Creating cost-effective regional algal bloom monitoring networks

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National Monitoring Conference

Portland, Oregon

2 May 2012

Acknowledgments

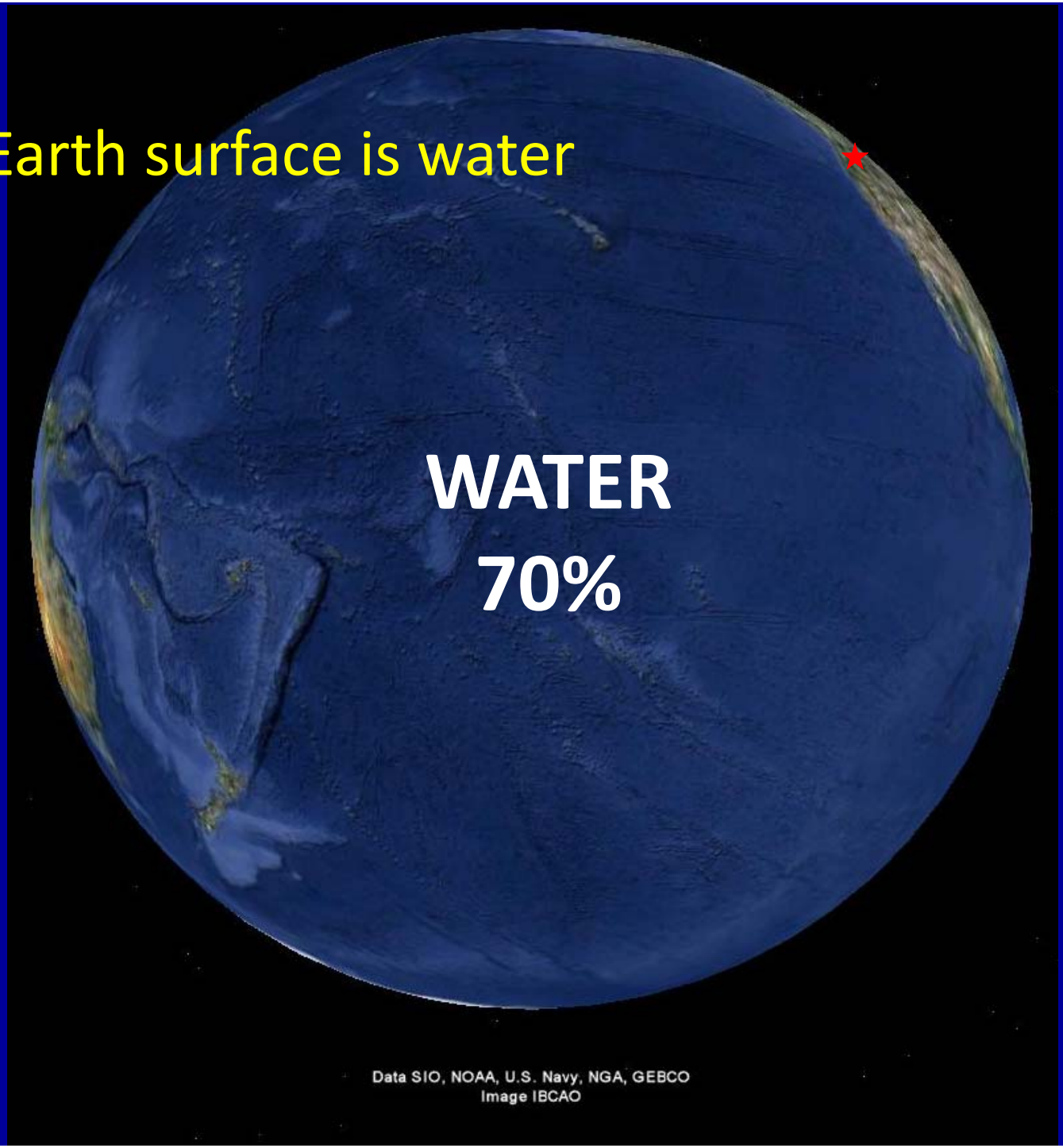
- Collaborators
  - Academic scientists from AR, GA, LA, MS, NC, PR, SC, and TN
  - Federal, state, and local agency scientists in AL, AR, DE, FL, GA, KY, LA, MS, NY, TN, and TX
  - Friends at Georgia Power and Fort Smith Utility
- Funding

Alabama Agricultural Experiment Station

NIWR
THE NATIONAL INSTITUTES FOR WATER RESOURCES

Google Earth

70% of Earth surface is water

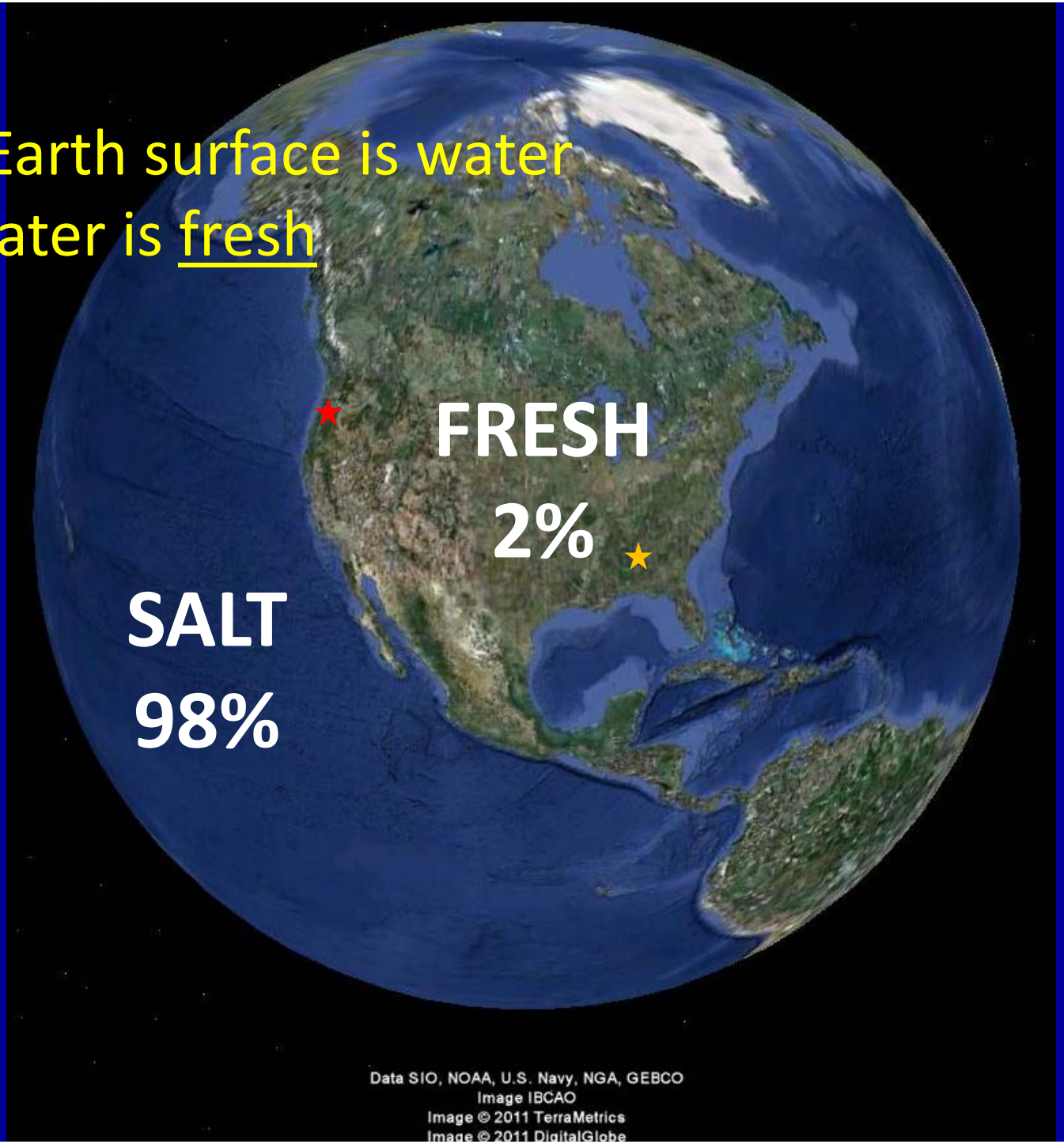


LAND
30%

Google Earth

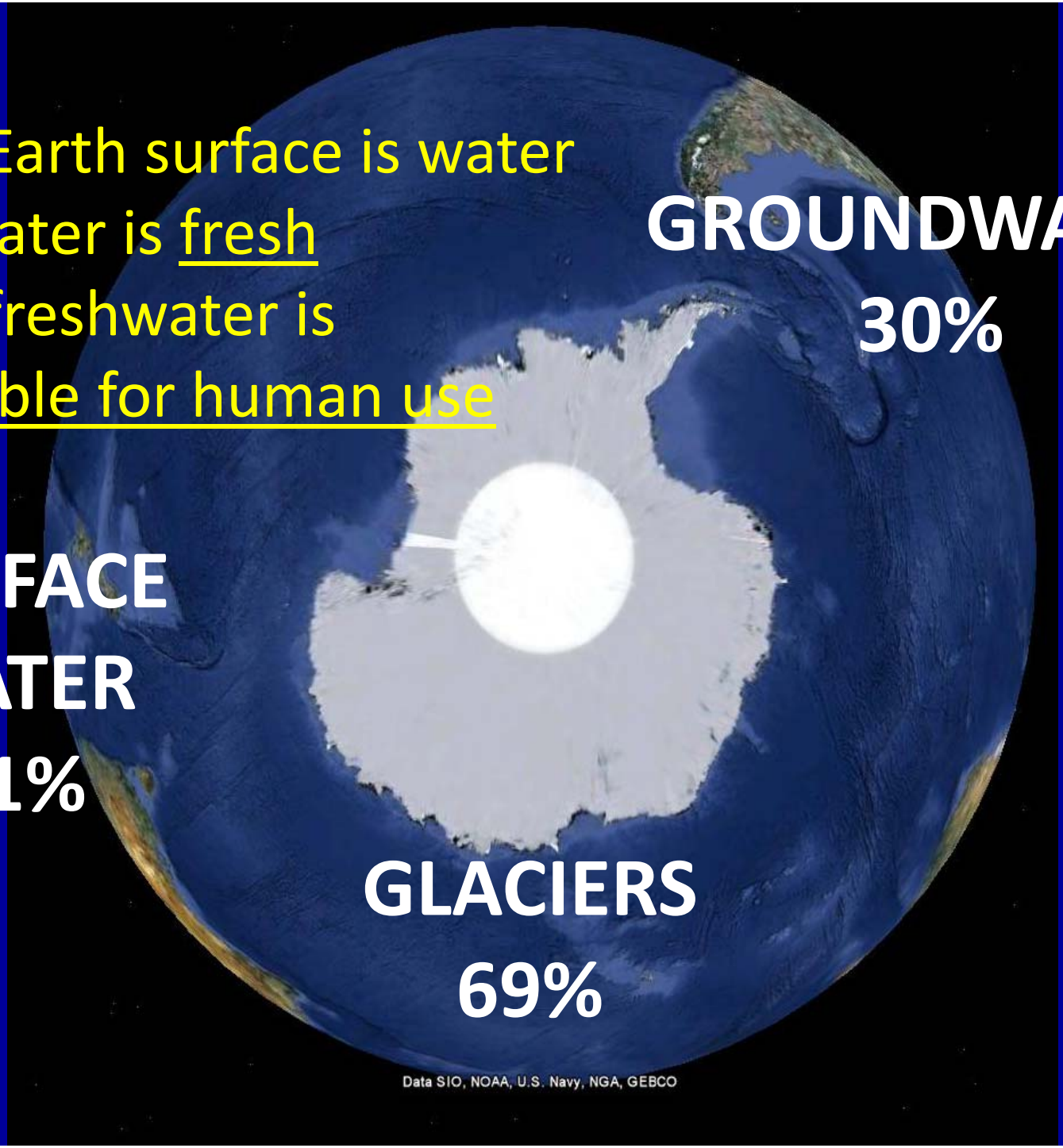
70% of Earth surface is water

2% of water is fresh



Google Earth

70% of Earth surface is water
2% of water is fresh
<1% of freshwater is available for human use



GROUNDWATER 30%

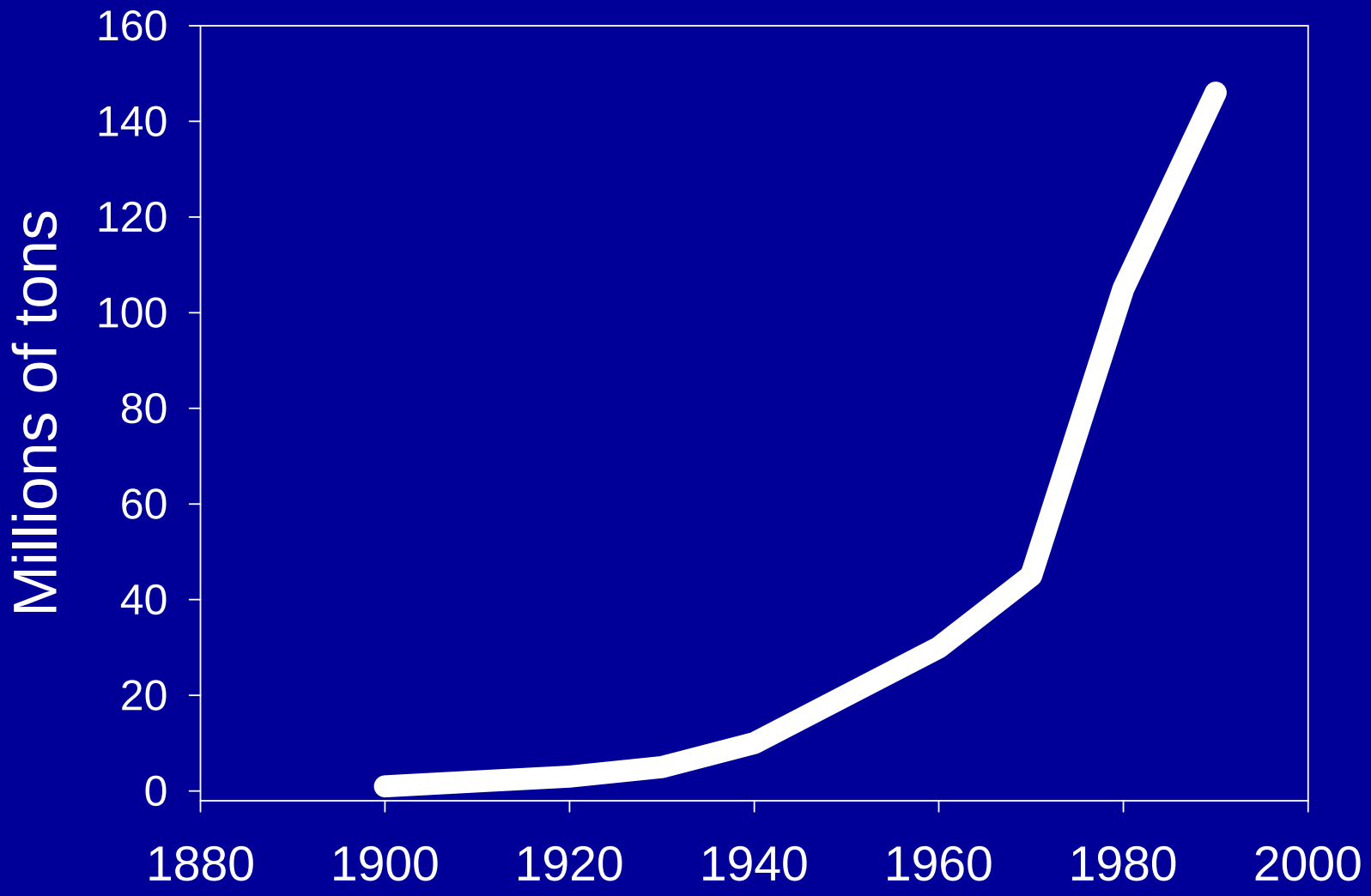
SURFACE WATER <1%

GLACIERS 69%

Google Earth

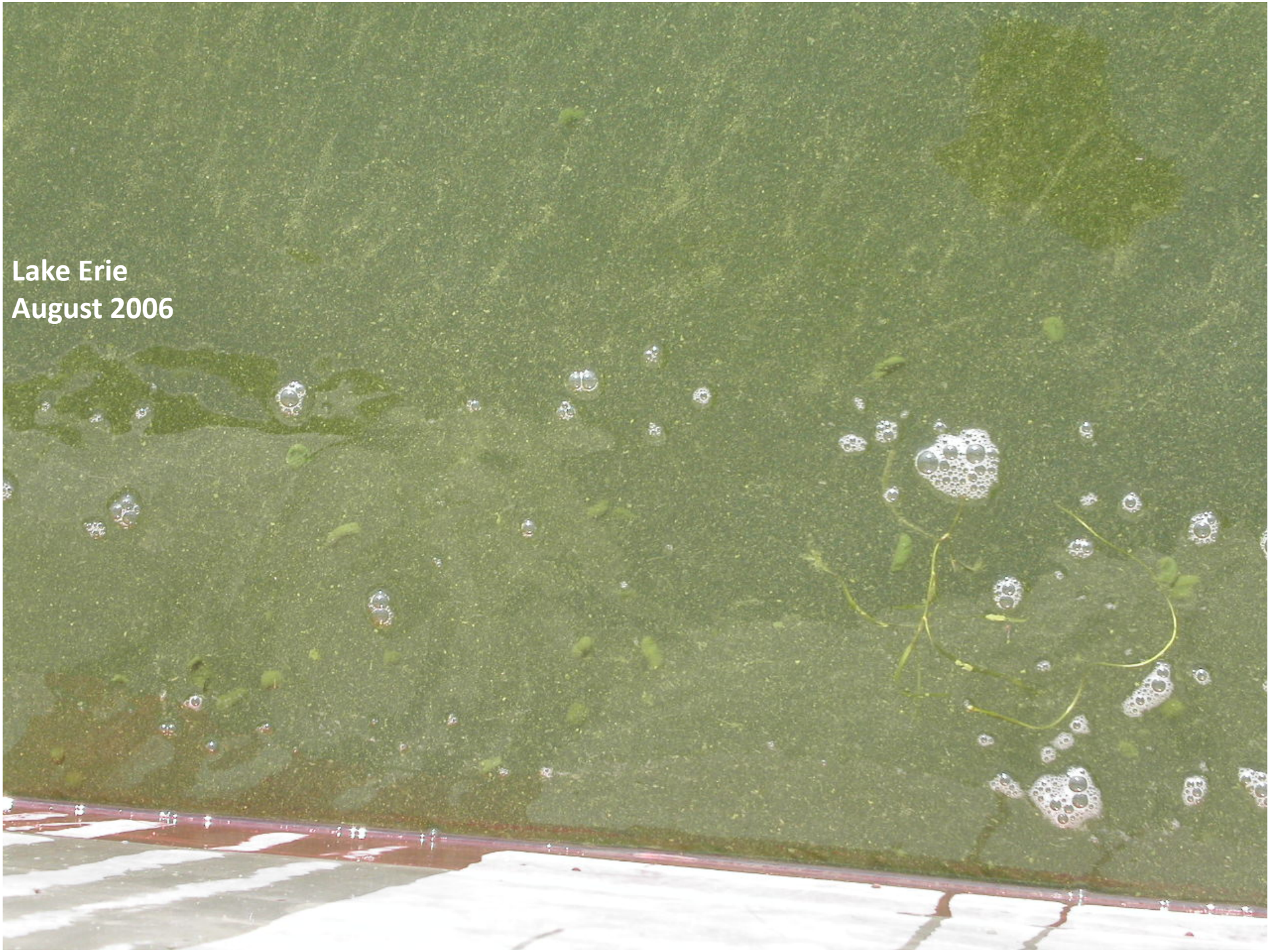
FRESHWATER IS LIMITED AND SUFFERS FROM MULTIPLE STRESSORS

Global fertilizer use

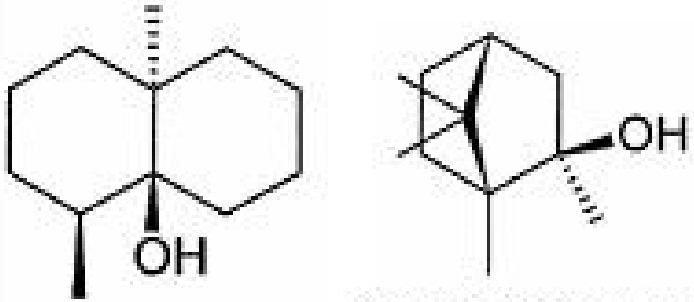


Aquaculture pond
Alabama, August 2008


Lago de Pátzcuaro
Mexico, July 2008


Lake Erie
August 2006

Off-flavor compounds



Geosmin *2-Methylisoborneol*

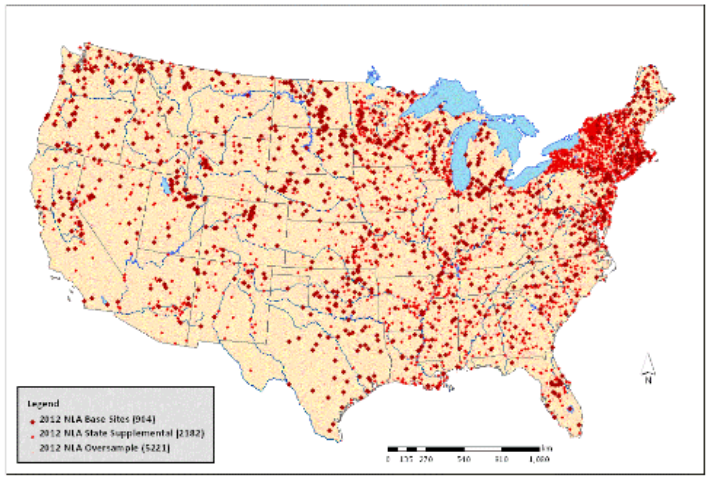
Alabama farm pond, 25 May 2010

MONITORING IS IMPORTANT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

STORET

Design Sites for the
2012 National Lakes Assessment



USGS
science for a changing world

National Water-Quality Assessment (NAWQA) Program

USGS
science for a changing world

National Water Information System: Web Interface

Eutrophication of lakes cannot be controlled by reducing nitrogen input: Results of a 37-year whole-ecosystem experiment

David W. Schindler*†, R. E. Hecky‡, D. L. Findlay§, M. P. Stainton§, B. R. Parker*, M. J. Paterson§, K. G. Beaty§, M. Lyng§, and S. E. M. Kasian§

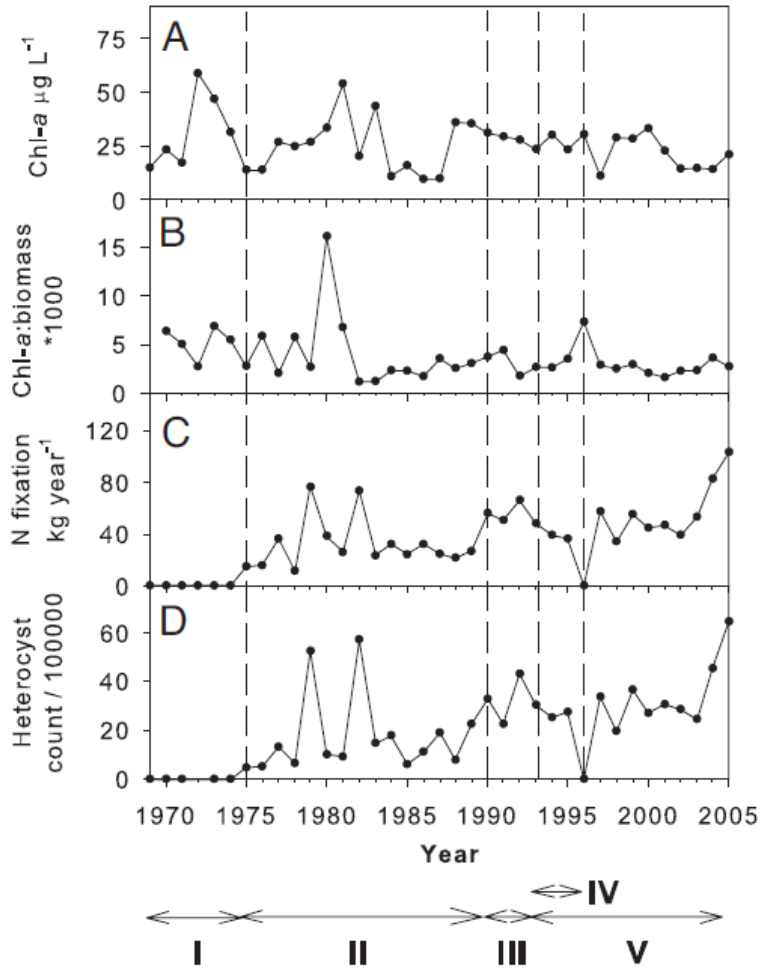


Fig. 4. Other measures of phytoplankton and nitrogen fixation, 1969–2005. (*A*) Chlorophyll *a*. (*B*) Ratio of chlorophyll *a*:phytoplankton biomass (μg/mm^3). (*C*) Nitrogen fixation calculated from heterocyst counts. (*D*) Heterocyst counts. Vertical dashed lines are as in Fig. 2.

Limnol. Oceanogr., 49(2), 2004, 482–487
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Dominance of the noxious cyanobacterium *Microcystis aeruginosa* in low-nutrient lakes is associated with exotic zebra mussels

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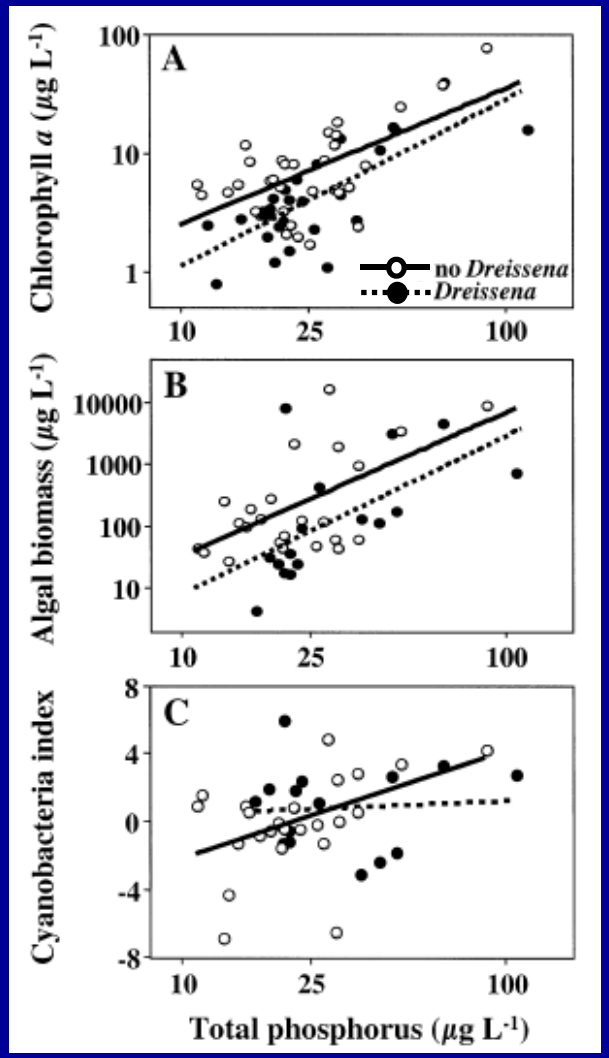
Orlando Sarnelle and Alan E. Wilson[2]
Department of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan 48824

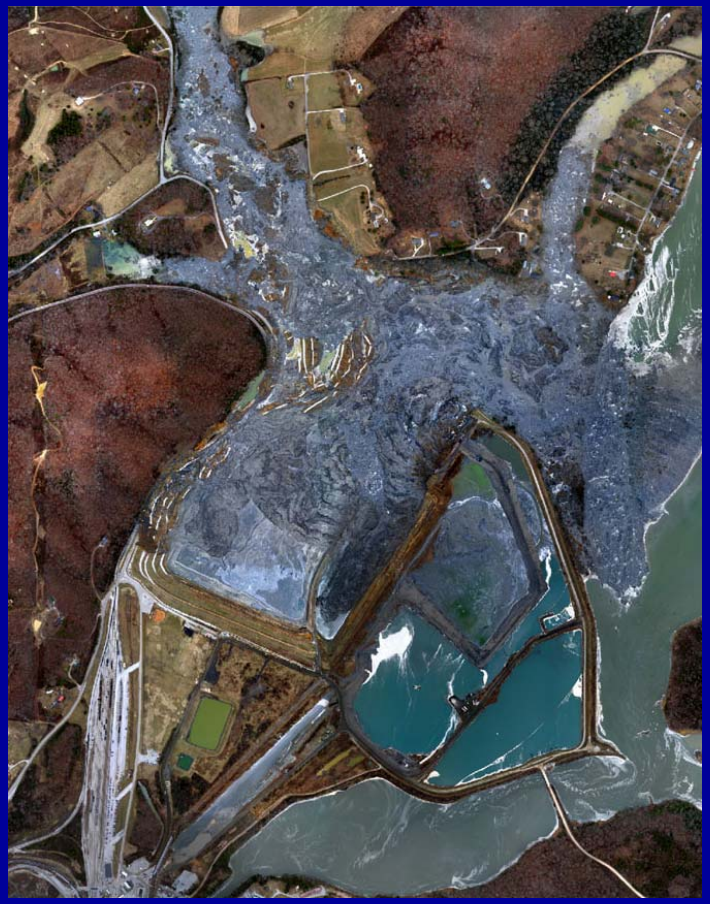
Stephen K. Hamilton[3]
Kellogg Biological Station and Department of Zoology, Michigan State University, 3700 East Gull Lake Drive, Hickory Corners, Michigan 49060



Kingston Coal Ash Spill

BEFORE SPILL

AFTER SPILL

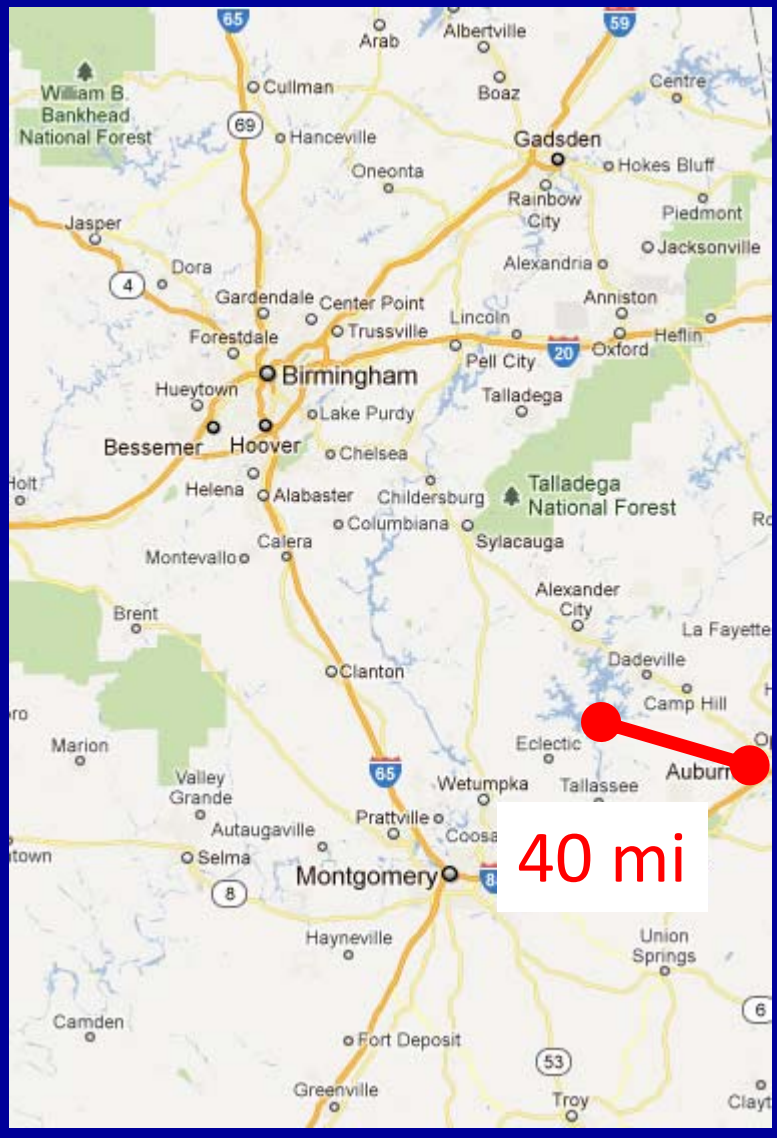


MONITORING IS EXPENSIVE

Sample cost estimates

chlorophyll, nutrients, TSS, microcystin

- Consumables = $20
- People = $10
- Travel (mileage ($0.50/mi) + people) = **depends**
  - Nearby site = $40 + $40

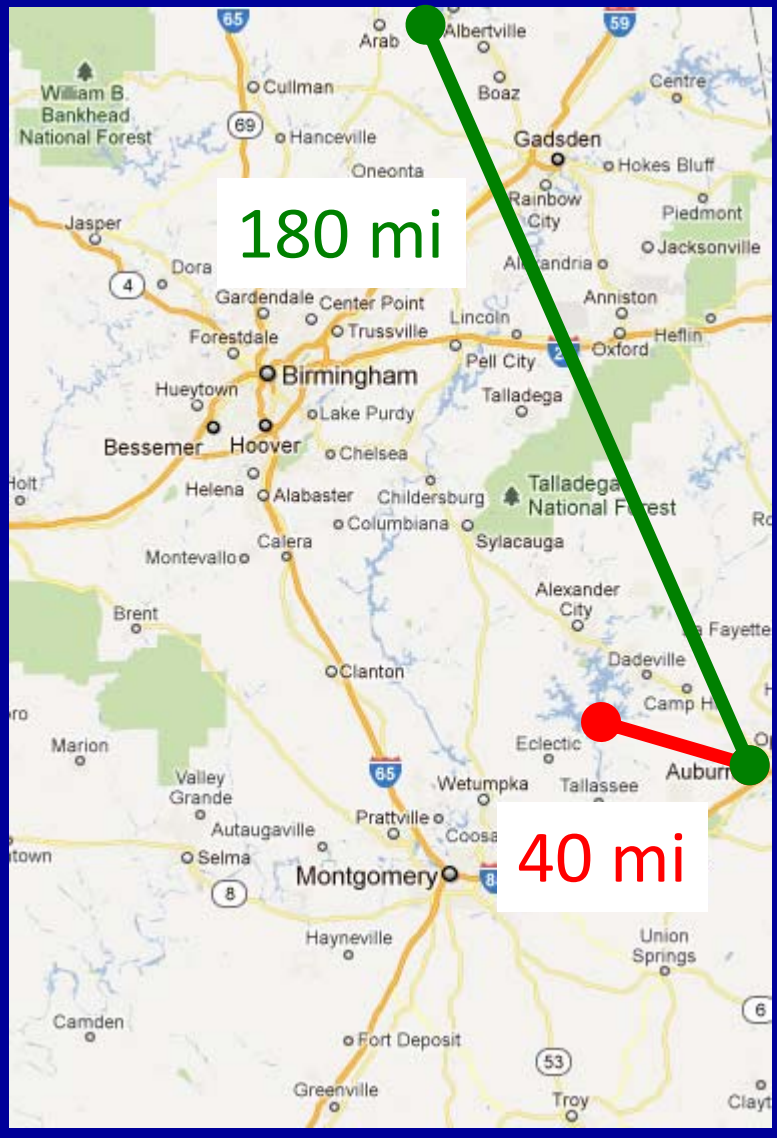


Sample cost estimates

chlorophyll, nutrients, TSS, microcystin

- Consumables = $20
- People = $10
- Travel (mileage ($0.50/mi) + people) = **depends**
  - Nearby site = $40 + $40
  - Faraway site = $180 + $120
- Total = $110-$330/sample

Travel costs = 73-91%



MONITORING IS DIFFICULT TO FUND

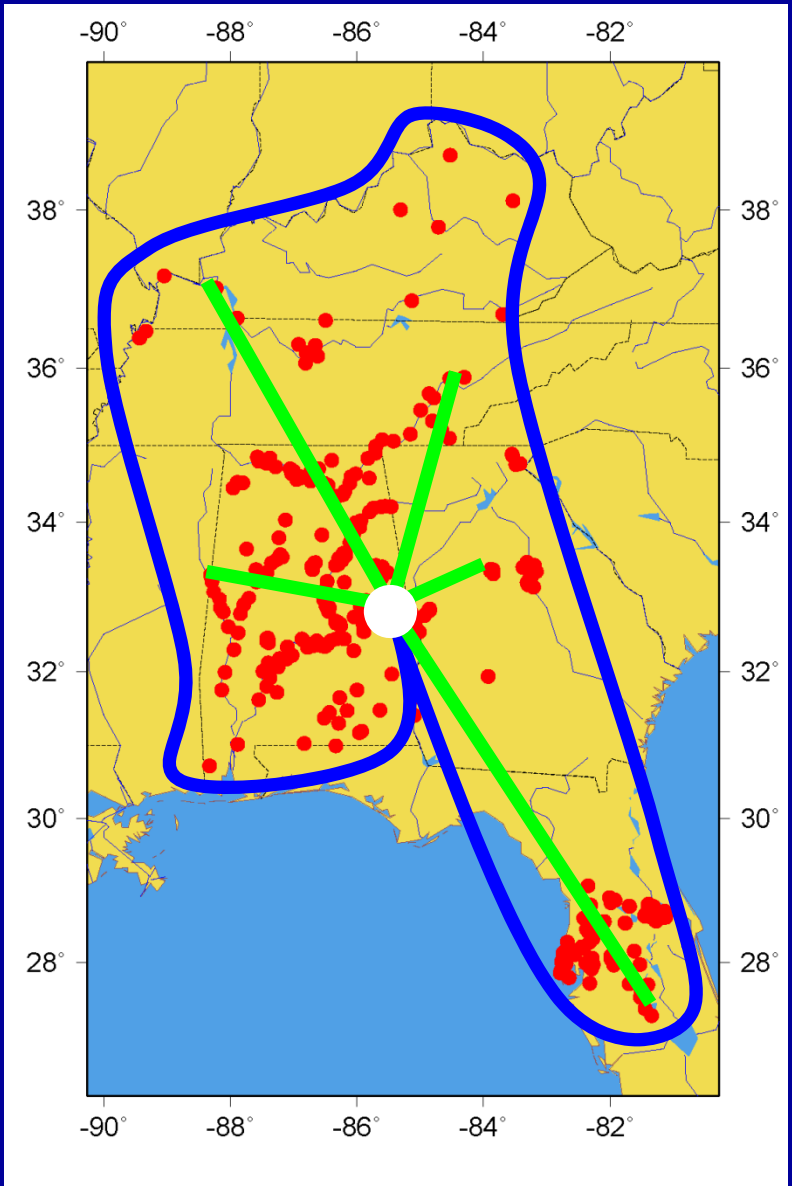
Programs that fund monitoring studies

- NOAA – Monitoring and event response for HABs (MERHAB)
- NSF – Long-term ecological research (LTER)
- EPA – Wetlands grant program
- NPS-USGS – Water quality partnership program
- State specific programs

SO, WHAT IS THE SOLUTION?

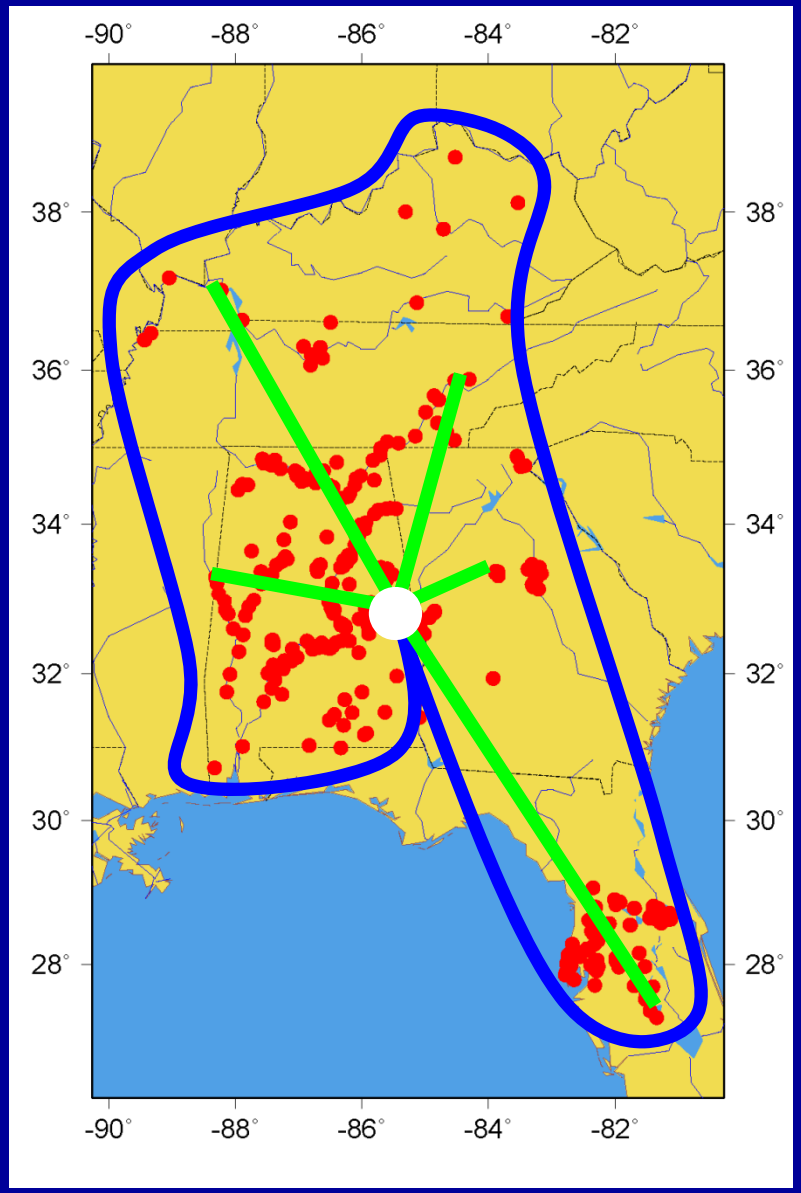
COLLABORATION

SAMPLE AND DATA SHARING



EXAMPLE LAKE SURVEY

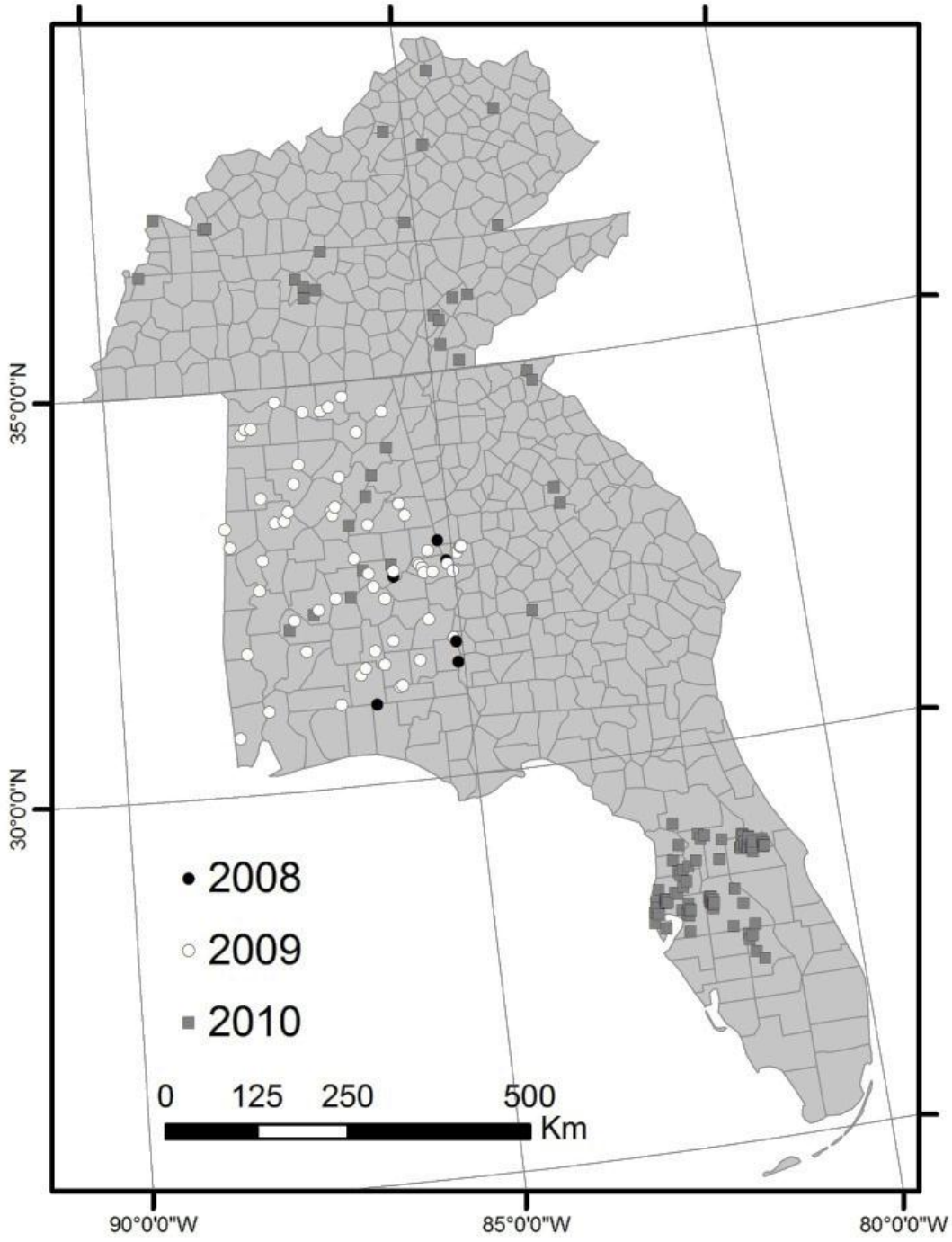
- 717 samples from 238 waterbodies
- Sample analyses
  - phycocyanin and microcystin
- Consumables = $20
- People = $10
- Analyses cost = $21,510
- Mileage = $2,500-$136,318
- People = $1,667-$90,879
- **Total = $25,676-$248,707**



EXAMPLE LAKE SURVEY

- 717 samples from 238 waterbodies
- Sample analyses
  - phycocyanin and microcystin
- Consumables = $20
- People = $10
- **Actual cost = $50,000 (AL Ag Exp Station grant)**

HOW?



SAMPLING EFFORTS

2008 - WilsonLab

2009 - WilsonLab + ADEM

2010 - many collaborators

Alabama

AL Dept of Environmental Management
Auburn University

Florida

FL Dept of Environmental Protection
Lakeland Lakes and Stormwater Division
Pinellas County Dept of Environ Management
Seminole County Public Works
Seminole County Water Quality Section
SW FL Water Management District

Georgia

Centers for Disease Control
Georgia Power, Southern Company
Georgia Southwestern State Univ
New Echota Rivers Alliance

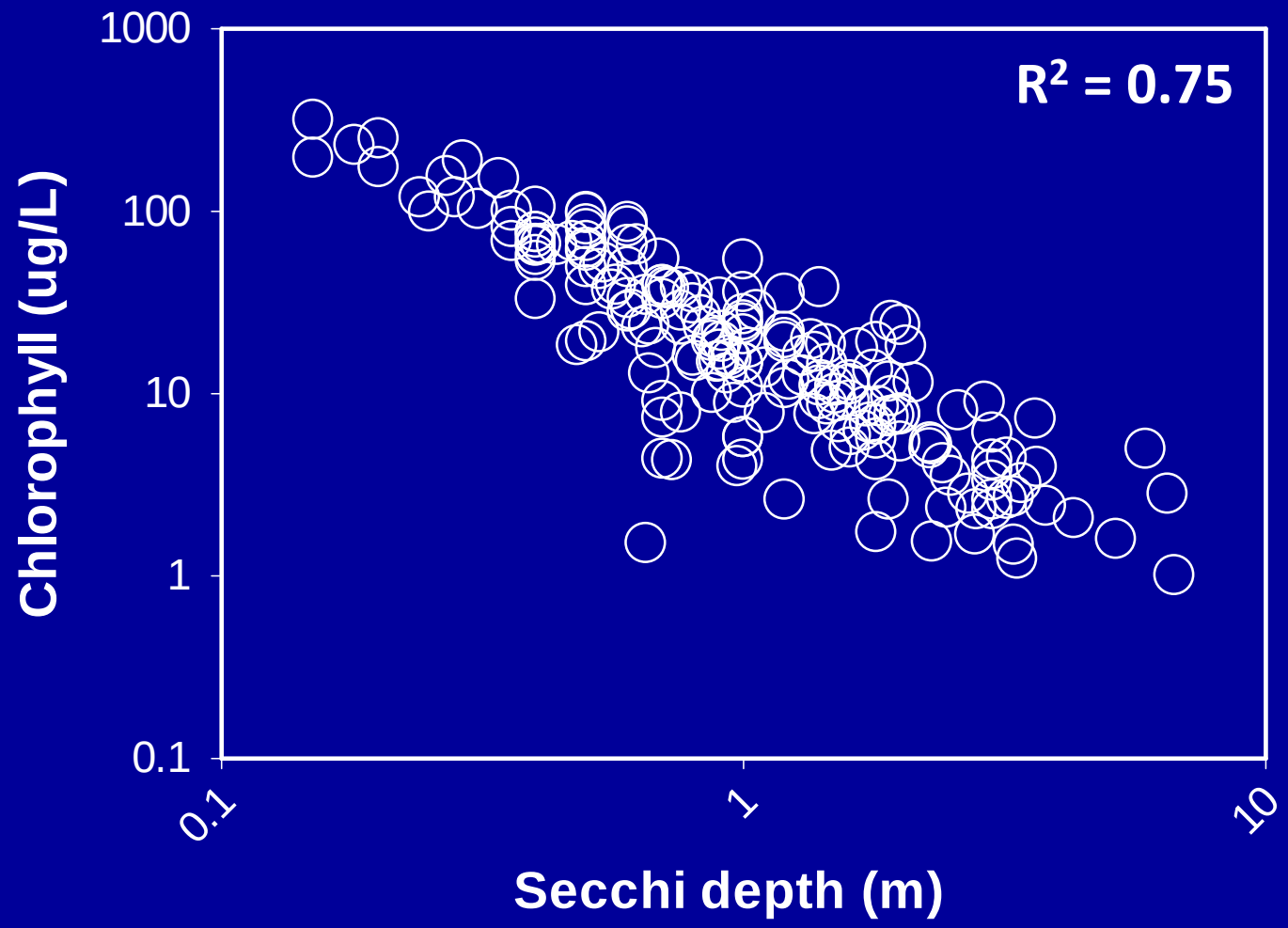
Kentucky

KY Division of Water

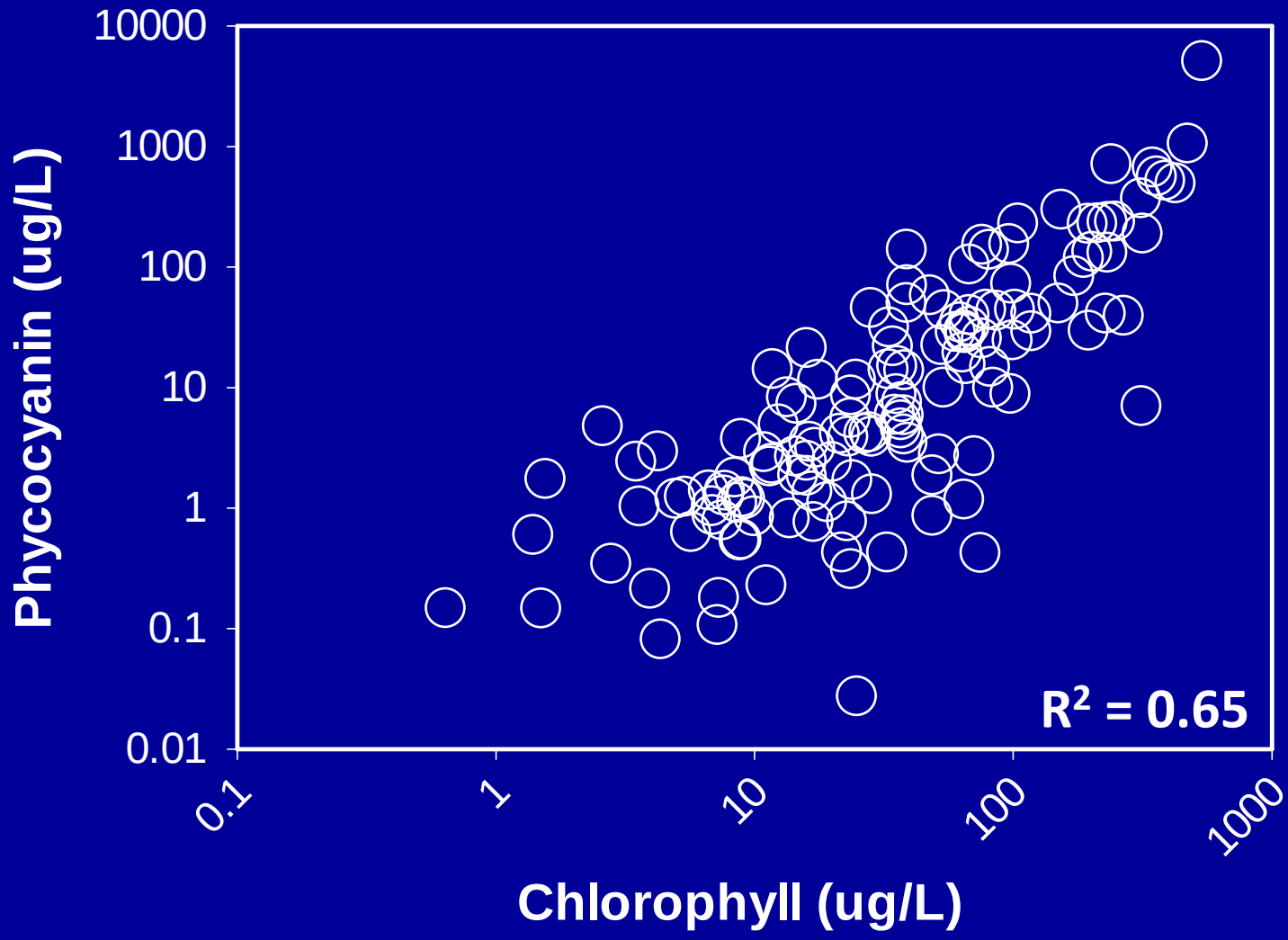
Tennessee

TN Dept of Environment and Conservation
TN Division of Water Pollution Control

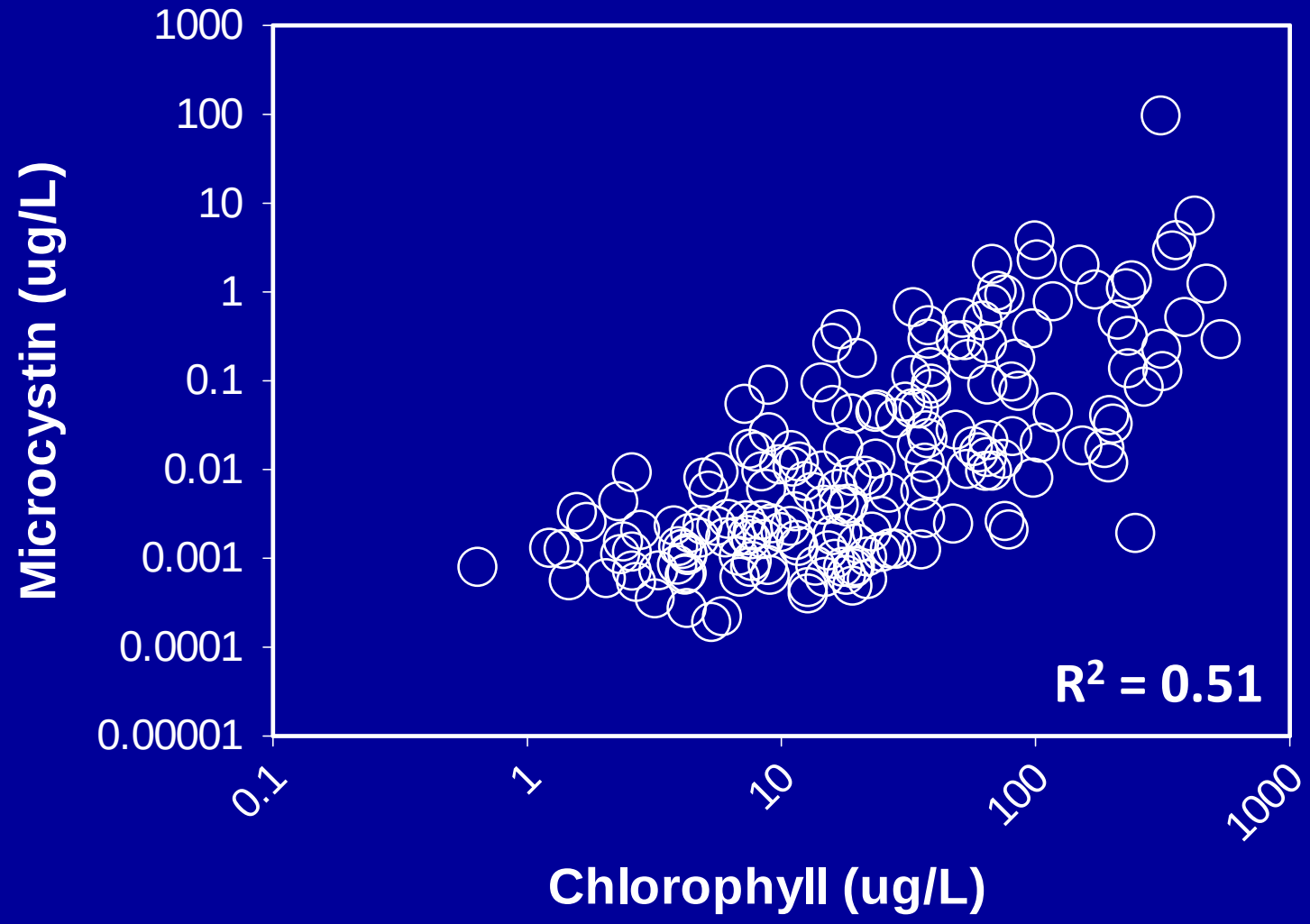
General data patterns



General data patterns



General data patterns



USGS Project 2011AL121G

Forecasting toxic cyanobacterial blooms throughout the southeastern U.S.

HOME | NEWS | SCHEDULE | PROTOCOLS | SAMPLING GEAR | SAMPLING VIDEO | CONTACT INFO

Project Links

- Home
- News
- Schedule
- Protocols

USGS PROJECT HOMEPAGE

Protecting diminishing water resources is one of the most pressing global environmental issues and will become more challenging as climate change, species invasions, and eutrophication further degrade surface water quality and quantity. In lentic freshwater systems, bloom-forming cyanobacteria (i.e., blue-green algae) are the primary biological indicators of poor water quality and tend to dominate algal communities under nutrient enrichment. Some cyanobacterial genera produce potent secondary metabolites, such as the hepatotoxin, microcystin, or the neurotoxin, anatoxin-a, that have been shown to lead to the poisoning of drinking water supplies, aquatic foodwebs, pets, and in extreme cases, humans. Cyanobacteria are also responsible for common

http://wilsonlab.com/bloom_network/

Project information

- Project period: 2011-2014
- Sampling: July-August, 2012-2014
- Objective: Create network of scientists (agencies, academia, industry) interested in forecasting cyanobacterial blooms throughout Southeast
- Collaborative nature: Sample and data sharing

Project information

- Outreach: two free annual water quality workshops (Orlando and Auburn)

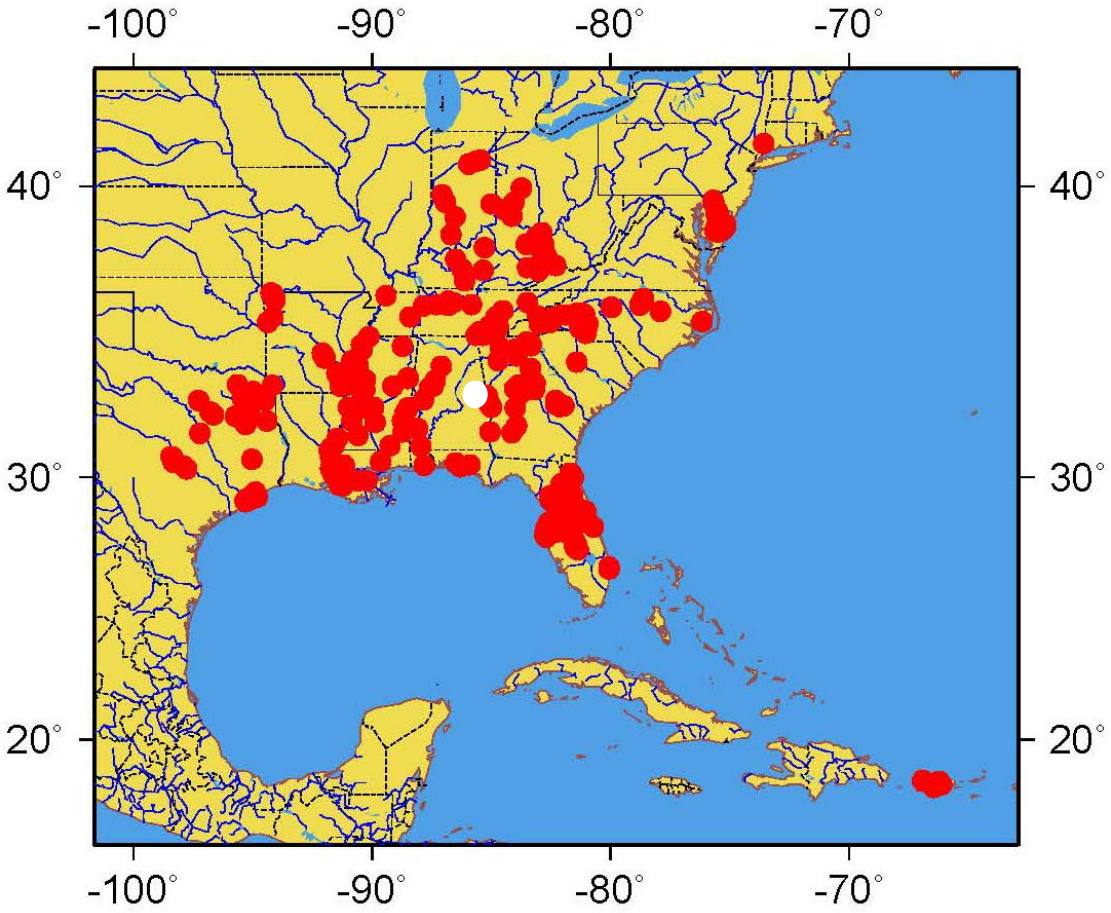
Orlando, FL
Feb 2012

Auburn, AL
Mar 2012

2012 project participants

- Alabama – AU, ADEM, ADCNR, USGS
- Arkansas – AUEX, Fort Smith, UofArk
- Deleware – DNREC
- Florida – DEP, Pinellas, Seminole County, OCFL, FWC, SWFWMD, Altamonte, NWFSC, Lakeland
- Georgia – UGA, Southern Co., DNR, EPA, North Georgia College
- Kentucky – Army Corps, DEP
- Louisiana – Army Corps, LSU
- Mississippi – FWS, DEQ, USDA, Jackson State Univ
- New York – NYCEP
- North Carolina – UNC, DENR, NCSU
- Puerto Rico – UPR-Mayaguez
- South Carolina – USC
- Tennessee – DEC, Carson-Newman College
- Texas - LCRA, TCEQ, Waco, Trinity, Red River Water Authority

2012 sample site map



373 waterbodies
13 states & PR

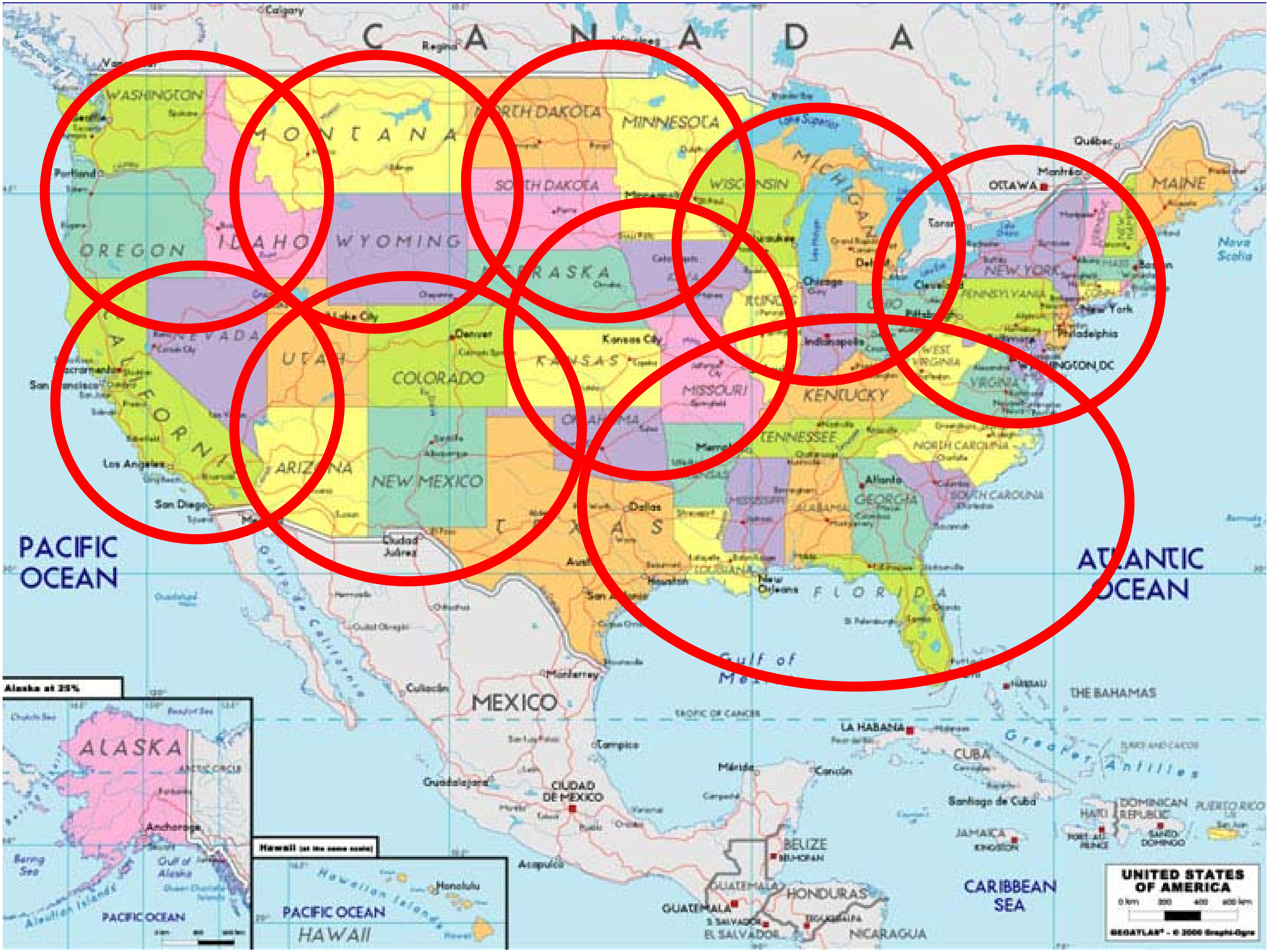
distance from Auburn
148,625 miles

mileage cost =

$0

Suggestions

- Connect with colleagues
- Find mutual benefits
- Leverage existing resources
- Document variation in techniques for sampling and analyses
- Think big!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WEST VIRGINIA
VIRGINIA
CALIFORNIA
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PUERTO RICO
BELIZE
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
CARIBBEAN SEA
Alaska at 35%
ALASKA
Anchorage
Gulf of Alaska
Bering Sea
PACIFIC OCEAN
Hawaii
Honolulu
PACIFIC OCEAN
HAWAII
UNITED STATES OF AMERICA


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