

LIMNOLOGY 101



Courtesy of Lake Partnerships

Wisconsin Department of Natural Resources

Wisconsin Association of Lakes

University of Wisconsin Extension





Wisconsin Lakes



Wisconsin has the 3rd largest concentration of fresh water glacial lakes on the planet.



OVERVIEW

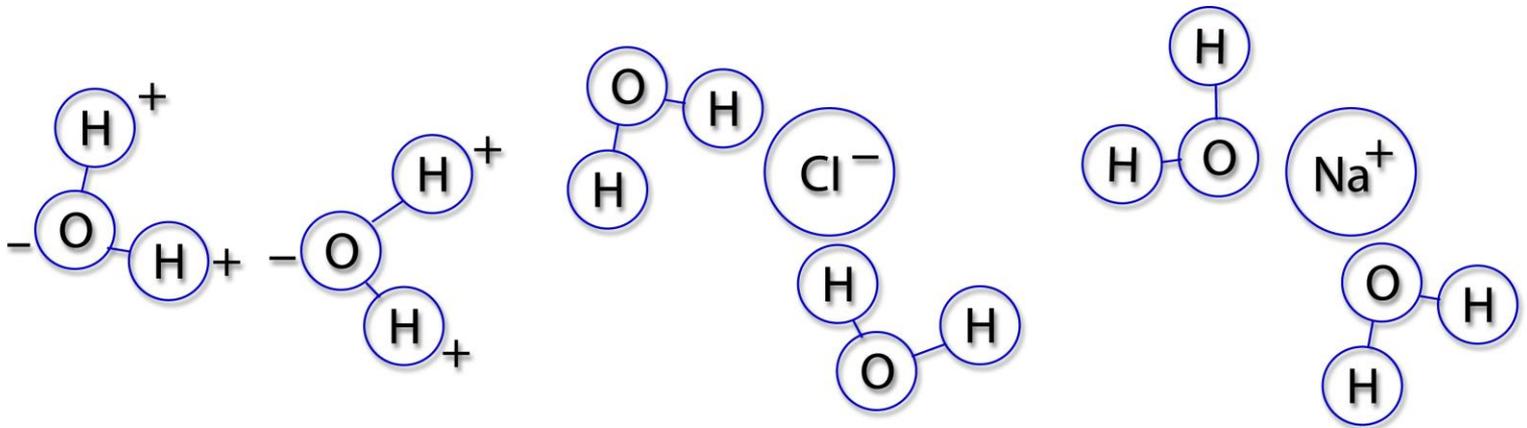
- **Unique Properties of Water**
- **Lake Types**
- **Physical, Chemical, Biological and Habitat Characteristics**
- **Technical Aspects**





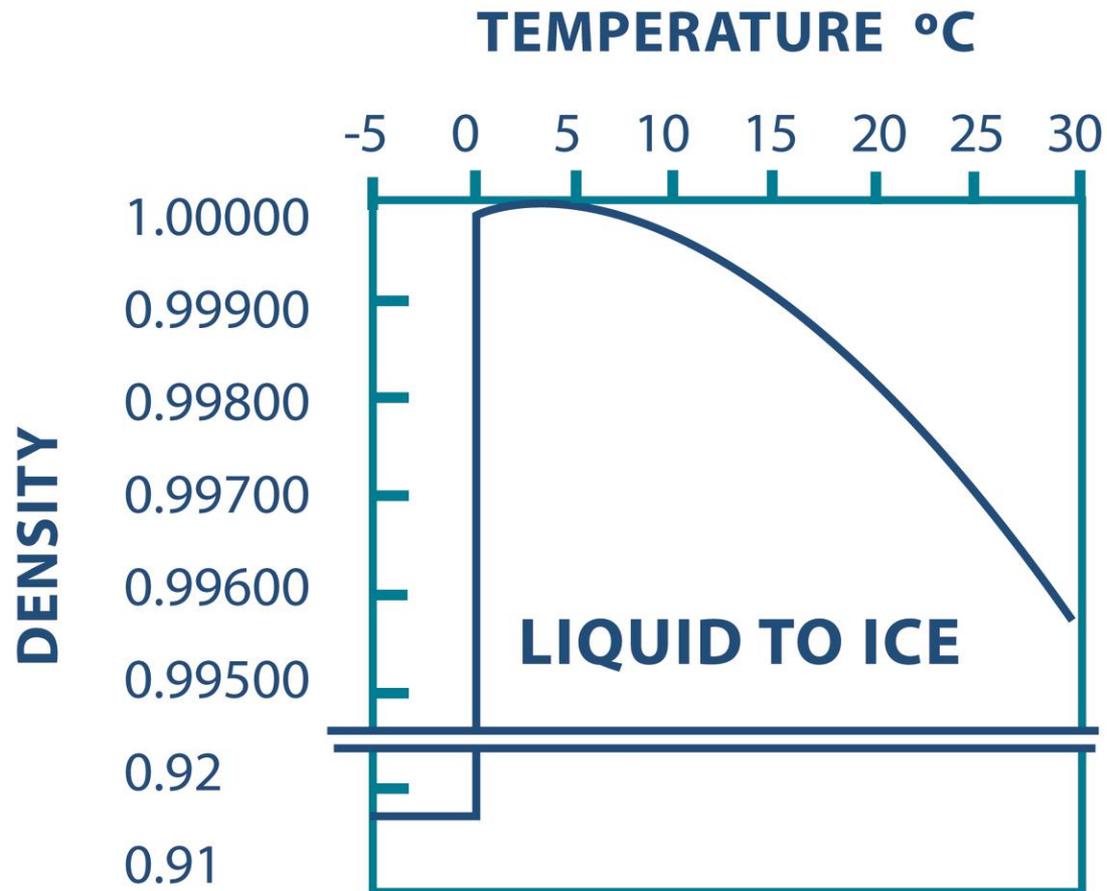
UNIQUE PROPERTIES OF WATER

- Universal Solvent
- Chemical Molecular Structure H_2O
- Greatest Density at $4^{\circ} C$ or $39^{\circ} F$

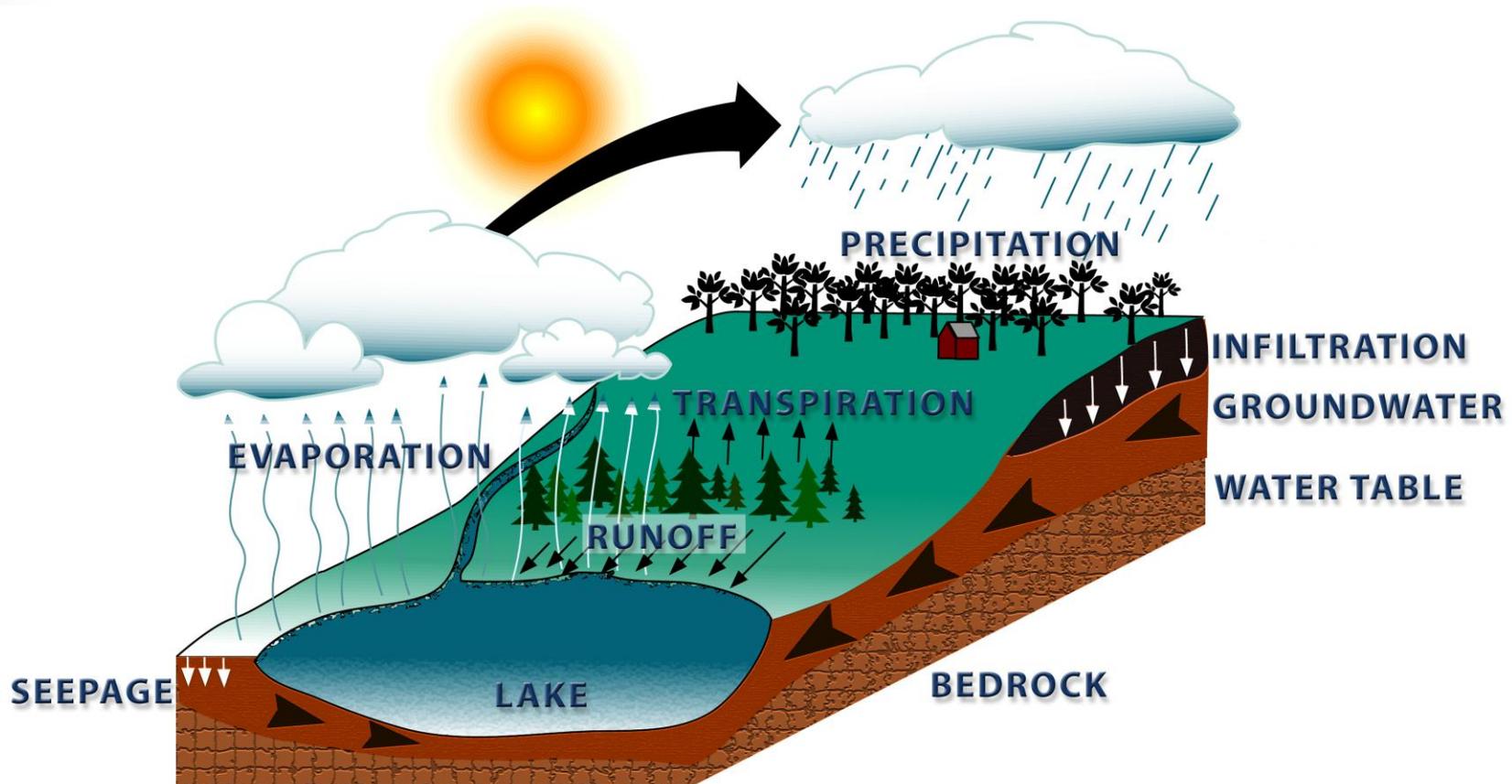


UNIQUE PROPERTIES OF WATER

- Physical Properties
- 71% Earth's Surface Covered by Water
- <1% Water on Earth is Freshwater
- .009% water on Earth is Freshwater Lakes



HYDROLOGIC CYCLE





OVERVIEW

- Unique Properties of Water
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- Technical Aspects





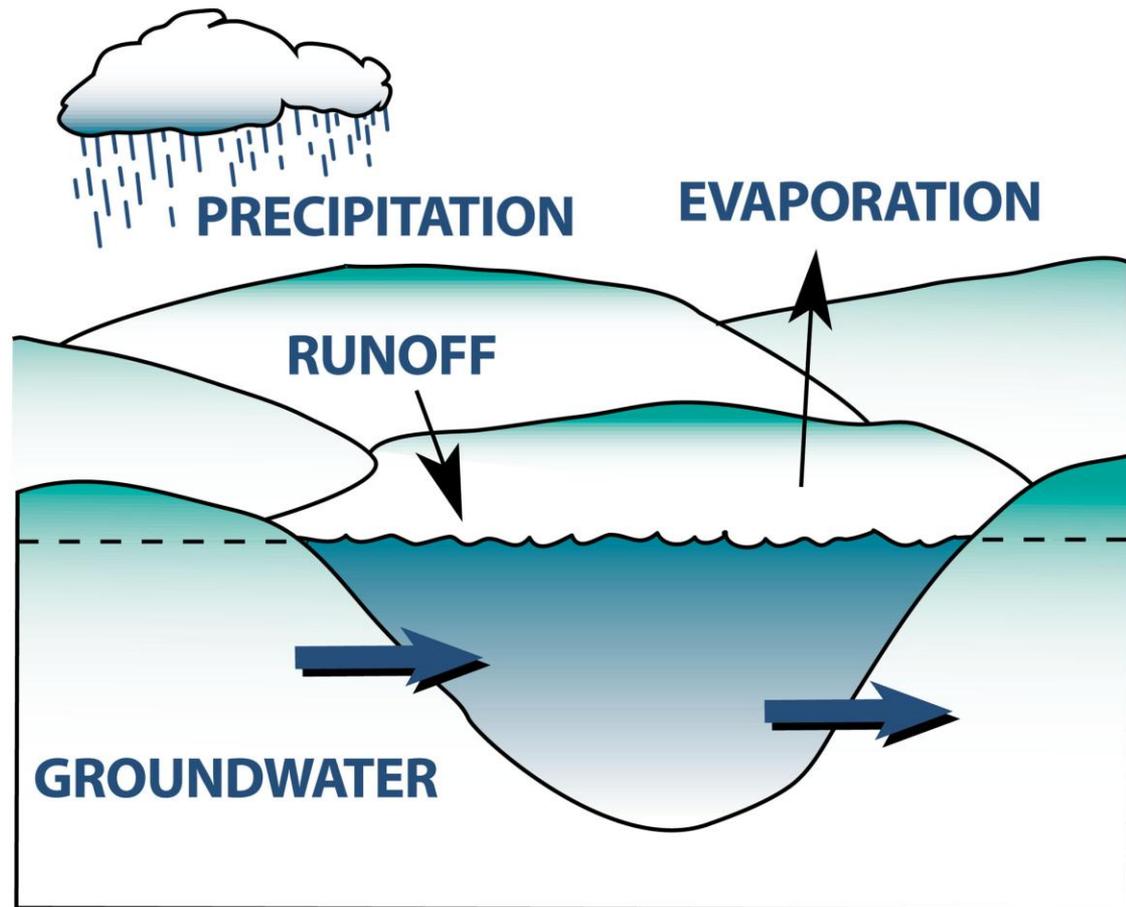
LAKE TYPES

- Seepage
- Groundwater Drainage
- Drainage
- Impoundments
- Oxbow



SEEPAGE LAKE

- Natural Lake
- Water Source
 - Groundwater
 - Precipitation
- No Stream Outlet Inlet



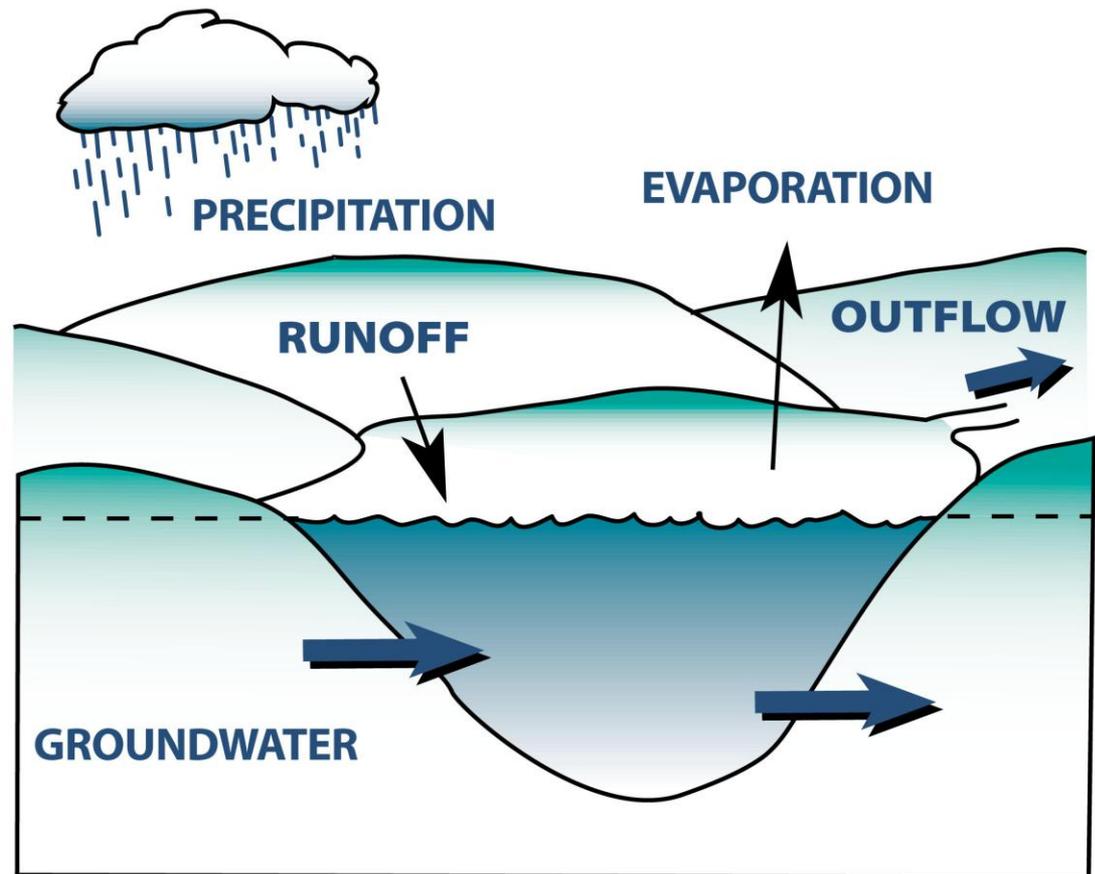
SEEPAGE LAKE

An aerial photograph showing a vast, flat landscape covered in dense green vegetation. The terrain is crisscrossed by a complex network of water bodies, including large lakes, smaller ponds, and narrow channels. The water appears dark blue or black, contrasting with the vibrant green of the surrounding forest and fields. The overall scene depicts a rich, interconnected wetland ecosystem.

■ Round Lake, Chippewa County

GROUNDWATER DRAINAGE

- Natural Lake
- Water Source
 - Groundwater
 - Precipitation
 - Limited Runoff
- Has Stream Outle



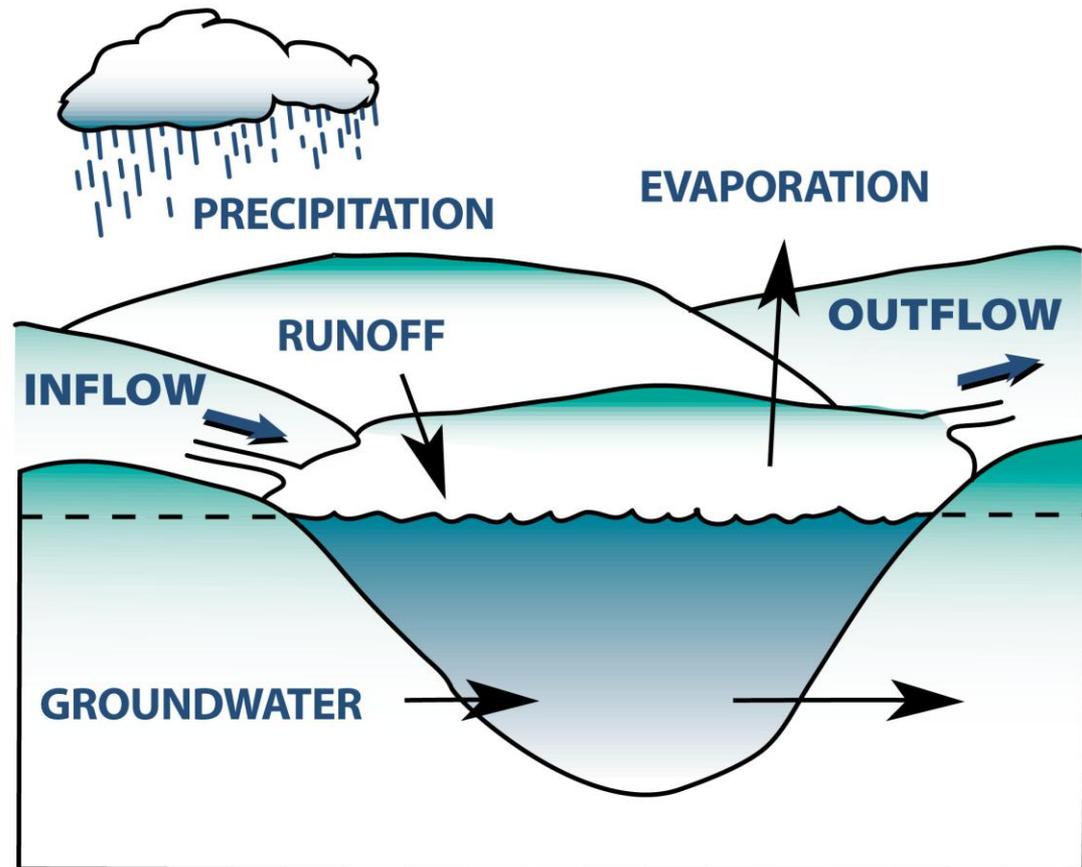
GROUNDWATER DRAINAGE LAKE



■ Sand Lake, Chippewa County

DRAINAGE LAKE

- Water Source
 - Streams
 - Groundwater
 - Precipitation
 - Runoff
- Stream Drained



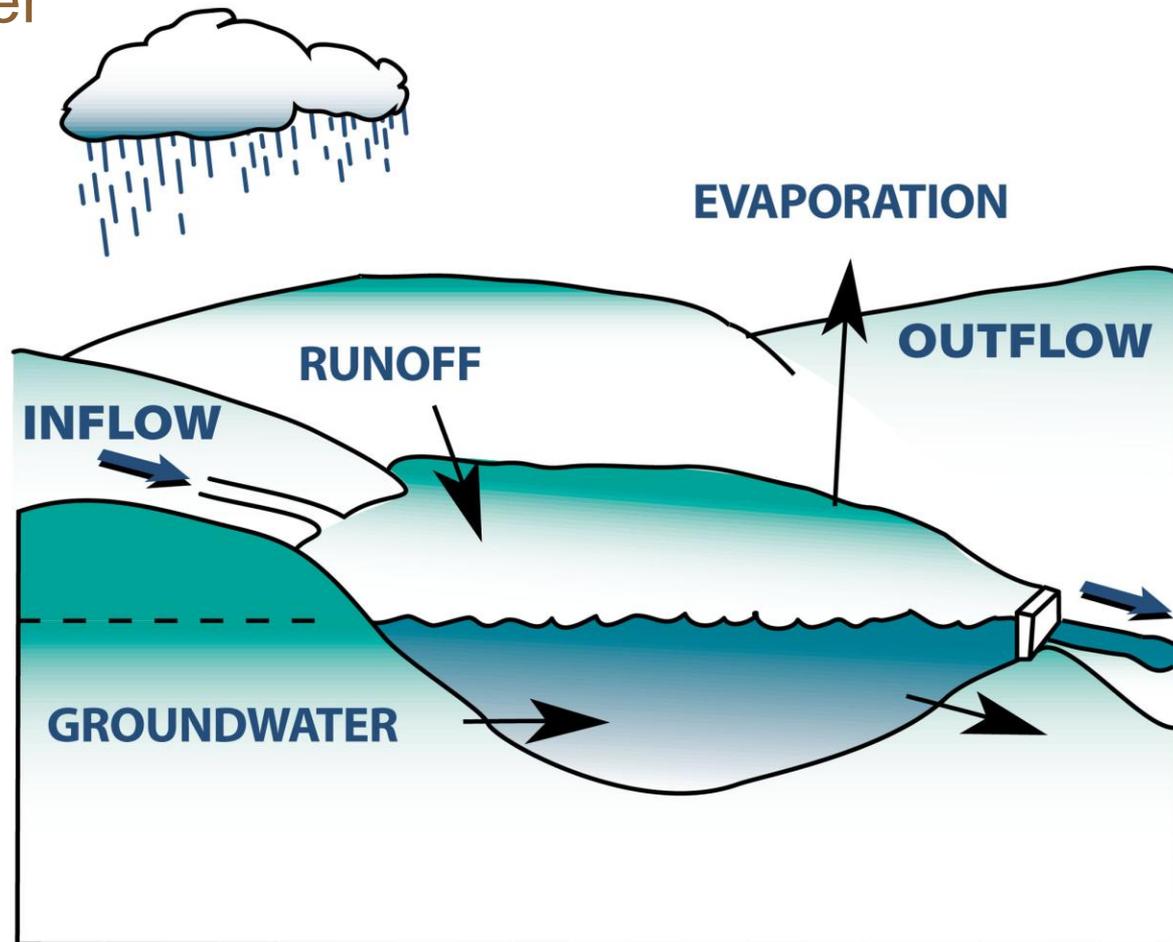
DRAINAGE LAKE



■ Long Lake, Chippewa County

IMPOUNDMENT

- A manmade lake
- Dammed River or Stream



IMPOUNDMENT



- Lake Altoona, Eau Claire County

OXBOW

An aerial photograph showing a large, dark, crescent-shaped oxbow lake. The lake is surrounded by dense green trees and fields. A road or path runs along the left side of the lake. In the background, there are more fields, some buildings, and a large body of water. The overall scene is a mix of natural and developed land.

■ Lake Hallie, Chippewa County



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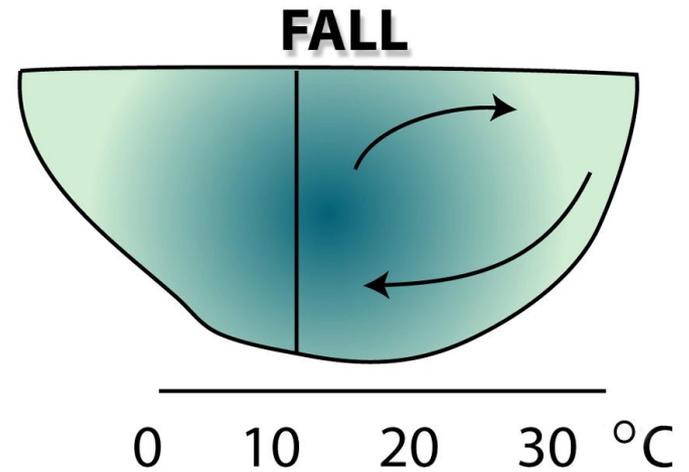
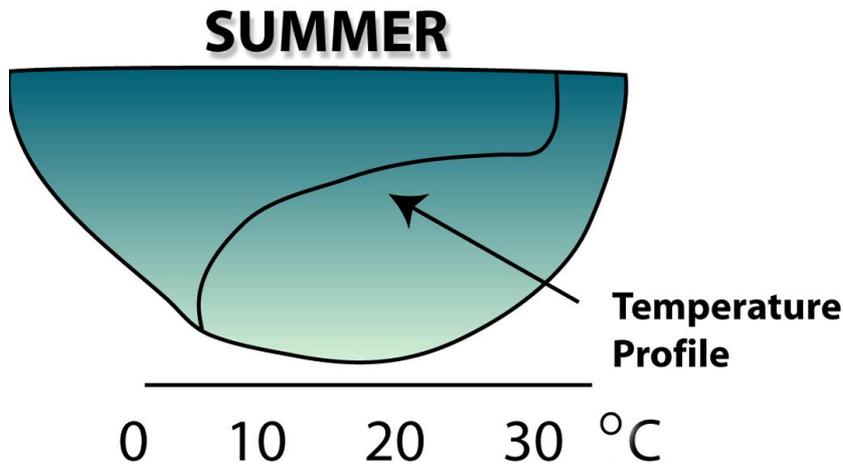
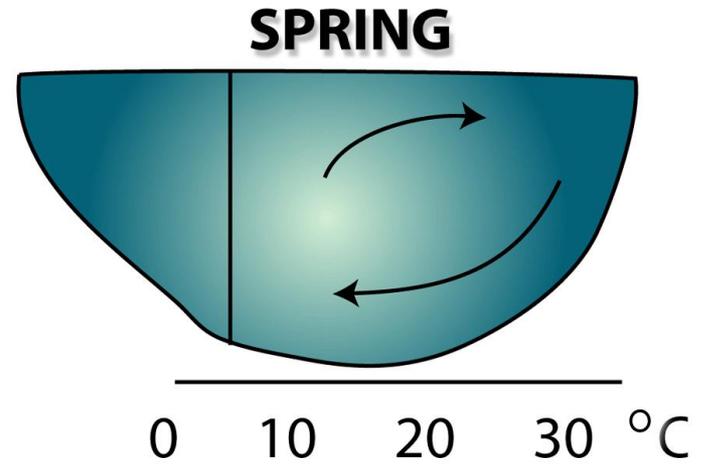
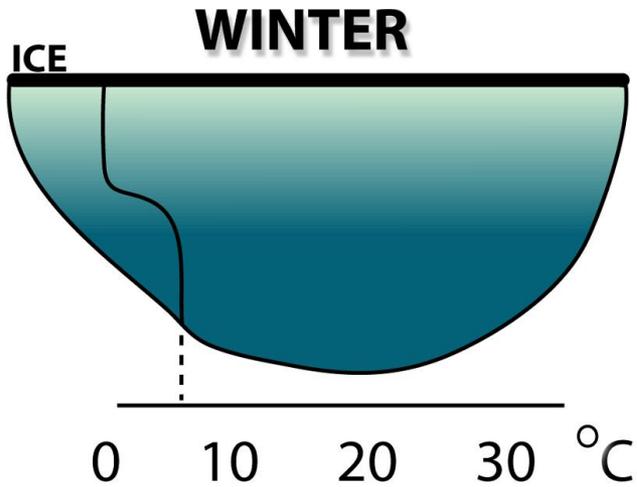


PHYSICAL CHARACTERISTICS

- Mixing / Stratification
- Lake Depth
- Retention Time / Flushing Rate
- Drainage Basin/ Lake Area Ratio
- Influence of Watershed Runoff

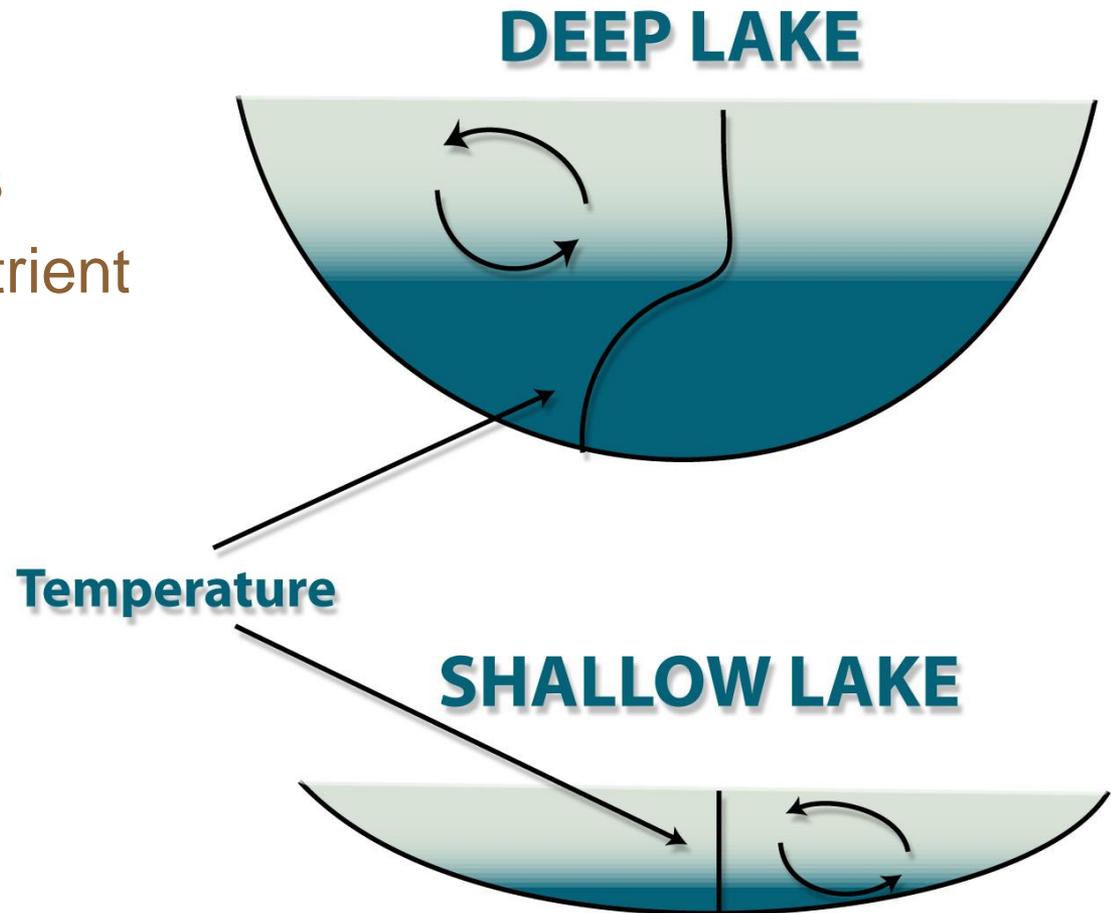


MIXING/ STRATIFICATION



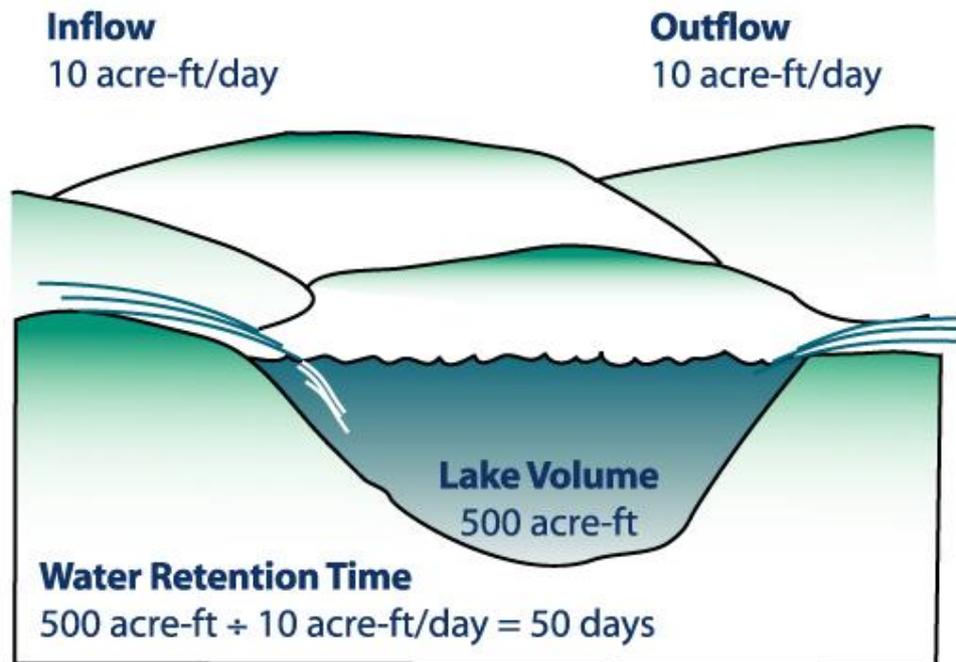
LAKE DEPTH MATTERS

- **Deep Lakes**
Stratify
- **Shallow Lakes**
Continuous Nutrient Recycling



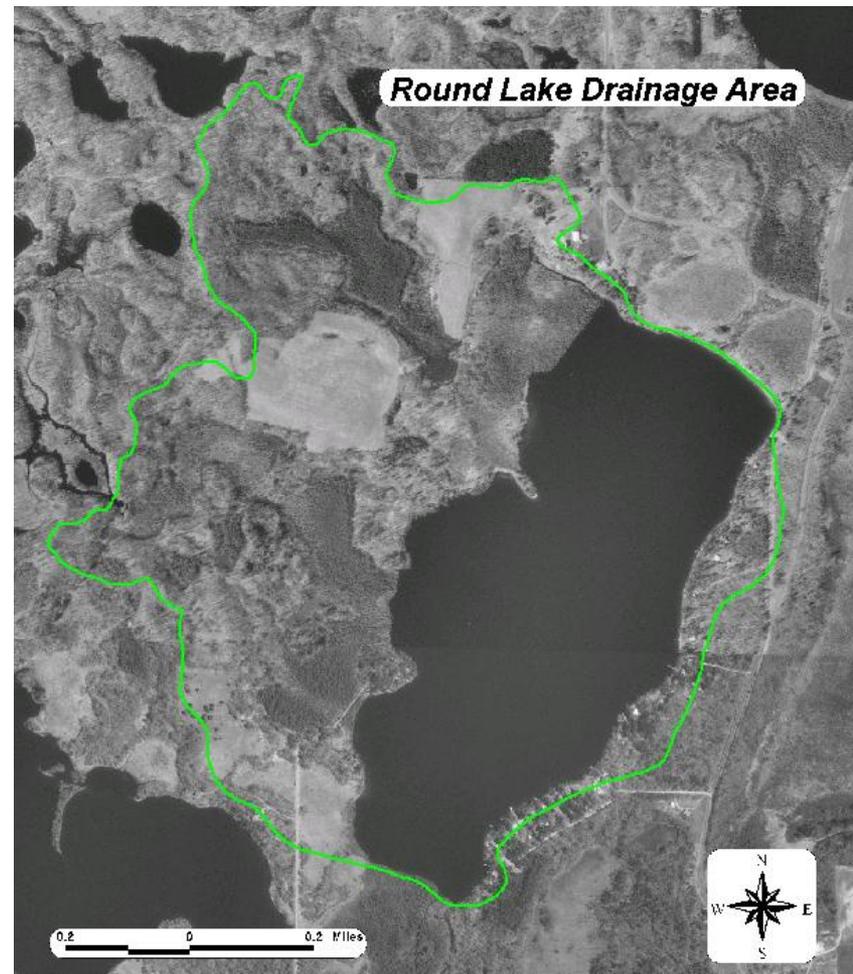
RETENTION TIME/ FLUSHING RATE

- How long would it take to fill a drained lake?
- Retention Time Matters
- Long Lake & Altoona
 - Long Lake, 7years
 - Lake Altoona, 22days

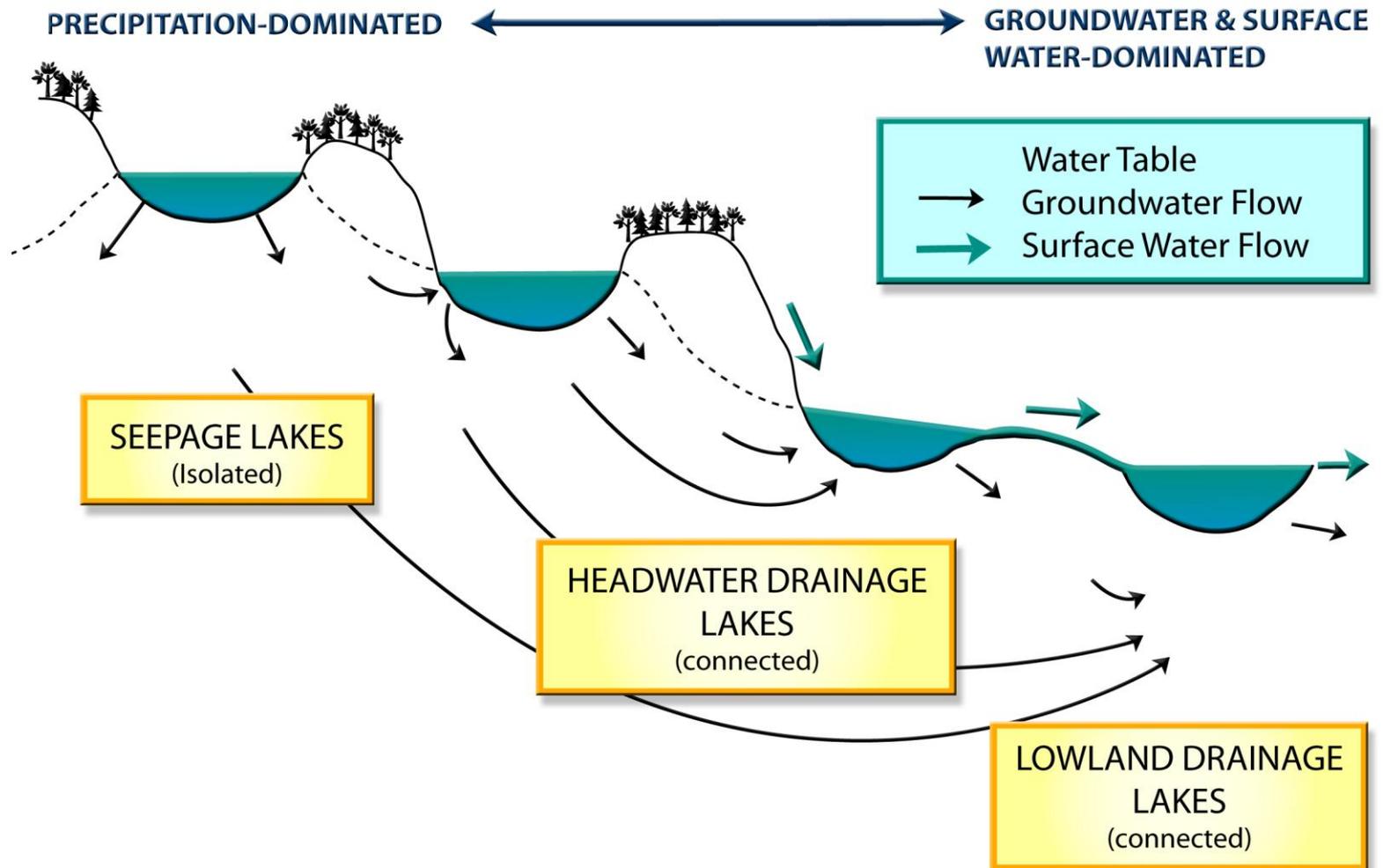


DRAINAGE BASIN/ LAKE AREA RATIO

- Seepage Lake- small
- Drainage Lake- large watershed
 - Seepage Lake w/
drainage area mapped
Round Lake



LANDSCAPE POSITION





LIMITING NUTRIENT PRINCIPLE

...That Nutrient in Least Supply
Relative to Plant Needs

N:P Ratio in plant Tissue 10:1 - 15:1

If the Ratio of N:P in Water is

<10:1 Nitrogen Limited

>15:1 Phosphorus Limited





PHOSPHORUS LIMITATION LAKE 227

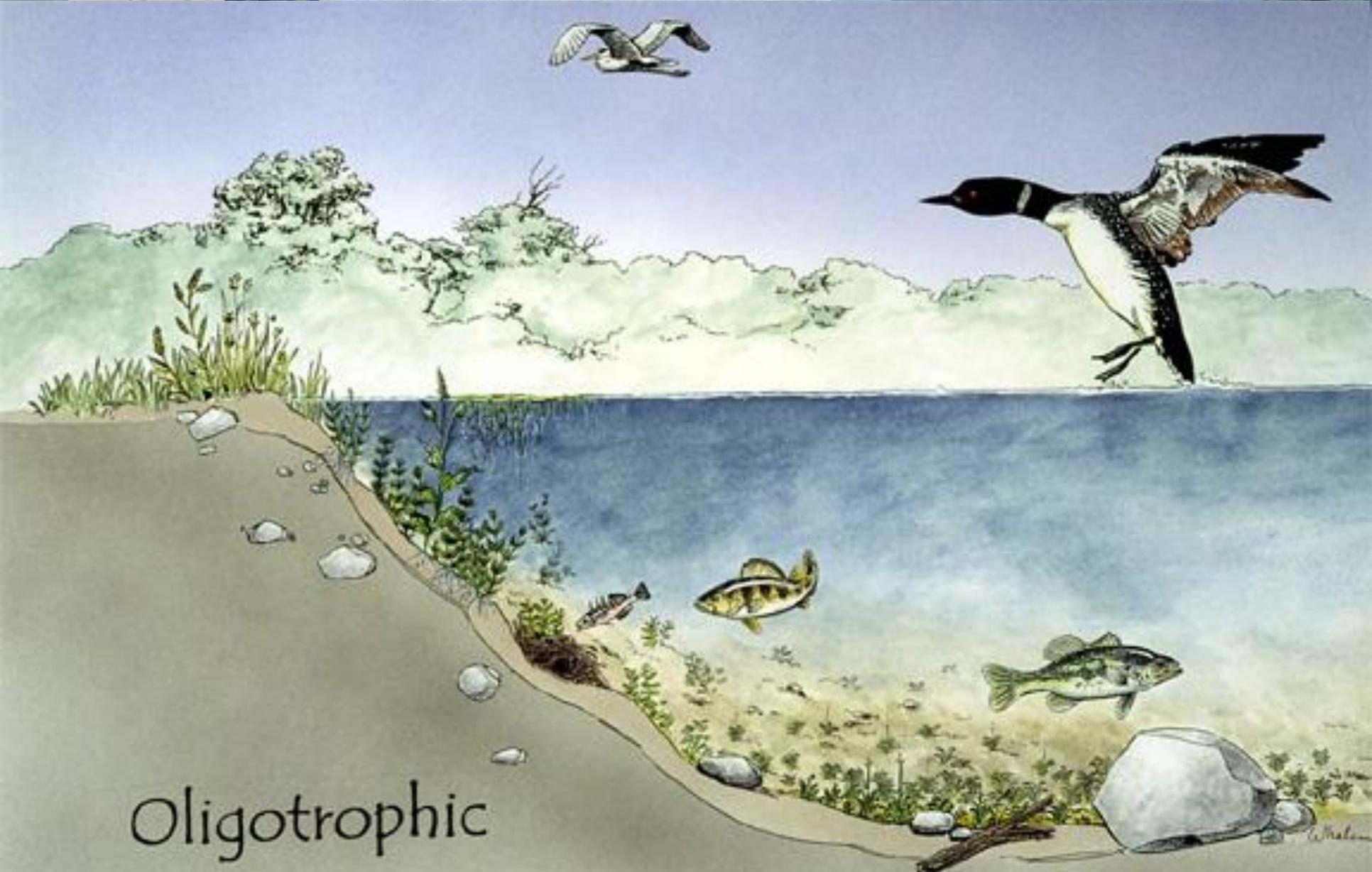




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Oligotrophic



Mesotrophic

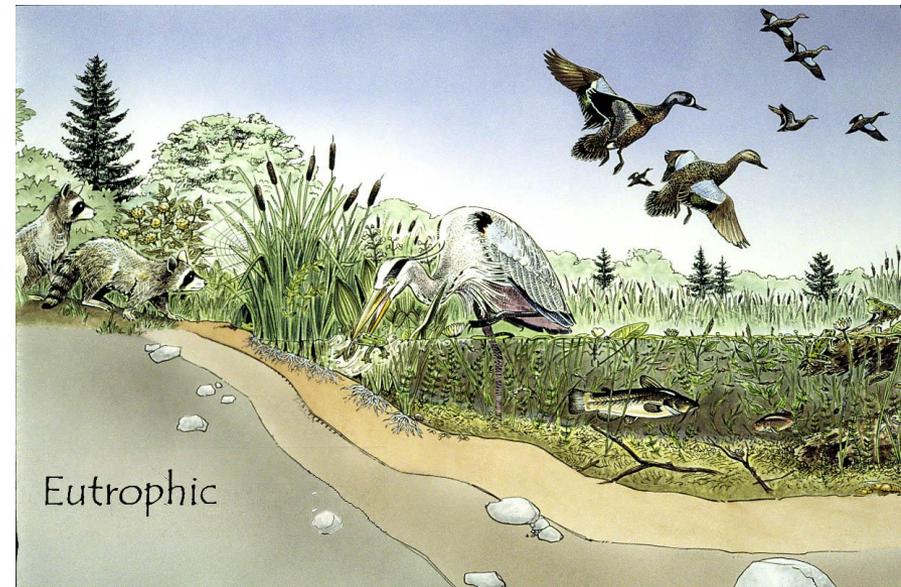
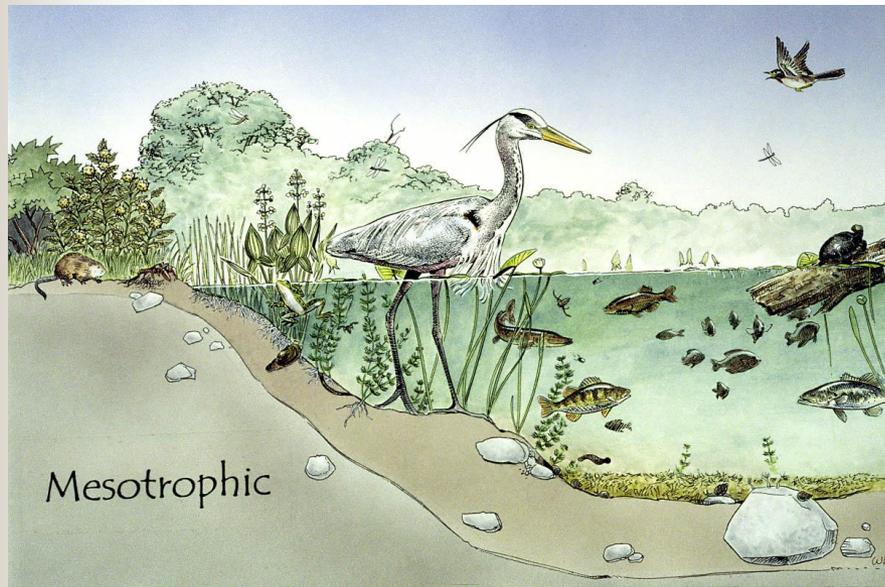
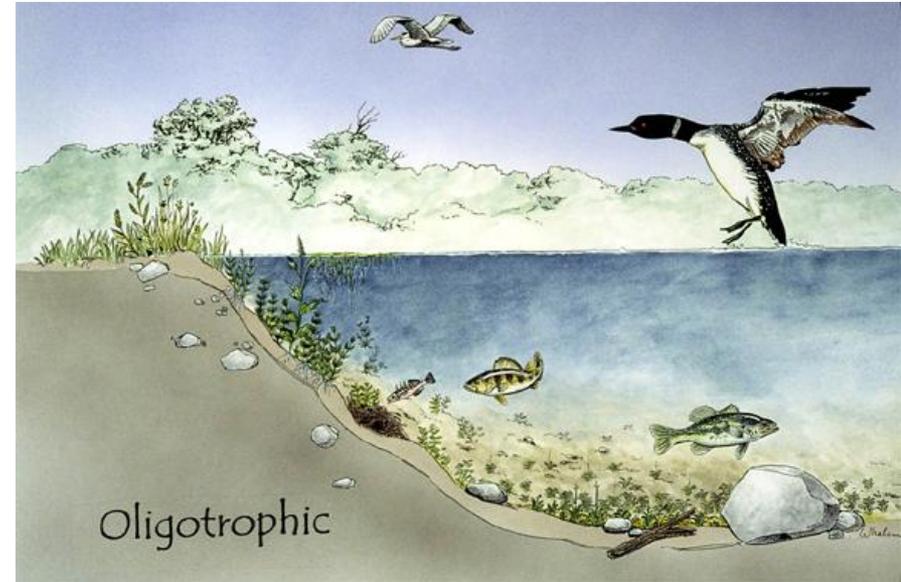
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Eutrophic

TROPHIC STATE

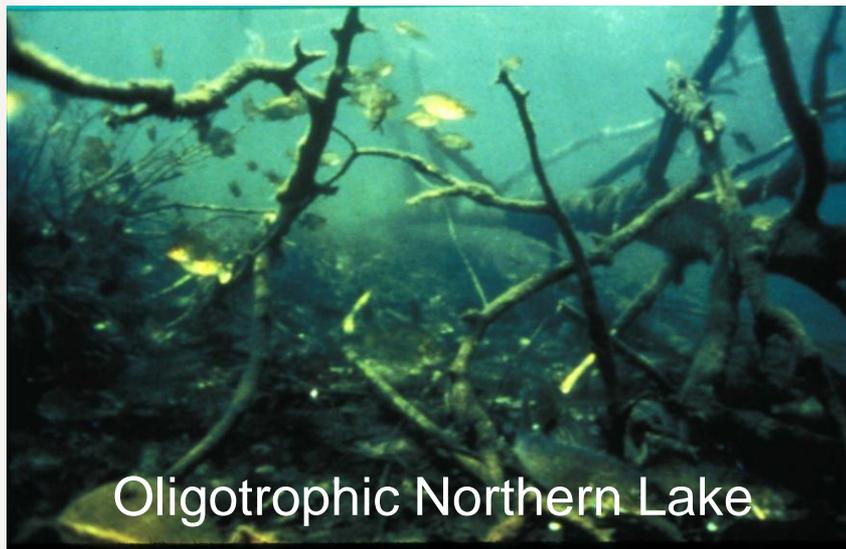
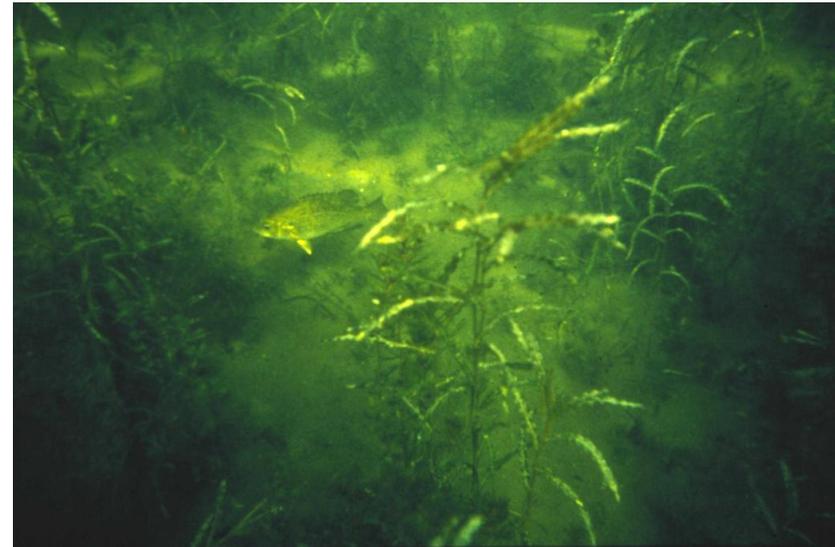
- Nutrients & Productivity
- Sediment & Accumulation
- Species Shifts
- Species Richness





LAKE LITTORAL ZONE

- Functions
 - Intercepts Nutrients
 - Refuge from Predators
 - Nursery for Fish

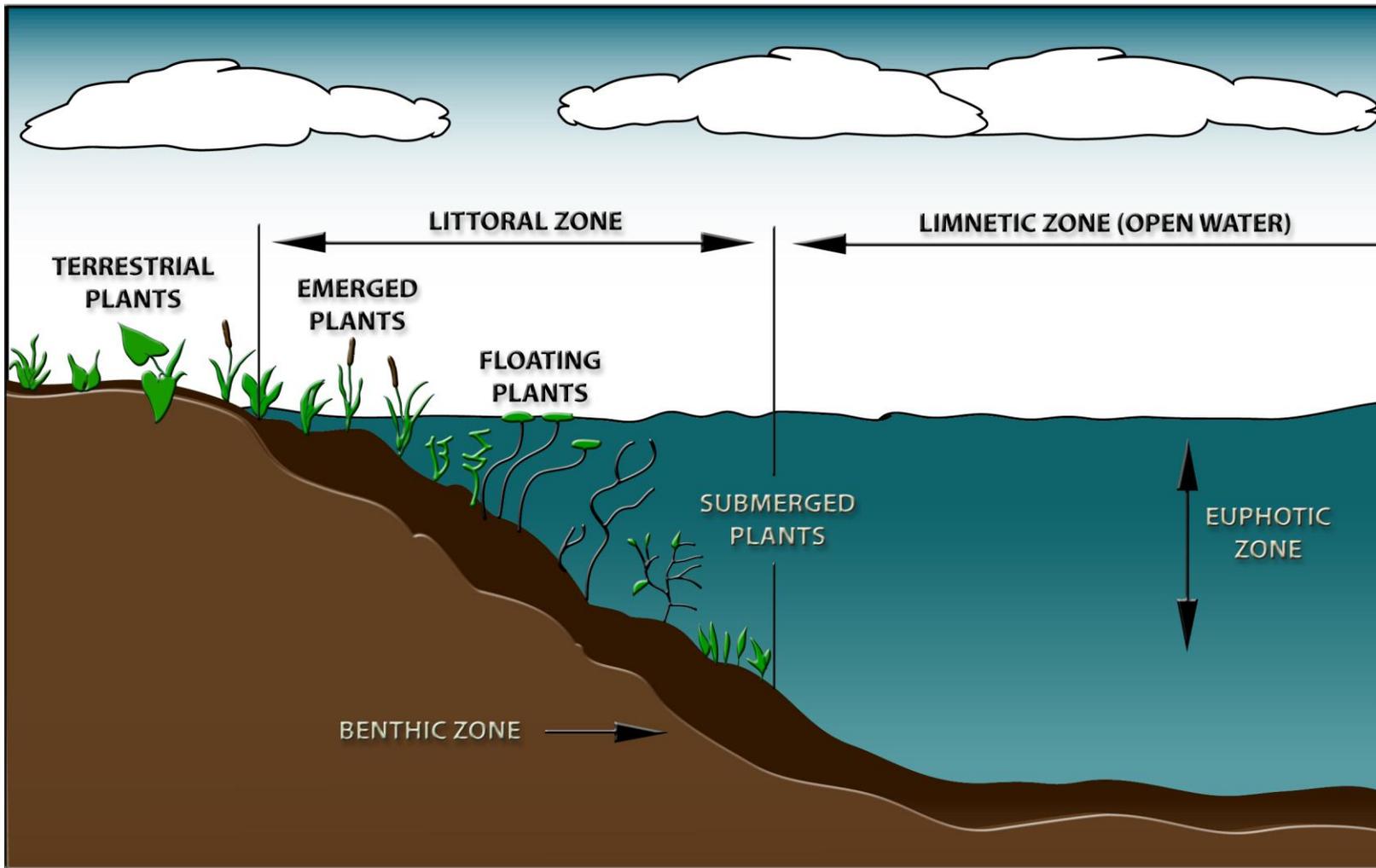


Oligotrophic Northern Lake



Eutrophic Southern Lake

LAKE HABITAT ZONES





LEAVING A LEGACY



Help Protect Wisconsin's...

WATER RESOURCES.

