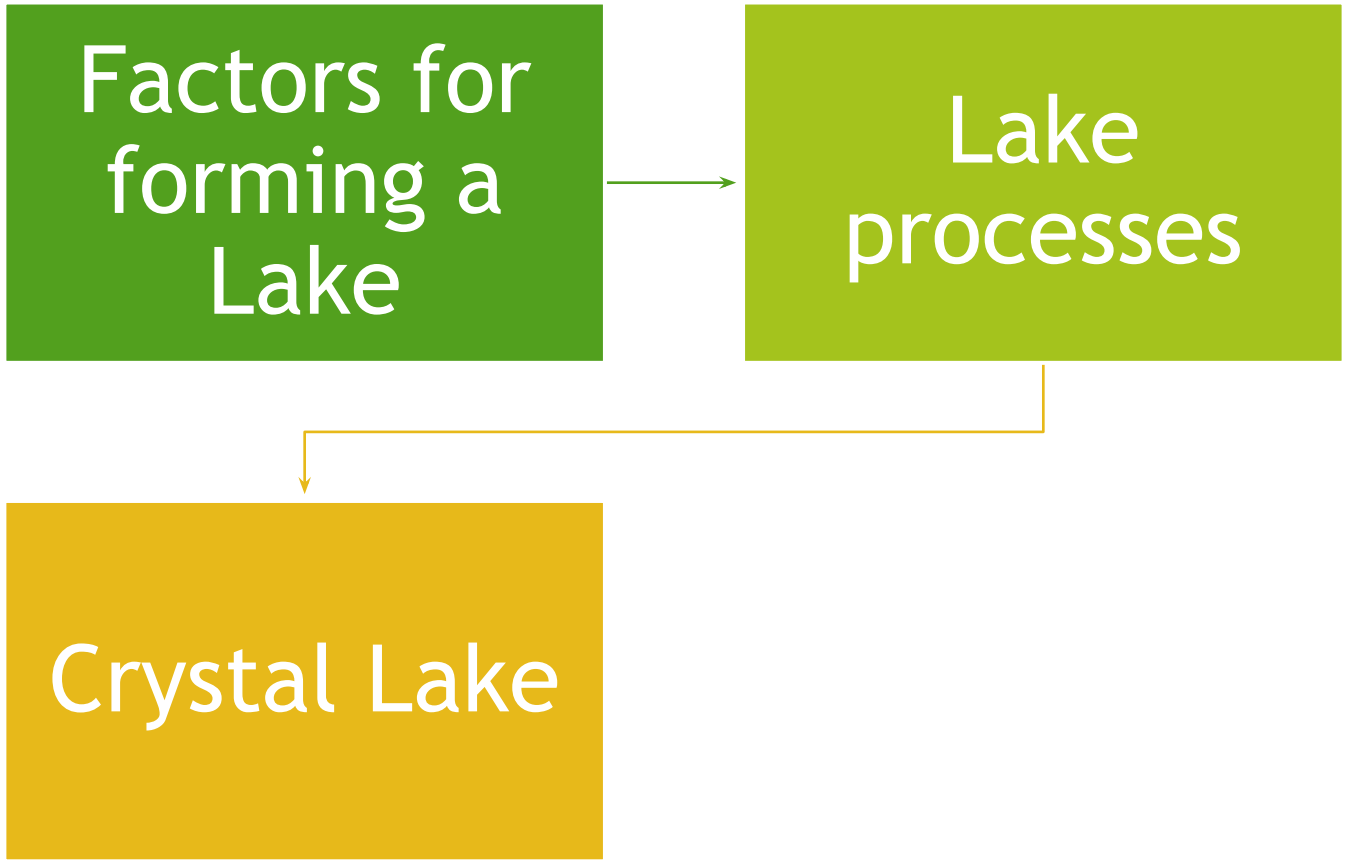
Crystal Lake: Past, Present and Future?

Photo courtesy of David Doud

Defining a Lake environment



I. Factors for forming lakes

A. Climate (Long and Short Term)
- Cold ▫ Warm ▫ Hot
- Wet ▫ Dry
- Change in Climate over time

B. Terrain
- Steep ▫ Flat
- Natural depressions
  - ✔ Weathering and Erosion
  - ✔ Tectonics

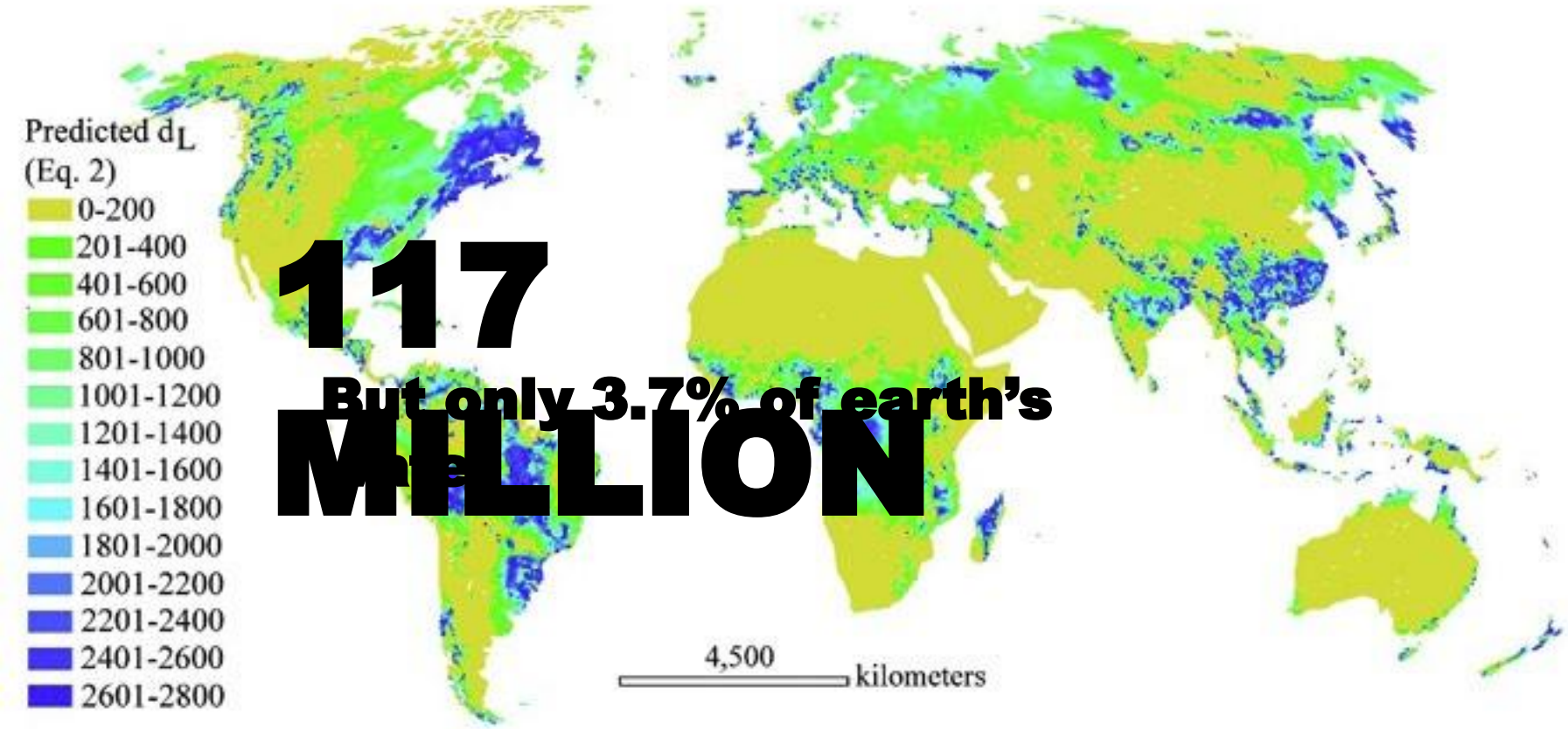
C. Interactions between Climate and Terrain
- Source of water
  - ✔ Rain (direct and/or indirect), Ice, Groundwater

D. Human intervention ▫ Dams

Crystal Lake is the product of all these factors to some extent

Examples:

I. Distribution of Lakes



117 MILLION

But only 3.7% of earth's

How many lakes are there in the world?

II. Origin of Lakes by Earth Processes

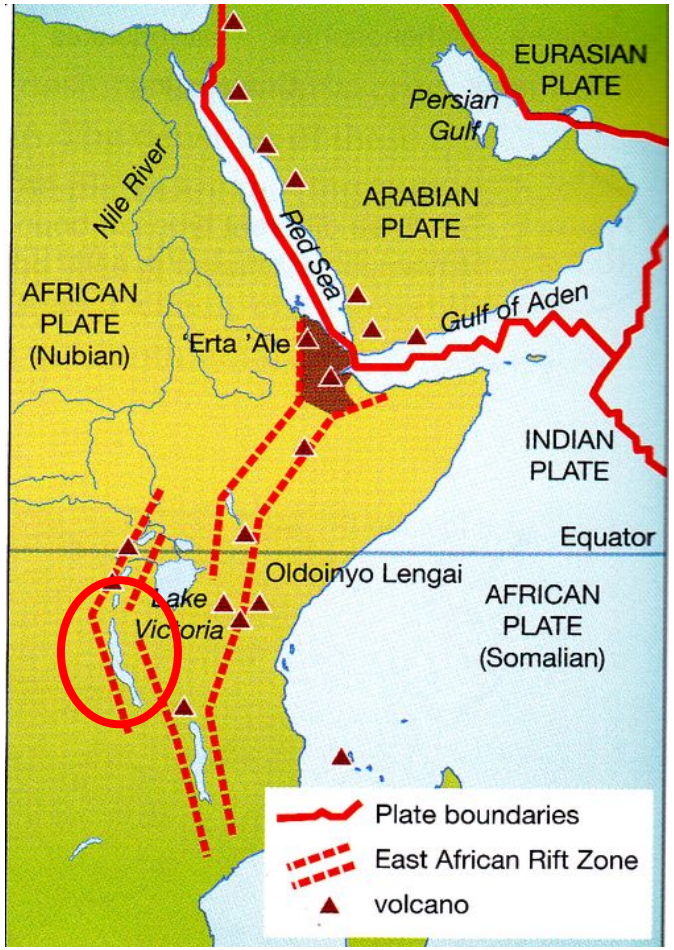
A. River Fed

e.g. Caspian Sea

- World's largest (371,000 km^2)

B. Tectonic Rift

- e.g. Lake Tanganyika
- Narrow but deep



C. Volcanic Calderas

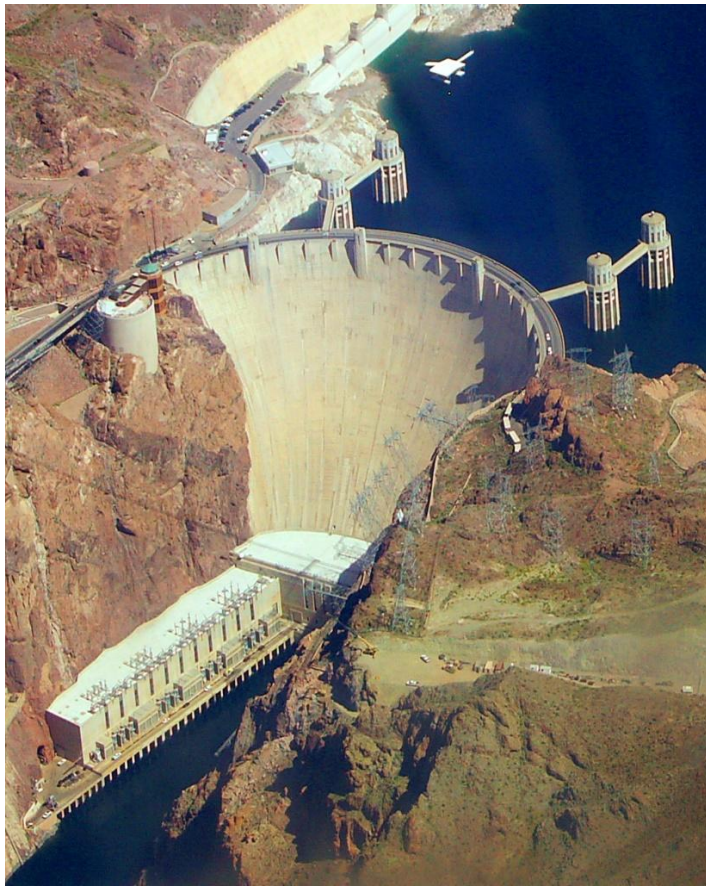
- e.g. Crater Lake
- Snow and rain fed
- 2000+ ft deep

D. Subsidence Lakes

- e.g.Florida Sinkholes
- Limestone dissolution
- Shallow groundwater table

E. Man-Made Lakes

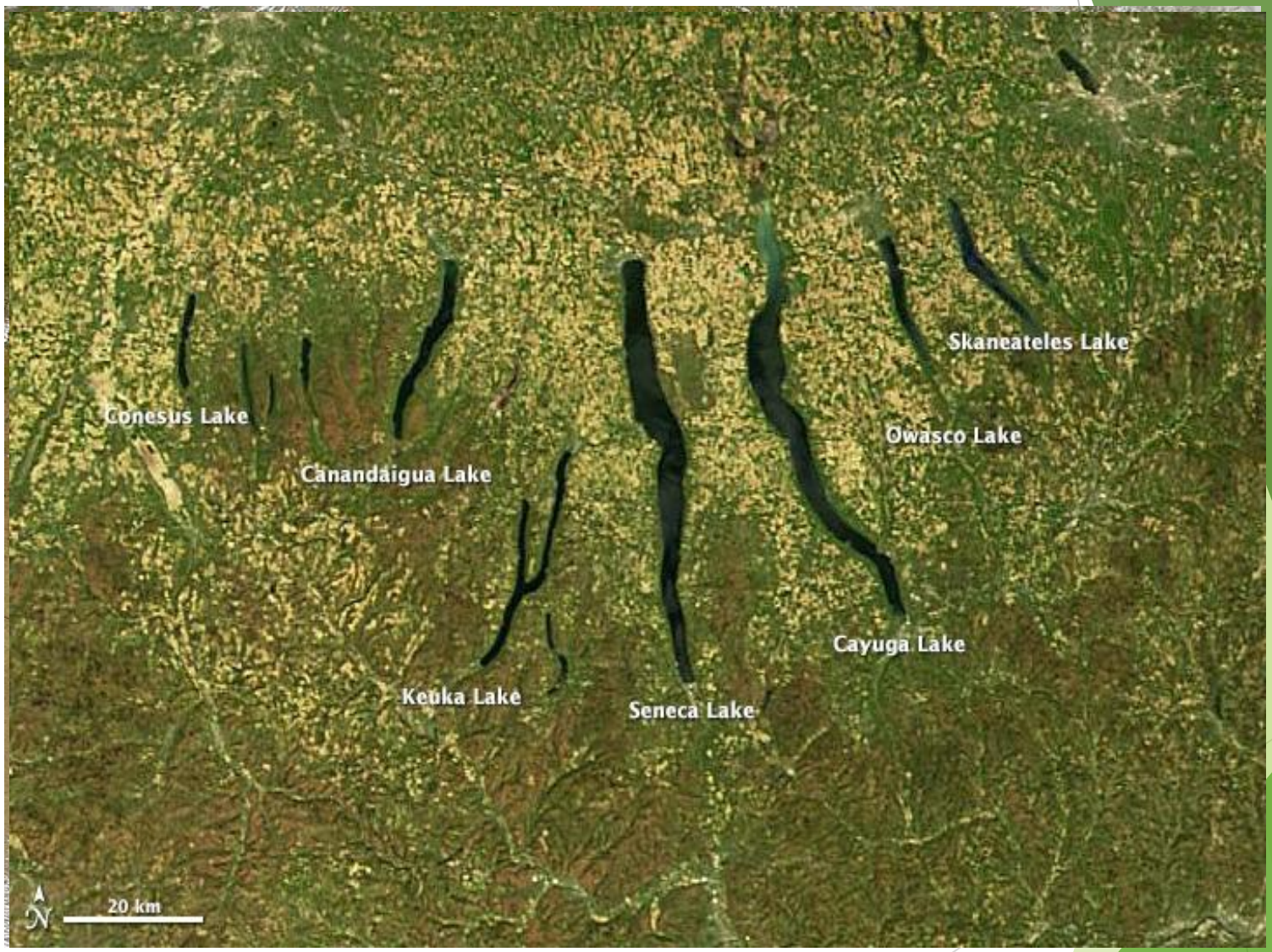
- e.g. Lake Mead
- Flooded river basin



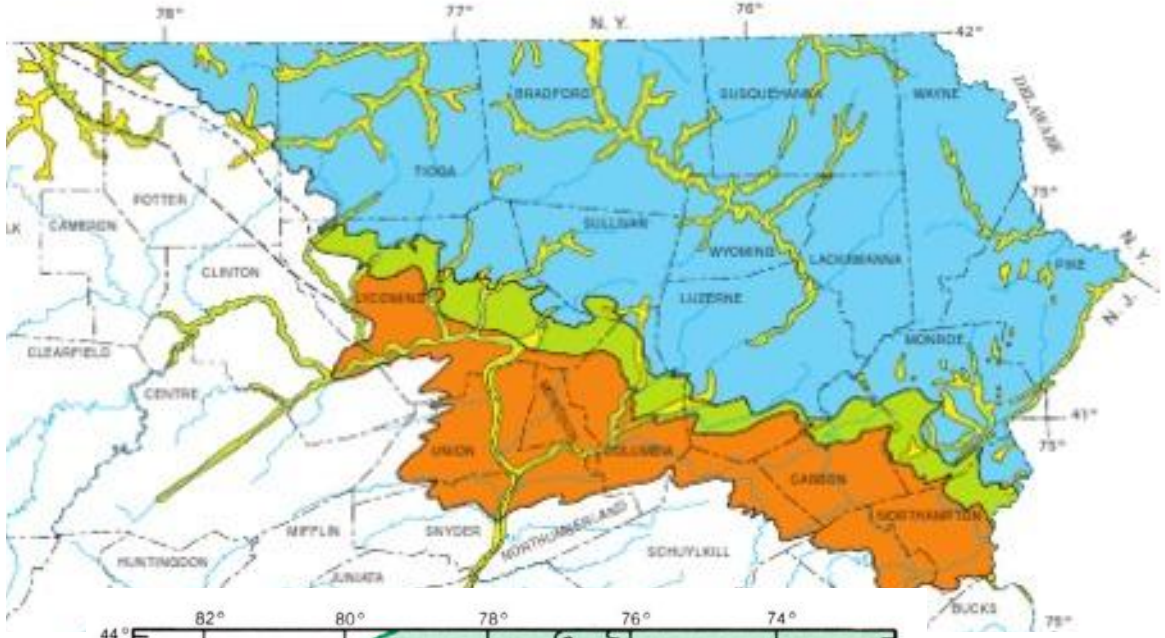
F. Glacial Lakes

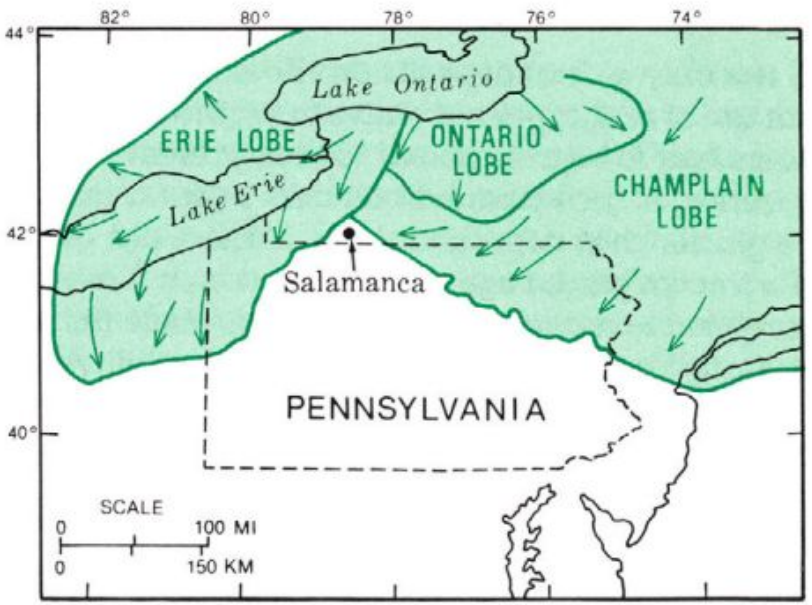
- e.g. US Great Lakes
- Glacial gouging and drainage
- #2, 4, and 5 largest in the world

Closer to “home” – The Finger Lakes



III. FORMATION OF CRYSTAL LAKE





ARCHIBALD POTHOLE ST. PARK

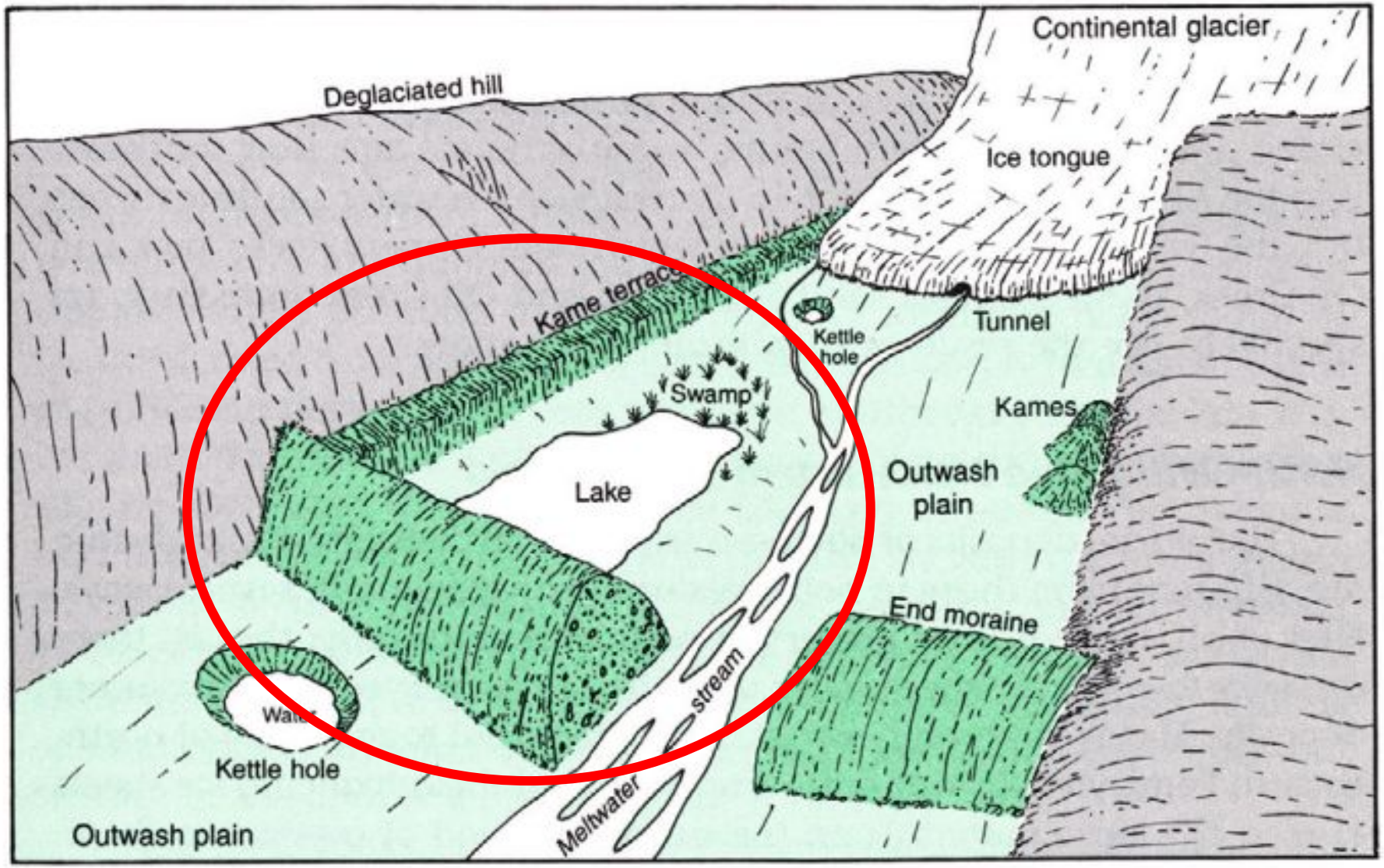
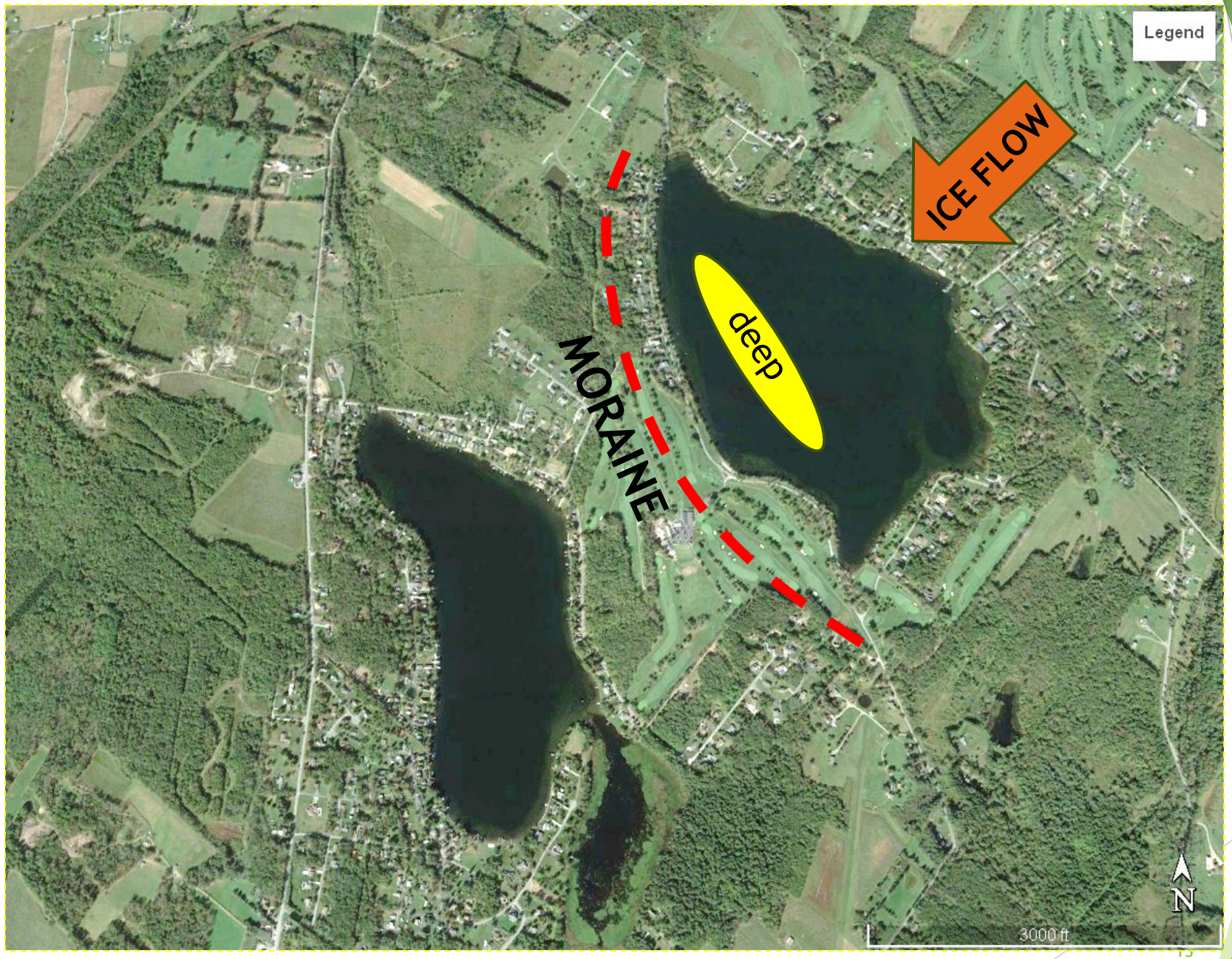
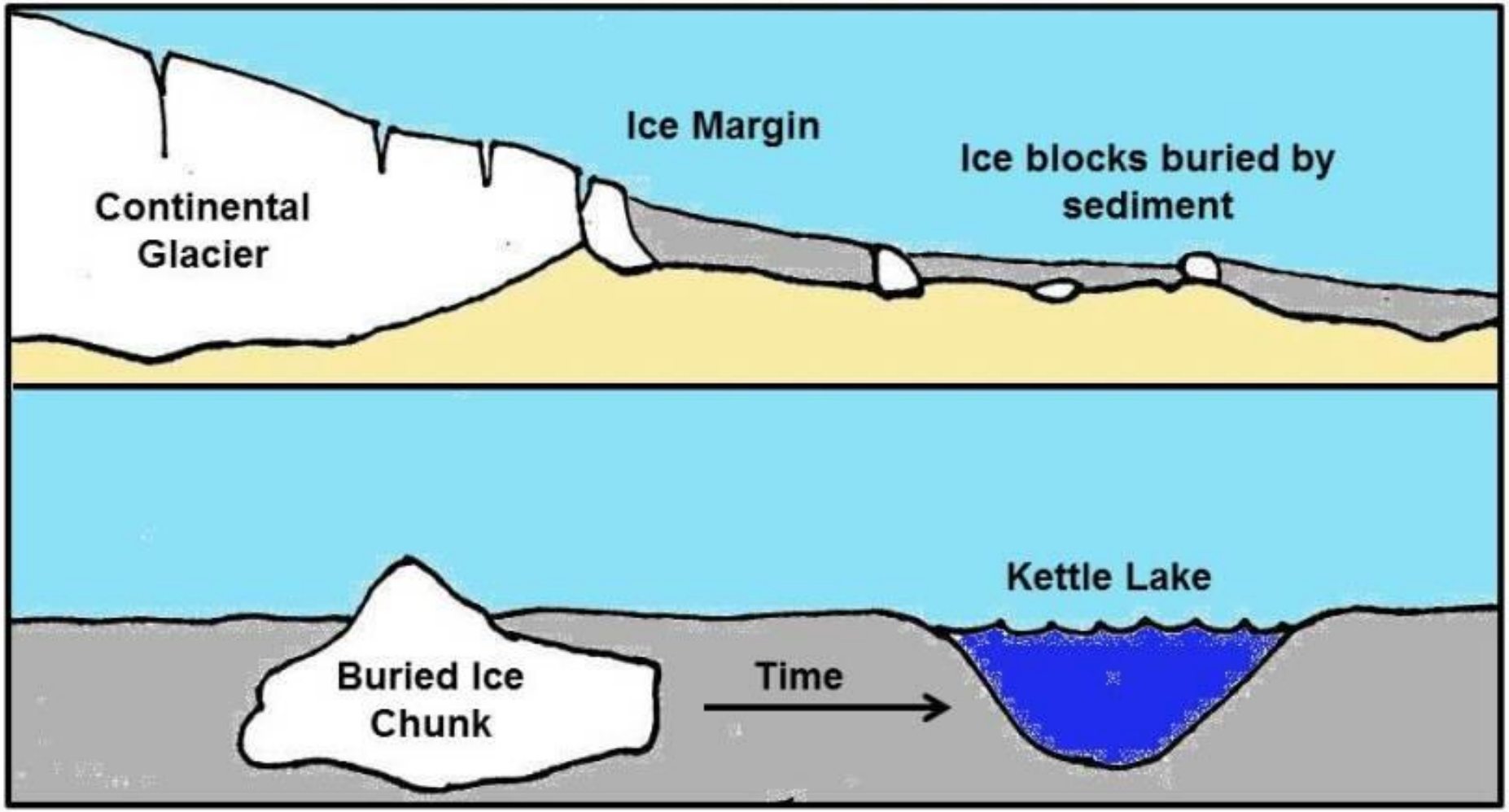


Diagram of deglaciation in a valley in northwestern Pennsylvania.


Legend
ICE FLOW
deep
MORAINE
N
3000 ft

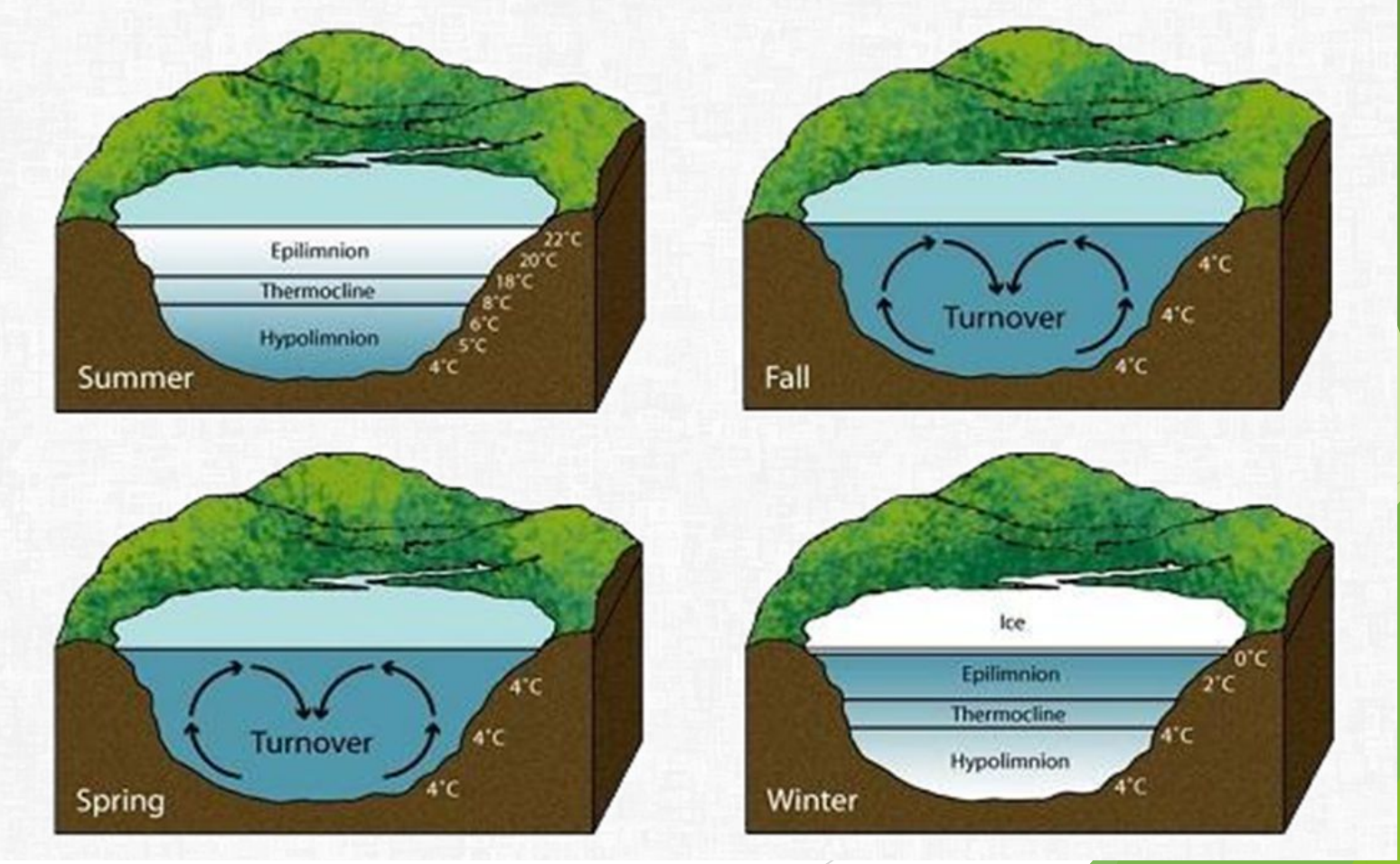
Formation of Kettle Lakes



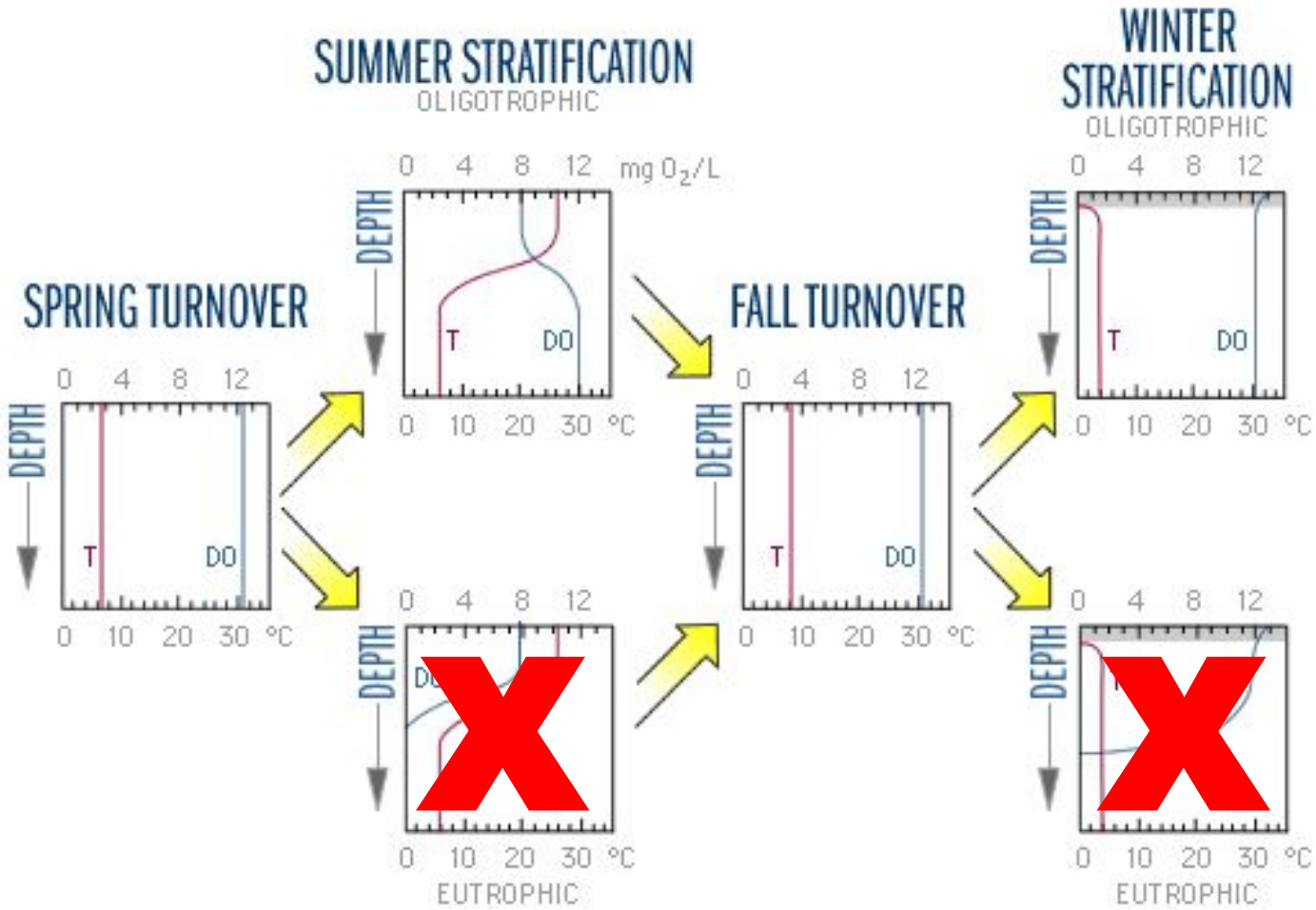
IV. Lake Processes

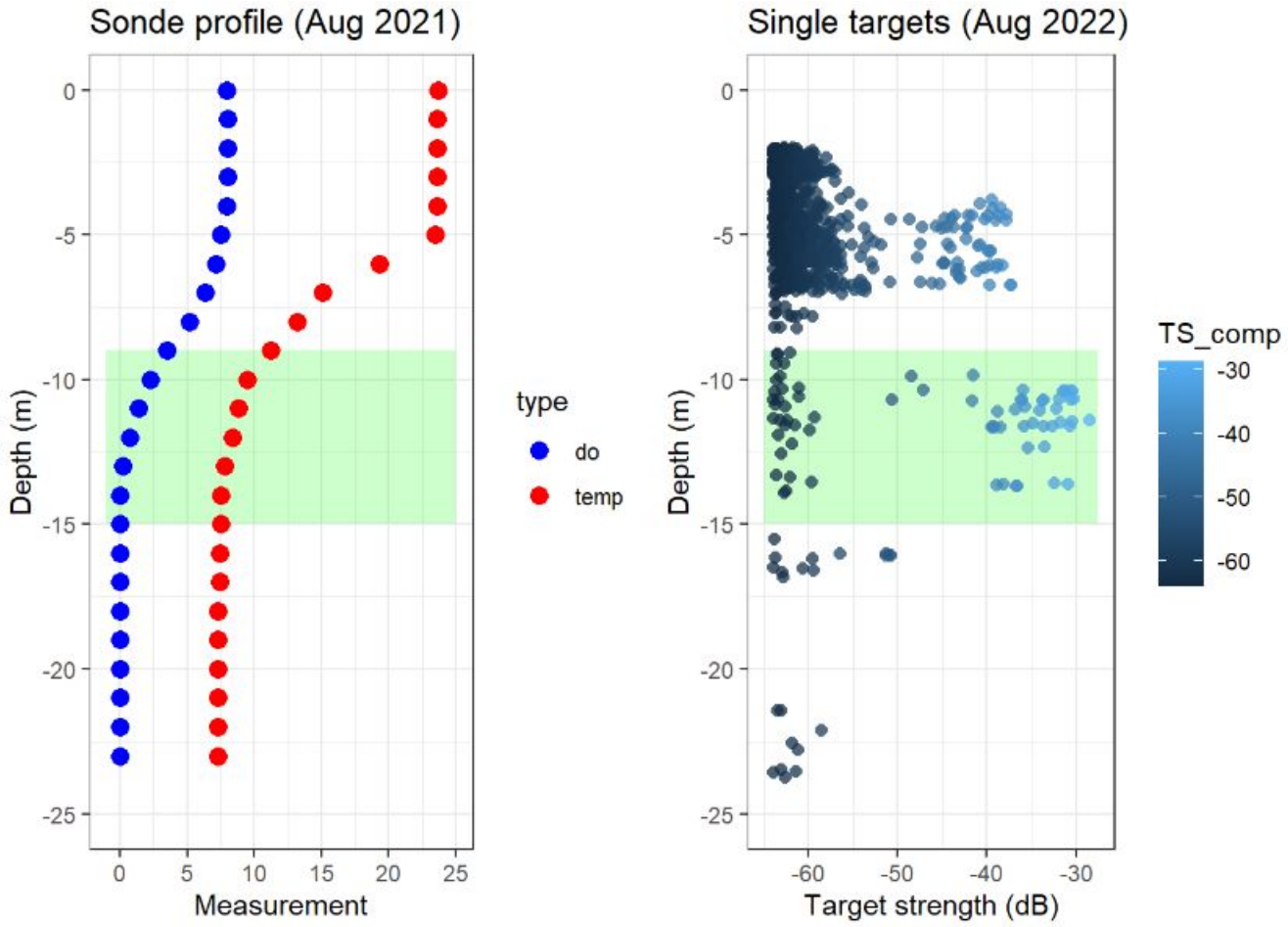
A. Interaction of physical and biological factors
B. Water temperature ▫ stratification/mixing
C. Oxygen availability ▫ oxic/anoxic conditions

Crystal Lake is a DIMICTIC lake (mixed twice per year)

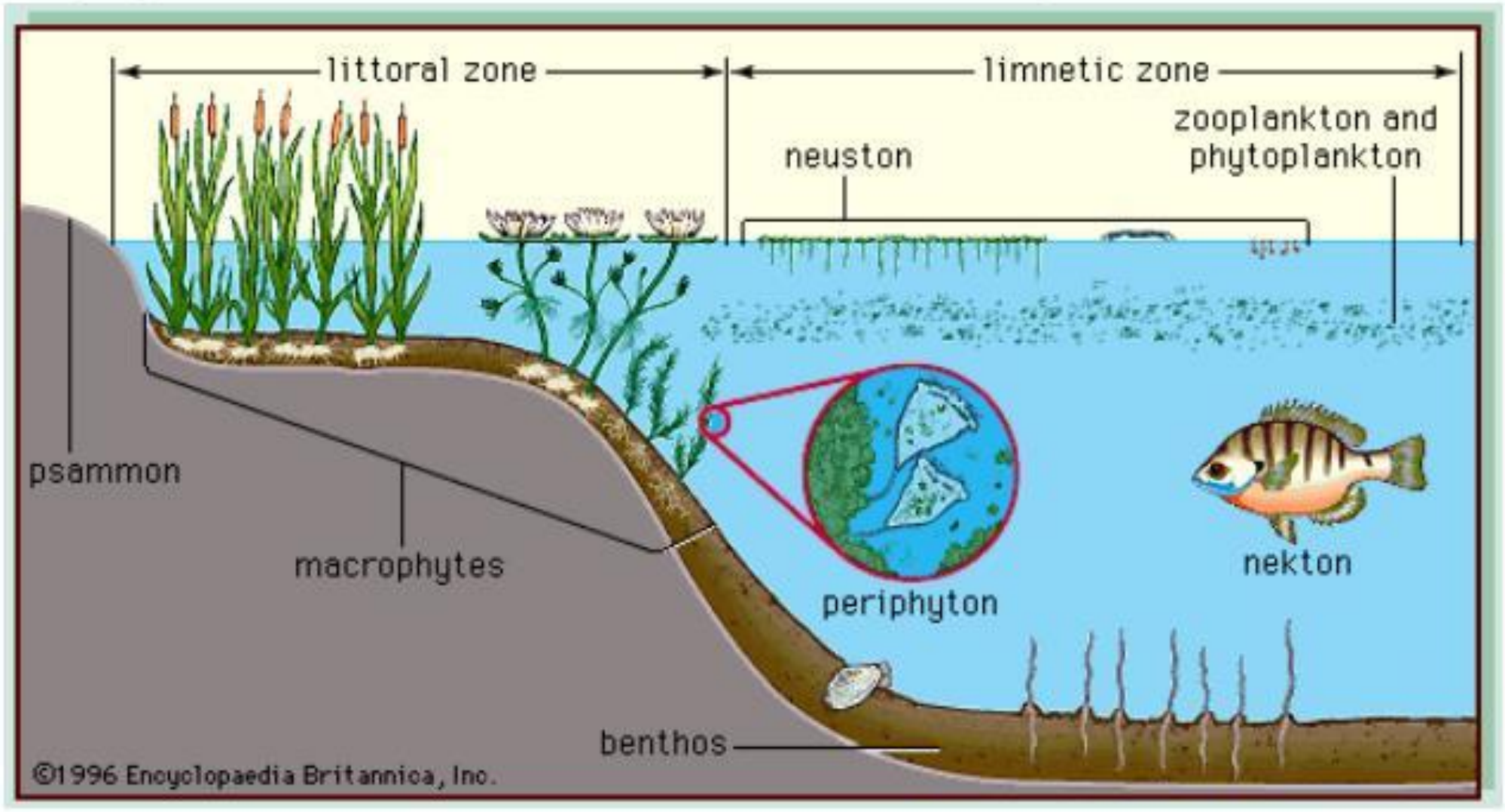


PHYSICAL CHANGES OVER A YEAR





Crystal Lake dissolved oxygen and Temperature from August 2022 (after DuFour and others, 2022)


littoral zone
limnetic zone
zooplankton and
phytoplankton
neuston
psammon
macrophytes
periphyton
nekton
benthos
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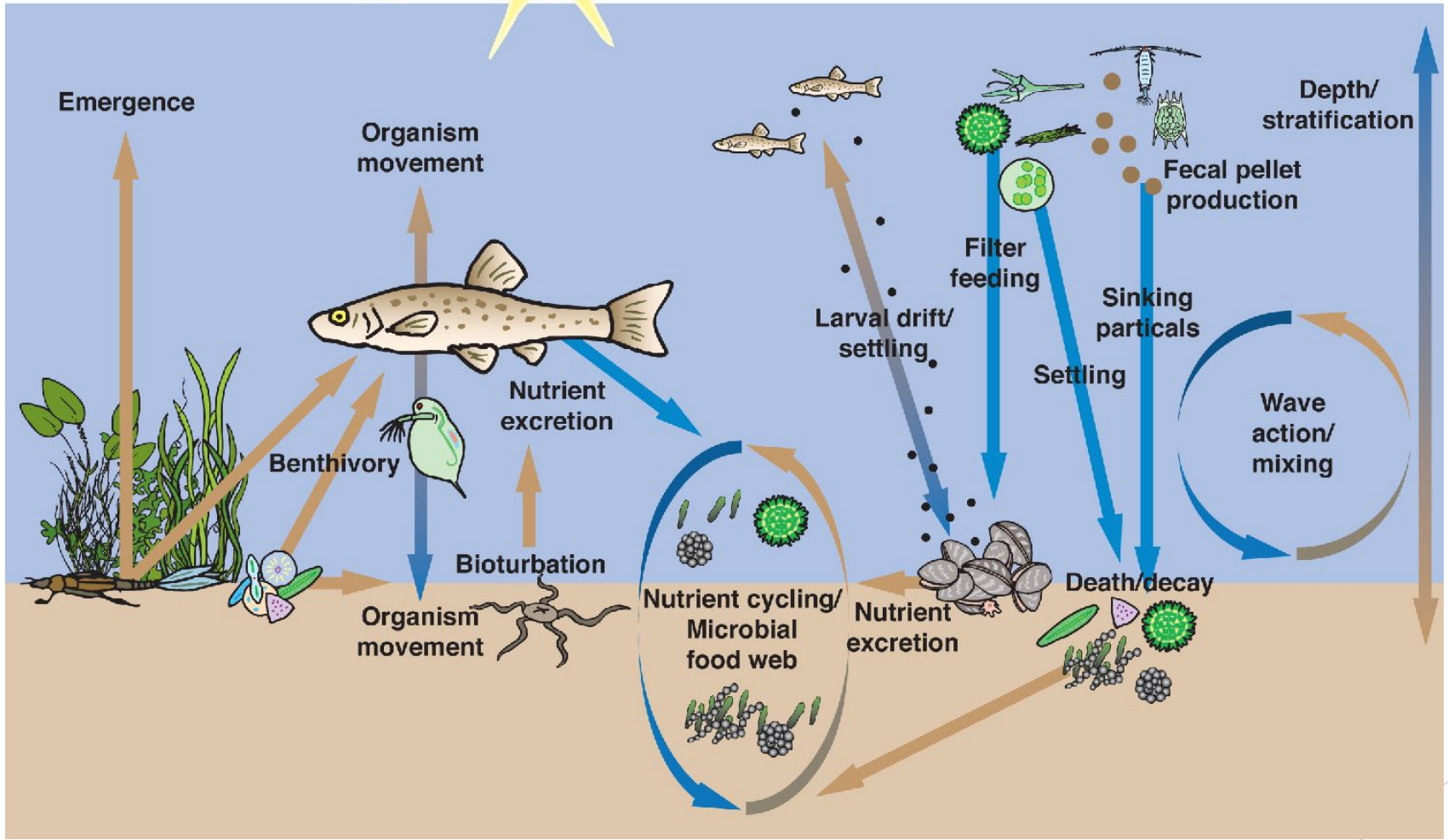
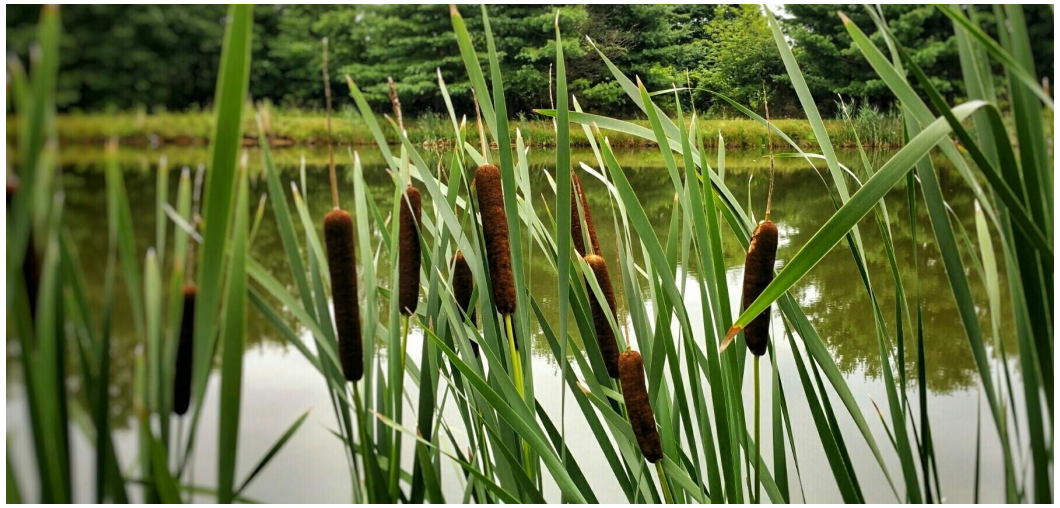
BIOGEOCHEMICAL CHANGES OVER A YEAR



NEKTON (FISH)


· FRESHWATER FISH of PENNSYLVANIA ·
STATE FISH
Brook Trout
Bluegill
American Eel
Redbreast Sunfish
Yellow Bullhead
Eurasian Carp
Fallfish
Black Crappie
Pumpkinseed
Rainbow Trout
Brown Bullhead
Brown Trout
White Sucker
White Perch
Yellow Perch
Rock Bass
Smallmouth Bass
Creek Chub
Largemouth Bass
Green Sunfish
Walleye
Banded Killifish
Channel Catfish
Blacknose Dace
Chain Pickerel

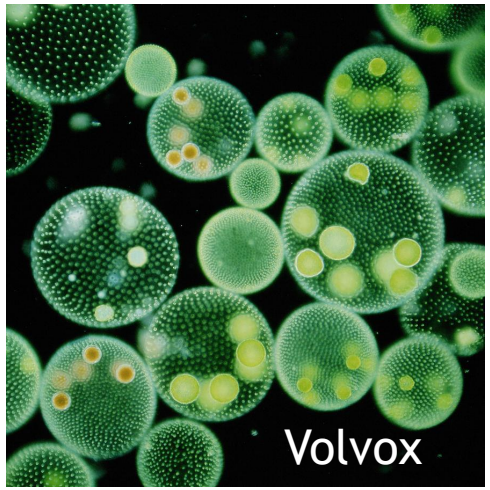
MACROPHYTES

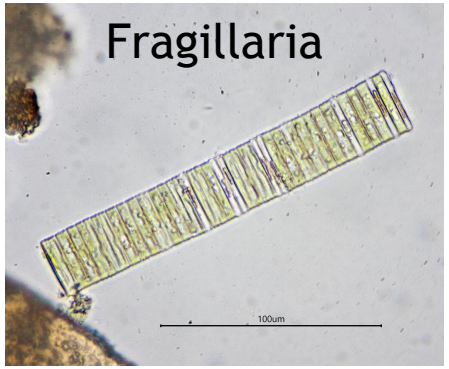


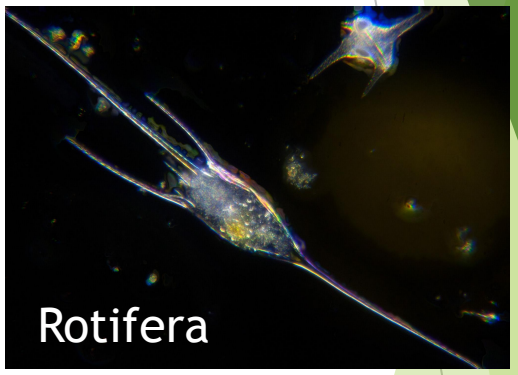
PLANKTON

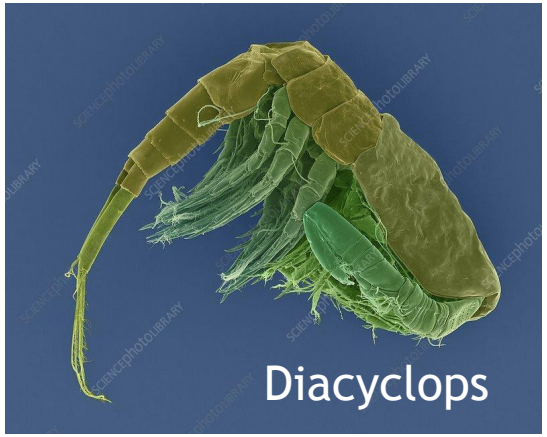
Phyto- = plant

Zoo- = animal





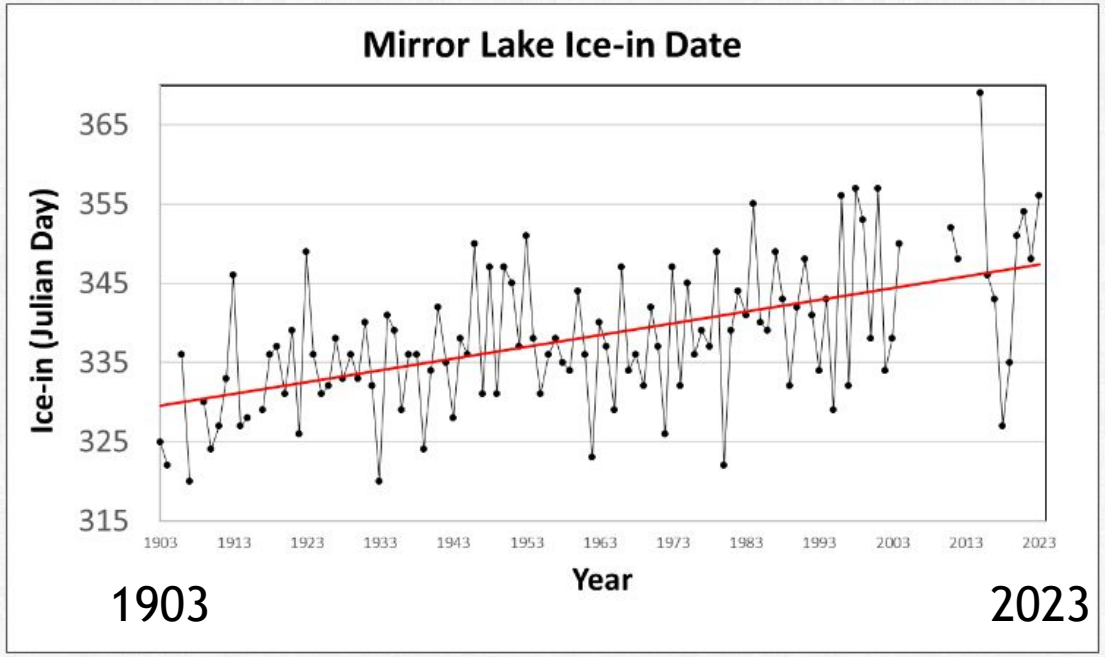




V. THE FUTURE OF CRYSTAL LAKE ???

I. FACTORS
   a. CLIMATE CHANGE
      1. Ice Cover Duration
      2. Summer Temperature/Rain
   b. DEVELOPMENT
      1. Excessive sediment runoff
      2. Nutrients (Fertilizer)
      3. Toxics (Herbicides)
      4. Water Clarity
   c. WATER as a RESOURCE
      5. Water Co. usage

Ice-In

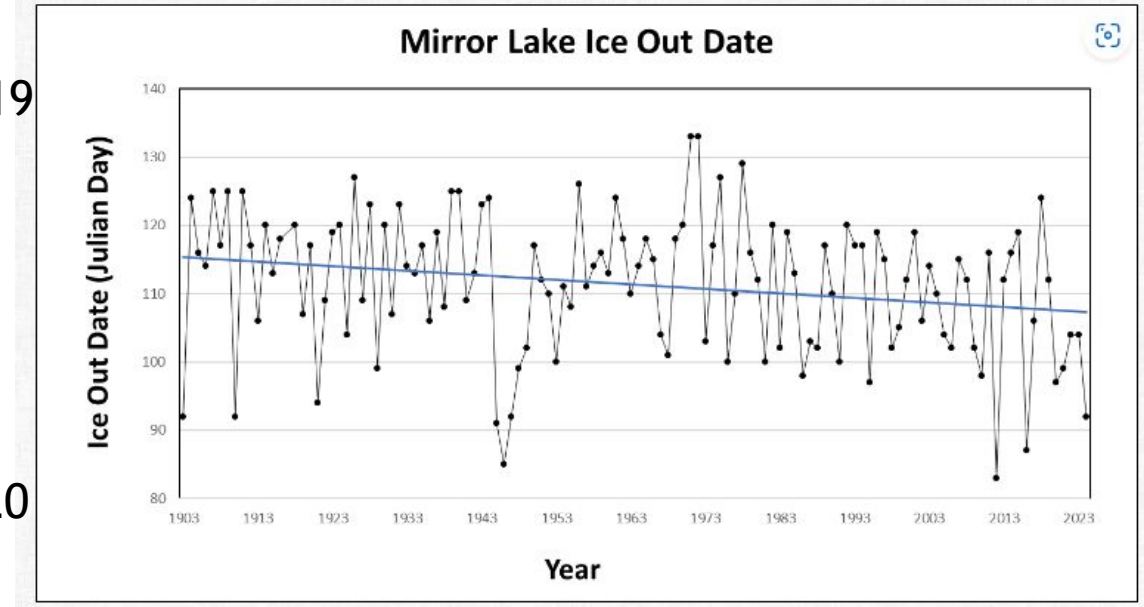


Dec 31

Nov 11

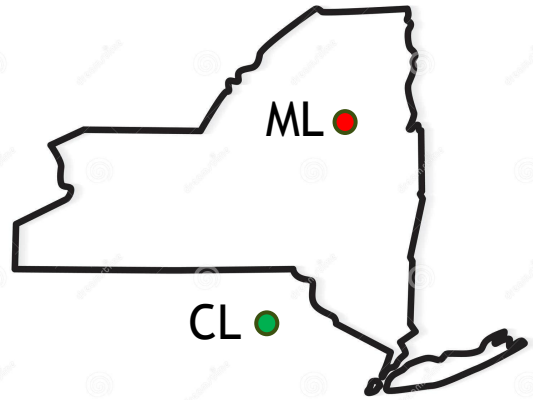
1903

2023



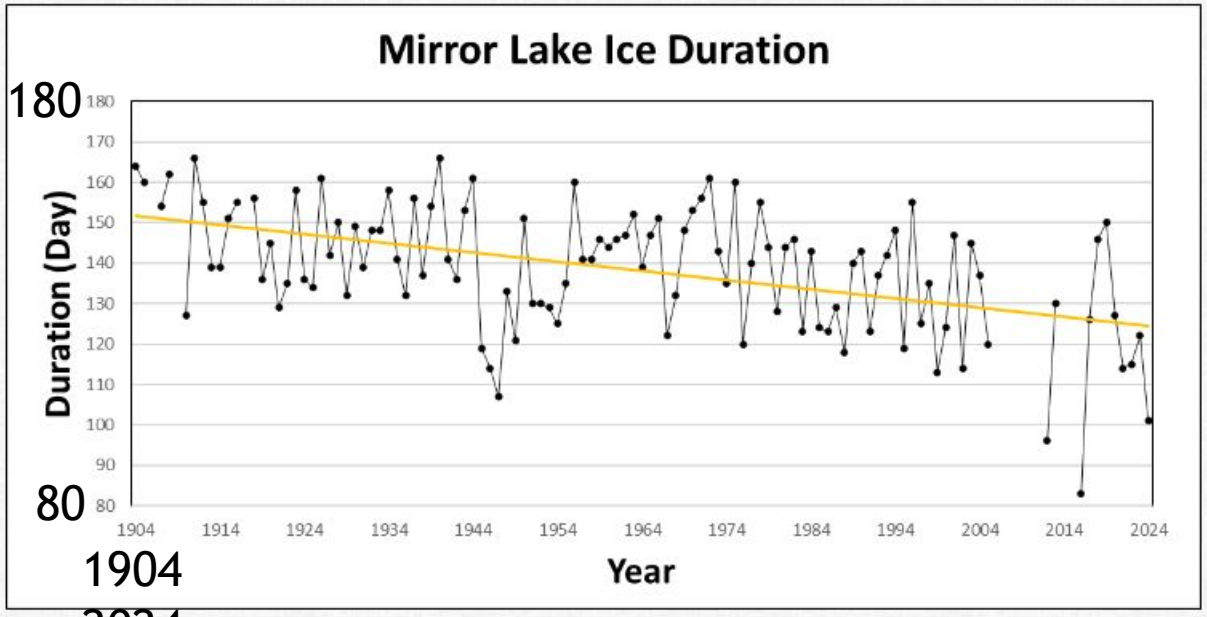
May 19

Mar 20



MIRROR LAKE, NY ICE RECORD

Duration of Ice Cover



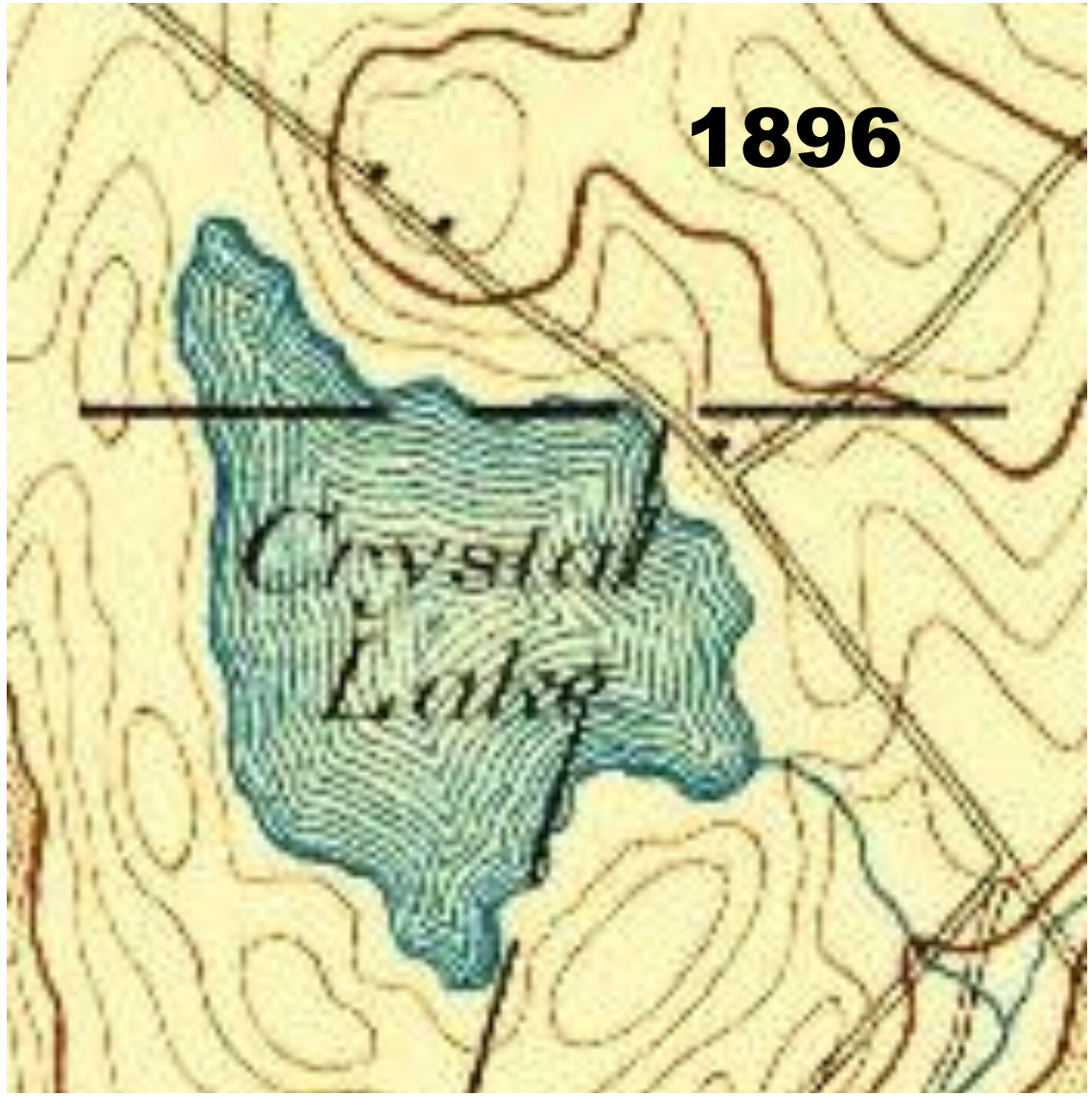
180

80

1904

2024

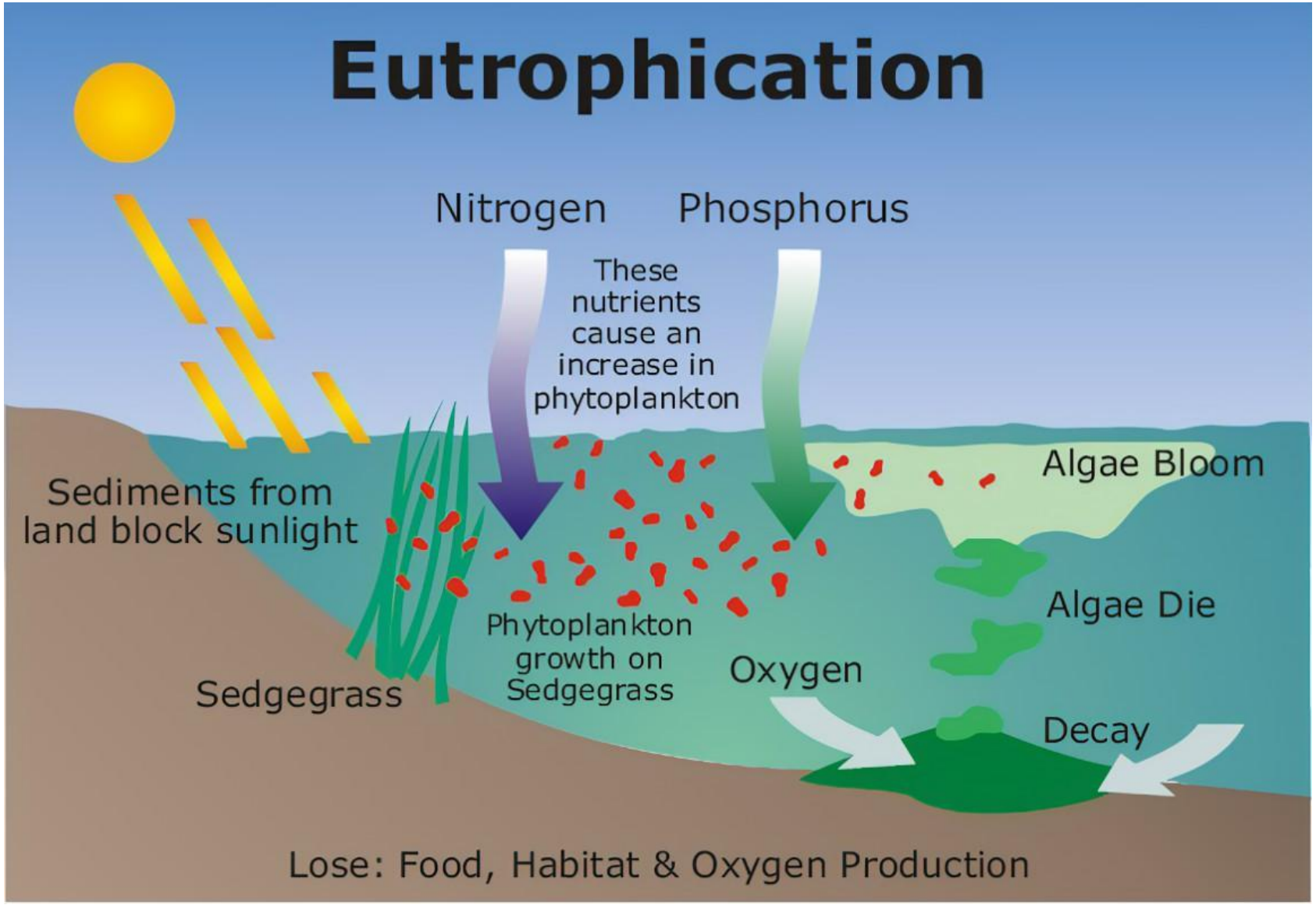
Claim that the Lake has been raised three times (1840, 1862, 1899) = 5-6 m



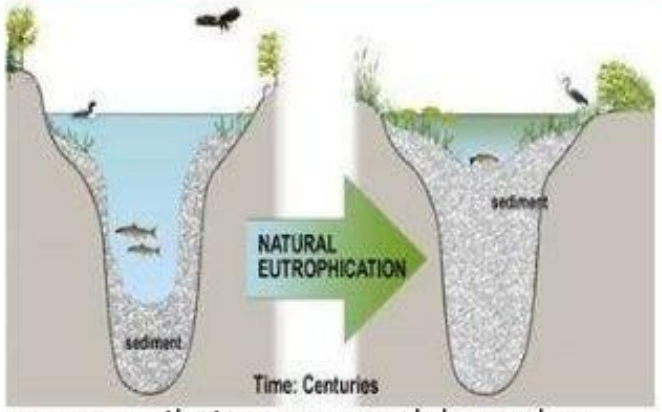
IV. THE FUTURE OF CRYSTAL LAKE ???

I. FACTORS
   a. CLIMATE CHANGE
      1. Ice Cover
      2. Summer Temperature
      3. Water Clarity
   b. DEVELOPMENT
      1. Excessive sediment runoff
      2. Nutrients (Fertilizer)
      3. Toxics (Herbicides)
   c. WATER as a RESOURCE
      1. Water Co. usage

II. Consequences
   = Eutrophication

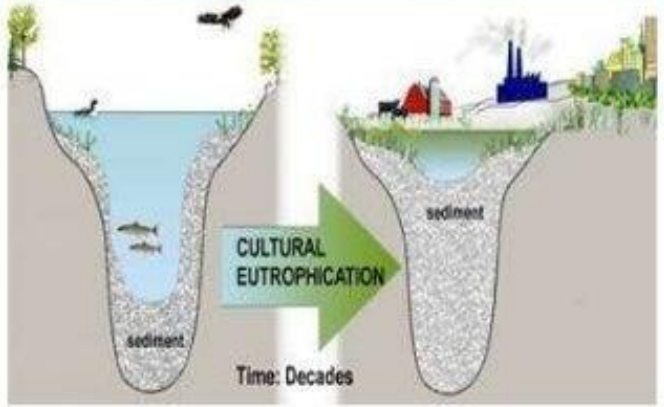


Natural Eutrophication

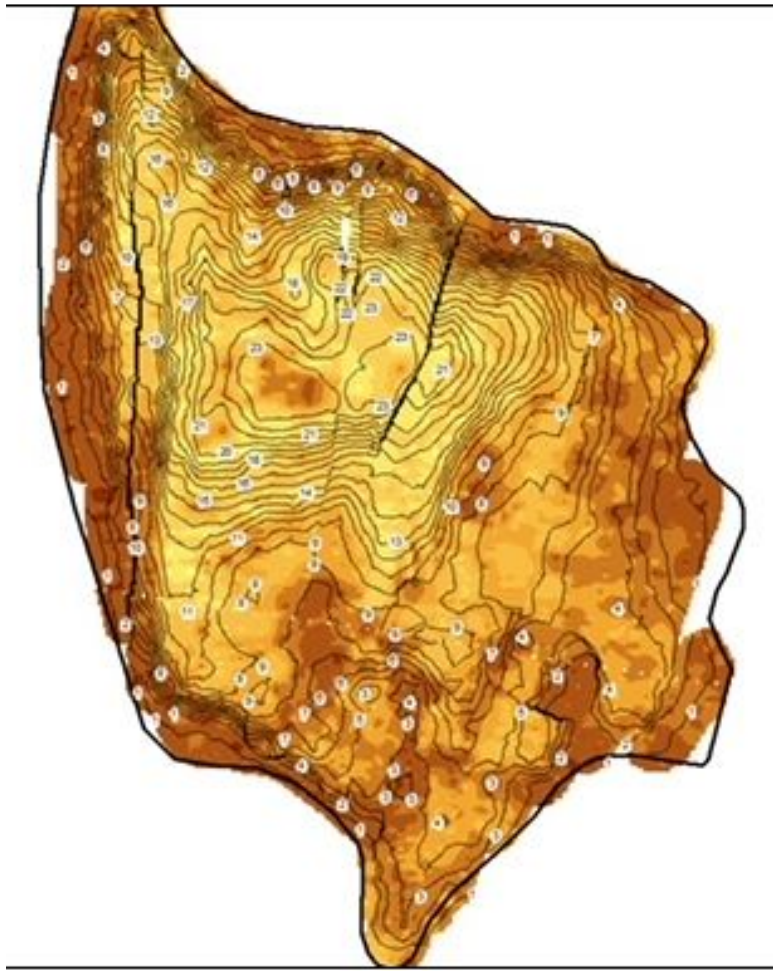


a process that occurs as a lake or river ages over a period of hundreds or thousands of years.

Cultural Eutrophication

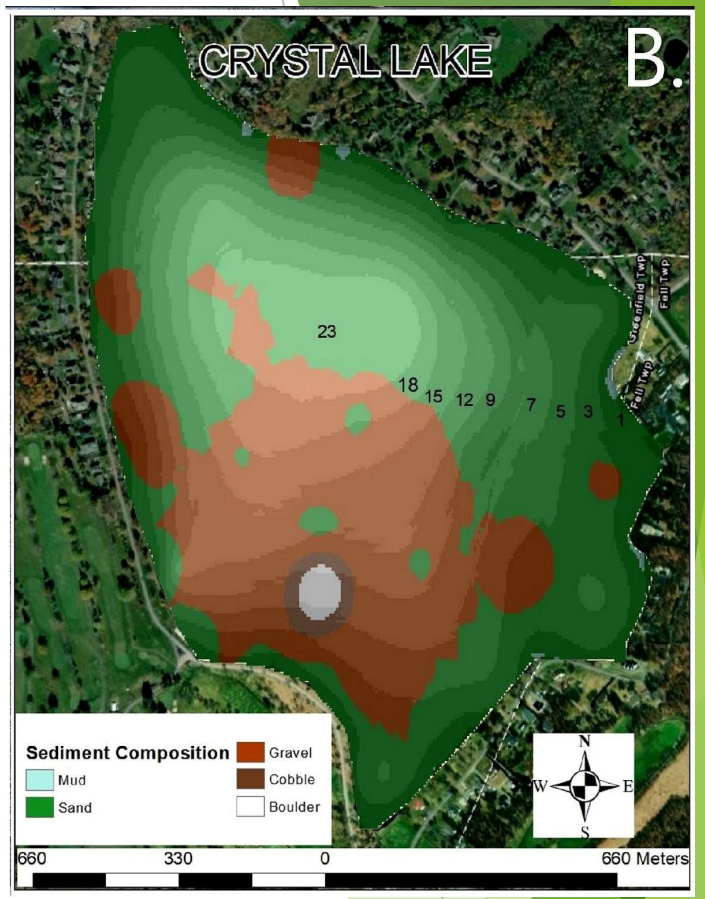


a process that occurs when humans release excessive amounts of nutrients; it shortens the rate of aging to decades.



(Bathymetry courtesy of Aaron Frey, PA Fish and Game Commission)

(after Schmitt and others, 2024)



QUESTIONS