2021 FOCA FALL SEMINAR

"The Changing Face of Cottage Country" webinar

Sat., Nov. 6, 2021

by Zoom webinar
9:00 am – 11:30 am

Welcome!

The event will begin at 9:00am

Five Part Webinar Series 2021

TROUBLED WATERS FORUM

Greater Sudbury Watershed Alliance

Vale LIVING WITH LAKES CENTRE
CENTRE POUR LA VITALITÉ DES LACS Vale

FOCA
Federation of Ontario Cottagers' Associations

Thursday February 4th - 7.00 p.m.
Dr. John Gunn
Imagine Sudbury in 2050: A Global Change Community

Thursday February 11th - 7.00p.m.
Dr. Norman Yan
From Fireplace to Pancakes: Solving the Widespread Problem of Calcium Decline in Ontario, Starting in Sugar Bushes

Thursday February 18th - 7.00 p.m.
Dr. Sapna Sharma
On Thin Ice: Are Lakes Feeling the Heat?

Thursday February 25th - 7.00 p.m.
Dr. Andrea Kirkwood
Using the Community Science Co-Production Model to Inform Lake Management

Thursday March 4th - 7.00 p.m.
Dr. John Smol
The Power of the Past: Tracking Lake Ecosystem Changes in an Anthropocene World

https://foca.on.ca/troubled-waters-webinar-series/

Saturday November 6, 2021
by Zoom webinar 9am-11:30am

FOCA
Federation of Ontario Cottagers' Associations

Fall Seminar for Lake Associations

Our Feature Speaker:

Dr. Norman Yan

Ph.D, FRSC

Past Senior Research Scientist with the Ontario Ministry of Environment, Conservation & Parks

Past-Chairman of

Friends of the Muskoka Watershed

Professor, York University Department of Biology

Saturday November 6, 2021
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FOCA
Federation of Ontario Cottagers' Associations

Fall Seminar for Lake Associations

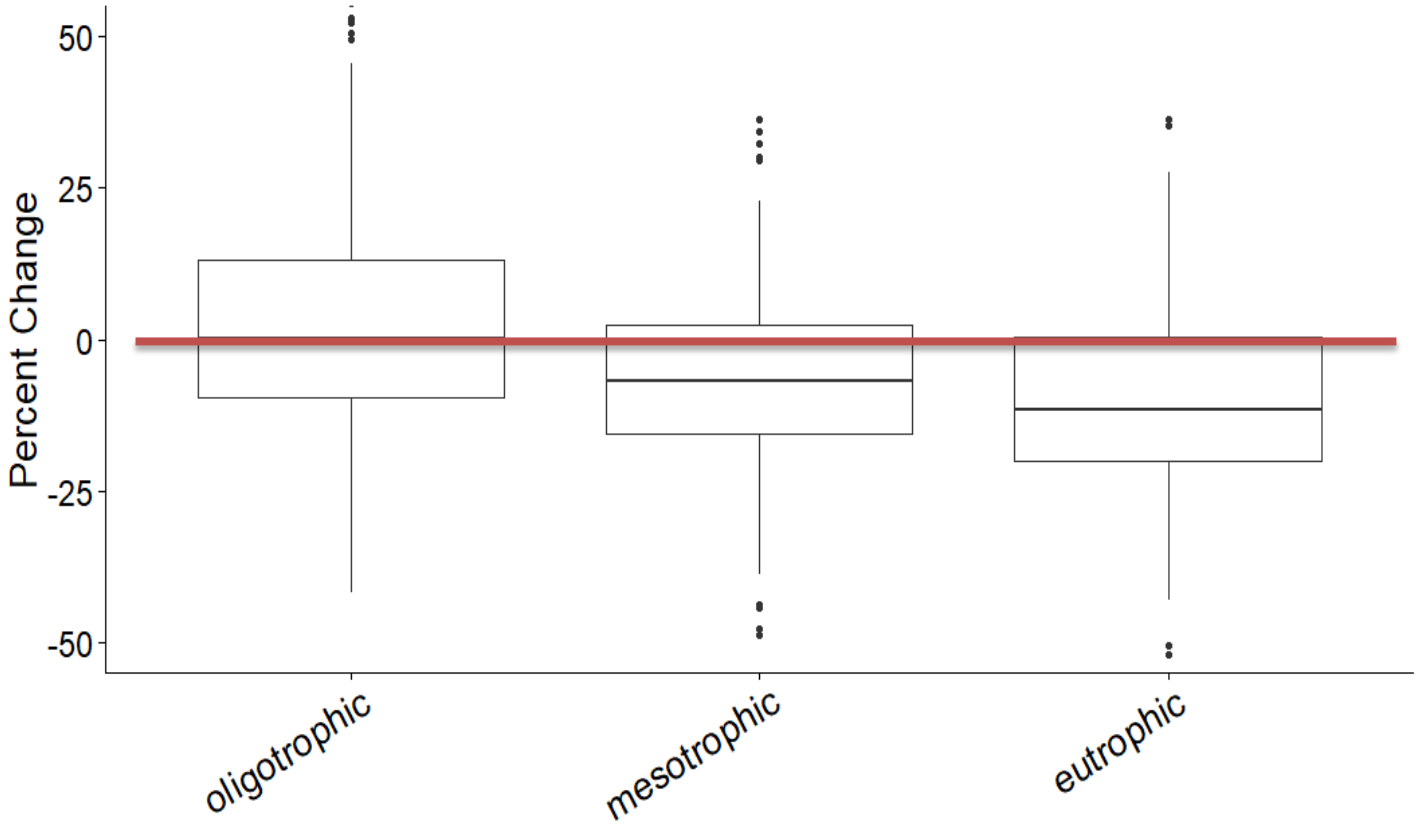
Imagining a good future for our lakes despite climate change

Norman Yan PhD FRSC
Friends of the Muskoka Watershed & York University

Four Good Questions

1. Where are we now?
2. How did we get here?
3. Where do we want to go?
4. How do we get there

1. Where are our lakes now?
TP levels have fallen in TP-rich lakes since 2005-2009
(n = 636 lakes, Favot FOCA, LPP data in Ontario Open Data Catalogue)



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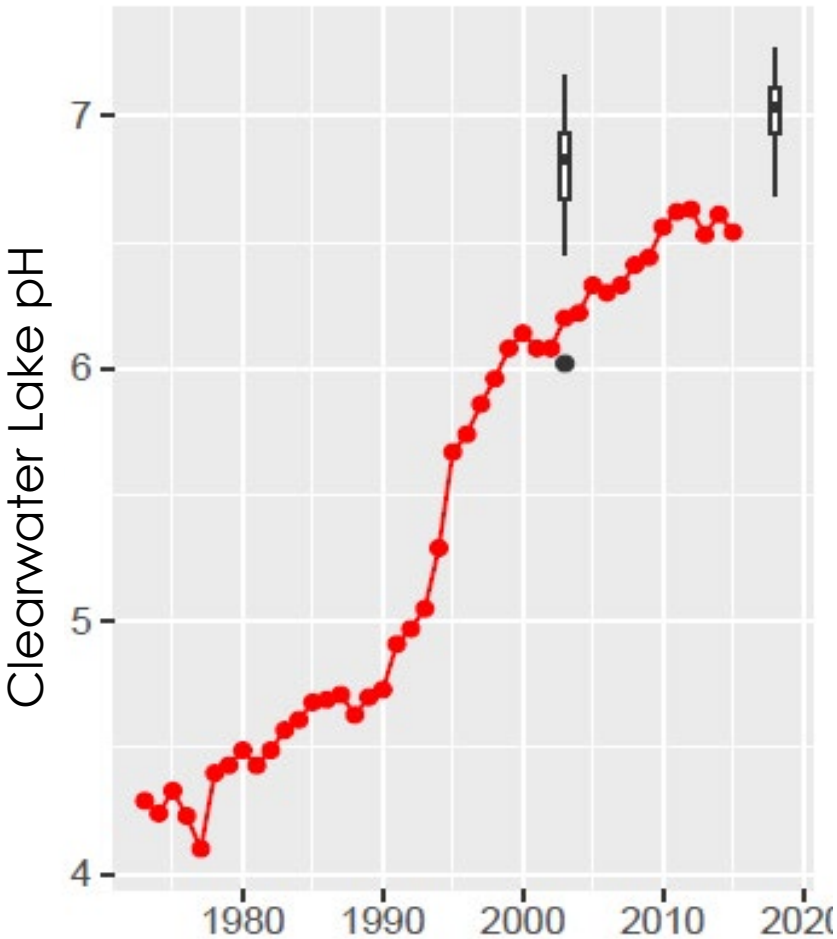
Lakes are recovering from acid rain



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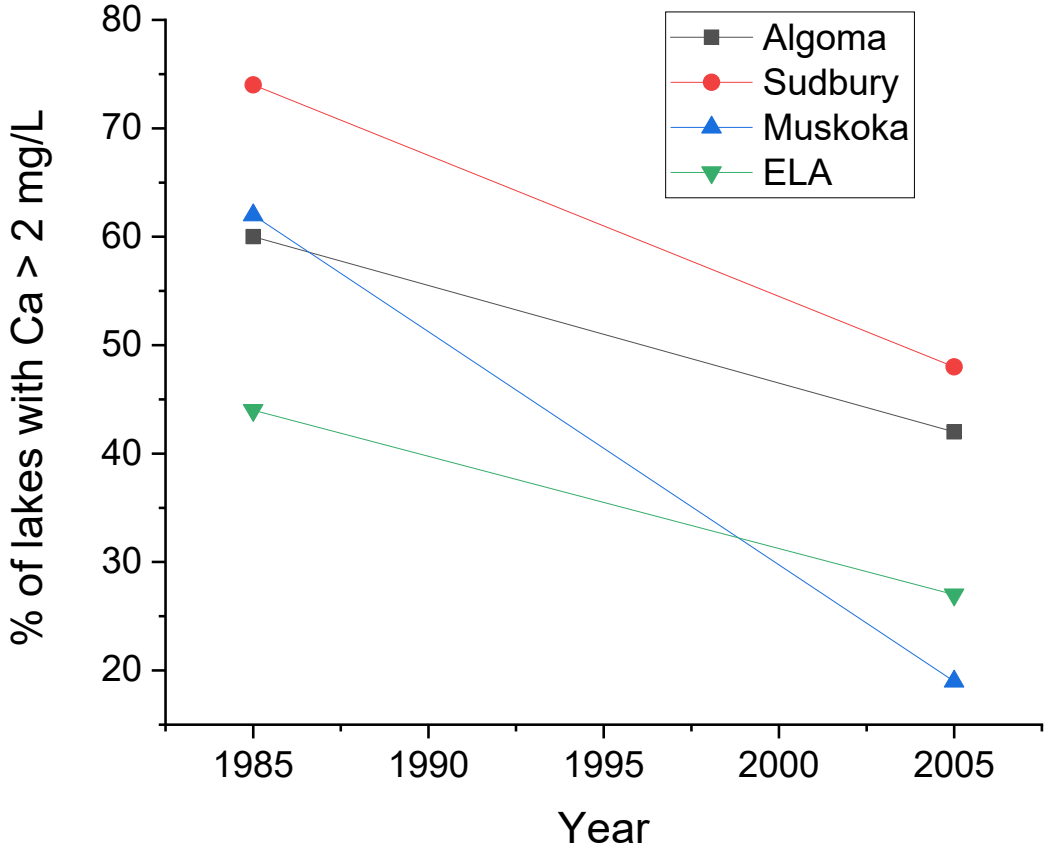
But calcium levels have fallen to worrisome levels in Shield lakes across Ontario

(% of 658 lakes with > 2 mg/L of Ca from Jeziorski et al. 2008)



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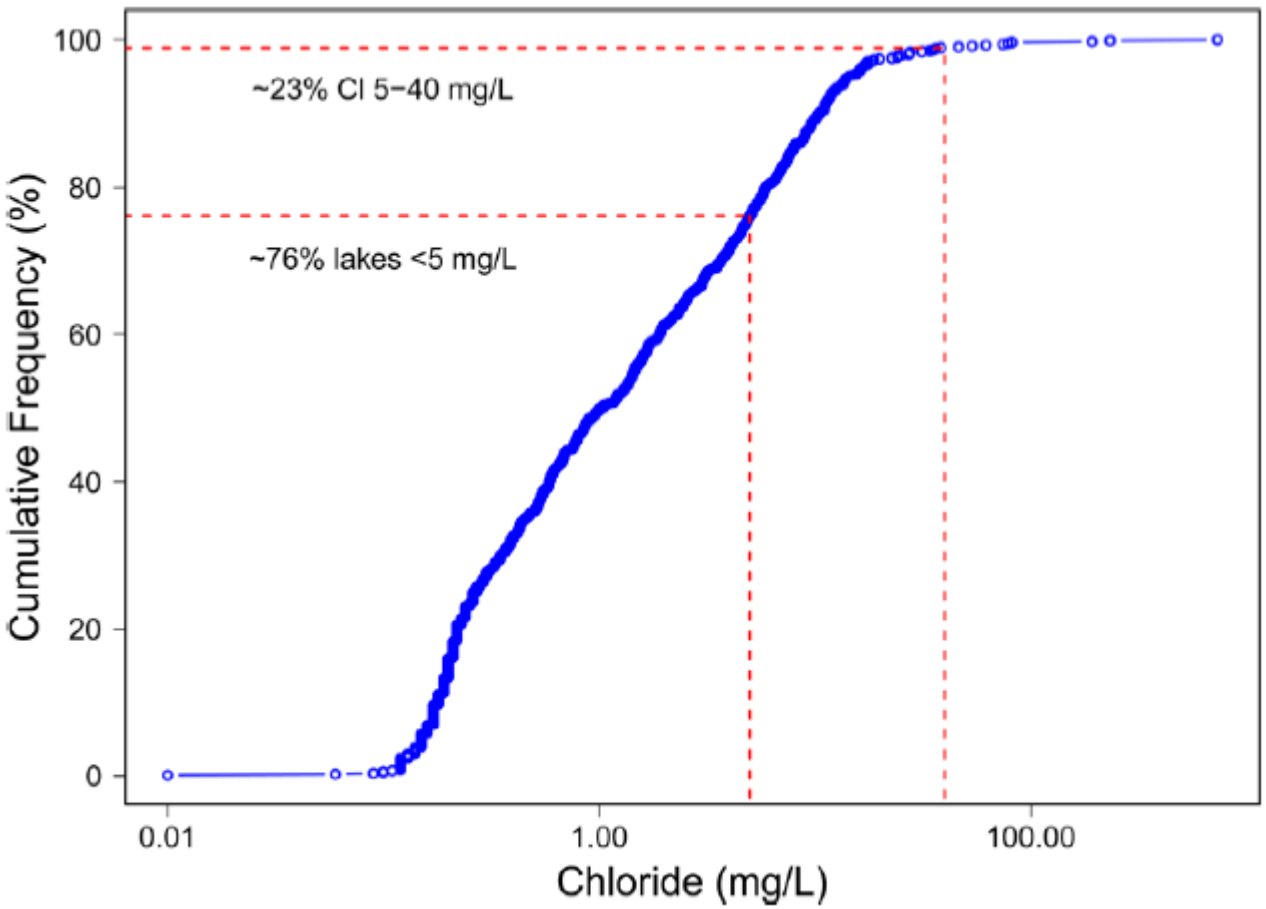
And road salt levels are now worrisome, >5 mg/L of Cl, in ¼ of our lakes

(n = 822 lakes from Arnott et al. 2020)



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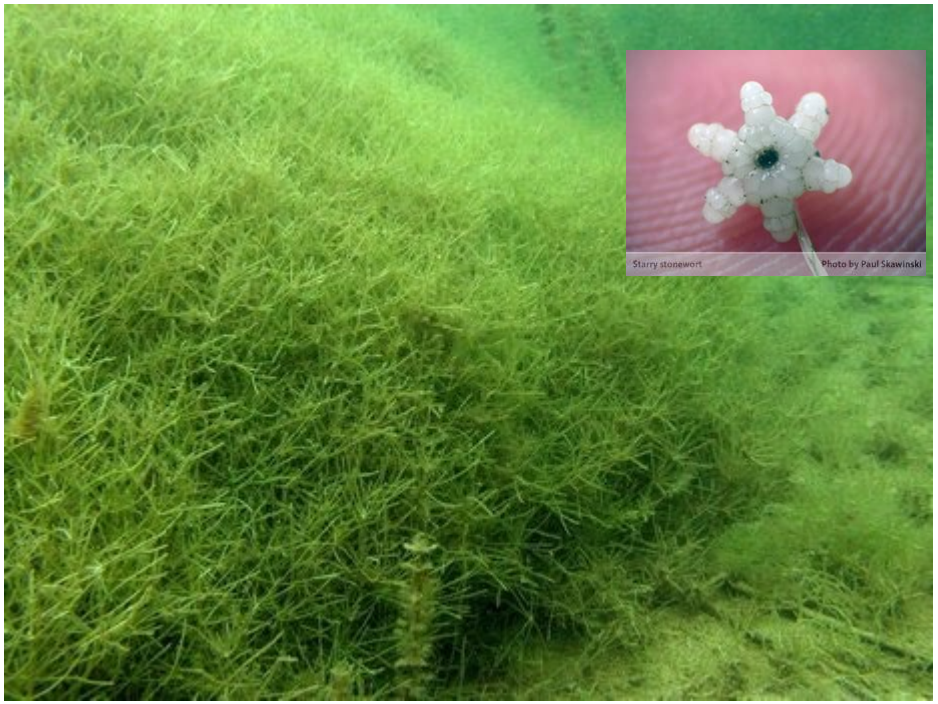
Spring floods can be severe

Image from Toronto.com

Invaders remain a threat, e.g.
Spiny water flea, *Bythotrephes* and starry stonewort, *Nitellopsis obtusa*



Images from LSCA

Image from bugguide.net

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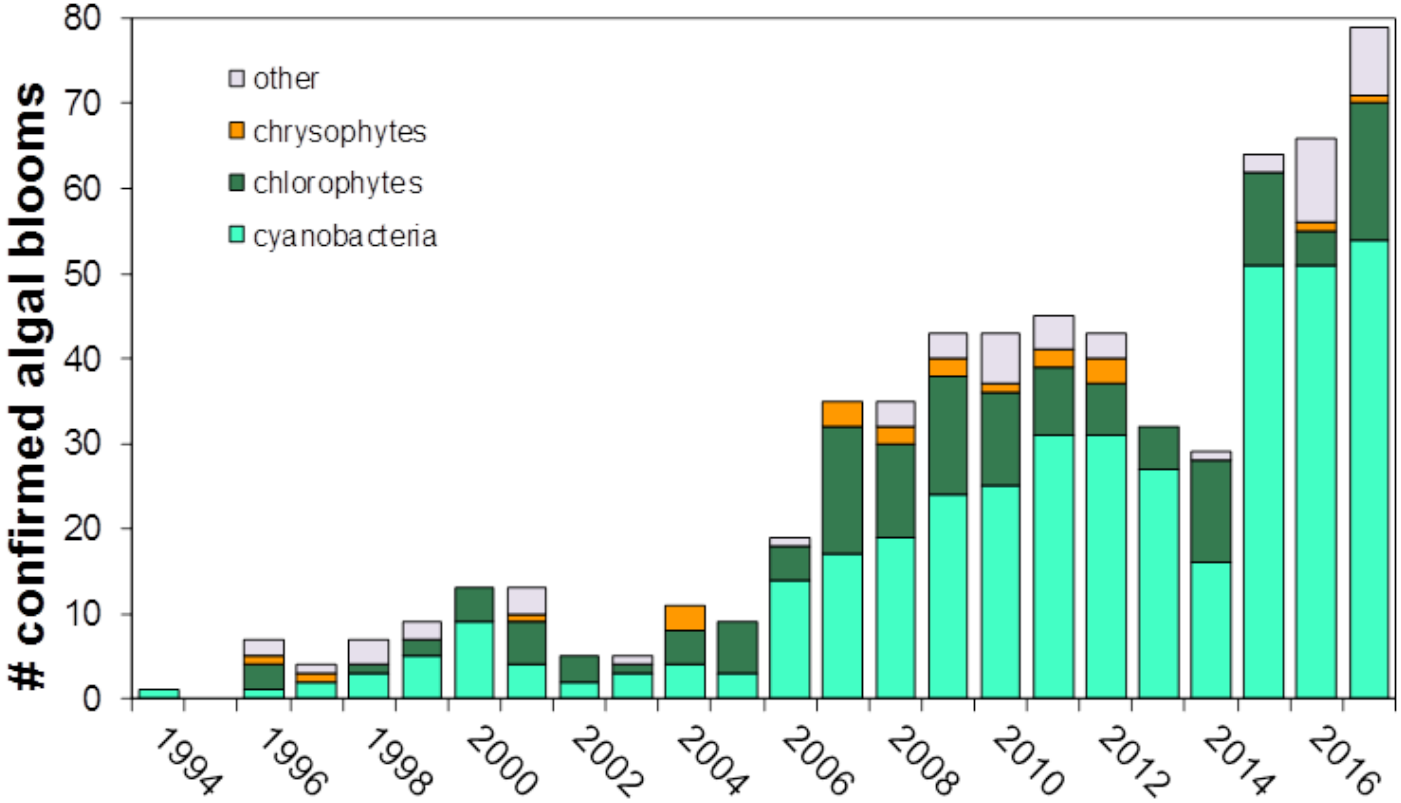
And algal blooms are again on the rise



Source: Claire Holeton via A. Paterson, MECP

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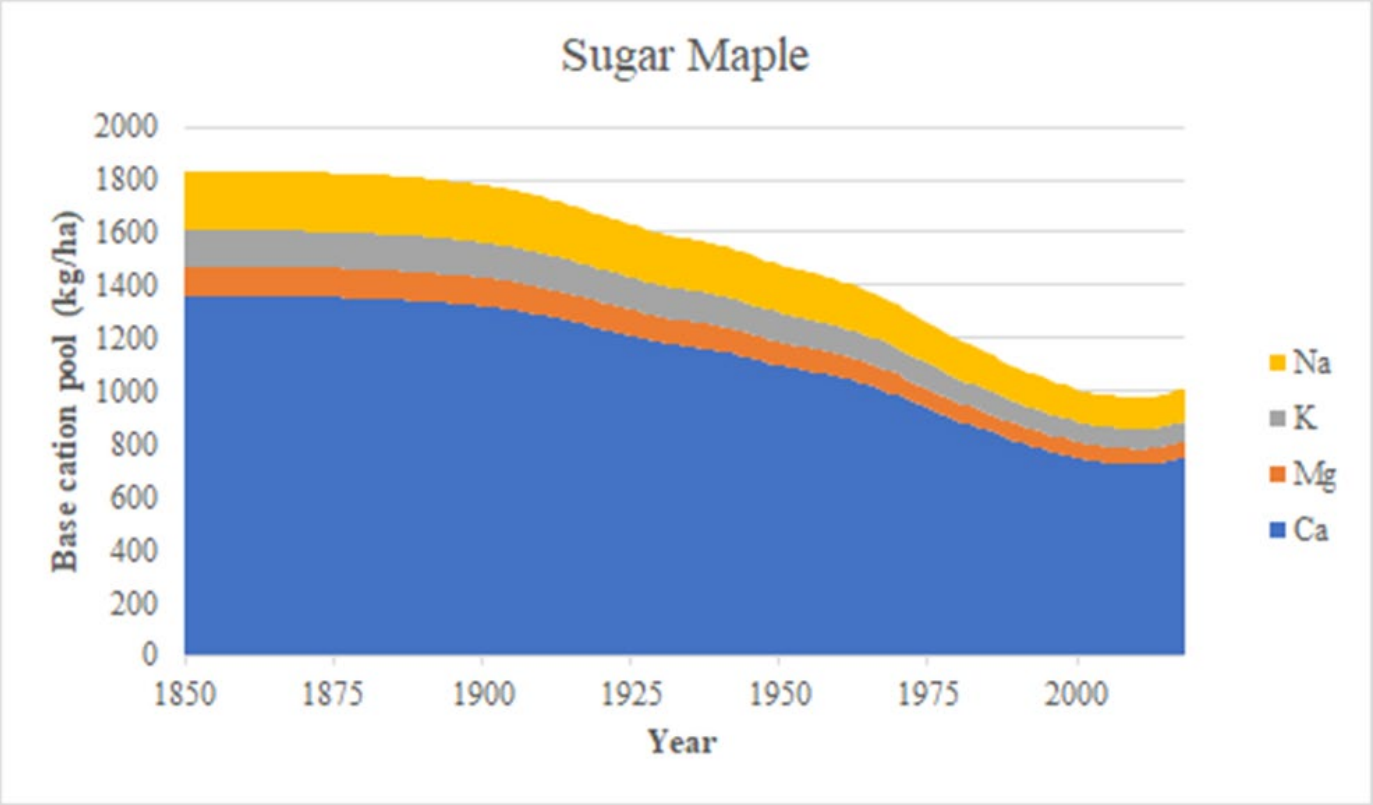
2. How did we get here for the problems we fixed: TP & pH?

- We recognized the problem
- Identified the cause
- Marshalled public will to act
- Took appropriate action
- Ensured it worked
- Kept watch for re-emergence

2. How did we get here for the problems that remain?

- Calcium decline
- Road salt
- Floods
- Invaders
- Algal blooms

For calcium decline: we didn't consider acid rain's legacy of nutrient leaching from soil



From S. Watmough's lab, Trent U

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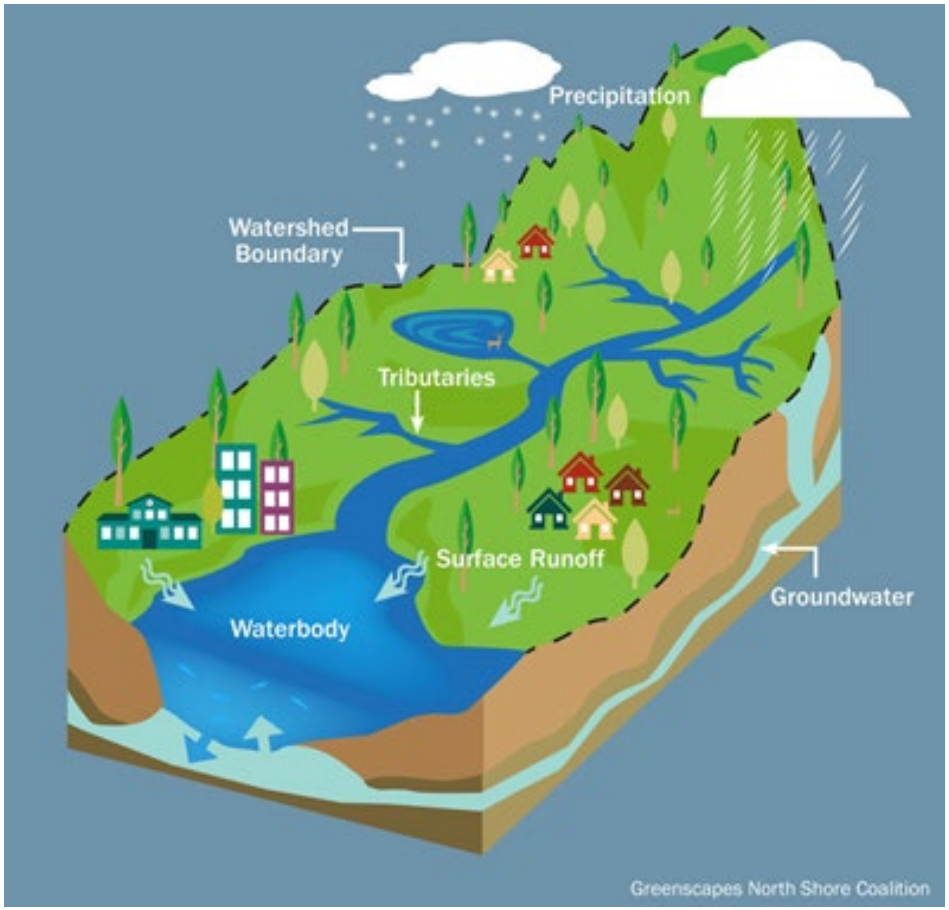
For road salt pollution: we pretended we can throw road salt away without consequence



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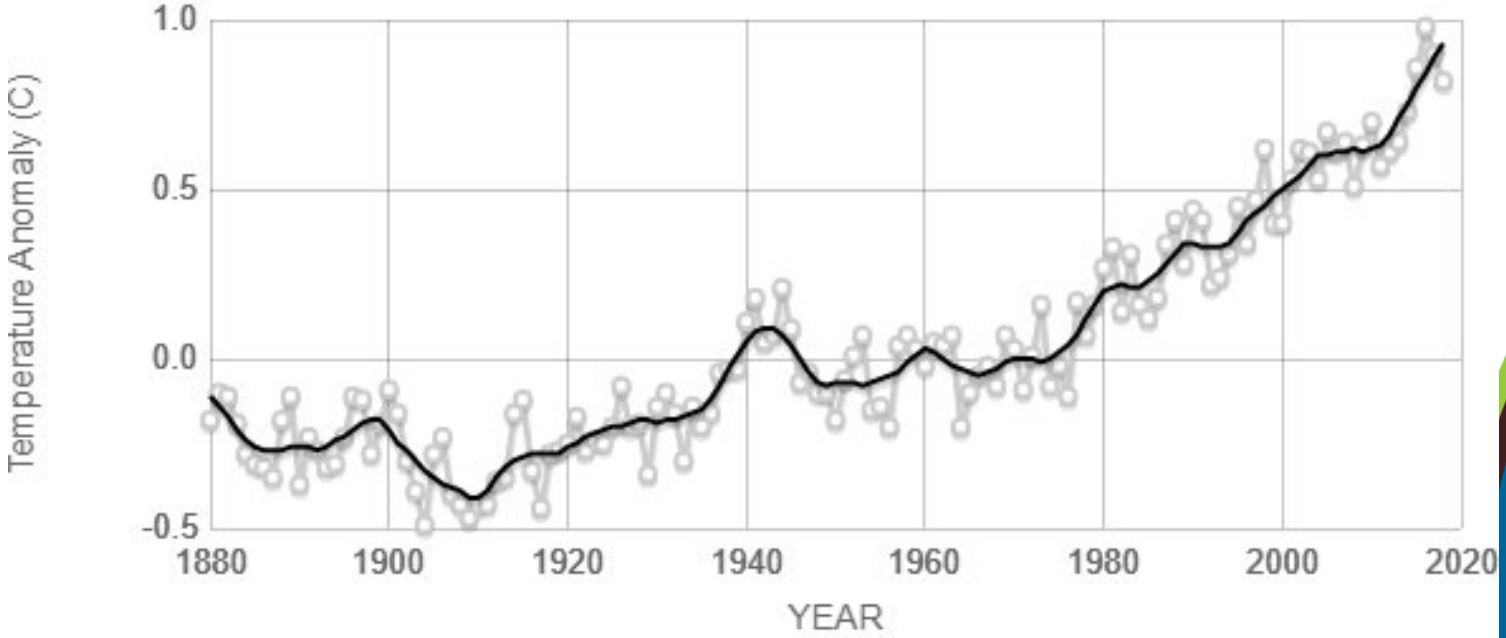
Images from Greenscapes North Shore Coalition

For flooding: we ignored our warming world
(global air temperature compared to 1950 to 1980 mean)



Source: climate.nasa.gov

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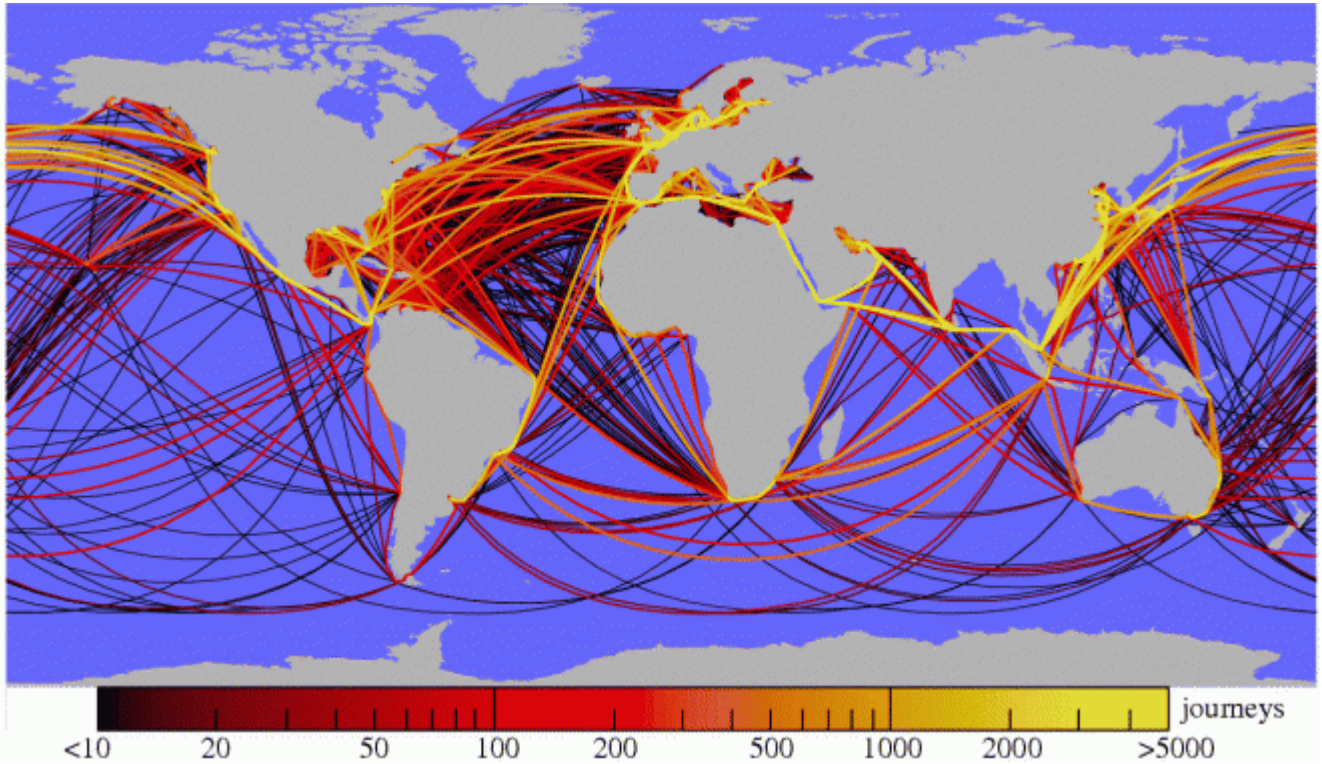
For invaders: we ignored key sources, e.g. ballast water exchange from shipping in our connected world



Kaluza P et al. the complex network of global cargo ship movements
J. Royal Soc : interface

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But algal blooms in remote lakes
e.g. in Dickson Lake, Algonquin Park*
This is still a deeply troubling mystery

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*Favot et al. 2019 J. Paleolim

3. Where do we want to go?

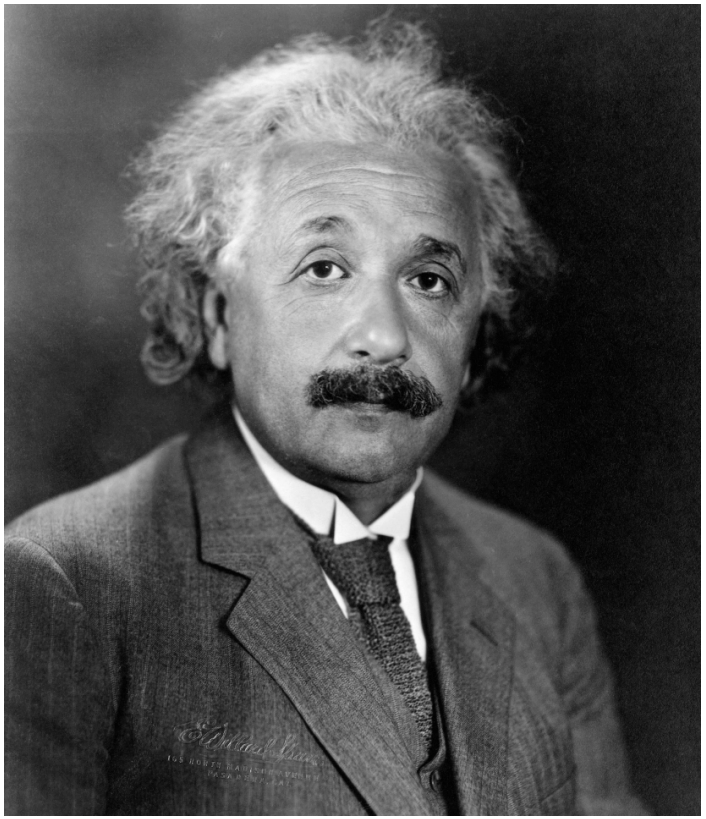
- From 2017 RBC Canadian Water Attitudes Study
  - Half of us believe fresh water (FW) is part of our national identity
  - All but 1 province believe FW is our most important natural resource
  - Most think water issues are worsening
  - 70% think climate change threatens our FW
  - 90% agree access to FW should be a right

3. Where do we want to go?

- To a place where our fresh water and water supply is
  - Better protected
  - Less threatened by climate change and pollution
  - And where drinking water is provided as a right

4. How do we get there?

- "We cannot solve our problems with the same thinking we used when we created them"
- "the only thing more dangerous than ignorance is arrogance"
- "Logic will get you from A to B. Imagination will take you everywhere"



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Can we imagine that new lake stressors coupled with climate are the cause of novel algal blooms?

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We thought we understood the cause of algal blooms: too much anthropogenic phosphorus

Lake 226 in the Experimental Lakes Area

How might stressor interactions increase the risk of algal blooms?

- Algal blooms are influenced by:
  - species habitat preferences: chemistry, oxygen and temperature
  - Algal growth rates linked to phosphorus supply
  - Algal death rates linked to grazing by zooplankton

It’s analogous to a good lawn

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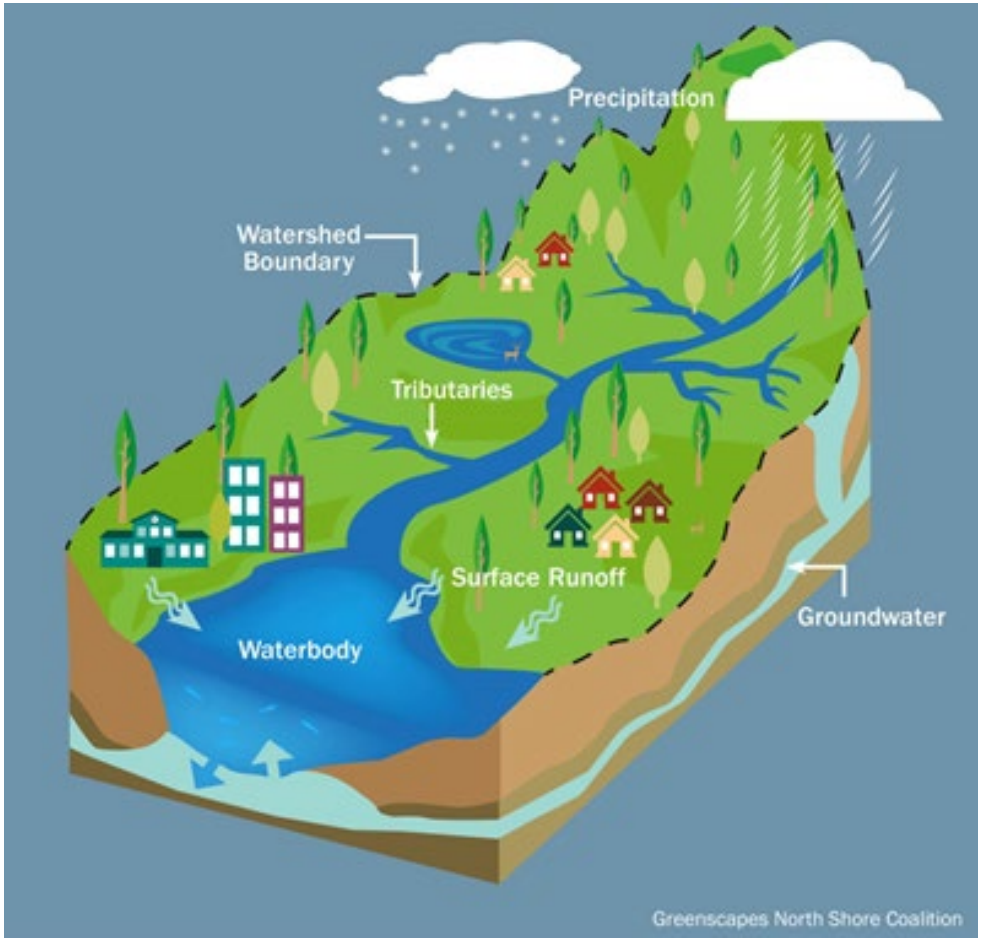
Where do lakes get their phosphorus?



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Images from Greenscapes North Shore Coalition

And zooplankton are the “mowers”

Image from Utah State U

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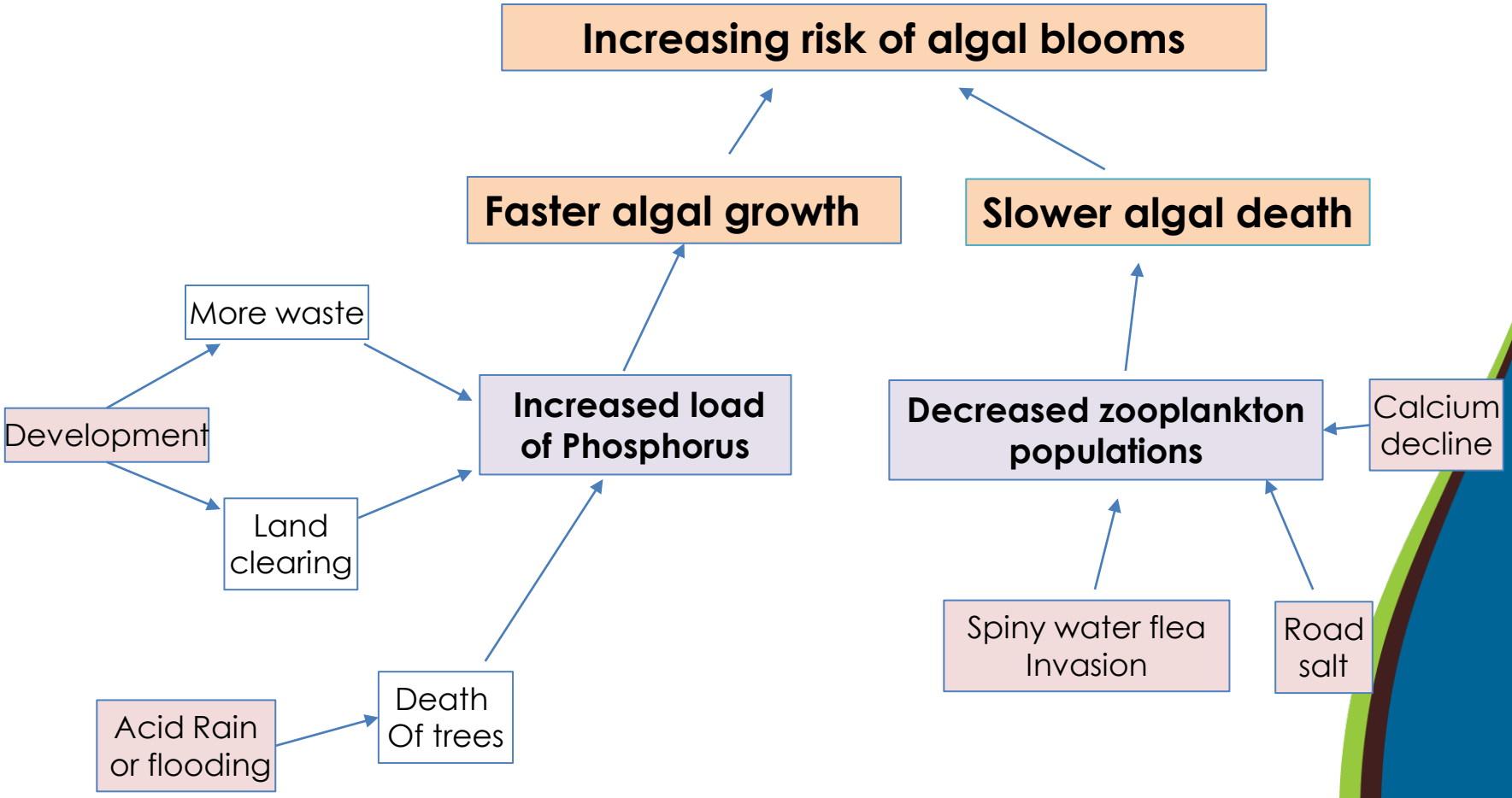

Linking emerging threats to algal blooms **without** climate change

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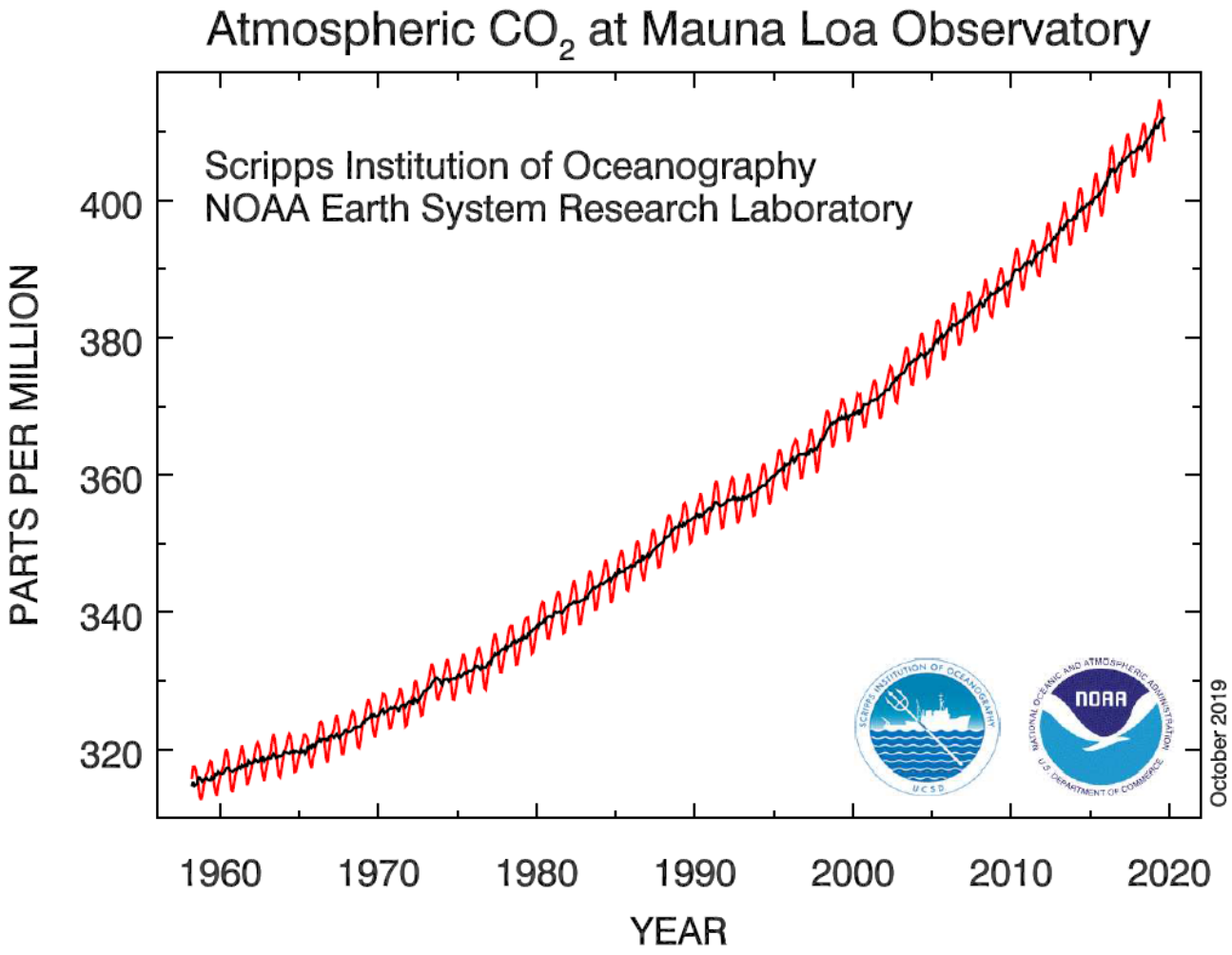
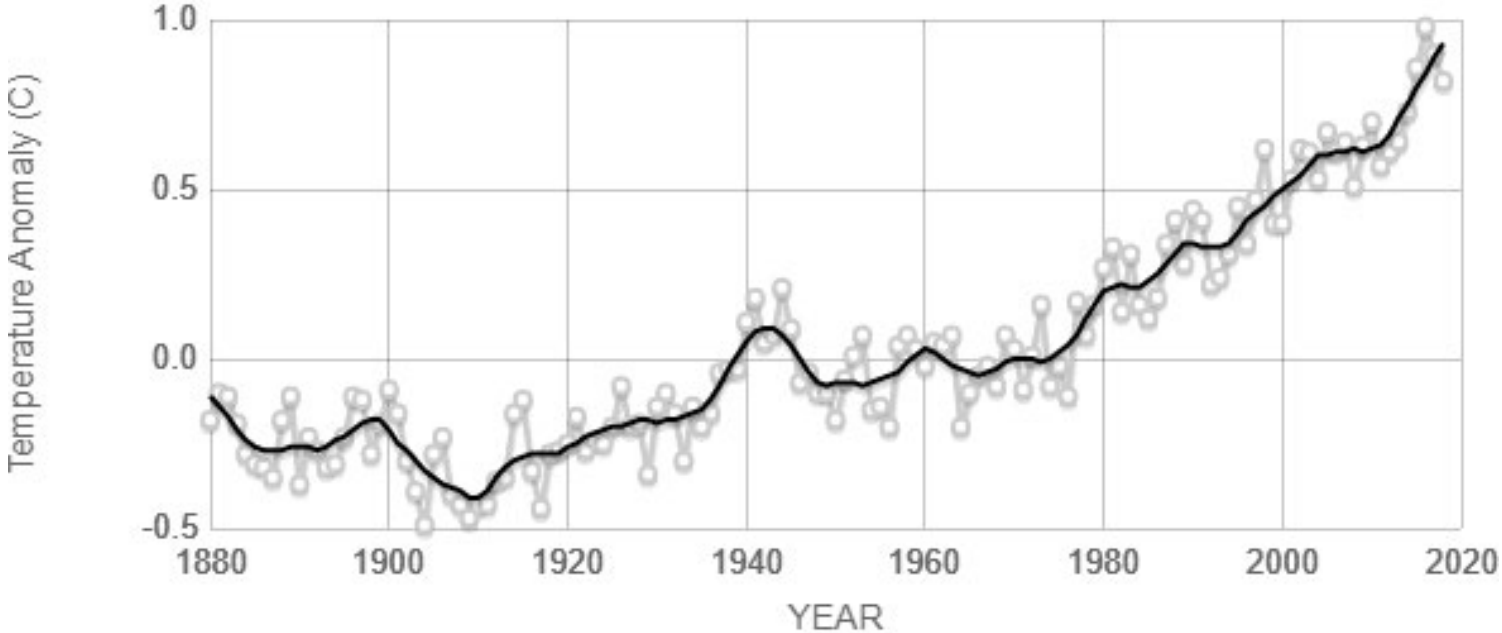
But atmospheric CO_2 levels are rising



Raising global air temperatures*
(compared to 1950 to 1980 mean)



Source: climate.nasa.gov

*Source: climate.nasa.gov

Might the climate be a threat multiplier? More lake-effect snow, so more salt

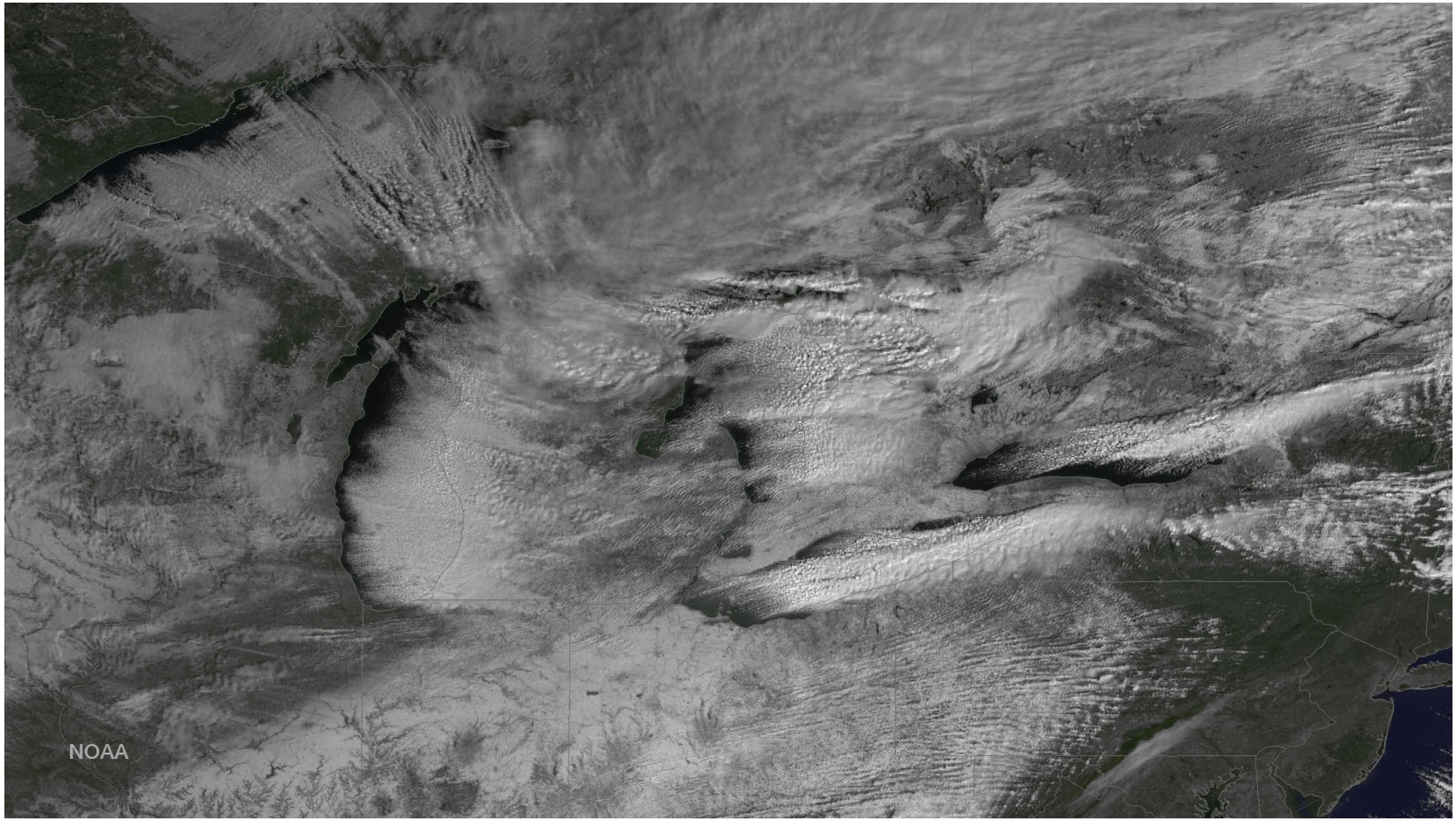
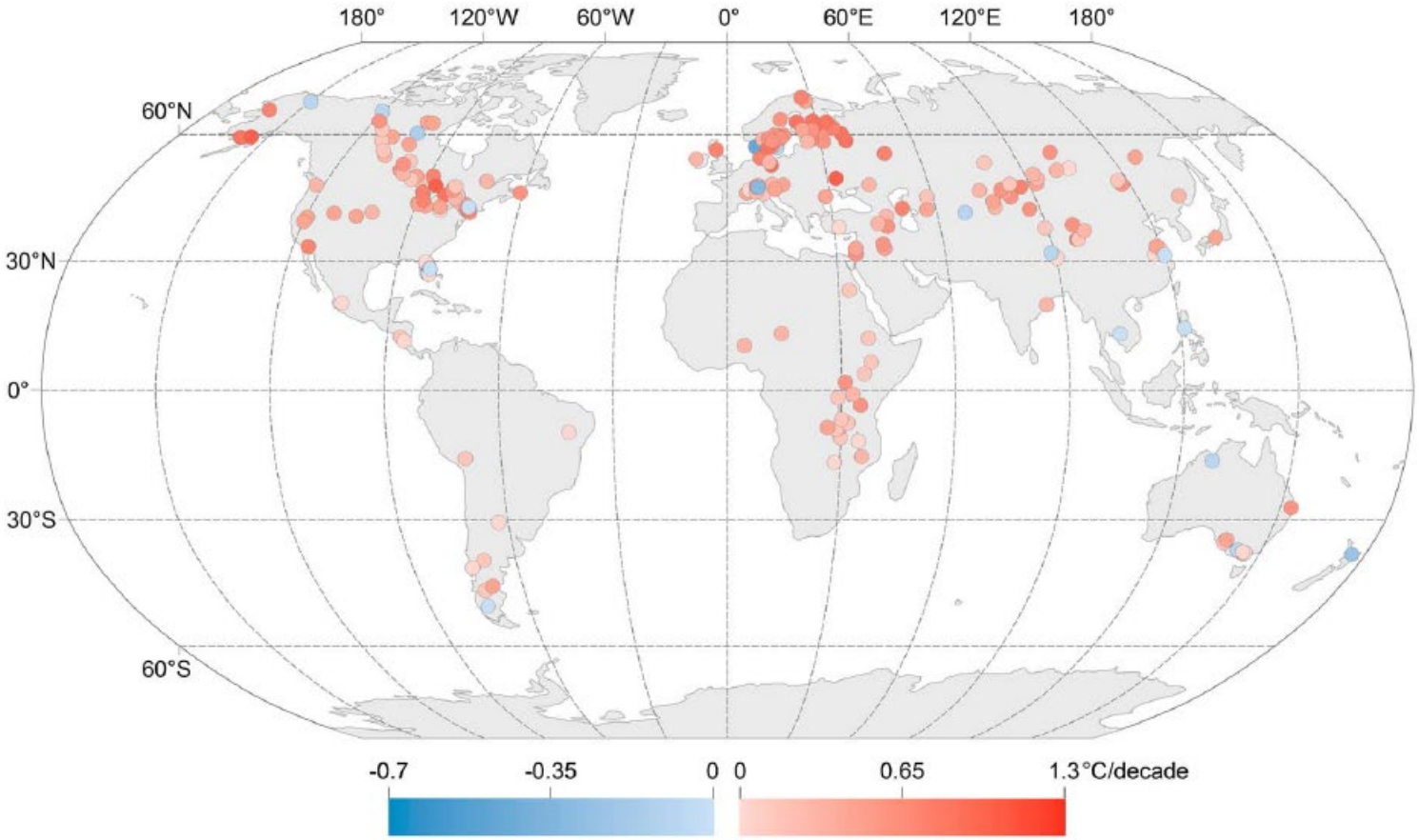


Image from NOAA

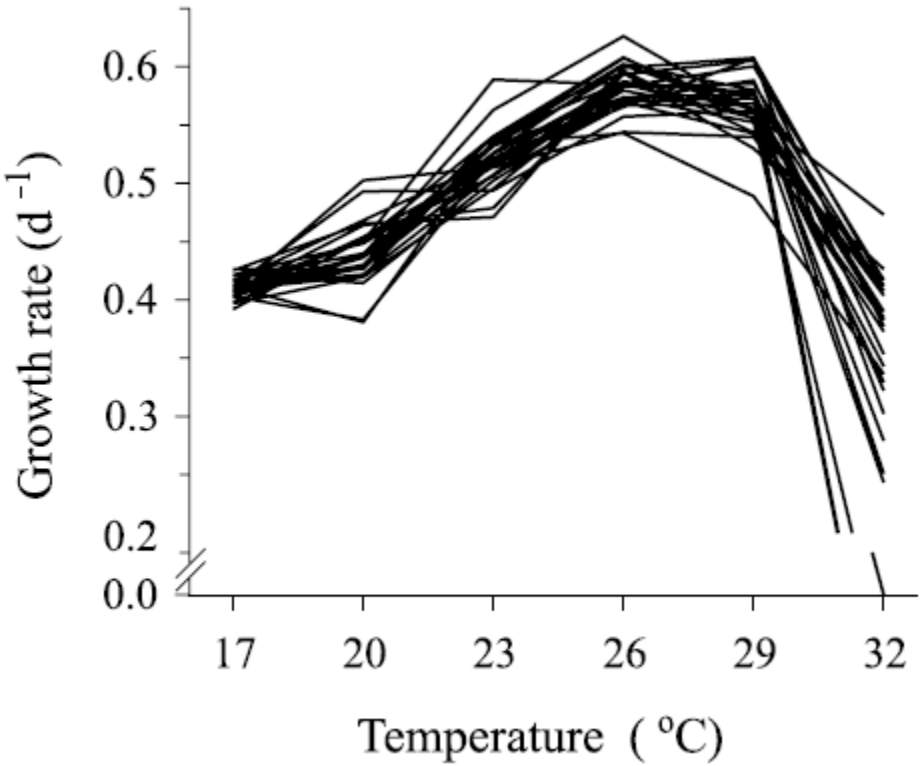
And lake surface waters are warming (from 1985 to 2009 in 240 lakes)



*O'Reilly, Sharma et al. 2015 Geophys. Res Lett.

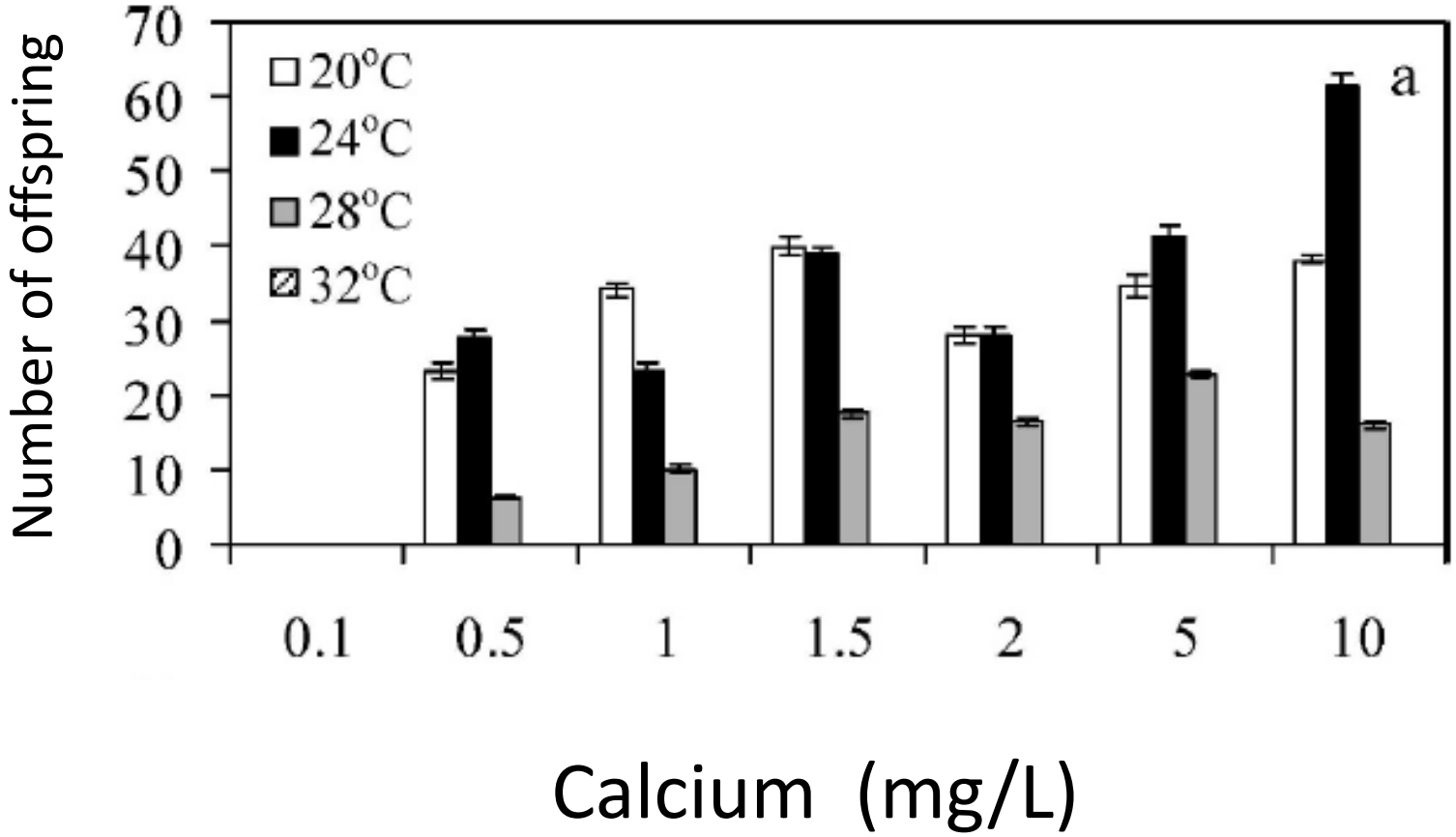
If too hot, zooplankton suffer

growth vs. temperature for *Daphnia magna**



*Lampert 2006 Pol. J. Ecol

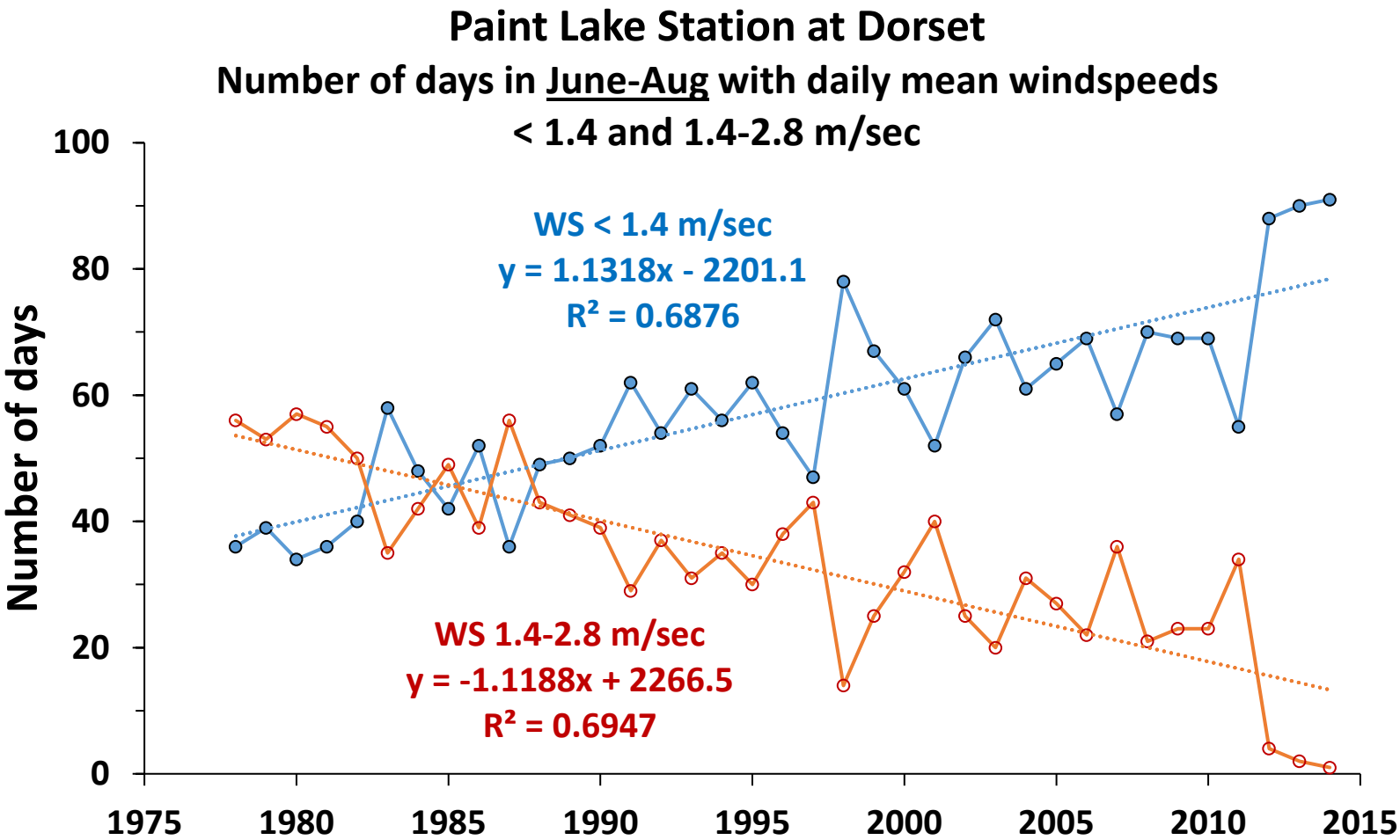
High temperatures interact with other stressors, e.g. increasing low Ca damage to *Daphnia**



*Ashforth and Yan 2008 Limnol. Oceanogr.

Flooding may also increase erosion and nutrient supply

Summer wind speeds in Muskoka are falling*, favouring blue-greens



*From Yao MECP DESC and Molot York U

Climate change is likely a threat multiplier for HABs

By damaging animal plankton, that eat algae via

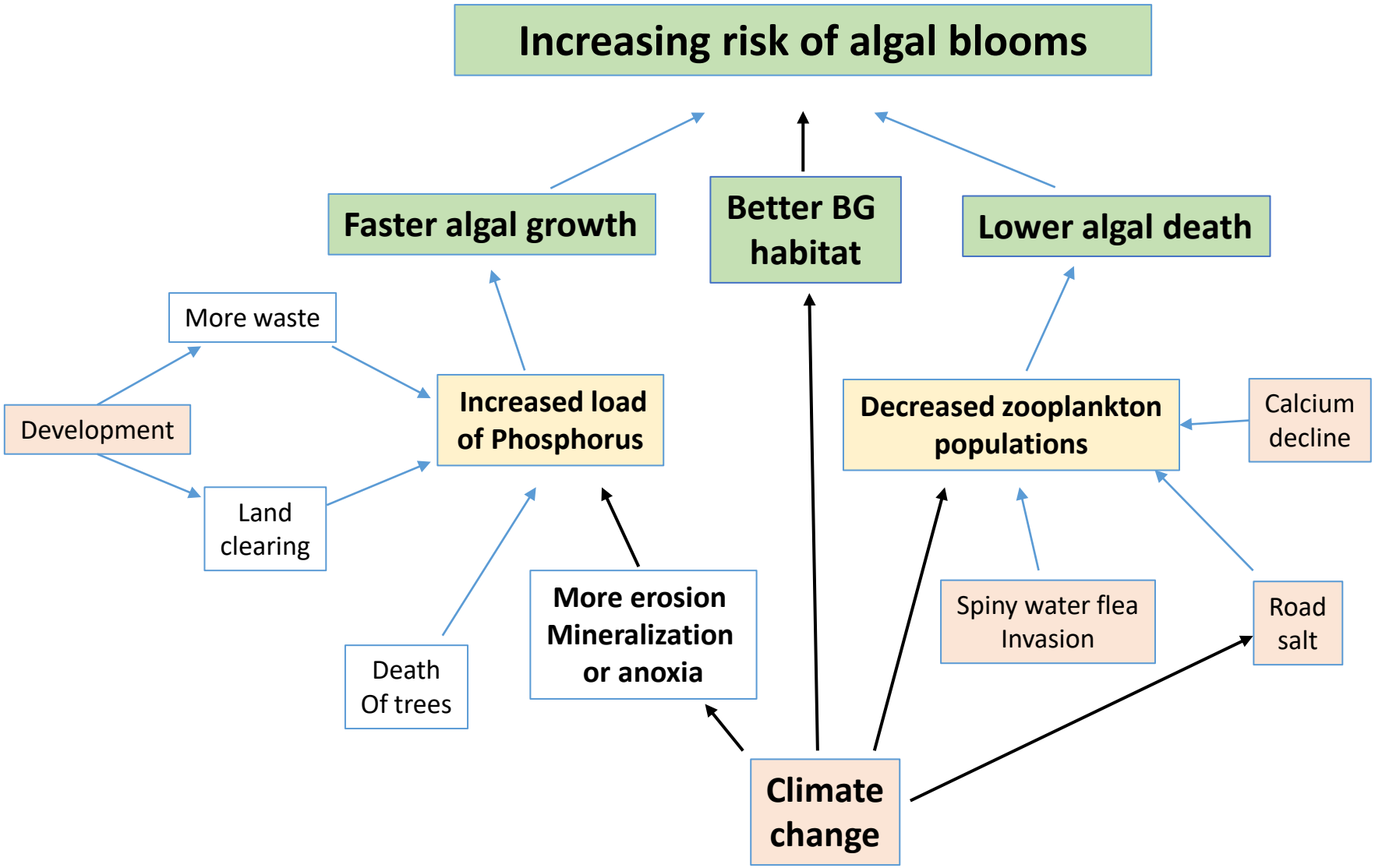
- more salt
- warmer water
- increasing damage from low calcium

Increasing nutrient supply

- more erosion via floods

Improving habitat for blue-green algae

- Warmer water
- Lower wind speeds
- Later fall turnover
- Lower bottom water oxygen in late summer



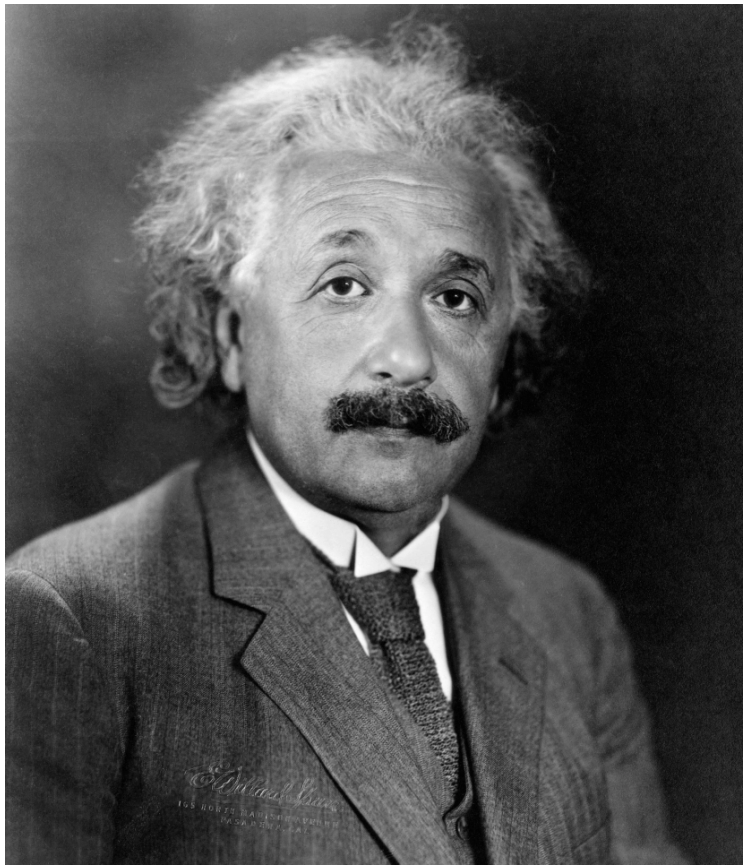
Linking emerging threats to algal blooms with Climate Change

4: How do we get there?

- Fix the problems we do understand
- Study those we don't yet understand
- Protect forests and animal plankton so they can protect the waters we all value

4. Once more from Dr. Einstein

- "If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and five minutes thinking about solutions"



Fix the problems we understand

The problem	The solution
• Faulty septic systems	• Ensure we get them fixed
• Too much salt	• Reduce salt use
• Too many invaders	• Prevent new introductions
• Too little calcium	• Add it, e.g. the ASHMuskoka project

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Study the problems we don't understand well enough to manage, e.g. HABs

Generate real-time, continuous lake monitoring in blue-green 'nursery areas' to ID conditions that precede HABs

More platforms like THELMA – on Harp Lake (DESC)

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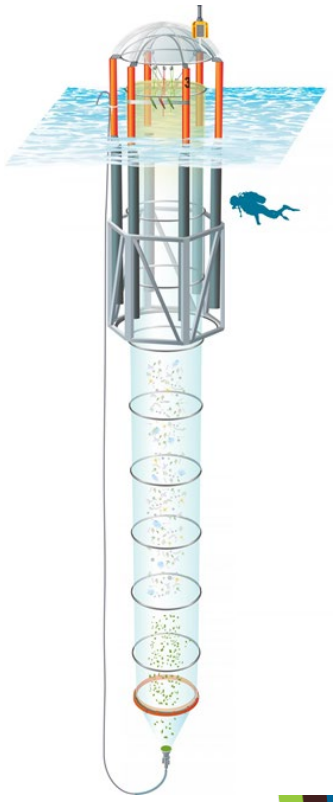
And confirm the triggers using engineered ponds or plankton towers or columns to test the probable causes



EAWAG's experimental pond facility

Swiss Federal Institute of Aquatic Science and Technology

Friends of the Muskoka Watershed

Friends of the Muskoka Watershed

Our vision:

Healthy Muskoka watersheds forever

Our mission:

To foster the understanding, choices, actions and wise management needed to protect our freshwater ecosystems forever

Please join us in this work
https://fotmw.org

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