Potential Sources of Cyanobacteria to the Chequamegon Bay Region

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NORTHLAND COLLEGE

Mary Griggs Burke Center
for Freshwater Innovation

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- Mary Griggs Burke
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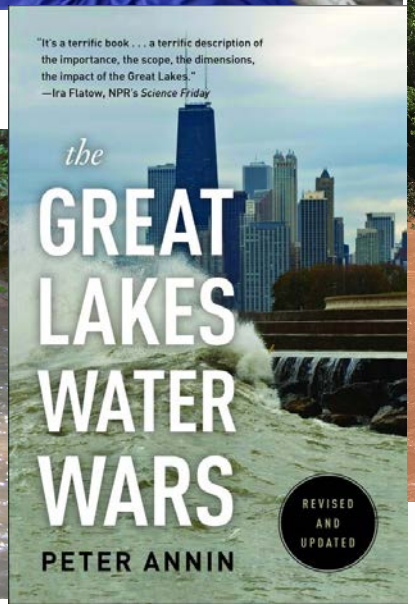
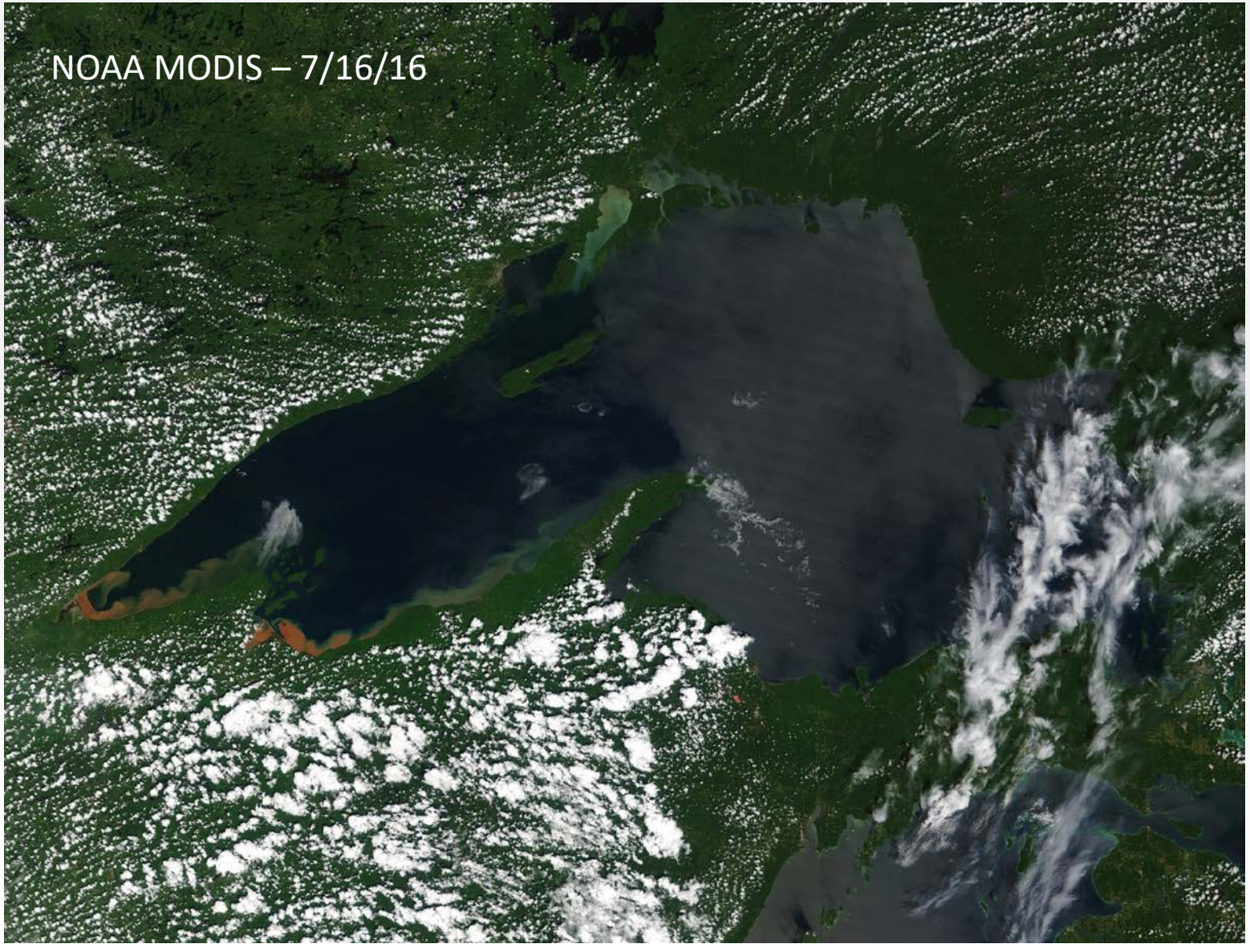
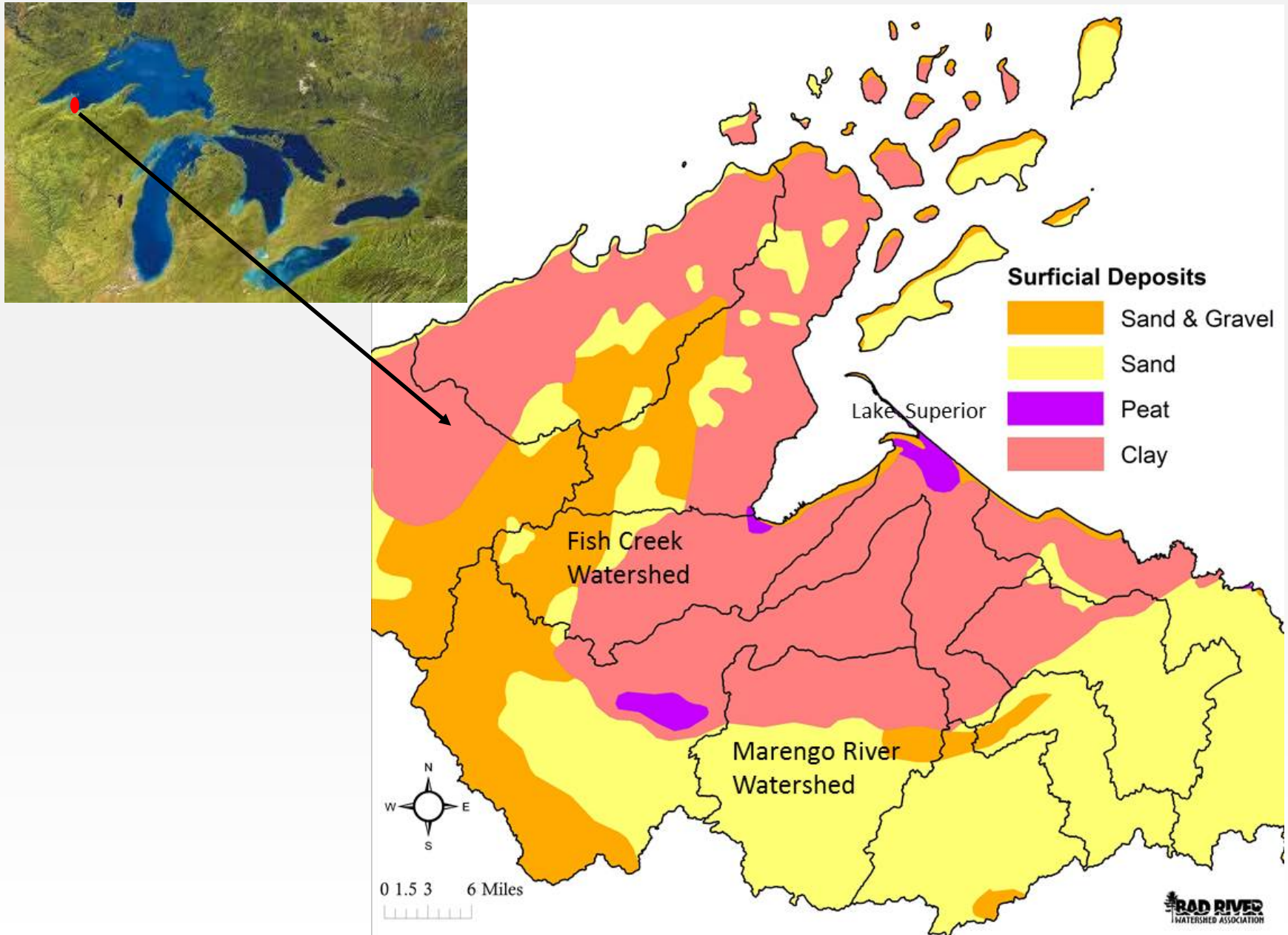


- Linking science and communications to support decisions
- Applied learning for undergraduates

Flood Events and Water Quality



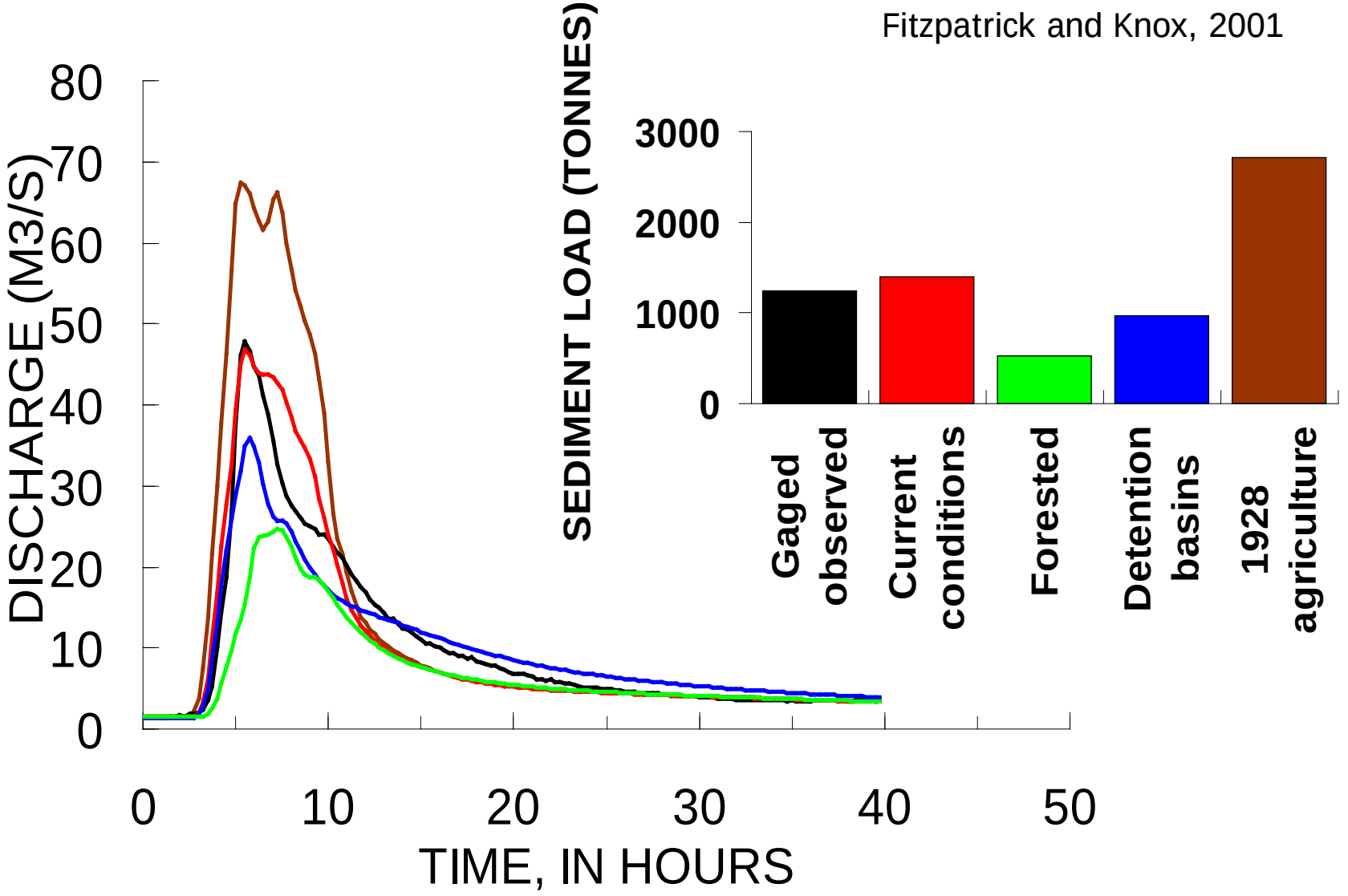
Vulnerable to Erosion



Land Cover Change

Northern Wisconsin landscape post-cutover.

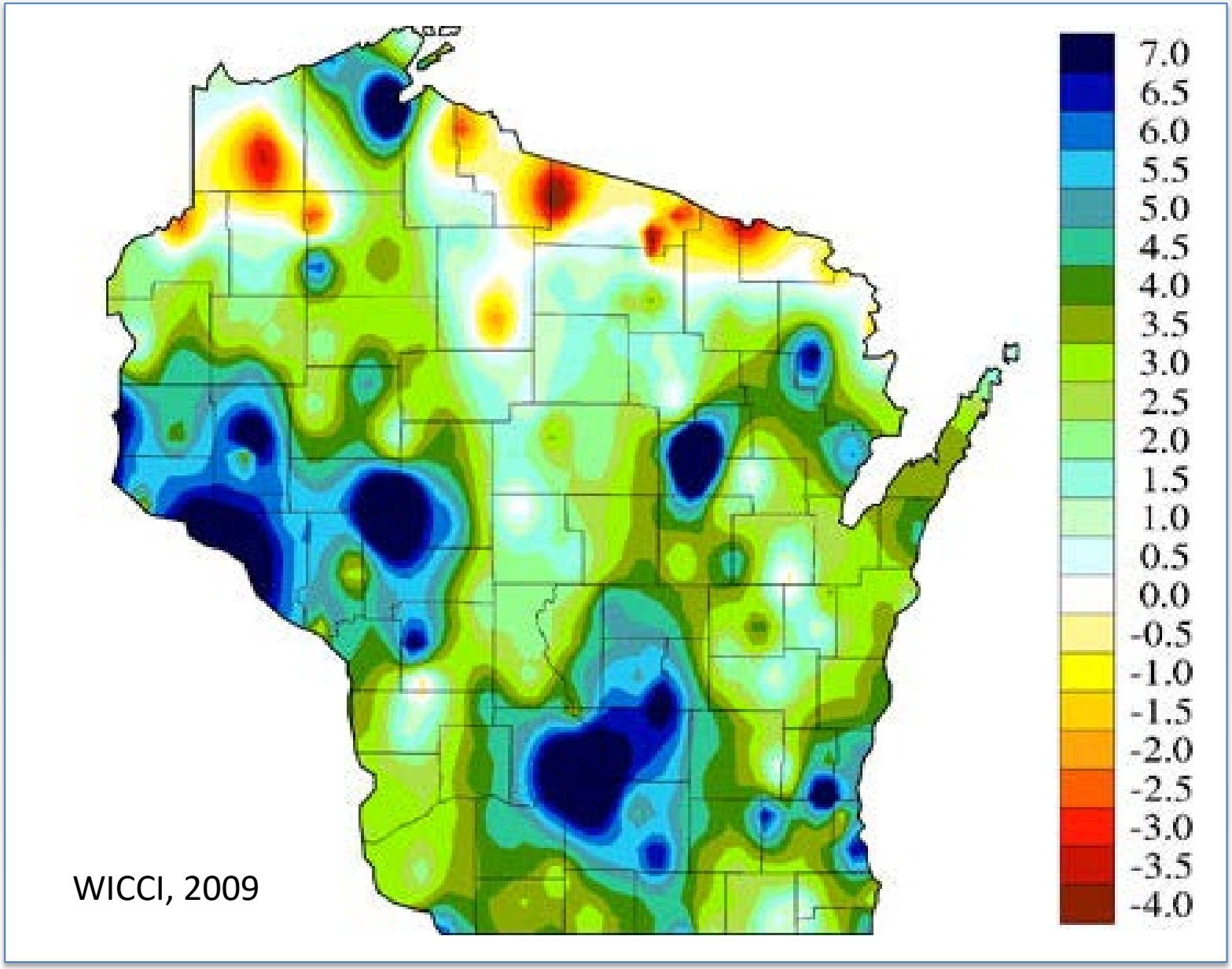
Historical Land Cover Change Drives Excess Erosion and Sedimentation



Bluff & Valley Wall Erosion

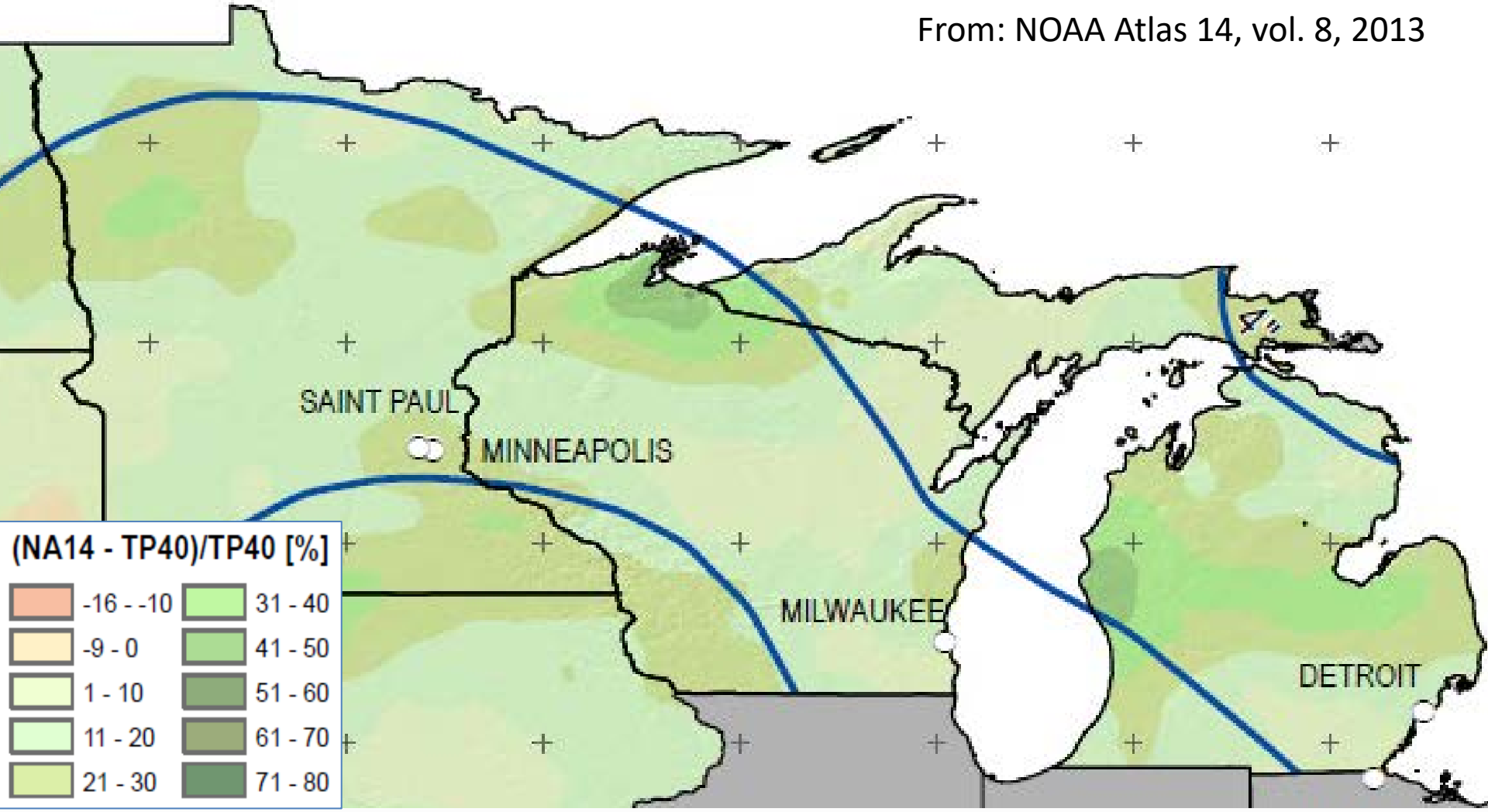
Sediment Plumes

Increase in Precipitation: 1950-2006

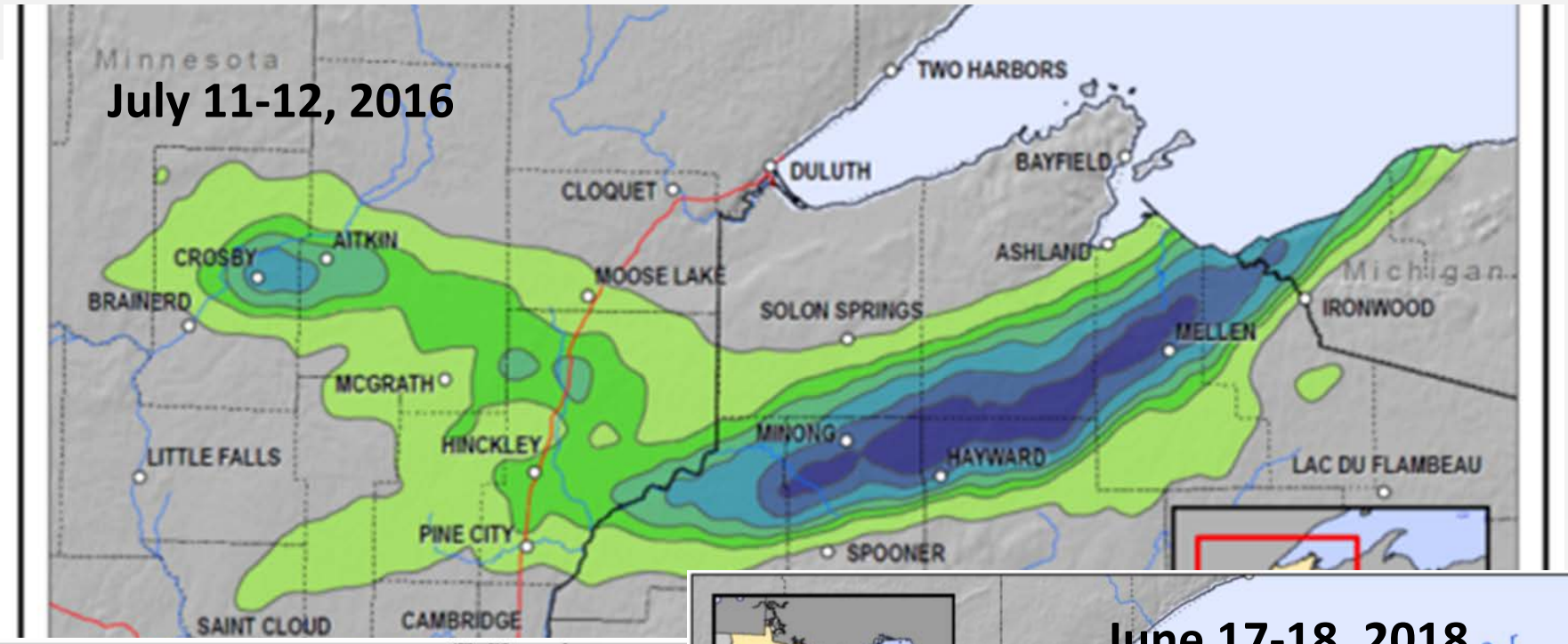


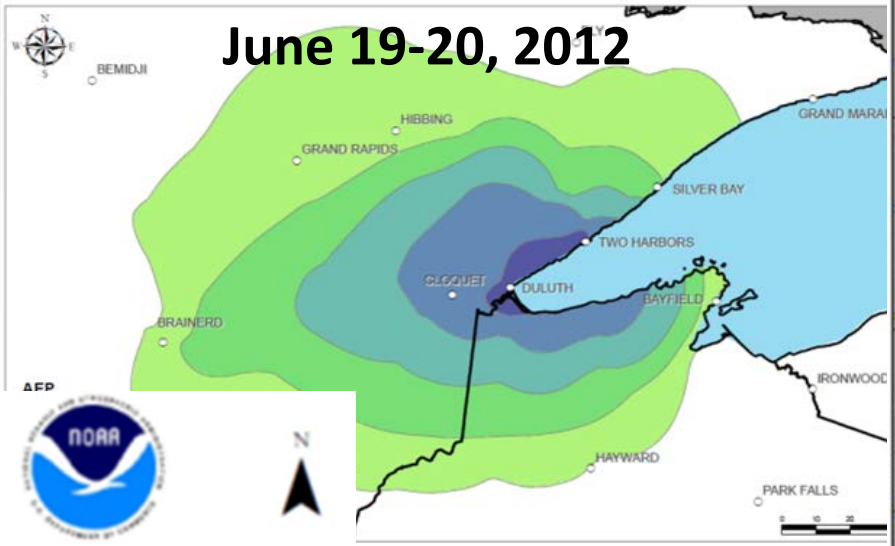
Increase in Event Magnitude

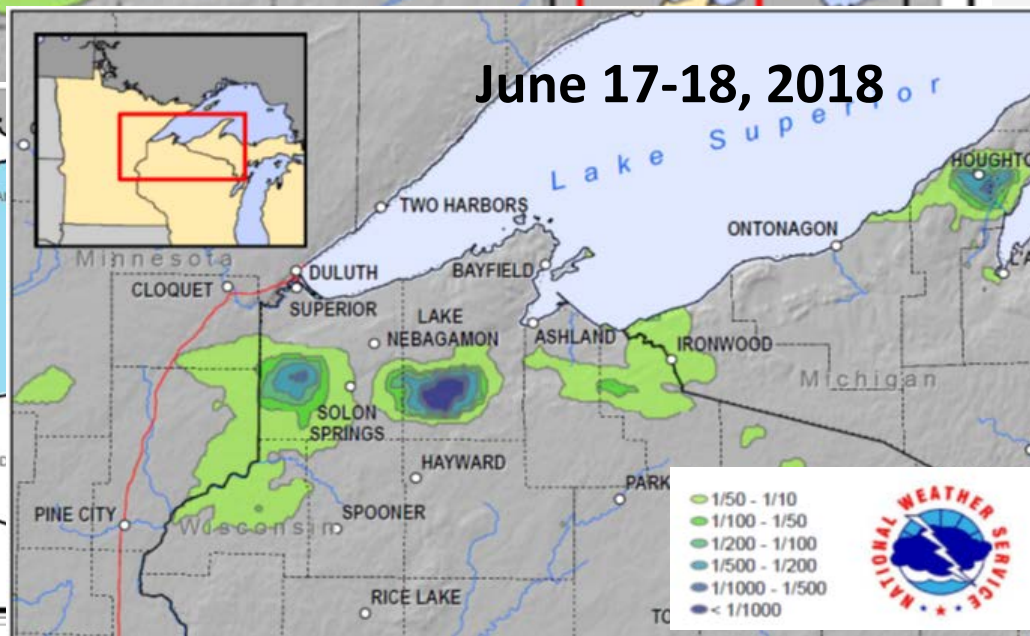
From: NOAA Atlas 14, vol. 8, 2013



Crosshairs on Our Region







Sediment & Nutrients in the Lake

NOAA –MODIS, 6/19/18

Cyanobacteria Blooms

2018 Bloom in Cornucopia, WI. Photo Credits: Brenda Moraska Lafrancois –NPS.

Why Not in Chequamegon Bay?

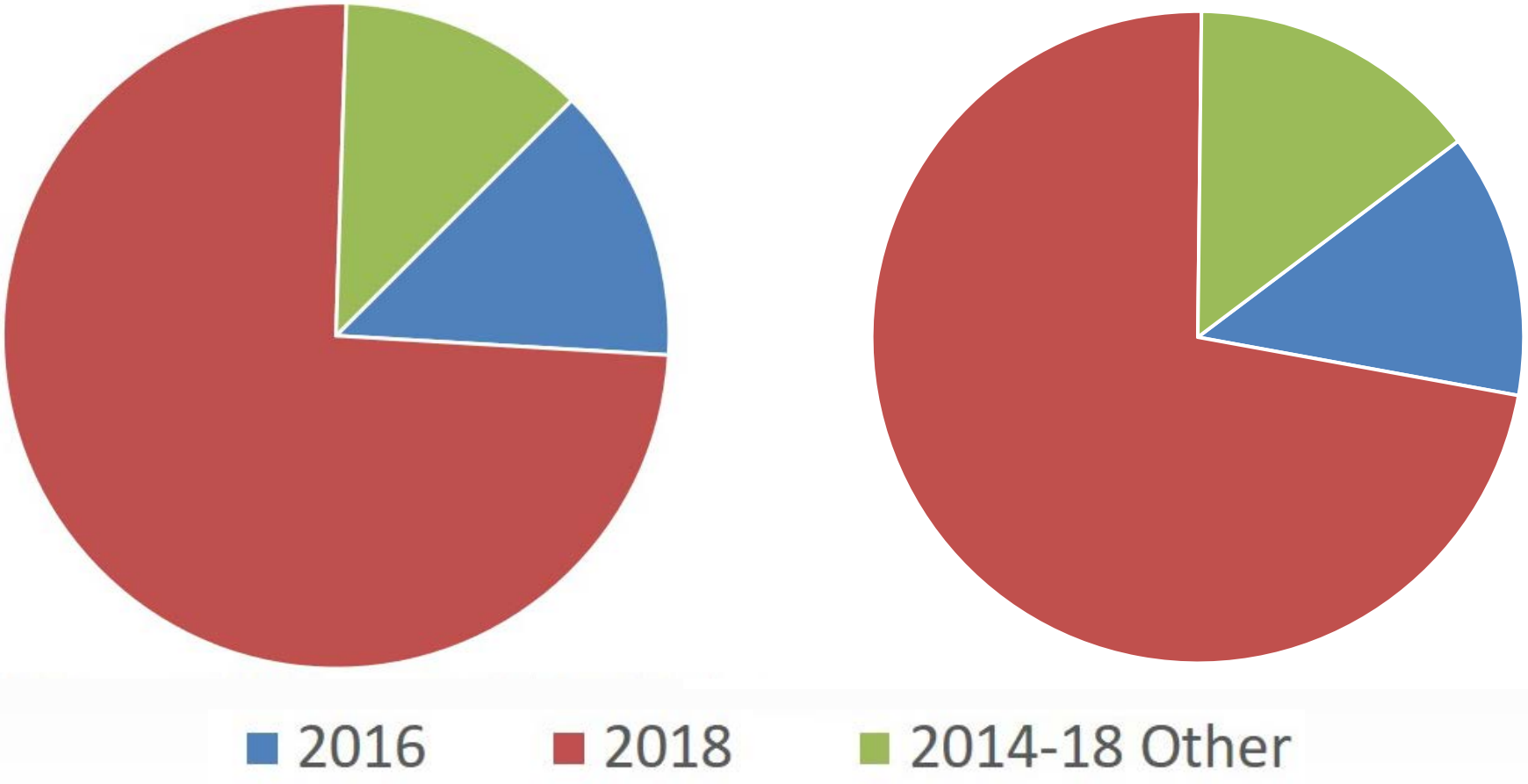
http://www.mappingspecialists.com/store/enhanced-chequamegon-bay-wall-map/

Water Quality Driven by Flood Events

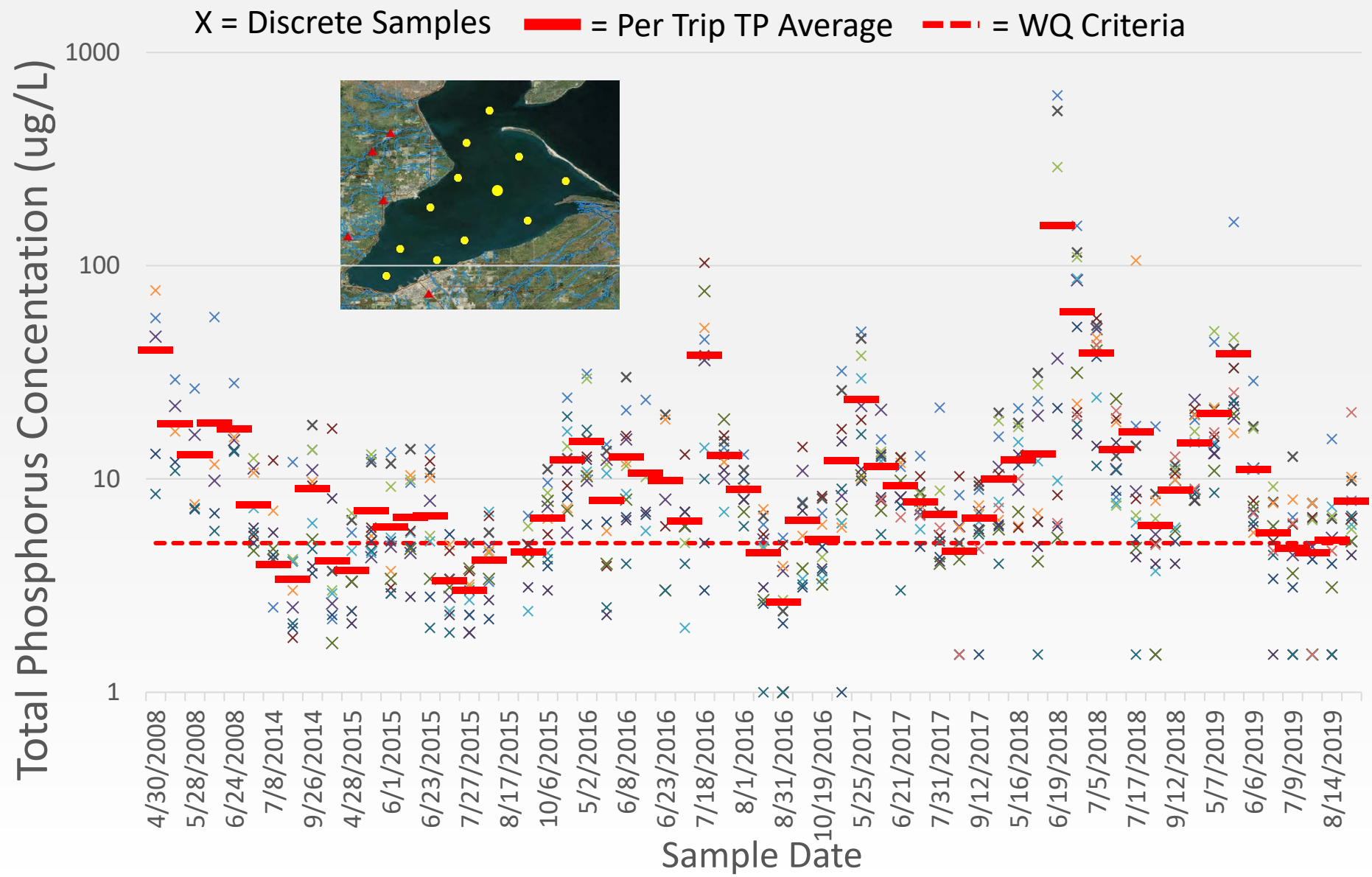
Suspended Sediment Load

Total Phosphorus Load

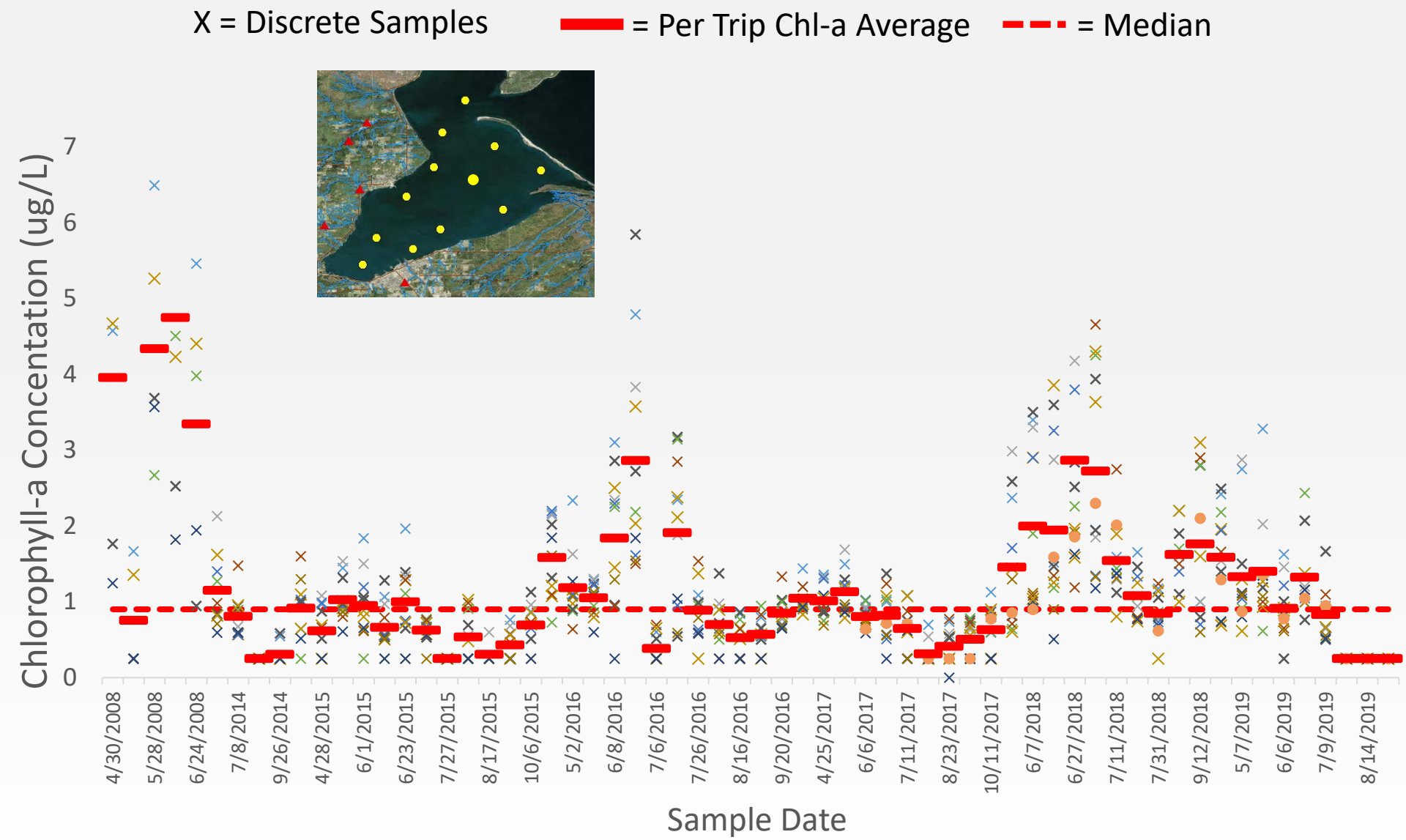
South Fish Creek



Surface Total Phosphorus: 2008, 2014-2019



Chlorophyll-a: 2008, 2014-2019

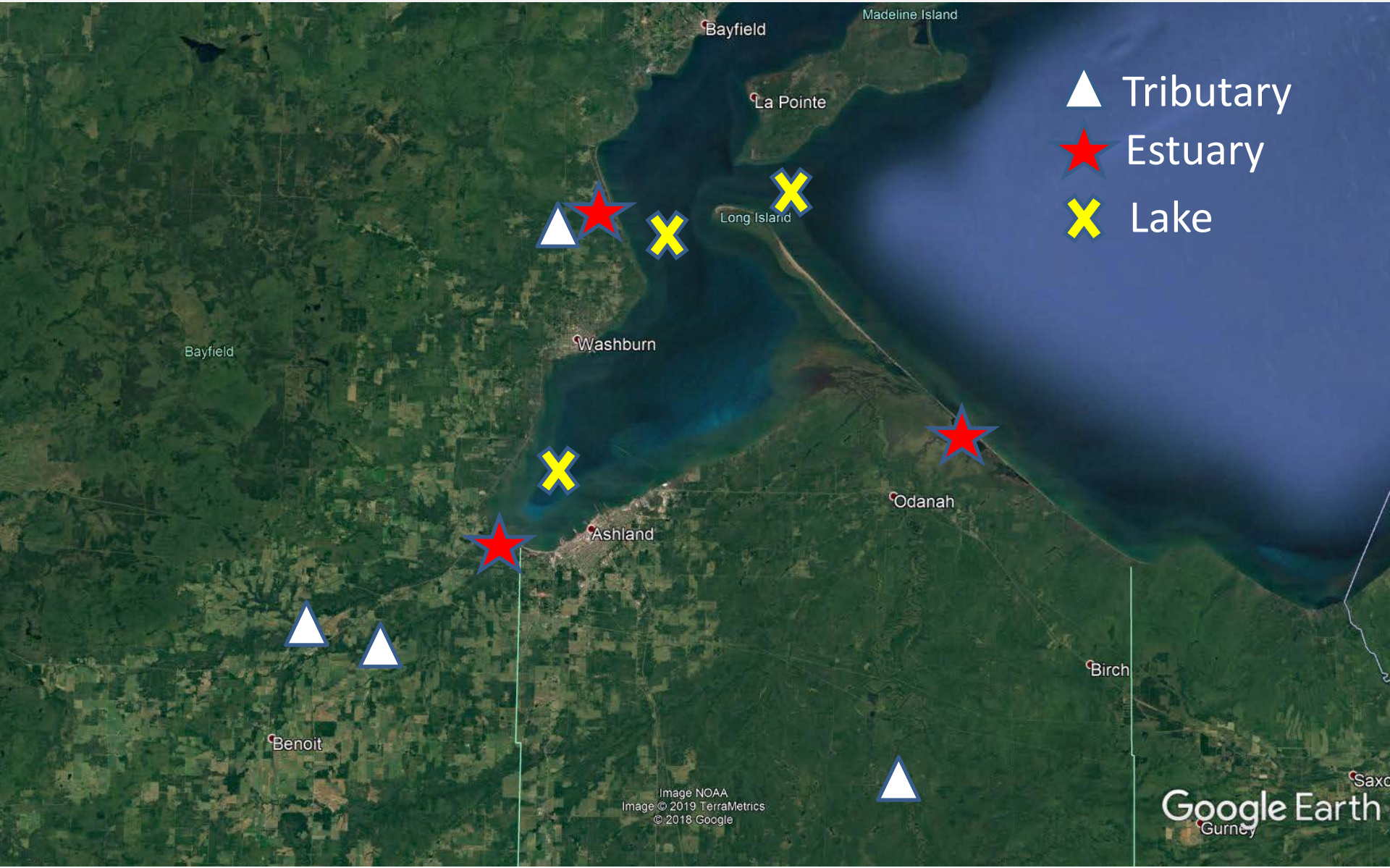


Experimental Approach

- Replicate UMD-LLO 2017 Experiments
- Where might cyanobacteria blooms come from and under what conditions will they grow?
- Sample tributary, estuary, and lake
- Water bath incubation at two temps: 15C & 25C
- High & low N:P
- 12 Combinations of

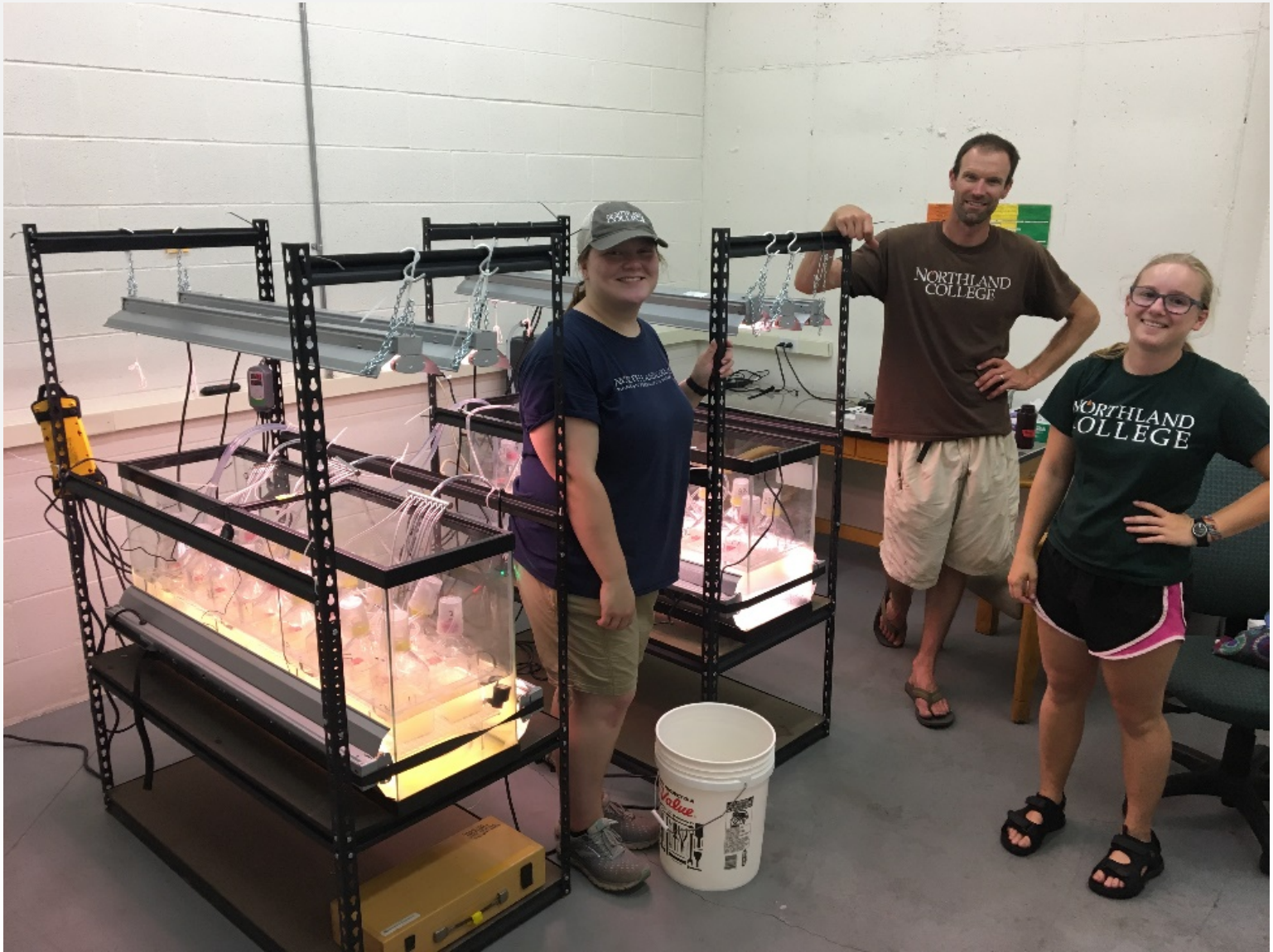
  Location x Nutrient x Temp

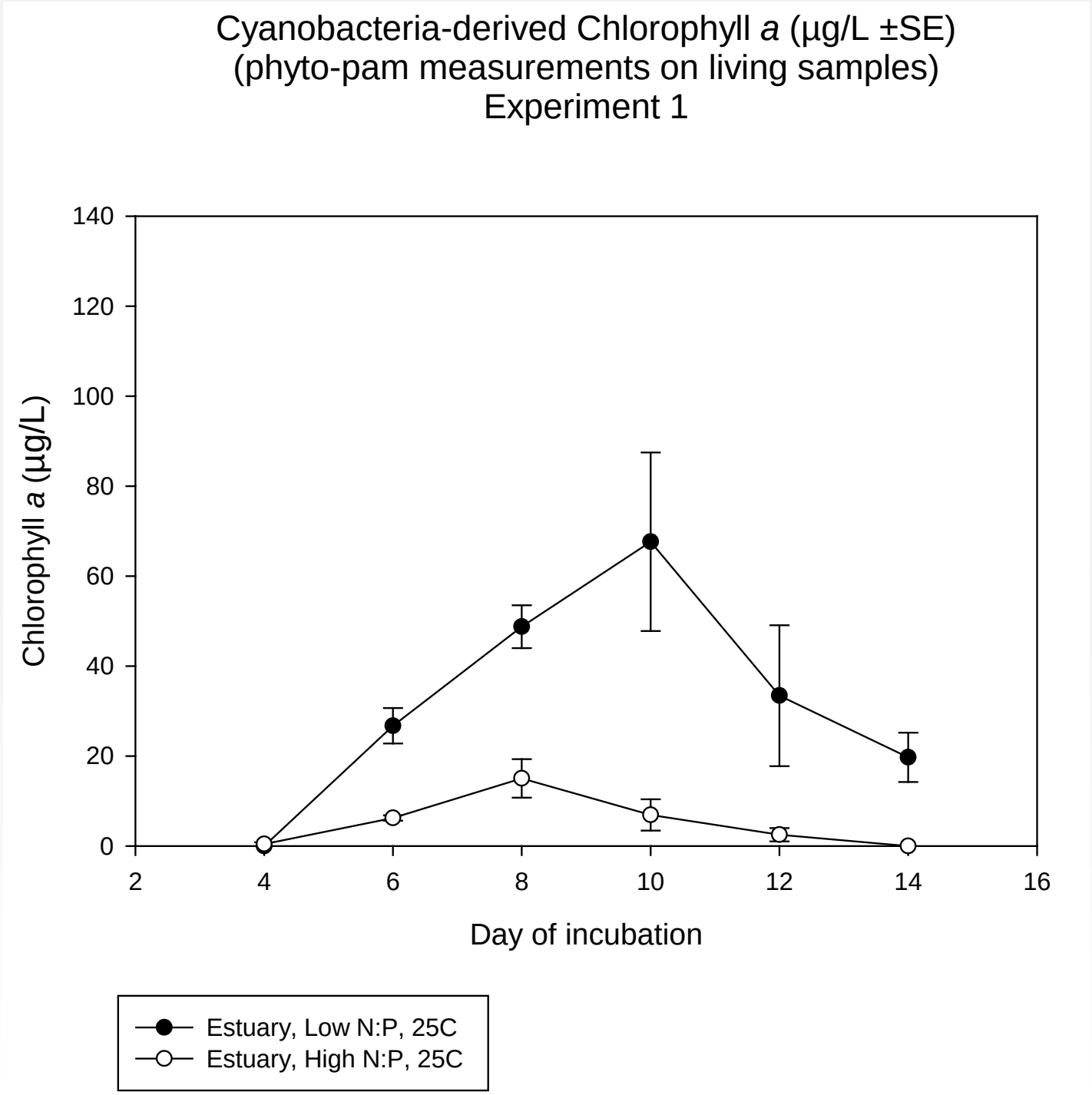
Sample Locations



Sample Collection, 8/5/19

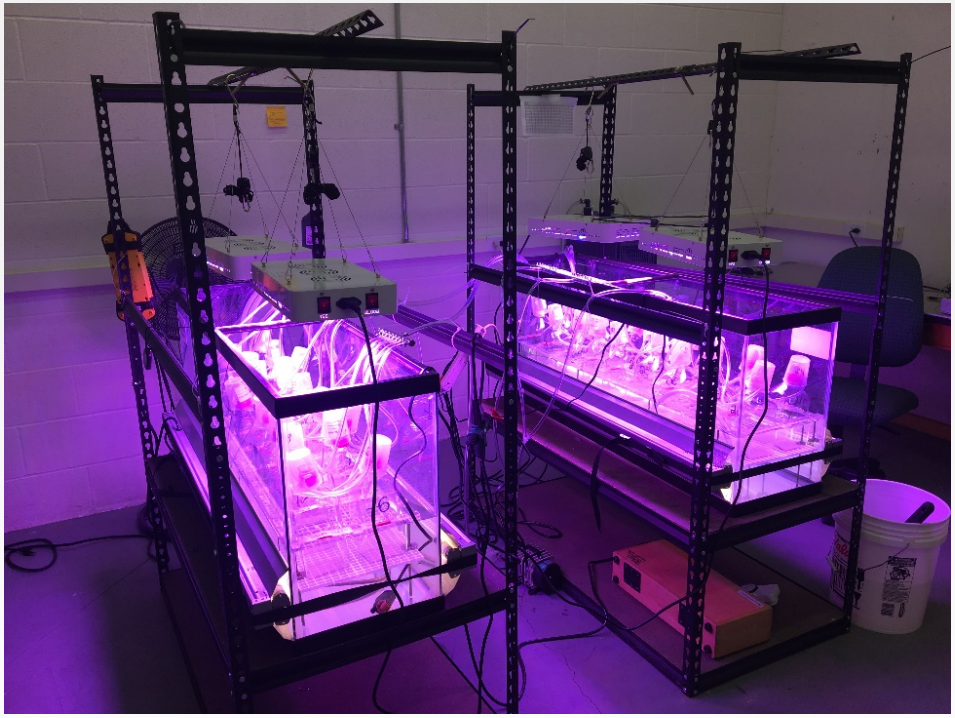
Culture Experiments

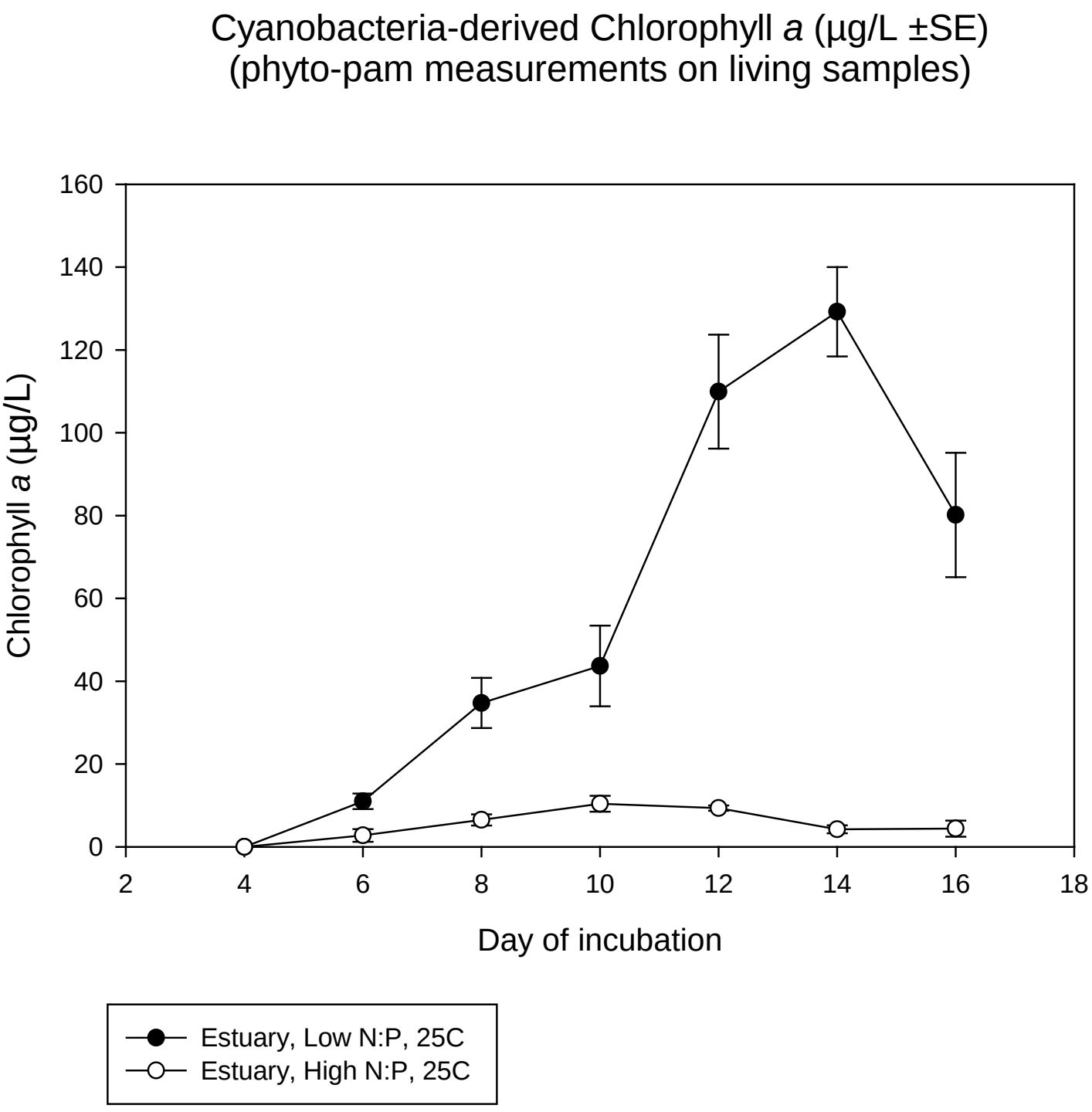


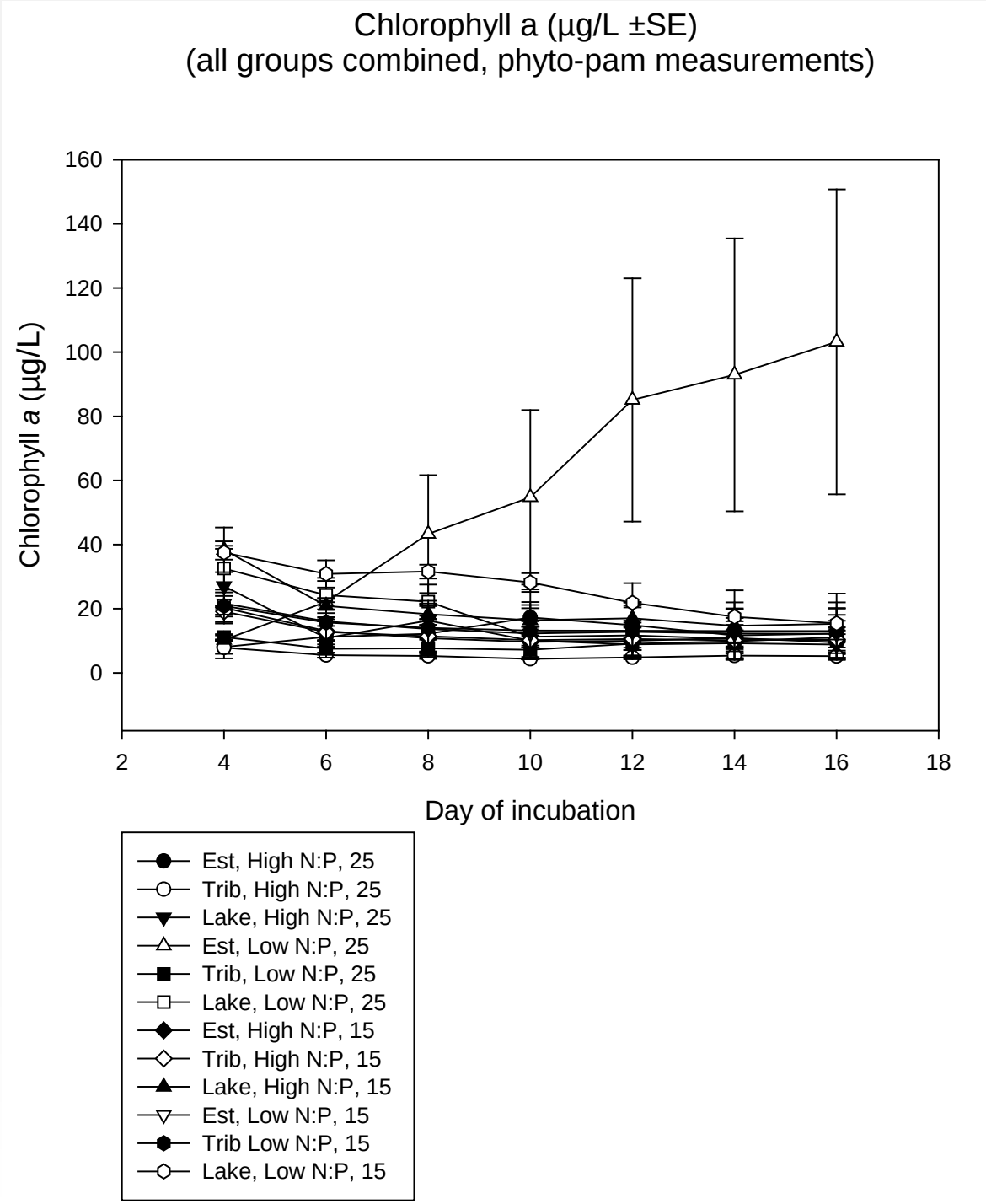

Cyanobacteria-derived Chlorophyll a (µg/L ±SE)
(phyto-pam measurements on living samples)
Experiment 1
Chlorophyll a (µg/L)
0
20
40
60
80
100
120
140
2
4
6
8
10
12
14
16
Day of incubation
Estuary, Low N:P, 25C
Estuary, High N:P, 25C

Tweak Experimental Set-Up

- Re-sample all locations on 9/4/19.




Cyanobacteria-derived Chlorophyll a (µg/L ±SE)
(phyto-pam measurements on living samples)
Chlorophyll a (µg/L)
160
140
120
100
80
60
40
20
0
2
4
6
8
10
12
14
16
18
Day of incubation
Estuary, Low N:P, 25C
Estuary, High N:P, 25C


Chlorophyll a (µg/L ±SE)
(all groups combined, phyto-pam measurements)
Chlorophyll a (µg/L)
160
140
120
100
80
60
40
20
0
2
4
6
8
10
12
14
16
18
Day of incubation
Est, High N:P, 25
Trib, High N:P, 25
Lake, High N:P, 25
Est, Low N:P, 25
Trib, Low N:P, 25
Lake, Low N:P, 25
Est, High N:P, 15
Trib, High N:P, 15
Lake, High N:P, 15
Est, Low N:P, 15
Trib Low N:P, 15
Lake, Low N:P, 15

Preliminary Conclusions

- Lake not a source for cyanobacteria propagules – same as UMD-LLO
- Only cyanobacteria response from estuaries. Still suggests land-lake connection similar to UMD-LLO
- In general, growth response less than UMD-LLO. Does this matter?
- Waiting for algal taxonomy results and summary of water chemistry to further clarify results

Next Steps

- Submit proposals for Phase II experiments to further investigate propagule source areas and bloom risk in Chequamegon Bay
  - Synoptic survey of coastal habitats
  - Culture experiments from coastal habitats with highest cyanobacteria signal
  - Further culture experiments to look at bloom potential & typical conditions in Chequamegon Bay

Questions?