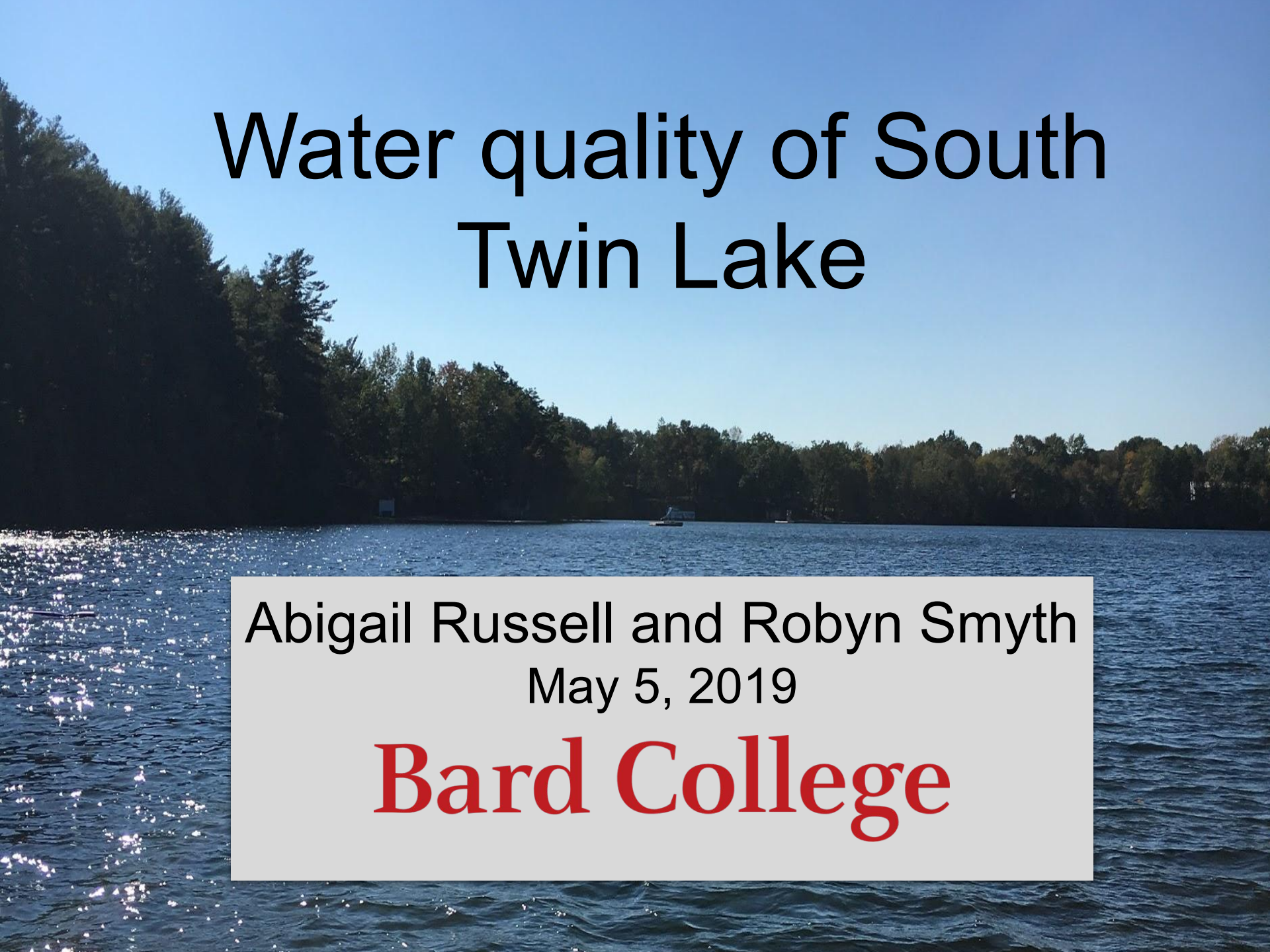


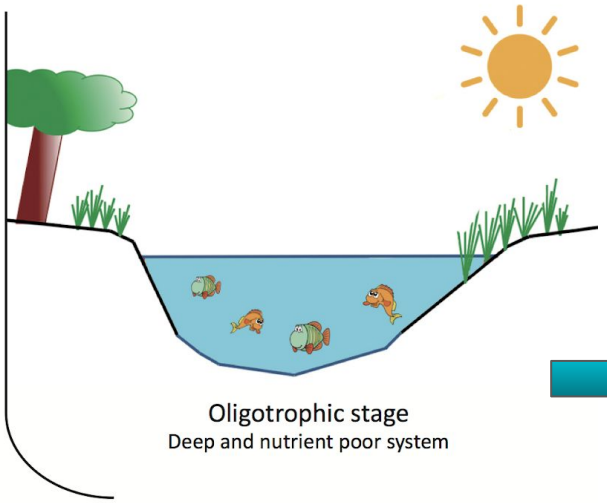
Water quality of South Twin Lake

Abigail Russell and Robyn Smyth

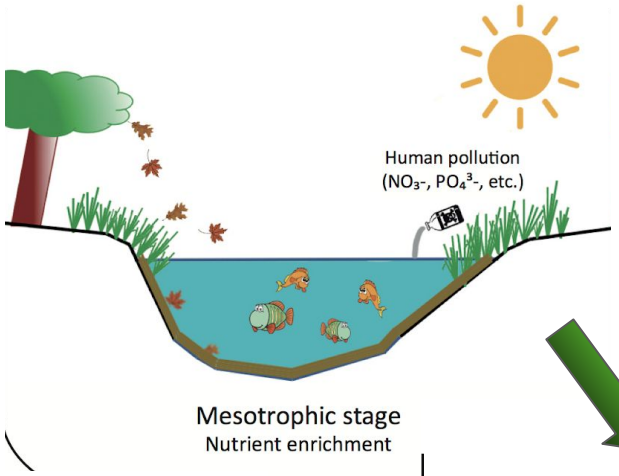
May 5, 2019

Bard College

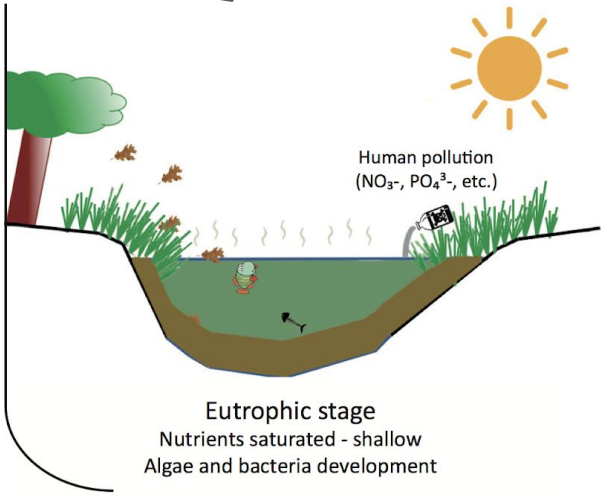
Eutrophication is the "**greening**" of lakes



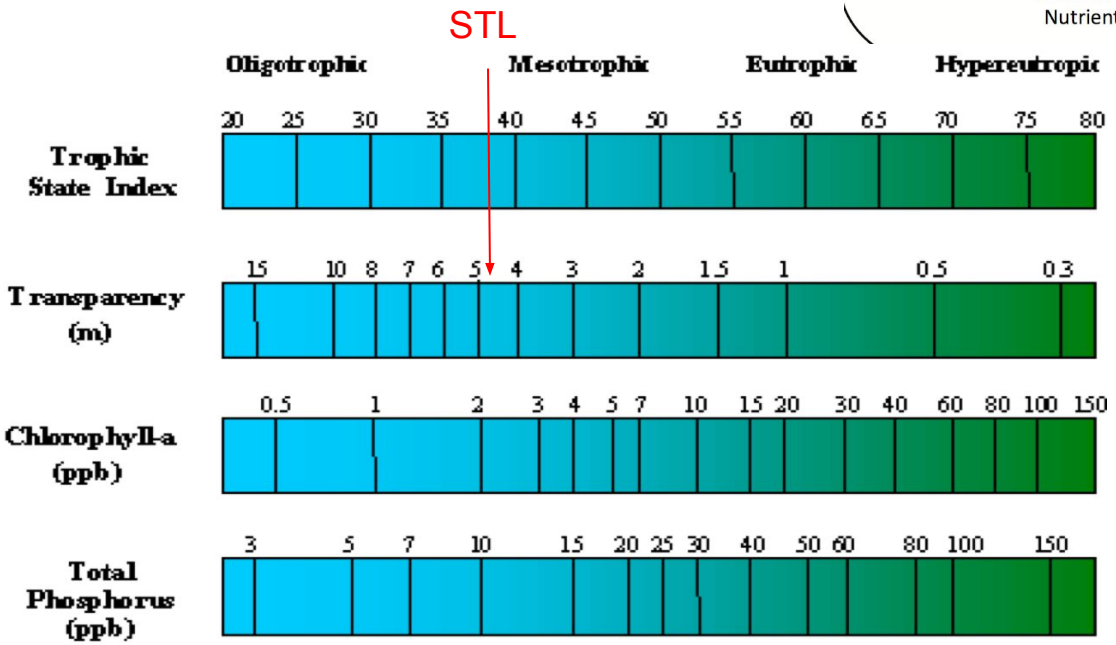
Oligotrophic stage
Deep and nutrient poor system



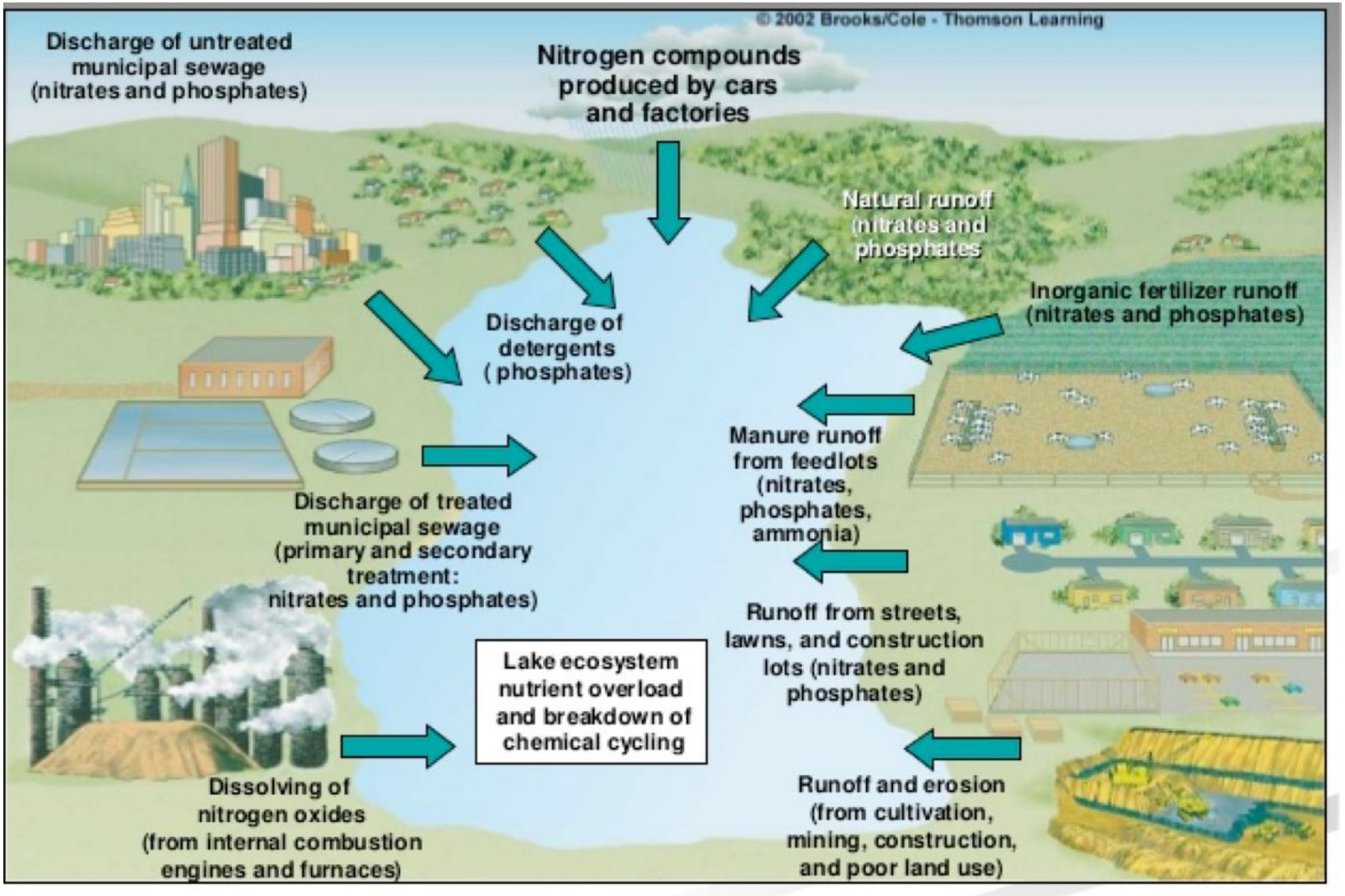
Mesotrophic stage
Nutrient enrichment

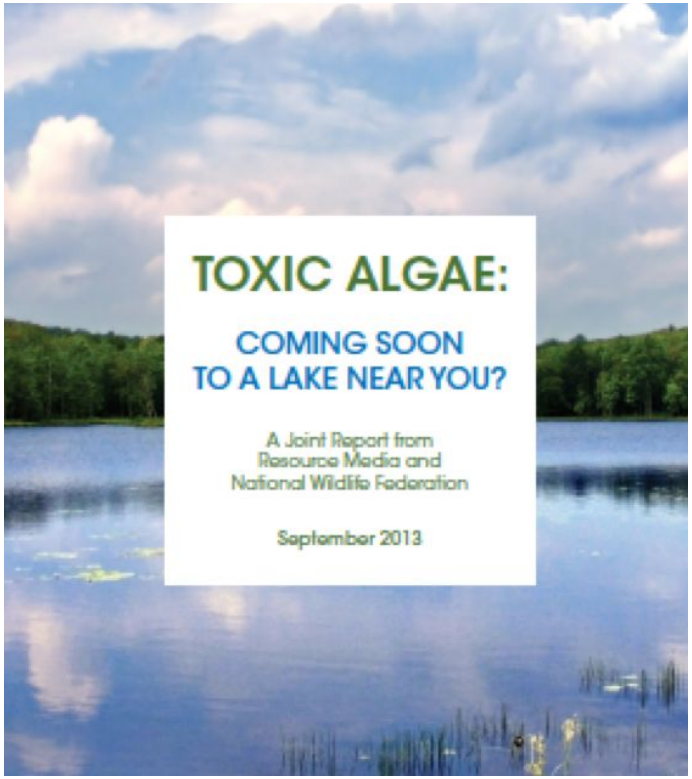


Eutrophic stage
Nutrients saturated - shallow
Algae and bacteria development



Nitrogen and phosphorus inputs accelerate eutrophication

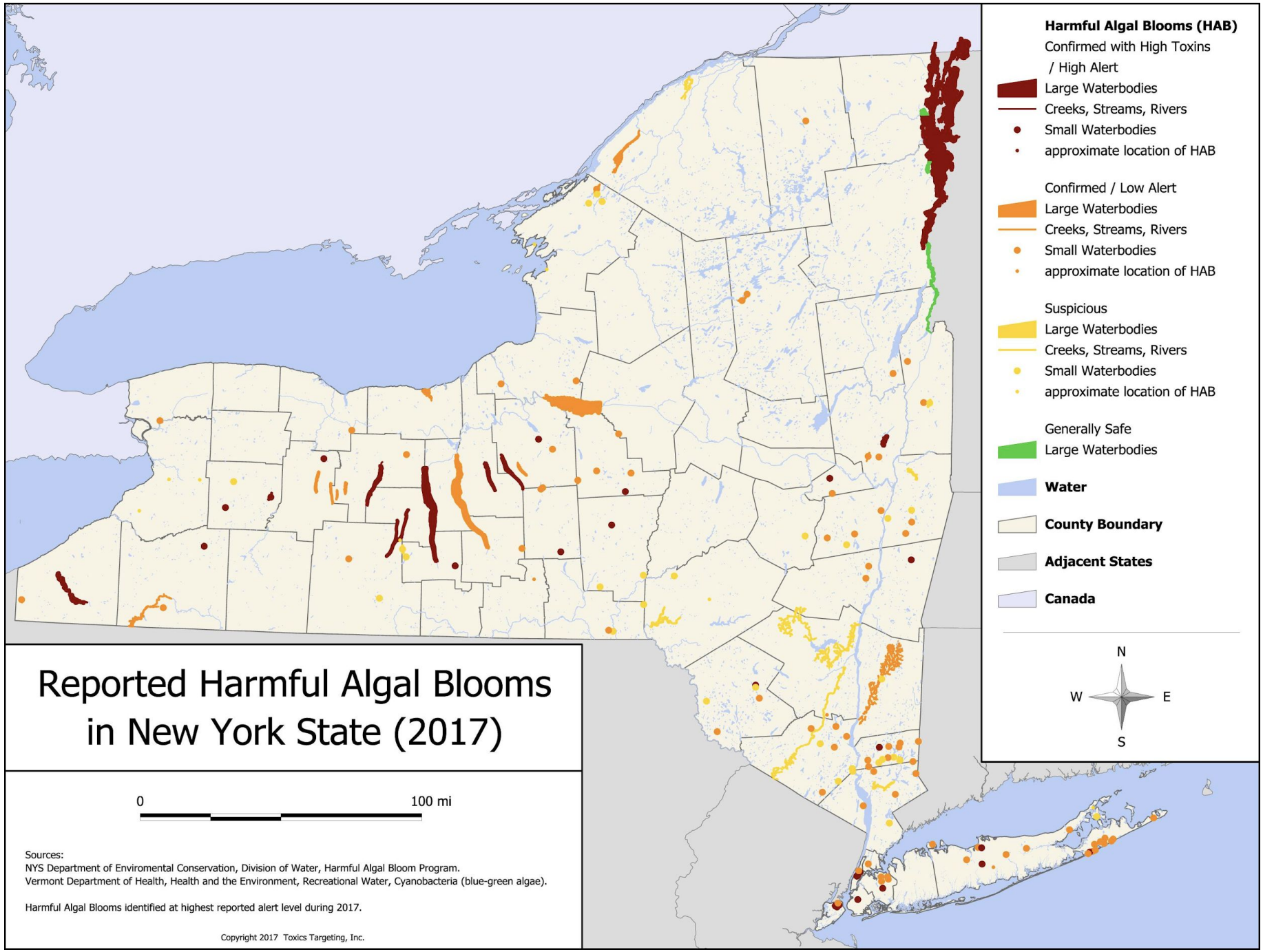




Sutherland Pond
Chatham

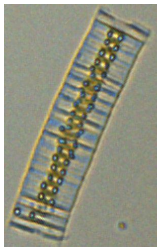
Kinderhook
Lake

Wilcox Lake
Milan


Harmful Algal Blooms (HAB)
Confirmed with High Toxins / High Alert
Large Waterbodies
Creeks, Streams, Rivers
Small Waterbodies
approximate location of HAB
Confirmed / Low Alert
Large Waterbodies
Creeks, Streams, Rivers
Small Waterbodies
approximate location of HAB
Suspicious
Large Waterbodies
Creeks, Streams, Rivers
Small Waterbodies
approximate location of HAB
Generally Safe
Large Waterbodies
Water
County Boundary
Adjacent States
Canada
N
W
E
S
Reported Harmful Algal Blooms in New York State (2017)
0
100 mi
Sources:
NYS Department of Enviromental Conservation, Division of Water, Harmful Algal Bloom Program.
Vermont Department of Health, Health and the Environment, Recreational Water, Cyanobacteria (blue-green algae).
Harmful Algal Blooms identified at highest reported alert level during 2017.
Copyright 2017 Toxics Targeting, Inc.

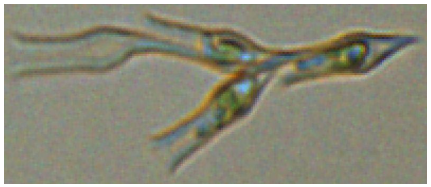
In South Twin, we found...

Many “good guys”

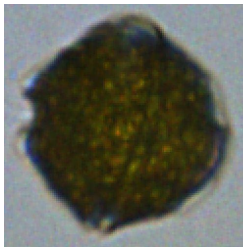


Fragilaria,
a diatom

Spirogyra, a
green algae



Dinobryon, a
golden algae

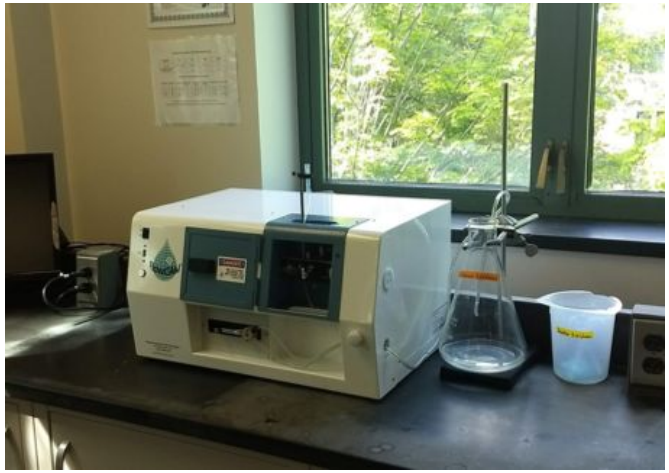


Peridinium, a
dinoflagellate

One “bad guy”

Anabaena, a toxin-producing
cyanobacteria

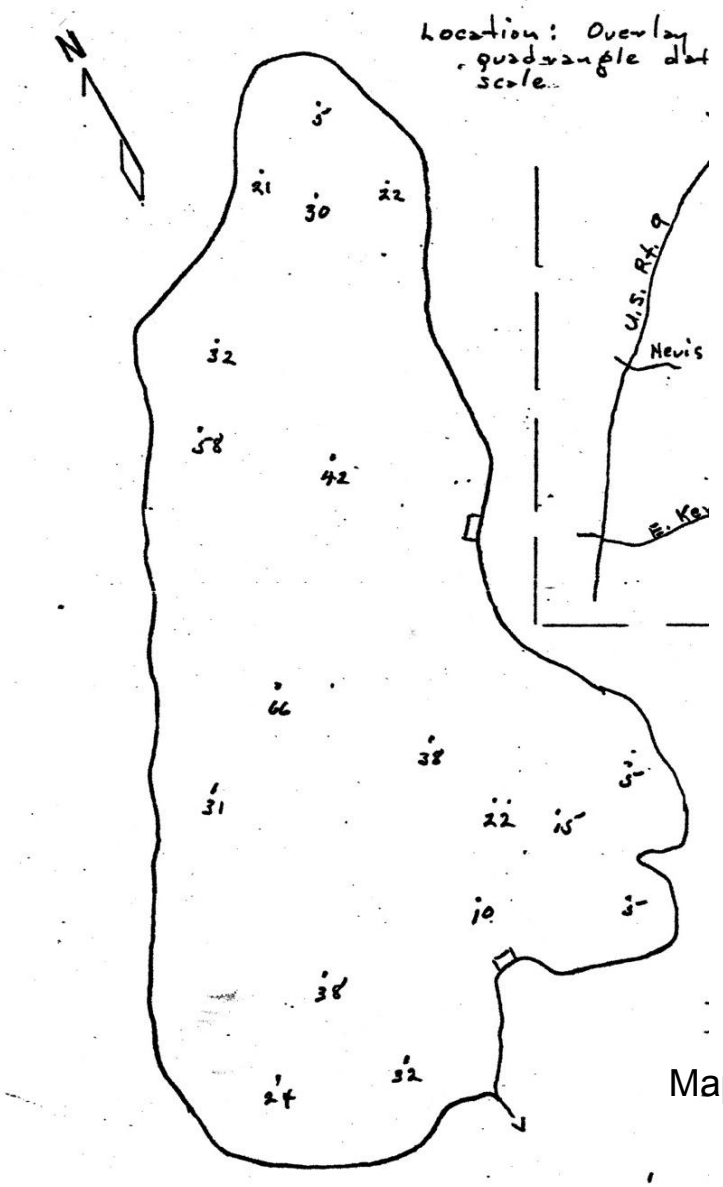
bard water lab



Anabaena can form large blooms

Anabaena bloom in Oregon

Photo credit: Joe Eilers

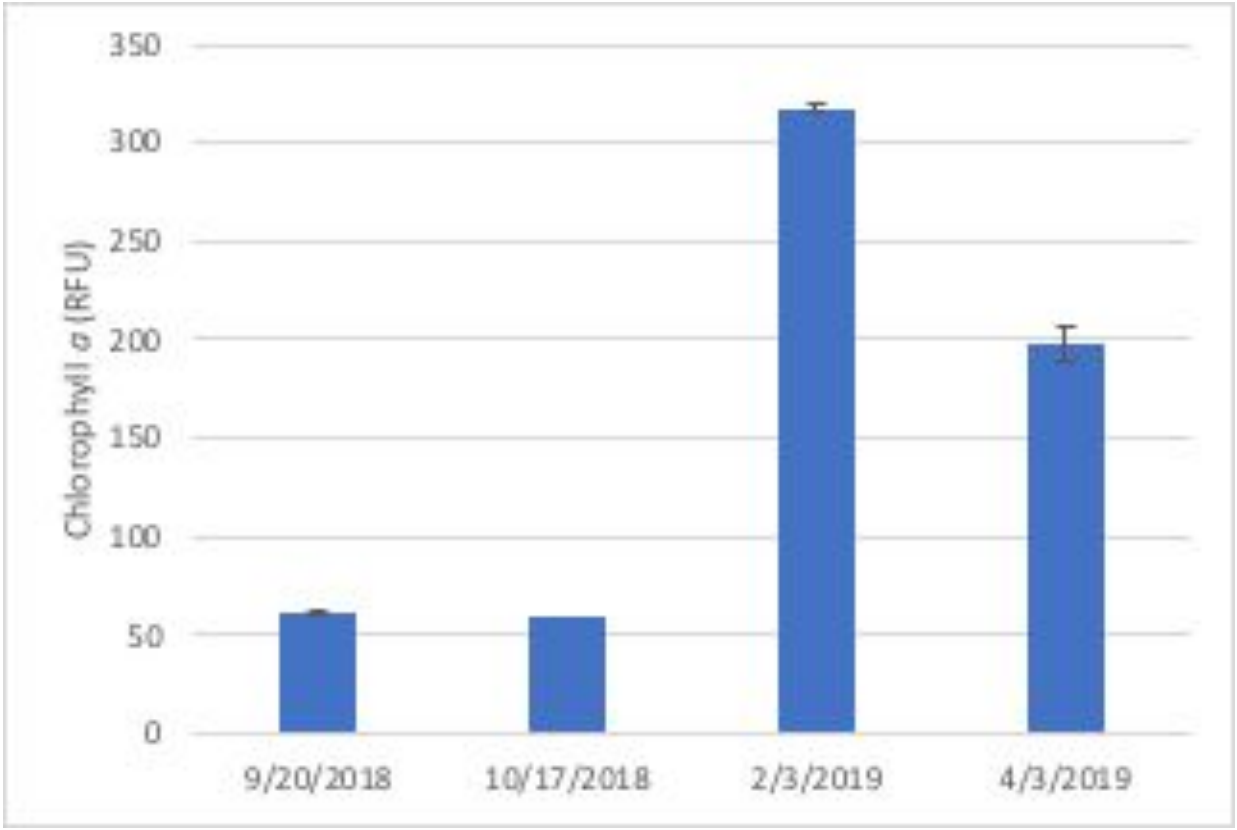


Lake depth provides a buffer but there are now signs of water quality decline

lake is 80 feet deep in places and has around 41,500,000 cubic feet of water.

Map from 1995 lake assessment by J.S. Grim

There was an algae bloom under the ice



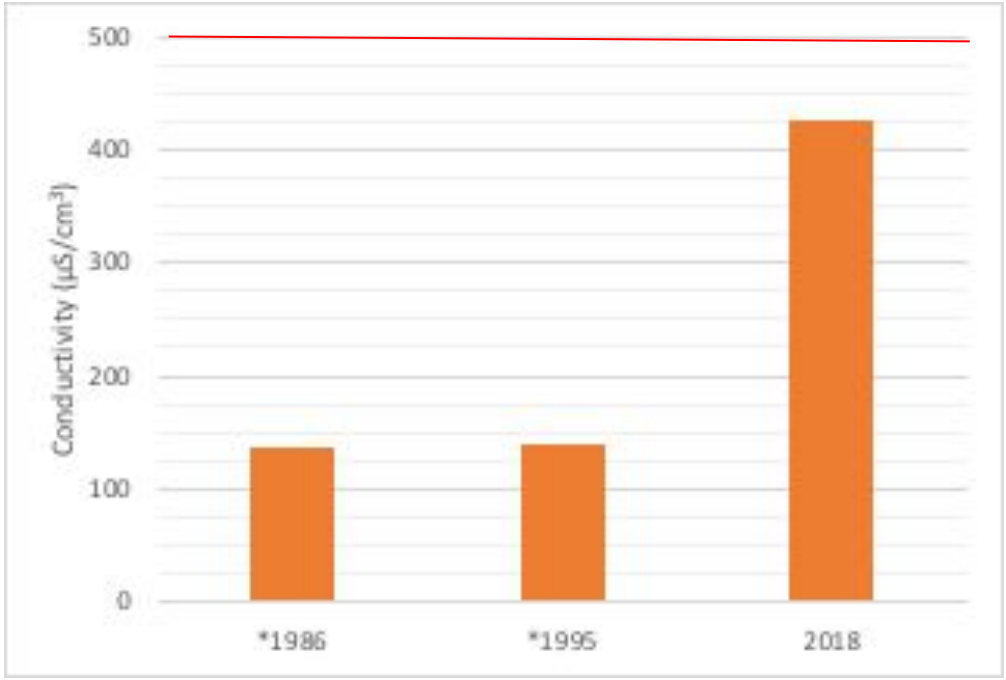
Algae biomass indicator in the middle of the lake from September to April. This does not include summer when algae biomass should be highest.

Septic system maintenance is critical

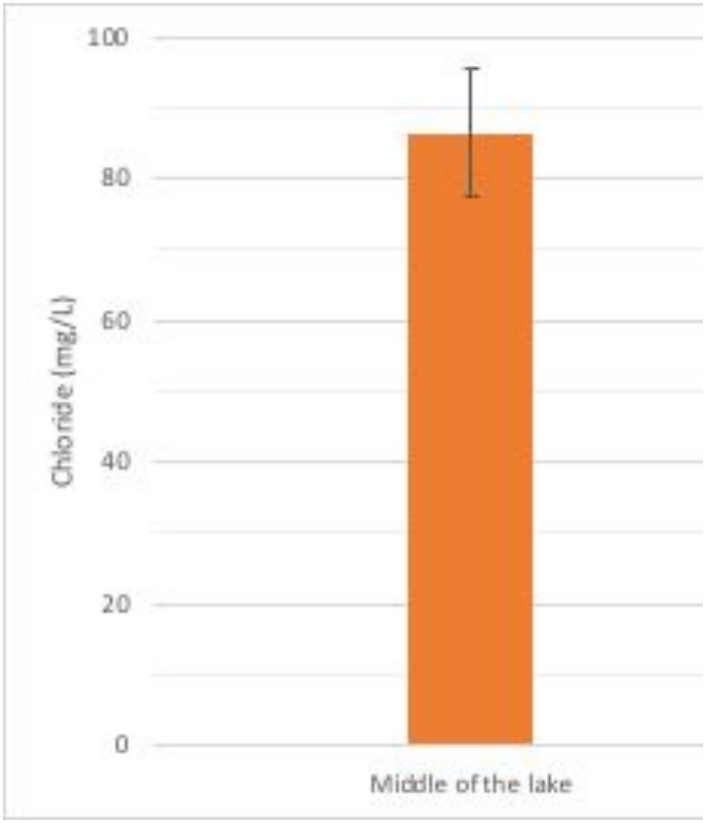
Fecal bacteria levels were generally low

Area of the Lake	MPN for Total Coliform	MPN for E. coli	MPN for Enterococcus
Middle of the lake	< 10 (range 0.0 - 37)	< 10 (range 0.0 - 37)	No Data
Southwest shore	< 10 (range 0.0 - 37)	< 10 (range 0.0 - 37)	< 1 (range 0.0 - 3.7)
South end	< 10 (range 0.0 - 37)	< 10 (range 0.0 - 37)	< 1 (range 0.0 - 3.7)
Bay to southeast	202 (range 124 - 307)	97 (range 45 - 172)	2.0 (range 0.3 - 5.6)
Northeast bank	40 (range 11 - 89)	< 10 (range 0.0 - 37)	< 1 (range 0.0 - 3.7)
North end by the white house	43 (range 12 - 91)	< 10 (range 0.0 - 37)	< 1 (range 0.0 - 3.7)
By community beach,	96 (range 44 - 169)	< 10 (range 0.0 - 37)	1.0 (range 0.0 - 3.7)
Northwest shore	144 (range 77 - 236)	10 (range 1 - 55)	< 1 (range 0.0 - 3.7)

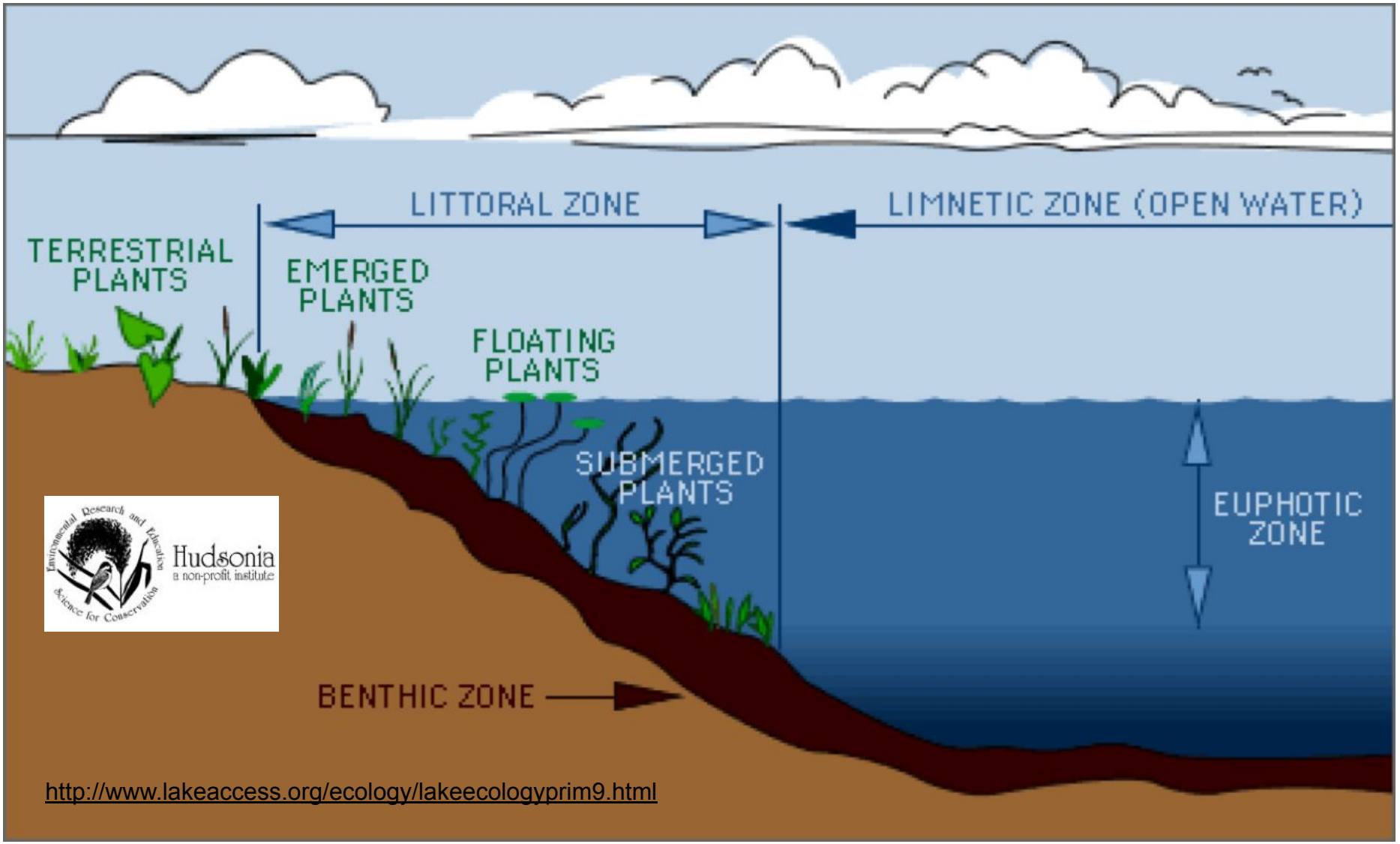
Lake salinity is increasing, likely from road salt



Level where biological impacts have been found



Aquatic vegetation is healthy, diverse, and mostly native



Recommendations for maintaining water quality

1. Avoid additional nitrogen and phosphorus inputs to the lake by maintaining septic systems, avoiding fertilizers, and planting shoreline and aquatic vegetation
2. Consider a floating wetland or other nutrient extraction techniques
3. Reduce salt inputs to the lake to the extent possible
4. Annual monitoring of chloride, nitrogen, phosphorus, and cyanobacteria

http://www.aquabiofilter.com/guidecasestudies.html

See Lake George and Lake Placid as examples


Thank you!
Questions?
Bard Environmental and Urban Studies Program
Environmental Research and Education
Science for Conservation
Hudsonia
a non-profit institute
B
bard water lab

Extra slides

Protect and Restore Riparian areas, shorelines

Photos courtesy of LCBP

Additional resources on harmful algae

- NYS Dept Environmental Conservation
  - https://www.dec.ny.gov/chemical/77118.html
- NYS Federation of Lake Associations
  - http://nysfola.mylaketown.com/HABs

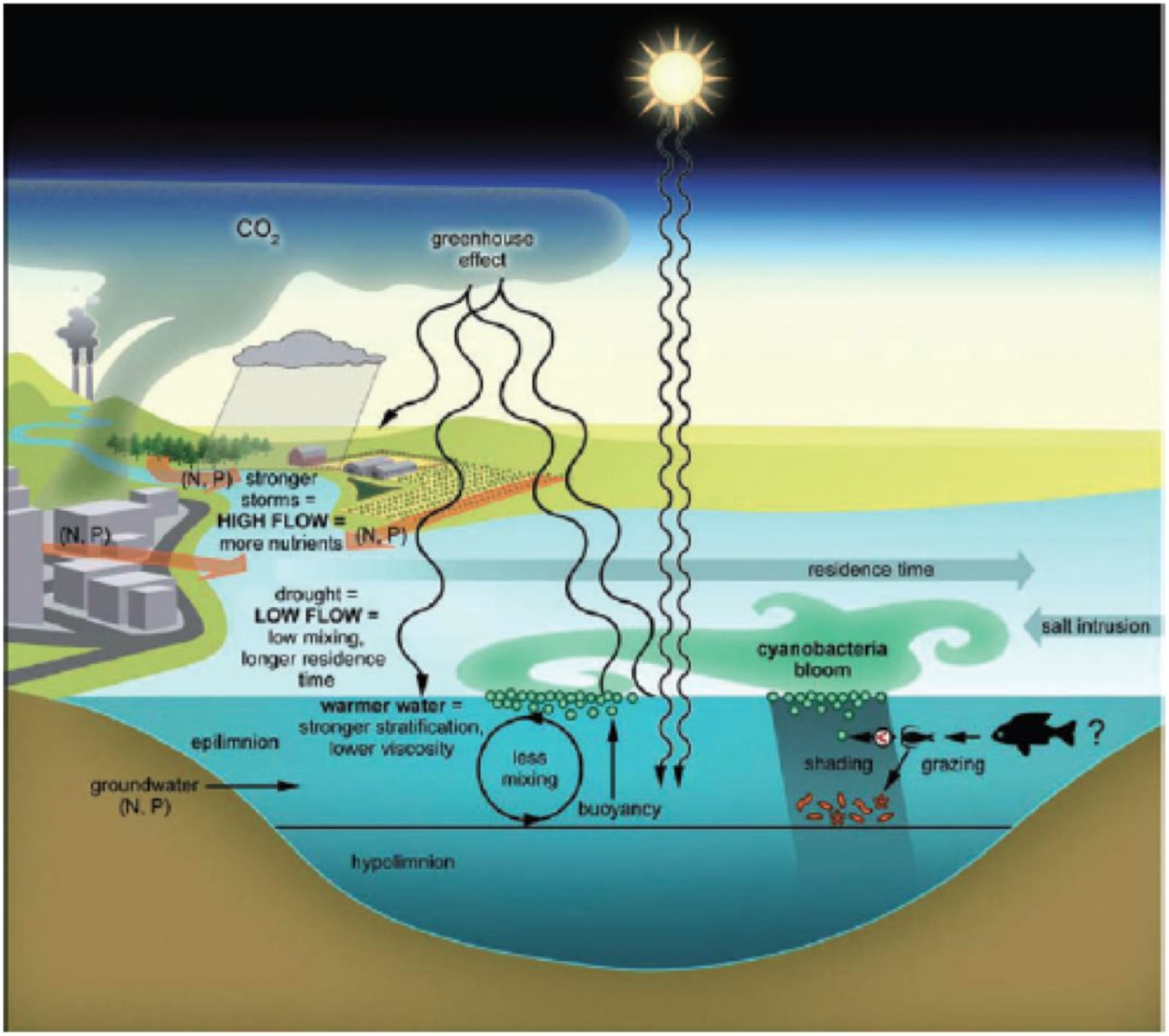
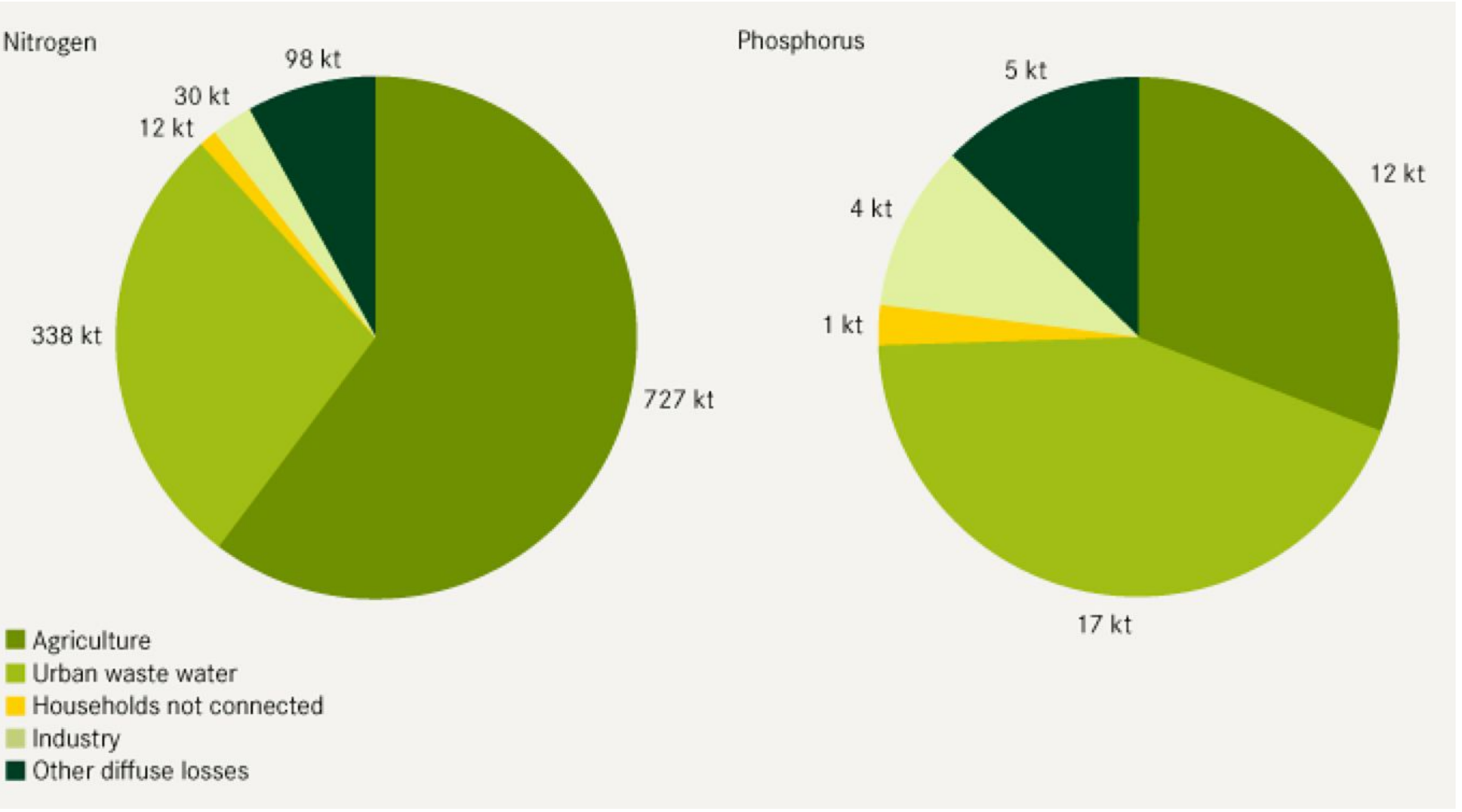
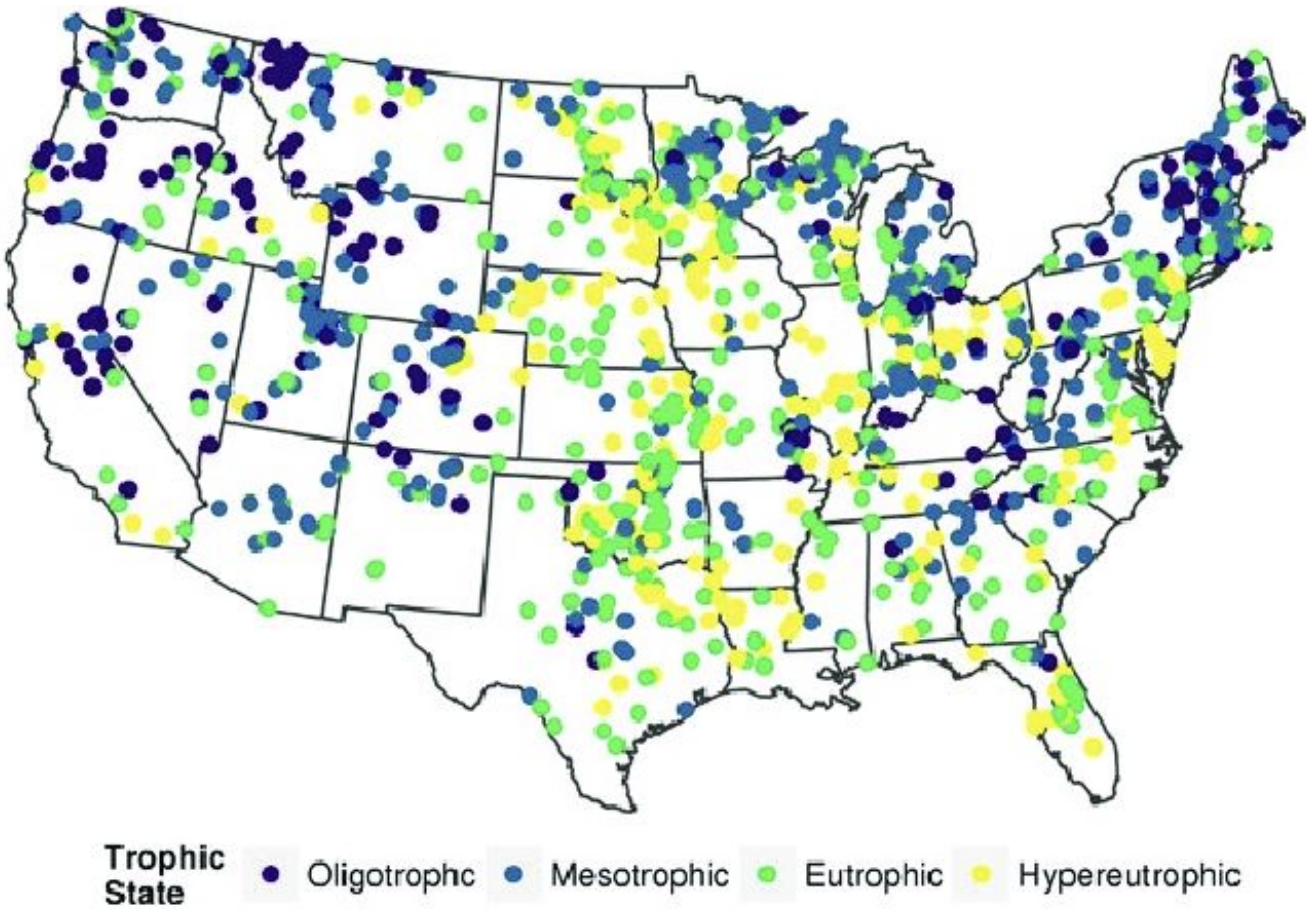
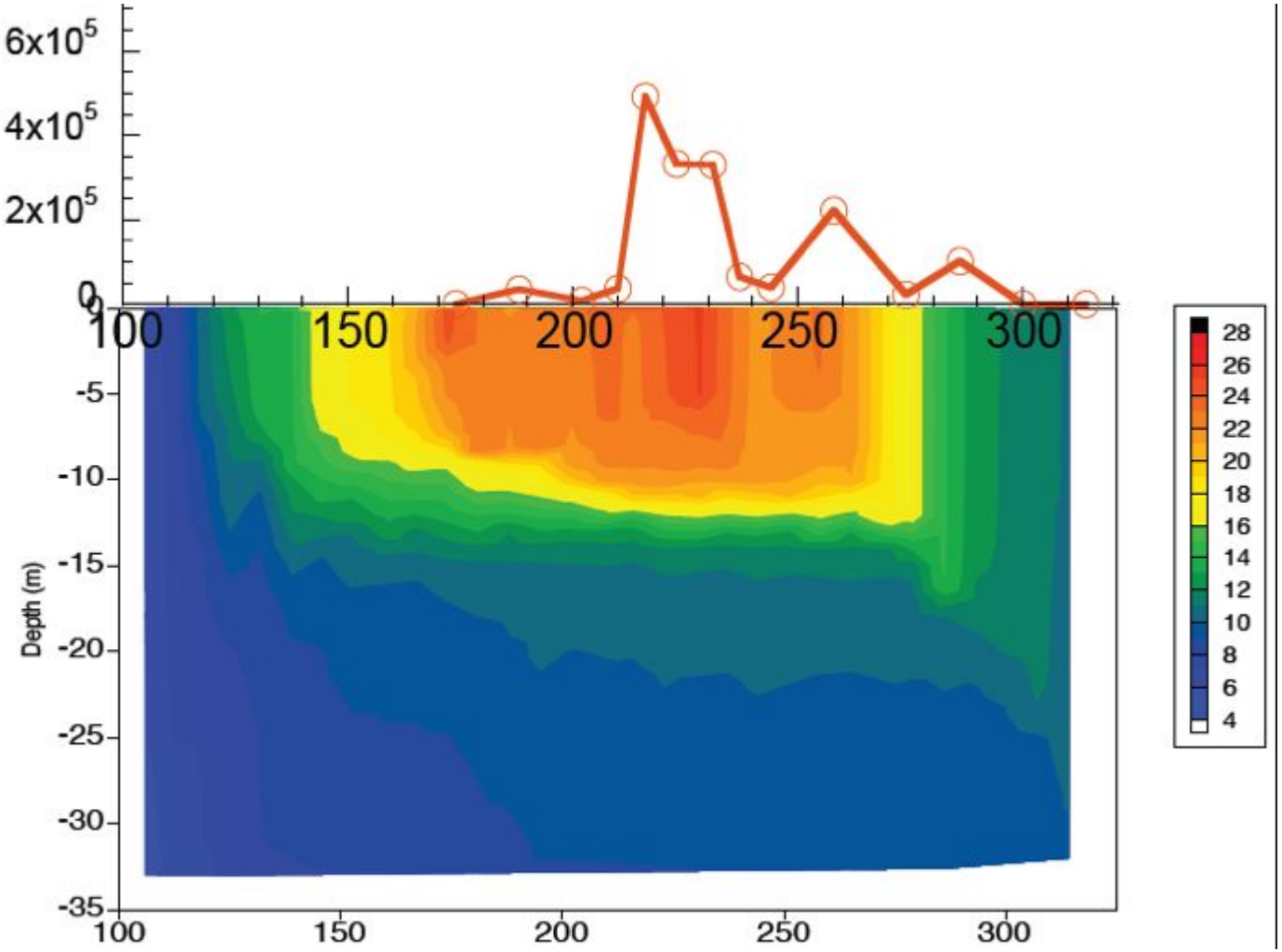


Fig. 4. Conceptual figure, illustrating the environmental controls of cyanobacterial bloom dynamics, and the direct and indirect effects of climate change on these dynamics.


Nitrogen
98 kt
30 kt
12 kt
338 kt
727 kt
Phosphorus
5 kt
12 kt
4 kt
1 kt
17 kt
Agriculture
Urban waste water
Households not connected
Industry
Other diffuse losses


Trophic State
Oligotrophic
Mesotrophic
Eutrophic
Hypereutrophic


6x10^5
4x10^5
2x10^5
0
100
150
200
250
300
-5
-10
-15
-20
-25
-30
-35
Depth (m)
28
26
24
22
20
18
16
14
12
10
8
6
4

bard water lab