Emerging Issues in Wetland Science

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Future Threats to Wetlands

- Learn from the past
  - Cuyahoga River burns June 22, 1969
    - Actually burned 12 times before - first in 1868
    - 1969 fire wasn't even the worst – November 1952
    - Why everyone know about 1969?
  - Time Magazine August 1, 1969

The Cuyahoga River was once one of the most polluted rivers in the United States. It has caught fire a total of 13 times dating back to 1868, including this blaze in 1952 which caused over $1.3 million in damages. Photo: Cleveland State University Library

The History

- 1st Earth Day - April 22, 1970
- NOAA formed - October 3, 1970
- US EPA – December 2, 1970
- Great Lakes Water Quality Agreement – 1972
- Clean Water Act -1972

» What if instead of ?

Currently

» Wetlands are NOT appreciated by general public

In 2003 Michigan Legislature Amended Michigan's Wetlands Protection Act :

Allow 'Beach' Maintenance Activities.

These Include:

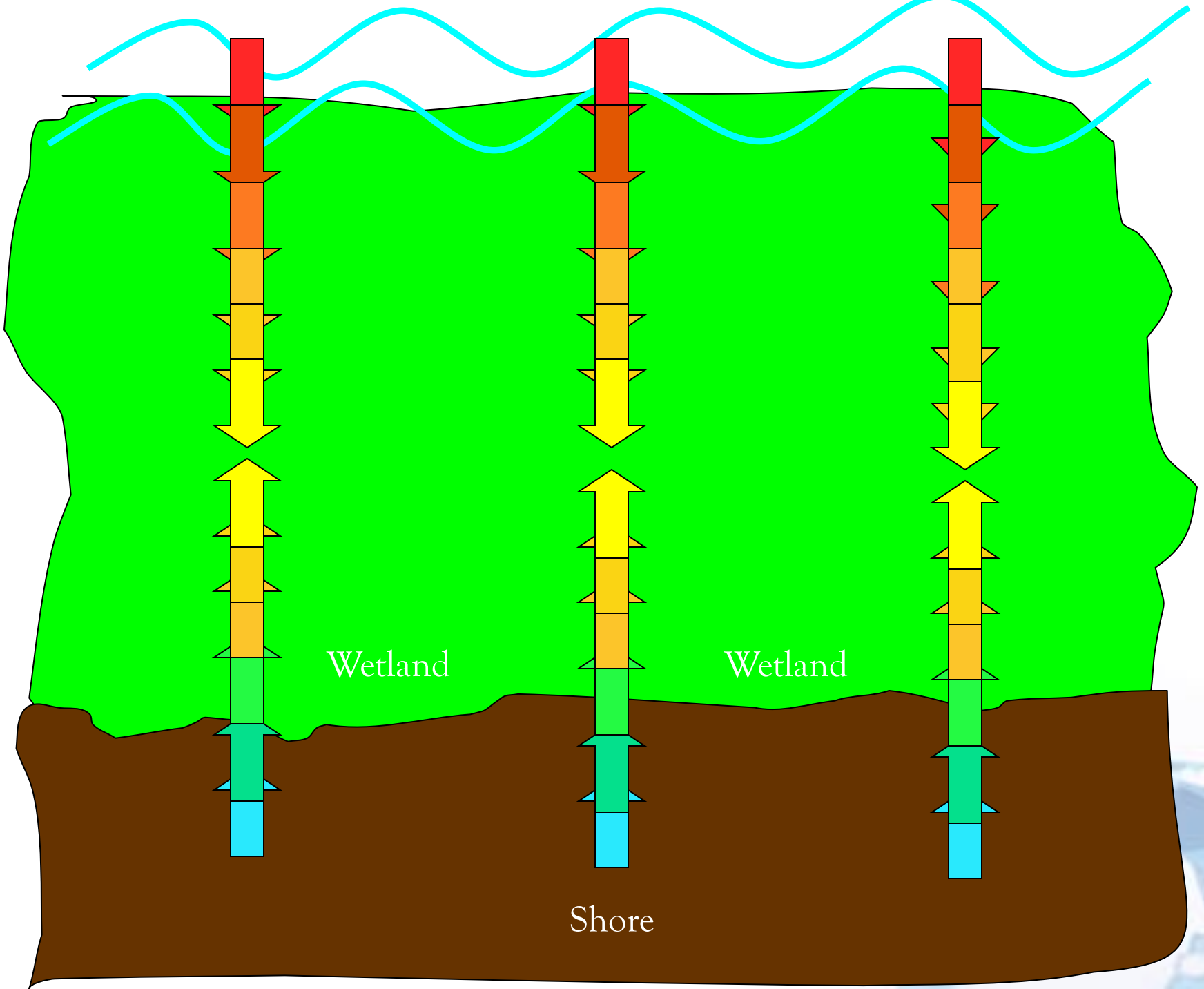
- » Hand Pulling of Vegetation
  - Except for Threatened or Endangered Species.
- » Mowing of Vegetation
  - to Height of Not Less than 2 Inches.
- » Grooming of the Soil
  - Raking the Top 4 Inches of the Soil Without Disturbing Roots.

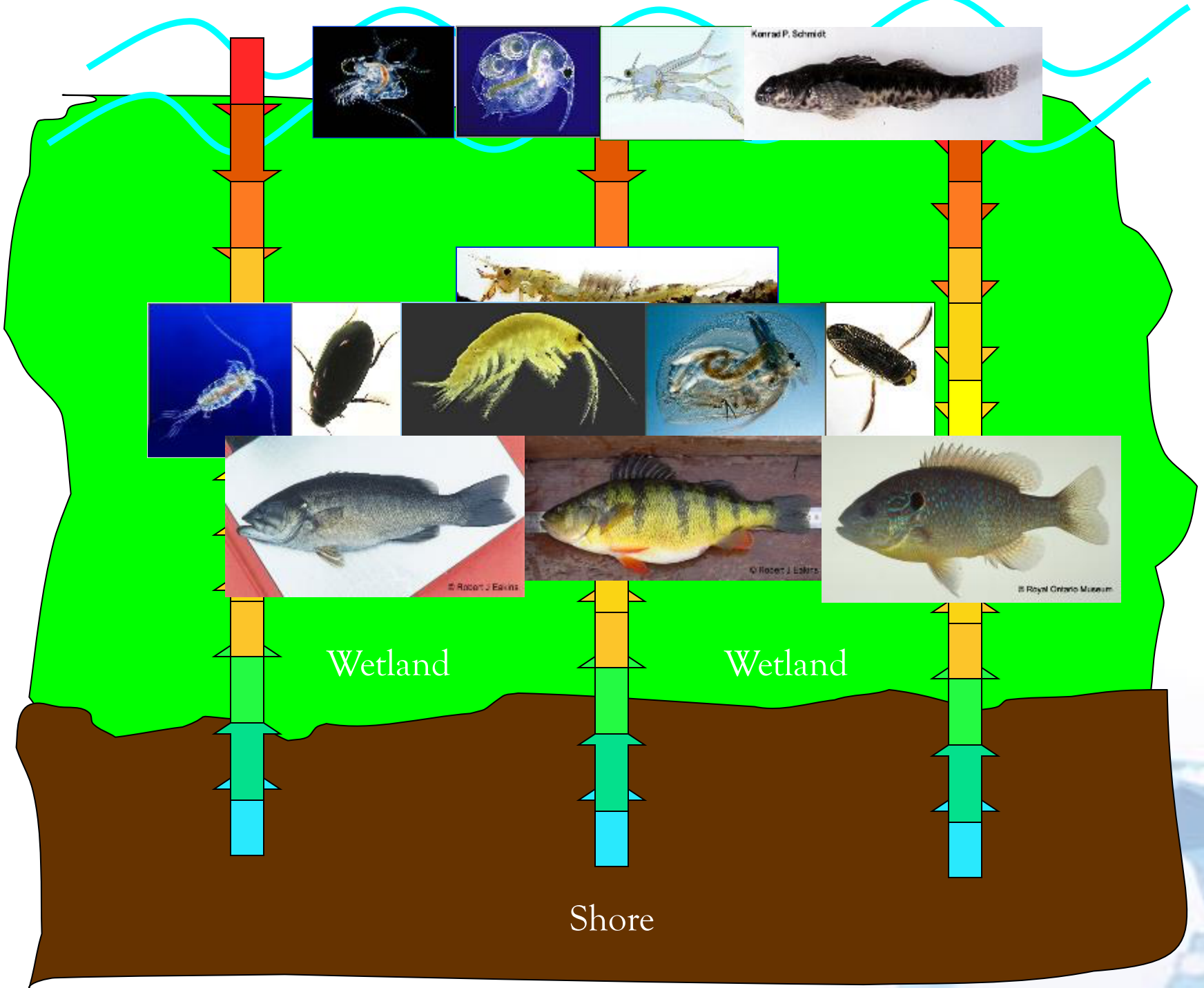
June 2004

November 2006

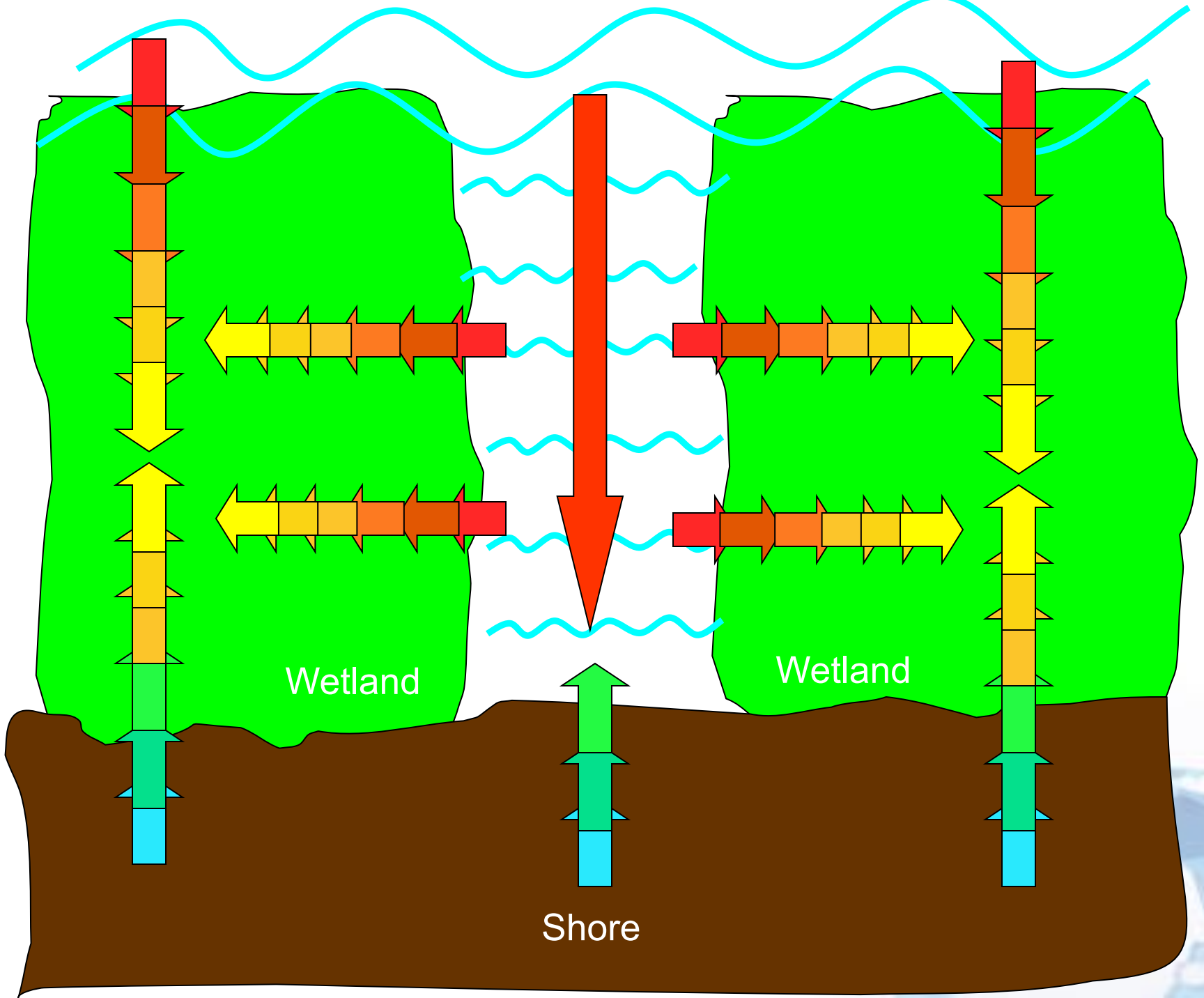
Our charge was to determined the impacts of Beach Maintenance Activities on:

- Chemical and Physical Conditions of the water
- Plants (Dennis Albert-MNFI)
- Micro and Macroinvertebrates
  - Base of food web
- Larval Fish
  - Early development (i.e. spawning)
- Juvenile and Adult Fish
  - Later in development (i.e. nursery and foraging)


Wetland
Wetland
Shore


Konrad P. Schmidt
Wetland
Wetland
Shore


Reference
Groomed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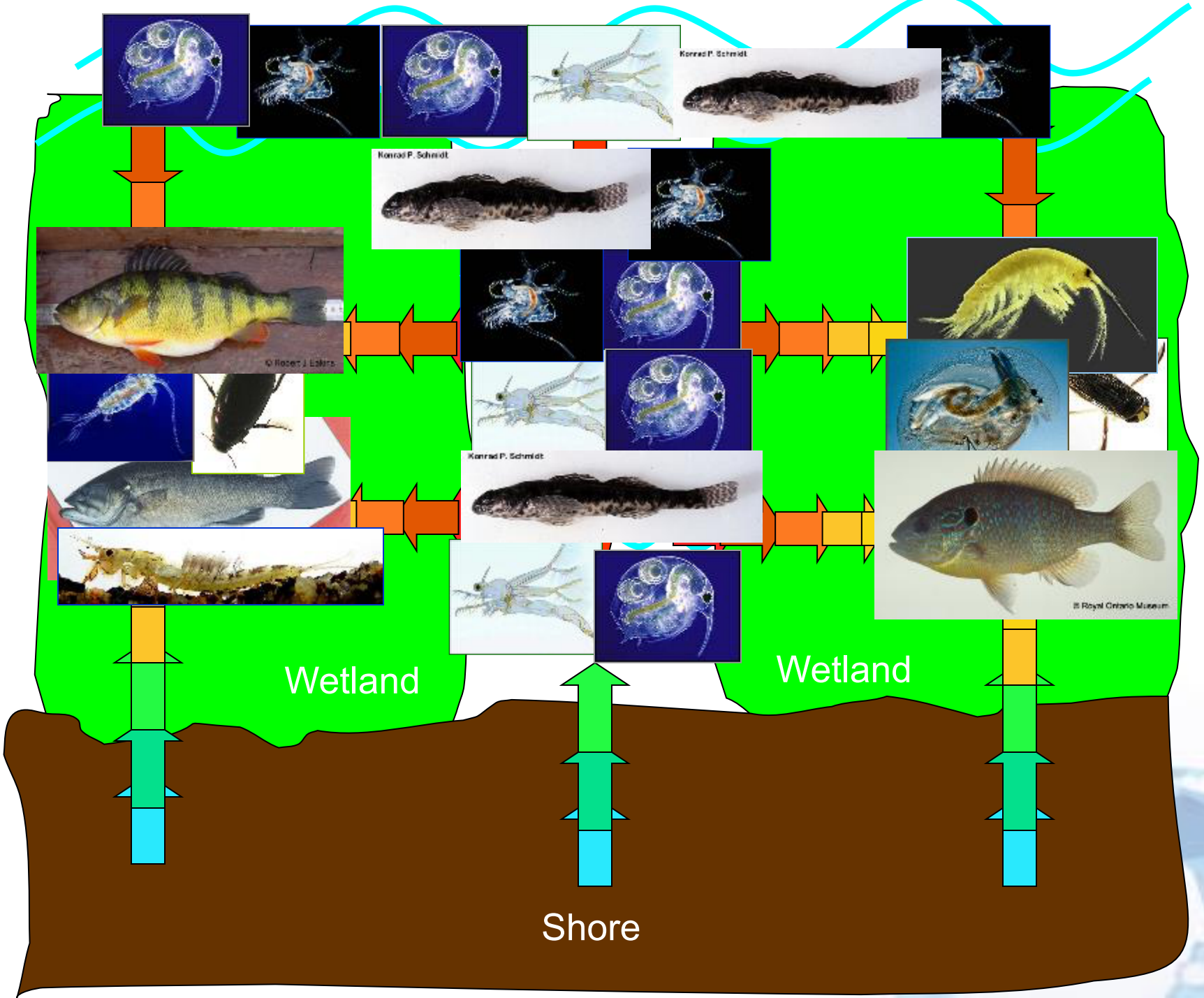
Konrad P. Schmidt
Konrad P. Schmidt
Konrad P. Schmidt
© Robert J. Lilliott
© Royal Ontario Museum
Wetland
Wetland
Shore

Sunset Provisions Attached to Public Act 14

- Presented our studies to MI Senate and House Committees.
  - Property rights activists hired consultant from Maryland
    - Testify against me
    - Quote:
      - "Dr. Uzarski is an incompetent fool"
- June 2006 provisions (grooming) allowed to sunset.
- MDEQ & property rights activists formed a working group.
  - Working together to find common ground
- Final provisions (mowing) was allowed to sunset in November 2006.
- 2009 appointment by Governor to the MI Wetland Advisory Council
- Effective July 2, 2012, the Michigan legislature passed 2012 PA 247
  - Exempts mowing and other limited shoreline management activities from Part 303, Wetlands Protection and Part 325, Great Lakes Submerged Lands, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).

Climate Change

» Increased CO_2 concentrations in the atmosphere

Climate Change

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- Carbon Dioxide Absorbs and Re-emits Infrared Radiation.
- Heat = Energy

» Drastically increasing the occurrence and magnitude of extreme events.

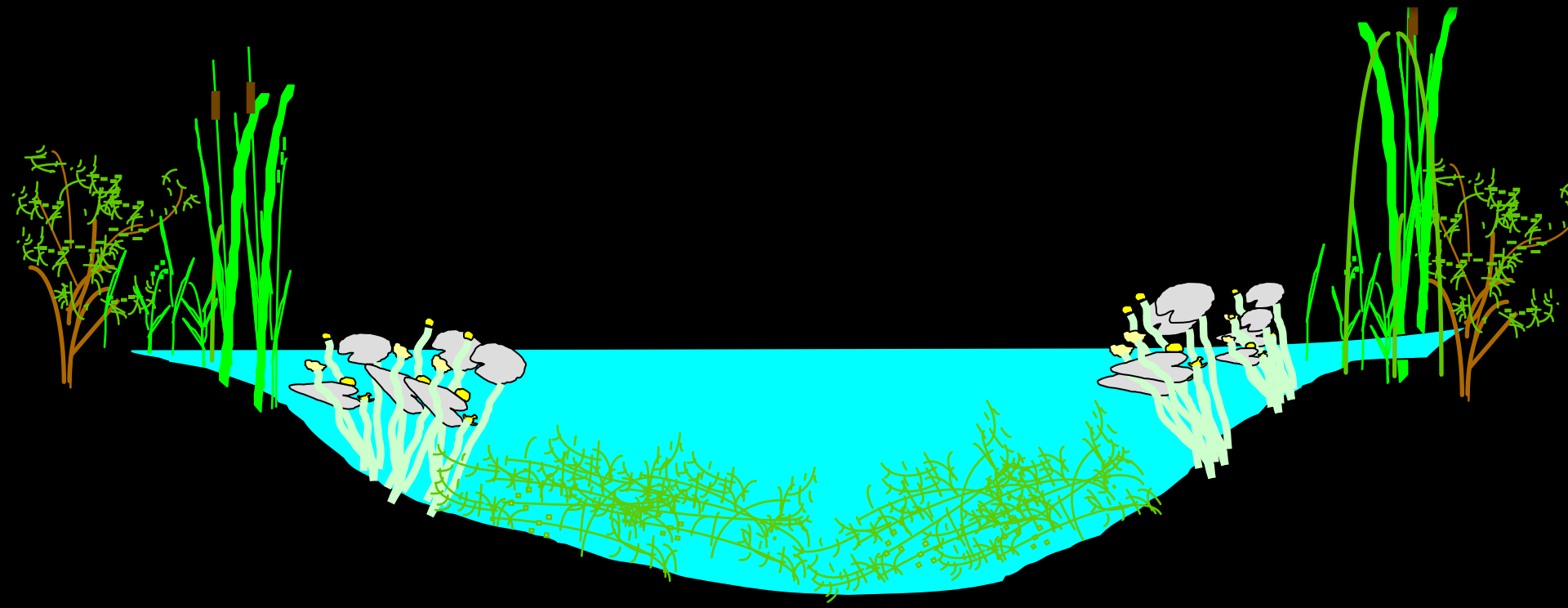
- Average, Mount Pleasant, MI gets 32” precipitation/yr.
- June 22, 2017 Mount Pleasant, MI receives 6.5” in ~24 hrs.
- 20.3% of annual precipitation

Hydrology Determines Structure and Function of Wetlands

- Hydrosere succession

Natural Wetland Succession

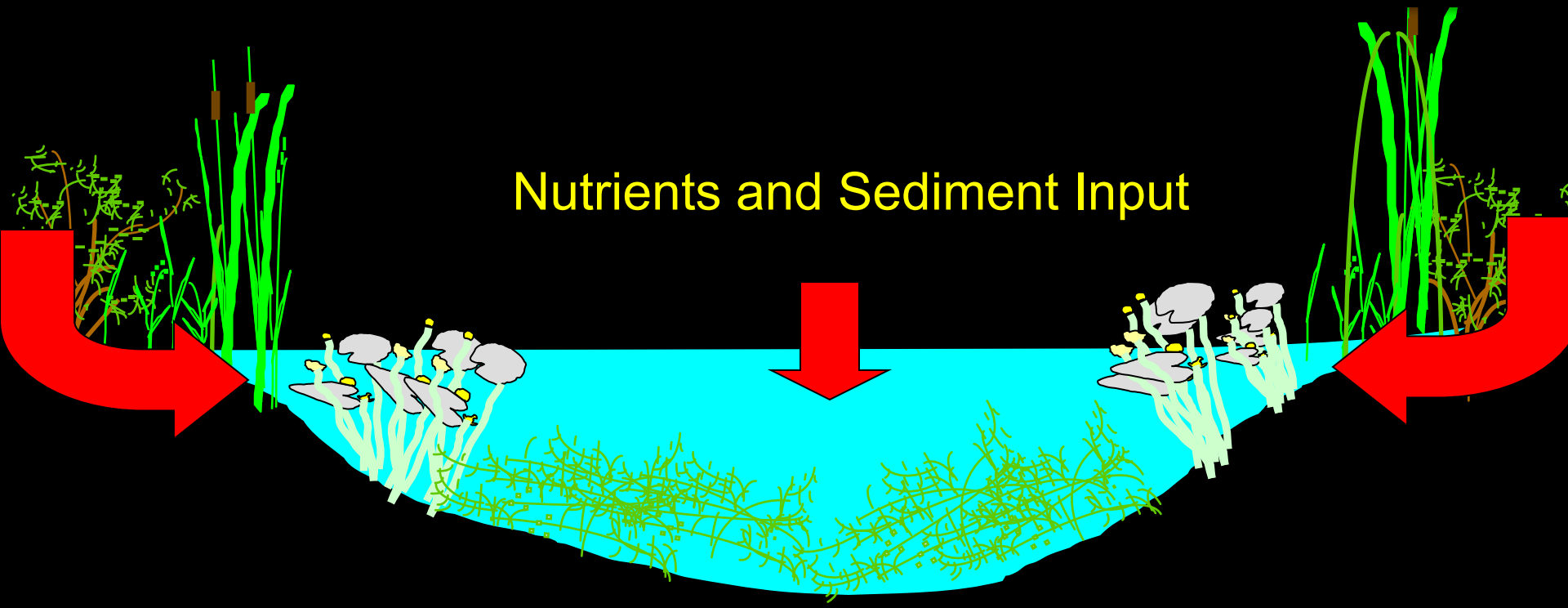
Inland Depressional Wetland (Palustrine)



Deep Water = Aquatic Bed and Floating Leaf Plants
most competitive

Natural Wetland Succession

Inland Depressional Wetland (Palustrine)



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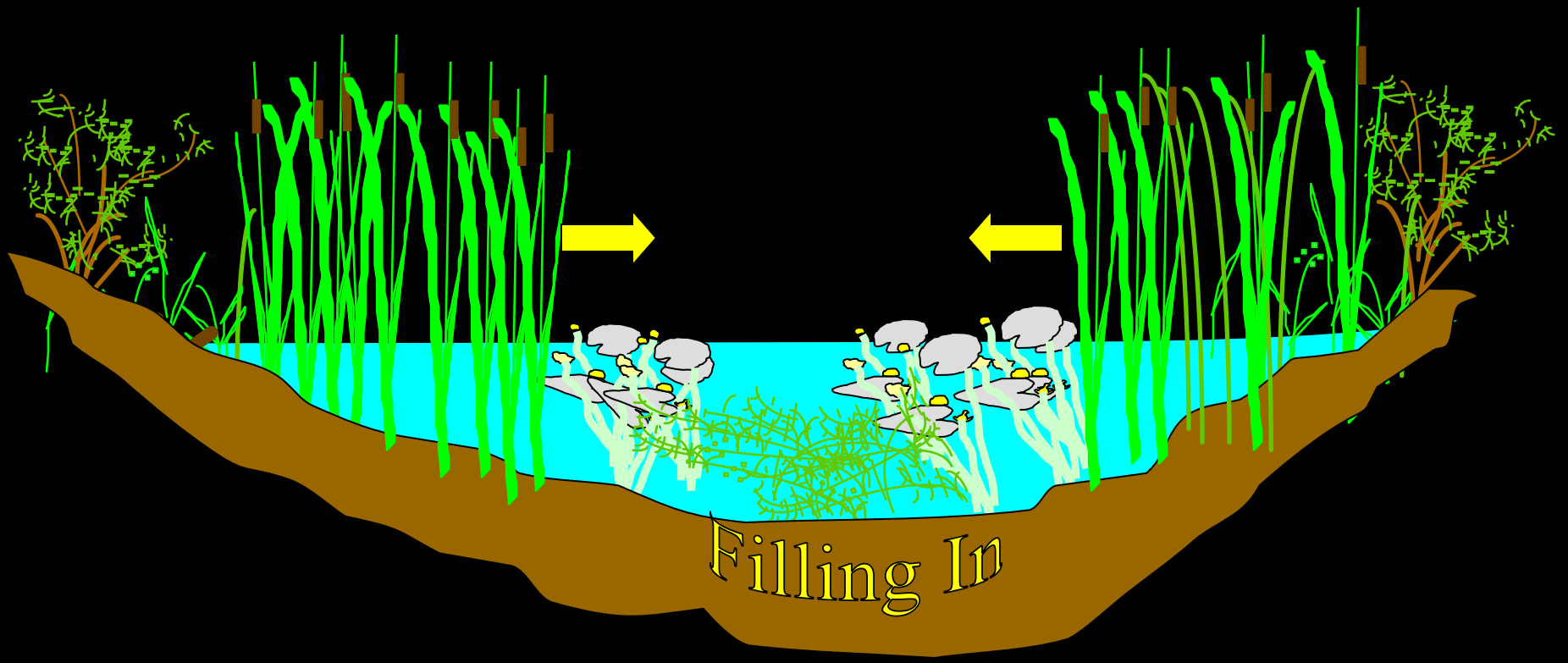
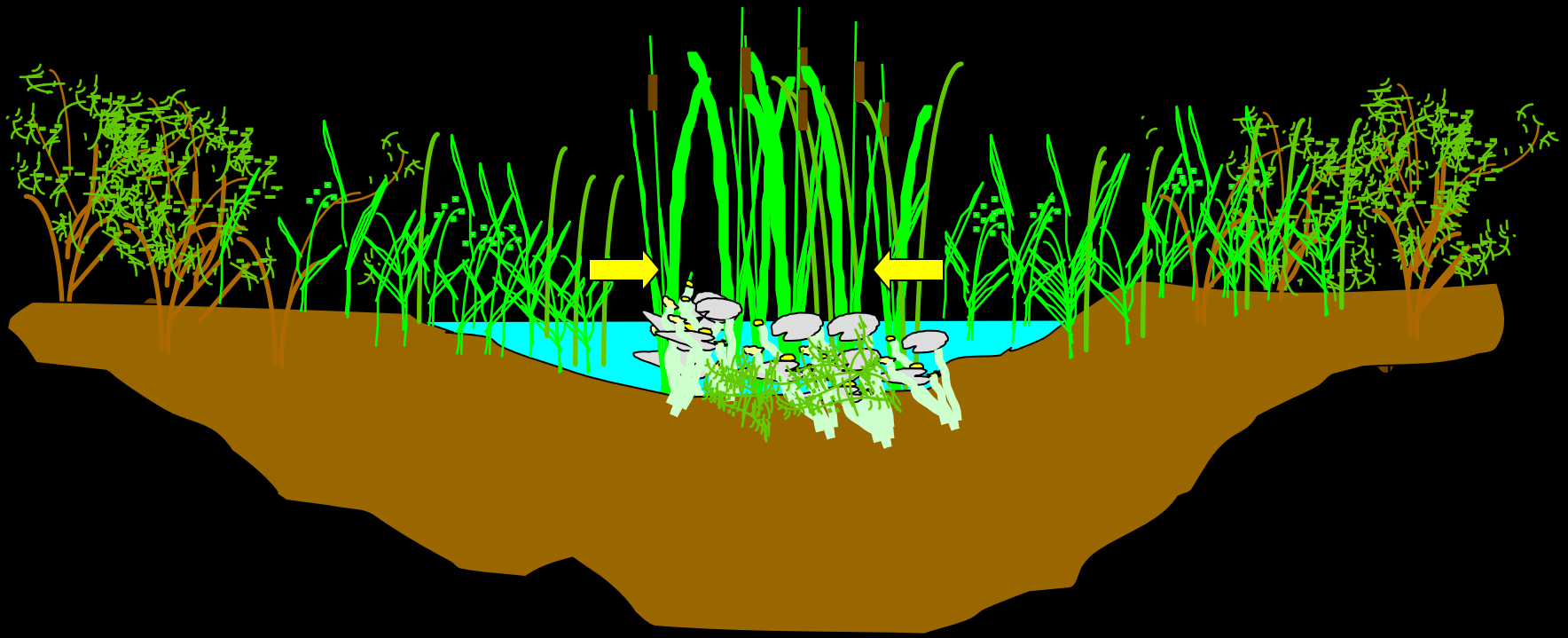


Intermediate Depth = Emergent Vegetation
becomes more competitive

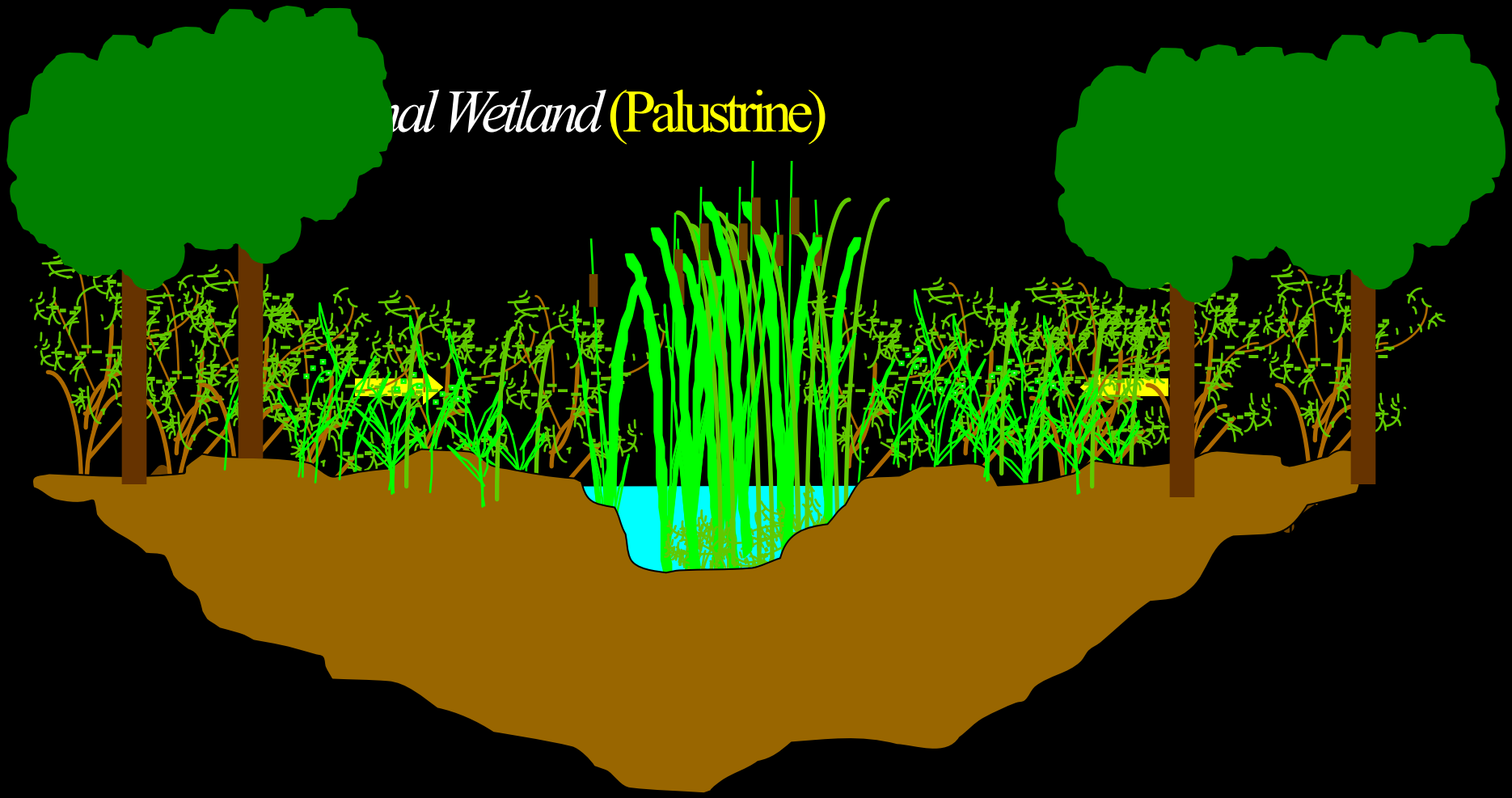
Natural Wetland Succession

Inland Depressional Wetland (Palustrine)

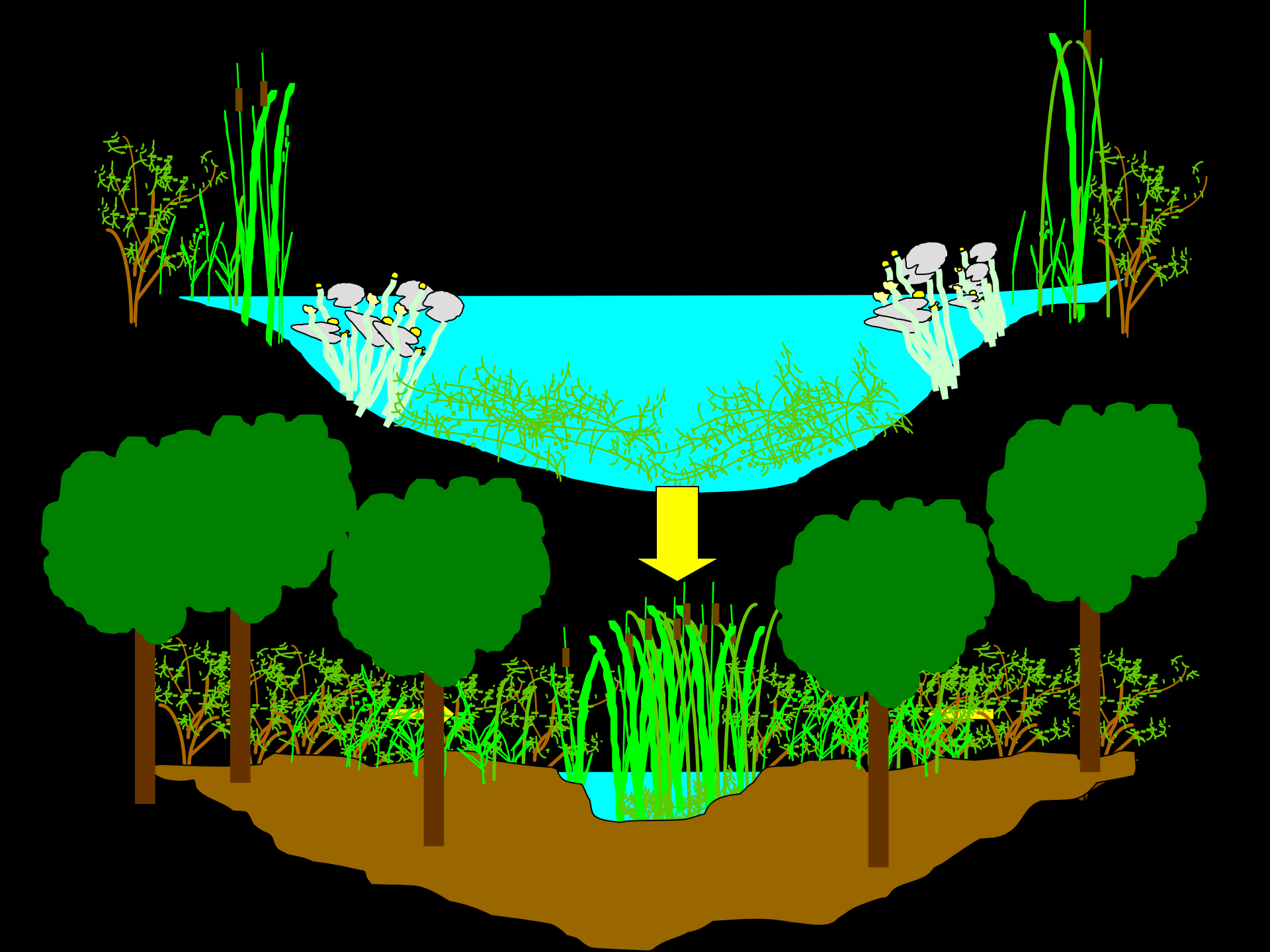


Shallow = Grasses and Sedges,
become more competitive

Natural Wetland Succession



Shallow = Grasses, Sedges, and Shrubs
become more competitive



Decrease in the Duration of Deep-Water Inundation

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Climate Change

- More prolonged periods of drought
- Severe flooding

Great Lakes Issues

Photo taken from IAGLR publication: The Great Lakes at a Crossroads

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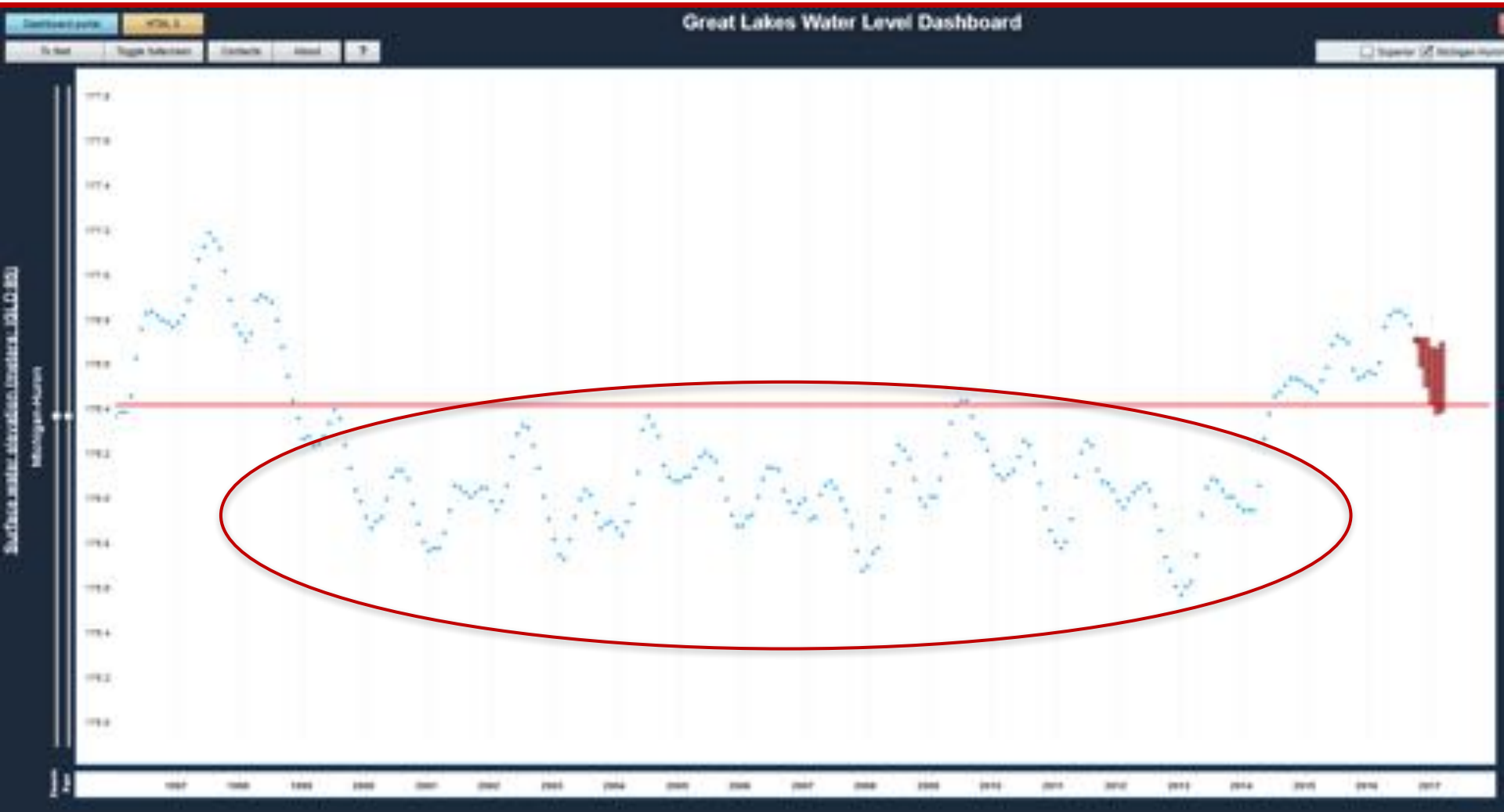
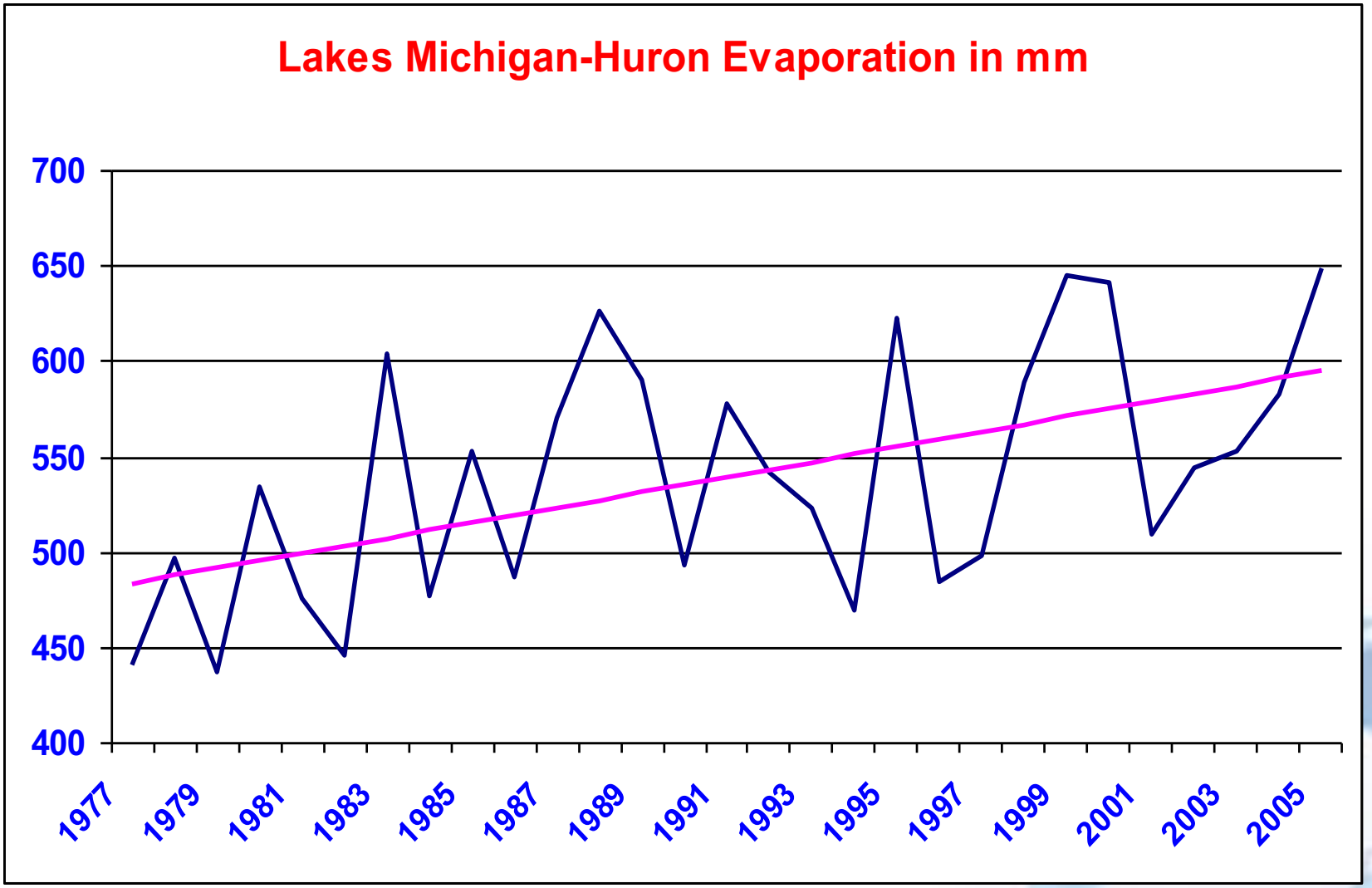
Lake Michigan-Huron Water Levels 1997-2016



Lakes Michigan-Huron Evaporation Rates 3.98 mm/yr



June 2004

November 2006

Fish Point, Saginaw Bay

Climate Change Invasive Species Interaction

Photos courtesy of Doug Wilcox, USGS

Vanderbilt Park Coastal Wetland
Saginaw Bay, MI

Phragmites Increased Sedimentation Rate

Increase Elevation of the Marsh

Decrease Fish Habitat

Pinconning Coastal Wetland,
Saginaw Bay, MI

Not All Negative

- Example from Saginaw Bay
  - With Prolonged Low Water Levels
    - Invasive Phragmites (Common Reed) Spread ~300 m
      - Poor Fish and Wildlife Habitat
      - Decrease Recreation Opportunities
      - Increase Sedimentation Rate
    - 300 m of Phragmites = Filter

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Not All Negative

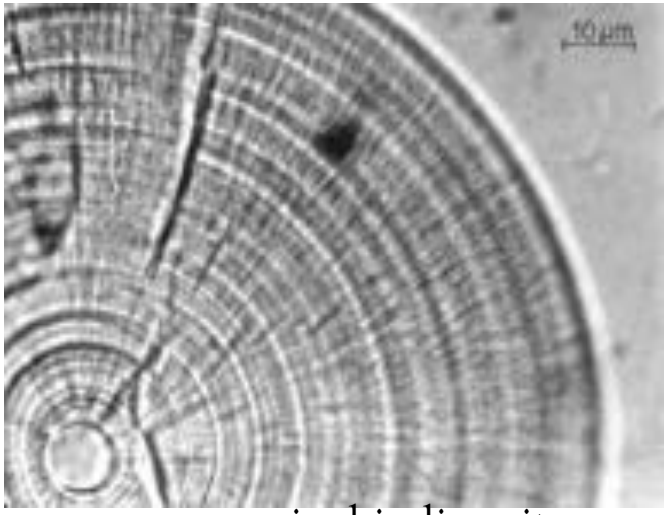
- Example from Saginaw Bay
  - With Prolonged Low Water Levels
    - Invasive Phragmites (Common Reed) Spread ~300 m
      - Poor Fish and Wildlife Habitat
      - Decrease Recreation Opportunities
      - Increase Sedimentation Rate
    - 300 m of Phragmites = Filter
      - Aquatic Portion = Increase Water Quality
      - Wetland Still Has Functions and Values
      - Function as a Filter Better than Before

The Good News…

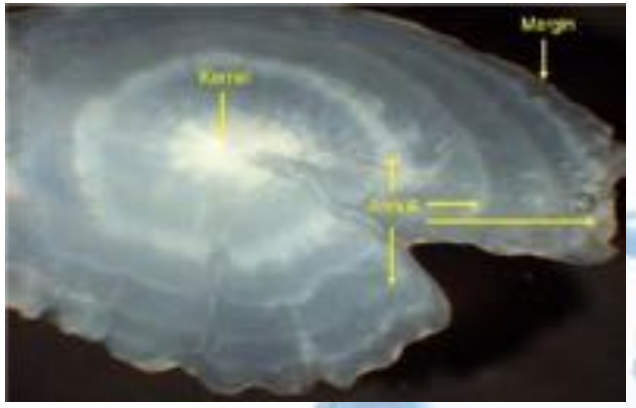
- Now have capacity to collect enormous amounts of data
- Currently sampling chemical/physical/biological parameters at over 1000 coastal wetlands every 5 years.
- Expanding our capabilities
- For example…

Otolith Trace Element Chemistry

- Otolith microchemistry
  - "Ear stones"
  - Calcium Carbonate ($CaCO_3$)
  - Grow in permanent, daily rings
    - Obtain materials from water column
  - Use ICPMS with laser ablation to link pelagic fish to wetlands
    - Chemical 'fingerprint' from wetland



marinebiodiversity.ca



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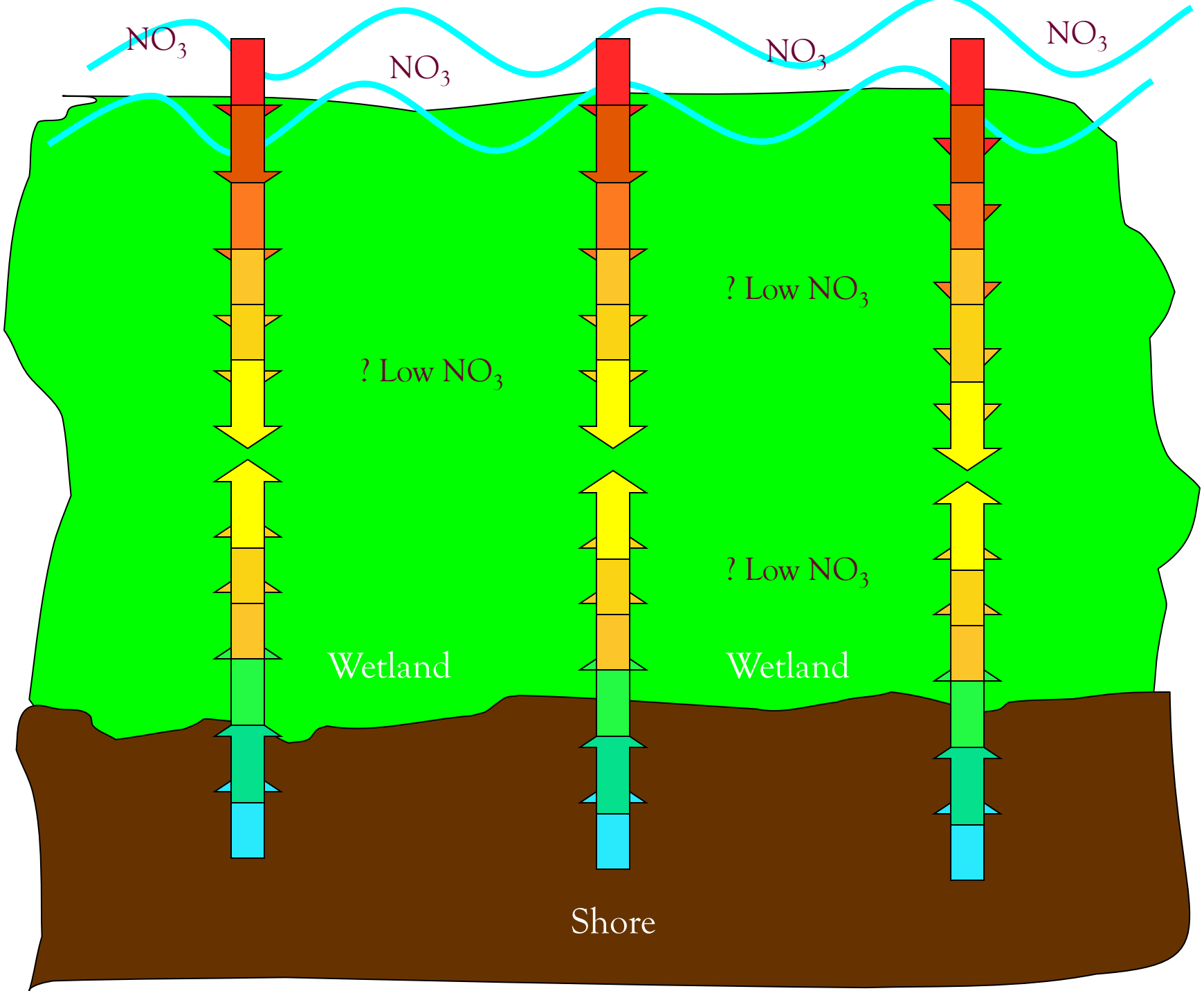
Algal blooms and nitrogen

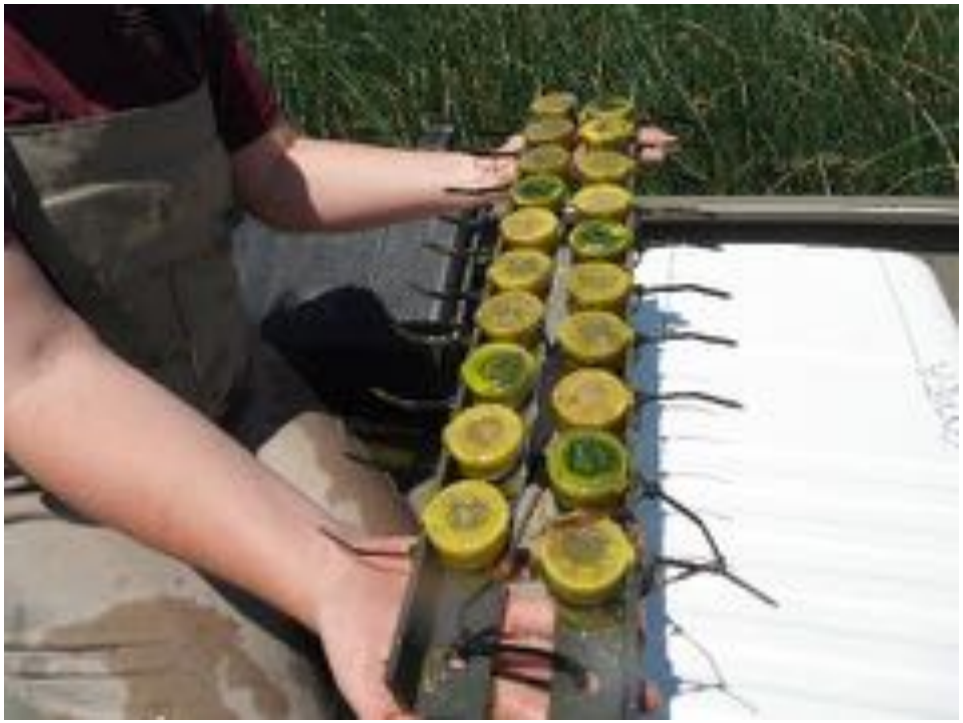
- Since Clean Water Act (1972) and Great Lakes Water Quality Agreement (1972)
  - Focus on phosphorus reductions
  - Did well with phosphorus but almost completely ignored nitrogen

- 2012 Great Lakes Water Quality Agreement does not contain the word 'nitrogen'

- Today, NO_3 concentrations in open water of Lake Michigan are ~ 0.33 mg/l.
  - About 10-fold what they should be
  - SRP is almost always non-detectable


NO_3
NO_3
NO_3
NO_3
? Low NO_3
? Low NO_3
? Low NO_3
Wetland
Wetland
Shore

Nutrient Diffusing Substrates



- Dark green = N addition
- Others either
  - P addition
  - N+P addition
  - Controls
- 80% of all sites N limited!

- 28 nautical miles (32 statute)
- Up to 4 times per day
- Installed equipment
- Collecting continuous water quality data

February 25, 2016

Joe Snowaert (BIBCO engineer)

Margo S. Marks, President
BIBCO

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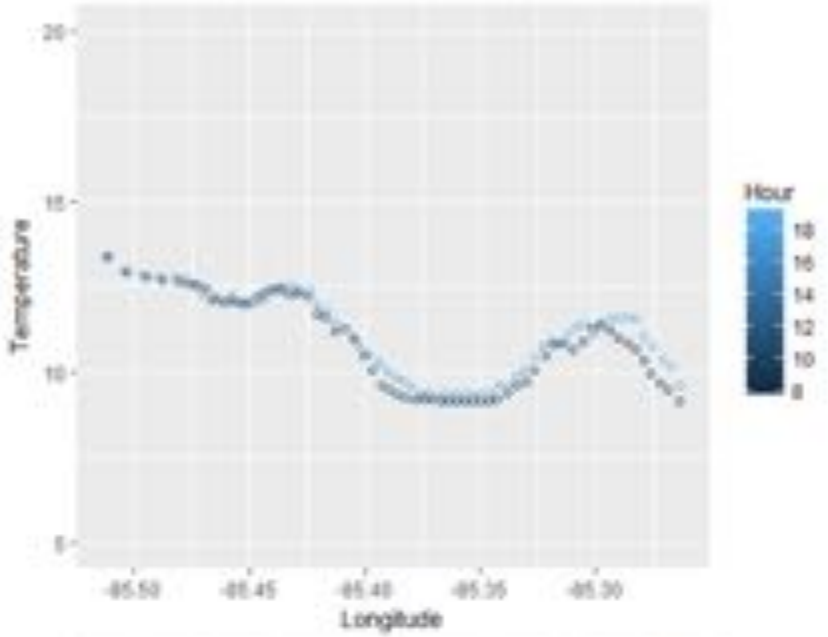
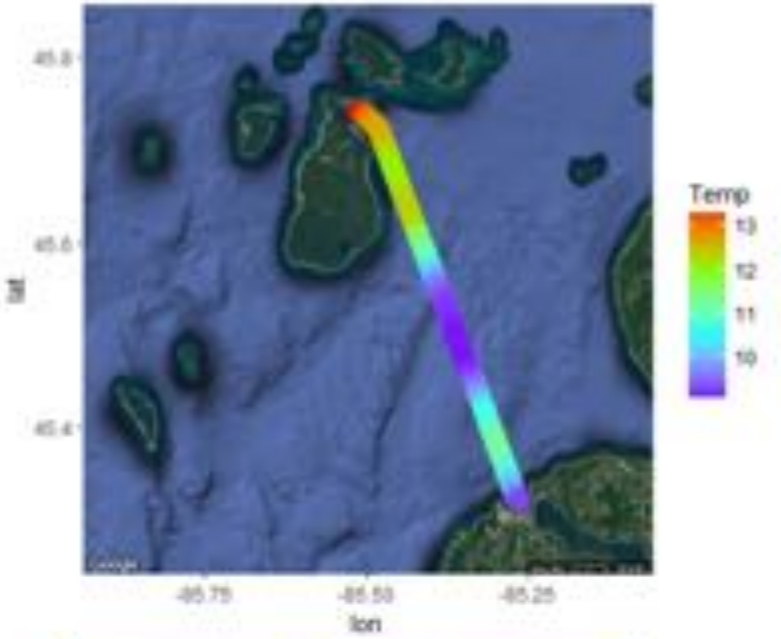

Temperature
Longitude
Hour


lat
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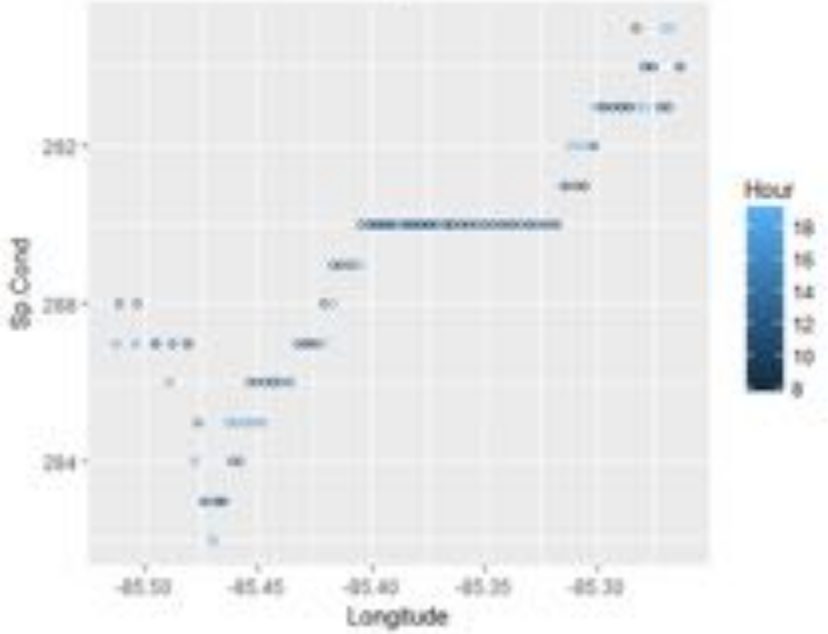
Temp


Sp Cond
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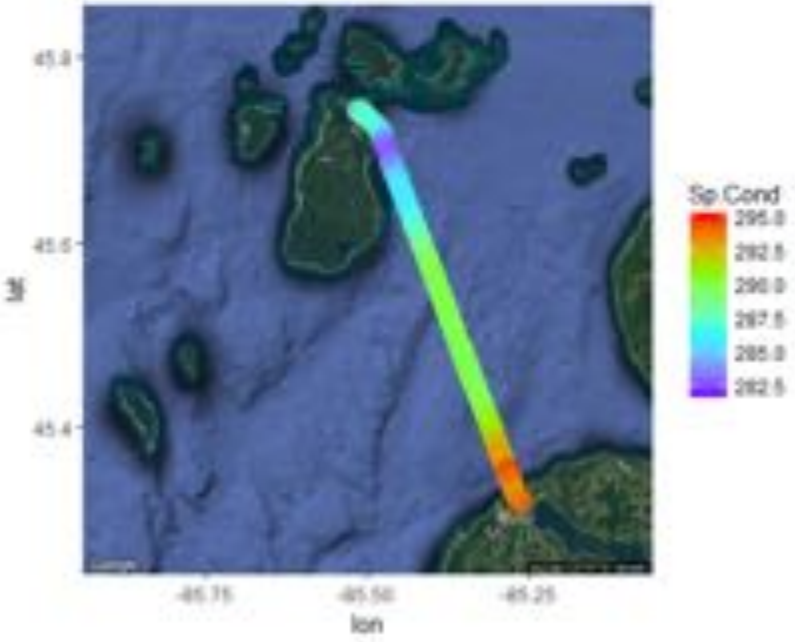
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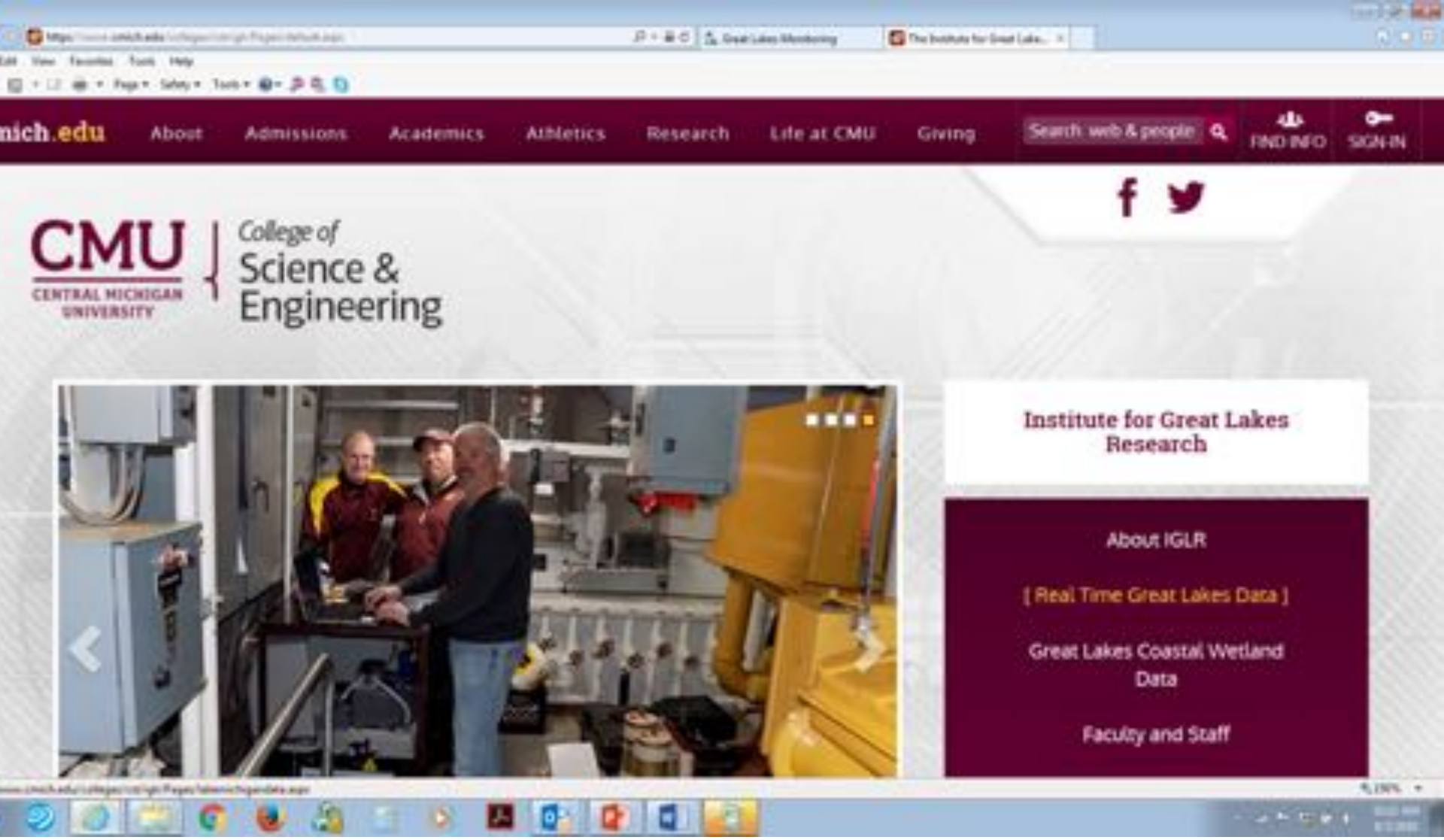

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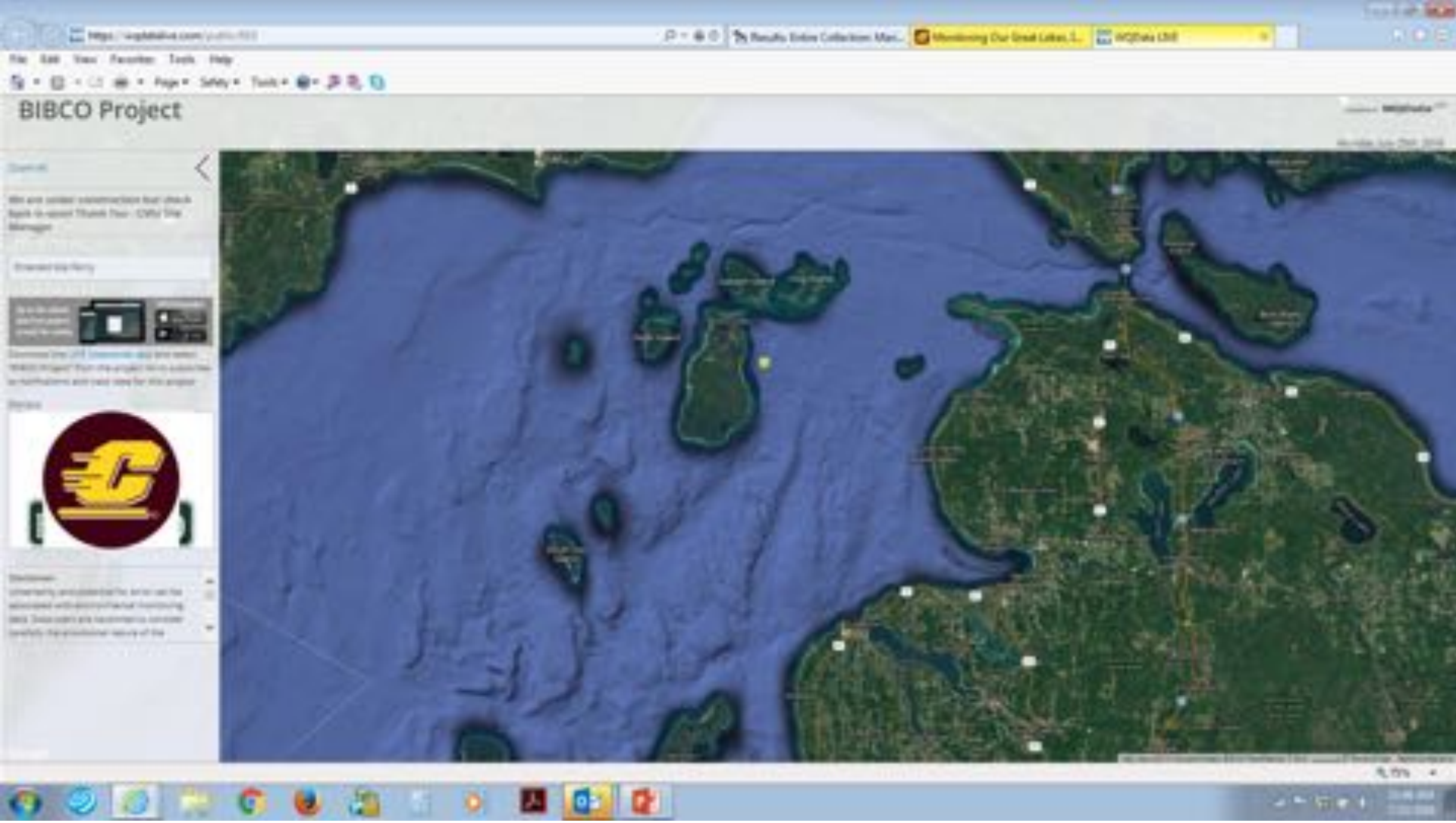

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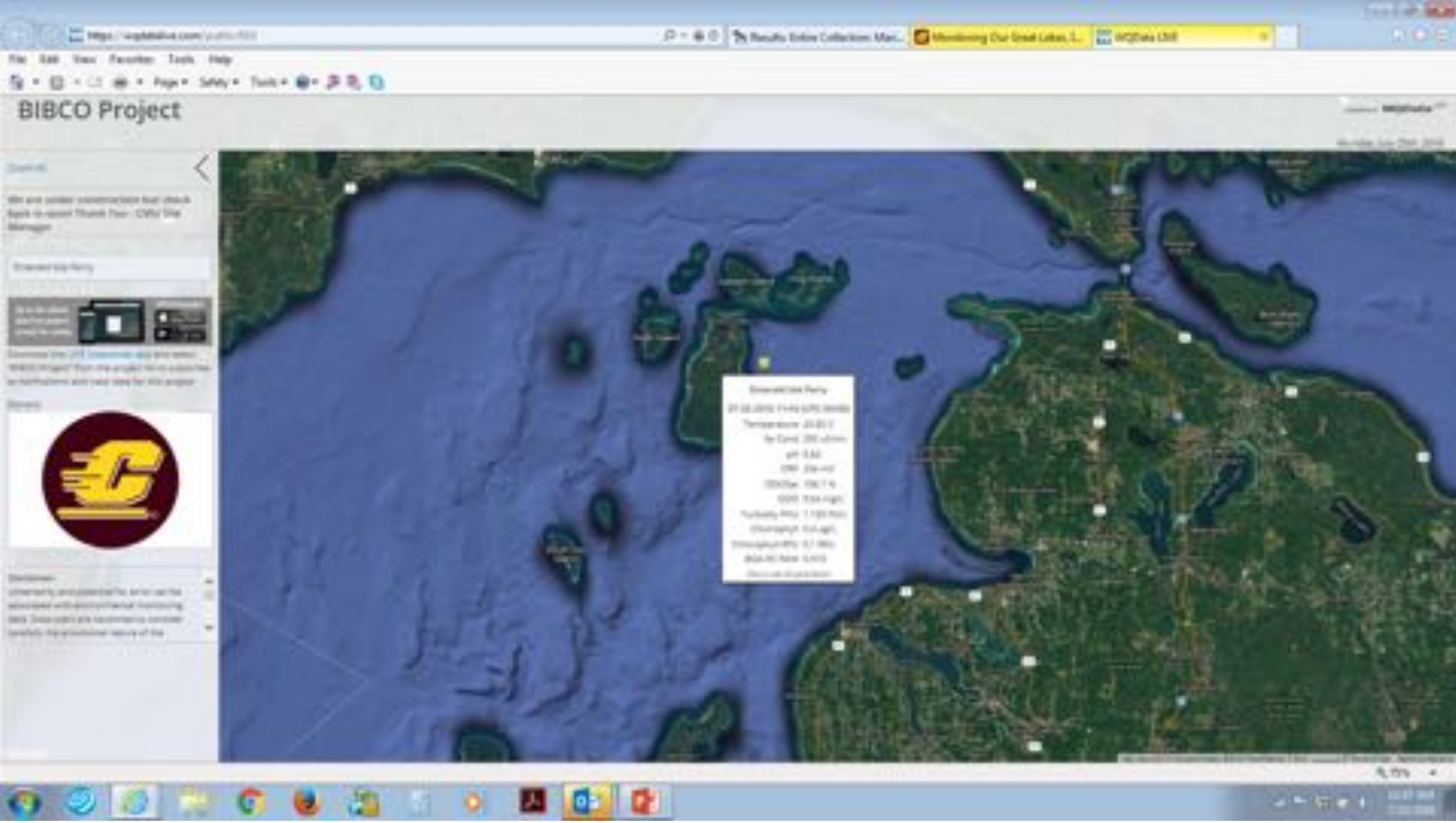

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More complex problems

More technology to address them

Thank You!



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