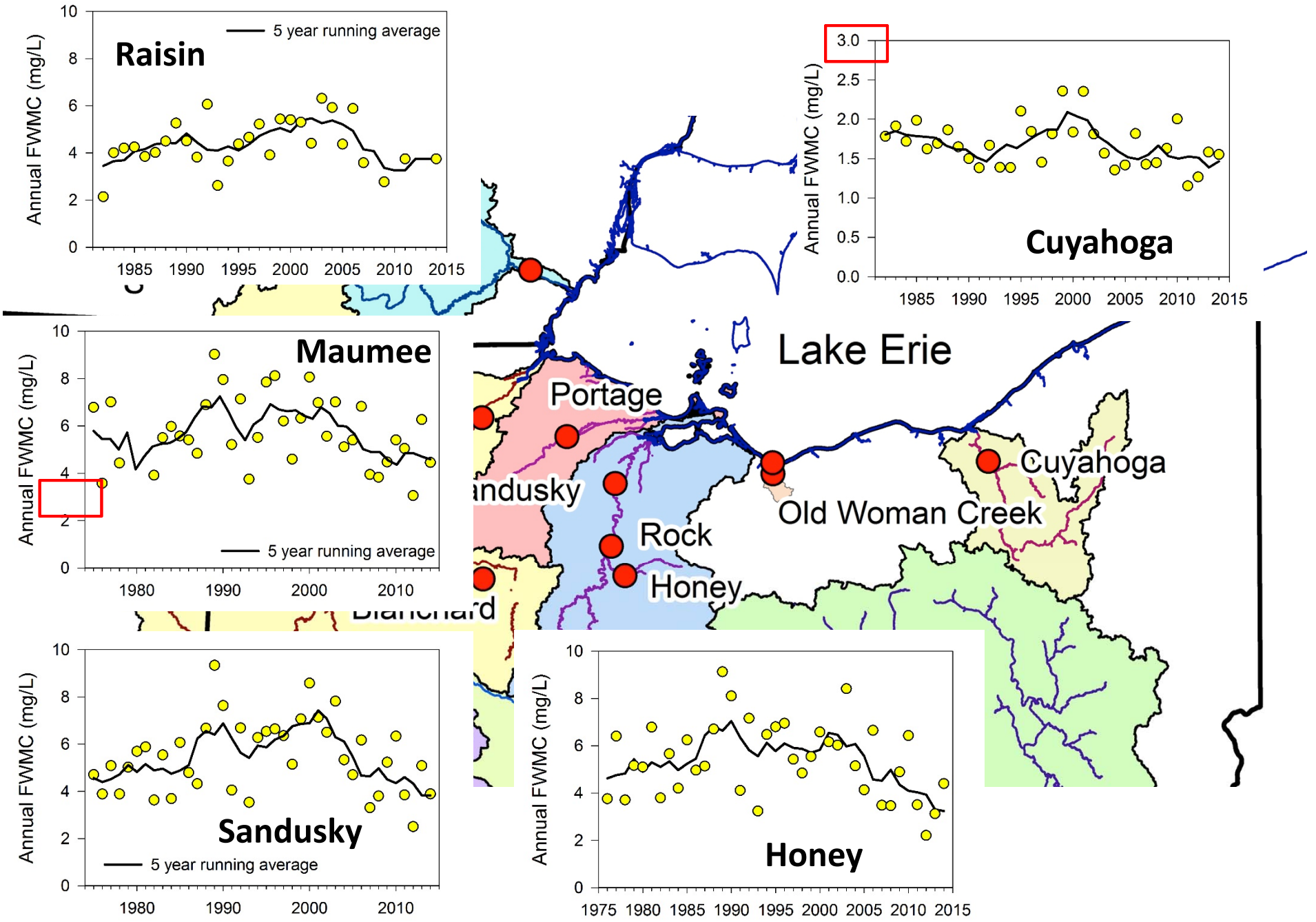

Maumee
5 year running average
Annual FWMC (mg/L)
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1980 1990 2000 2010
Water Year


Sandusky
Annual FWMC (mg/L)
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1980 1990 2000 2010
Water Year

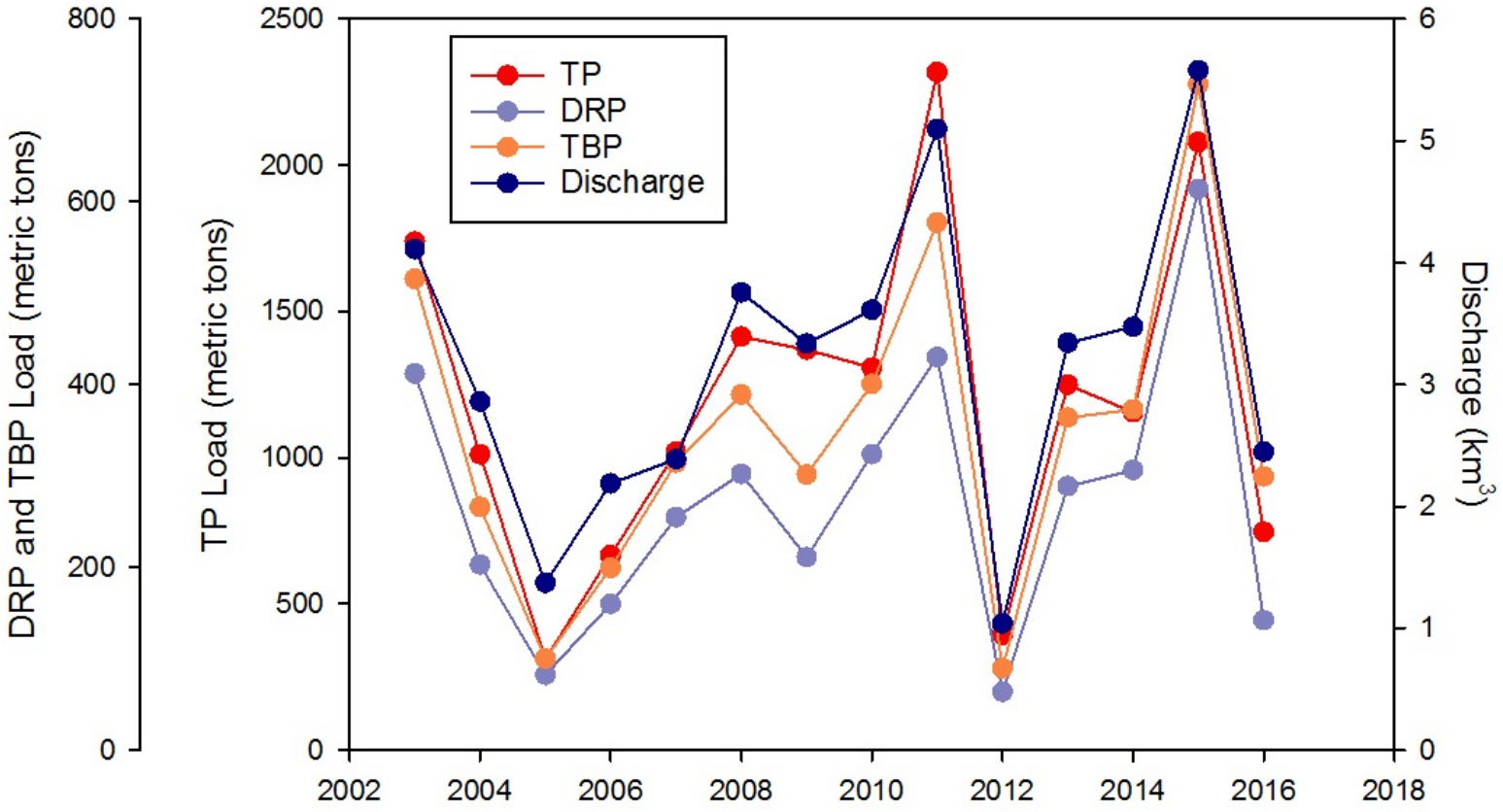

Portage
ndusky
Rock
Honey
Old Woman Creek
Cuyahoga

Cuyahoga
5 year running average
Annual FWMC (mg/L)
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1985 1990 1995 2000 2005 2010 2015
Water Year

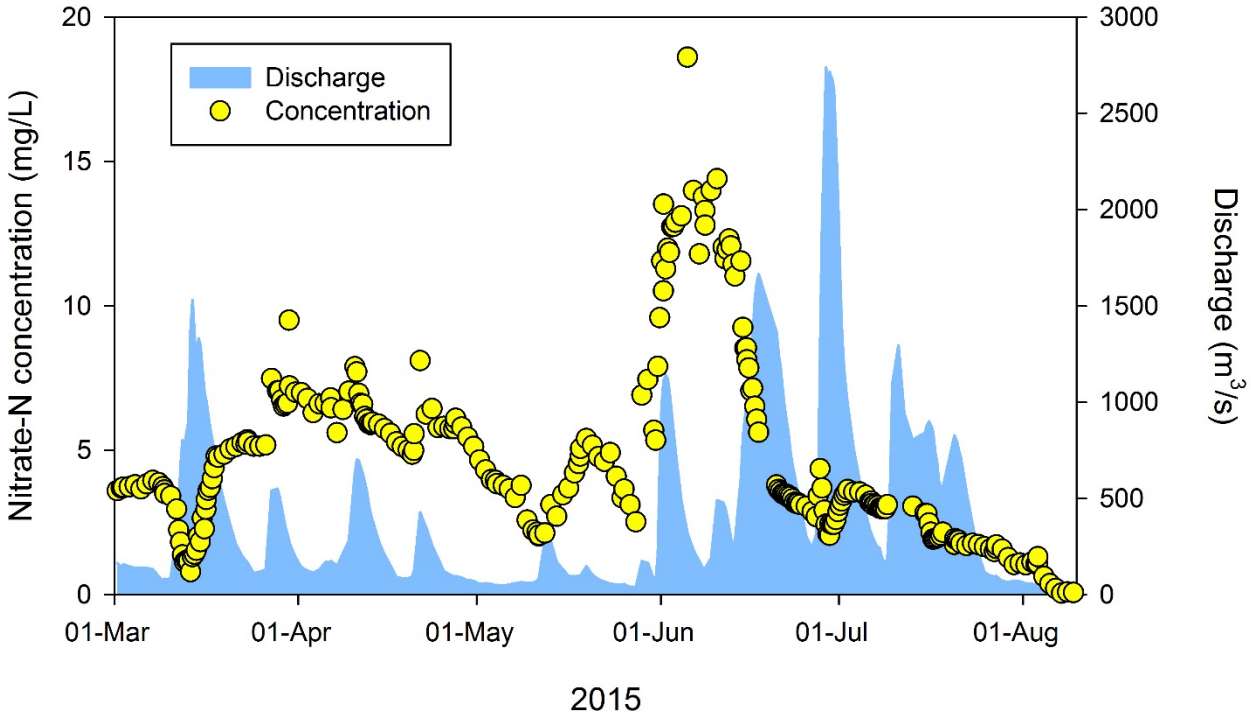

Honey
Annual FWMC (mg/L)
0.25
0.20
0.15
0.10
0.05
0.00
1975 1980 1985 1990 1995 2000 2005 2010 2015
Water Year


Raisin
5 year running average
Annual FWMC (mg/L)
Cuyahoga
Maumee
Sandusky
Honey
Lake Erie
Portage
Cuyahoga
Old Woman Creek
Rock
Honey

Maumee River P loads vary with discharge indicating strong hydrologic control on runoff

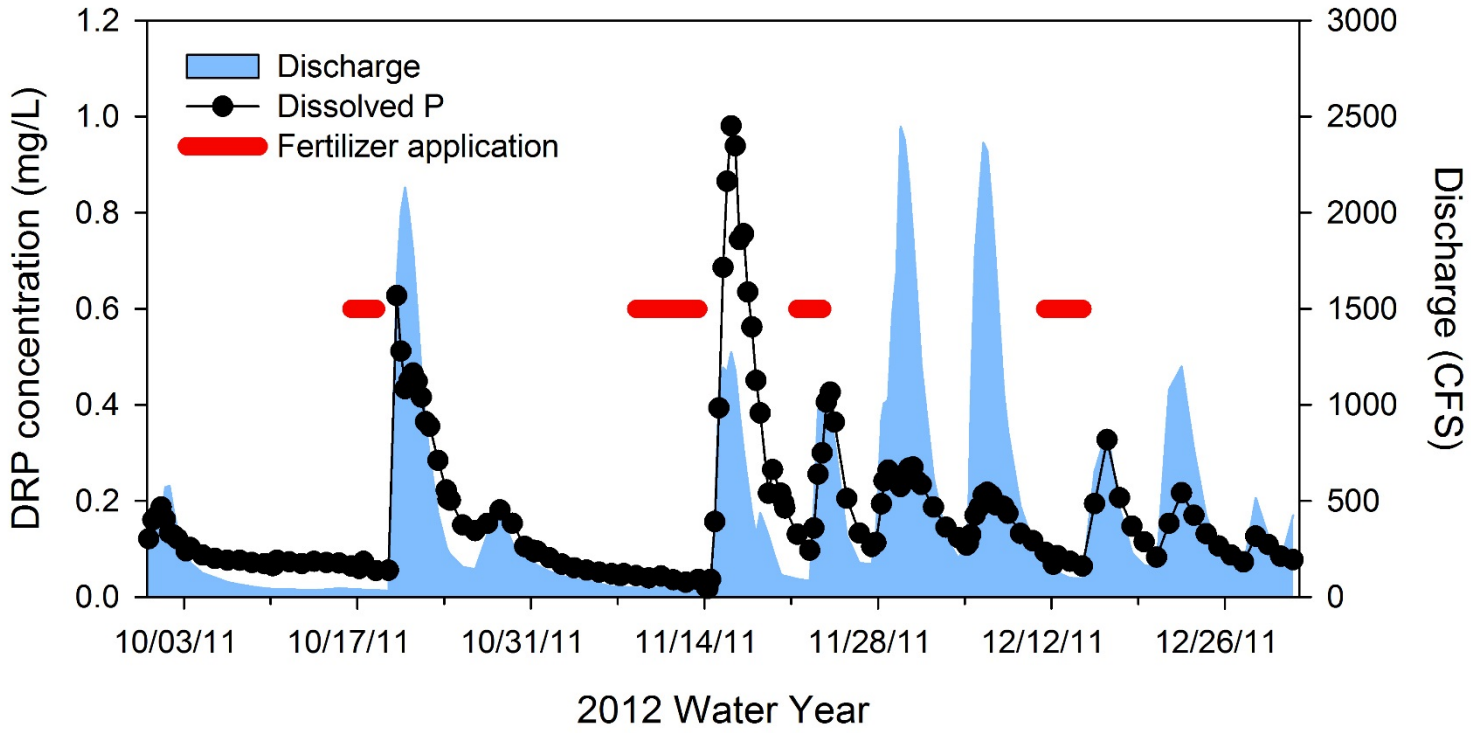


Maumee River dissolved P export is chemostatic- indicating a large source present

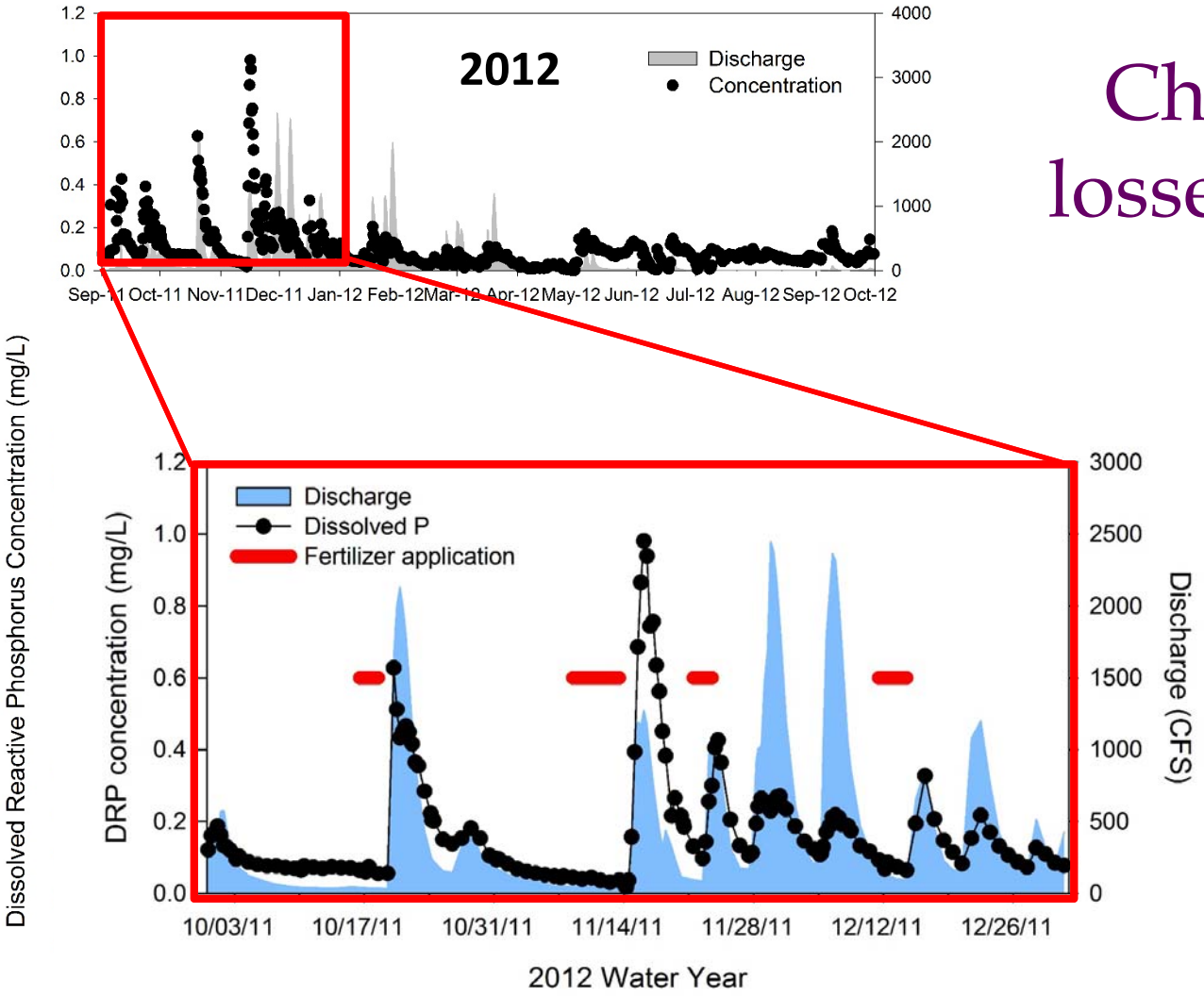


Instances of acute runoff are easy to spot

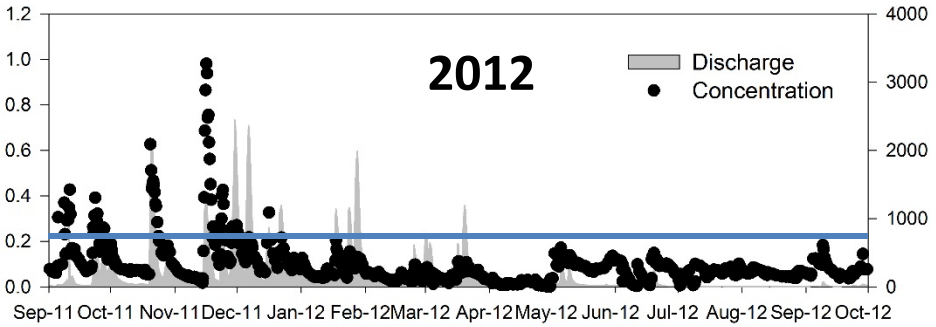
Honey Creek in Fall 2011



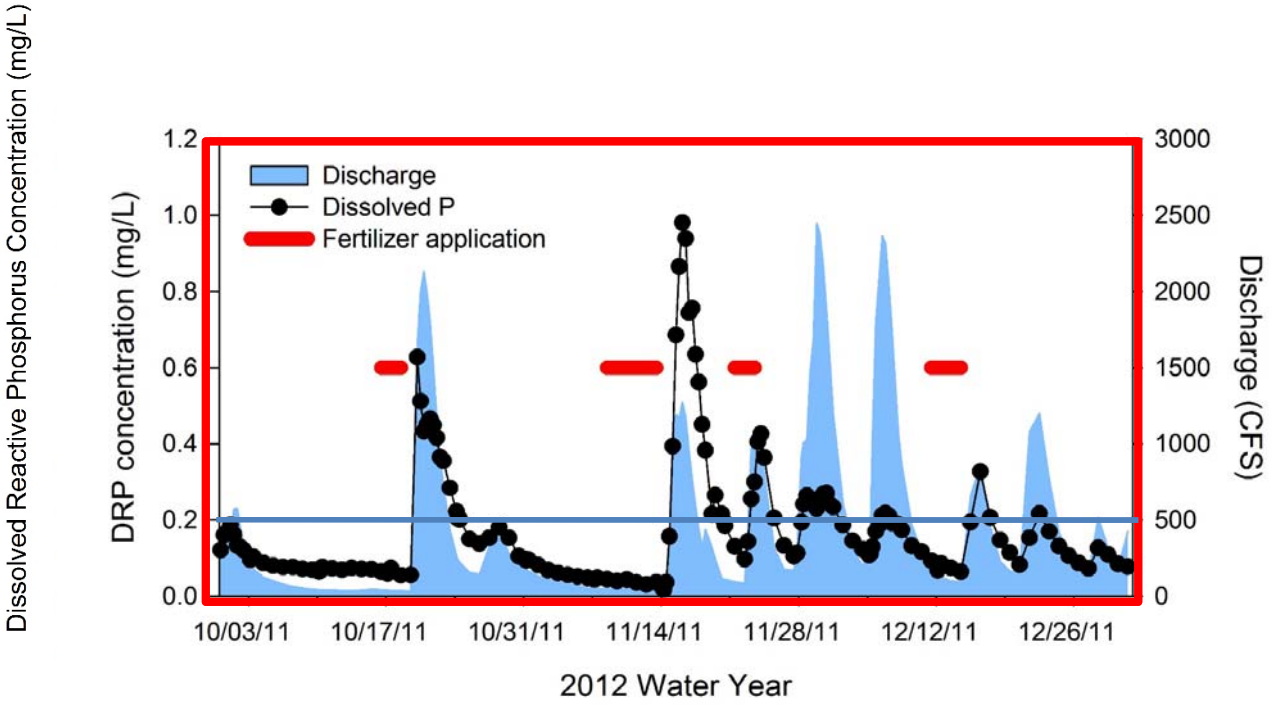
Chronic edaphic losses are prevalent



Honey Creek
2012-2015

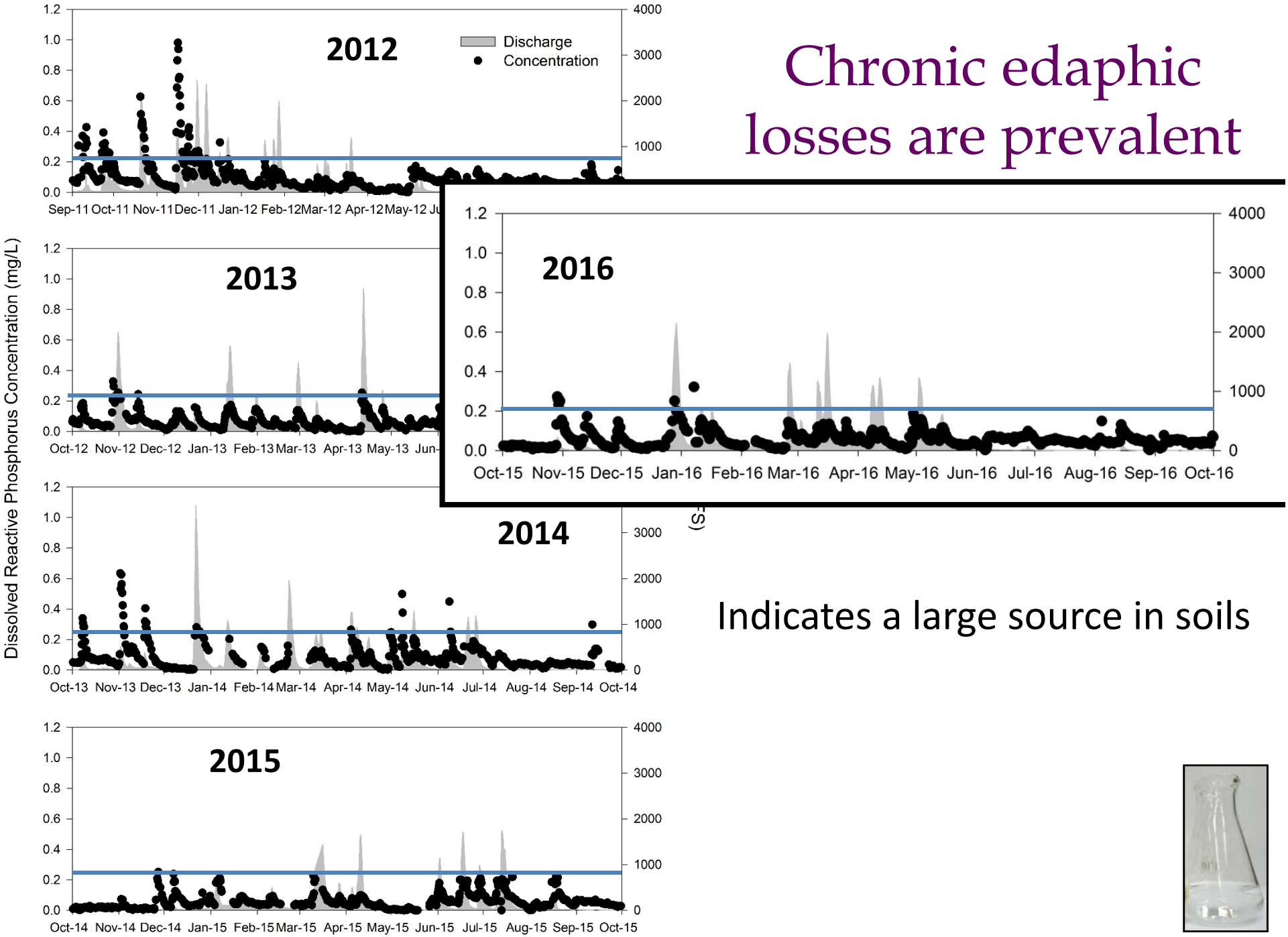


Chronic edaphic losses are prevalent



Honey Creek
2012-2015

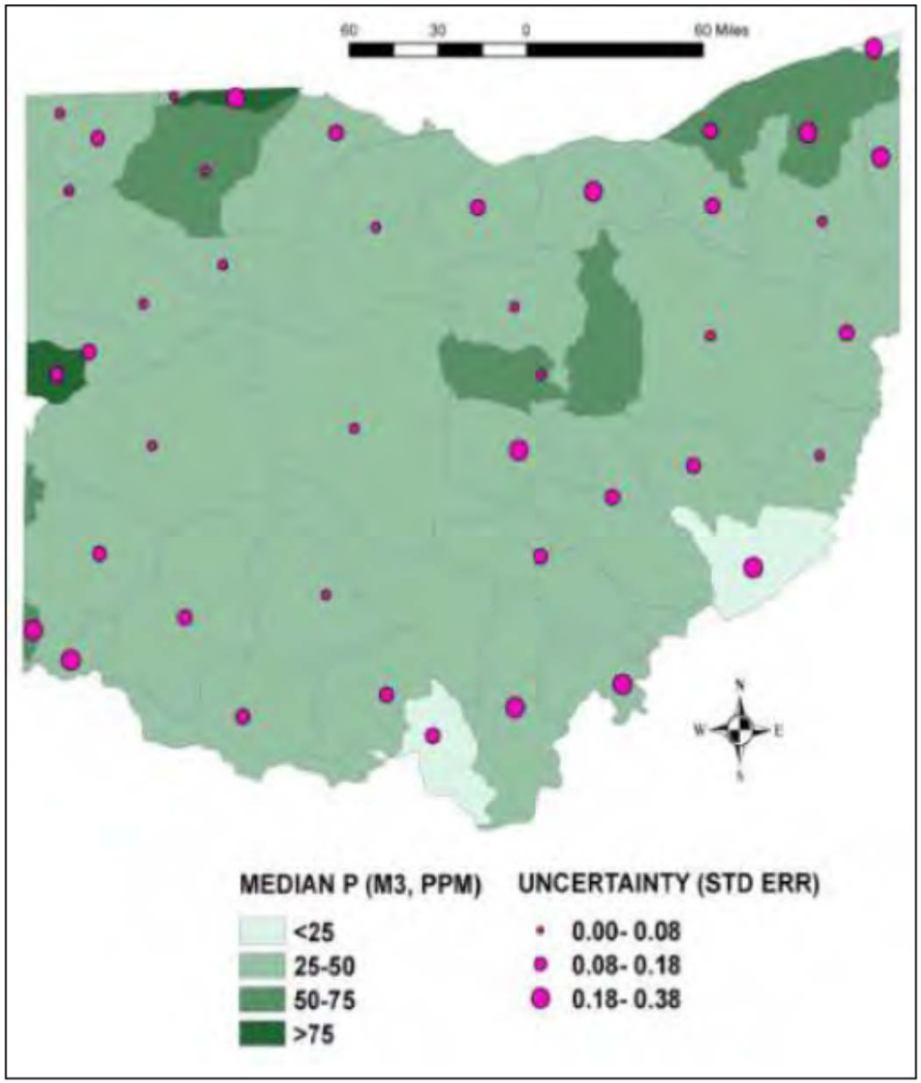
Chronic edaphic losses are prevalent



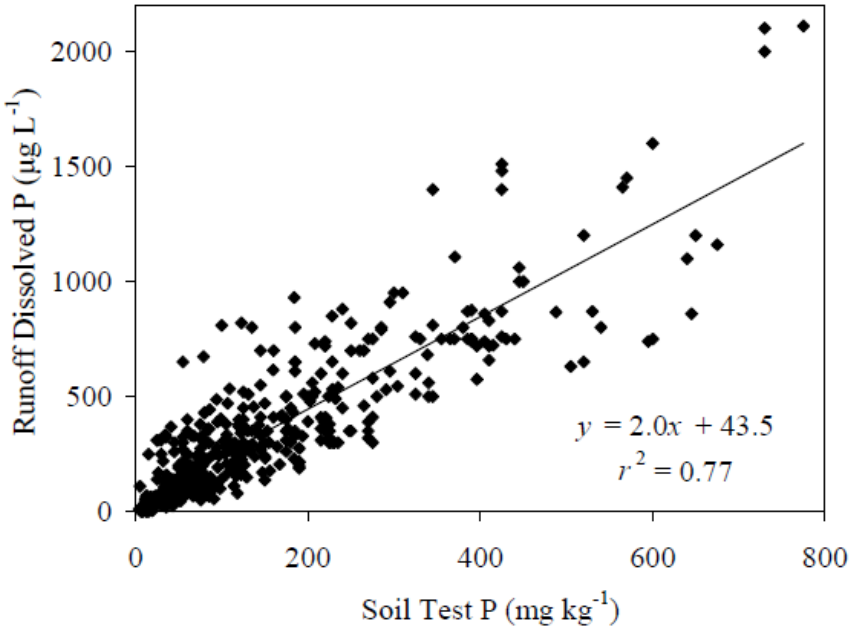
Indicates a large source in soils

Why did dissolved P increase and why does it run off consistently?

Is soil P high indicating over application of fertilizer or manure?



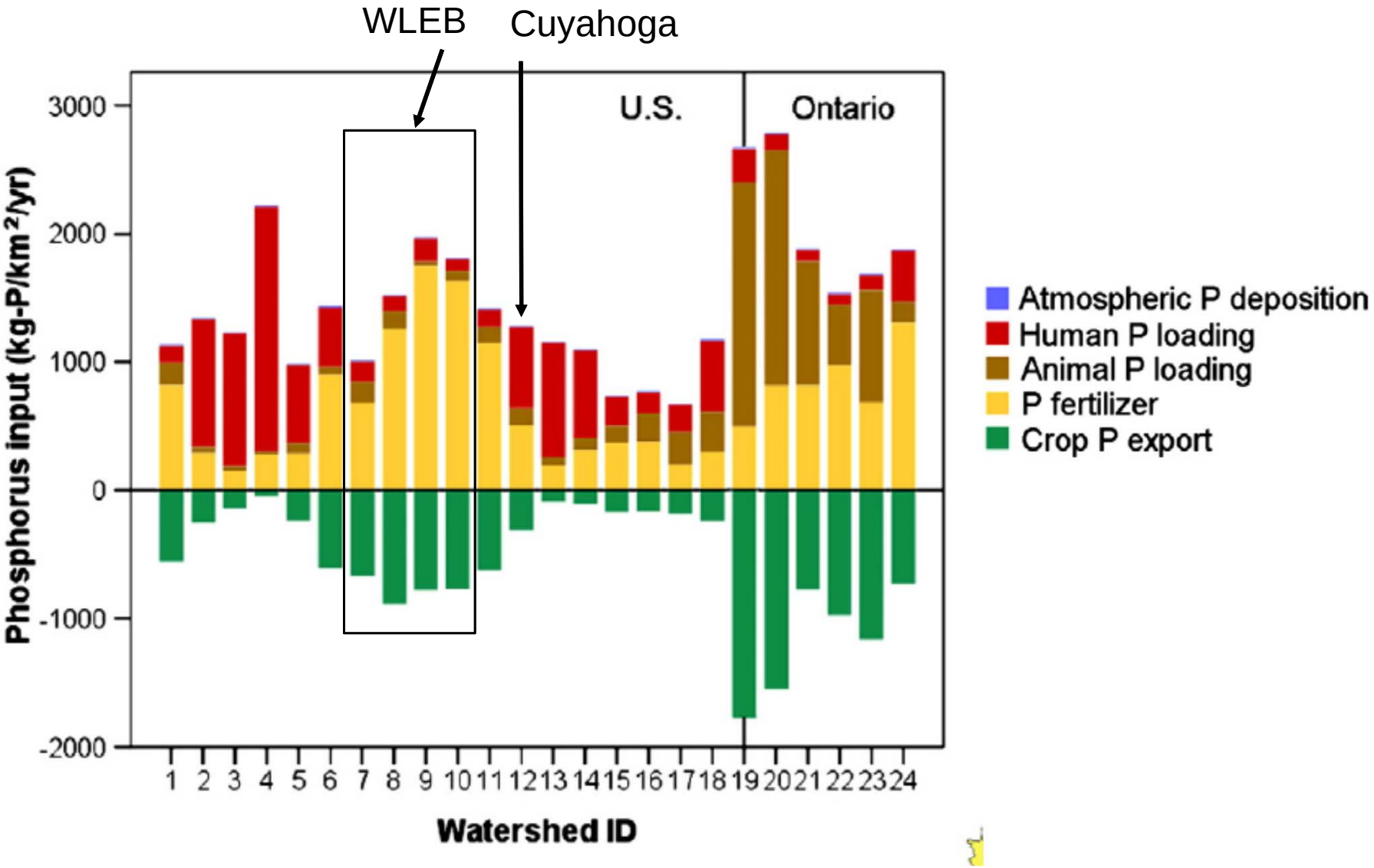
Ohio Phosphorus Taskforce II report



From Vadas et al. 2005

Phosphorus input budget

Scavia et al. 2014



From Sharpley 2003

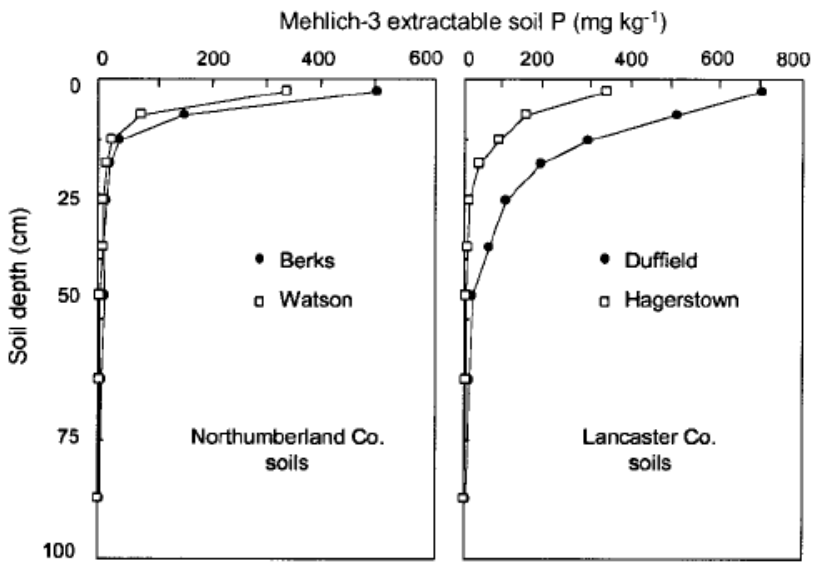
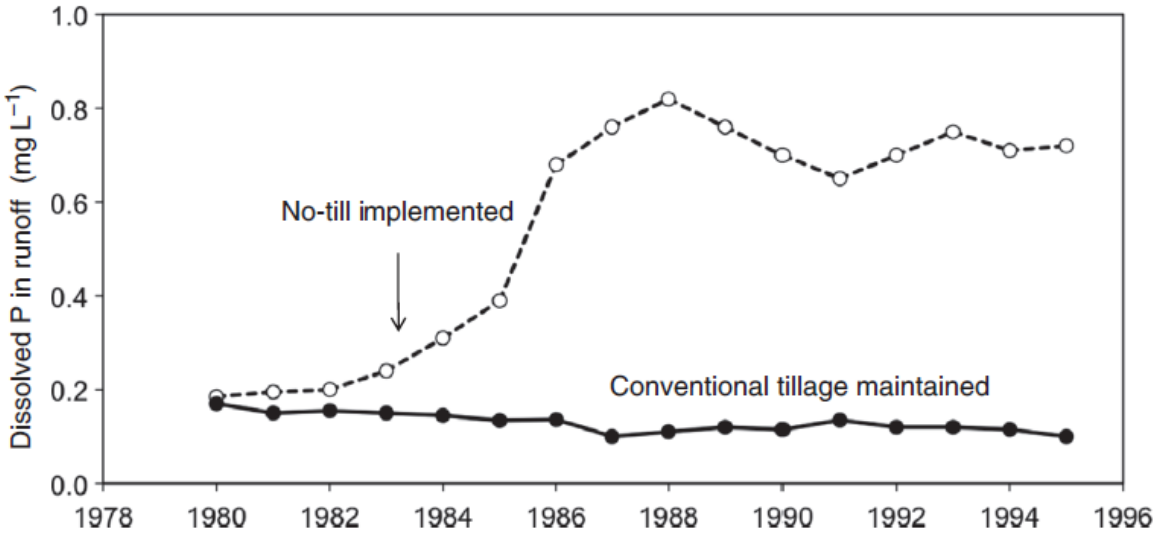


Fig. 1. Mehlich-3 extractable soil P concentration with profile depth for soils in Lancaster and Northumberland counties of Pennsylvania.

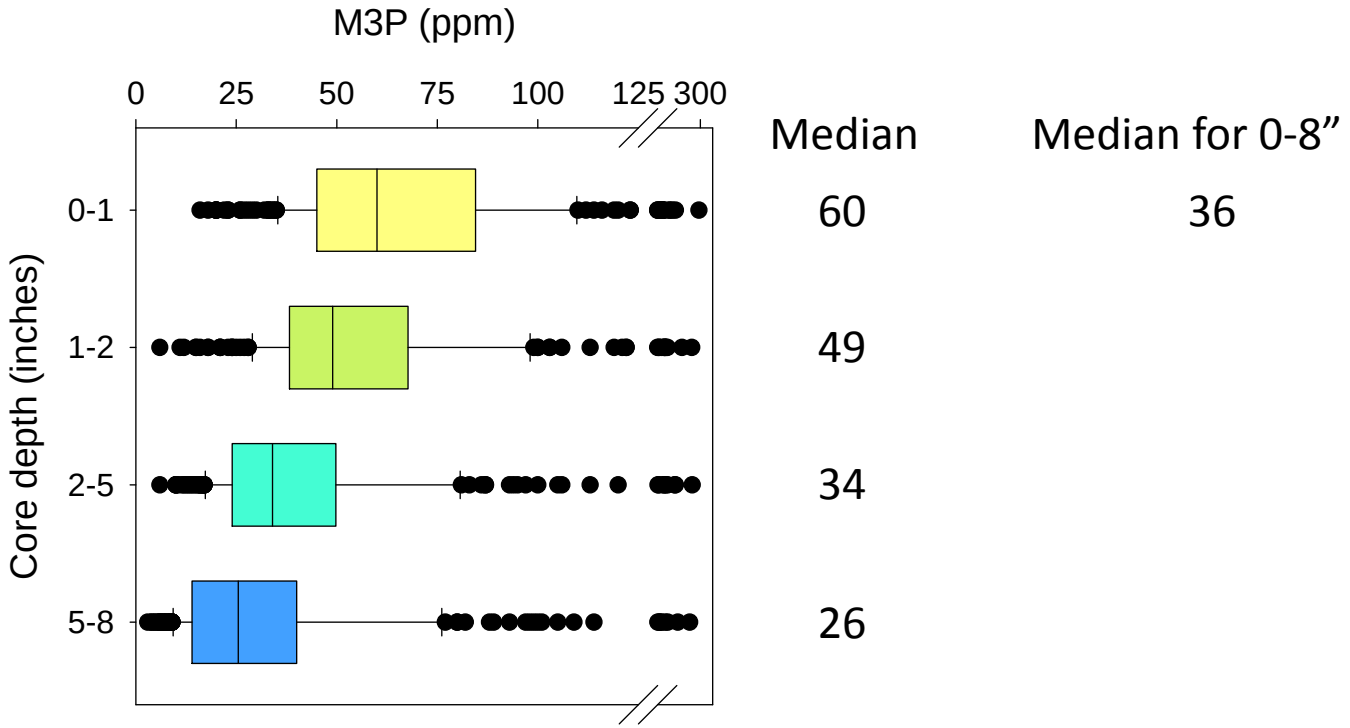
Potential for soil P stratification

- Will stratification develop under rotational no-till with commercial fertilizer use?



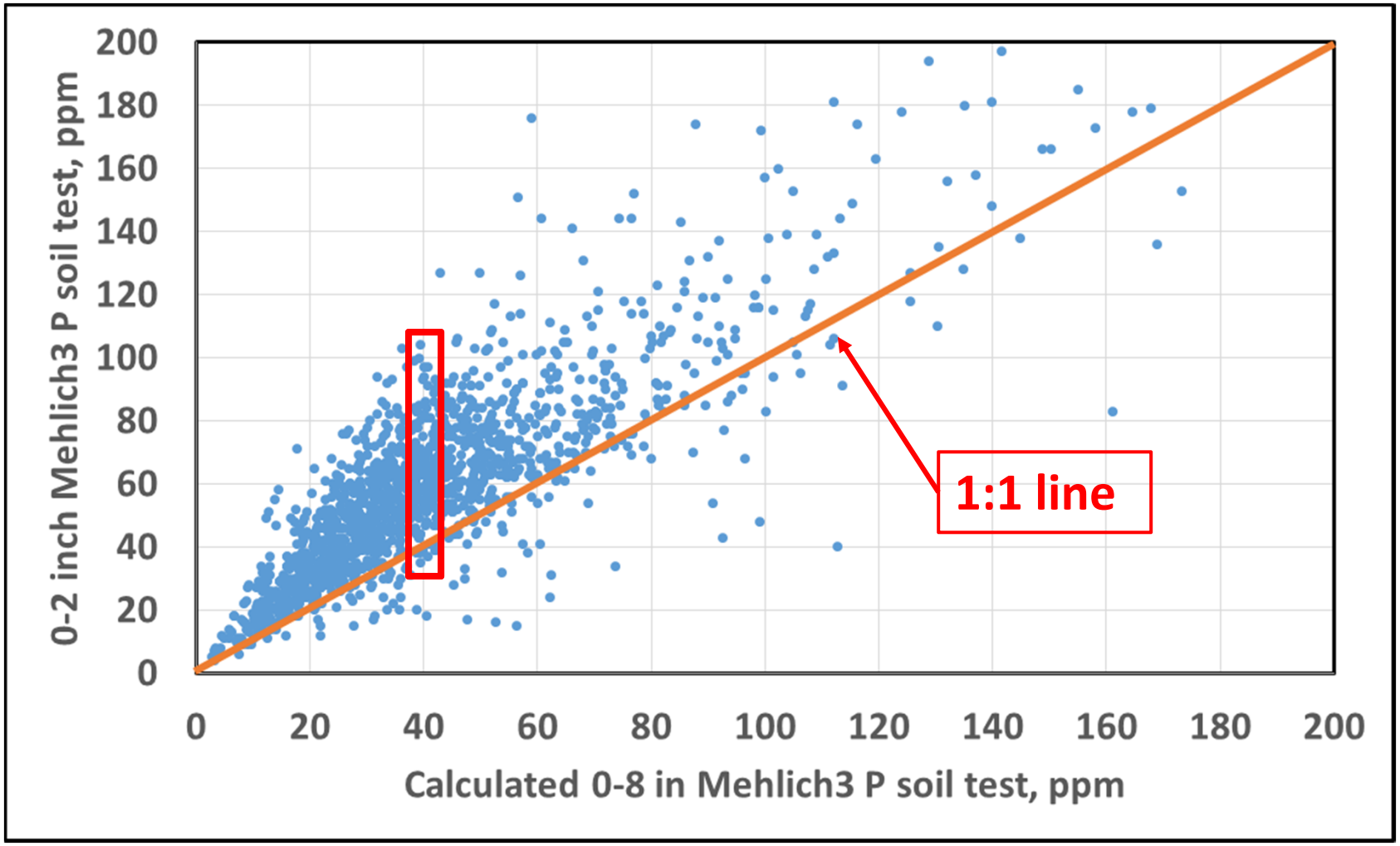
From Kleinman et al. 2011

Soil test P at varying depths across the Sandusky River watershed

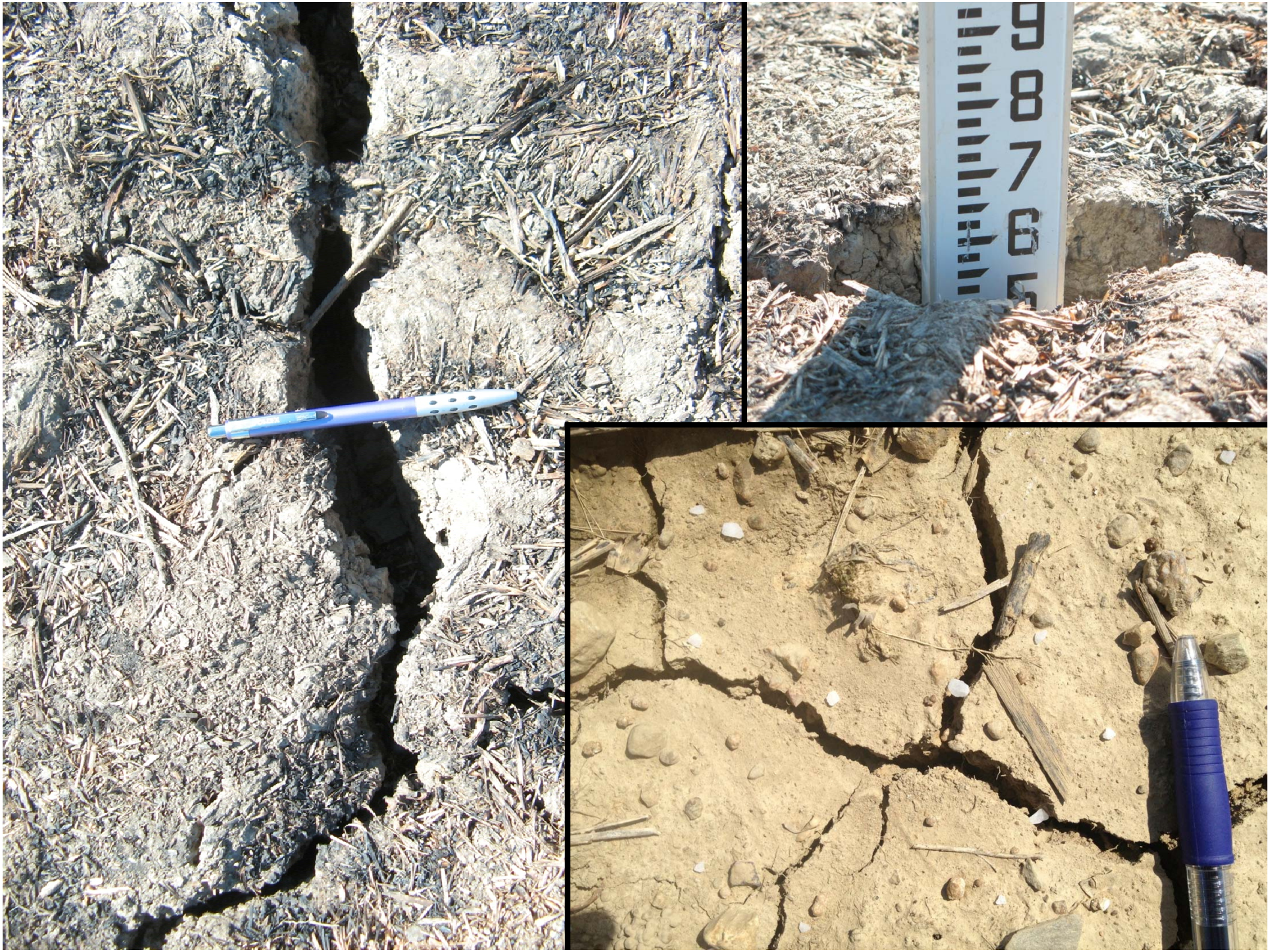


- Top 1” is 40% higher than 0-8”
- If we reduced the top 2” to the mean of the 8” core, we’d reduce the risk for runoff by 28%

Comparing the 0-2” STP to 0-8” STP



Note: 0-2 inch samples vary greatly at a given 0-8 in sample. Can’t predict 0-2 inch value from 0-8 inch value.

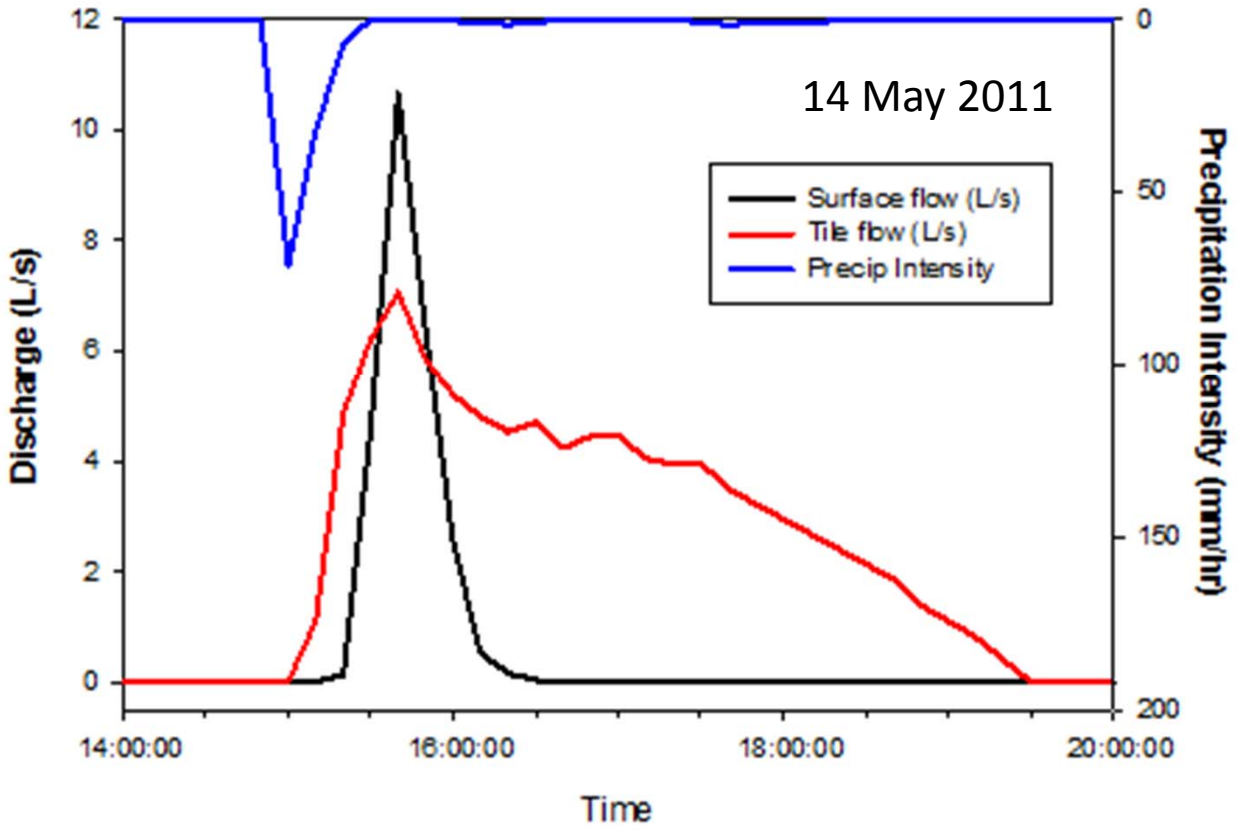

9
8
7
6

Evidence of macropore tile drain flow

Data from Doug Smith, USDA-ARS

St. Joseph River watershed

- Tile drain flow peaked with surface flow at in a May 2011 storm

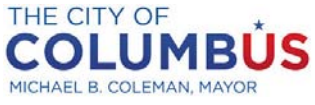


Smith et al. 2014, JEQ

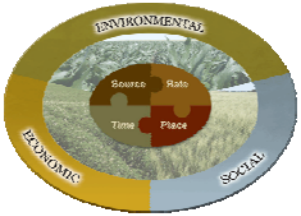
To reduce dissolved P loss, we need to control P stratification and improve nutrient management

- >80% of dissolved P load from tile drainage
- Losses are only ~1% of inputs
- Soil phosphorus is at recommended levels
- **Soil phosphorus must be in the wrong place and recommended STP may be too high!**

Heidelberg Tributary Loading Program – Current Sponsors



Sponsors of Current Research Projects



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