--- Ohio Water Environment Association ---

OHIO SEA GRANT AND STONE LABORATORY

A Close Look at Lake Erie HABS and Current Research Efforts

Dr. Christopher J. Winslow

Interim Director, Ohio Sea Grant College Program

November 12th, 2015

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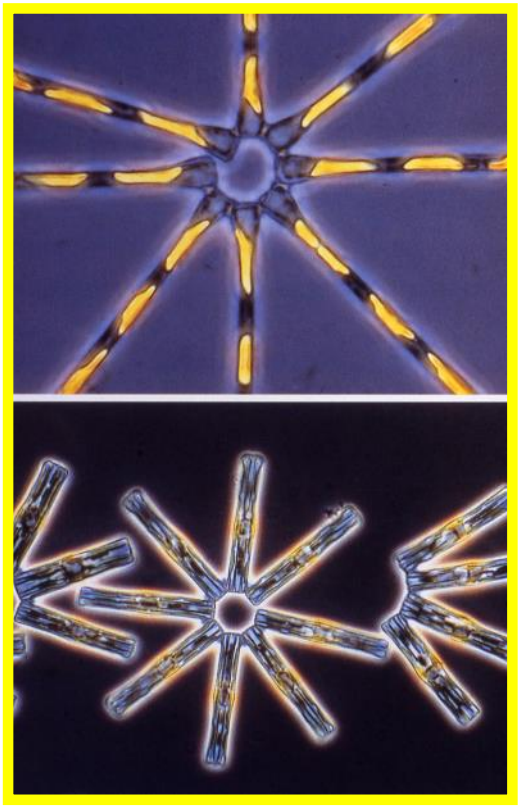
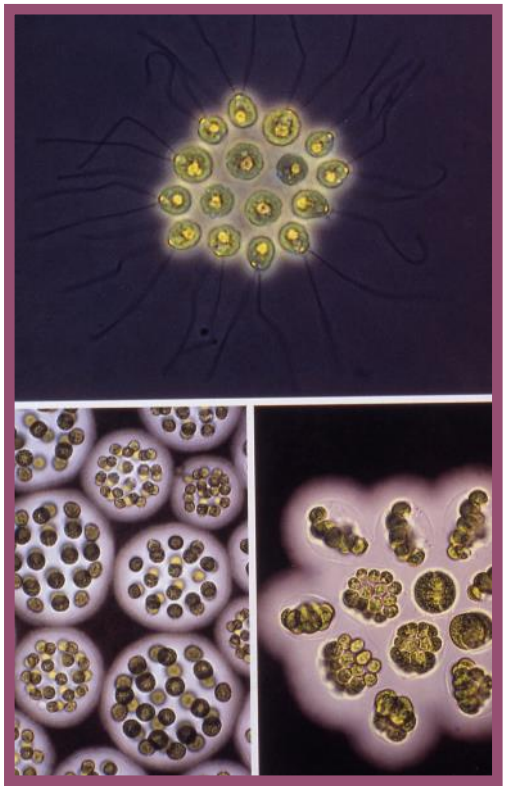
Major groups/kinds in Lake Erie



Diatoms



Greens

Source: Tom Bridgeman, UT

Blue-greens
(Cyanobacteria)

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Source: Tom Bridgeman, UT

The Economic Impact of Tourism in the Lake Erie Region of Ohio

Total Tourism Impact	
Lake Region	
Sales	$12.9 billion

Funded by the Ohio Sea Grant College

Oher economic factors to consider:

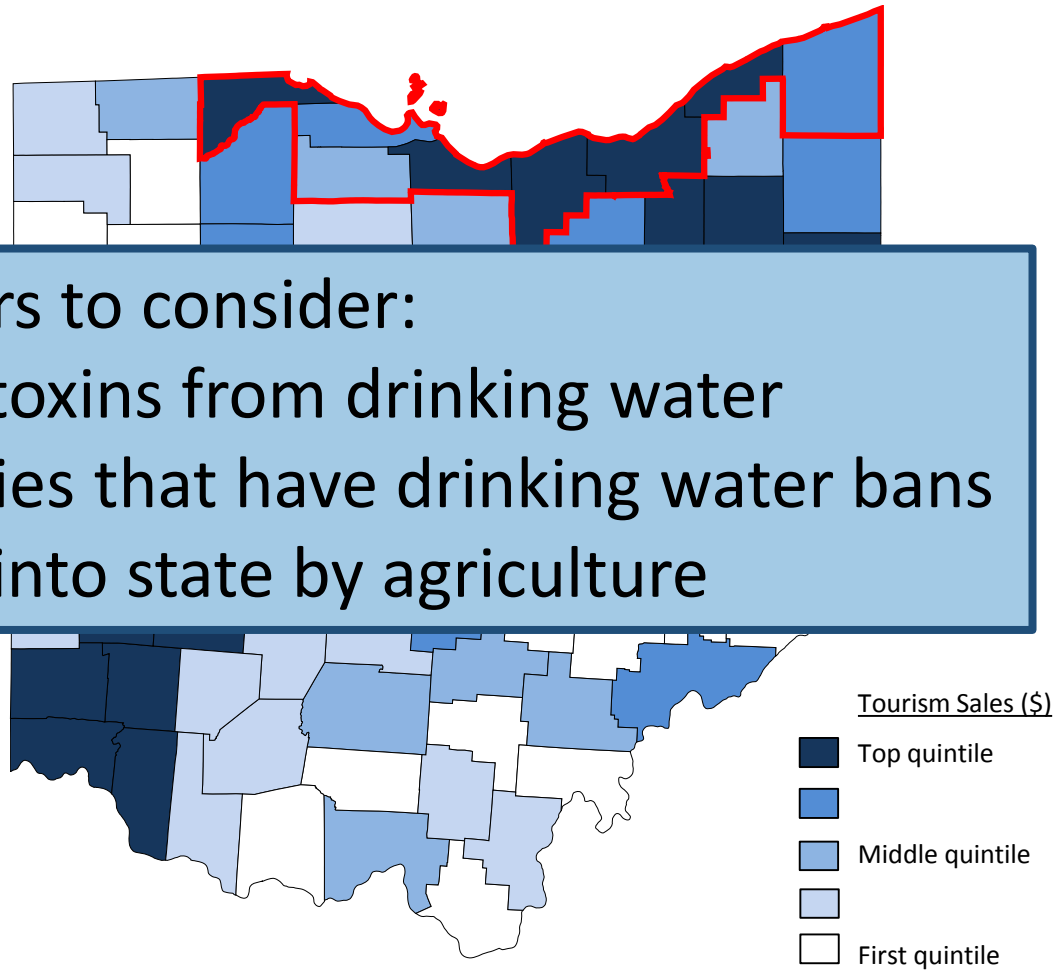
— Cost of removing toxins from drinking water

— Cost to communities that have drinking water bans

— Revenue brought into state by agriculture

ECONOMICS

AN OXFORD ECONOMICS COMPANY



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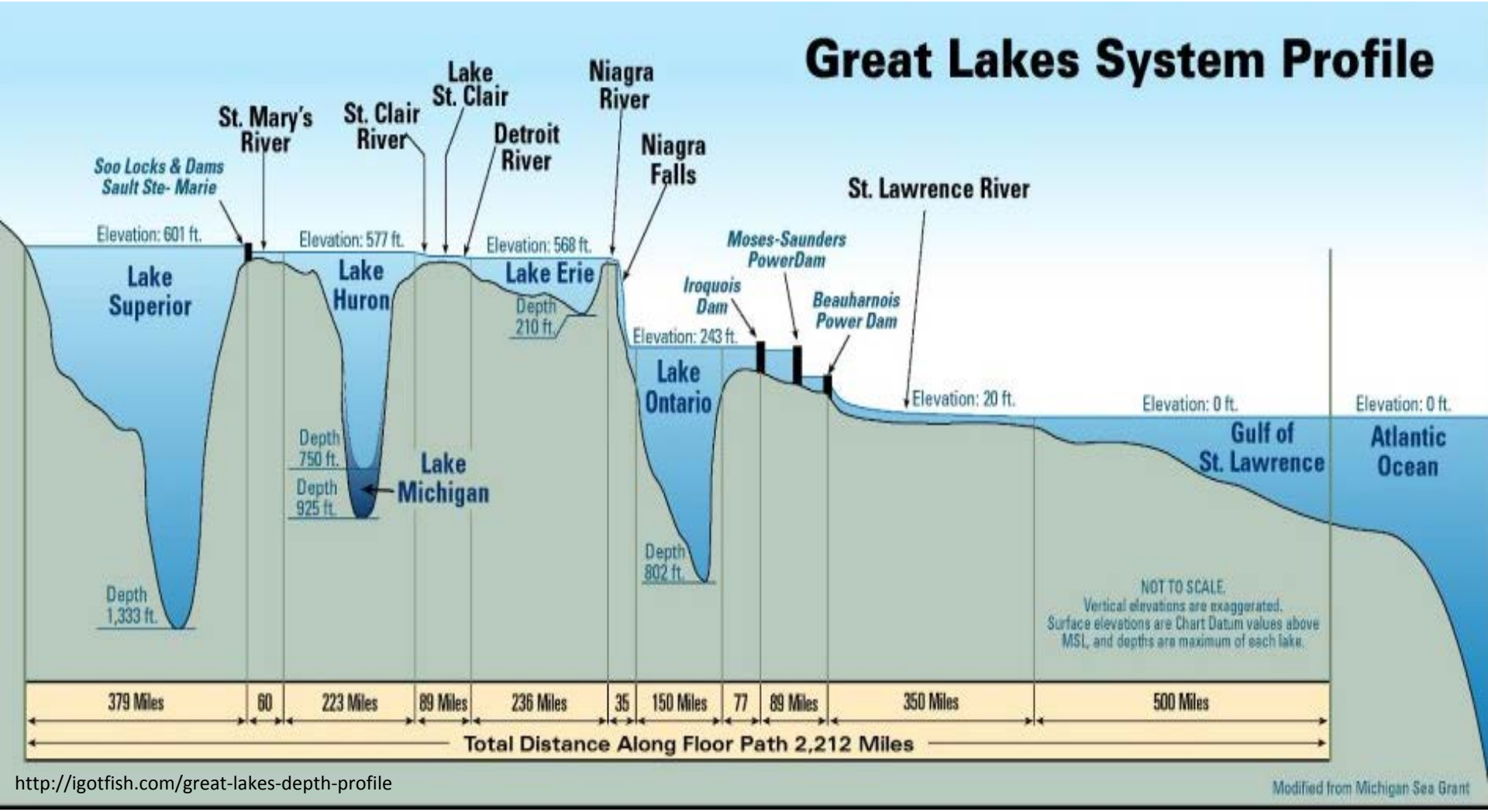
Setting the Stage for Lake Erie HABs



http://igotfish.com/great-lakes-depth-profile

Great Lakes Land Use

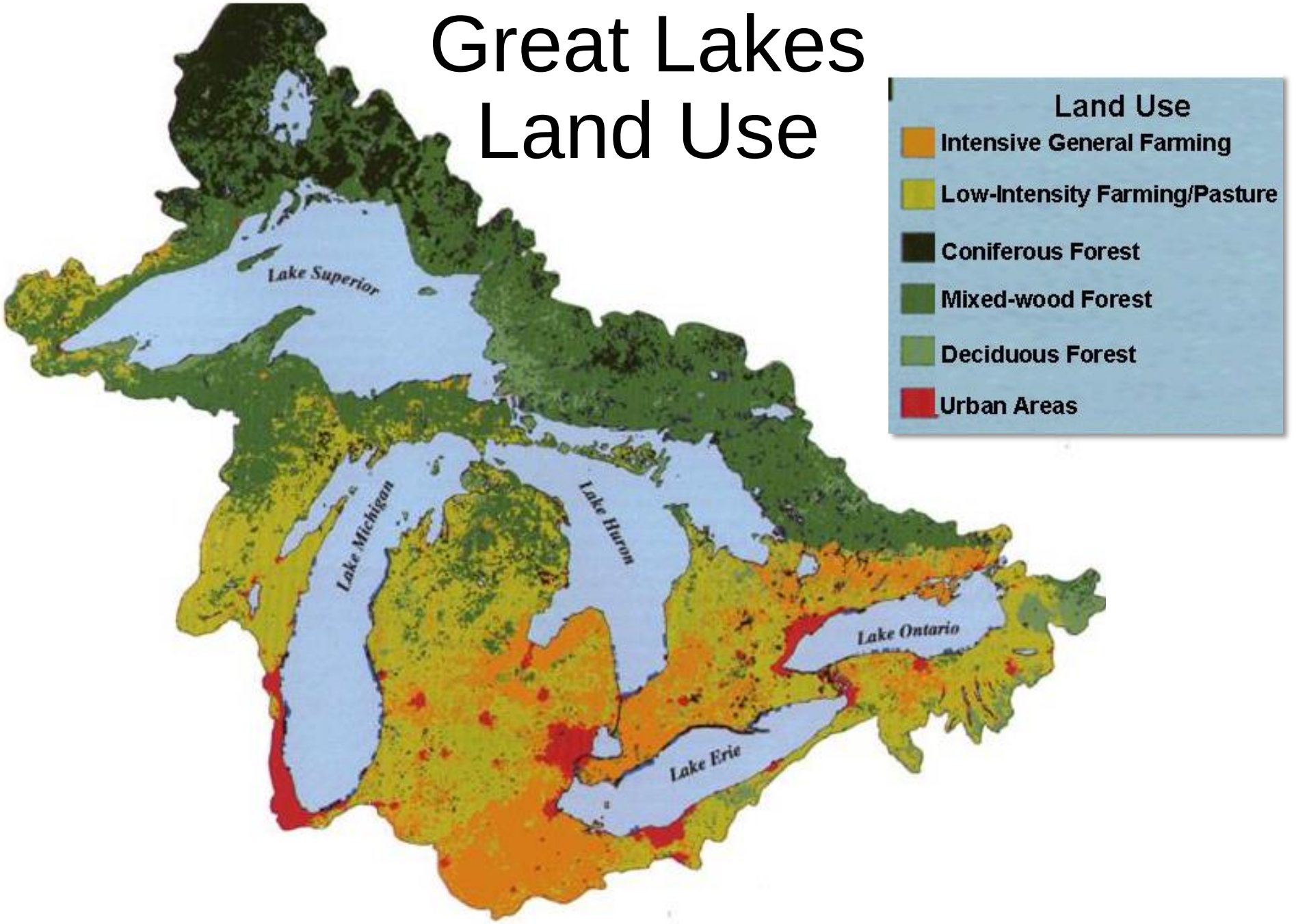
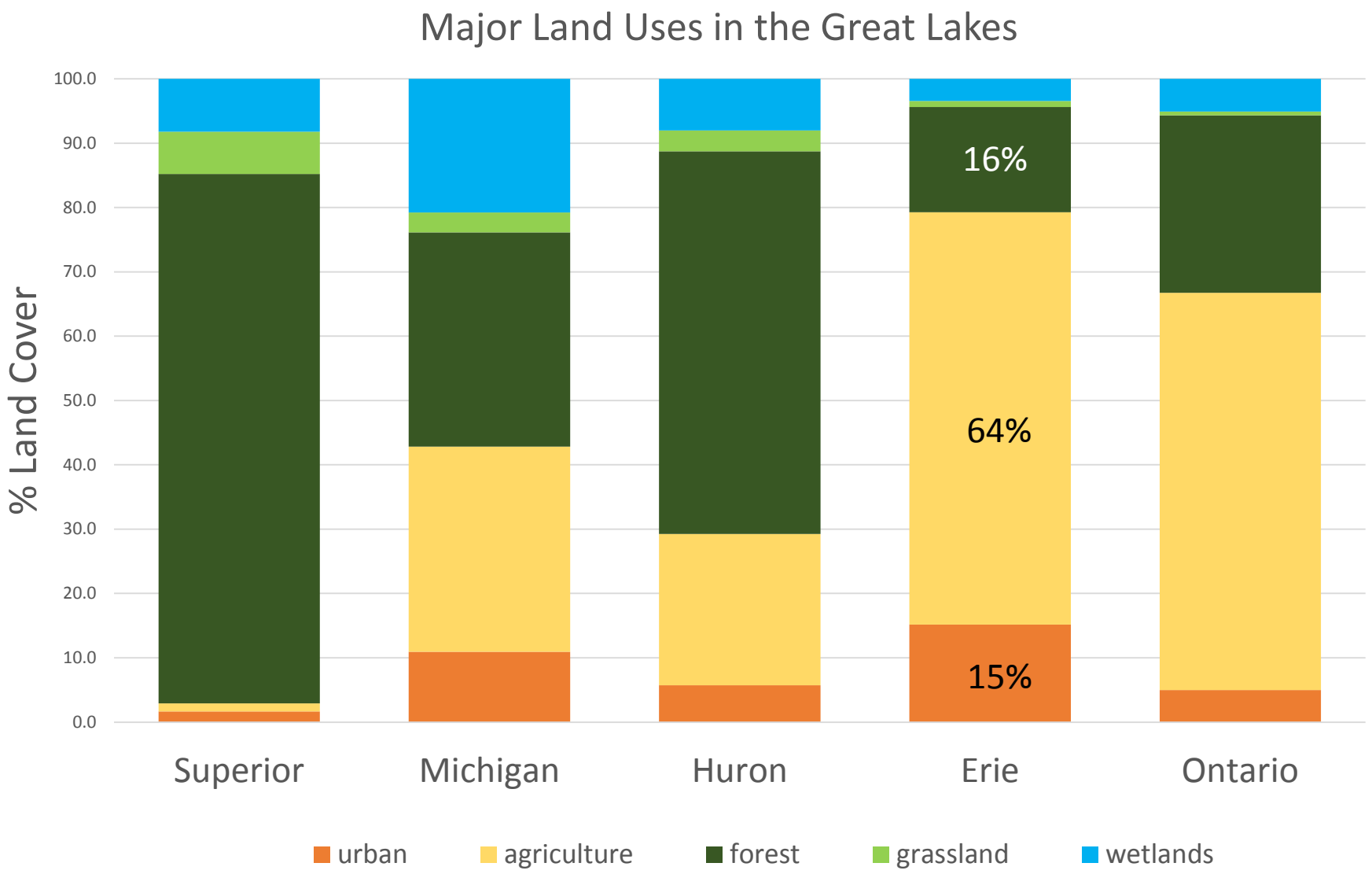


Image: Ohio Sea Grant



Modified from Lizhu Wang et al. 2015; GLR-00879

Because of Land Use Lake Erie Gets…..

- More sediment and nutrients (i.e., fertilizers, manure, and sewage) than all the other Great Lakes
- Above are exacerbated by storms
  - We are seeing more frequent and severe storms due to climate change
  - Data to come
- Don't forget, it is also the shallowest (sunlight)
- As a result Lake Erie is the most productive of the Great Lakes, and likely will be (50:2) !!


http://www.dispatch.com/content/stories/local/2011/08/26/algae-warning-tarnishes-kelleys-island.html

Maumee Storm Runoff Statistics (from 1960-2010)

- Statistically significant increases in :
  - Number of storm runoff events per year (up 67%)
  - Number of spring runoff events (up 40%)
  - Number of winter runoff events (up 47%)
  - Annual storm discharge (up 53%)
  - Summer storm discharge (up 27%)
- Other seasonal comparisons show increases but

80-90% of loading occurs 10-20% of time

Source: Dr. Peter Richards, Heidelberg University

Microcystis at Stone Lab (8/10/10)


September 11th, 2011

Microcystis near Marblehead

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http://coastwatch.glerl.noaa.gov/gallery/jpg/a1.13267.1852.LakeErie.143.250m.jpg

Not Just Western Basin Problem?

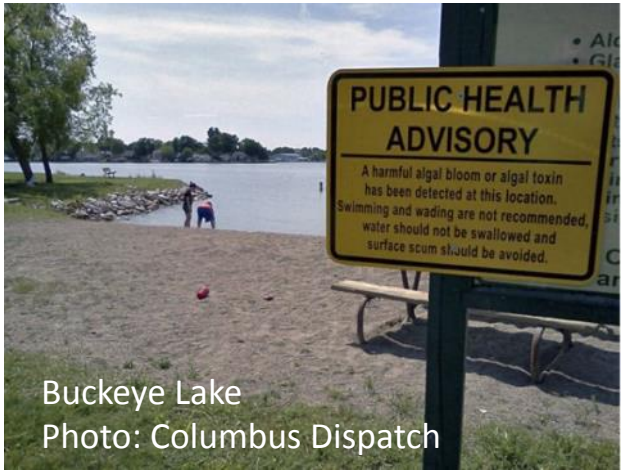
October 9, 2011

Photo: NOAA Satellite Image

HABs…Not Just a Lake Erie Problem


Muddy Creek
Photo: Ohio EPA


Lake Hope
Photo: Ohio EPA



Buckeye Lake
Photo: Columbus Dispatch

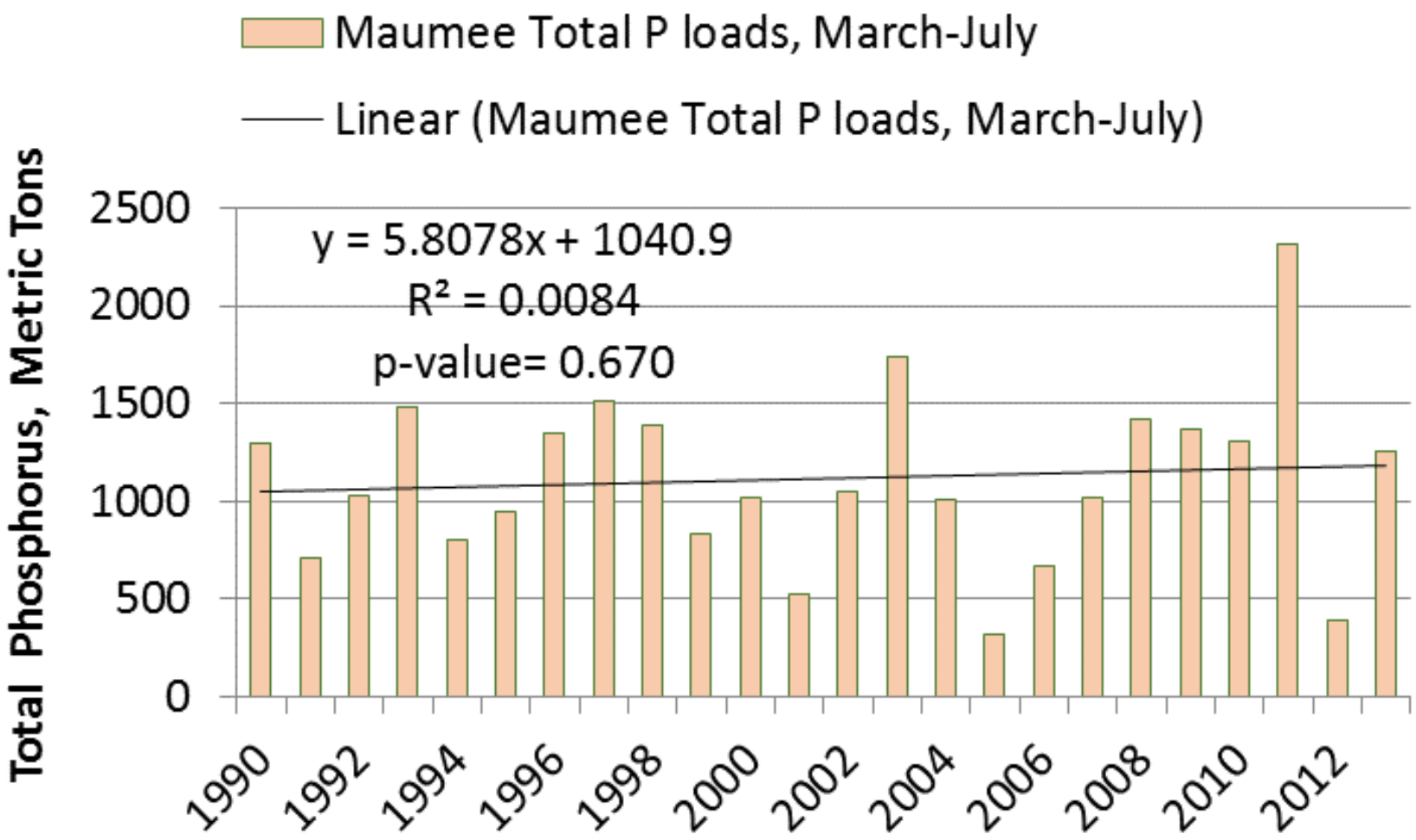

Burr Oak
Photo: Ohio EPA


Caesar Creek Lake
Photo: Ohio EPA


Ohio River
Photo: Ohio EPA


Grand Lake St. Marys
Photo: Ohio EPA

13% Increase in TP



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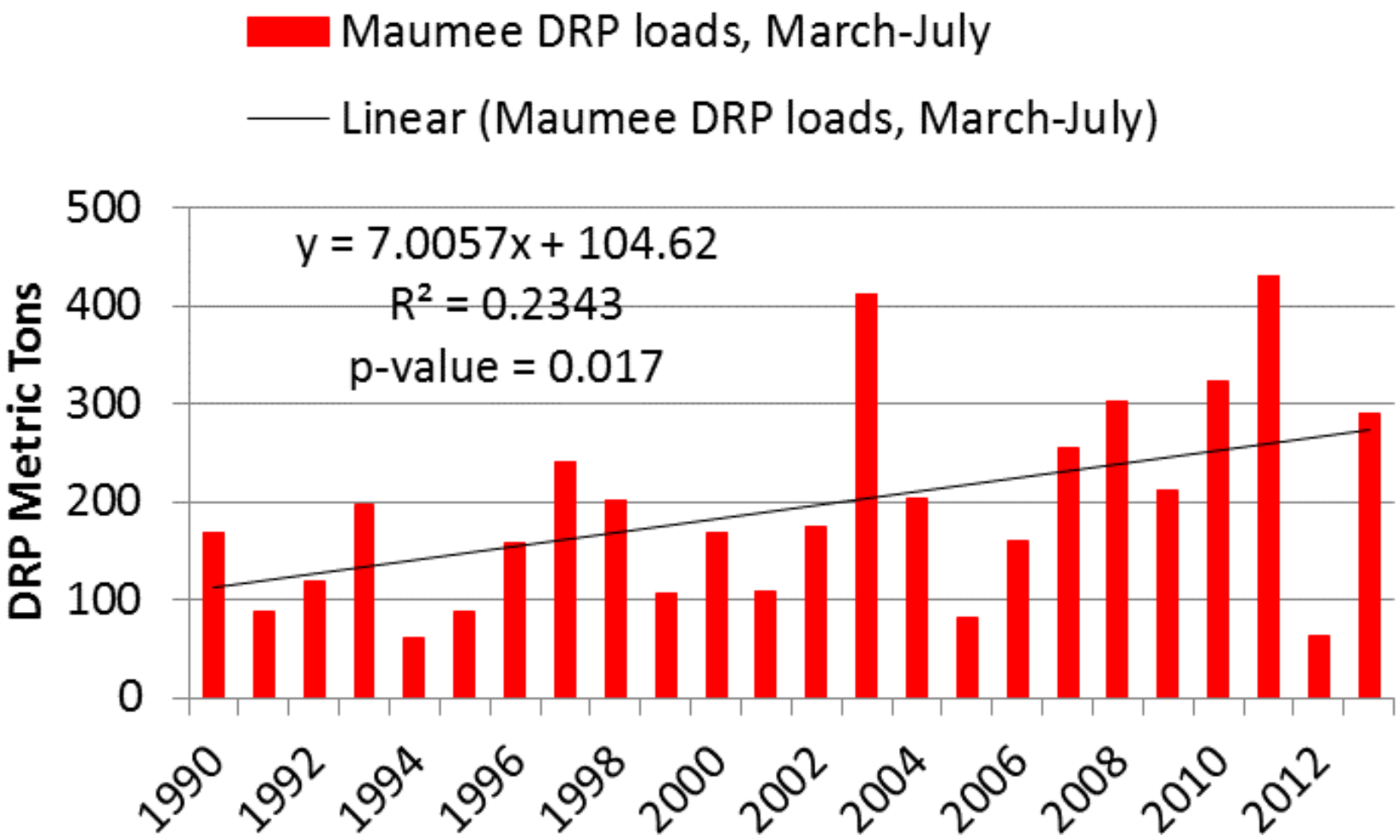
144% Increase in DRP



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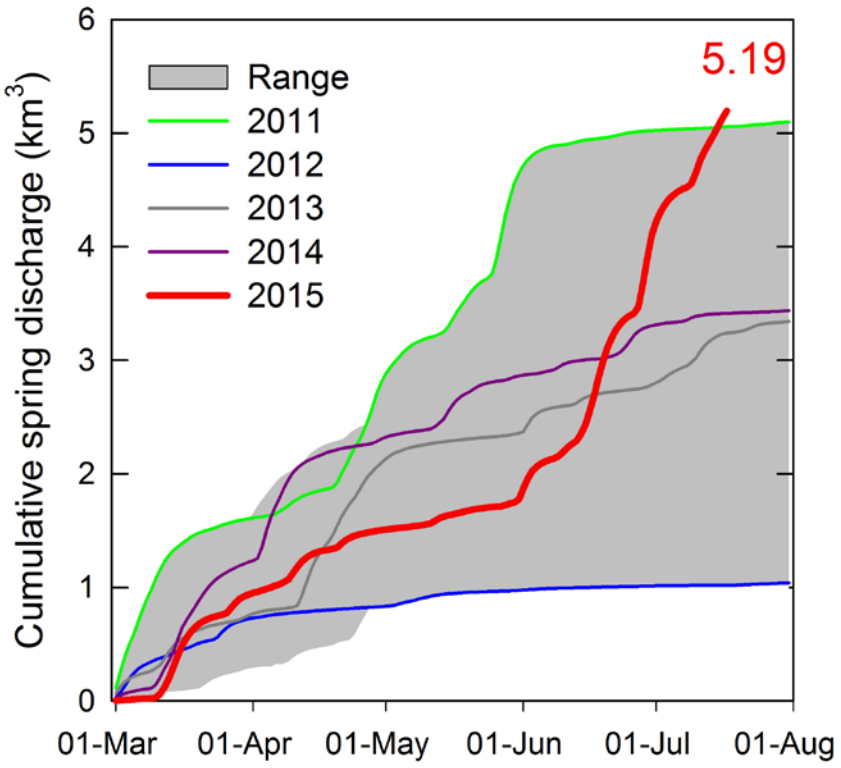
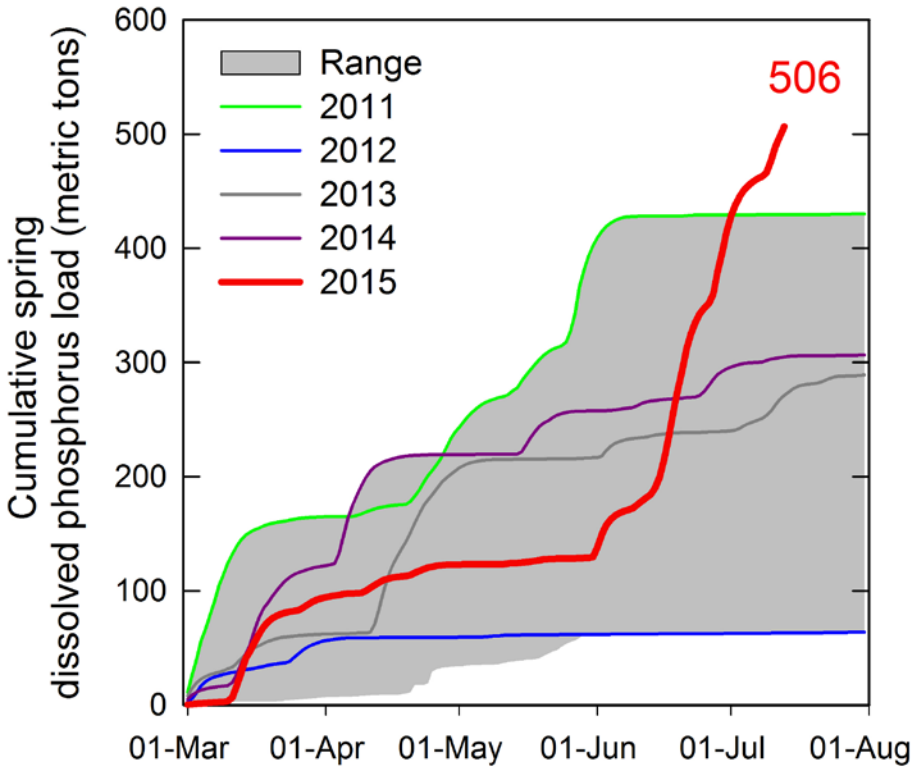
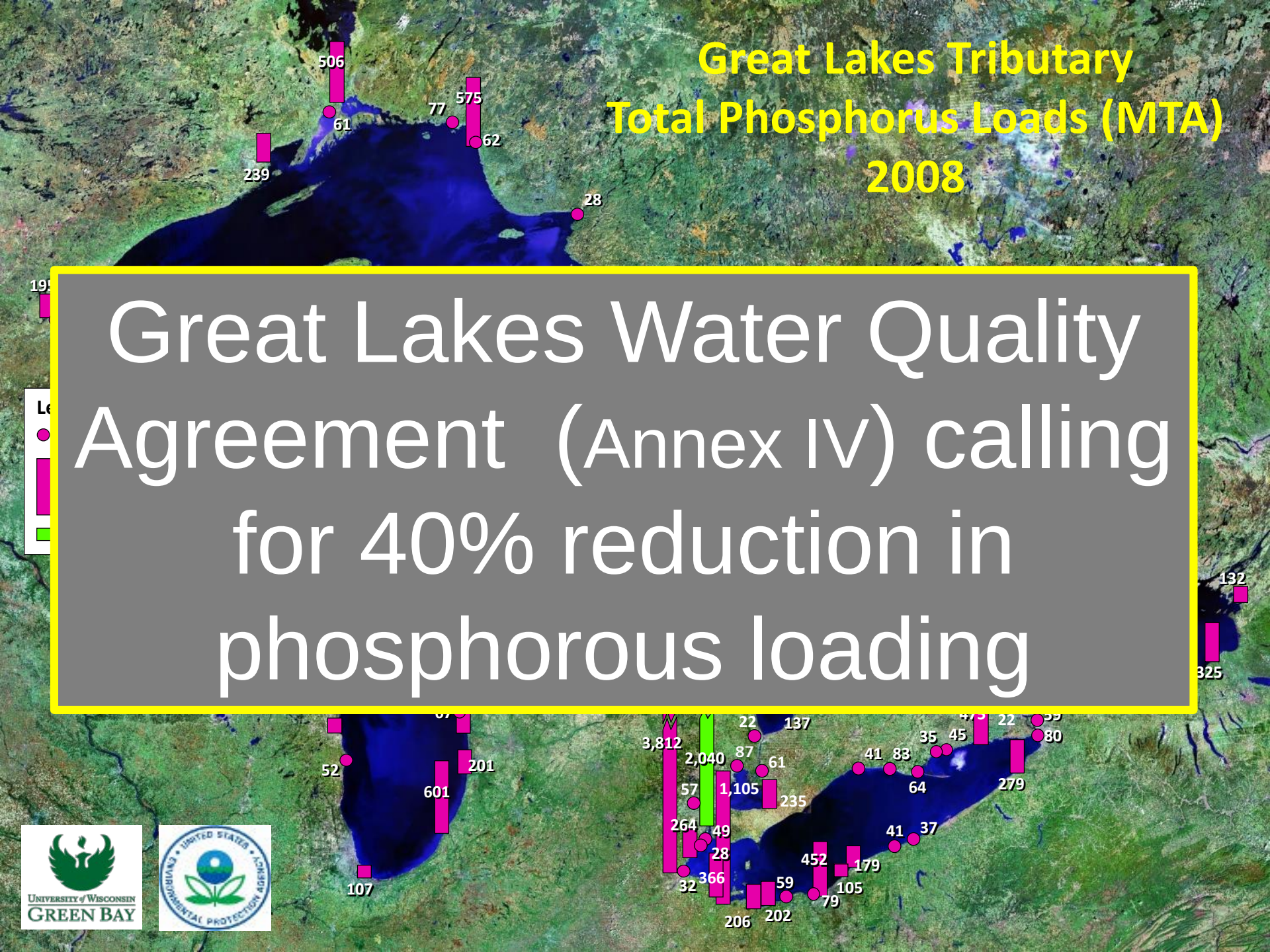

Cumulative spring discharge (km3)
Range
2011
2012
2013
2014
2015
5.19
0
1
2
3
4
5
6
01-Mar
01-Apr
01-May
01-Jun
01-Jul
01-Aug

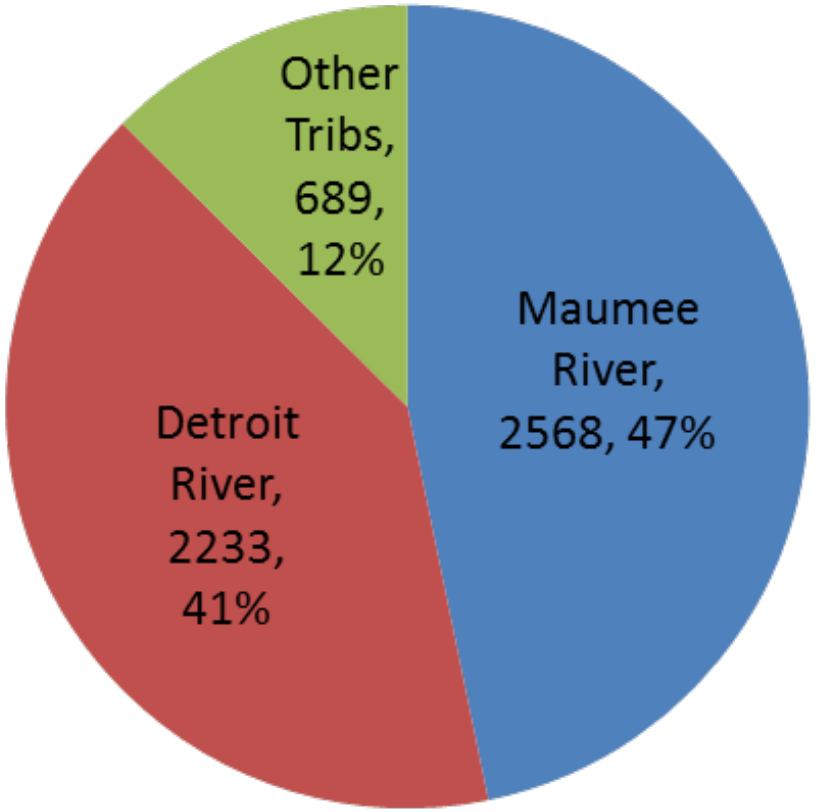

Cumulative spring dissolved phosphorus load (metric tons)
Range
2011
2012
2013
2014
2015
506
0
100
200
300
400
500
600
01-Mar
01-Apr
01-May
01-Jun
01-Jul
01-Aug

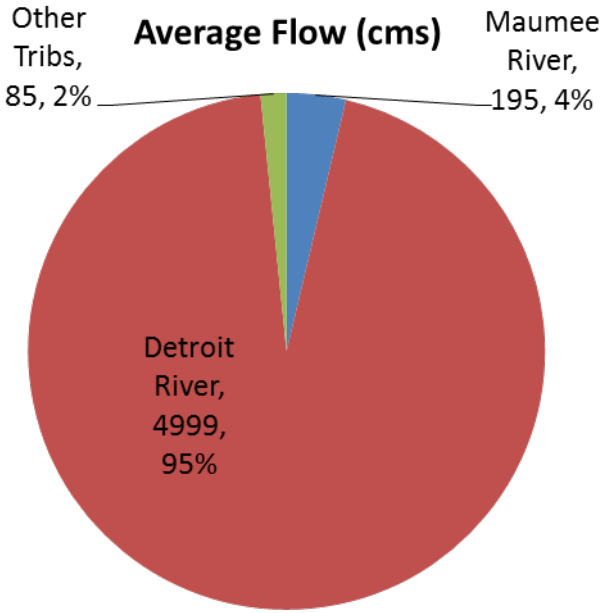


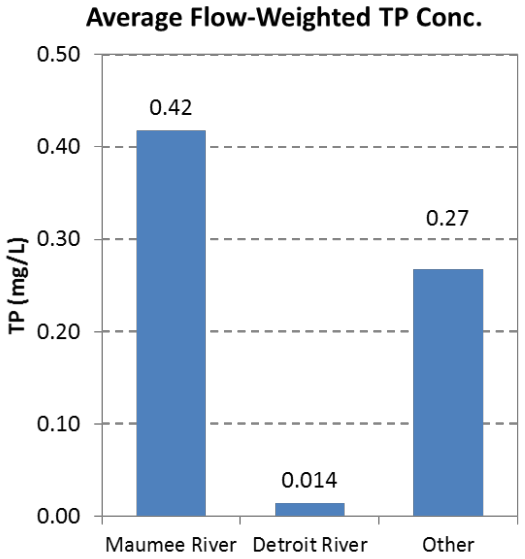
Great Lakes Water Quality Agreement (Annex IV) calling for 40% reduction in phosphorous loading

University of Wisconsin Green Bay

United States Environmental Protection Agency

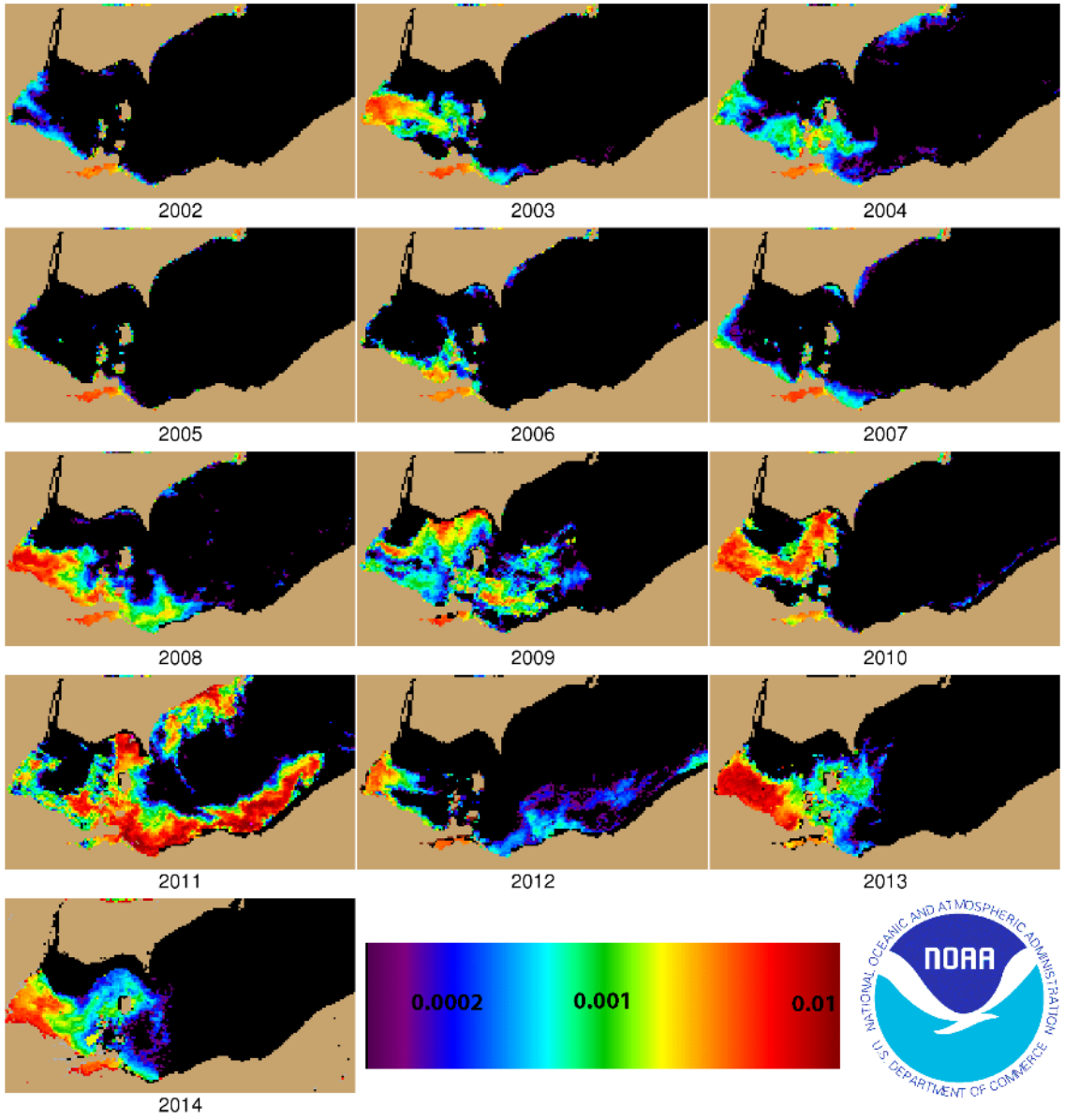


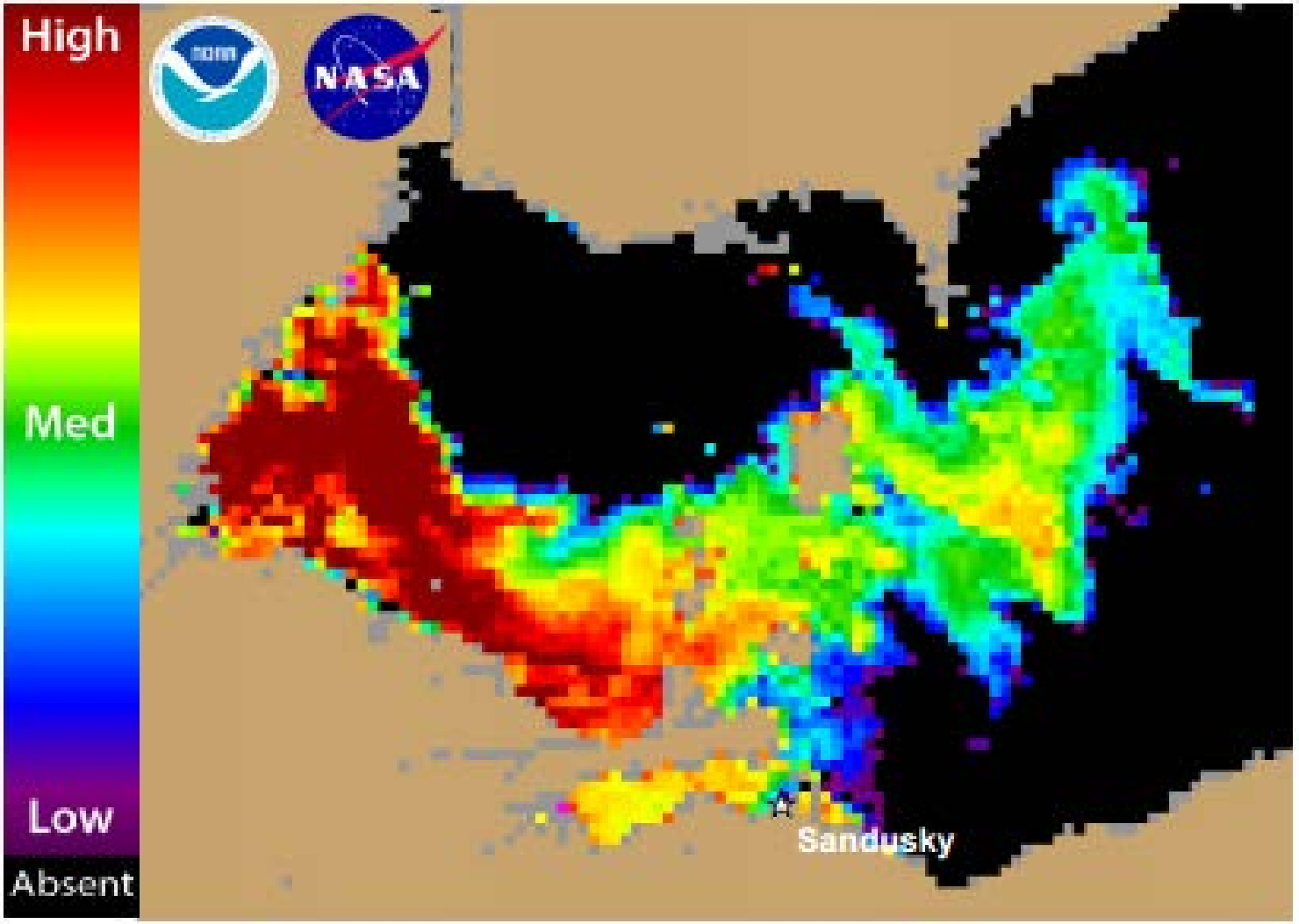




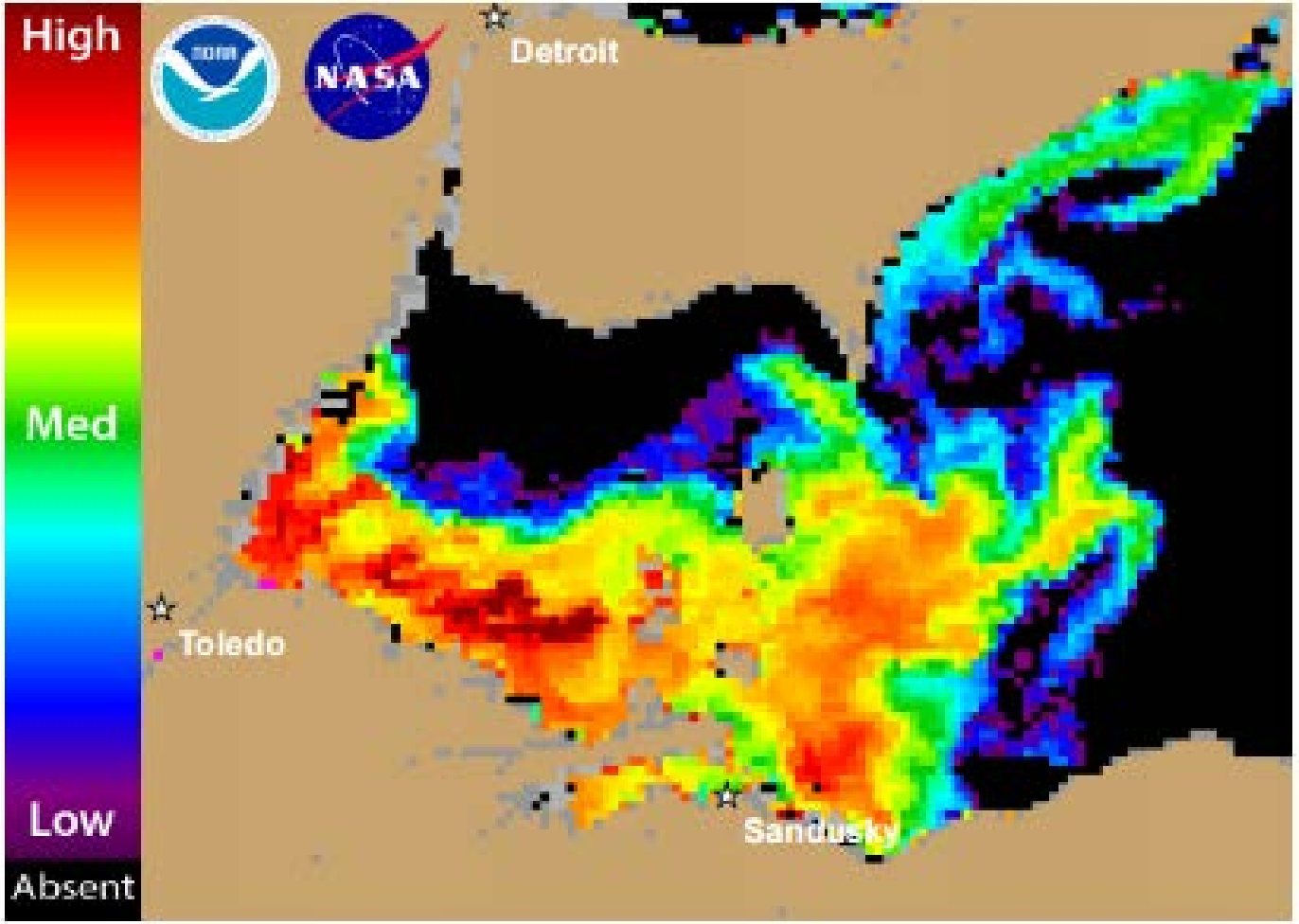
FWMC of 0.23 mg/L TP and 0.05 mg/L of DRP

13 Years of Satellite Bloom Data

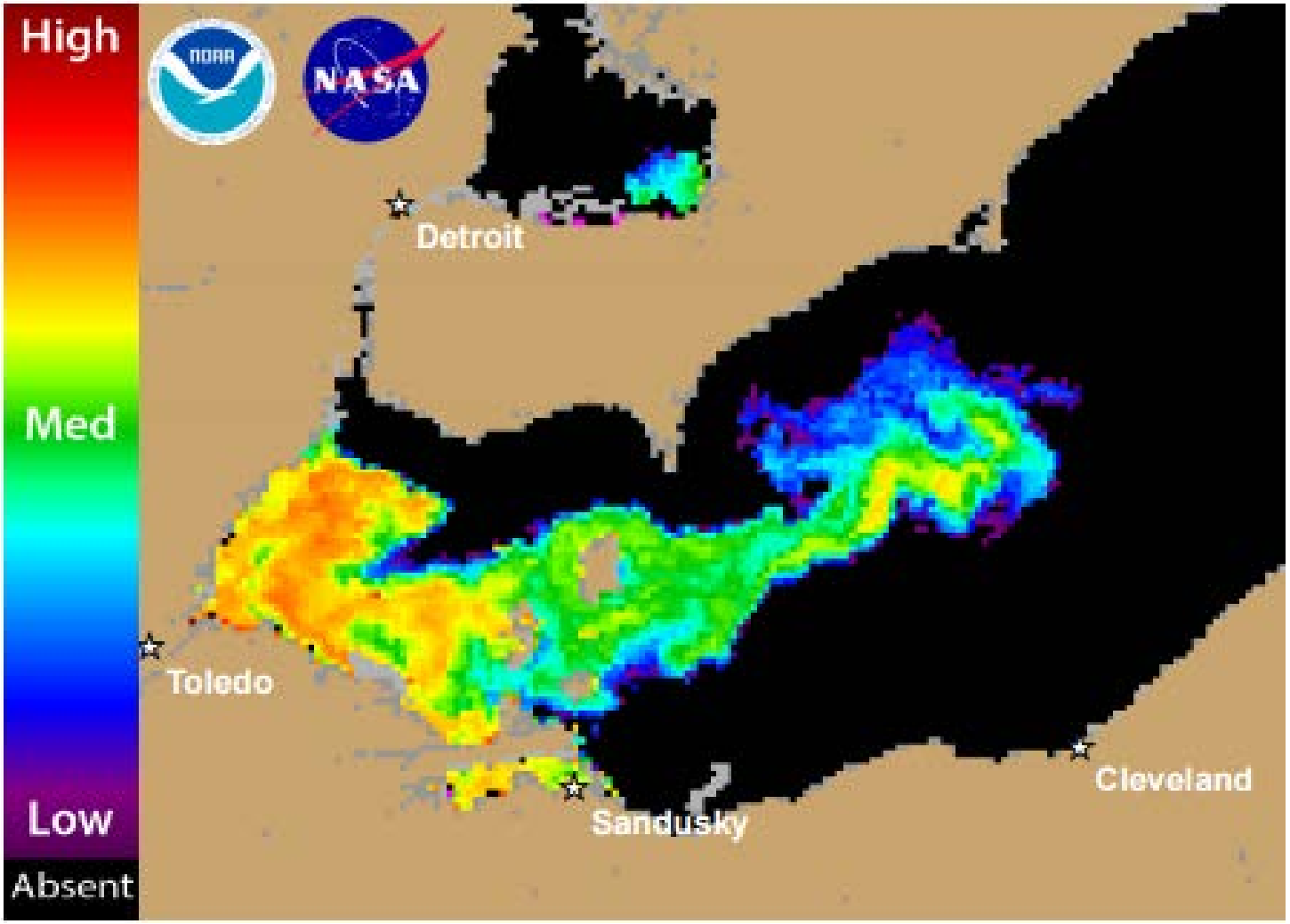




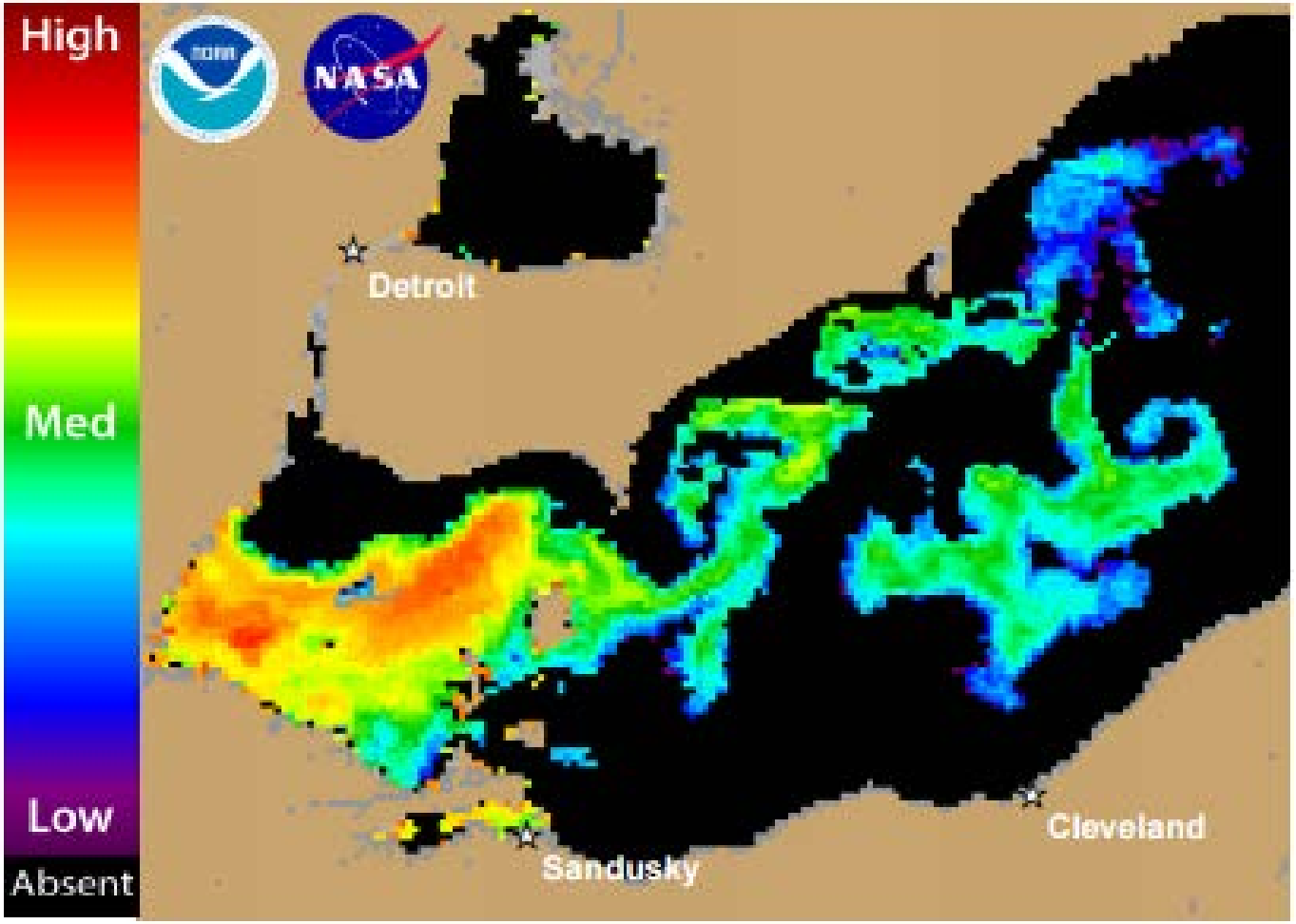
NOAA HAB bulletin, August 5 2015



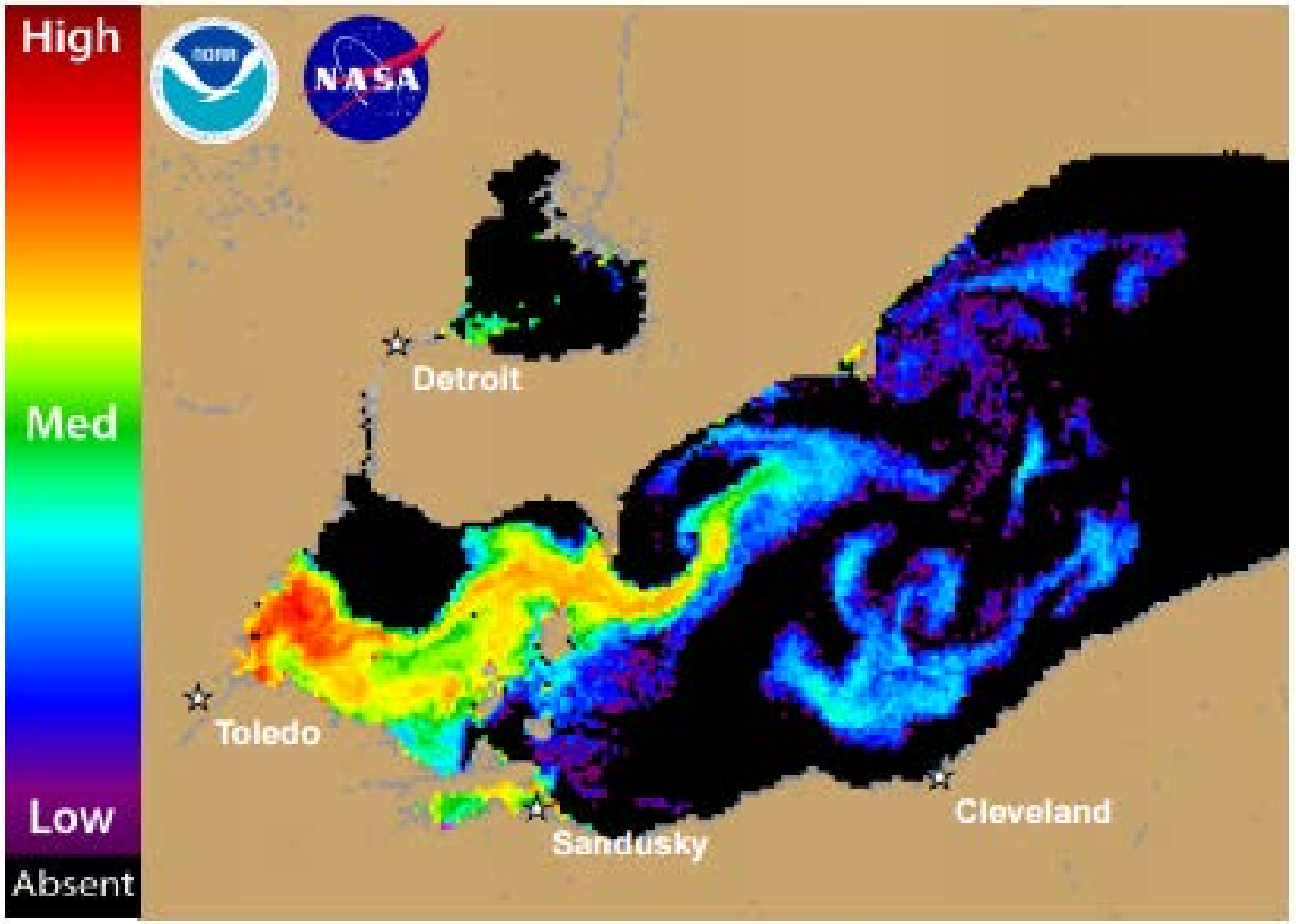
NOAA HAB bulletin, August 17 2015



NOAA HAB bulletin, August 24 2015



NOAA HAB bulletin, Sept. 3 2015



NOAA HAB bulletin, Sept. 8 2015

Lake Ecosystem Objectives

Location	Issue	Lake Ecosystem Objective
Western Basin	Blue-Green Algae (Cyanobacteria)	Maintain cyanobacteria at levels that do not produce concentrations of toxins that pose a threat to human or ecosystem health in the waters of the Great Lakes.
Central Basin	Low oxygen issues	Minimize the extent of low-oxygen zones (Dead zones).
Eastern Basin	Benthic Algae (Cladaphora)	Maintain the levels of algae below nuisance conditions
Entire lake		Maintain mesotrophic conditions (“moderate” nutrients) in the open waters of the western and central basins of Lake Erie, and oligotrophic conditions (“low” nutrients) in the eastern basin of Lake Erie.

Ohio Department of Higher Education Research Initiative

4 Million allocated across five “Focus Areas”:

1.
2.
   training to remove toxins
3. Land Use Practices, Sources of Enrichment, Water Quality and Engineered Sy nitoring and BMPs)
4. Human Health and liver impact)
5. Economics and Policy

OSU CFAES’s “Field to Faucet” adding additional support

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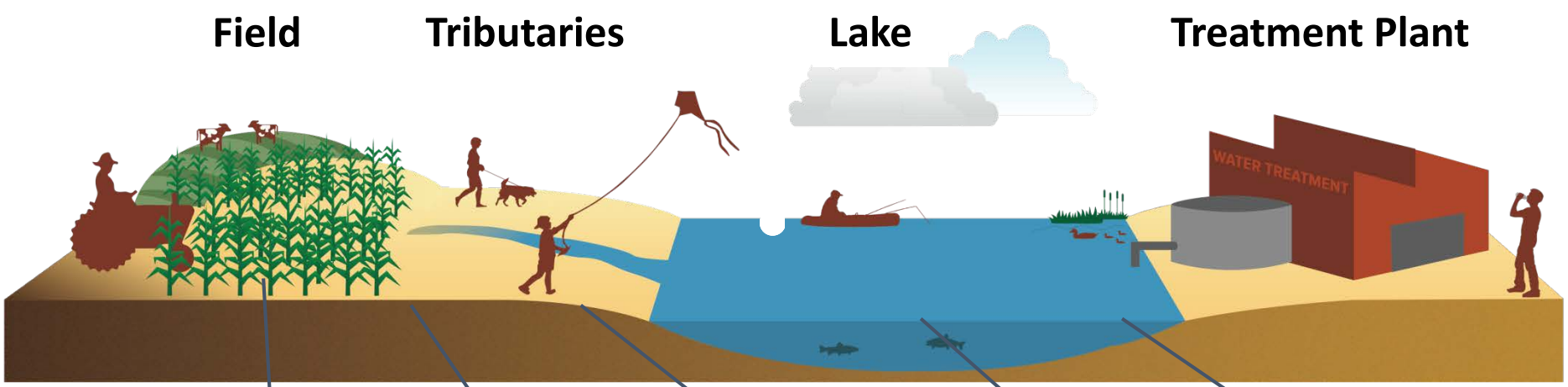

Field to Faucet Projects

- Field Mgt. Apps
- Manure Recycling
- Data Co-op
- Microcystin Detector
- Bloom Detection

What Can Agriculture Do?

- Avoiding fall and winter **application** of fertilizer and manure (SB1)
- Eliminate **broadcast application** and **incorporate** fertilizer (i.e., subsurface placement; band/inject)
- **Soil testing** of all fields to prevent application of too much P
  - Do not apply P above agronomic need (Tri-state recommendations)
  - At least 30% of Ohio fields have too much P already; hotspots/legacy
- N
- **Dr**
  -
  -
  -
- Ac
  - Treat manure and commercial fertilizer the sam
  - The algae don't care about P source

The 4R Nutrient Program (SB150):

- Right fertilizer **source** (i.e., manure and P free)
- Right **rate** (i.e., amount; Ag need)
- Right **time** (i.e., rain and frozen ground)
- Right **place** (i.e., only where needed)

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What Other Levers Can We Turn?

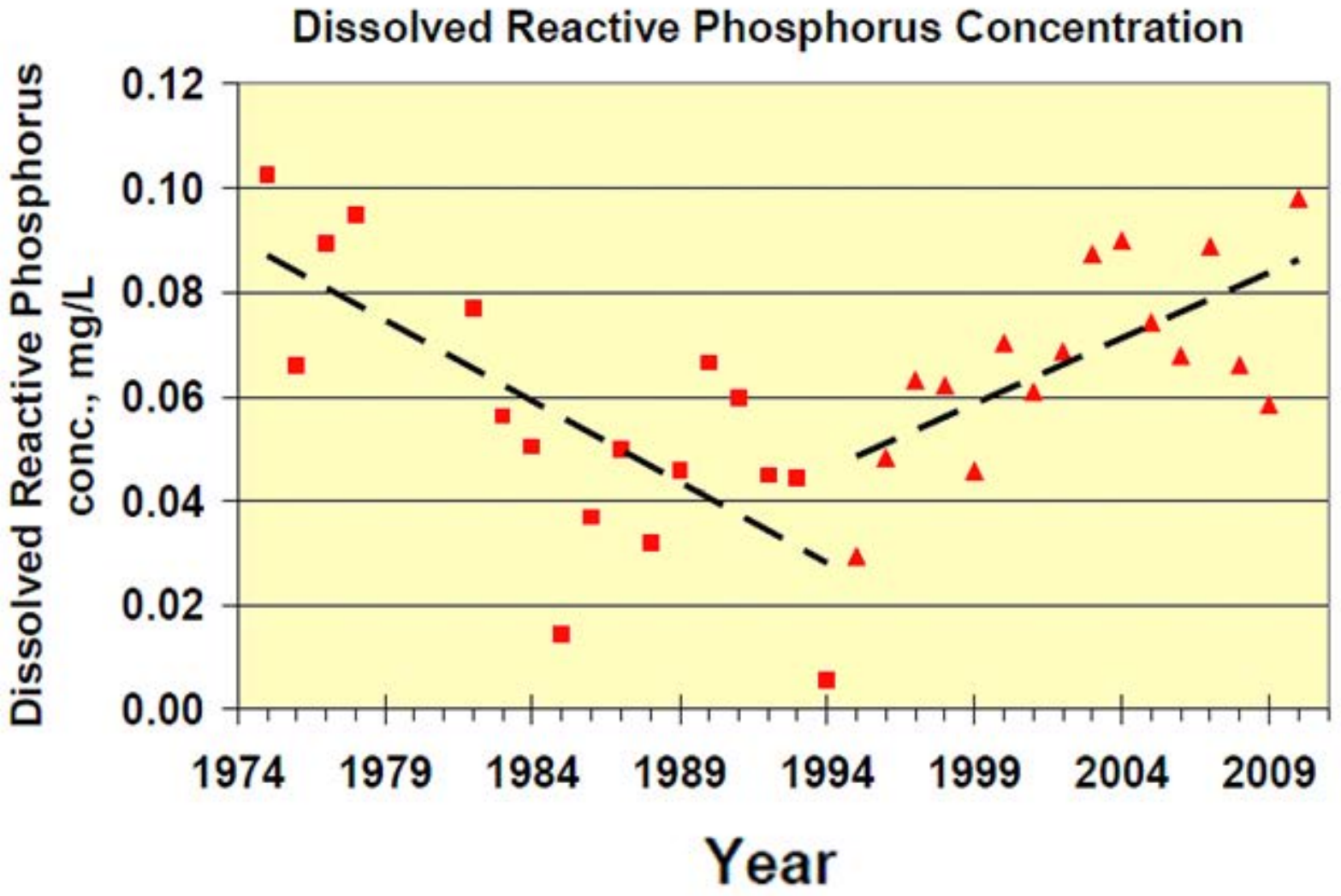
- **Lawn Care** Recommendations:
  - Follow Scott's lead…..all lawn care fertilizer sellers and lawn care applicators meet the zero P goal
- Reduce **property runoff** (e.g., rain barrels, terraces, porous surfaces, etc.)
- S
- W
- M

Immediate Needs:

- Arm water treatment plants with tools, technology, and training to remove toxins
  - Find surrogate for toxin
- Reduce load of P into Lake Erie by 40%
  - Water management
  - Soil testing (<30ppm)

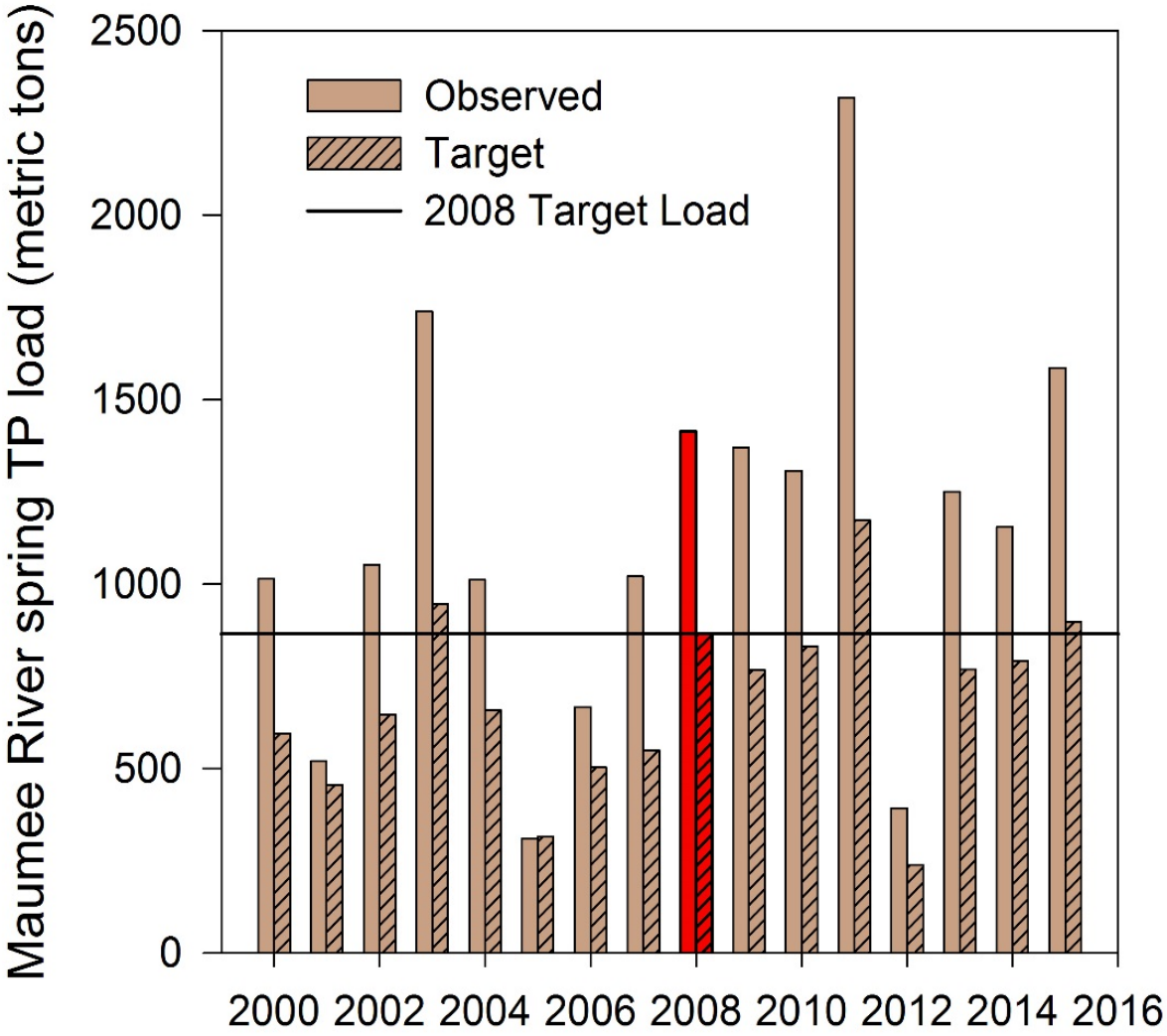
Questions?

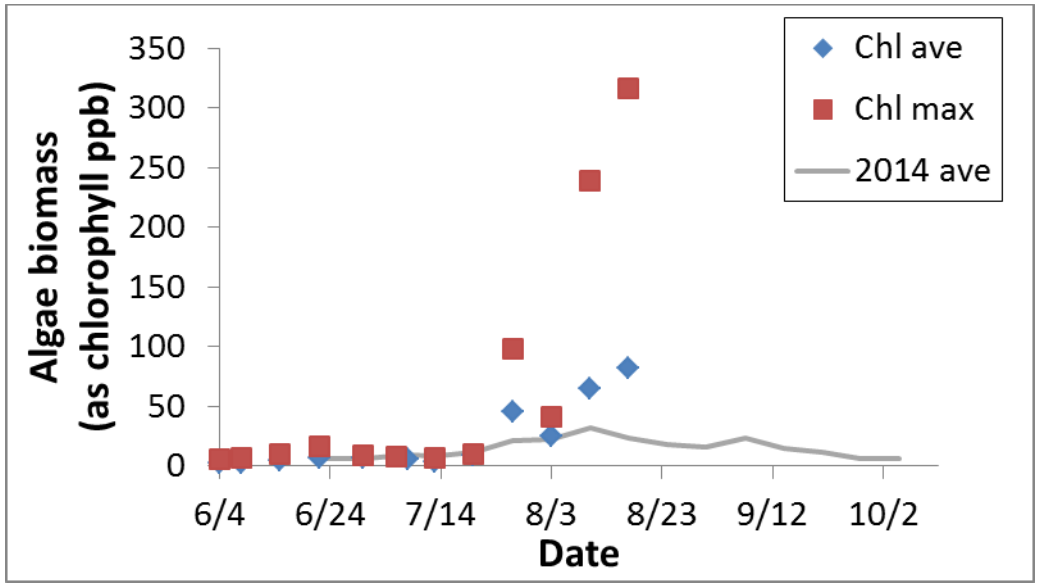
- For more information:
  - Dr. Christopher Winslow
  - ***Phone***: 614-292-8949
  - ***E-mail***: winslow.33@osu.edu

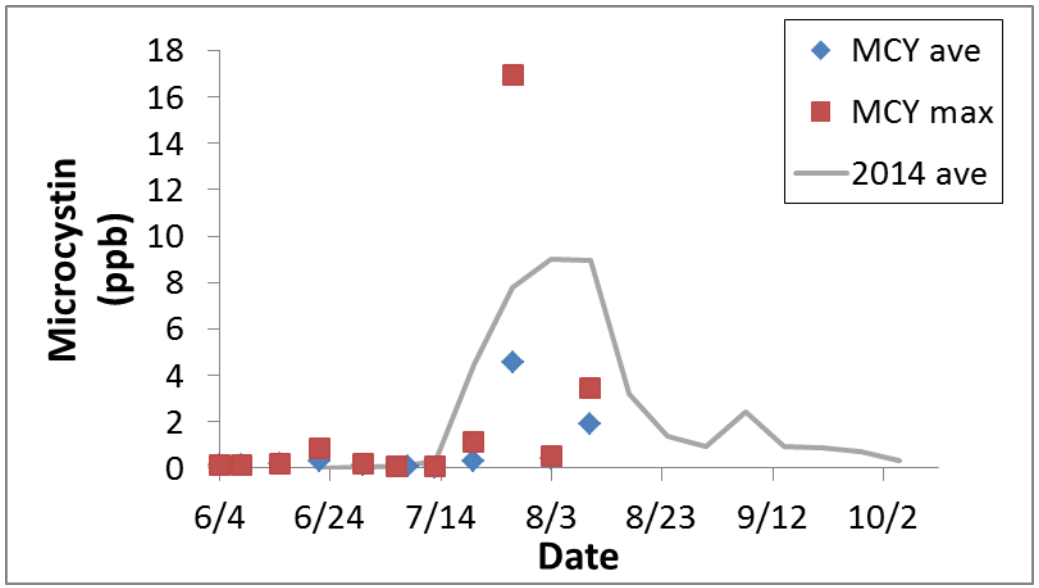


Modified from: David Baker, National Center for Water Quality Research, Heidelberg University

Maumee spring total P target load







Charter boat sampling data update

- Algae levels dramatically increased in late July and August.
- Average algae levels in 2015 are greater than average levels in 2014, indicating a worse bloom.
- The high levels indicate that the bloom is underway.
- Target concentration for western basin chlorophyll is 15 ppb.

- Microcystin, the toxin produced by blooms and responsible for the Toledo crisis, peaked in early August 2014.
- Average microcystin concentrations have been relatively low compared to the 2014 average and low for the amount of algae biomass.
- The new drinking water standard for adults is 1.6 ppb

- ppb = parts per billion

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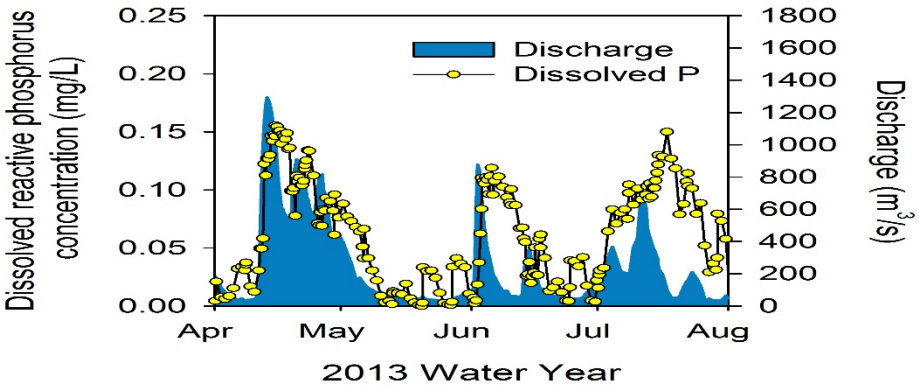
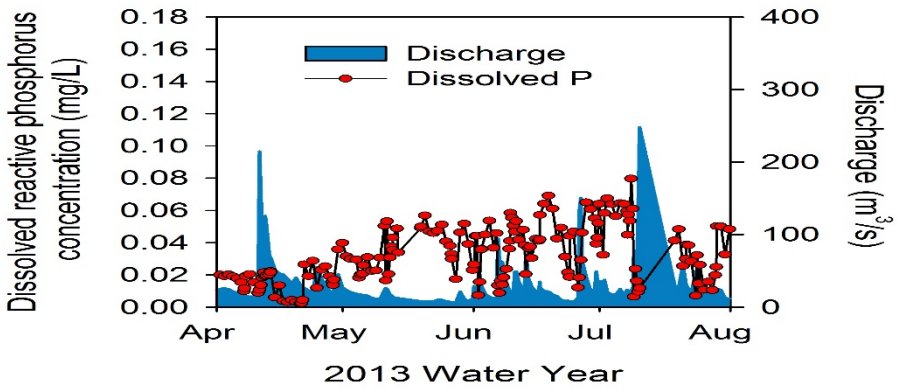
Indicators of non-point sources
e.g., land runoff
Example: Maumee River

Indicators of point sources
e.g., effluent
Example: Cuyahoga River

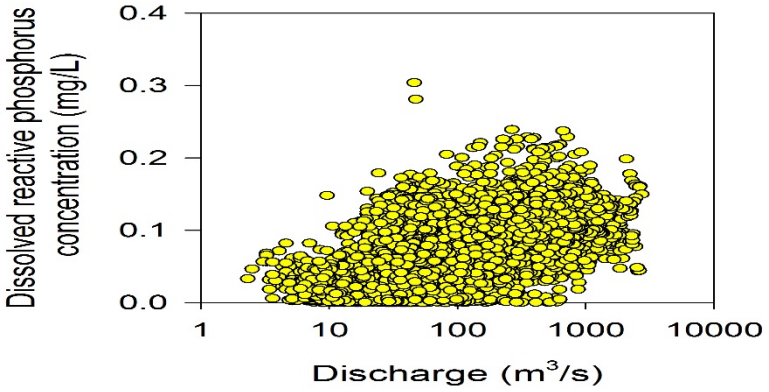
1) Concentration increases during storms



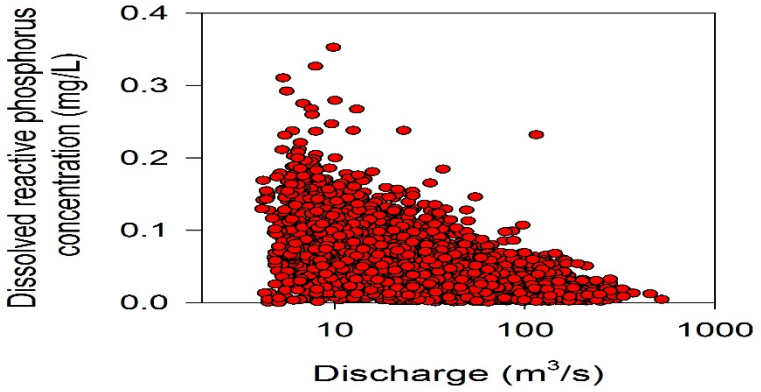
1) Concentration increases during low flow



2) Concentration increases with flow



2) Concentration decreases with flow



What is Causing the Harmful Algal Blooms in Lake Erie?

Clean Air Act
Climate change
Commodity prices
Cropping systems
Crop uptake
Equipment size
Ethanol
Fertilizer placement
Fertilizer rates
Fertilizer source
Fertilizer timing
Glyphosate
GMOs
Increased soil pH
Ignoring amounts of P loss
Larger farm size
Lower levels of sediment in the water
Manure
Misconceptions about P by researchers
Conservation Tillage (No-till & reduced till)
Nitrogen
Rental agreements
Products sold to increase P solubility in soil
Soil biology alterations
Soil testing and analysis
Stratification of P
Tile drainage
Zebra mussels, "near-shore shunt"

Smith et al., 2014