USING SEDIMENT CORES FOR MANAGING LAKES

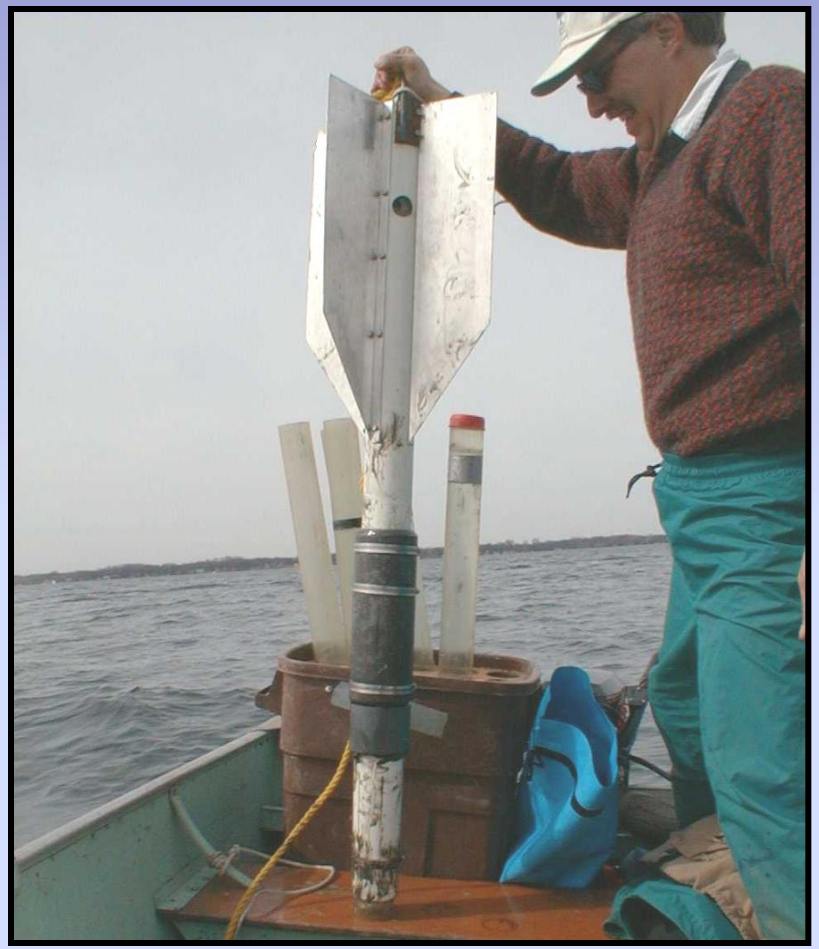
Paul Garrison

Bureau of Science Services

Wisconsin Department of Natural Resources

Wisconsin Department of Natural Resources
FISHERIES and AQUATIC SCIENCES RESEARCH

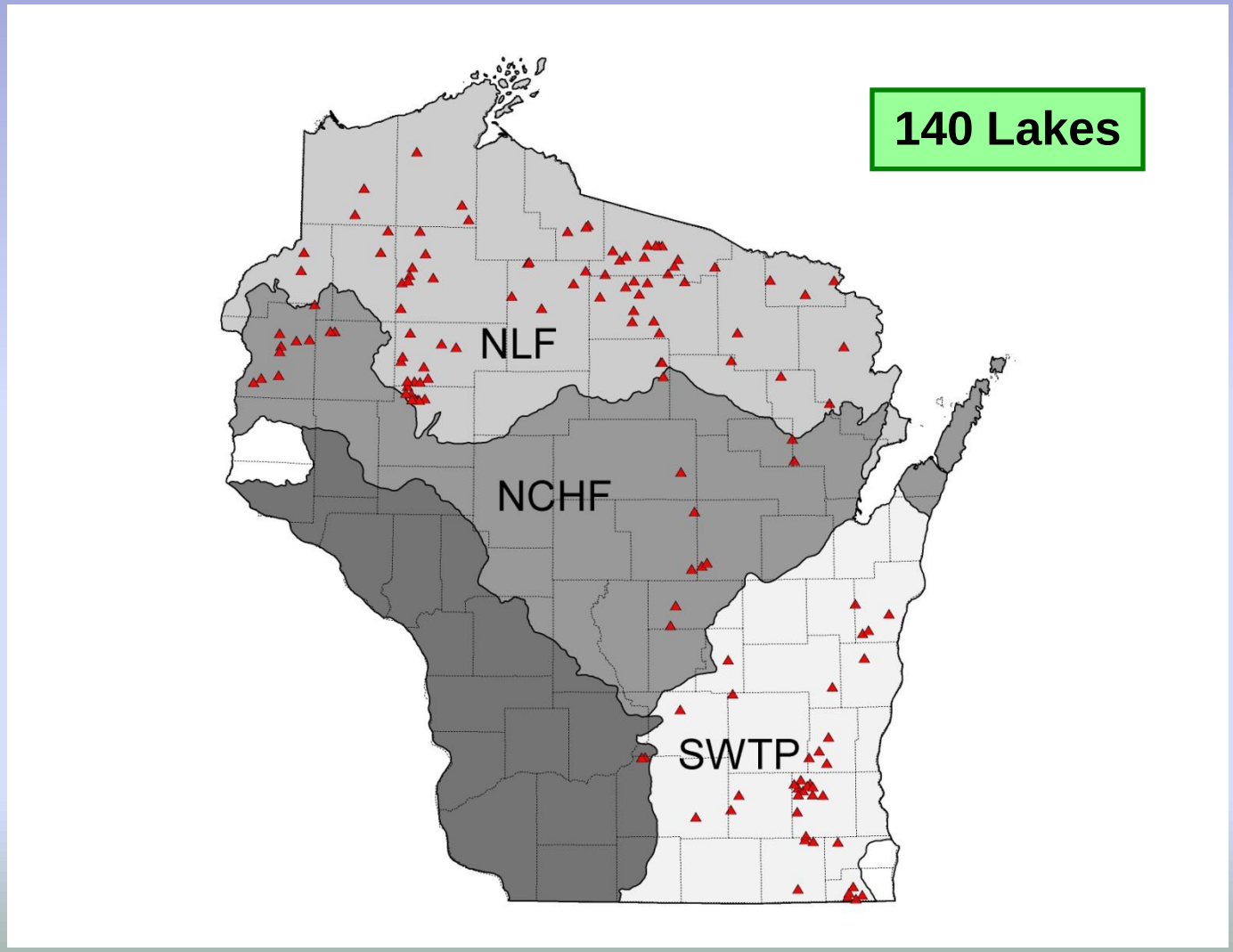
HOW DO YOU COLLECT SEDIMENT CORES?



Gravity Corer

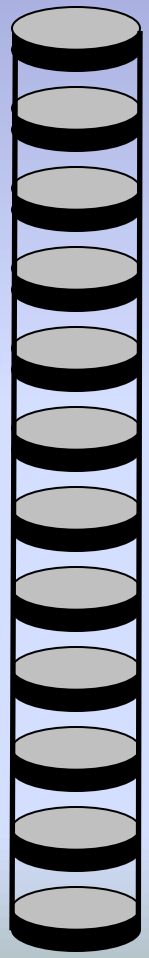
Piston Corer

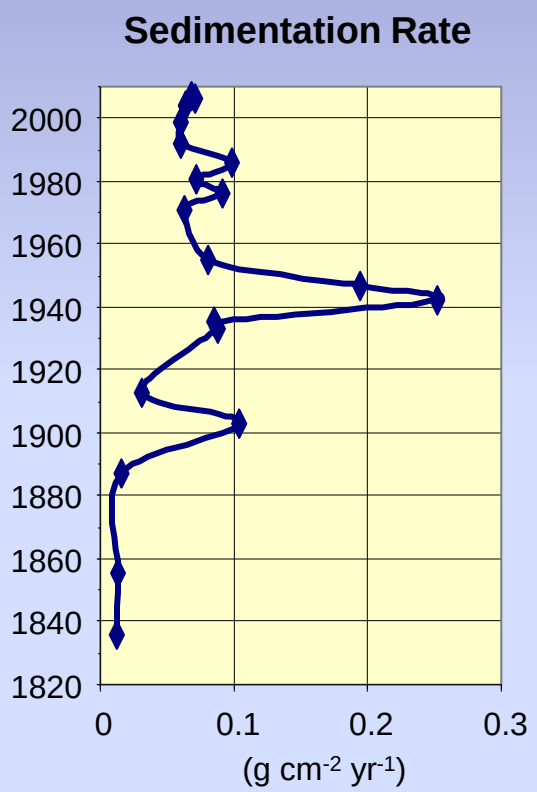
CORED LAKES



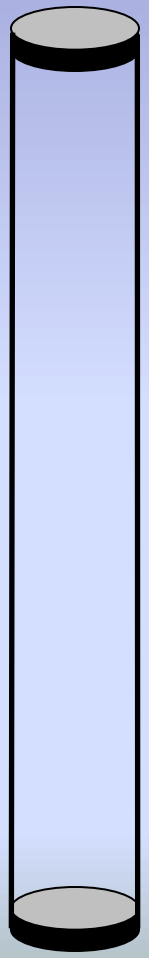
Types of Cores

Full core





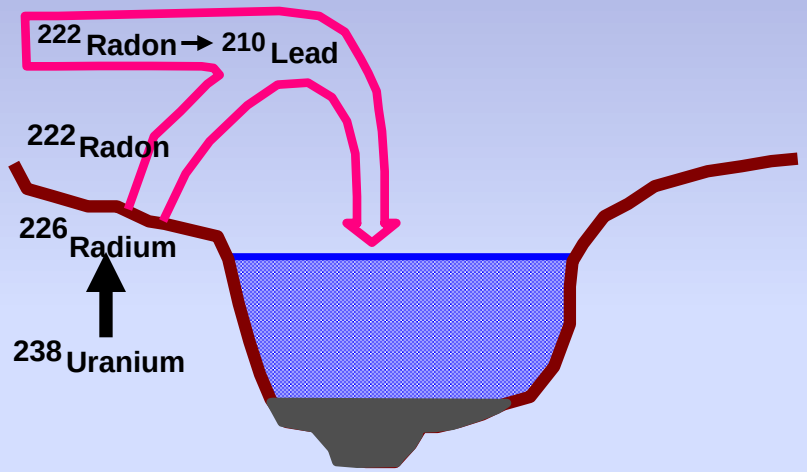
Top/Bottom



WHAT INFORMATION IS RECORDED IN THE SEDIMENTS?

- **Geochemistry**
  - **Nutrients** -- phosphorus, nitrogen
  - **Soil erosion**--aluminum, titantium
  - **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

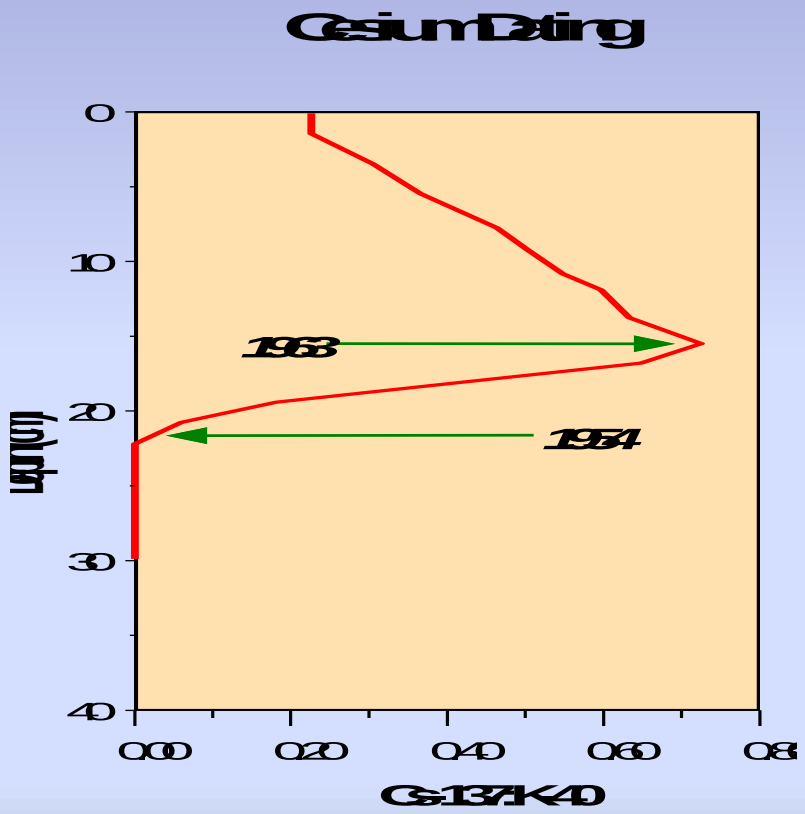
Lead-210 Dating



HALF LIVES

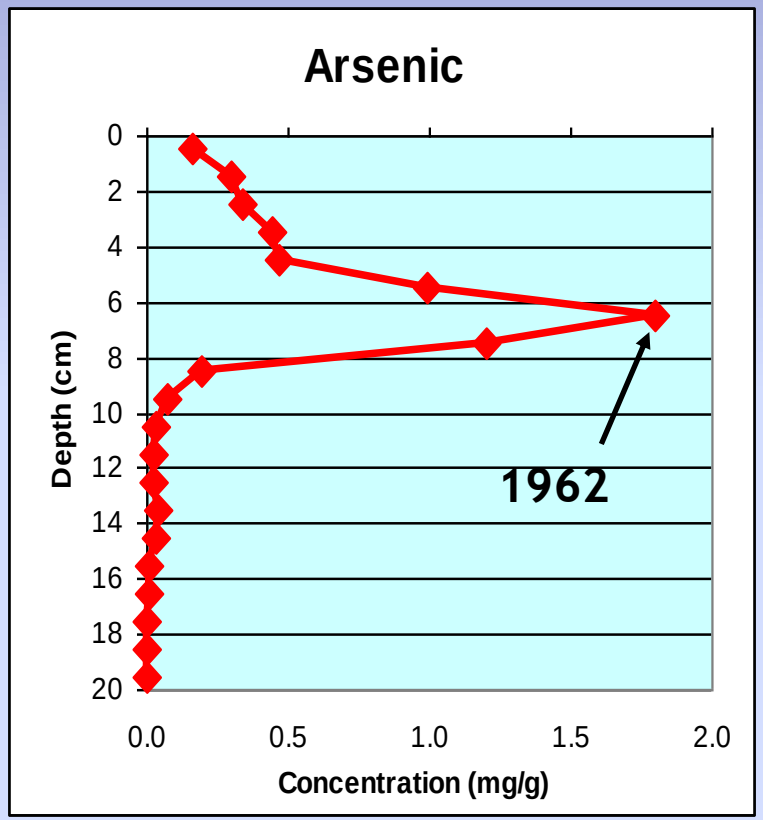
^{226}Radium	1024 yr
^{222}Radon	3.8 days
^{210}Lead	22.26 yr

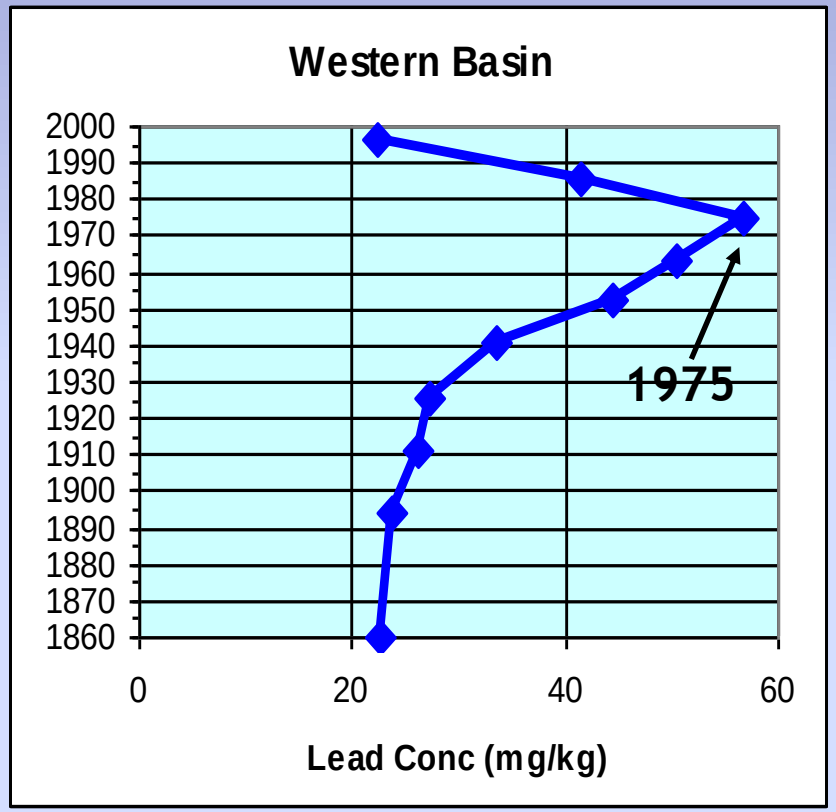
FALLOUT FROM ATMOSPHERIC BOMB TESTING



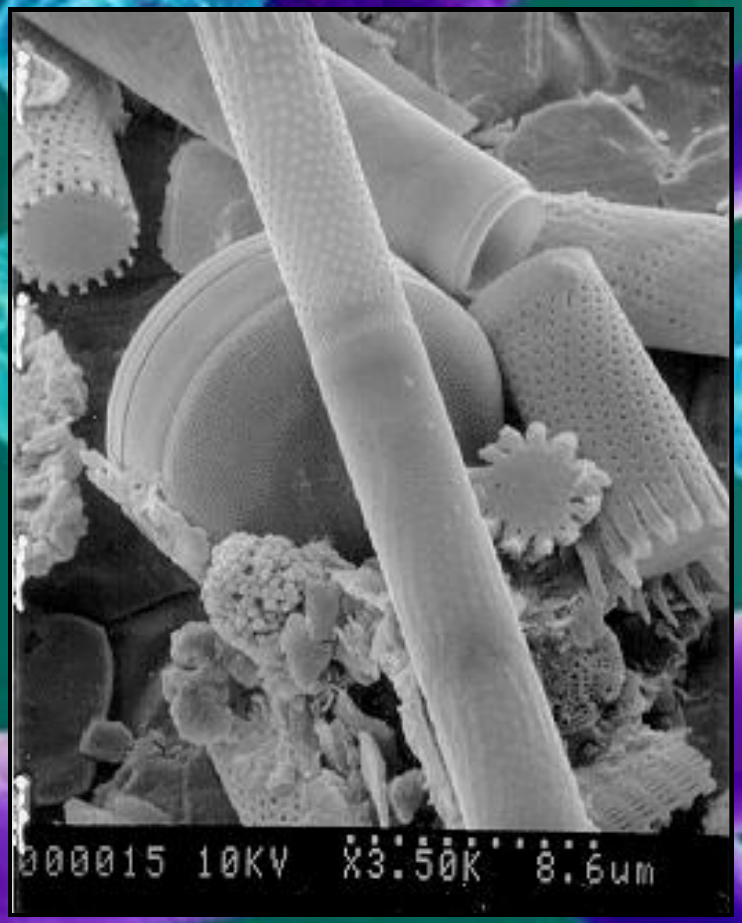
MACROPHYTE CONTROL

GASOLINE EMISSIONS

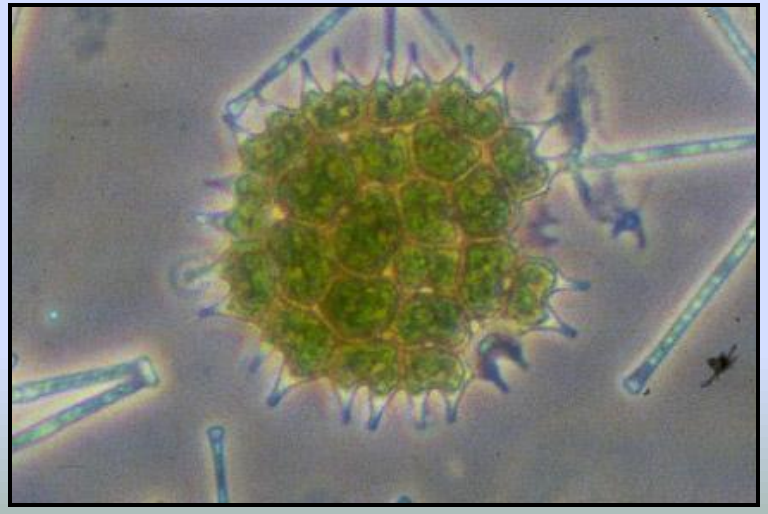




DIATOMS



BLUE-GREEN and GREEN ALGAE



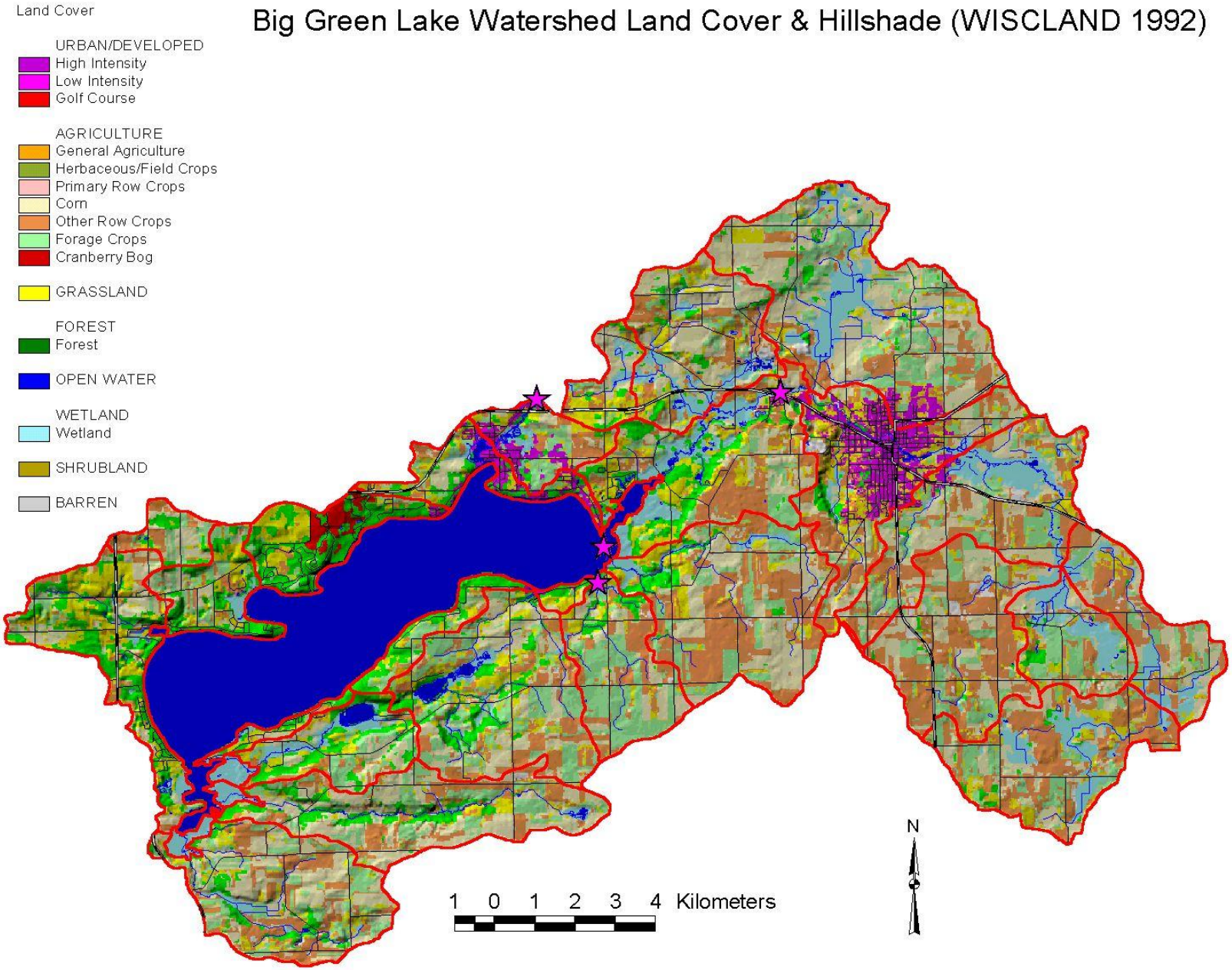
AGRICULTURE

Circa 1880

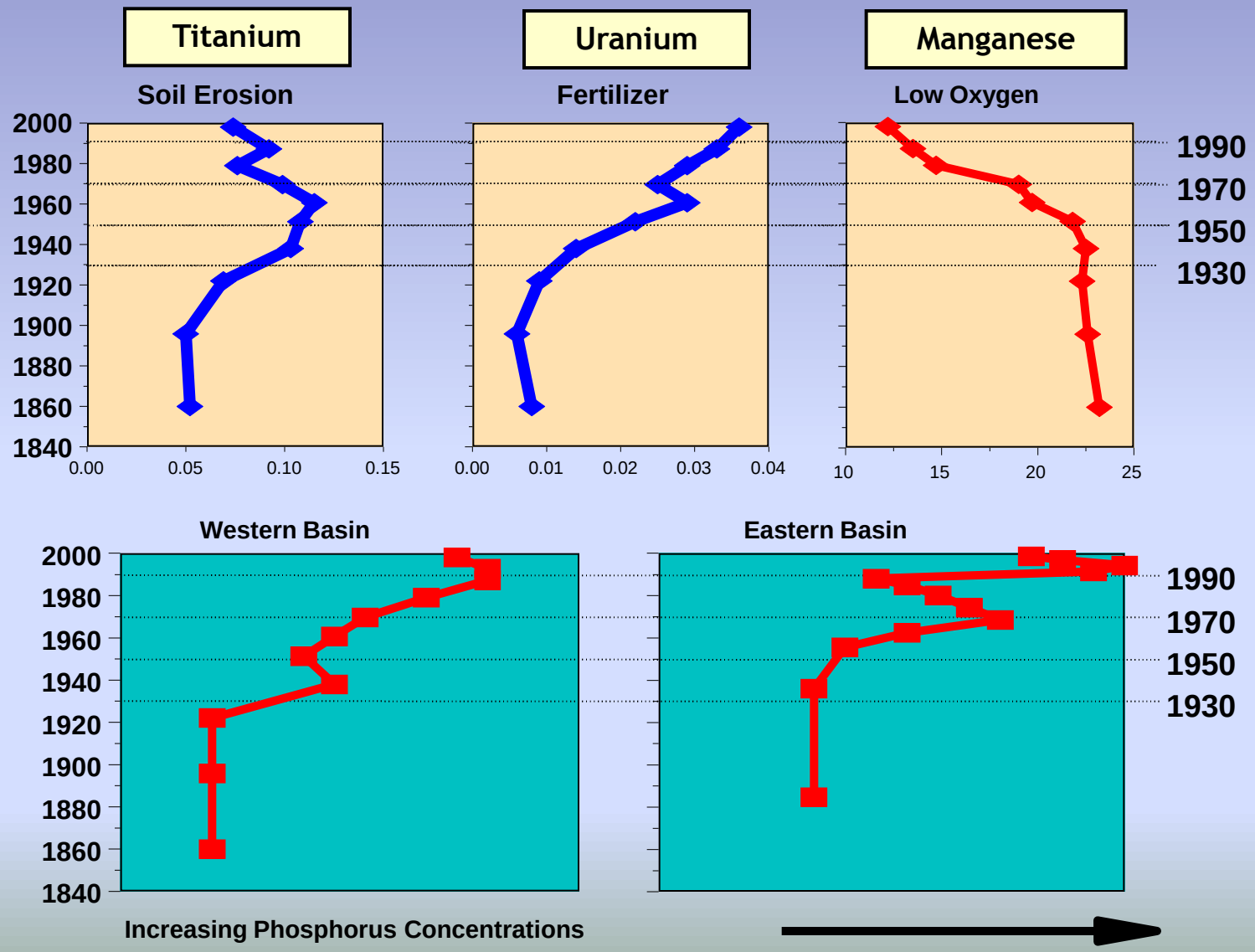
Circa 1910


Green
Lake

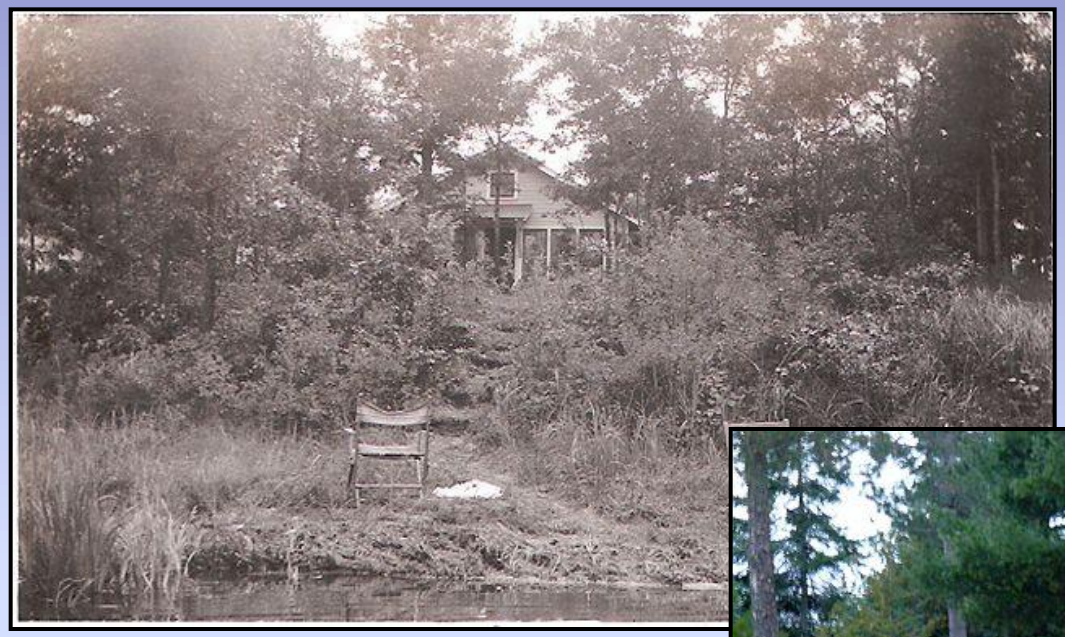
Big Green Lake Watershed Land Cover & Hillshade (WISCLAND 1992)



Green Lake


Titanium
Uranium
Manganese
Soil Erosion
Fertilizer
Low Oxygen
2000
1980
1960
1940
1920
1900
1880
1860
1840
0.00
0.05
0.10
0.15
0.00
0.01
0.02
0.03
0.04
10
15
20
25
1990
1970
1950
1930
Western Basin
Eastern Basin
Increasing Phosphorus Concentrations

SHORELAND DEVELOPMENT



circa 1940

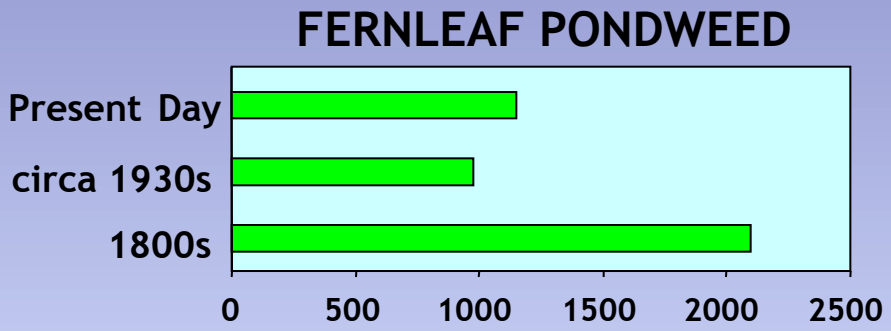
2009

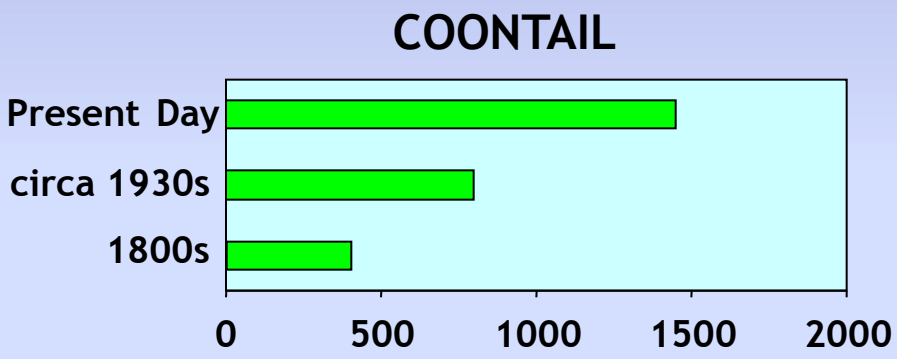
HABITAT CHANGE

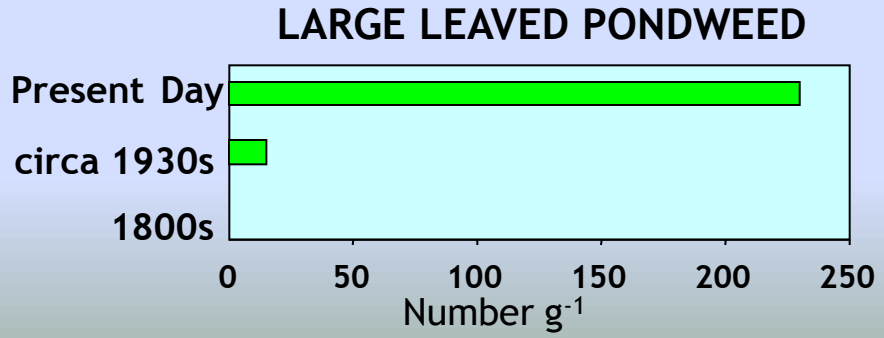
circa 1910

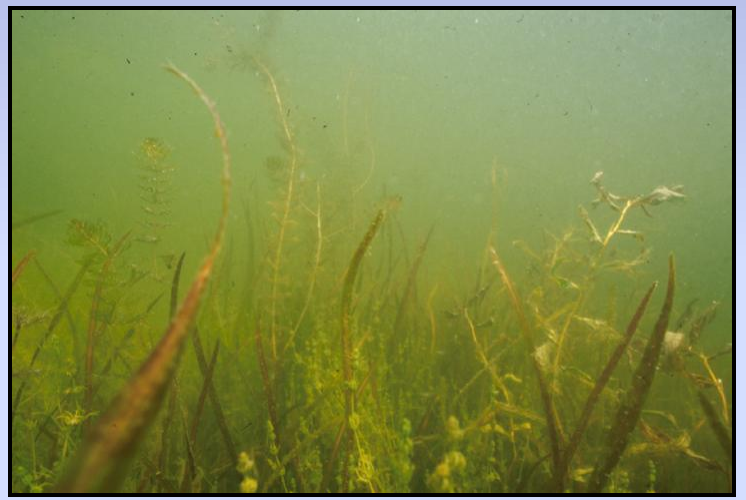

Little
Bearskin
Lake

Little Bearskin Lake

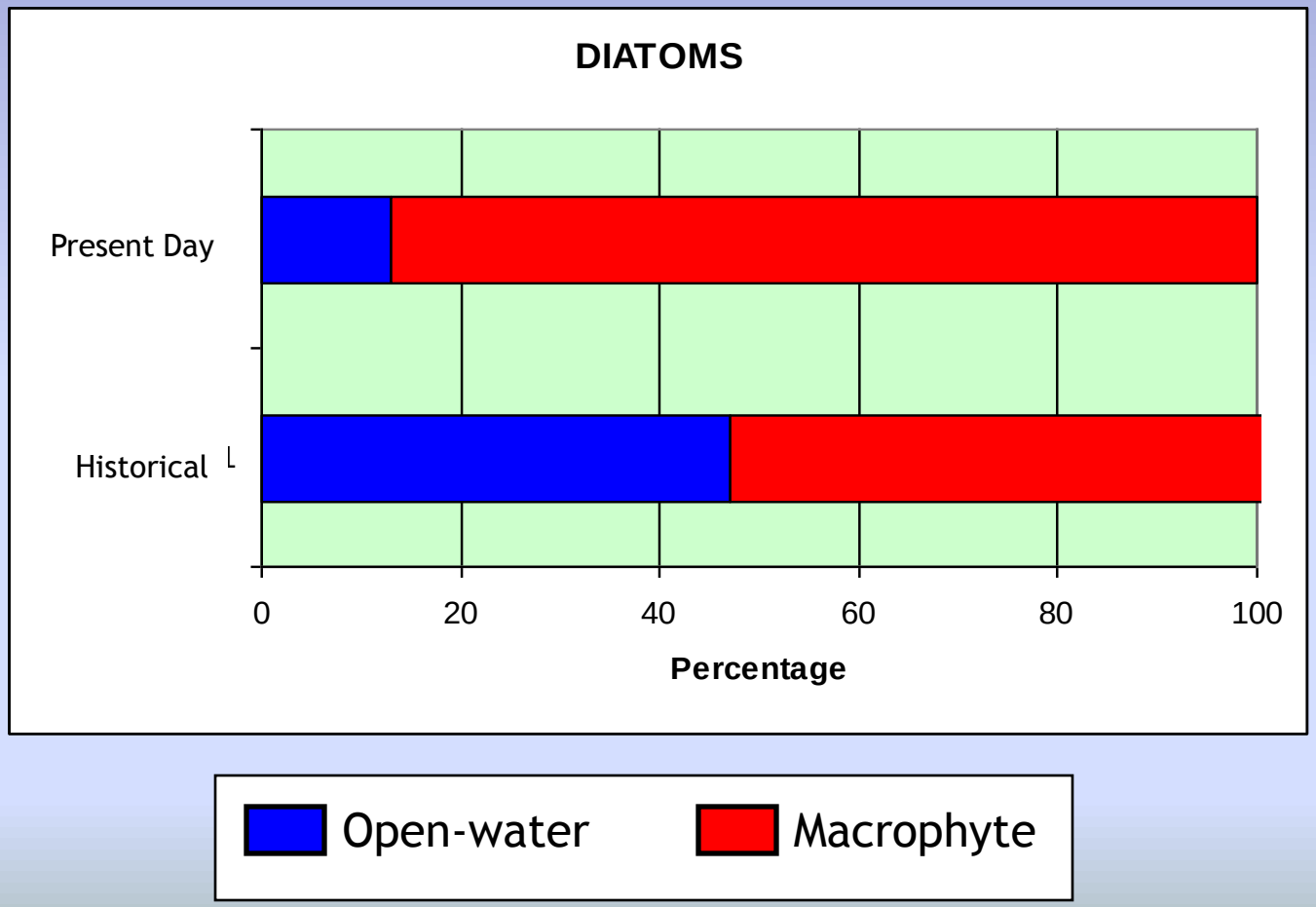








Little Bearskin Lake



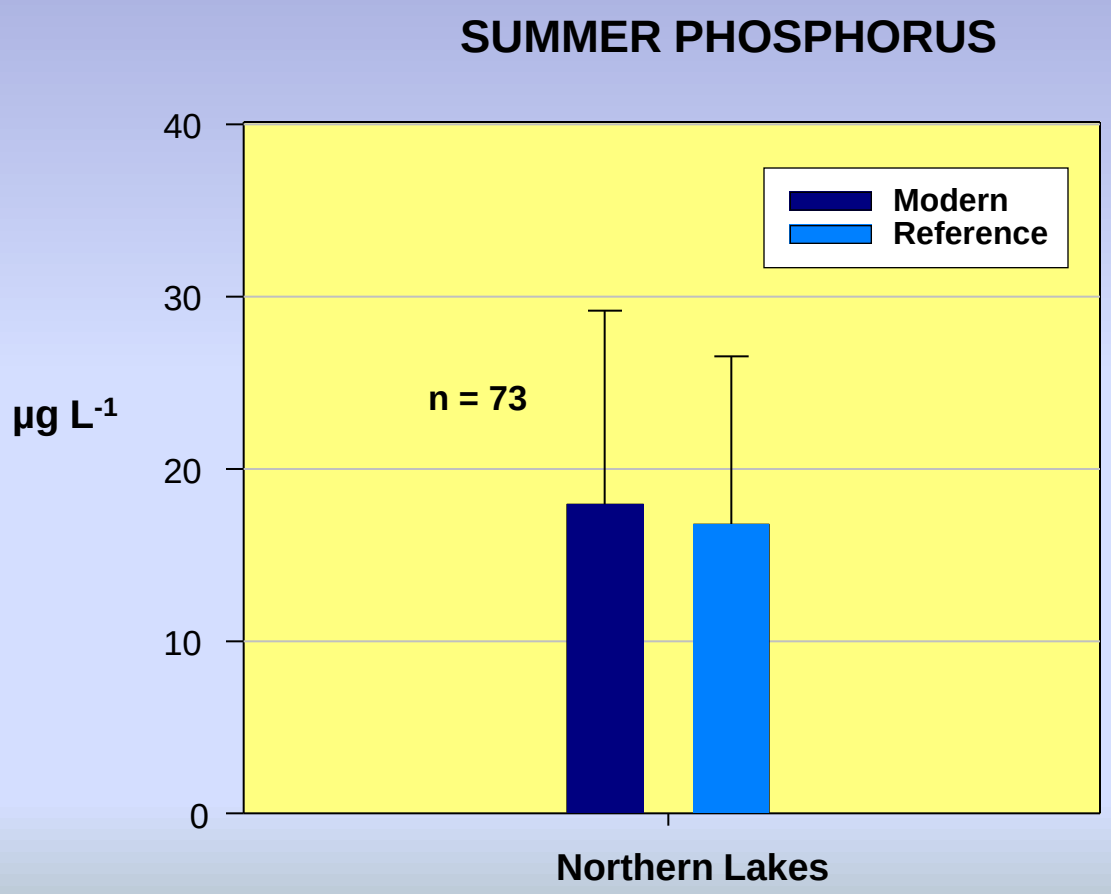
Shift in the ratio of isoetids to elodeids

1930s: 50/50

2000s: 30/70

Susan Borman and Ray Newman-U. of Minnesota

CHANGE IN PHOSPHORUS



CHANGING WATER LEVELS

Berry Lake, Oconto County

LAKE TYPE: Seepage

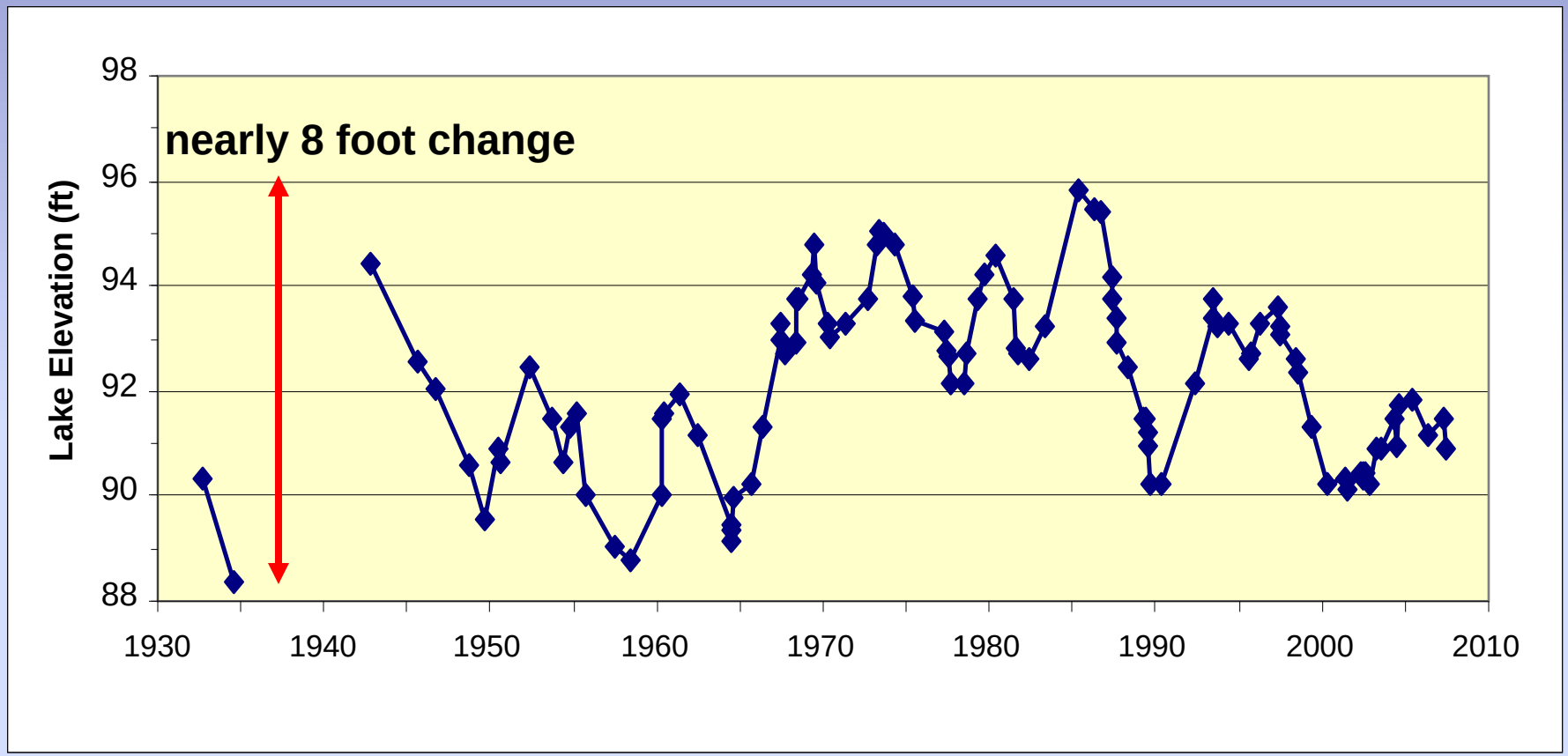
AREA: 81 ha

MAXIMUM DEPTH: 8.2 meters

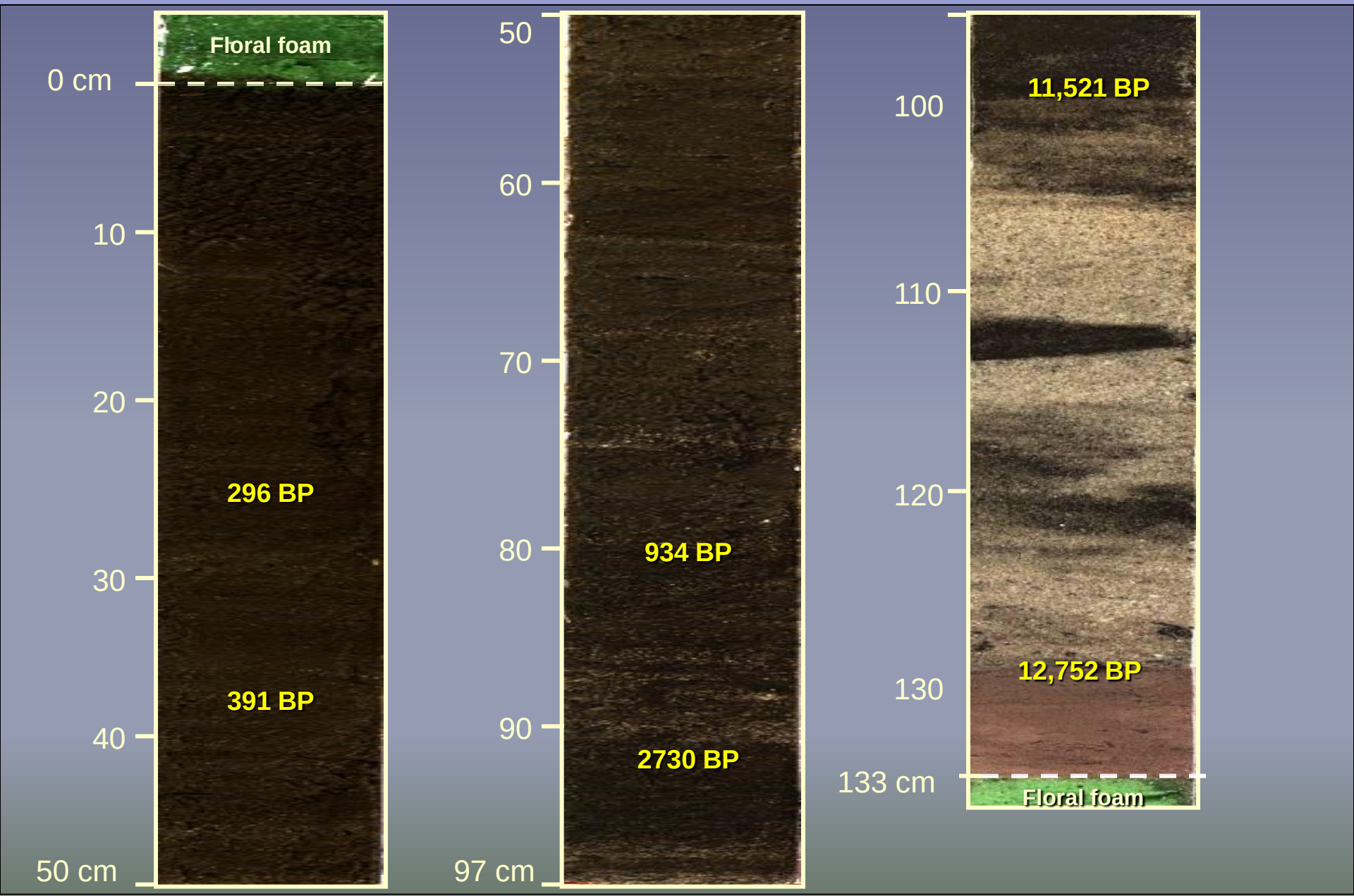
MEAN DEPTH: 2.1 meters

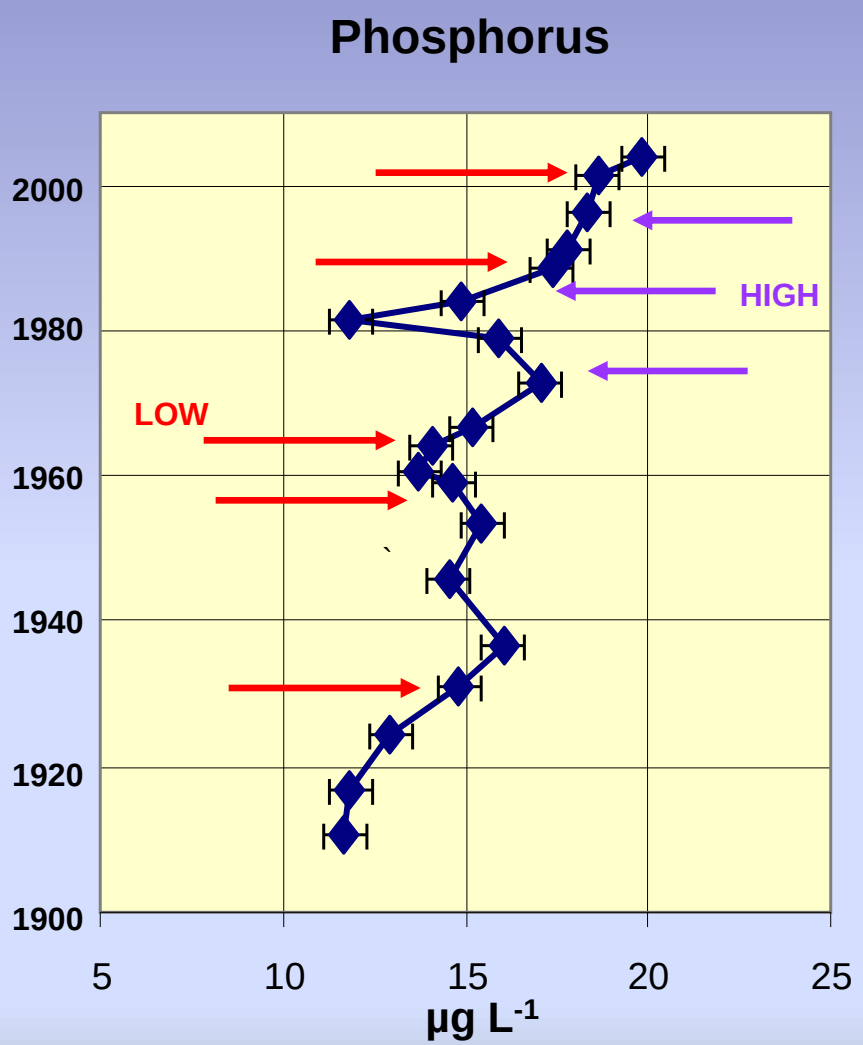
SHORELINE PROPERTIES: 113 or 21 dwellings per kilometer

LAKE LEVEL


nearly 8 foot change
Lake Elevation (ft)
98
96
94
92
90
88
1930
1940
1950
1960
1970
1980
1990
2000
2010

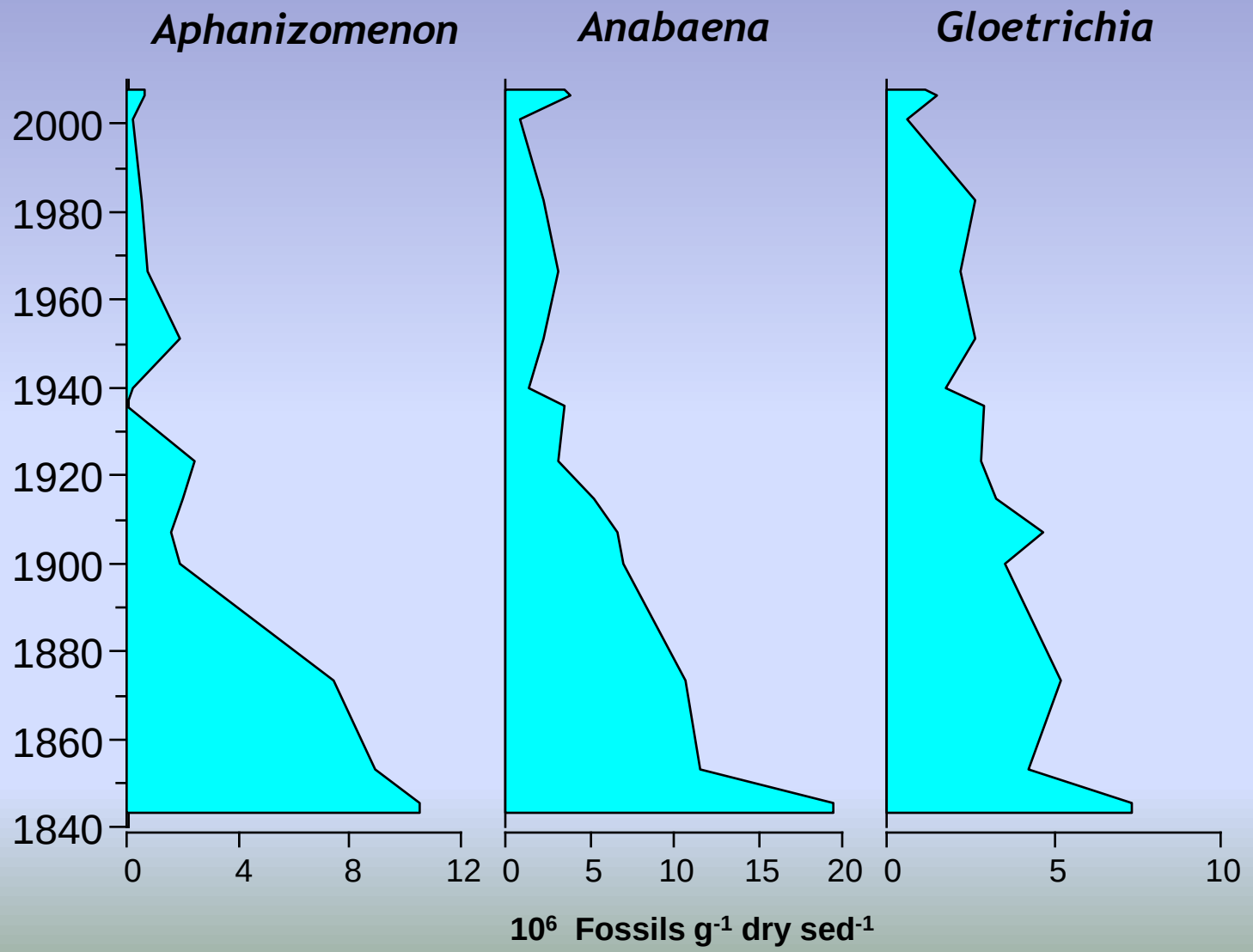
Dr. Samatha Kaplan—
UW Stevens Point



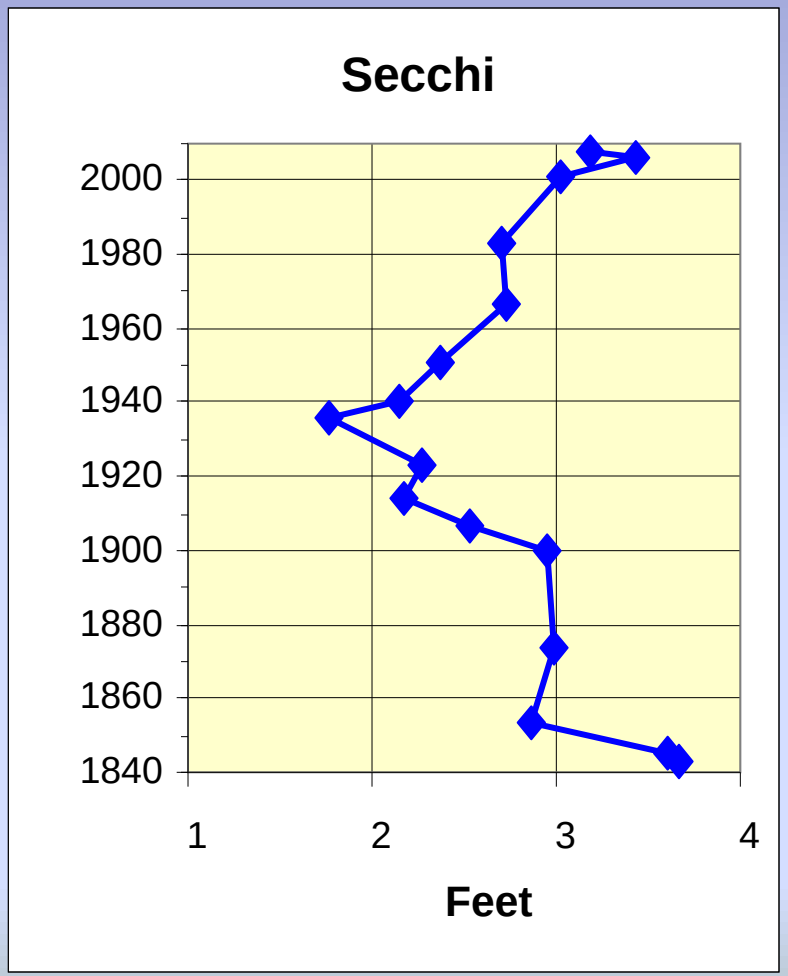

Phosphorus
2000
1980
1960
1940
1920
1900
LOW
HIGH
5
10
15
20
25
µg L-1

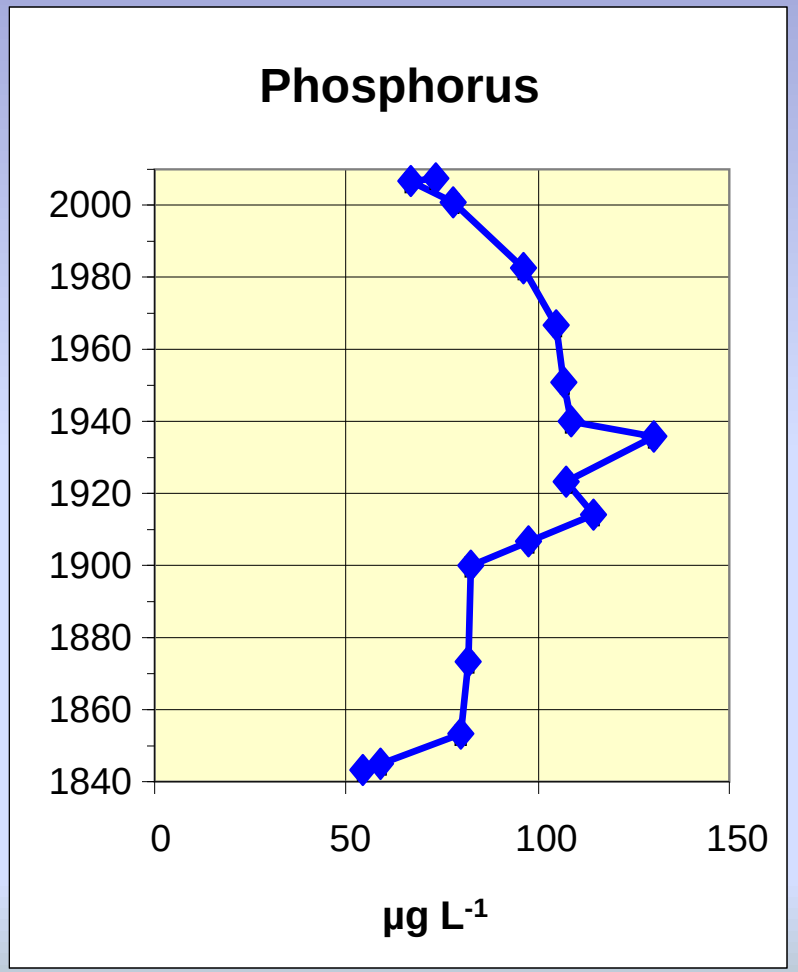

Lake
Chetac

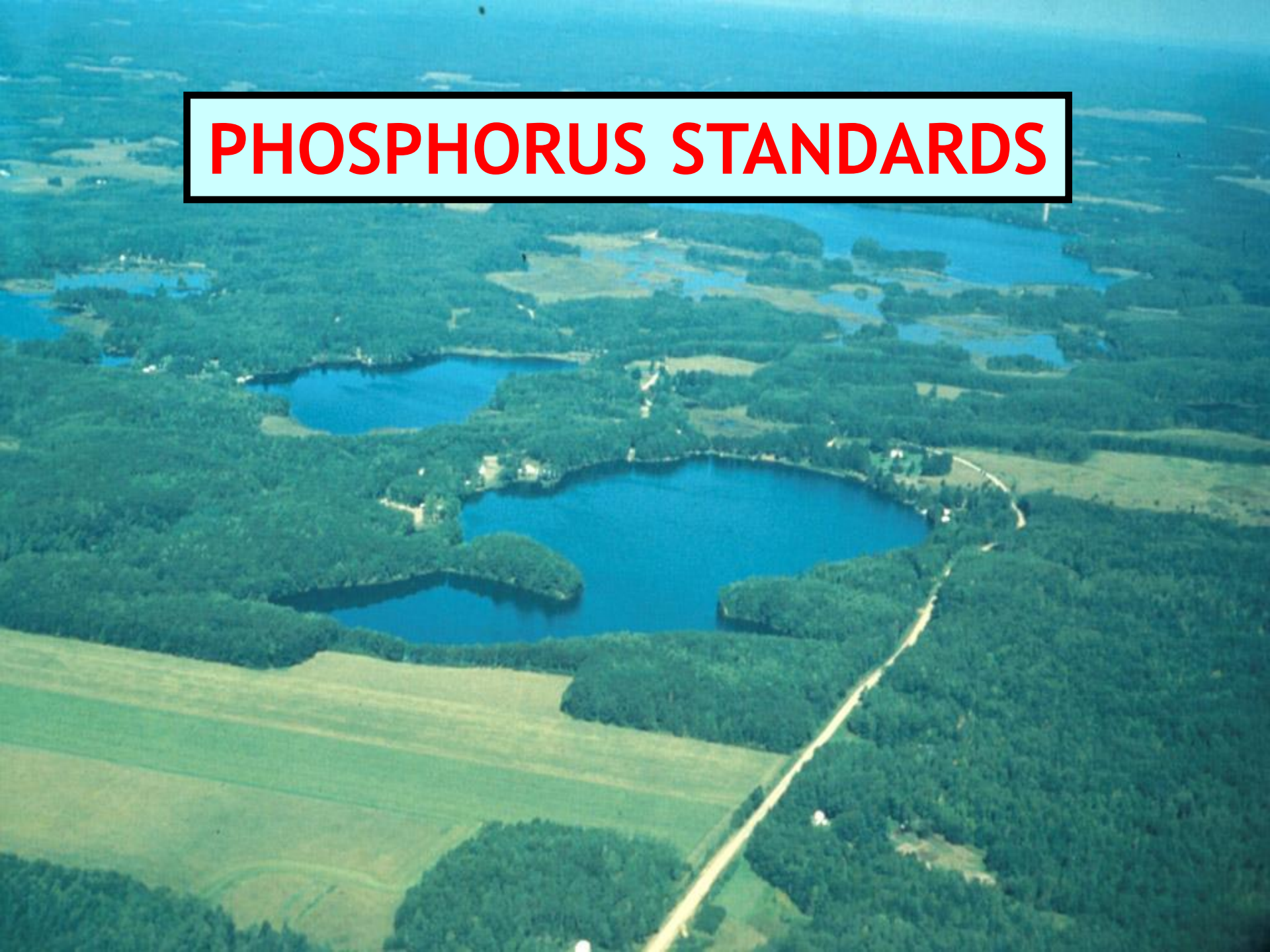
BLUE-GREEN ALGAE



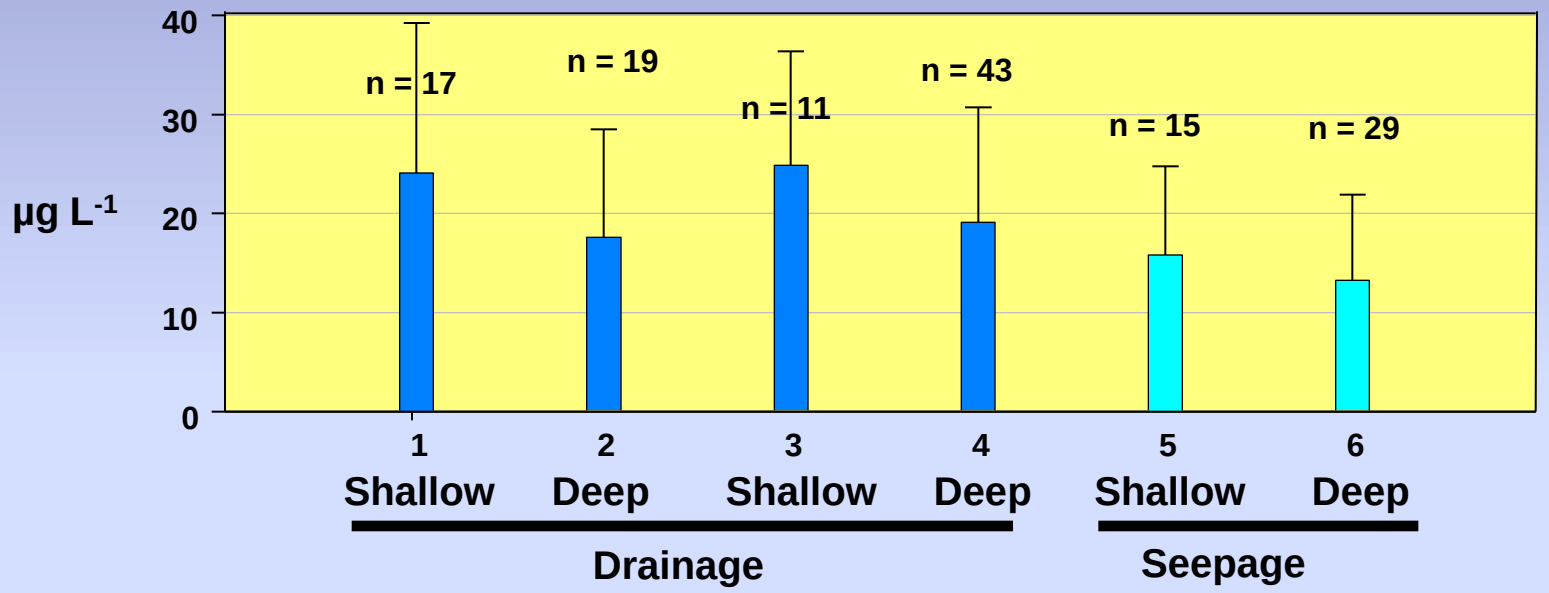
LAKE CHETAC


Secchi
2000
1980
1960
1940
1920
1900
1880
1860
1840
1
2
3
4
Feet


Phosphorus
2000
1980
1960
1940
1920
1900
1880
1860
1840
0
50
100
150
µg L-1


PHOSPHORUS STANDARDS

SUMMER PHOSPHORUS



CLASS	REFERENCE	75TH PERCENTILE
1	24	**30**
2	18	**20**
3	25	**30**
4	19	**20**
5	16	**17**
6	13	**15**

SUMMARY

- Many lakes with significant agriculture in their watersheds have experienced a reduction in soil erosion during the last 30 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.

- With a change in our climate - watershed landuse will have the greatest impact on nutrients.

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?

LAKETIDES

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

QUESTIONS?