"*All In*: Nutrients Exported from the Maumee River Watershed Drive Harmful Algal Blooms in Lake Erie"

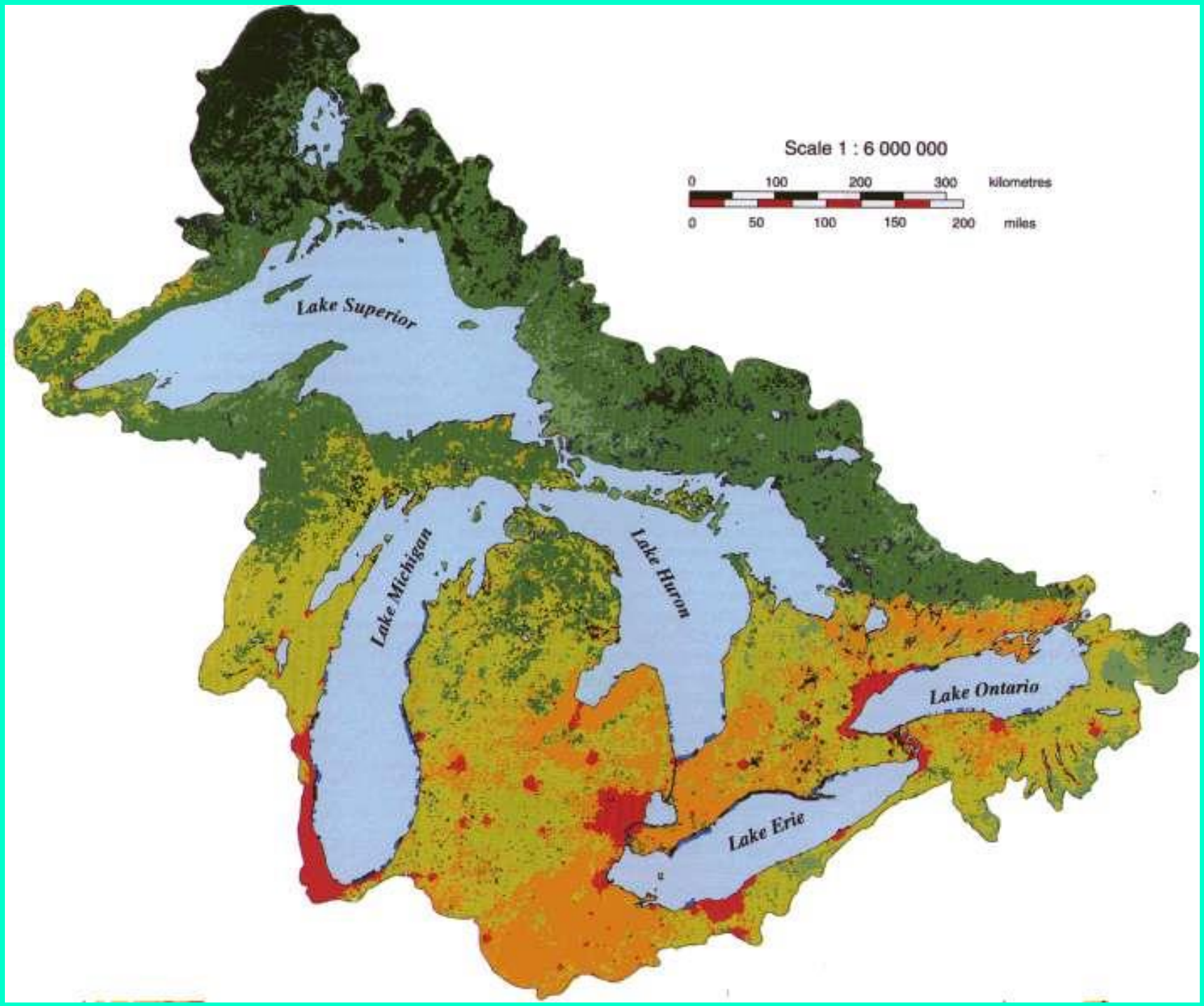
Douglas D. Kane
Defiance College

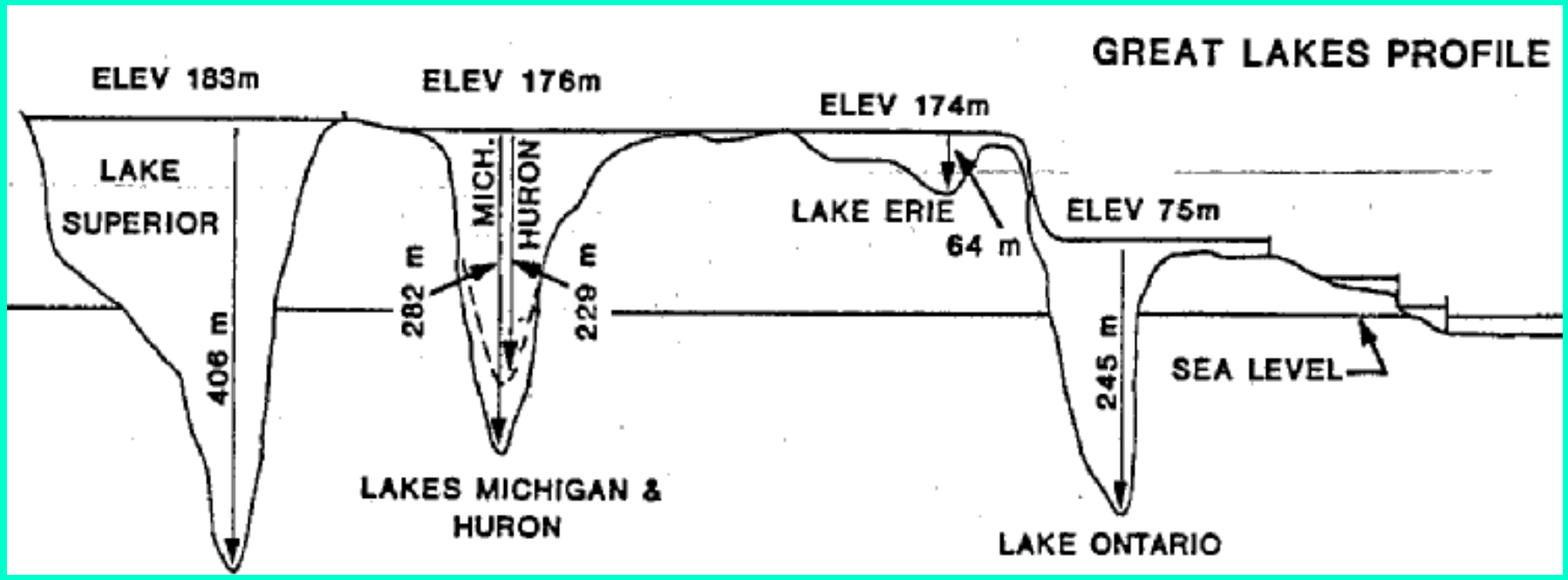
DEFIANCE COLLEGE
To Know ◆ To Lead ◆ To Serve ◆ To Understand

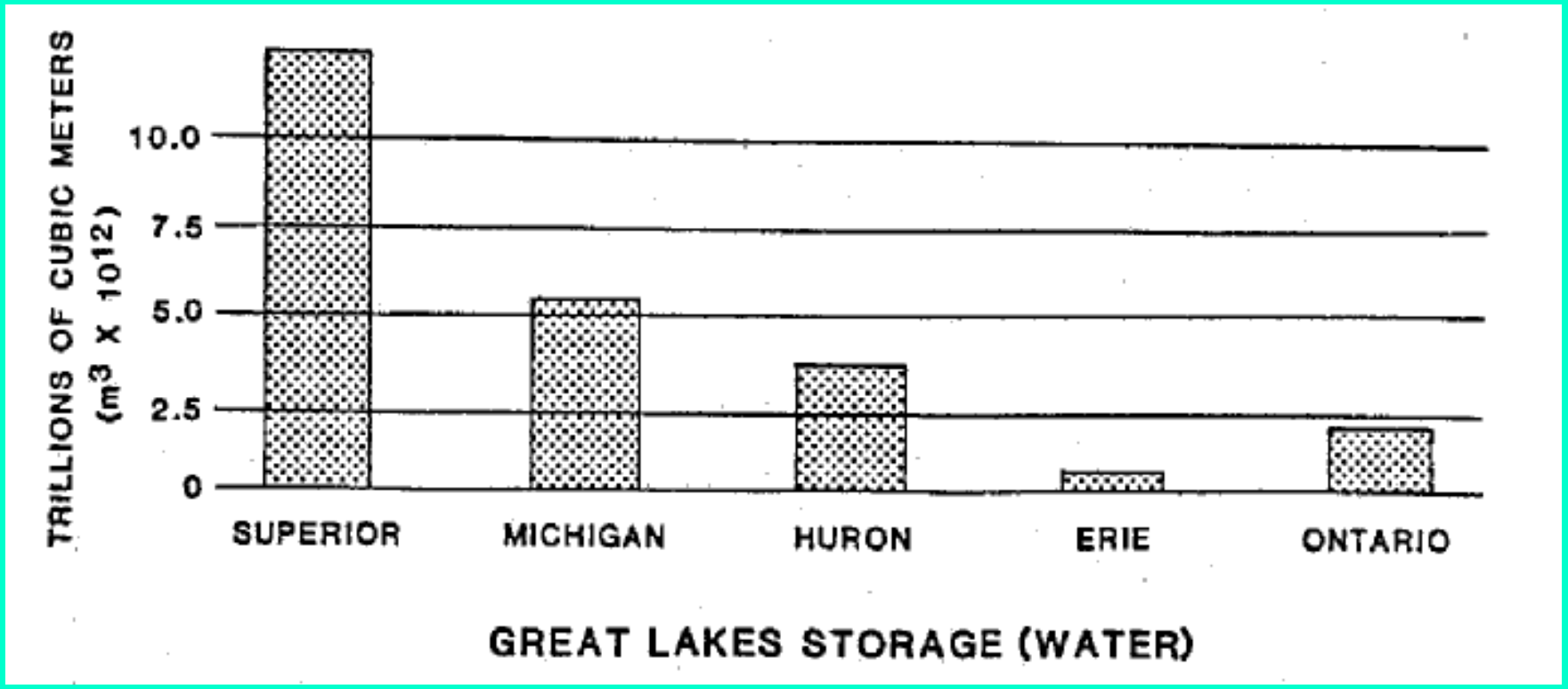

#EMPTY
GLASS CITY

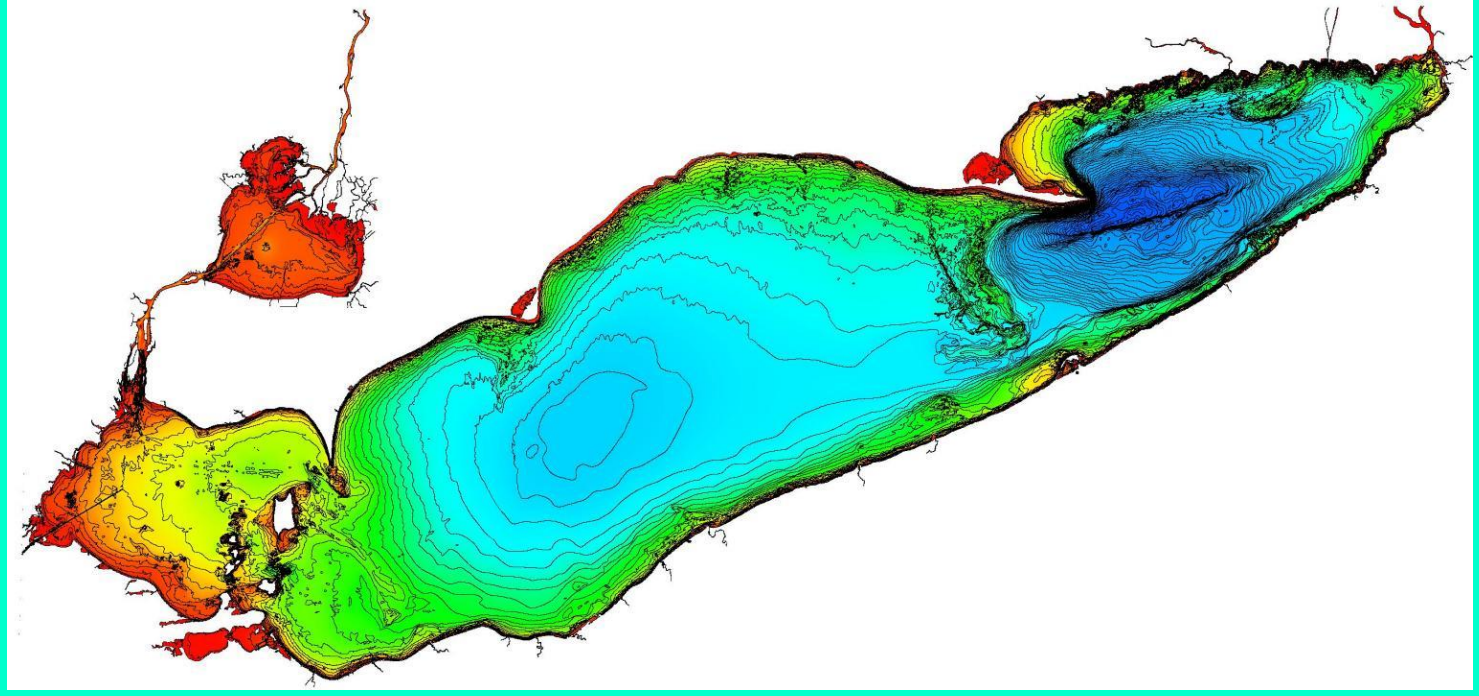

propel
propel
propel


FOX NEWS
FOX NEWS
LIVE
HOW VULNERABLE ARE WE TO THREATS
TO OUR WATER SUPPLY & POWER GRID?
JUSTICE
Judge Jeanine
EXPERTS SEARCHED A TWO-SQ-MILE AREA WHERE THE PLANE'S WRECKA


Scale 1 : 6 000 000
0 100 200 300 kilometres
0 50 100 150 200 miles
Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie


GREAT LAKES PROFILE
ELEV 183m
ELEV 176m
ELEV 174m
LAKE SUPERIOR
406 m
MICH.
HURON
282 m
229 m
LAKE ERIE
64 m
ELEV 75m
245 m
SEA LEVEL
LAKES MICHIGAN & HURON
LAKE ONTARIO


TRILLIONS OF CUBIC METERS
(m^3 X 10^{12})
10.0
7.5
5.0
2.5
0
SUPERIOR
MICHIGAN
HURON
ERIE
ONTARIO
GREAT LAKES STORAGE (WATER)



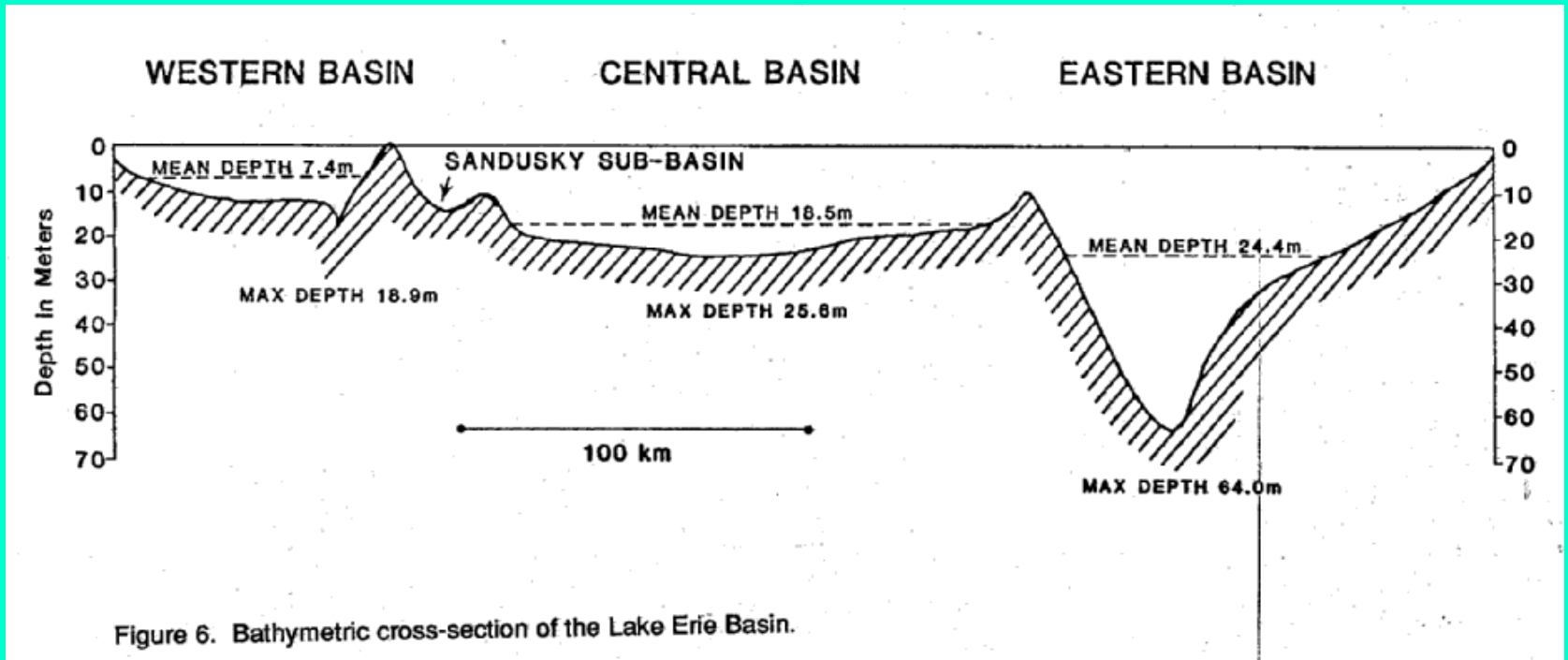


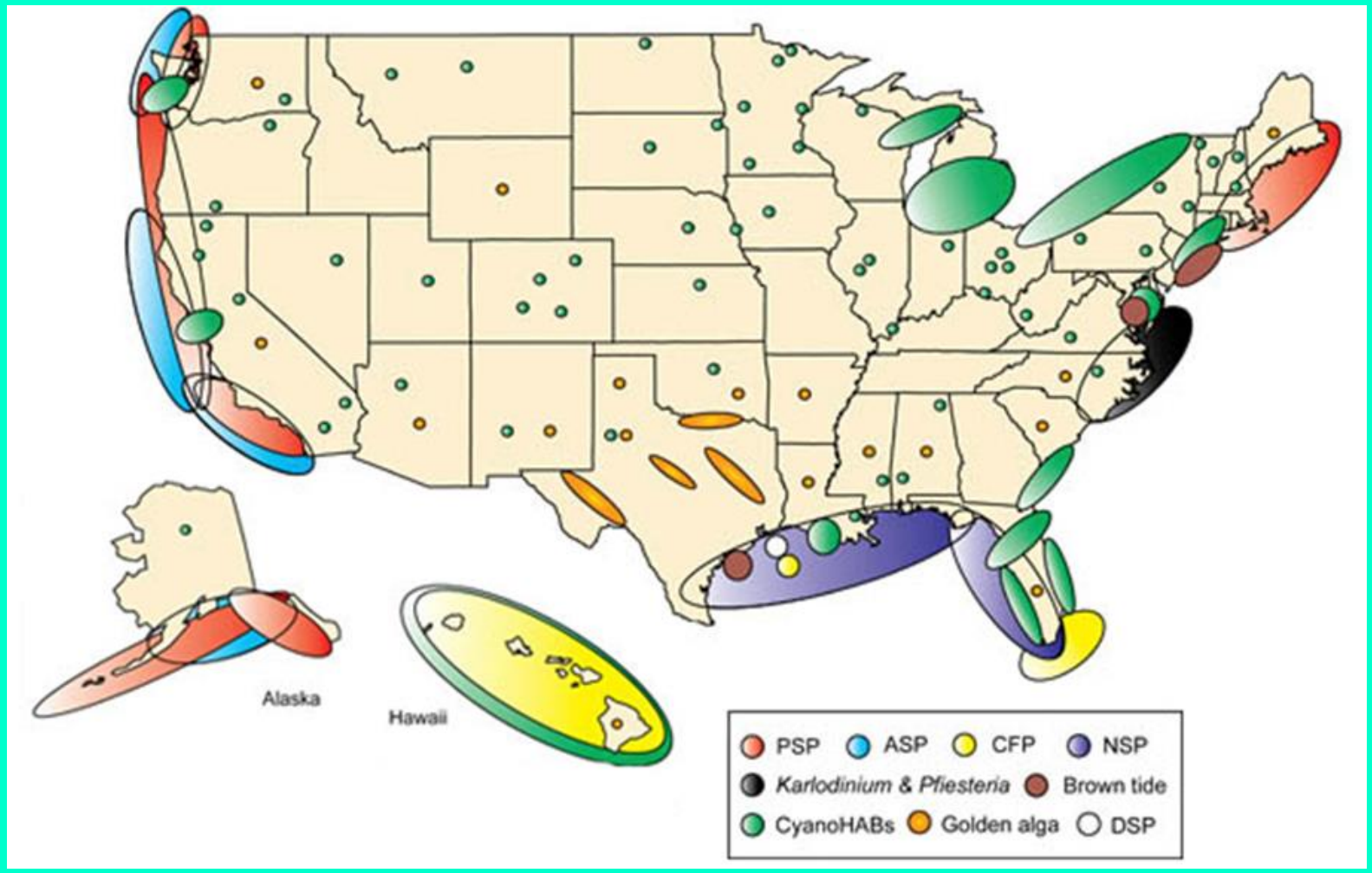
Figure 6. Bathymetric cross-section of the Lake Erie Basin.

"What is the problem?"

Douglas D. Kane
Defiance College

DEFIANCE COLLEGE
To Know ◆ To Lead ◆ To Serve ◆ To Understand

Harmful Algal Blooms (HABs) in the U.S.A.



Microcystin levels

WB > 1000 ppb

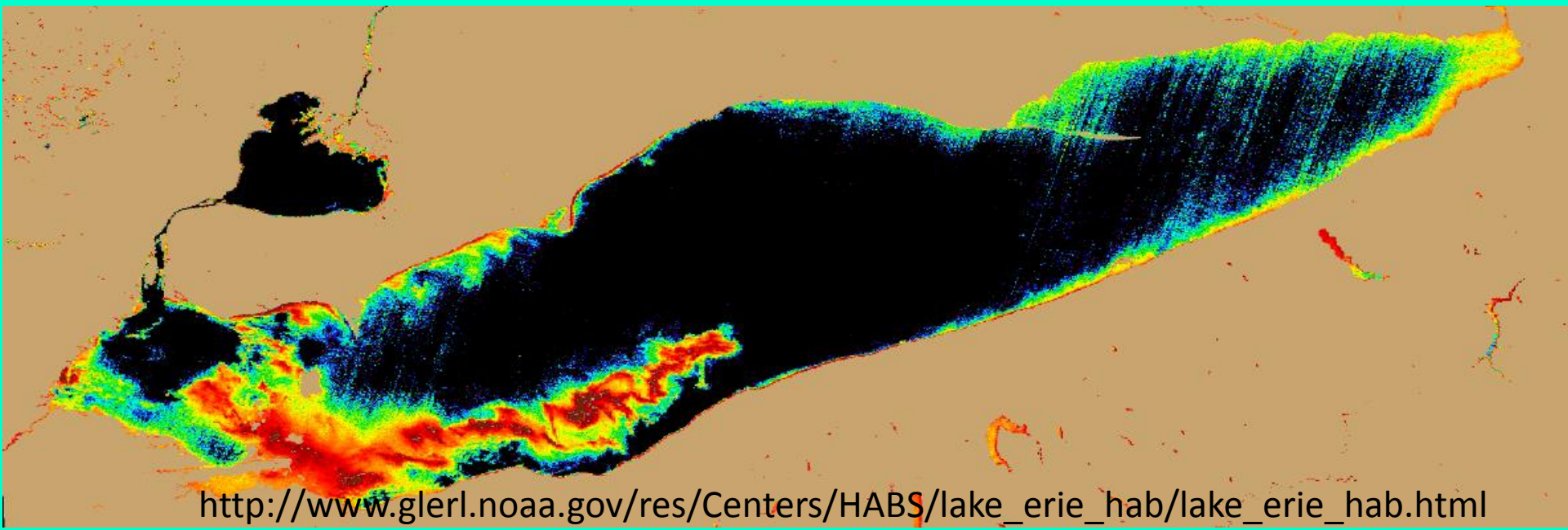
CB > 100 ppb

<u>State of Ohio</u>

Do Not Drink 1-20 ppb

Do Not Use >20 ppb

Recreational Contact Advisory Levels- 6 ppb



http://www.glerl.noaa.gov/res/Centers/HABS/lake_erie_hab/lake_erie_hab.html

Published: 9/7/2013 - Updated: 1 day ago

Toxins overwhelm Carroll Township water plant

Ottawa Co. treatment facility offline while remedy made

BY TOM HENRY
BLADE STAFF WRITER

OAK HARBOR, Ohio — The chief toxin produced by western Lake Erie's 2013 algae bloom spiked at such extreme levels along the Ottawa County shoreline this week that it knocked the water-treatment plant serving 2,000 Carroll Township residents offline.

Poisonous microcystin, the toxin in Lake Erie's most prevalent harmful blue-green algae, microcystis, was found at levels of 3.56 parts per billion in samples drawn from the Carroll Township facility, Heidi Griesmer, Ohio Environmental Protection Agency spokesman, said Friday.

That's 3.5 times higher than the 1.0 parts per billion threshold for drinking water established by the World Health Organization.

The discovery was a fluke: The Ohio EPA does not require Ohio's shoreline communities to test for microcystin, even though western Lake Erie has been coated by scum almost annually for weeks at a time since 1995.

Most area water-treatment plants test for microcystin voluntarily, though, Ms. Griesmer said.

In the case of Carroll Township, one of the region's smaller treatment facilities, tests have been done only weekly.

"We don't require them to sample at all," Ms. Griesmer said. "We're happy they're sampling weekly."

But Henry Biggart, Carroll Township water-plant superintendent, said he immediately sought approval from township trustees for more frequent testing.

Related stories

- Carroll Twp. warns against drinking water
- 2011 algae mess was a wakeup call
- Animal waste control would aid Lake Erie
- Kasich to speak at bicentennial
- U.S. EPA chief is asked to visit Clyde

Bob Vincent and Gerry Wicks- BGSU


October 2011
NASA

What is Eutrophication?

- Natural aging of lakes
- Lake becomes richer in nutrient concentrations
- Physical, chemical, and biological consequences
- **Cultural Eutrophication-** caused by human activities

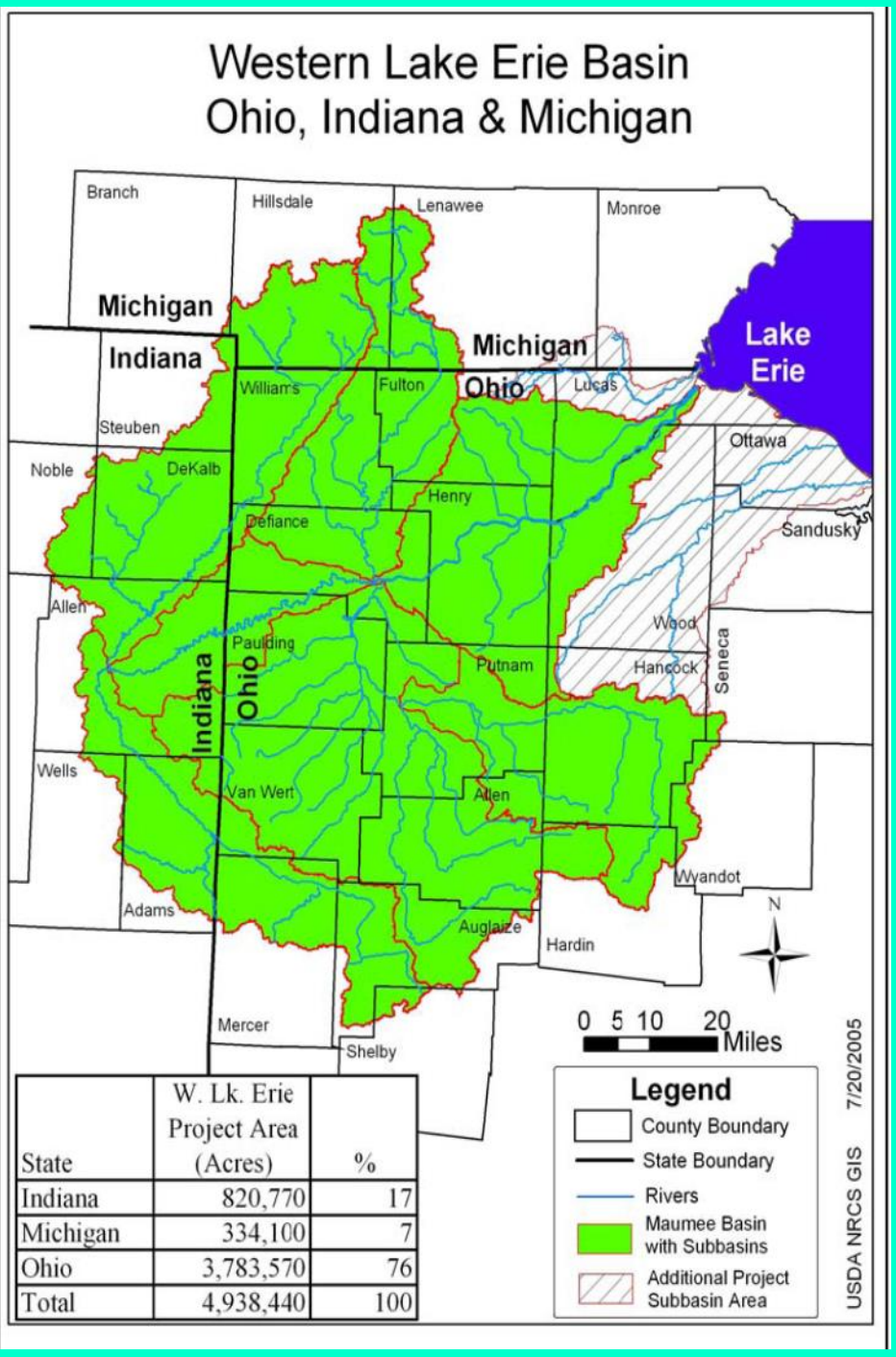
"Why do we have this problem?"

Douglas D. Kane
Defiance College

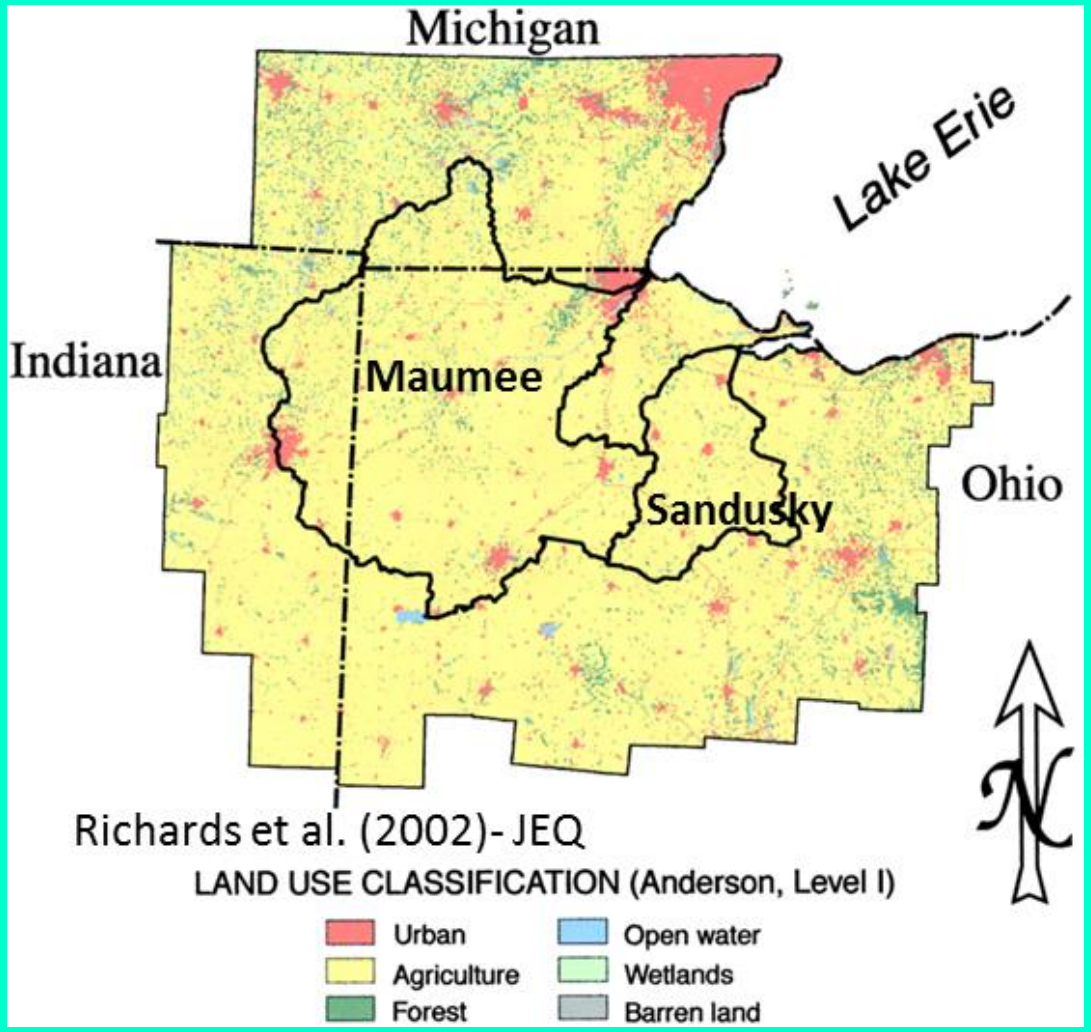
DEFIANCE COLLEGE
To Know ◆ To Lead ◆ To Serve ◆ To Understand


MICHIGAN
Lake Erie
Toledo
Bryan
SWAMP
BLACK
Defiance
GREAT
Fort Wayne
Findlay
Lima
OHIO
INDIANA

Western Lake Erie Basin
Ohio, Indiana & Michigan



State	W. Lk. Erie Project Area (Acres)	%
Indiana	820,770	17
Michigan	334,100	7
Ohio	3,783,570	76
Total	4,938,440	100


Michigan
Lake Erie
Indiana
Maumee
Sandusky
Ohio
N
Richards et al. (2002)- JEQ
LAND USE CLASSIFICATION (Anderson, Level I)
Urban
Agriculture
Forest
Open water
Wetlands
Barren land

Journal of Great Lakes Research 40 (2014) 469–472

Contents lists available at ScienceDirect

Journal of Great Lakes Research

journal homepage: www.elsevier.com/locate/jglr

Lake Erie nutrients: From watersheds to open water

Journal of Great Lakes Research 40 (2014) 496–501

Contents lists available at ScienceDirect

Journal of Great Lakes Research

journal homepage: www.elsevier.com/locate/jglr

Re-eutrophication of Lake Erie: Correlations between tributary nutrient loads and phytoplankton biomass

Douglas D. Kane [a,*], Joseph D. Conroy [b,1], R. Peter Richards [c], David B. Baker [c], David A. Culver [b]

[a] Natural Science, Applied Science, and Mathematics Division, Defiance College, Defiance, OH 43512, United States
[b] Limnology Laboratory, Department of Evolution, Ecology, and Organismal Biology, The Ohio State University, Columbus, OH 43210, United States
[c] National Center for Water Quality Research, Heidelberg University, Tiffin, OH 44883, United States

Phytoplankton Biomass Vs. Year

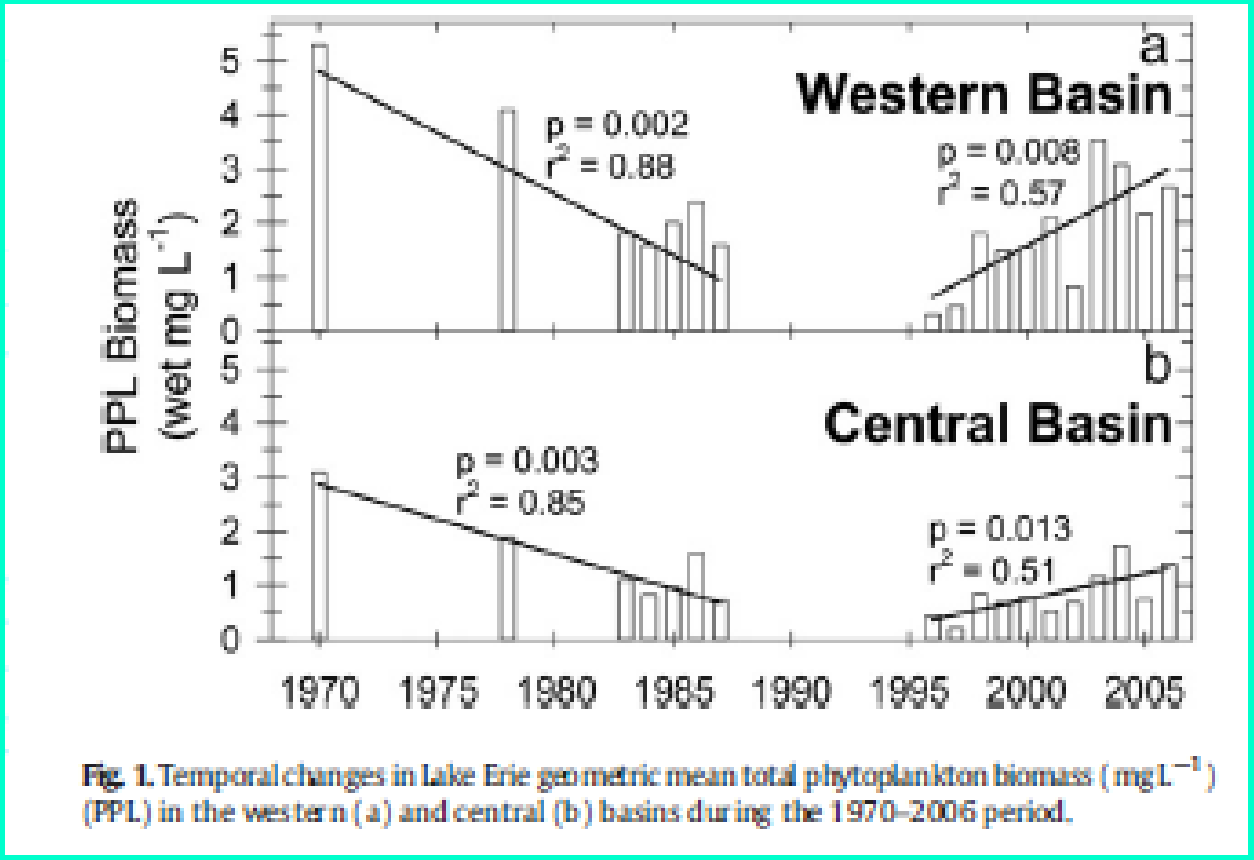
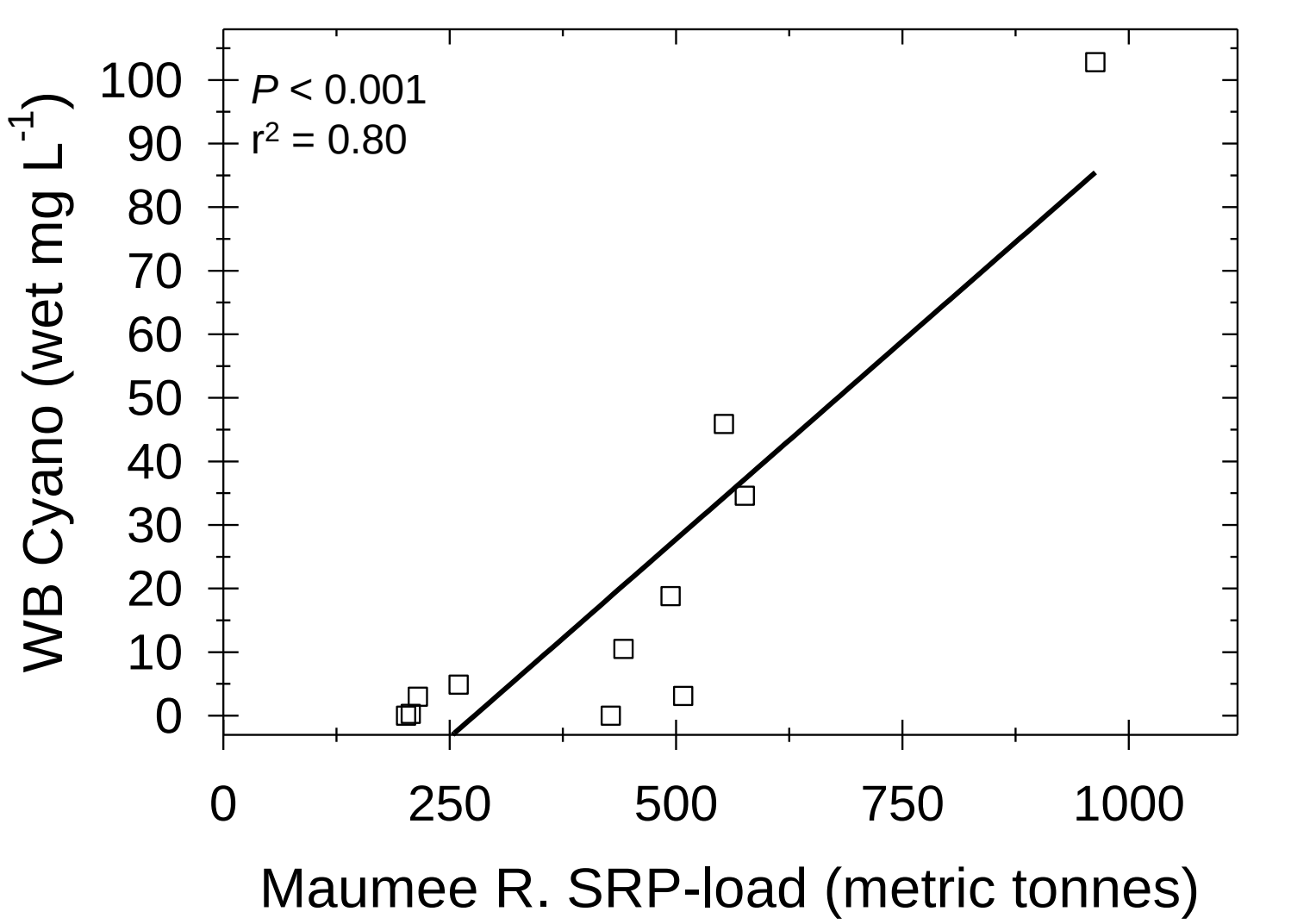


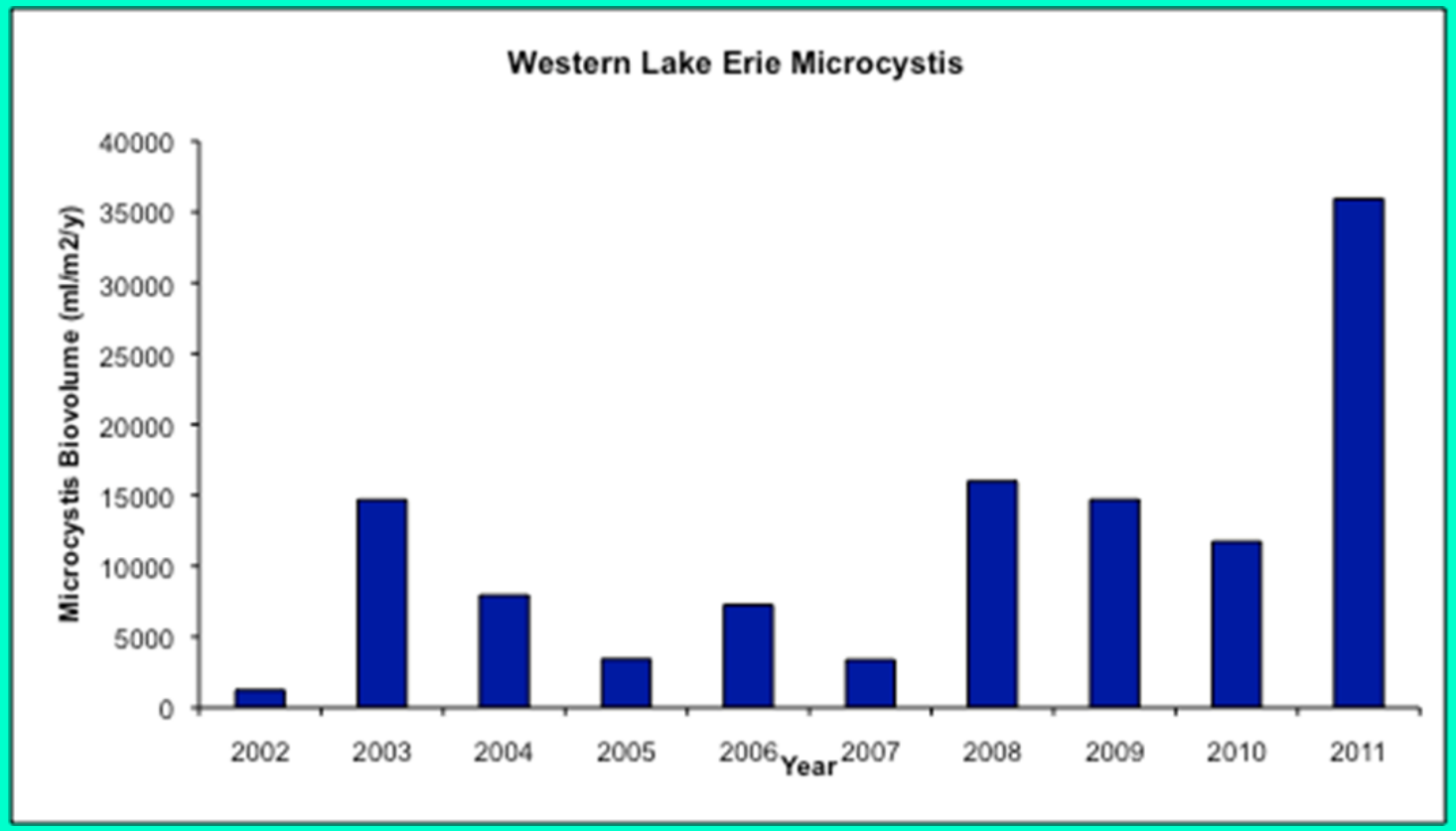
Fig. 1. Temporal changes in Lake Erie geometric mean total phytoplankton biomass (mg L^{-1}) (PPL) in the western (a) and central (b) basins during the 1970–2006 period.

Median Cyanobacterial Biomass vs. SRP Load



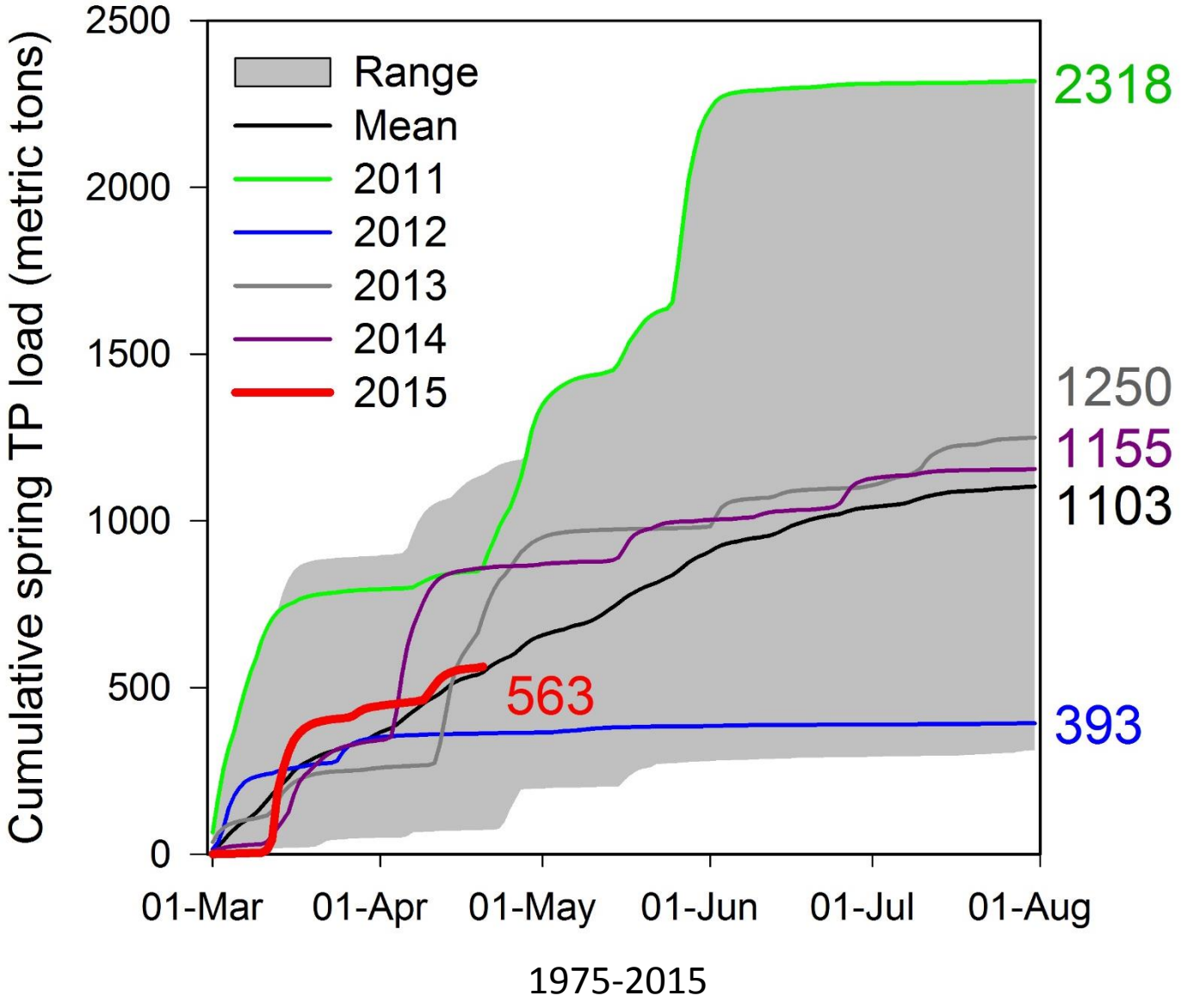
Microcystis in Lake Erie (near Maumee Bay)

- **The *Microcystis* bloom of 2011 was the largest in recent years.**

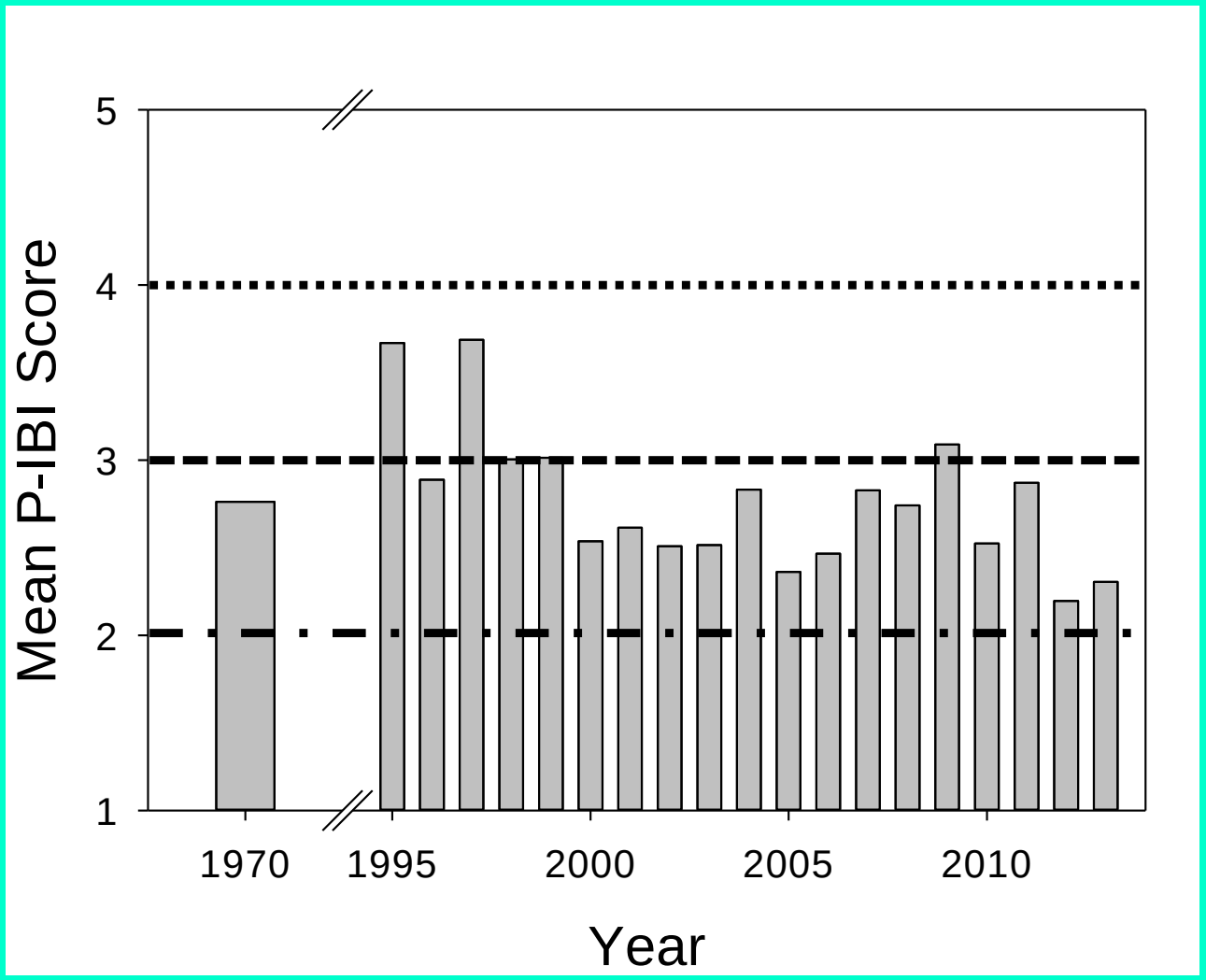


Courtesy of Dr. Tom Bridgeman- University of Toledo

Maumee River TP



WB Longterm P-IBI Scores



>4 = Excellent

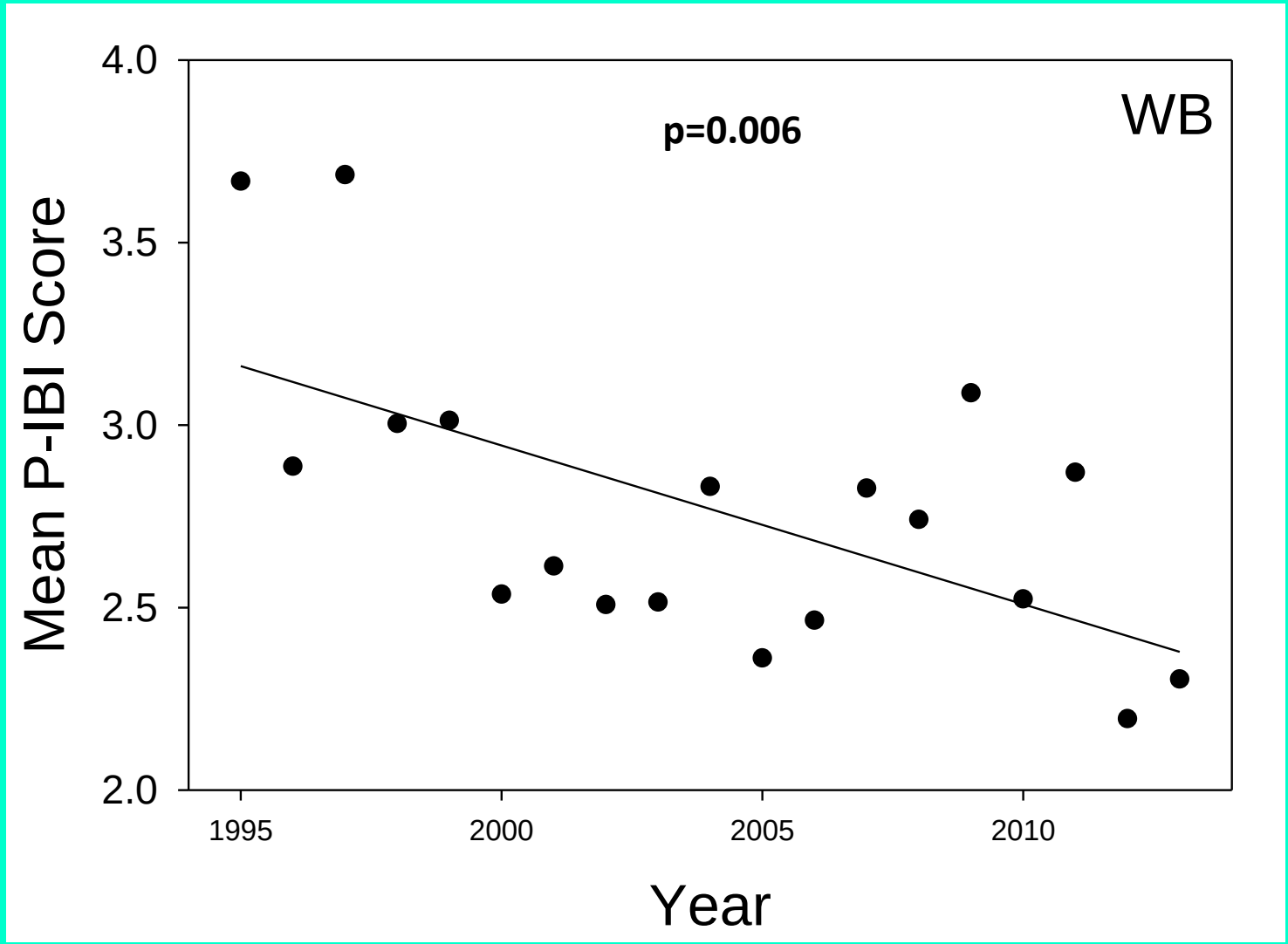
3-4 = Good

2-3 = Fair

<2 = Poor

Kane et al. In Review

WB Recent P-IBI Trends



Journal of Great Lakes Research 40 (2014) 469–472

Contents lists available at ScienceDirect

Journal of Great Lakes Research

journal homepage: www.elsevier.com/locate/jglr

Lake Erie nutrients: From watersheds to open water

Journal of Great Lakes Research 40 (2014) 518–523

Contents lists available at ScienceDirect

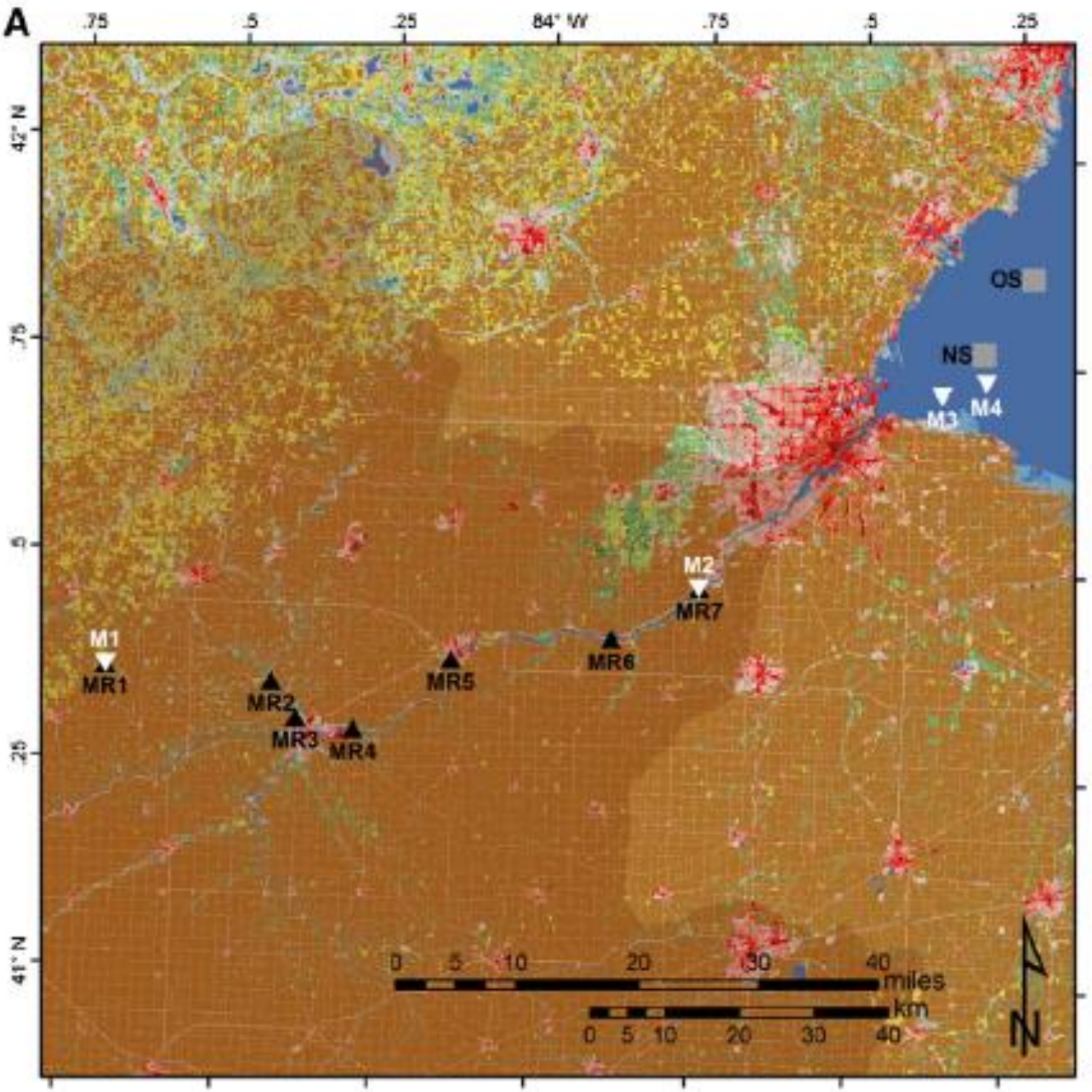
Journal of Great Lakes Research

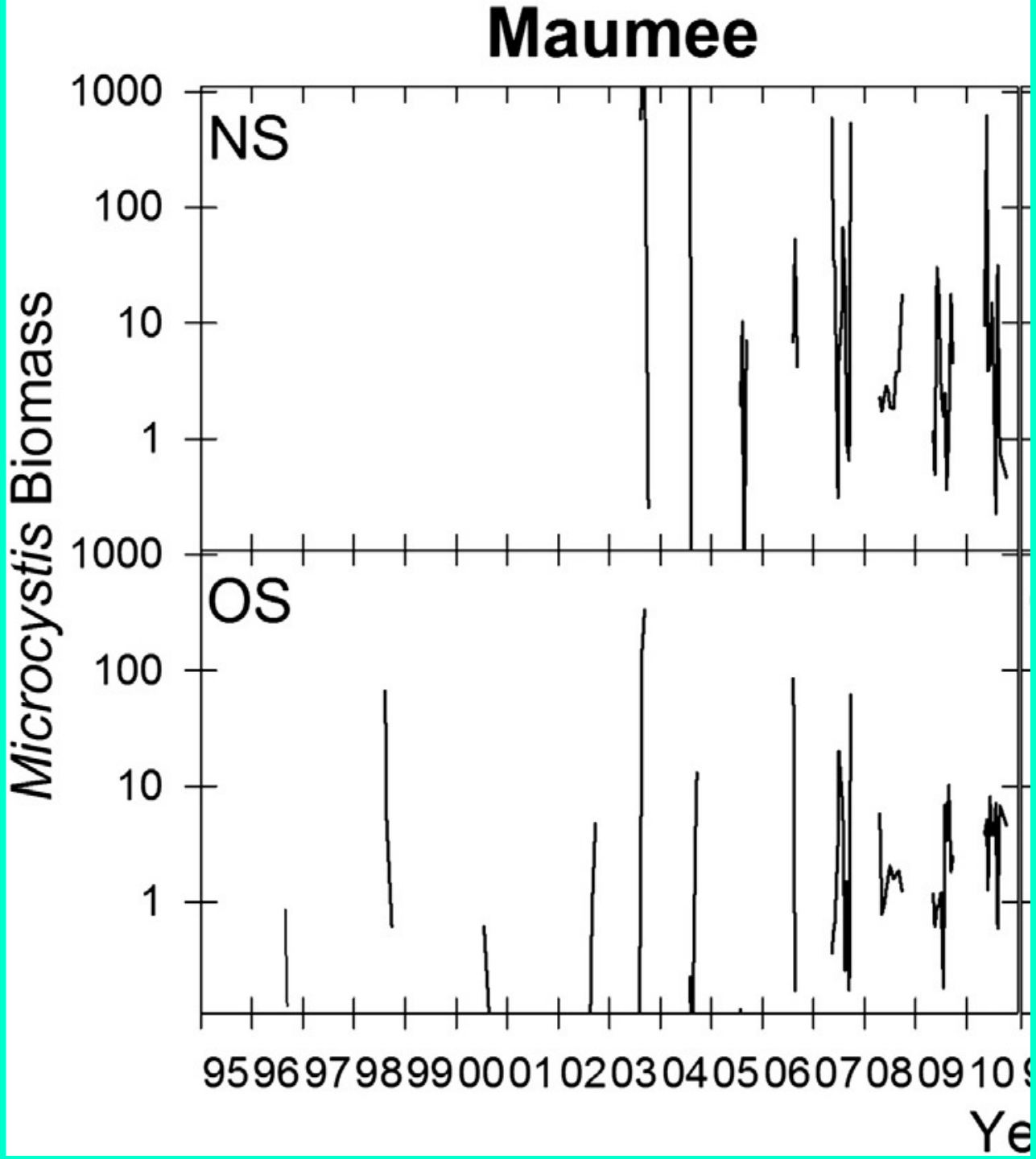
journal homepage: www.elsevier.com/locate/jglr

Systemic, early-season *Microcystis* blooms in western Lake Erie and two of its major agricultural tributaries (Maumee and Sandusky rivers)

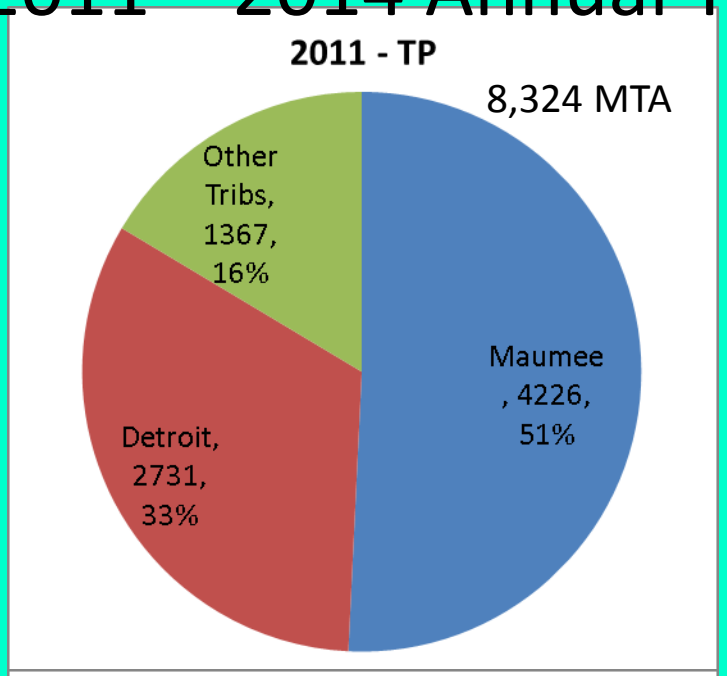
Joseph D. Conroy [a,*], Douglas D. Kane [b], Ruth D. Briland [a], David A. Culver [c]

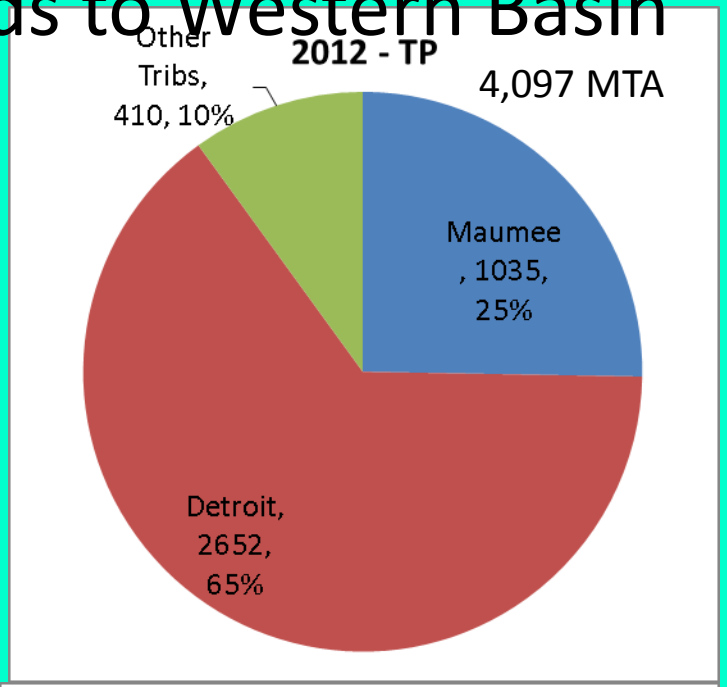
[a] *Aquatic Ecology Laboratory, Department of Evolution, Ecology, and Organismal Biology, The Ohio State University, Columbus, OH 43210, USA*
[b] *Natural Science, Applied Science, and Mathematics Division, Defiance College, Defiance, OH 43512, USA*
[c] *Limnology Laboratory, Department of Evolution, Ecology, and Organismal Biology, The Ohio State University, Columbus, OH 43210, USA*

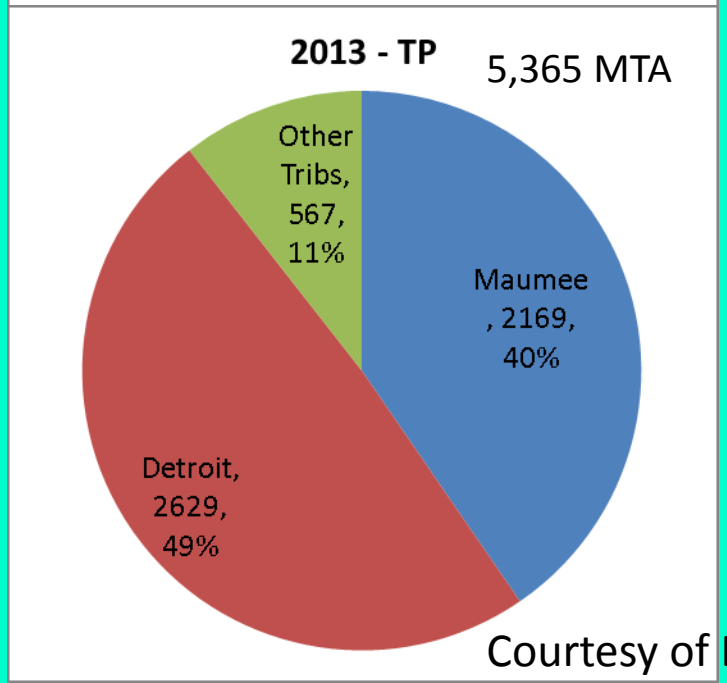

A
.75
.5
.25
84° W
.75
.5
.25
42° N
.75
.5
.25
41° N
OS
NS
M3
M4
M2
MR7
M1
MR1
MR2
MR3
MR4
MR5
MR6
0 5 10 20 30 40
miles
0 5 10 20 30 40
km
N

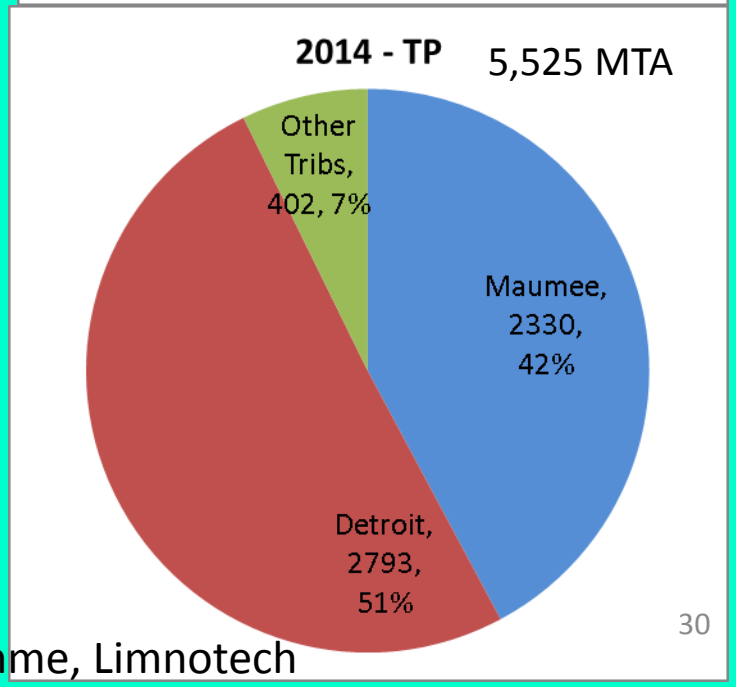

Maumee
NS
OS
1000
100
10
1
1000
100
10
1
Microcystis Biomass
95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10
Ye

2011 – 2014 Annual TP Loads to Western Basin



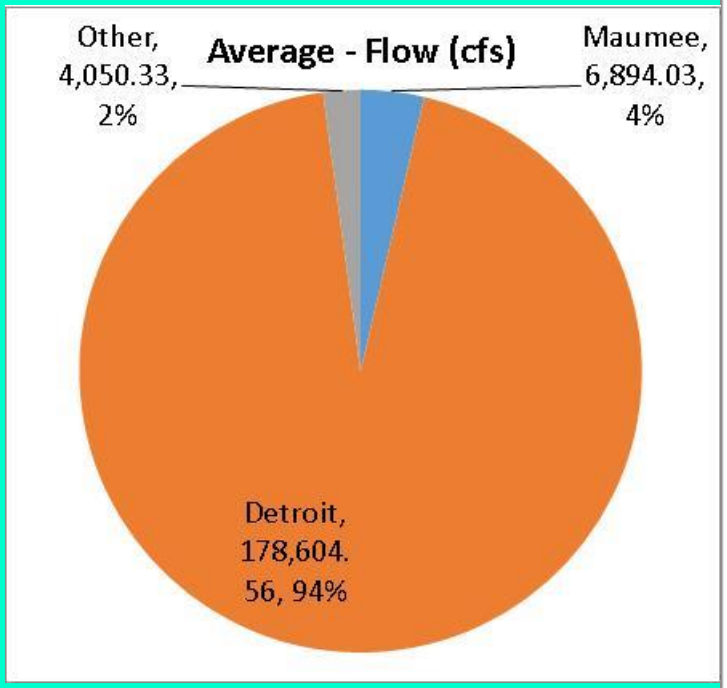


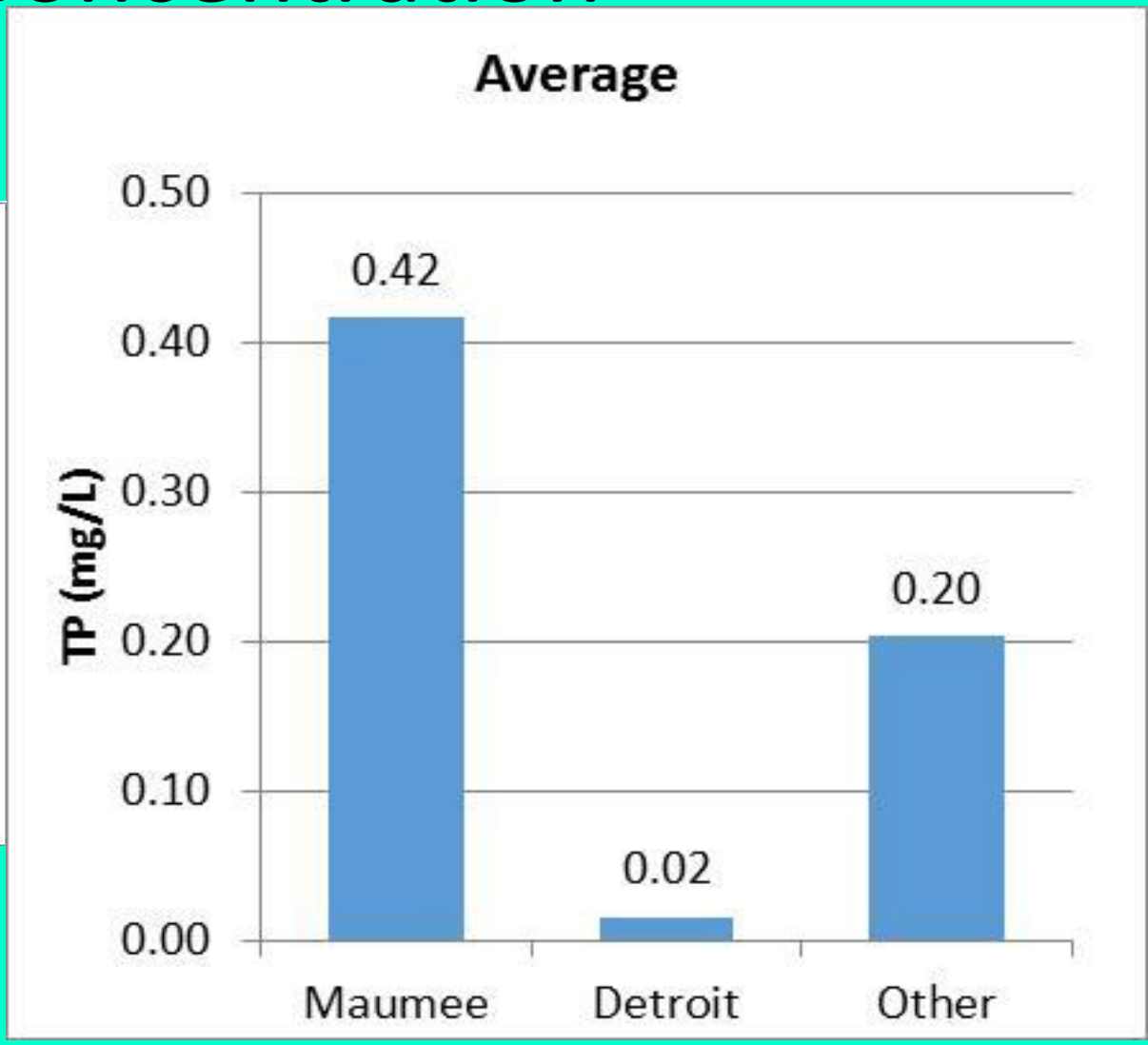




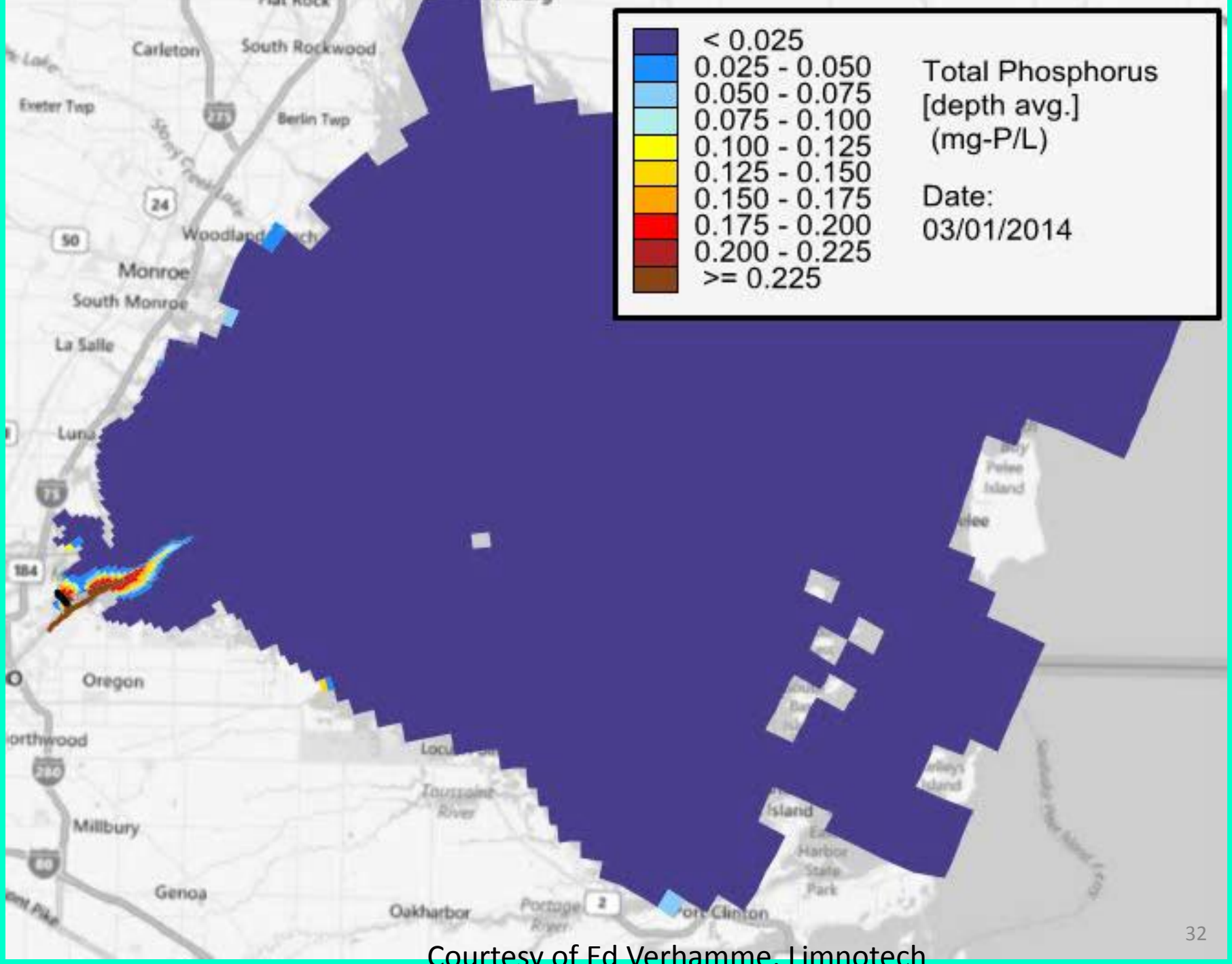
Courtesy of Ed Verhamme, Limnotech

Flow Weighted Mean TP Concentration





Courtesy of Ed Verhamme, Limnotech



Courtesy of Ed Verhamme, Limnotech

Upper Maumee River Watershed Management Plan

HUC 04100005

Prepared in Cooperation With:

Allen County Soil and Water Conservation District
3718 New Vision Drive
Fort Wayne, IN 46845
260.484.5848 ext.3
Greg.Lake@allenswcd.org

Defiance County Soil and Water Conservation District
06879 Evansport Road Suite C
Defiance, OH 43512
419.782.1794
swcd@defiance-county.com

Prepared By:

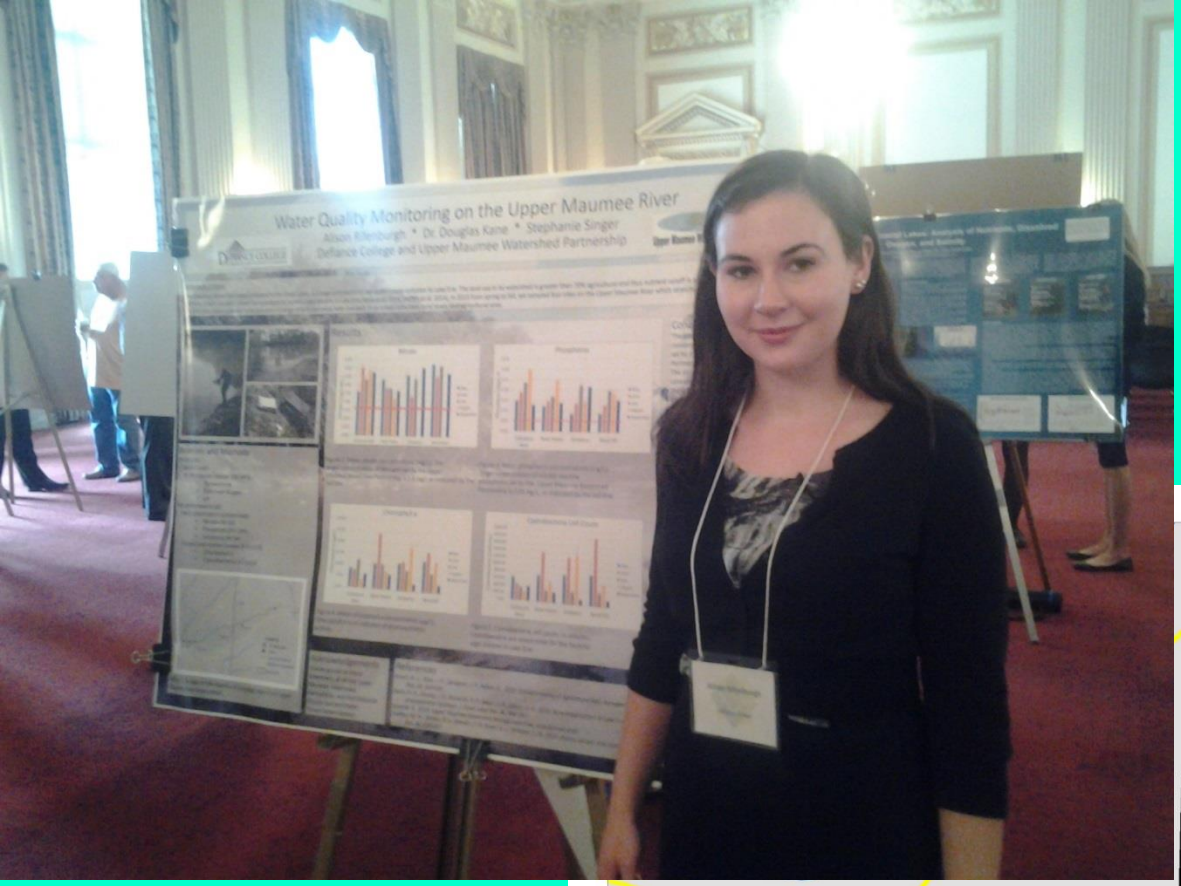
SNRT, Inc
Natural Resource Group

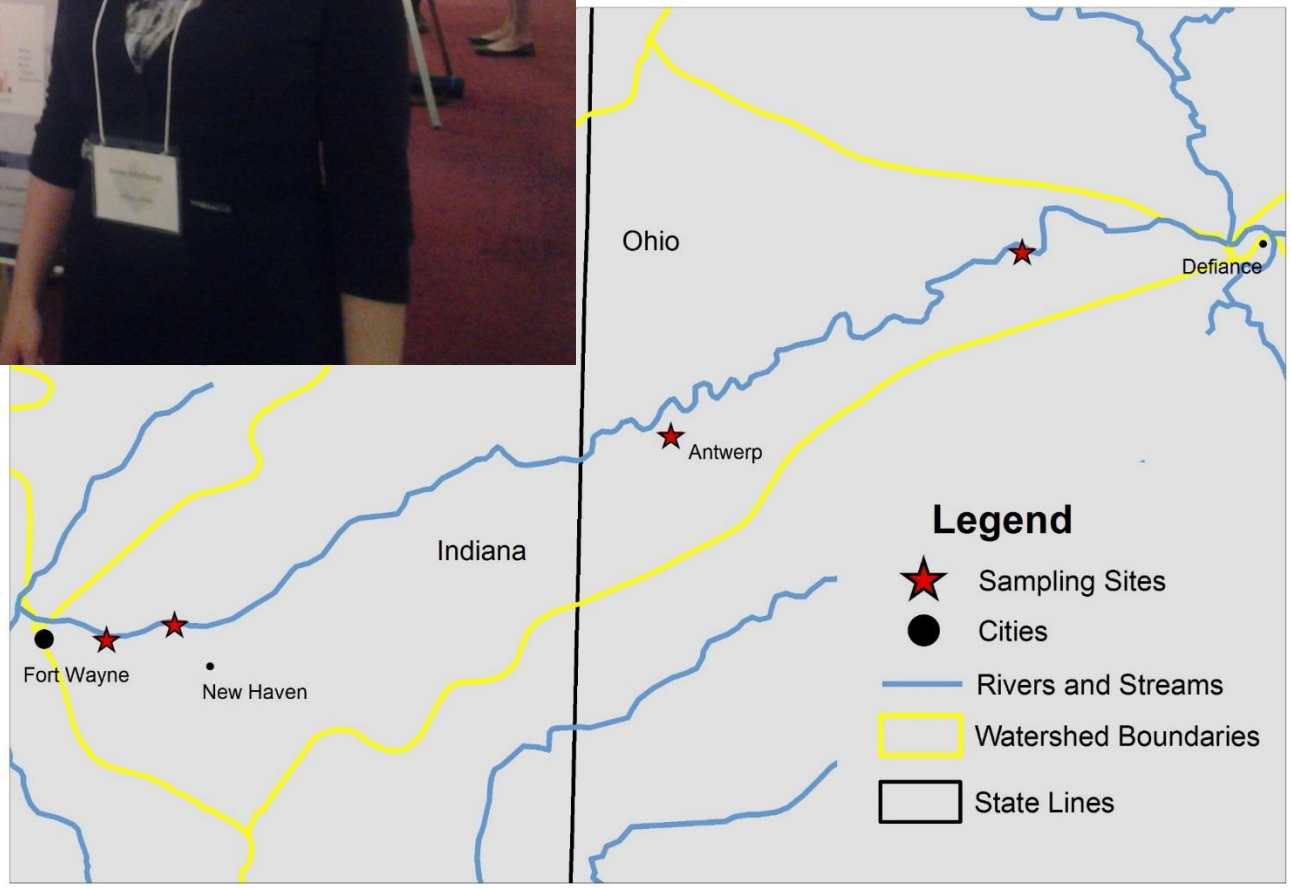
With Guidance from the Upper Maumee River Watershed Project Steering Committee

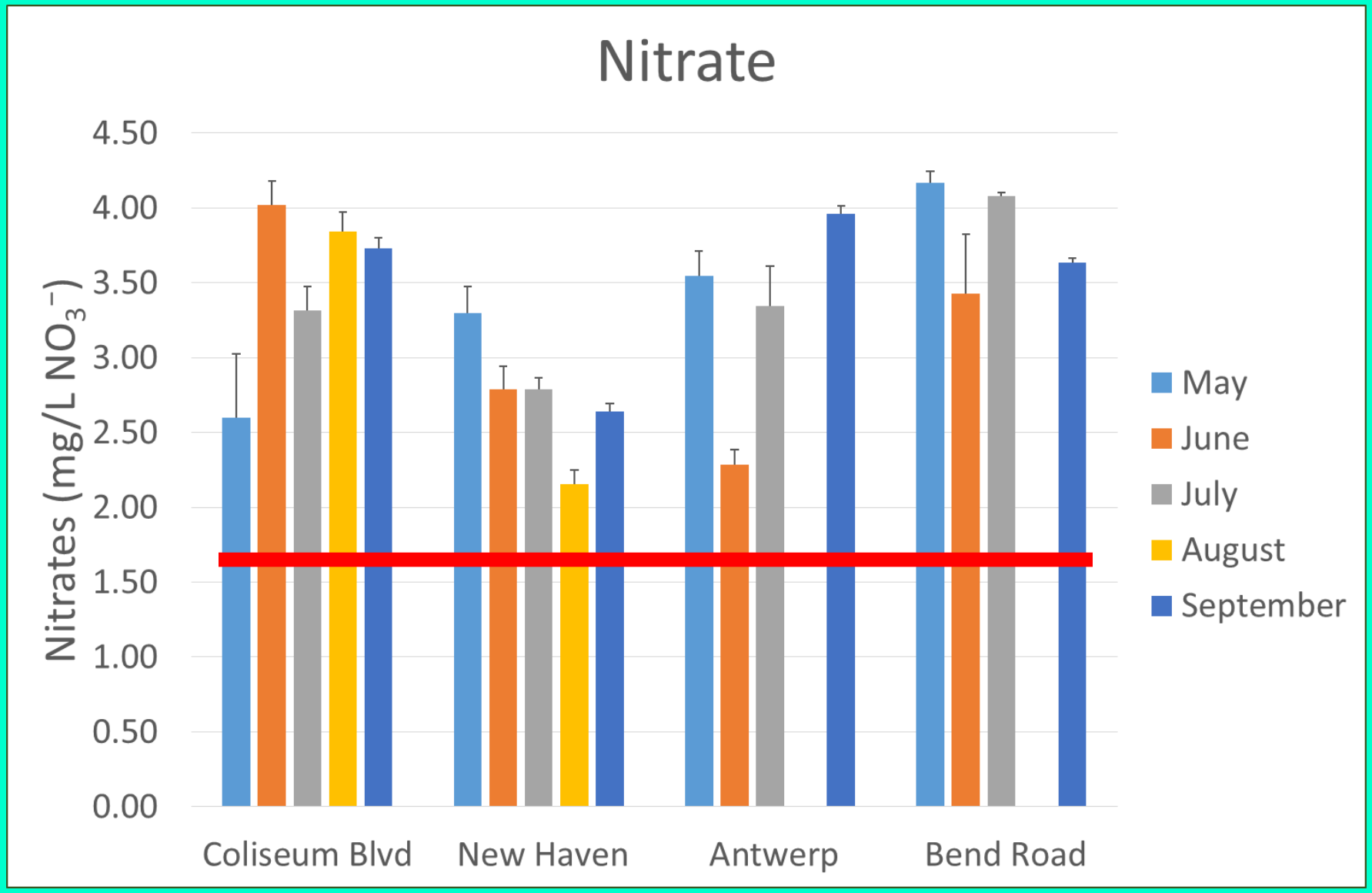
Principle Author: Kyle Quandt
5000 E 100 S
LaGrange, IN 46761

This project has been funded wholly or in part by the United State Environmental Protection Agency under assistance agreement (C9975482-11) to the Indiana Department of Environmental Management. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

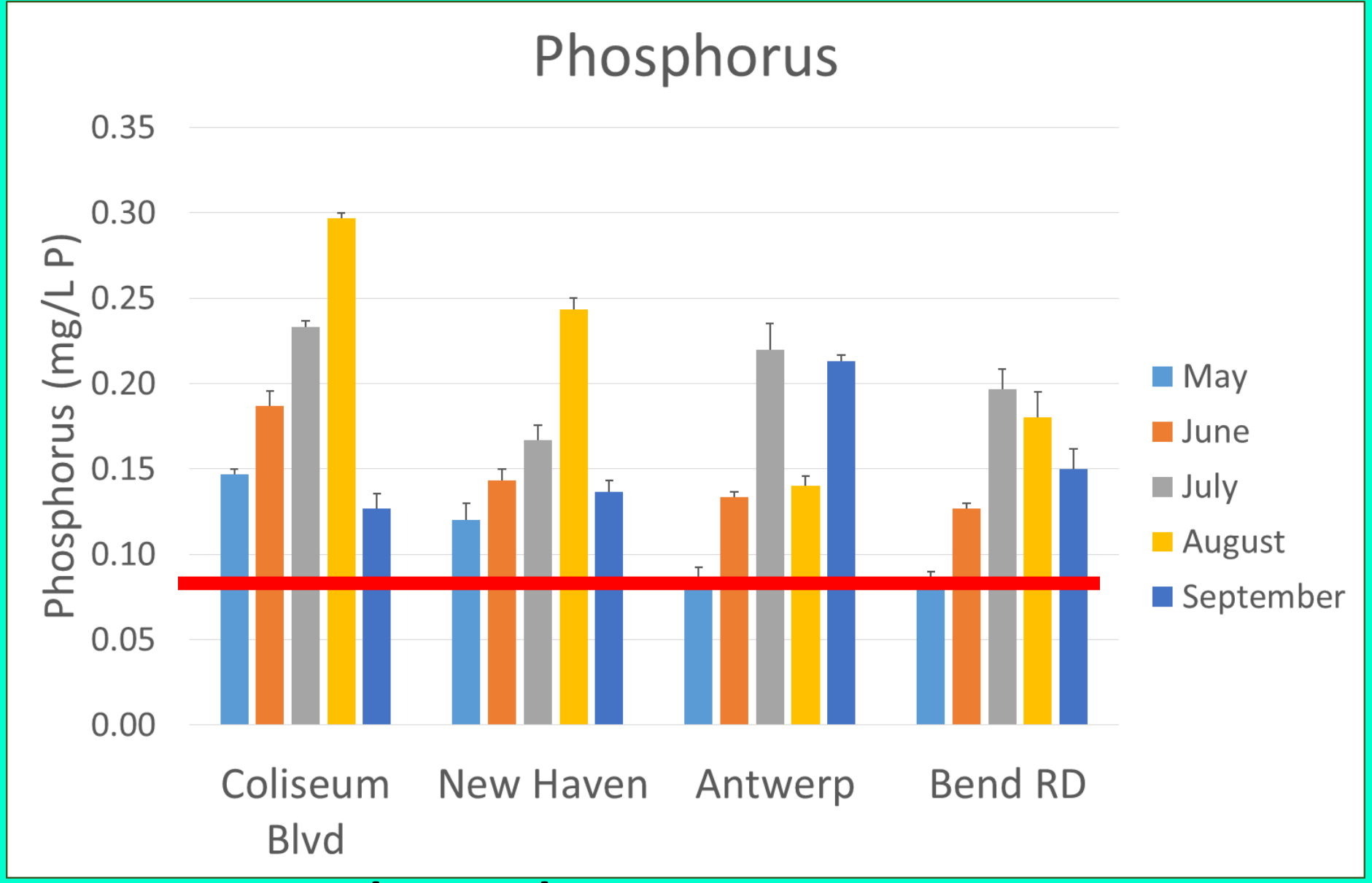
This report has been funded wholly or in part by the ODNR Division of Soil and Water Resources through the Defiance Soil and Water Conservation District under award NA12NOS4190115 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce through the Ohio Department of Natural Resources, Office of Coastal Management. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, Department of Commerce, Ohio Department of Natural Resources, or the Office of Coastal Management.


Water Quality Monitoring on the Upper Maumee River
Alison Allenbaugh * Dr. Douglas Kane * Stephanie Singer
Defiance College and Upper Maumee Watershed Partnership

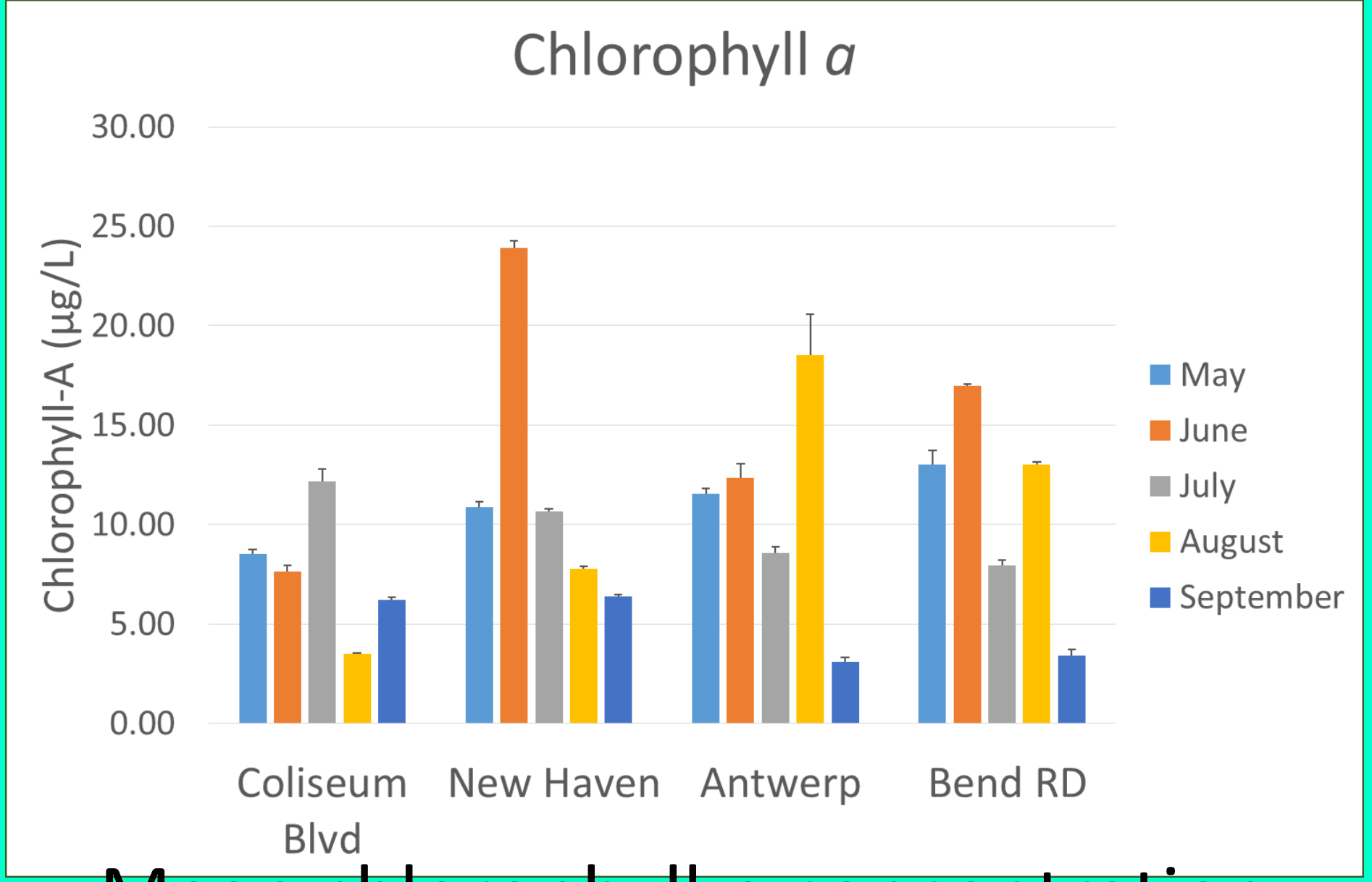

Ohio
Defiance
Antwerp
Indiana
Fort Wayne
New Haven
Legend
Sampling Sites
Cities
Rivers and Streams
Watershed Boundaries
State Lines



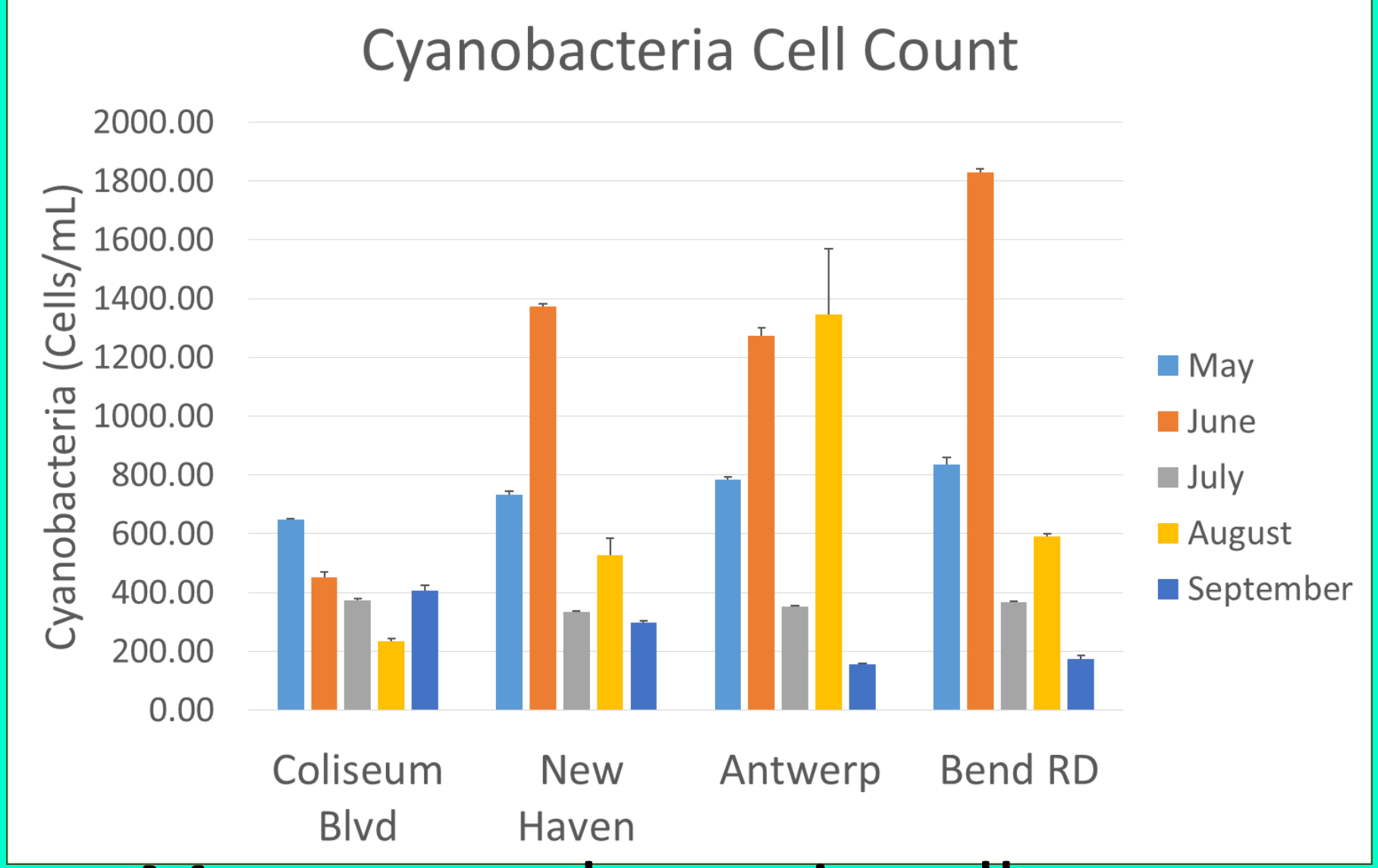
Mean nitrate concentrations (mg/L)



Mean phosphorus concentrations (mg/L)



Mean chlorophyll-a concentration (µg/L)



Mean cyanobacteria cell count (cells/mL)

"How can we fix this problem?"

Douglas D. Kane
Defiance College

DEFIANCE COLLEGE
To Know ◆ To Lead ◆ To Serve ◆ To Understand

Ohio

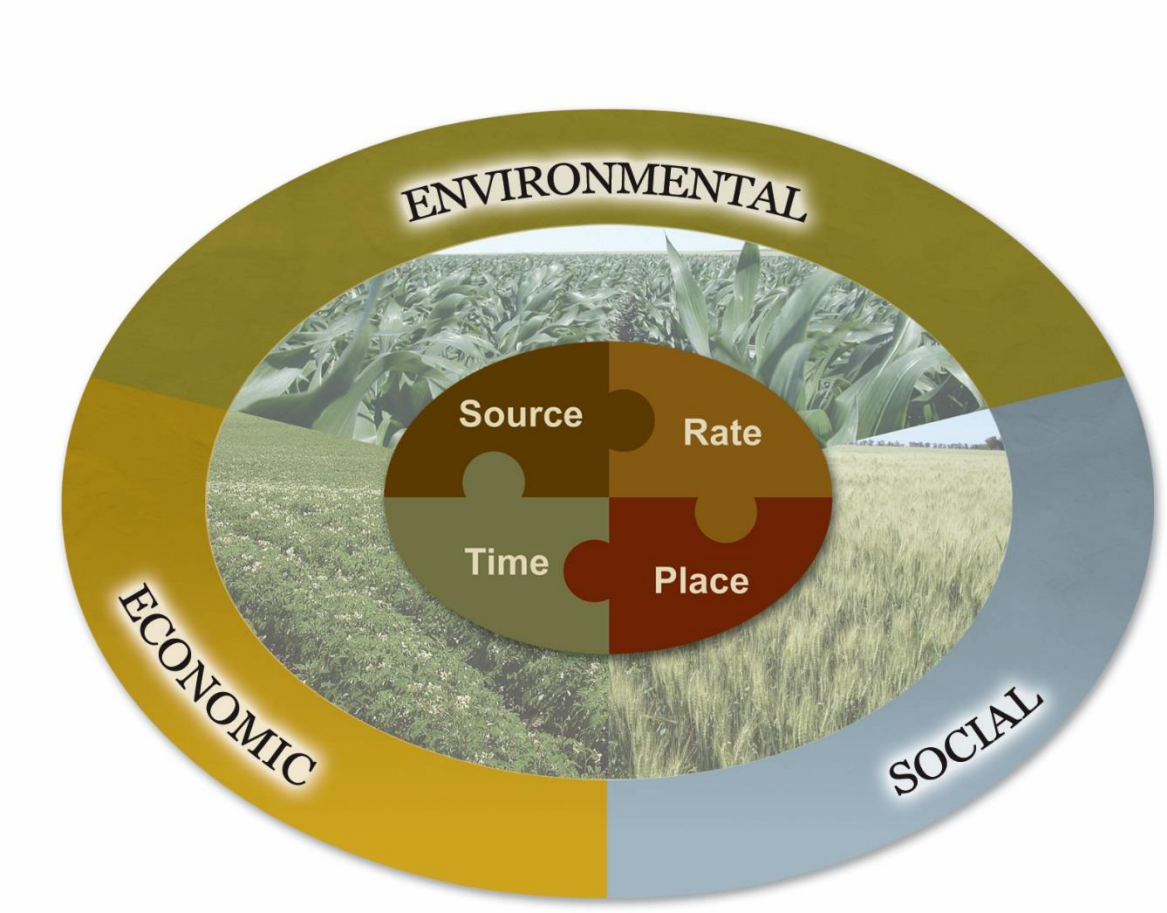
Department of Agriculture
Department of Natural Resources
Environmental Protection Agency
Lake Erie Commission

Ohio Lake Erie Phosphorus Task Force II Final Report

Final Report
November 2013

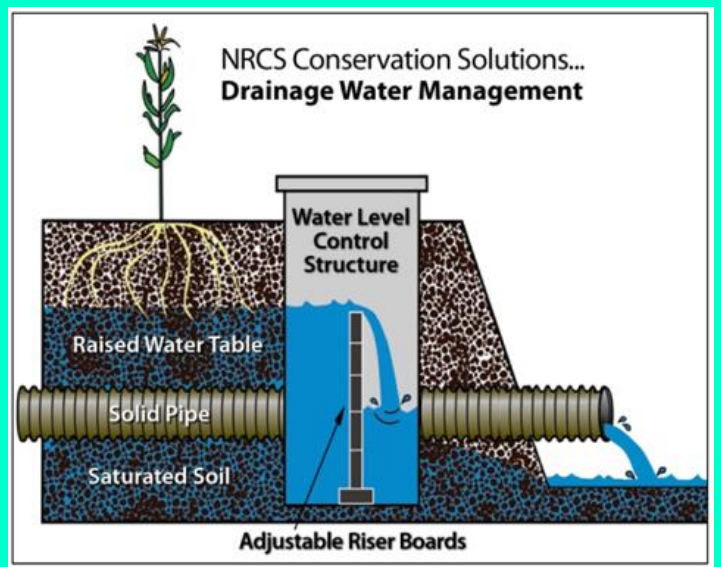
Recommendations

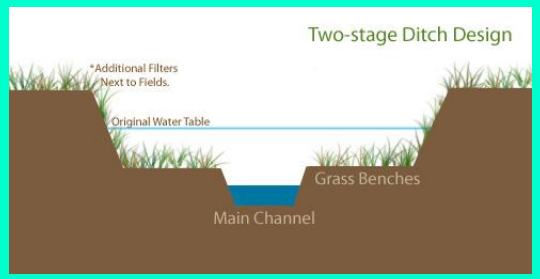
- Better Nutrient Stewardship(4 Rs)

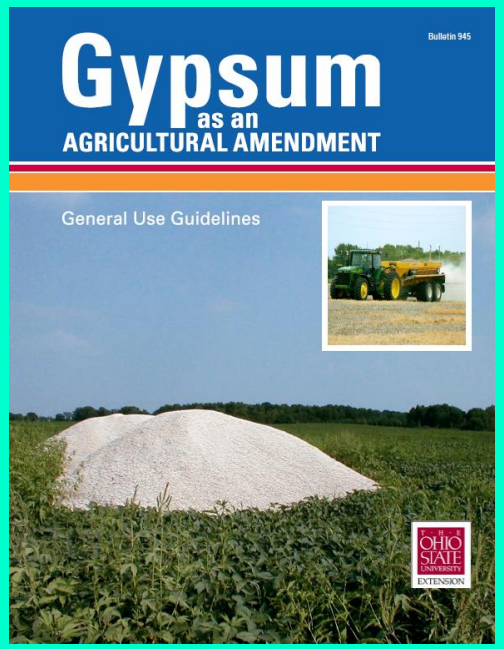


Recommendations II

- Better Drainage Management
- Reduce Combined Sewer Overflows
- Improve Soil Health
- Others



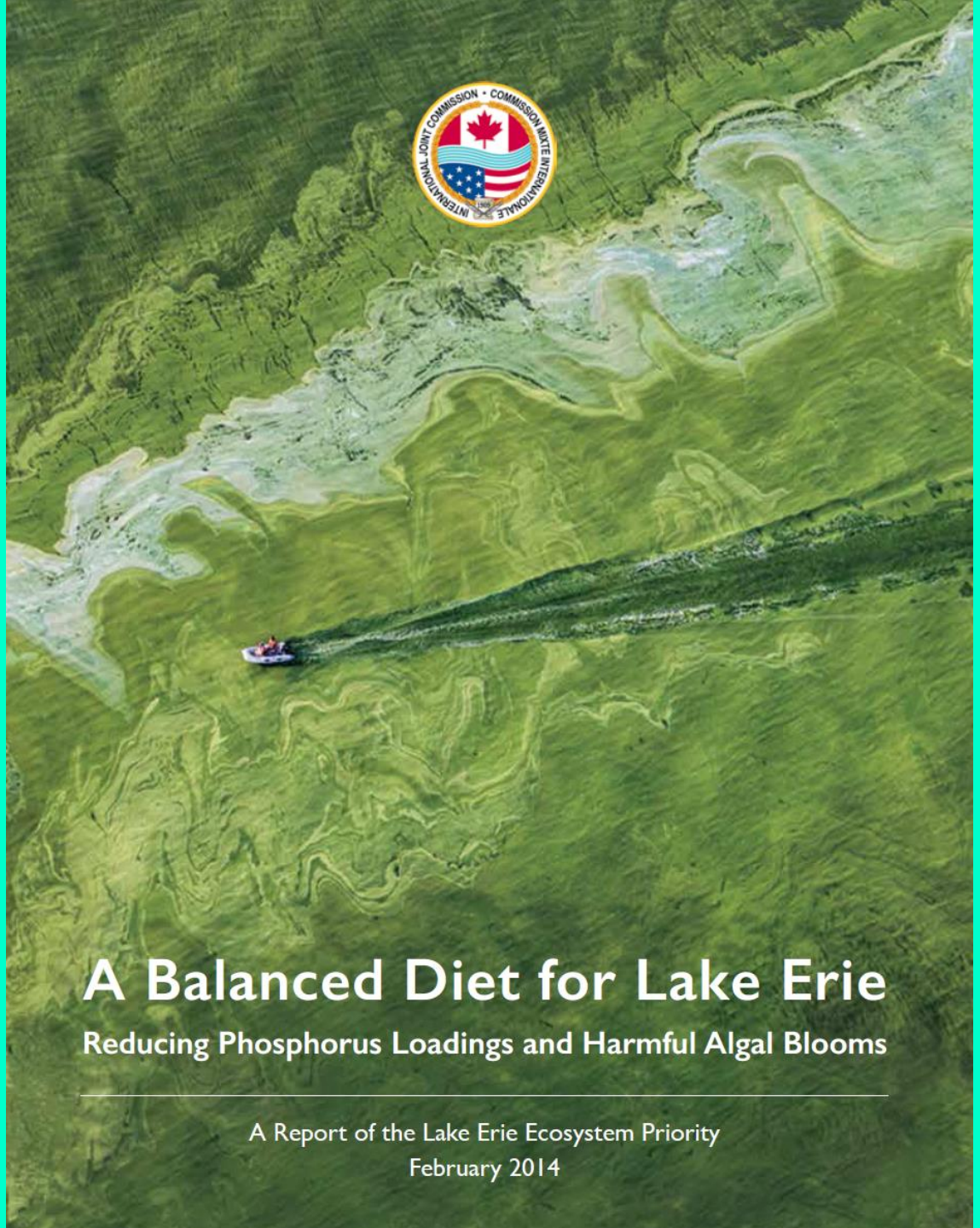




The Challenge

- ***40% Reduction of SRP*** *to lessen HABs in Lake Erie!*

- ***78% Reduction of SRP*** *to Lessen Hypoxia in Lake Erie (Scavia et al. 2014)*



A Balanced Diet for Lake Erie

Reducing Phosphorus Loadings and Harmful Algal Blooms

A Report of the Lake Erie Ecosystem Priority

February 2014

- **WE ARE *ALL IN* THIS TOGETHER!**










Thank You!