

The Heidelberg Tributary Loading Program: *Keeping a Finger on the Pulse of Ohio's Watersheds*

Laura Johnson

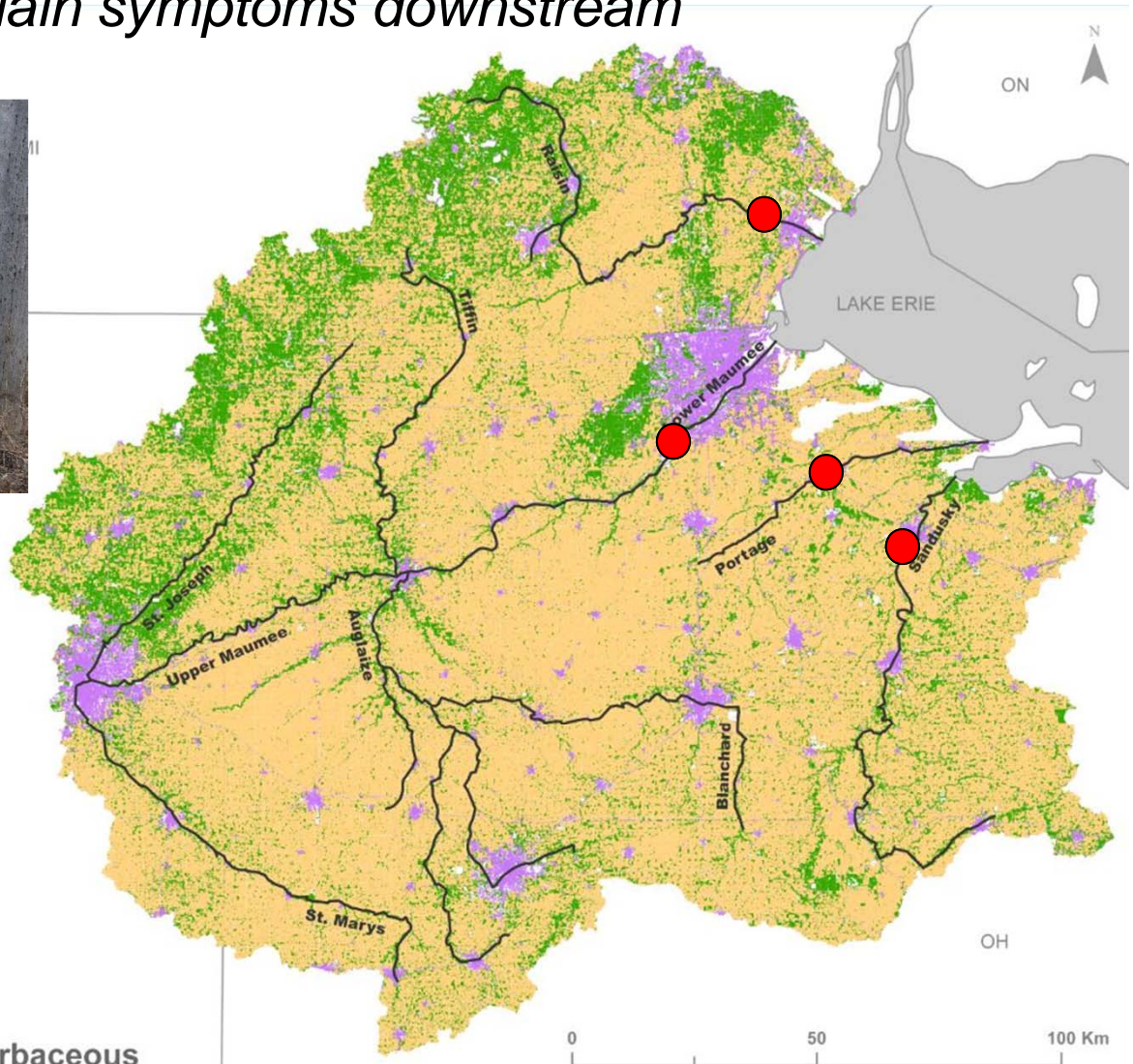


Why monitor rivers?

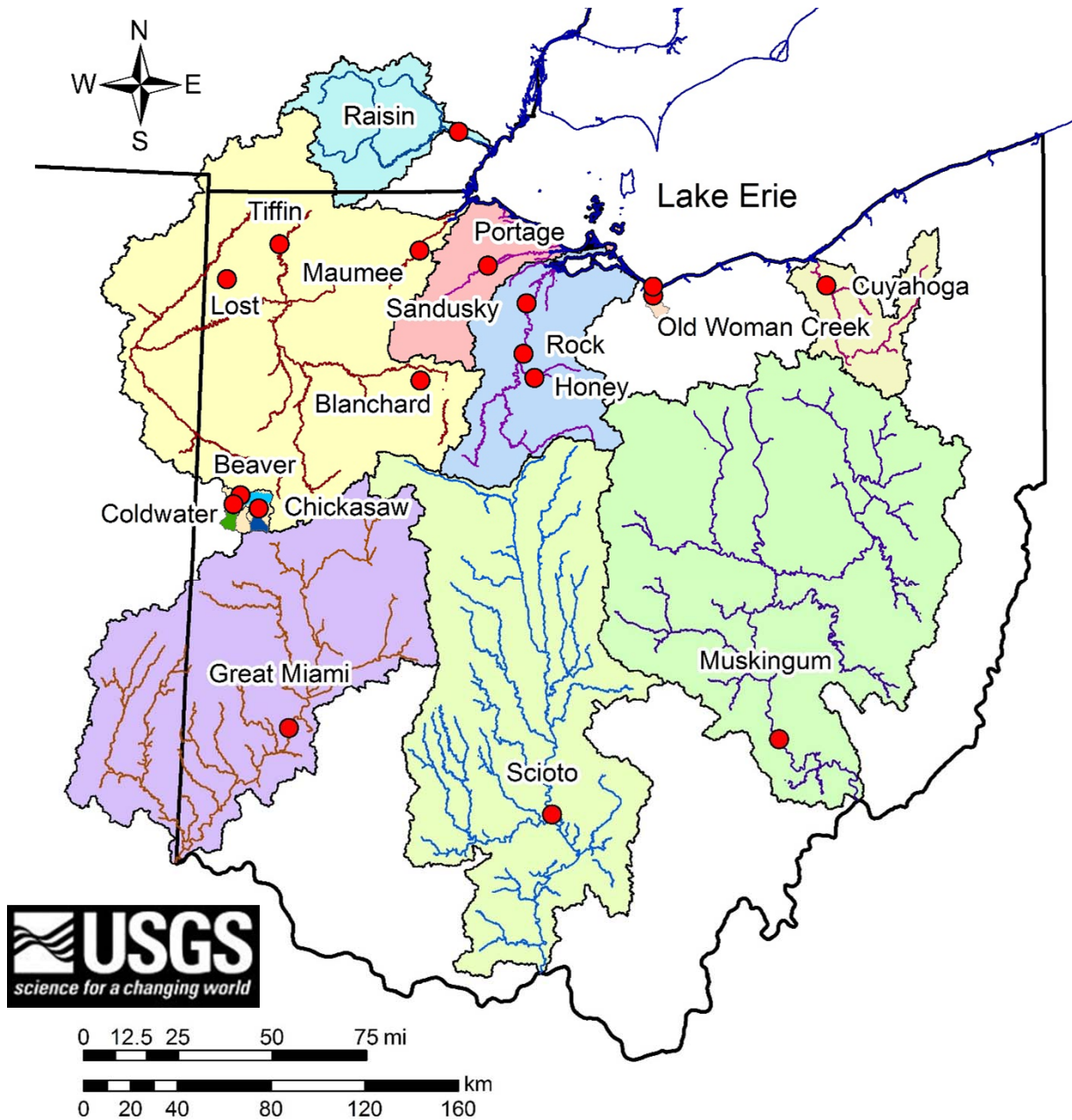
*Reflects health of entire system upstream,
and explain symptoms downstream*

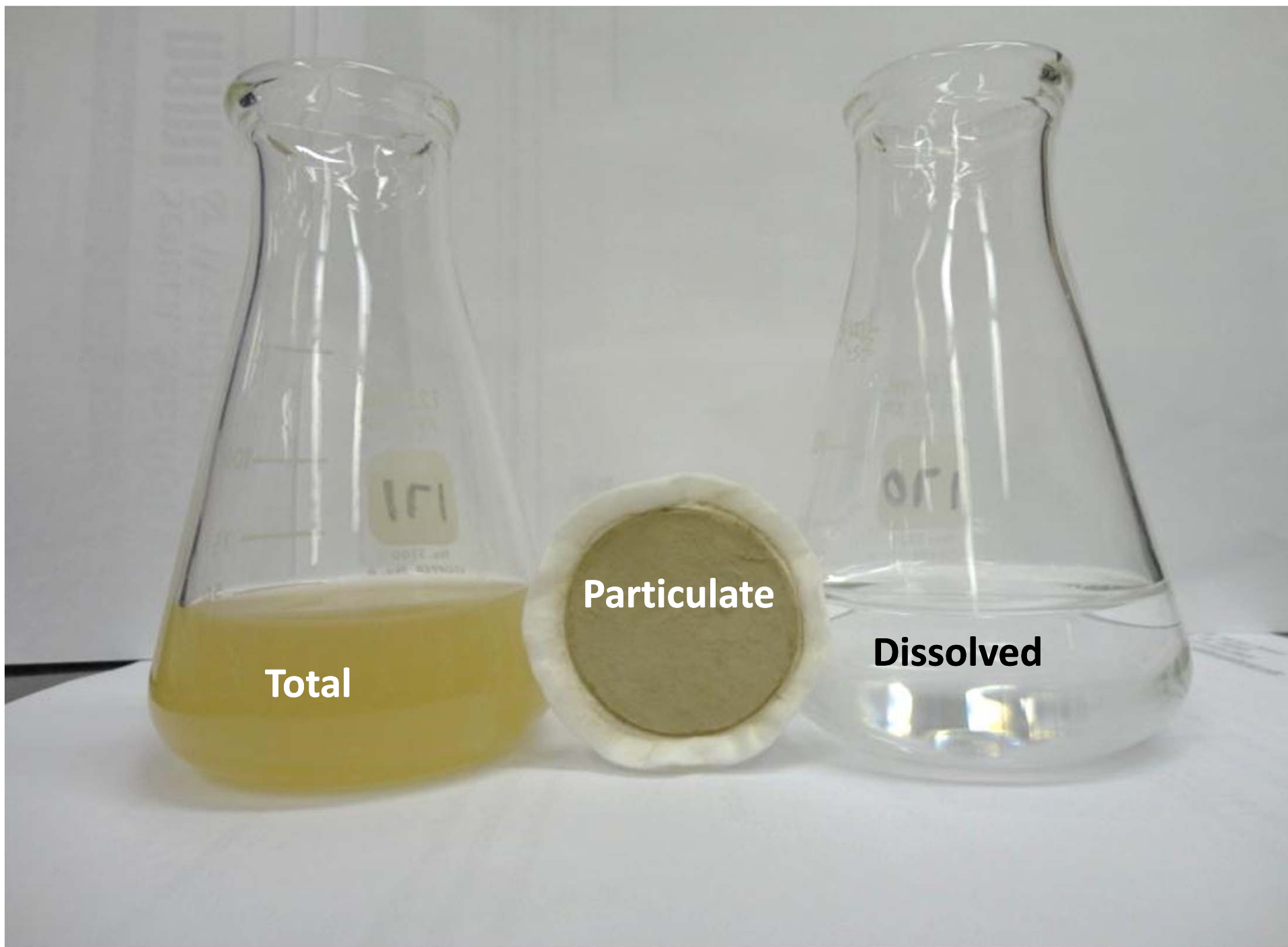


- Agricultural
- Developed
- Forested/Herbaceous



Heidelberg Tributary Loading Program





Total

Particulate

Dissolved

Load
Mass/time
Metric tons/year



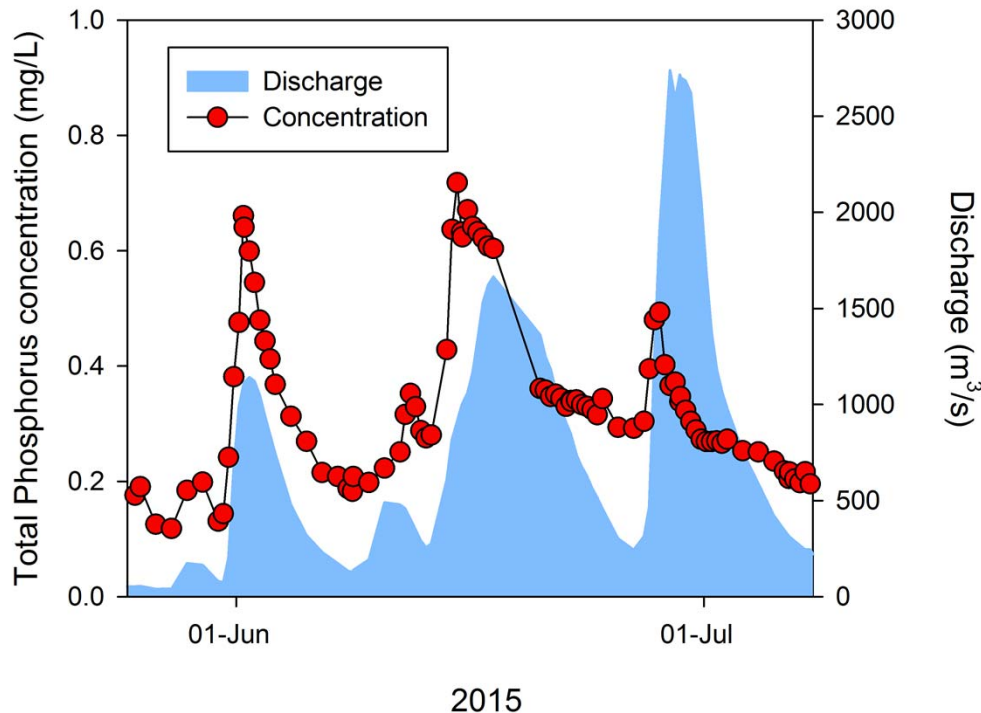
Concentration
Mass/H₂O volume
mg/L



Discharge
H₂O volume/time
m³/s

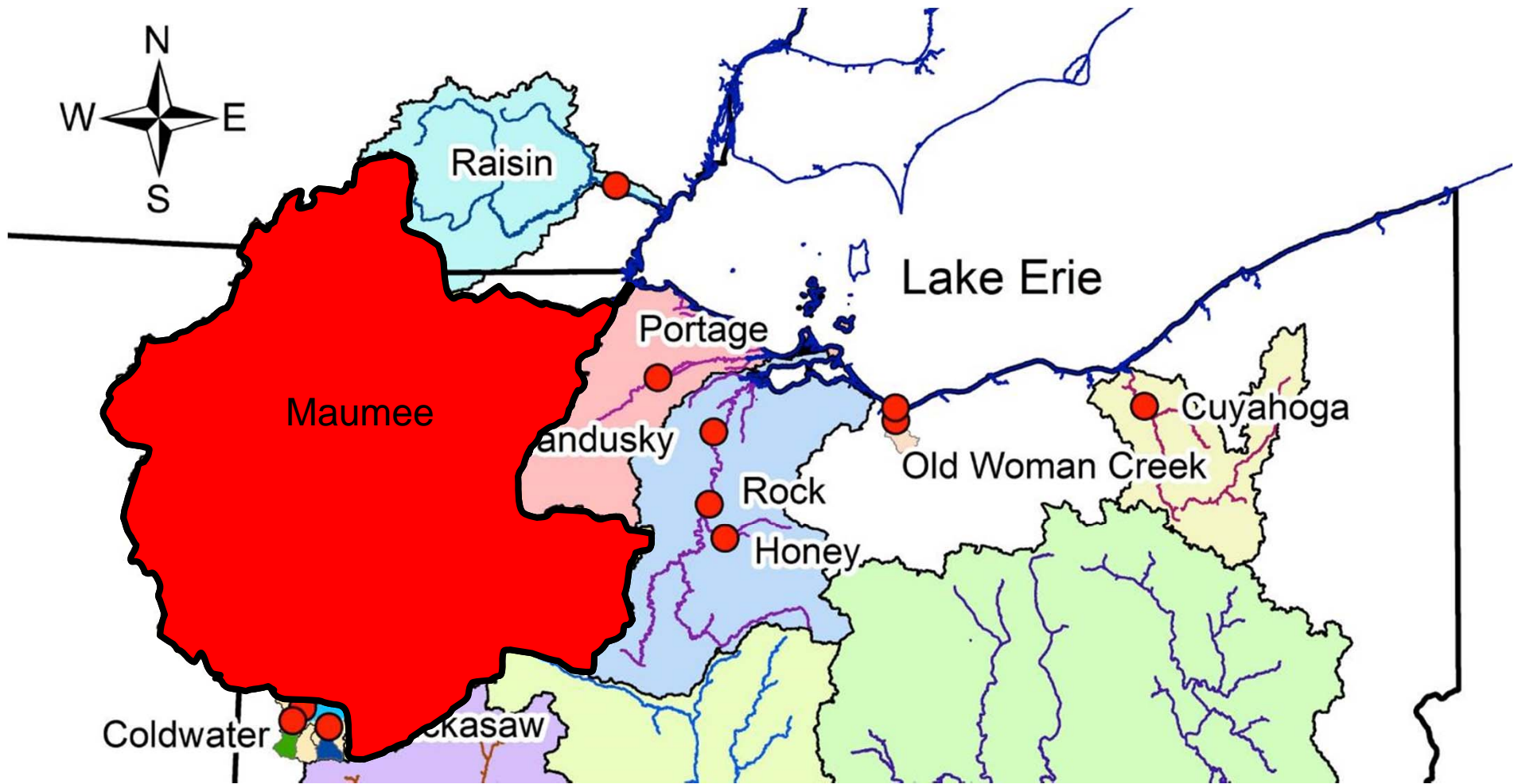


What is the average concentration?



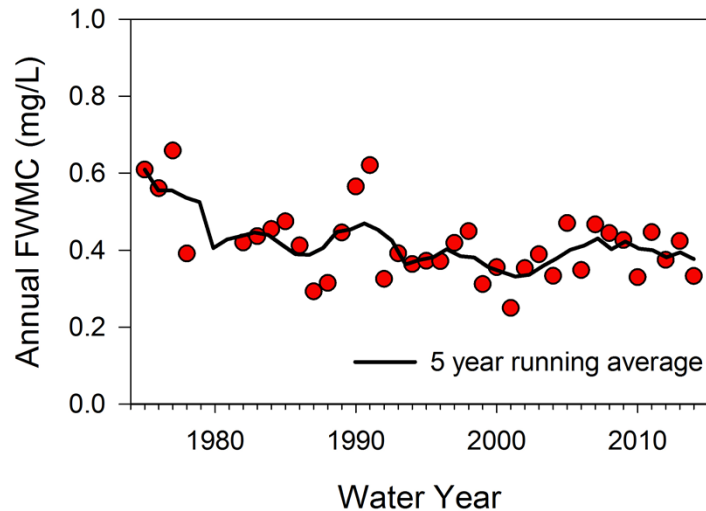
$$\text{Flow weighted mean concentration} = \frac{\text{Load}}{\text{Discharge}}$$

- Add up all samples, divide by number of samples
0.339 mg/L
- Calculate average with even time intervals, i.e., time weighted
0.306 mg/L
What you would experience if living in the river over time
- Calculate average with even flow intervals, i.e., flow weighted
0.377 mg/L
If you captured all the water in a bucket and sampled that



Maumee is the largest tributary to any of the Great Lakes

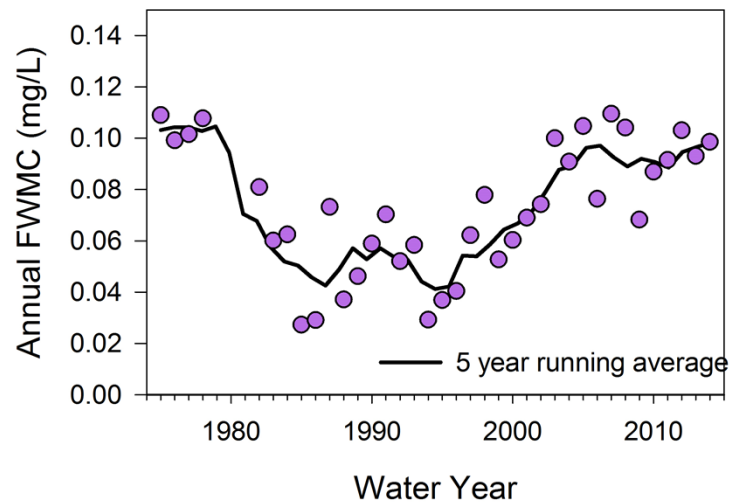
Total Phosphorus
Annual Flow-Weighted Mean Concentration

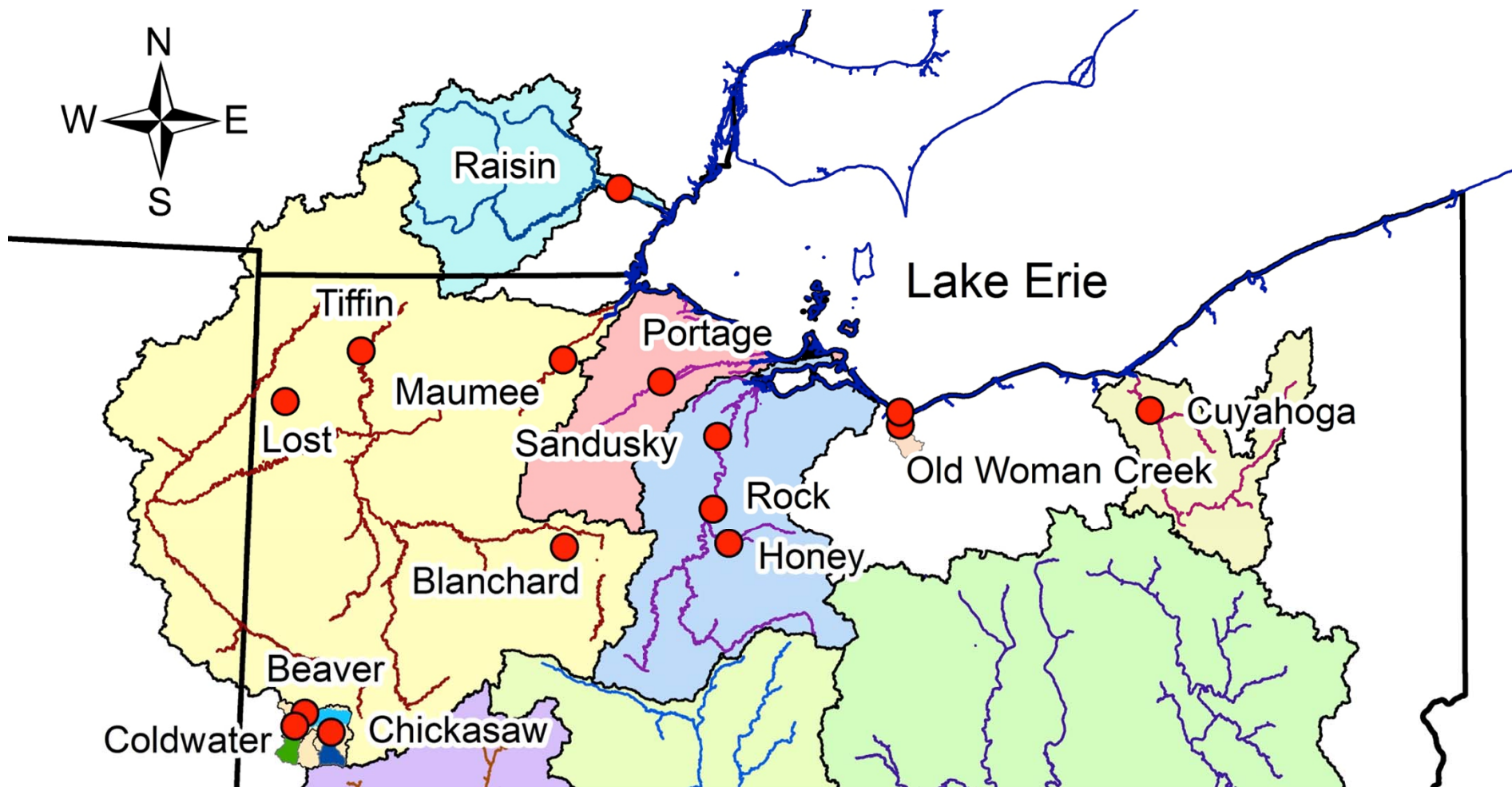


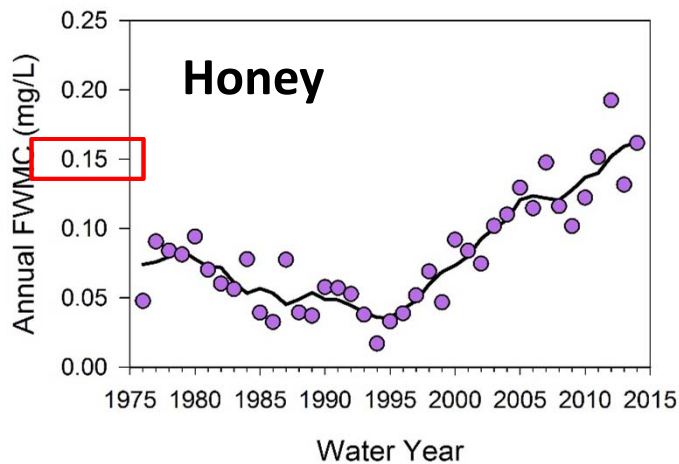
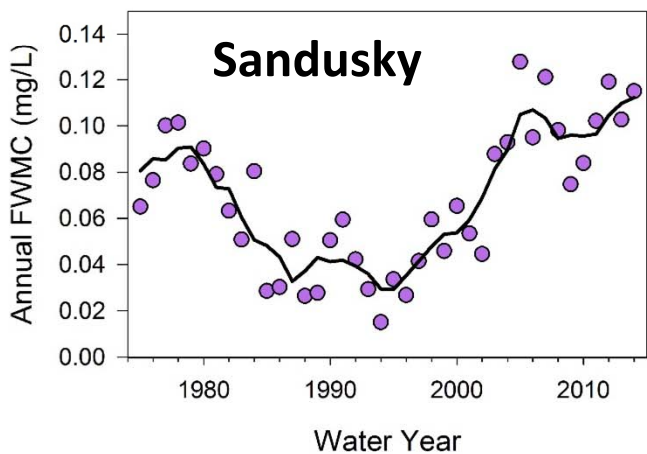
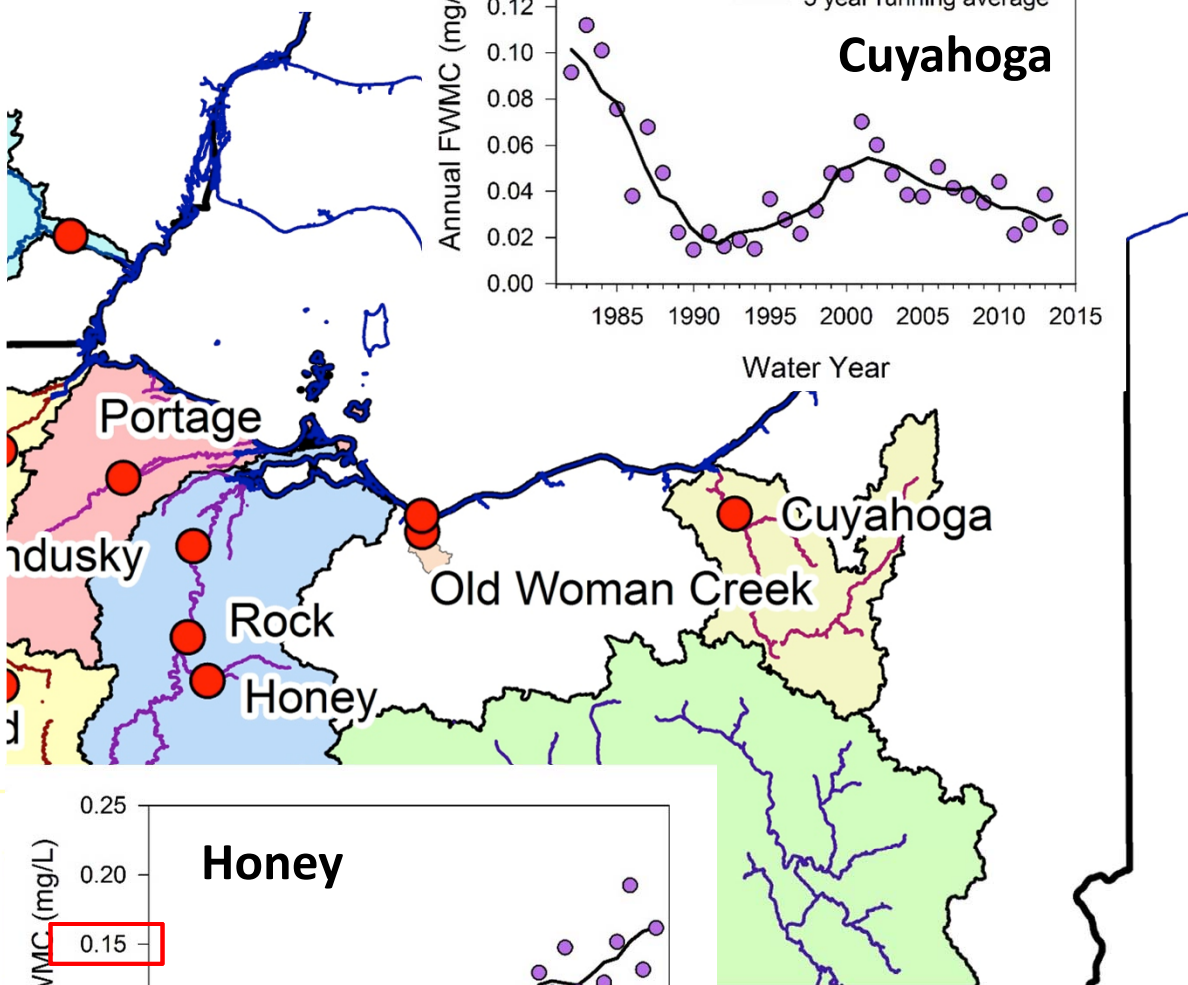
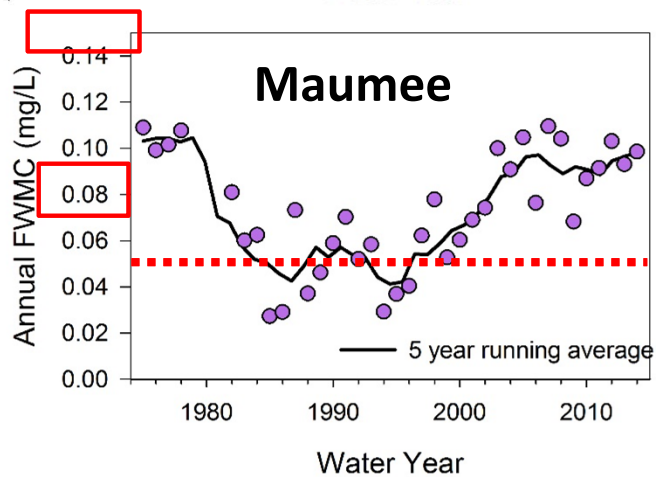
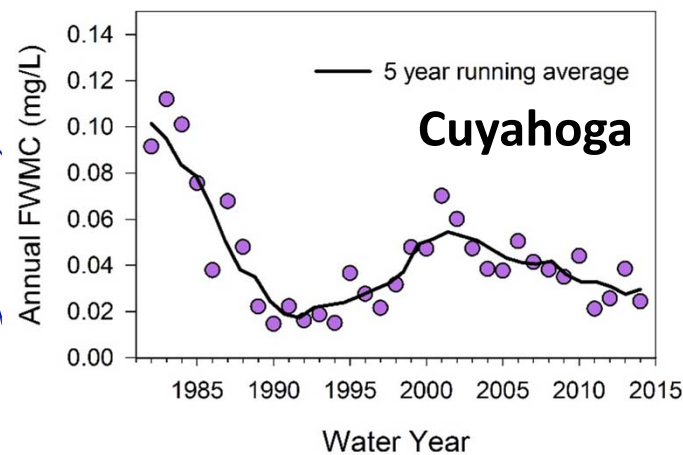
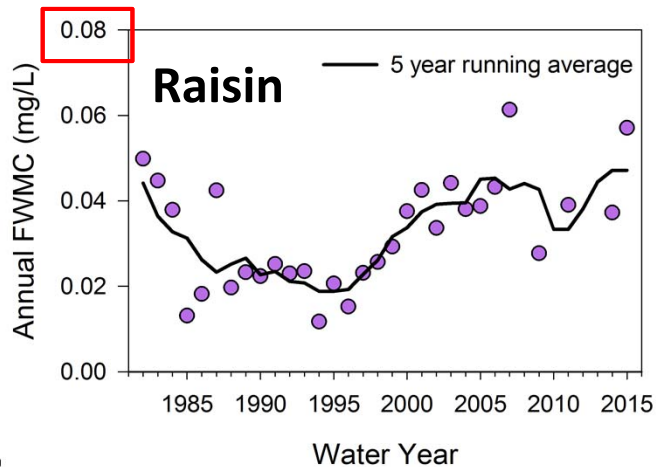
Maumee River trends

- Total P has decreased slightly over time
- Dissolved P has increased almost 2 fold since the mid-1990s
- Do we see this pattern elsewhere?

Dissolved Reactive Phosphorus
Annual Flow-Weighted Mean Concentration



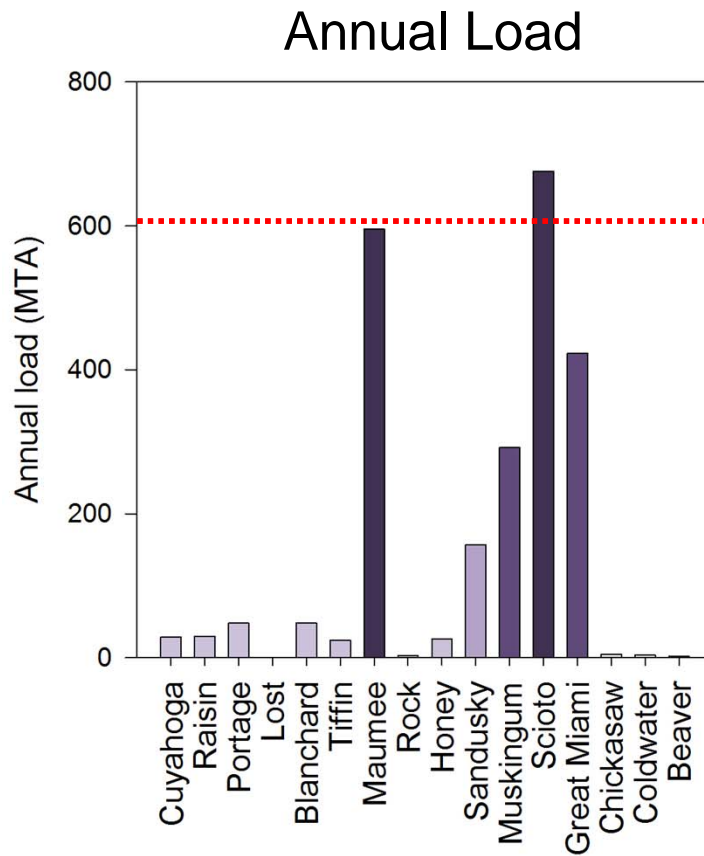




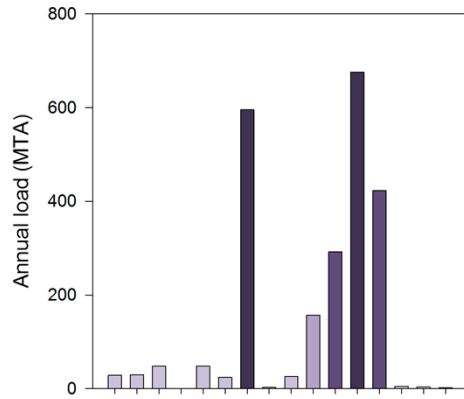
How can we compare across
watersheds without long-term data?

Comparing watersheds

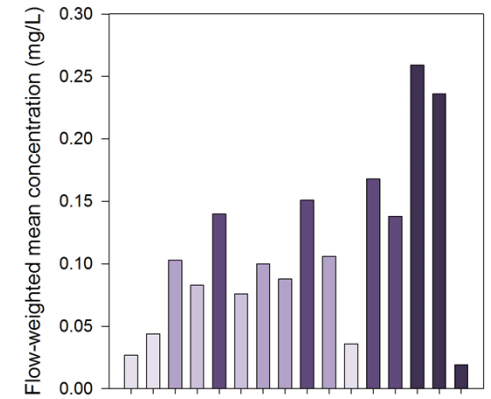
5 year average



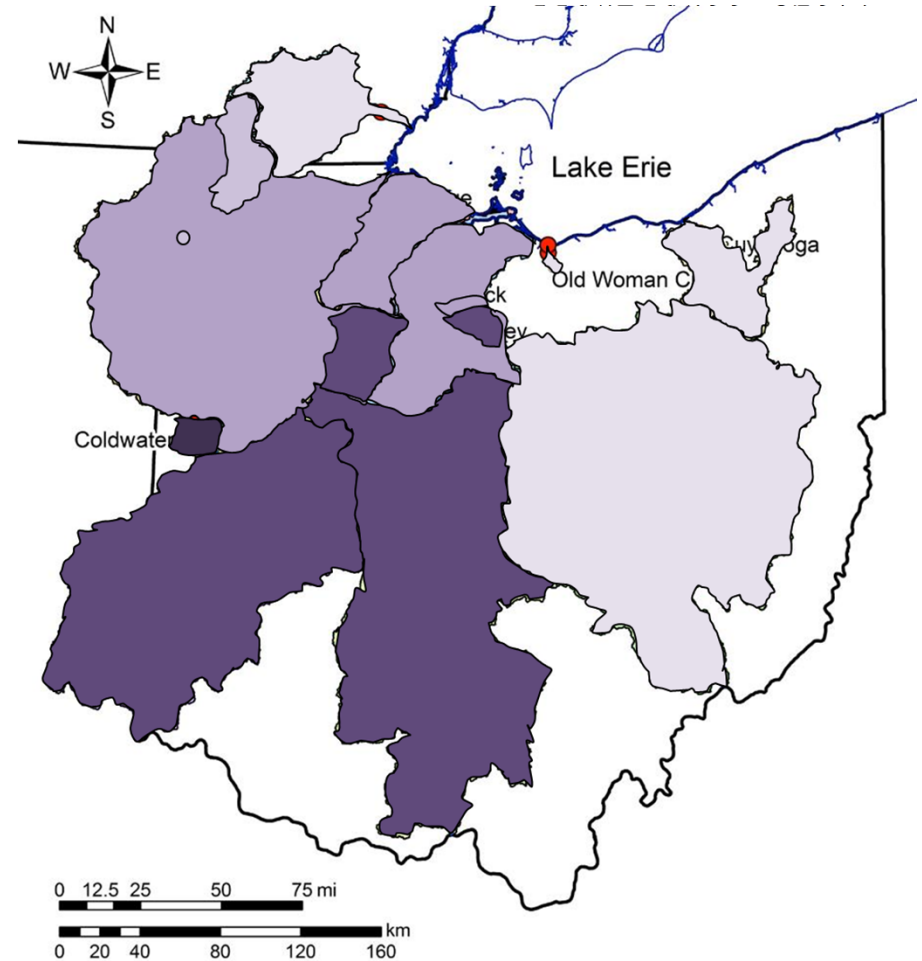
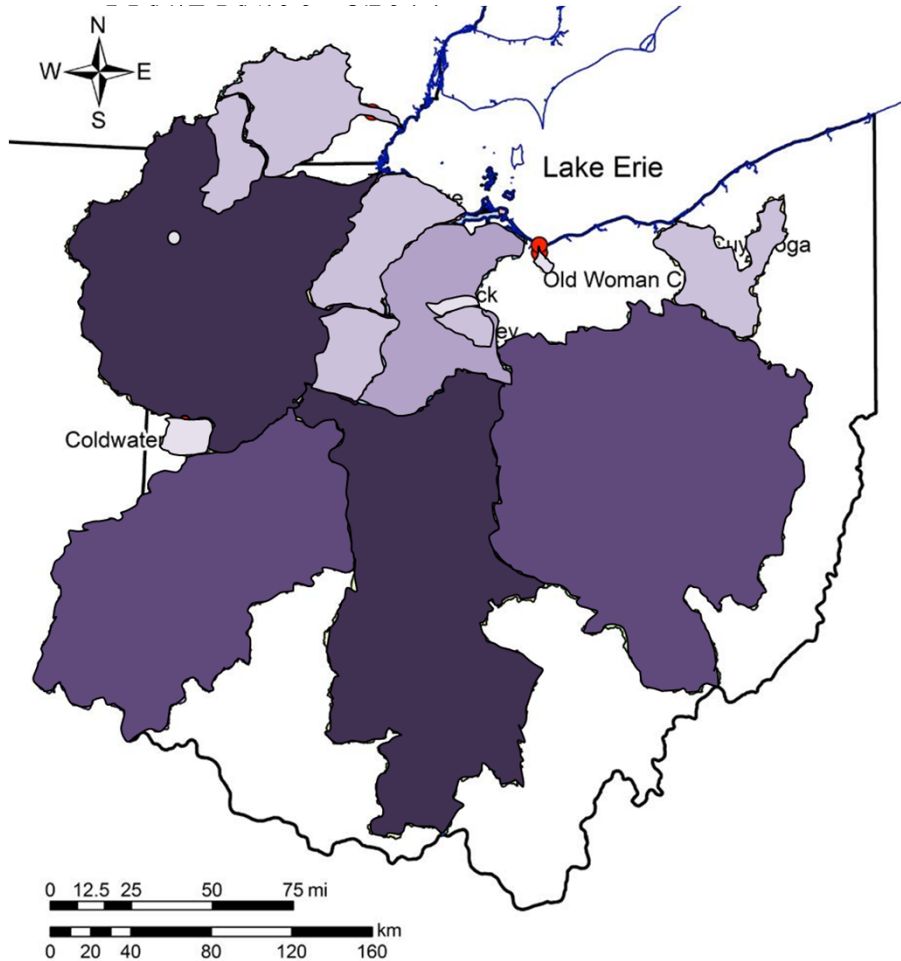
Comparing watersheds *5 year average*



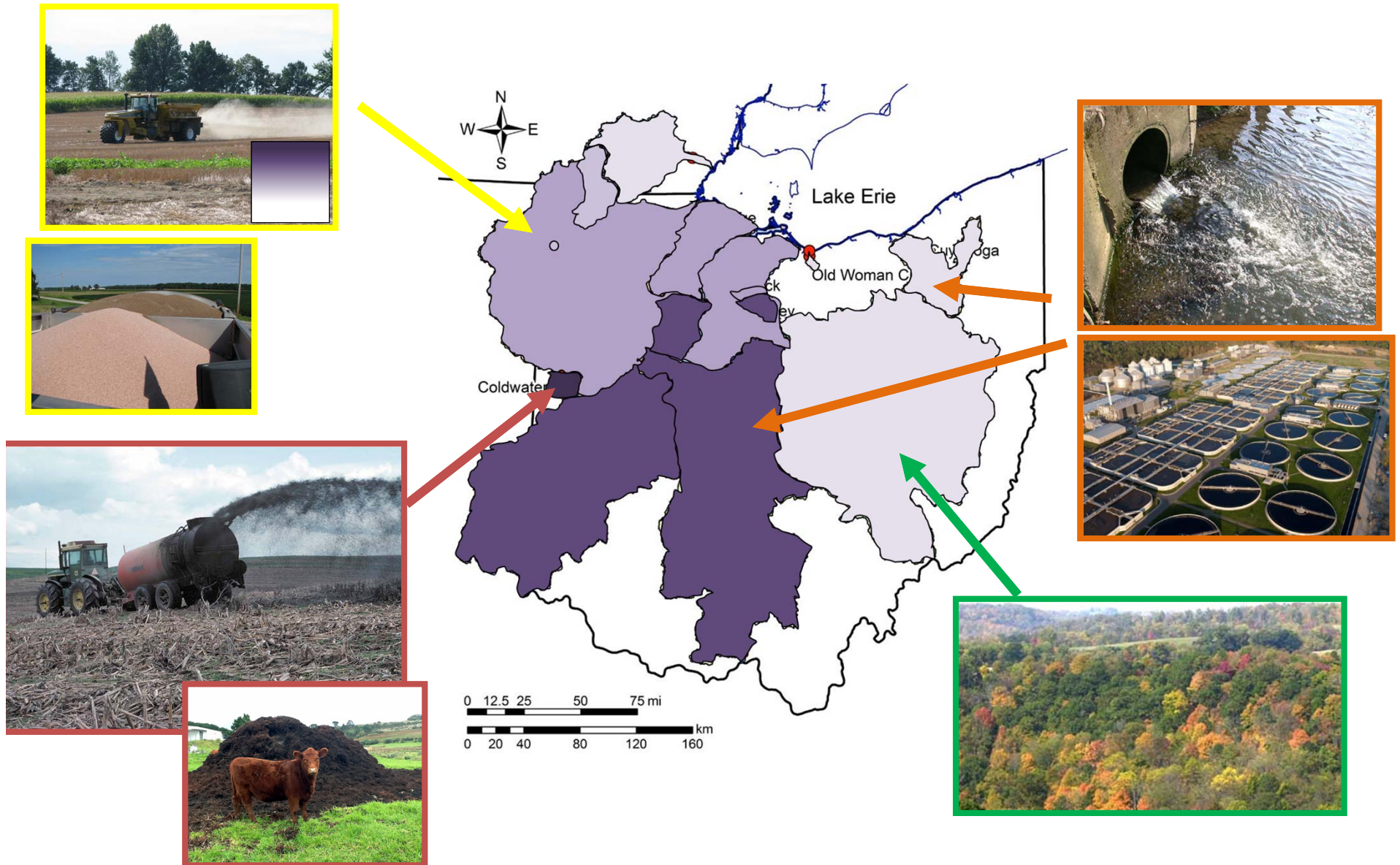
Annual Load



Annual
Concentration



Why are there differences in concentration?



Conclusions

- The return of algal blooms to Lake Erie corresponds to increased dissolved phosphorus from primarily agricultural watersheds
- Using flow-weighted mean concentration will allow us to compare to targets normalized for variation in watershed size and weather
- Dissolved P concentrations among HTLP monitored watersheds were highest at Grand Lake St Marys
 - A history of overapplication of manure
- ...and lowest in watersheds with less agriculture and sandier soils
- Dissolved P in Lake Erie watersheds comes from current agricultural practices → commercial P fertilizer application, rotational no-till
 - To reduce current loads efforts should be focused on reducing P stratification and nutrient management
 - To prevent legacy P problems, efforts should be focused on better management and application of manure

Heidelberg Tributary Loading Program – Current Sponsors



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Questions?

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