

# PALEOLIMNOLOGY AS A LAKE MANAGEMENT TOOL



*Paul Garrison*

*Wisconsin Department  
of Natural Resources*

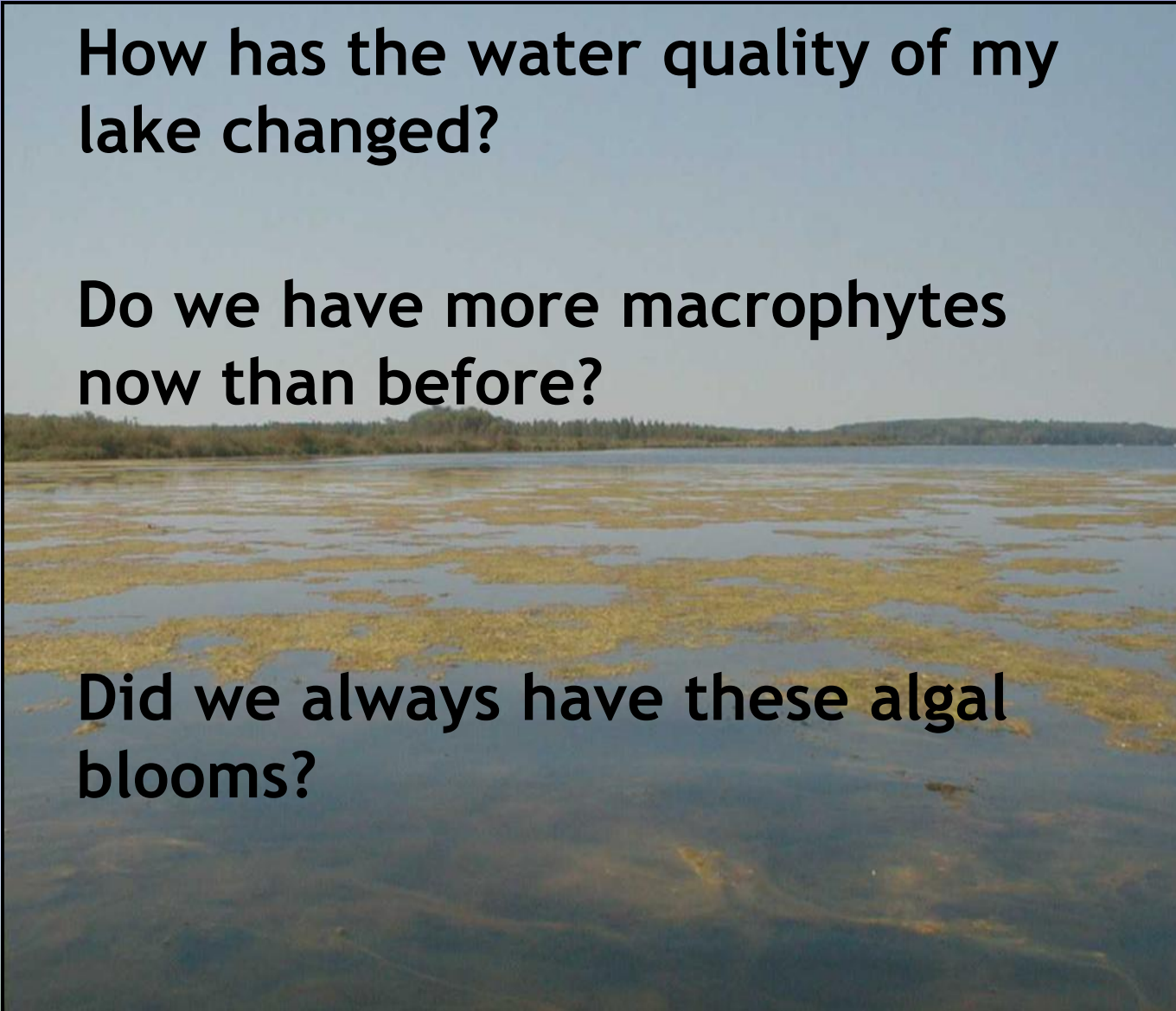


# WHAT QUESTIONS CAN BE ANSWERED?

How has the water quality of my lake changed?

Do we have more macrophytes now than before?

Did we always have these algal blooms?



# HOW DO YOU COLLECT SEDIMENT CORES?



**Gravity Corer**



**Piston Corer**

# WHAT INFORMATION IS RECORDED IN THE SEDIMENTS?

## • Geochemistry

- Nutrients -- phosphorus, nitrogen
- Soil erosion--aluminum, titanium
- Urbanization--zinc, copper
- Synthetic fertilizer--uranium, cadmium
- Anoxia--iron, manganese

## • Diatoms

- Water quality history
  - nutrients
  - pH
- General aquatic plant growth

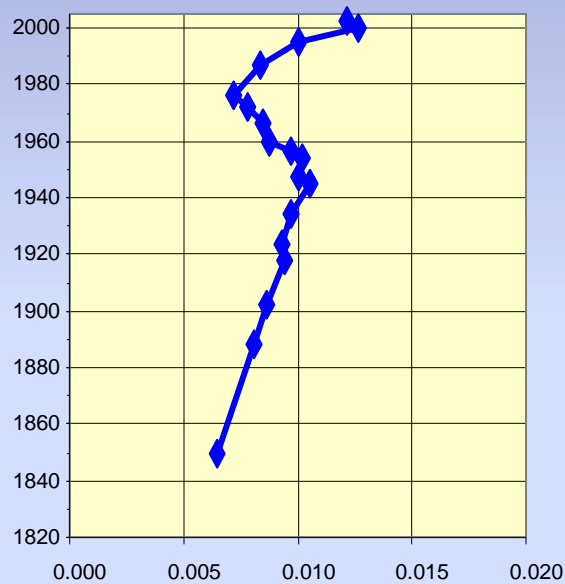
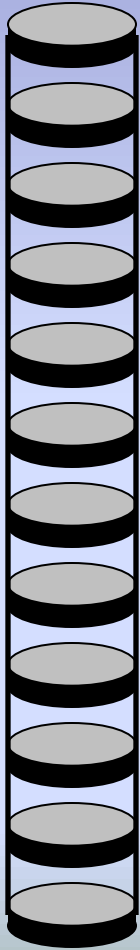
## • Blue-green algae

## • Plant remains

- History of macrophytes

# Types of Cores

Full core



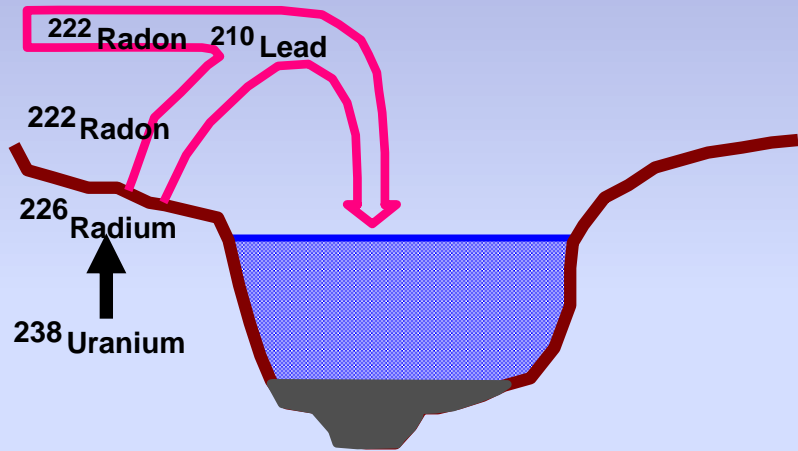
Top/Bottom



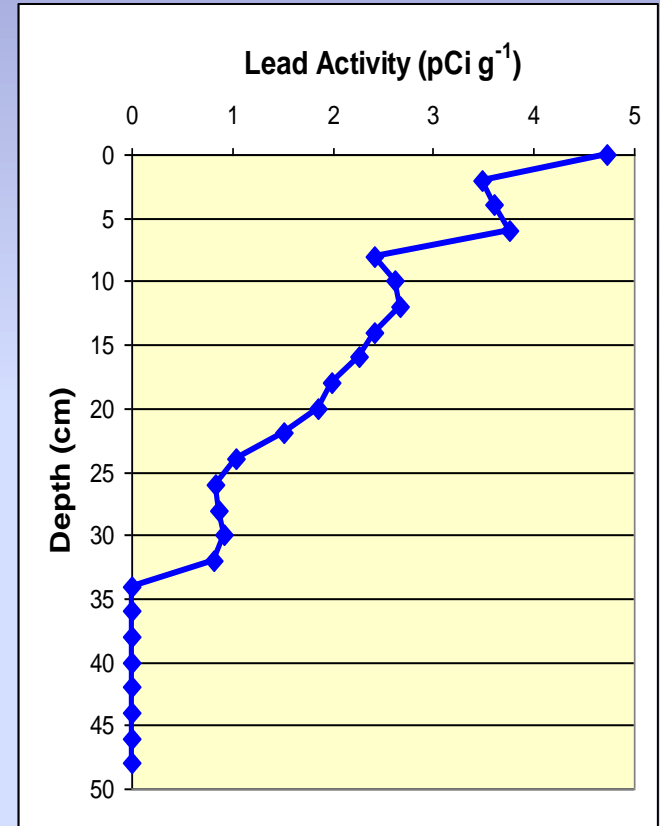
Modern

Reference

# Lead-210 Dating

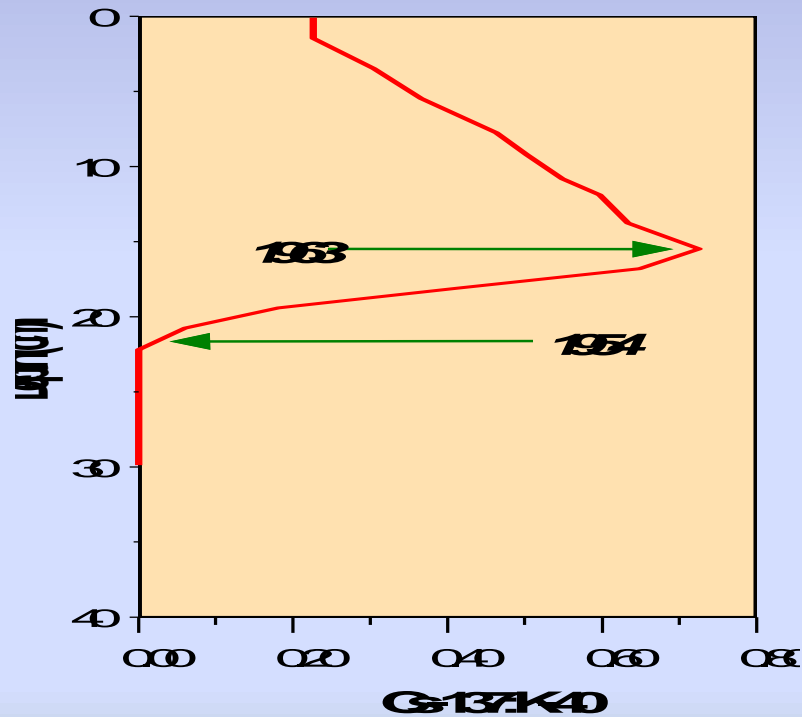


HALF LIVES	
<sup>226</sup> Radium	1024 yr
<sup>222</sup> Radon	3.8 days
<sup>210</sup> Lead	22.26 yr



# FALLOUT FROM ATMOSPHERIC BOMB TESTING

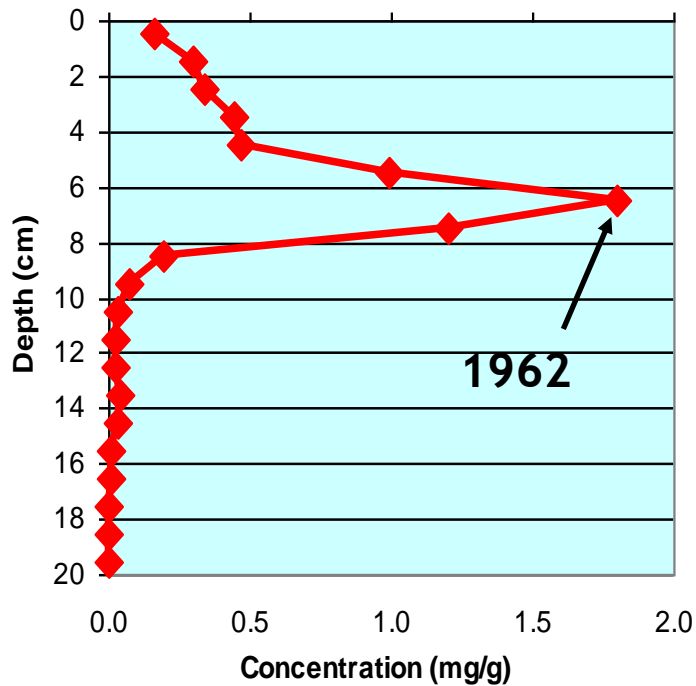
Cesium Dating



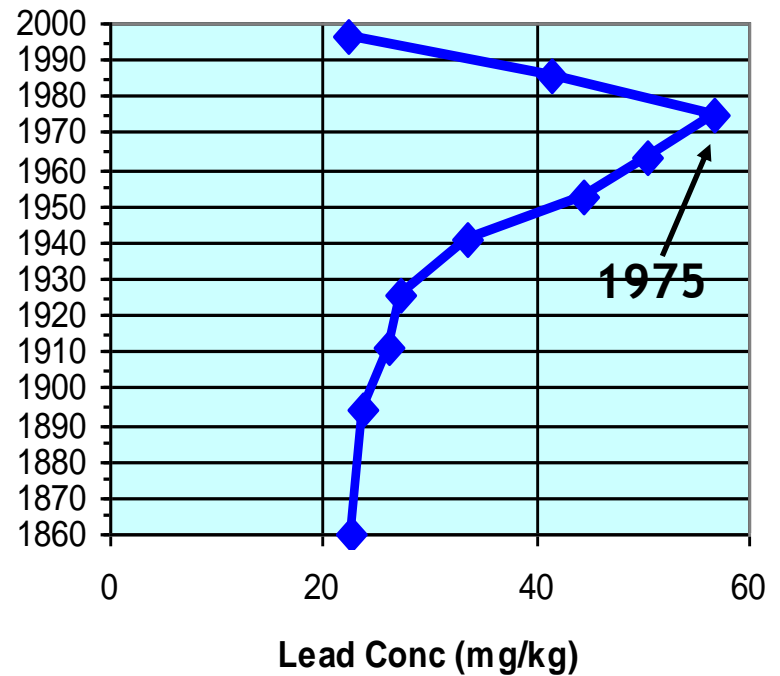
# MACROPHYTE CONTROL

# GASOLINE EMISSIONS

## Arsenic

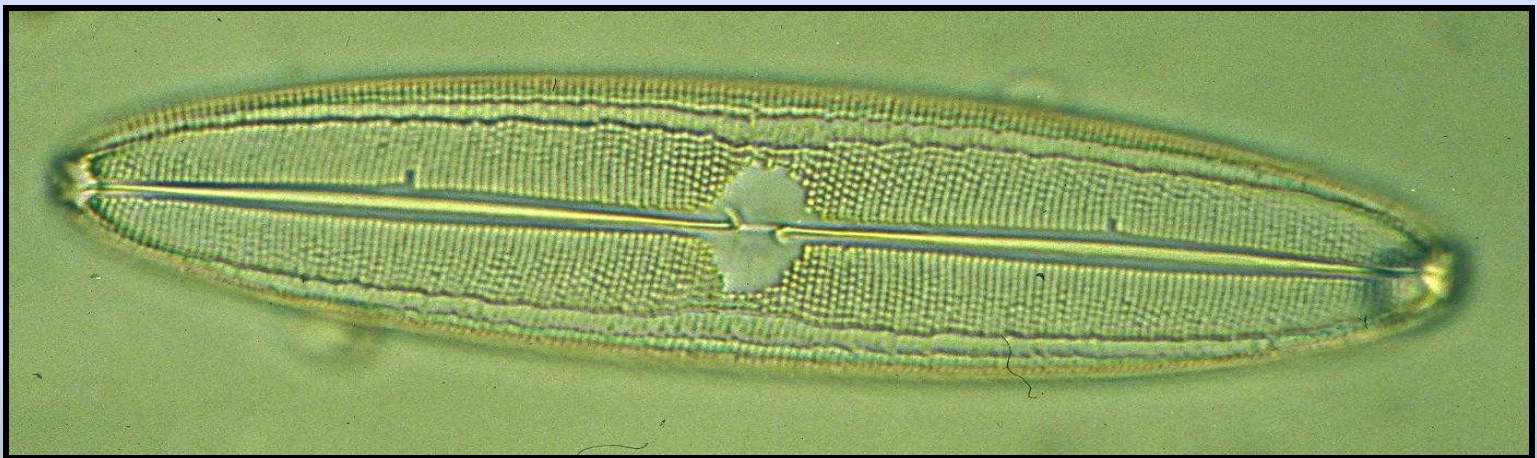
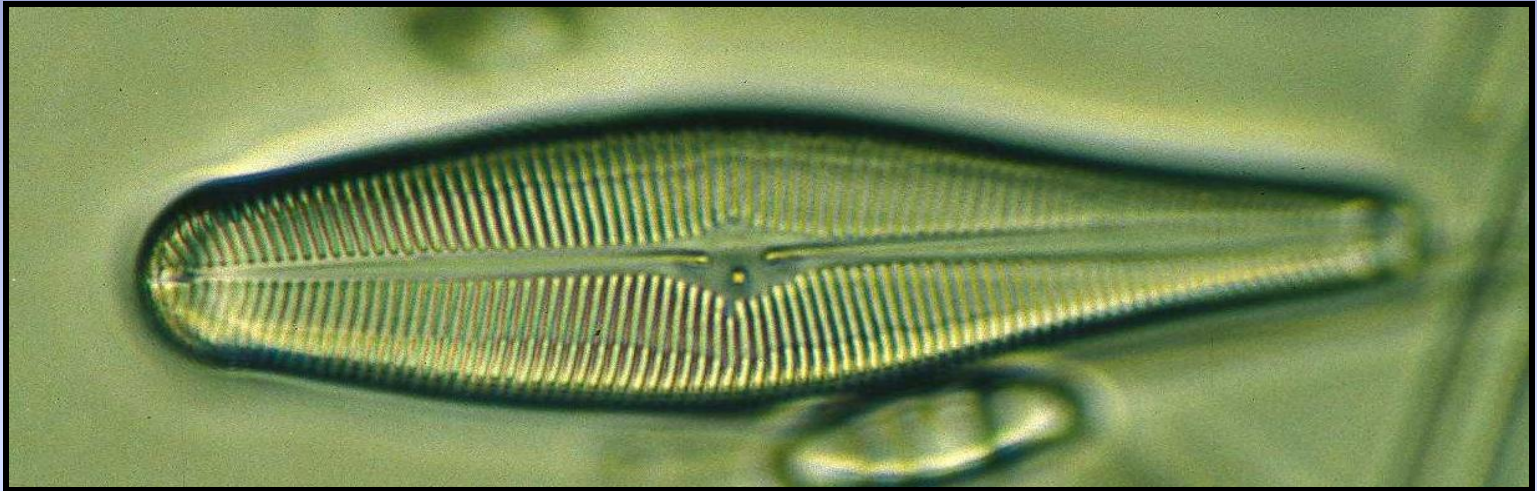


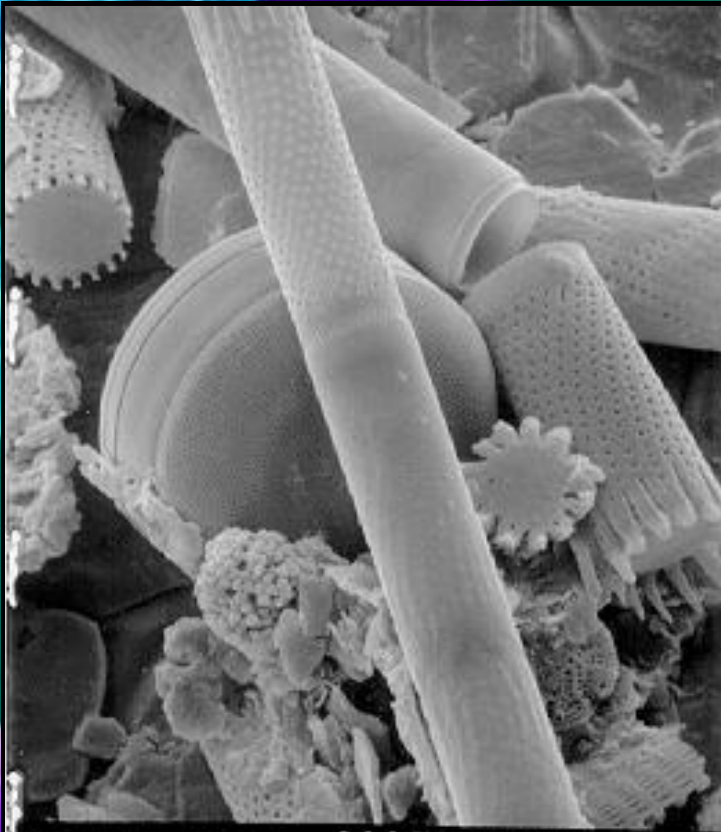
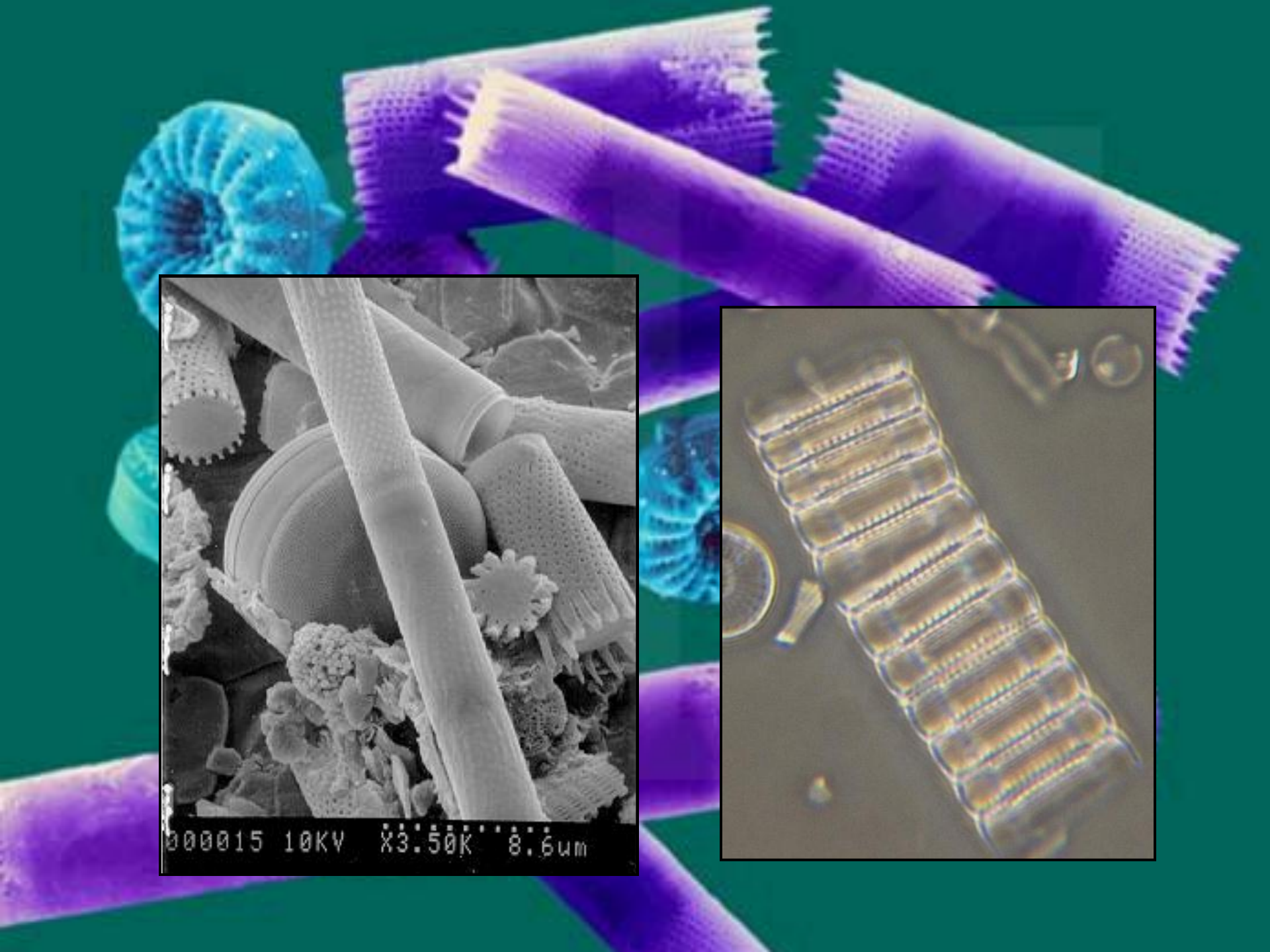
## Western Basin



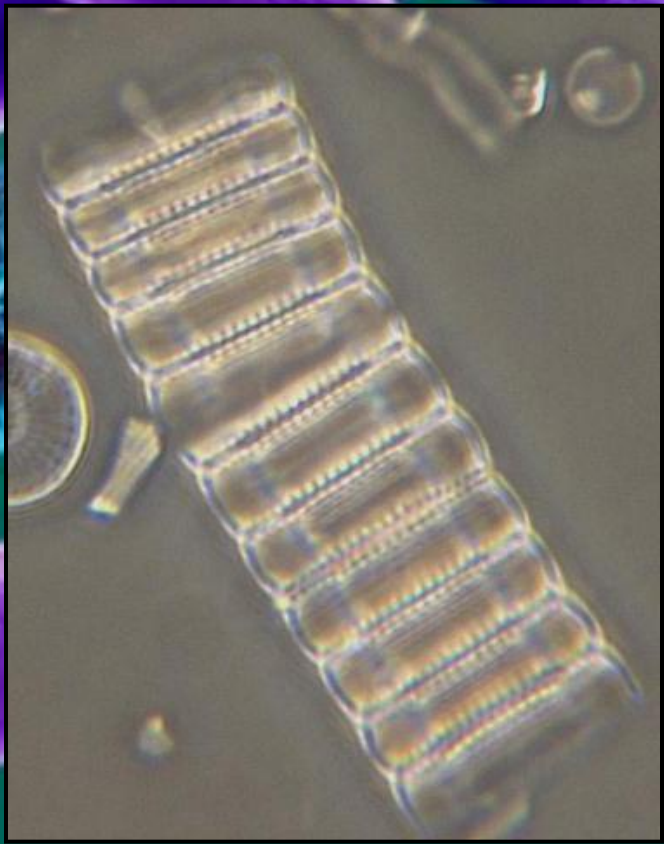


# WHAT ARE DIATOMS?

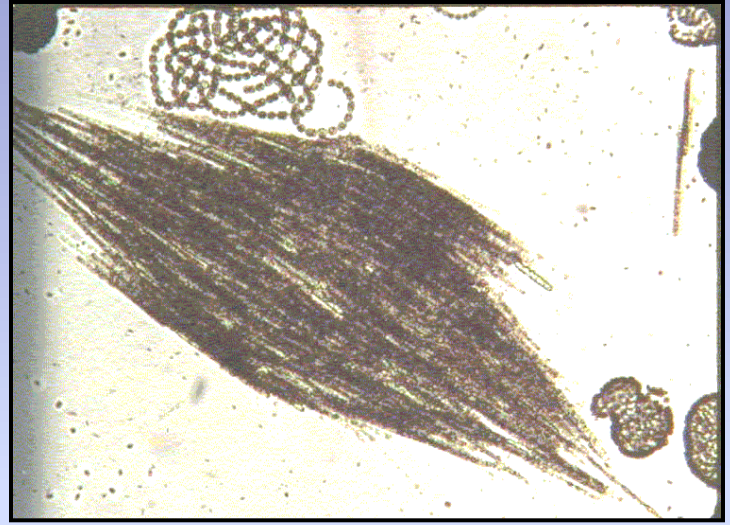




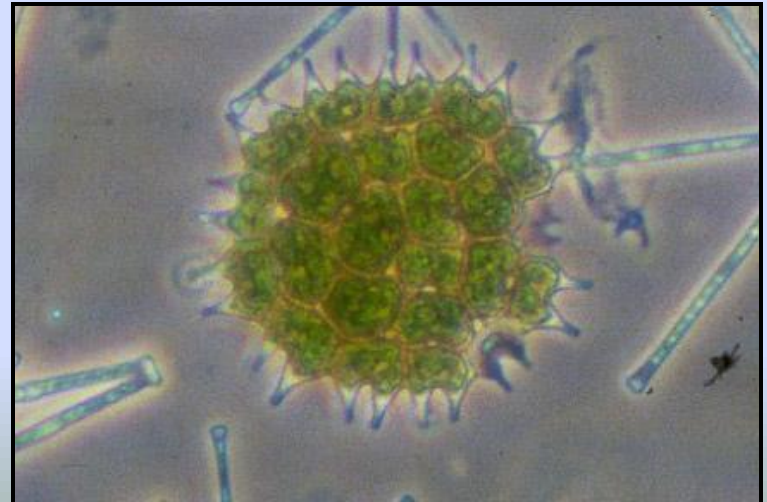
000015 10KV X3.50K 8.6um



# BLUE-GREEN and GREEN ALGAE



Peter Parks



# AGRICULTURE

Circa 1880



Circa 1910

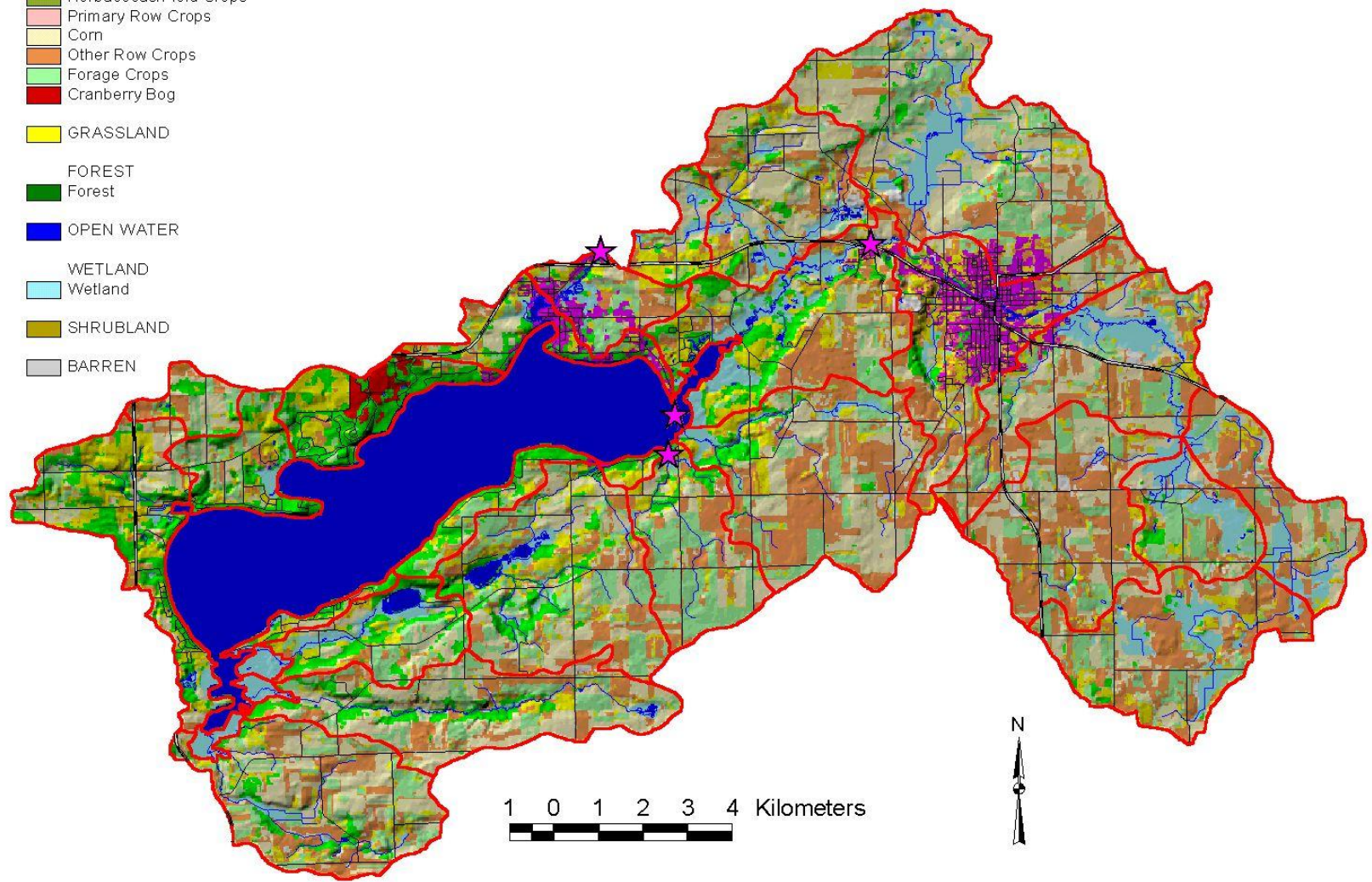




# Big Green Lake Watershed Land Cover & Hillshade (WISCLAND 1992)

## Land Cover

- URBAN/DEVELOPED
  - High Intensity
  - Low Intensity
  - Golf Course
- AGRICULTURE
  - General Agriculture
  - Herbaceous/Field Crops
  - Primary Row Crops
    - Corn
    - Other Row Crops
  - Forage Crops
  - Cranberry Bog
- GRASSLAND
- FOREST
  - Forest
- OPEN WATER
- WETLAND
  - Wetland
- SHRUBLAND
- BARREN



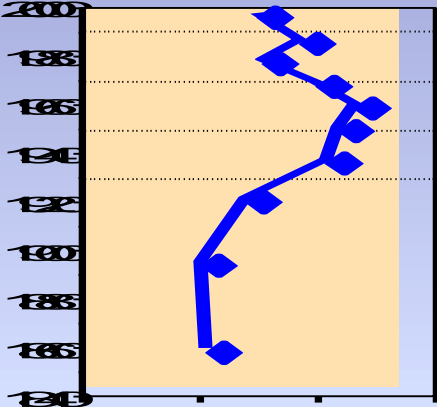
1 0 1 2 3 4 Kilometers



# Green Lake

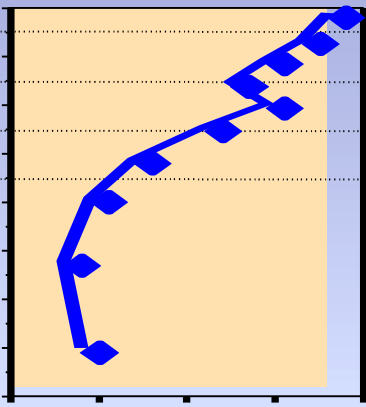
Titanium

1980 1985 1990 1995 2000 2005



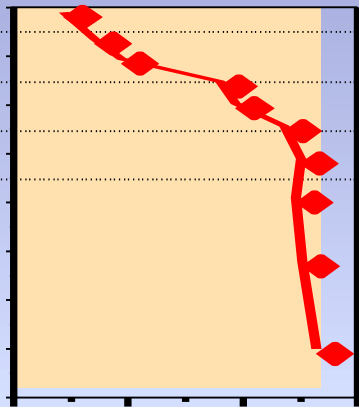
Uranium

1980 1985 1990 1995 2000 2005

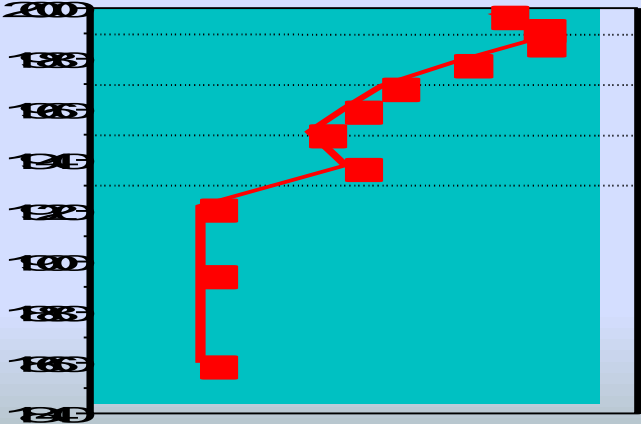


Manganese

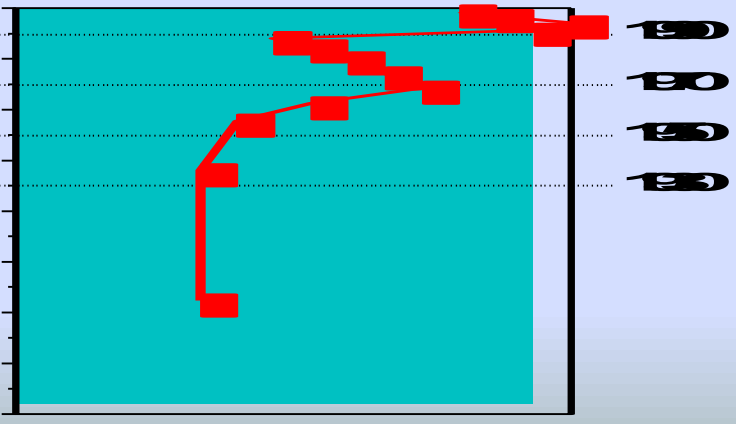
1980 1985 1990 1995 2000 2005



Water Rain

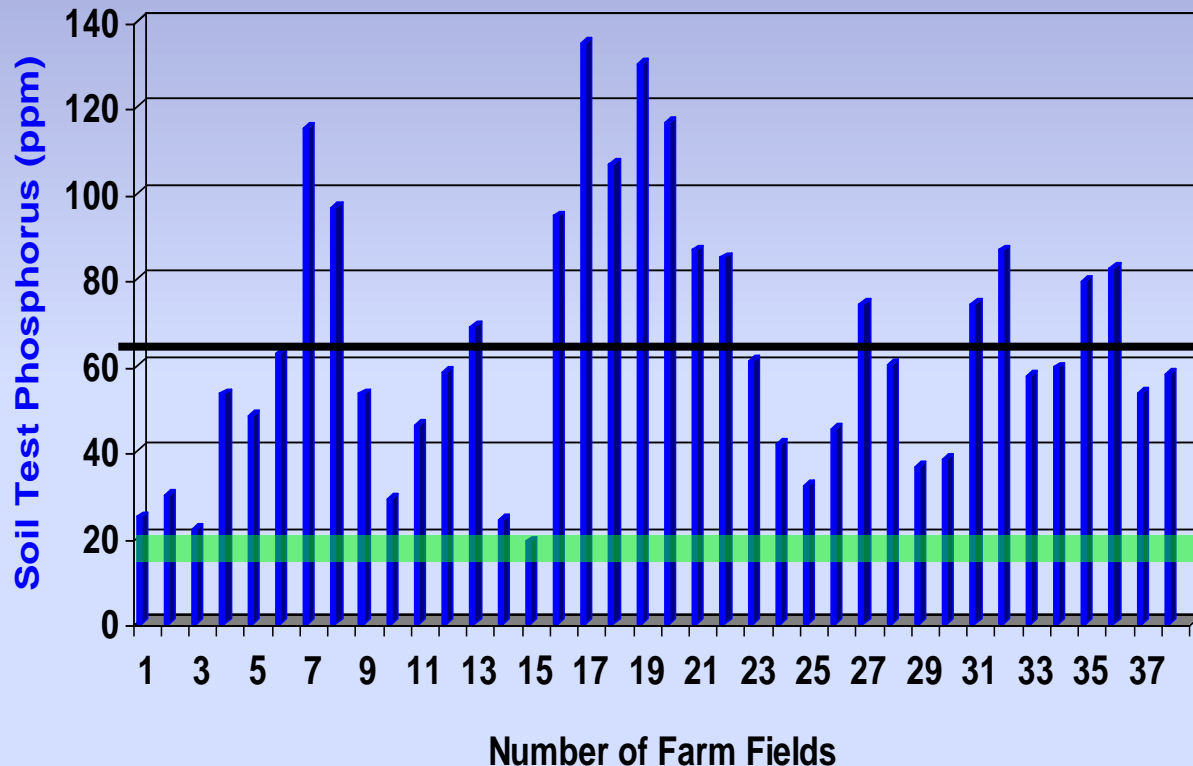


Water Rain



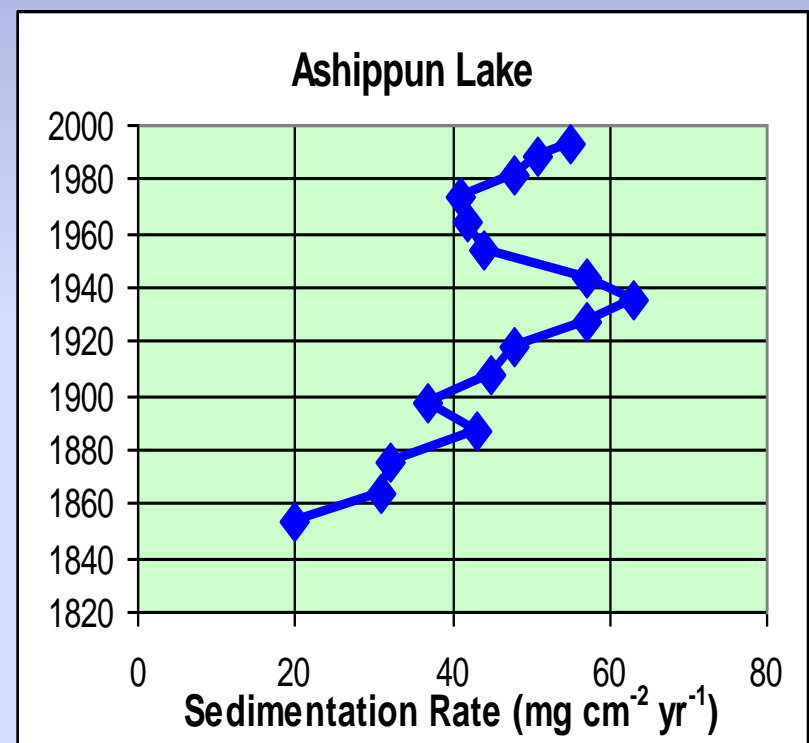
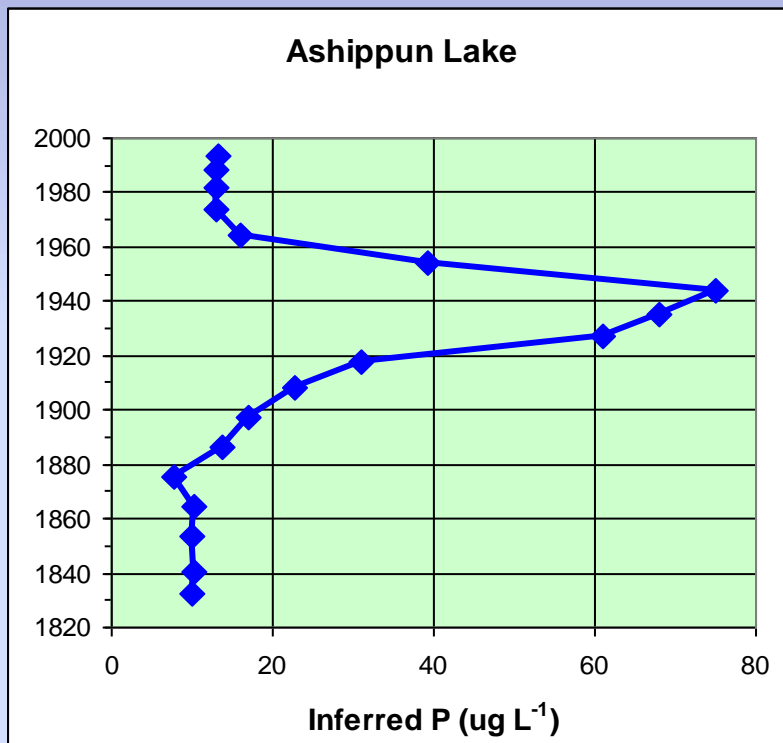
1980 1985 1990 1995 2000 2005

# Phosphorus Distribution Dane County - Farm 1





# AGRICULTURE CONVERTED TO HOMES

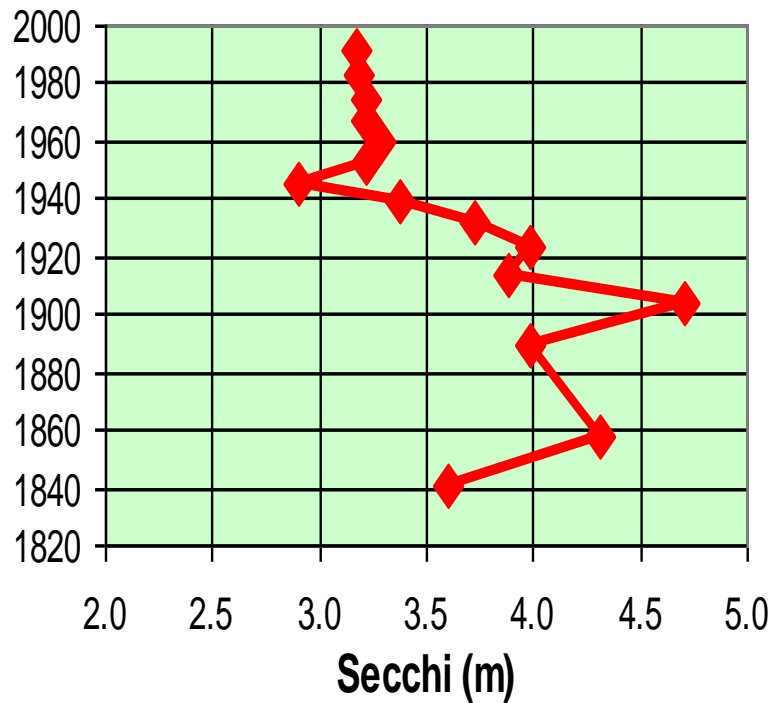


# SHORELAND DEVELOPMENT

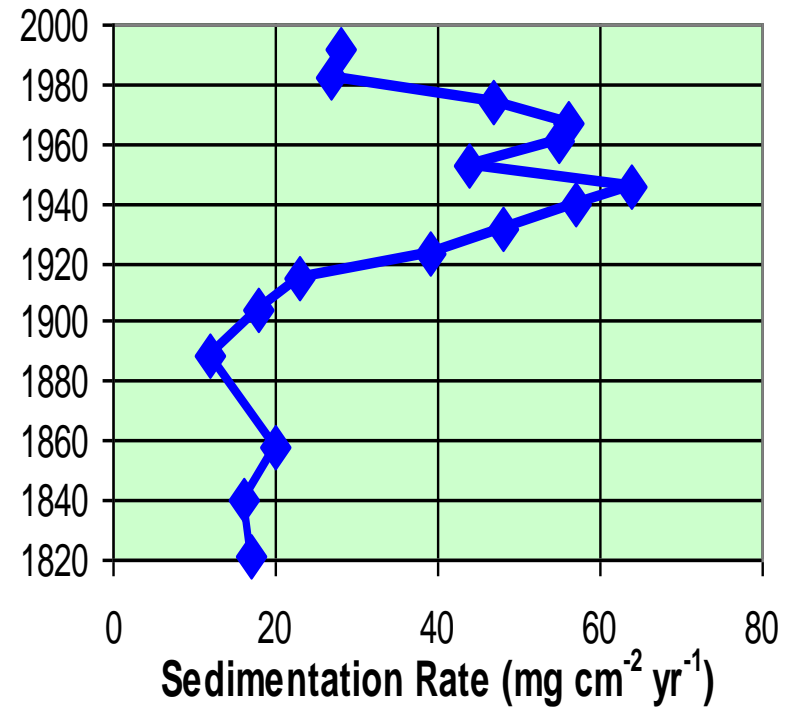


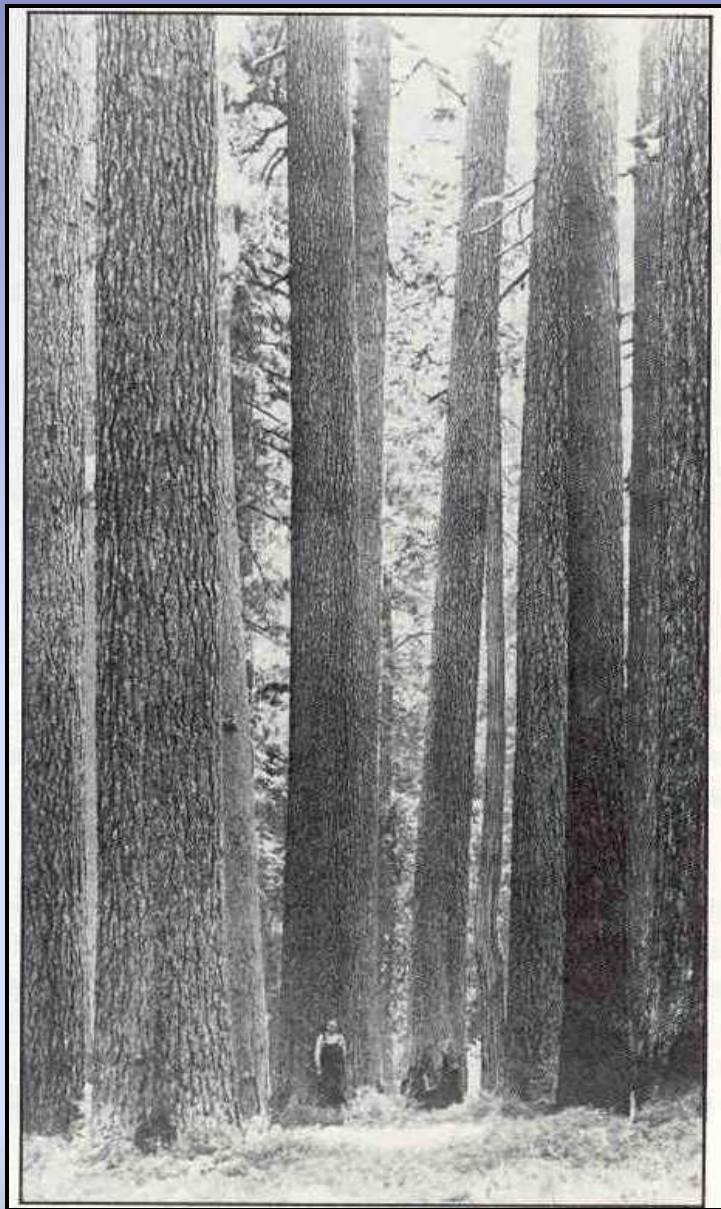
# SOUTHERN LAKES

## Silver Lake



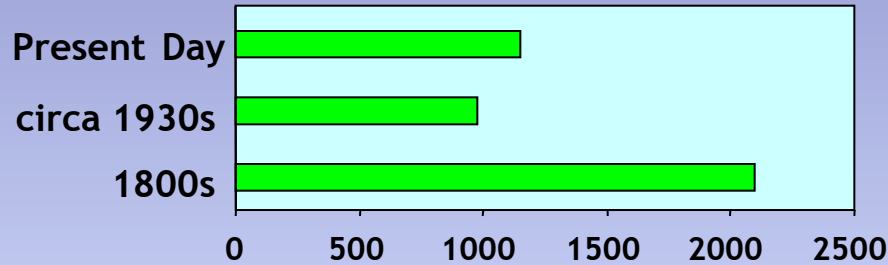
## Silver Lake



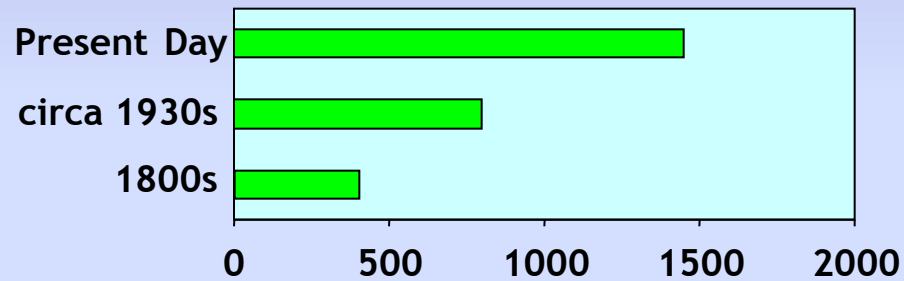


# Little Bearskin Lake

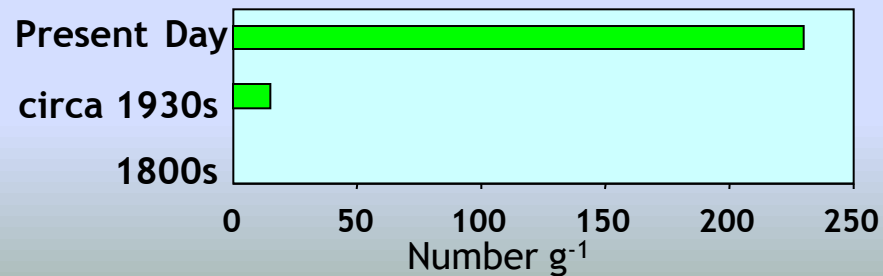
## FERNLEAF PONDWEED



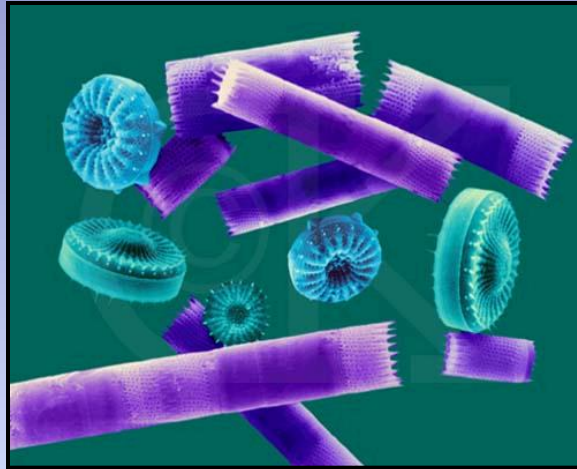
## COONTAIL



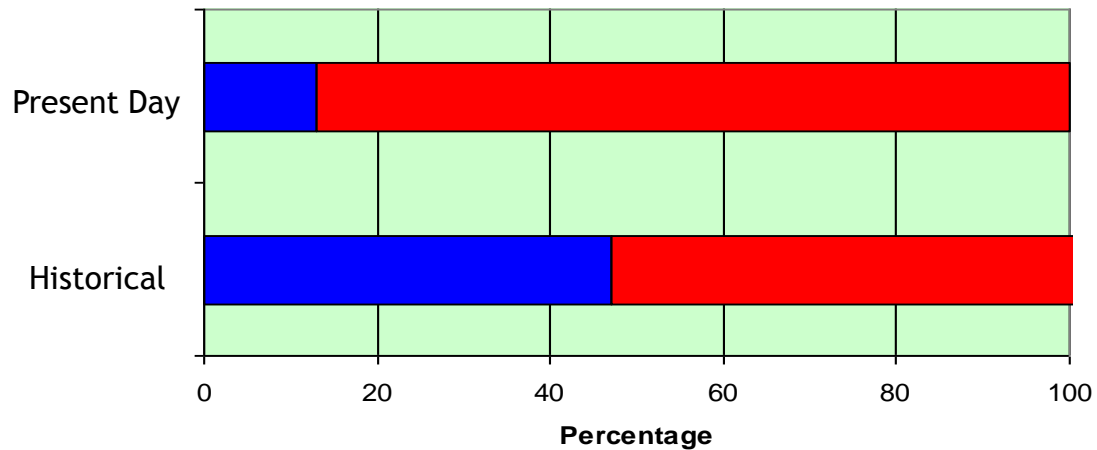
## LARGE LEAVED PONDWEED



# Little Bearskin Lake



## DIATOMS

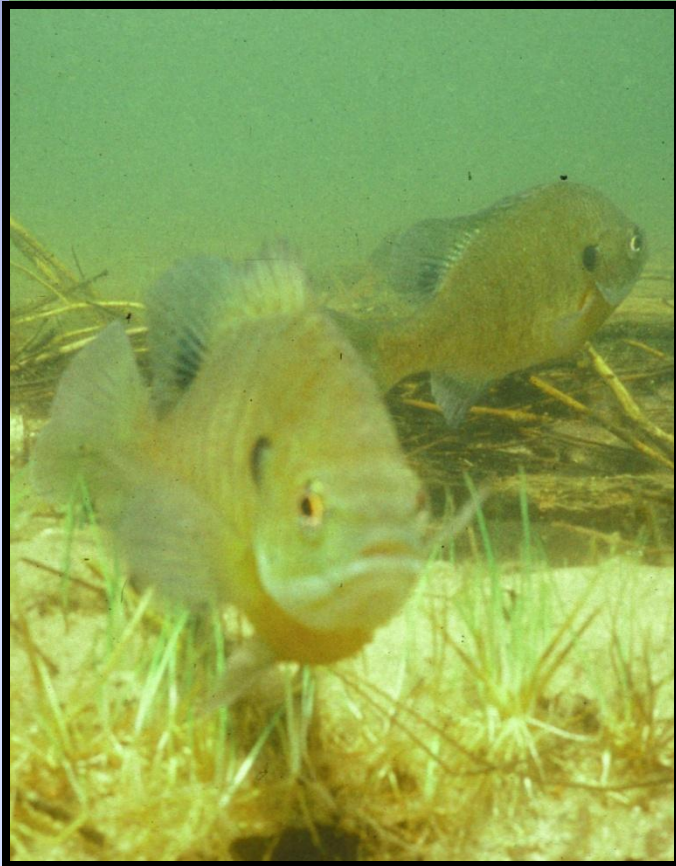


Open-water



Macrophyte

# Shift in the ratio of isoetids to elodeids



**1930s: 50/50**



**2000s: 30/70**



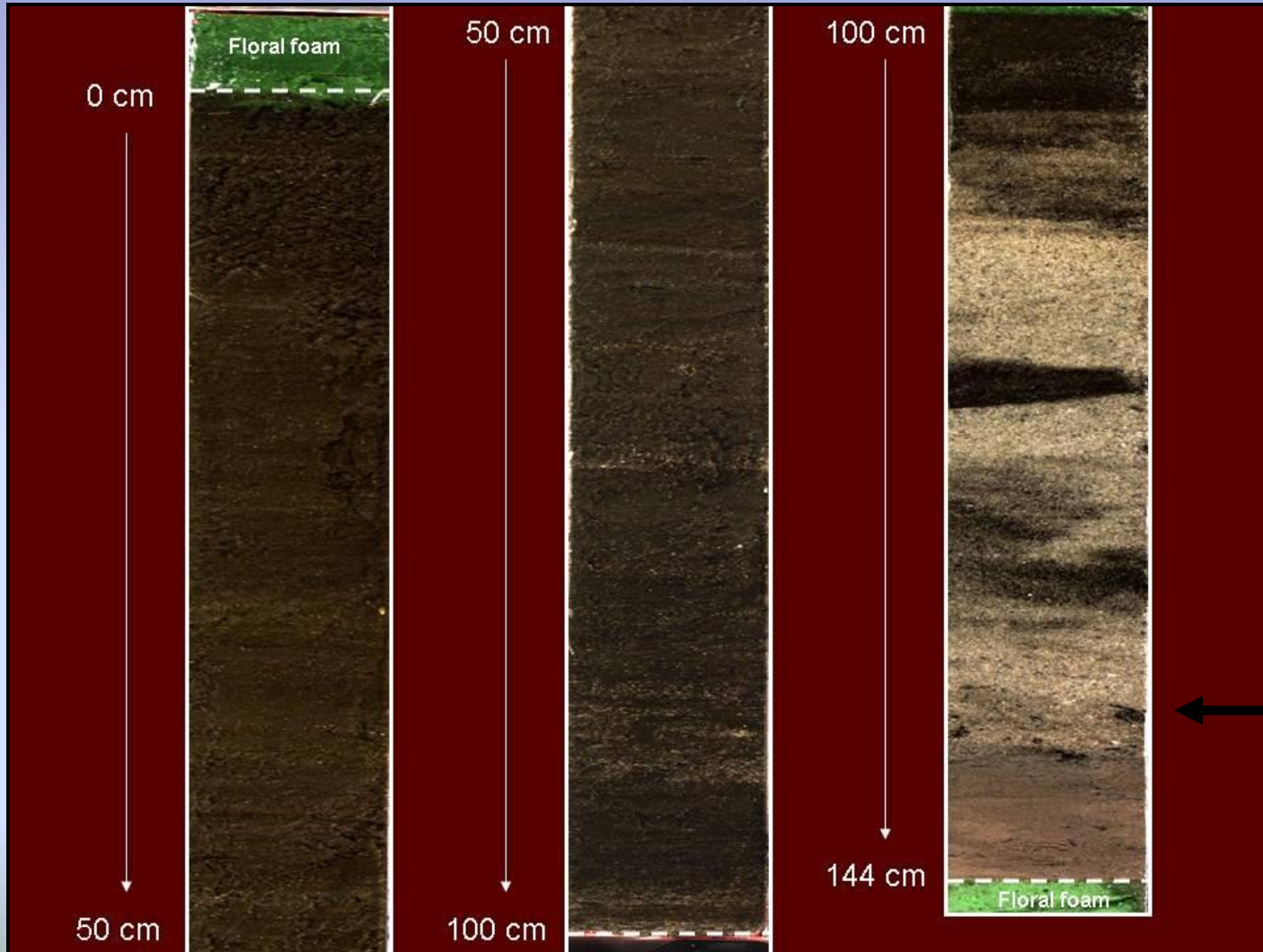


# CLIMATE CHANGE



Huron Lake, Waushara County

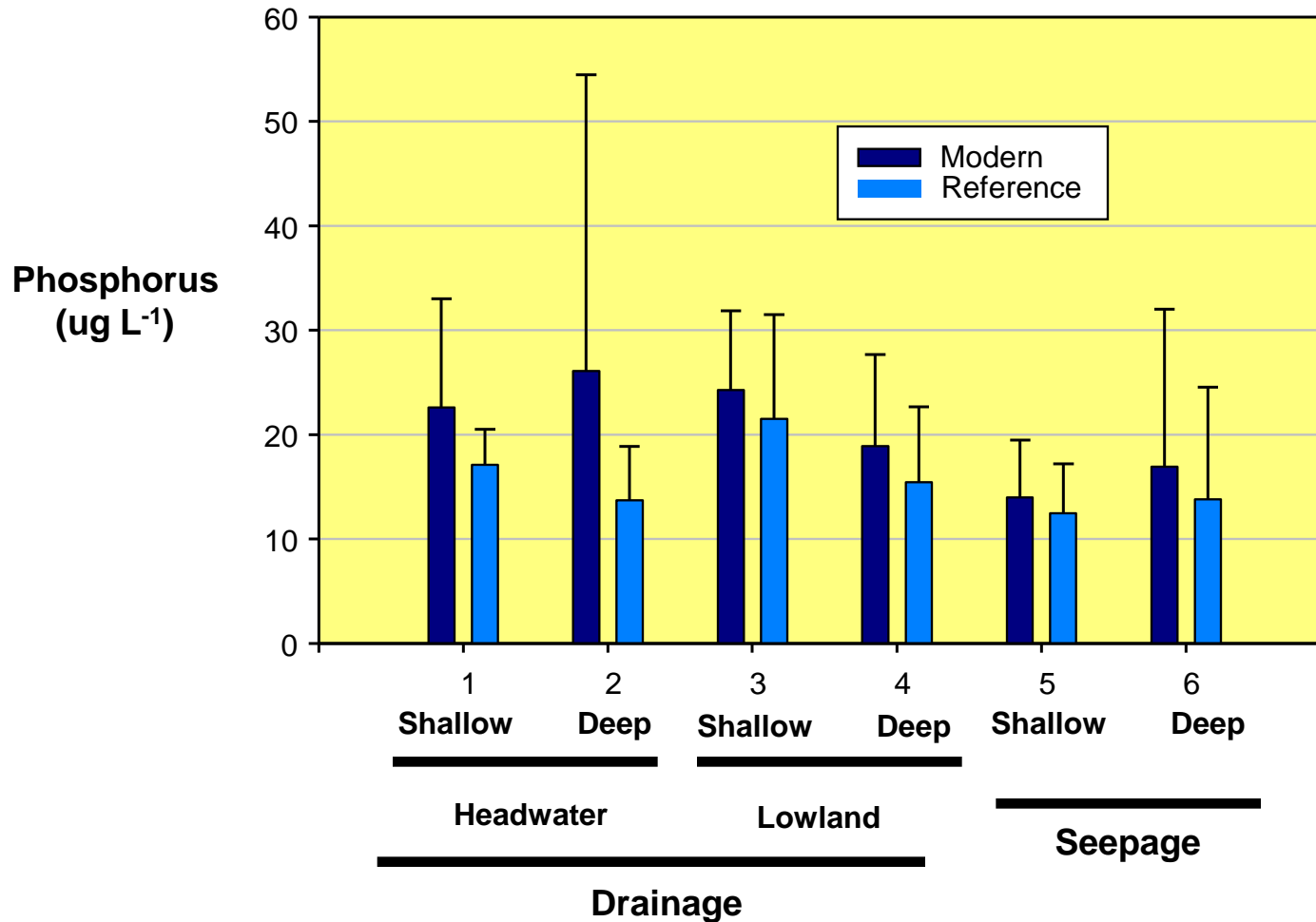
# Berry Lake



Dr. Samatha Kaplan—  
UW Stevens Point

12,000 old

# SUMMER PHOSPHORUS



# SUMMARY

- Some lakes are naturally eutrophic. These lakes always are drainage lakes and tend to be large and relatively shallow.
- Many lakes with significant agriculture in their watersheds have experienced a reduction in soil erosion during the last 20 years but not necessarily a reduction in nutrient input because of the use of synthetic fertilizers.
- In northern lakes that have experienced increased shoreland development during the last 2-3 decades, phosphorus levels may not have increased, but nearly all of these lakes have experienced an increase in plant growth.

# **PALEOLIMNOLOGY AS A LAKE MANAGEMENT TOOL**

- How is the current lake condition different from historical?**
- If there has been a change, how much has it been and what are the major causes?**
- How much of an effort do we want to put into improving our lake given fiscal and political costs?**

Winter 2007



## Paleolimnology History in the Mucking

*Lake folks often get into lively discussions over what the lake used to be like...more plants, fewer plants, clear water, murky water... Is there any way to really know for sure? Well, the answer is yes! In fact we can have a good idea of what lakes used to be like hundreds of years ago with a science called Paleolimnology.*

Winter 2008

## Paleolimnology A Reflection of Our History

*An article in Lake Tides (vol. 32, no. 1), "Paleolimnology: History in the Mucking," discussed how sediment cores are taken and utilized to understand past changes in lakes. This article will take us on a historical journey that links changes on the landscape with environmental impacts to our lakes, which are revealed in the lake sediments.*

on the land. The opening of the forest allowed large amounts of sediments and nutrients to be exported from the land to the water.

Major events in the history of our country, like World War II, had definite impacts on our lakes. World War II marked another period in which agricultural practices intensified. To

- Anvil Lake
- Whitefish Lake
- Rusk County Lakes
- Rock Lake
- Cloverleaf Lakes
- Plum Lake

# QUESTIONS?

