Freshwater Ecosystems

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Freshwater Ecosystems

- Include standing water or lentic habitats such as lakes, ponds, marshes and wetlands and flowing water or lotic habitats such as spring, streams and rivers
- Highly variable with characteristics depending upon geology, land use and pollution
- Salinity is very low.
- Affected by different factors like temperature, light penetration, turbidity among others

Types of Freshwater Habitats

I. Lentic Habitats

Calm, freshwater habitat, standing water

Refers to standing or relatively still water

From the the Latin *lentus*, meaning sluggish

II. Lotic habitat

Running water

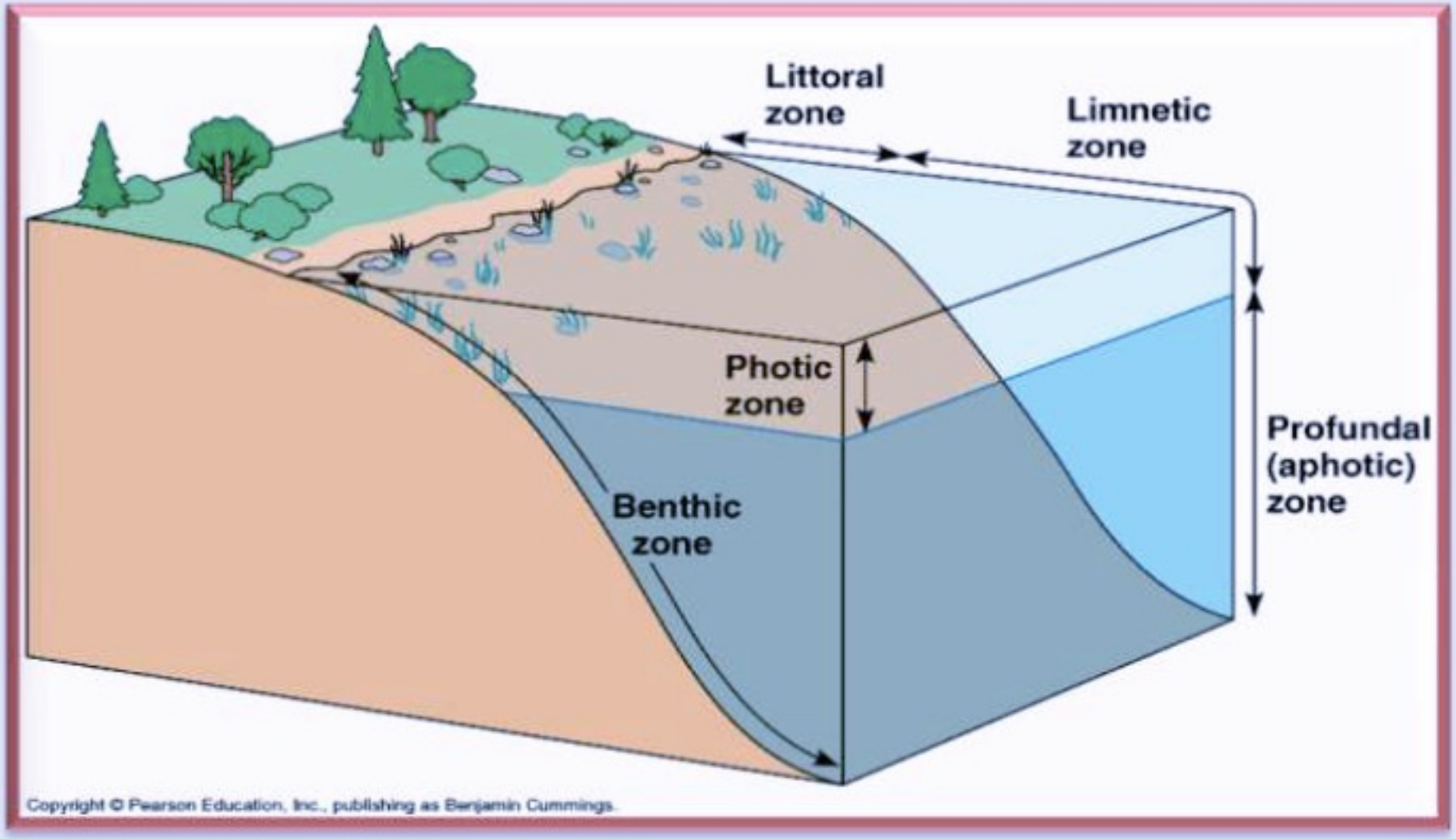
From the Latin *lotus*, meaning to wash

Lentic Habitats

Lakes

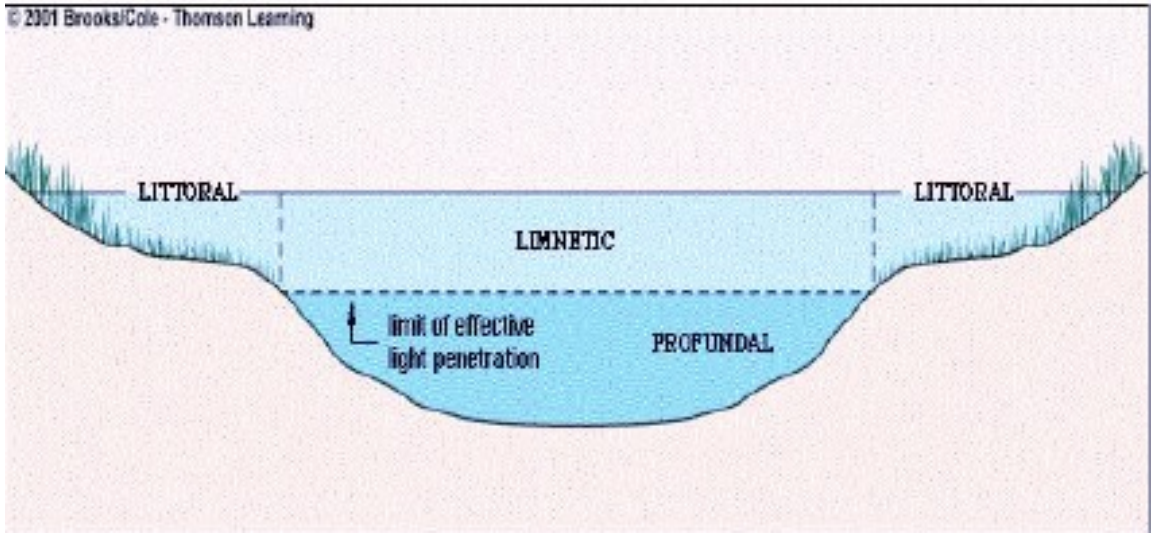
- Body of relatively still freshwater of considerable size, localized in a basin that is surrounded by land.

Zones of a lake



Zones of a Lake

- Littoral zone - the shallow water region with light penetration to the bottom, Limnetic zone - the open water zone to the depth of effective light penetration called the compensation level.
- Euphotic zone is the total illuminated stratum including littoral and limnetic.
- Profundal zone is the bottom and deep-water area, which is beyond the depth of effective light penetration.



Vertical Gradients in Light, Temperature and Dissolved Gases

In summer:

1. Epilimnion – layer of warm water circulating on top in deeper lakes and ponds

2. Thermocline – where temperature drops rapidly

3. Hypolimnion – bottom layer of denser water, low temperature, low in oxygen but high in nutrients

In fall and spring:

surface waters cool and warm, differences in water density between layers decrease so water circulates throughout the lake. Fall and spring over turn which is important in mixing the bottom water with the top water layer thus circulating and mixing the nutrients.

Ponds

Body of standing water, either natural or man-made usually smaller than a lake

Swamps

Wetland that is forested

Bogs

Wetland that accumulates peat, a deposit of dead plant material, often mosses and Sphagnum moss in majority of cases.

Lotic Habitats

Lotic Ecosystem or Flowing Ecosystem

- Characterized by inputs of detrital materials from terrestrial sources and current of different velocities which carry nutrients and other materials downstream
- Exhibit continuous physical and ecological variables such as a longitudinal gradient in temperature, depth and nature of the bottom. Biotic components reflect changes in physical conditions.
- Open and largely heterotrophic.
- Major energy source is detrital material carried to it from the outside. The concurrent of nutrient cycling and downstream transport is called spiraling.
- Most important erosional agent modifying the earth’s surface

Spring

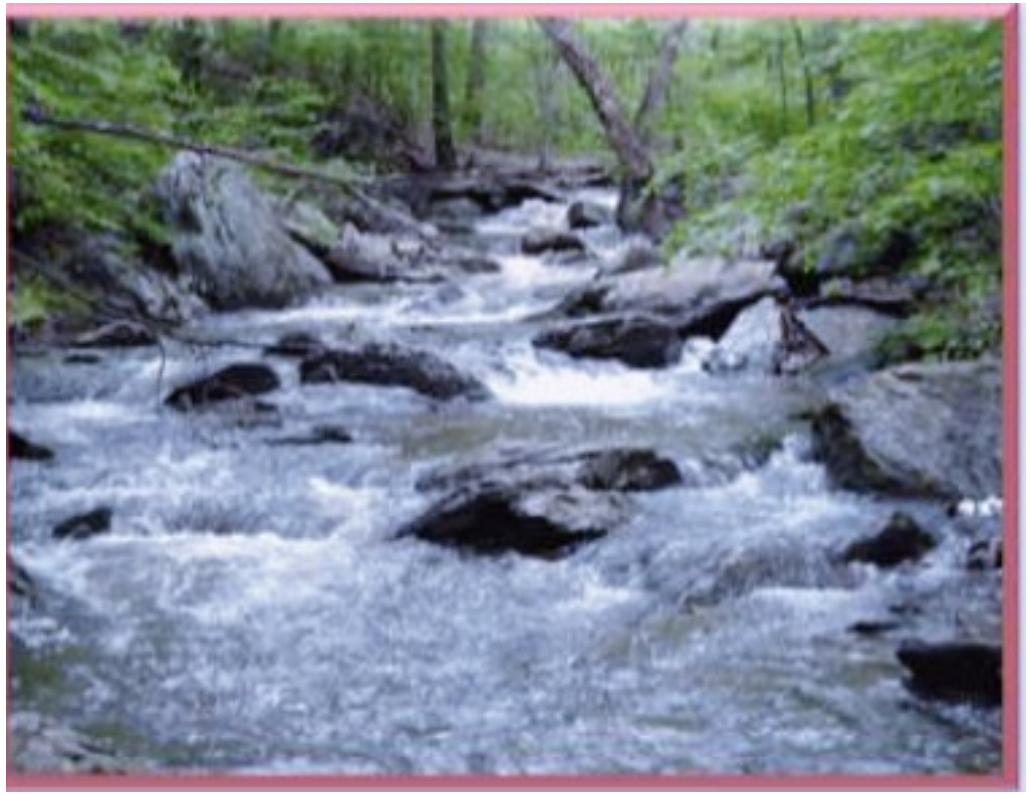
Freshwater habitat where water flows out of the ground

River

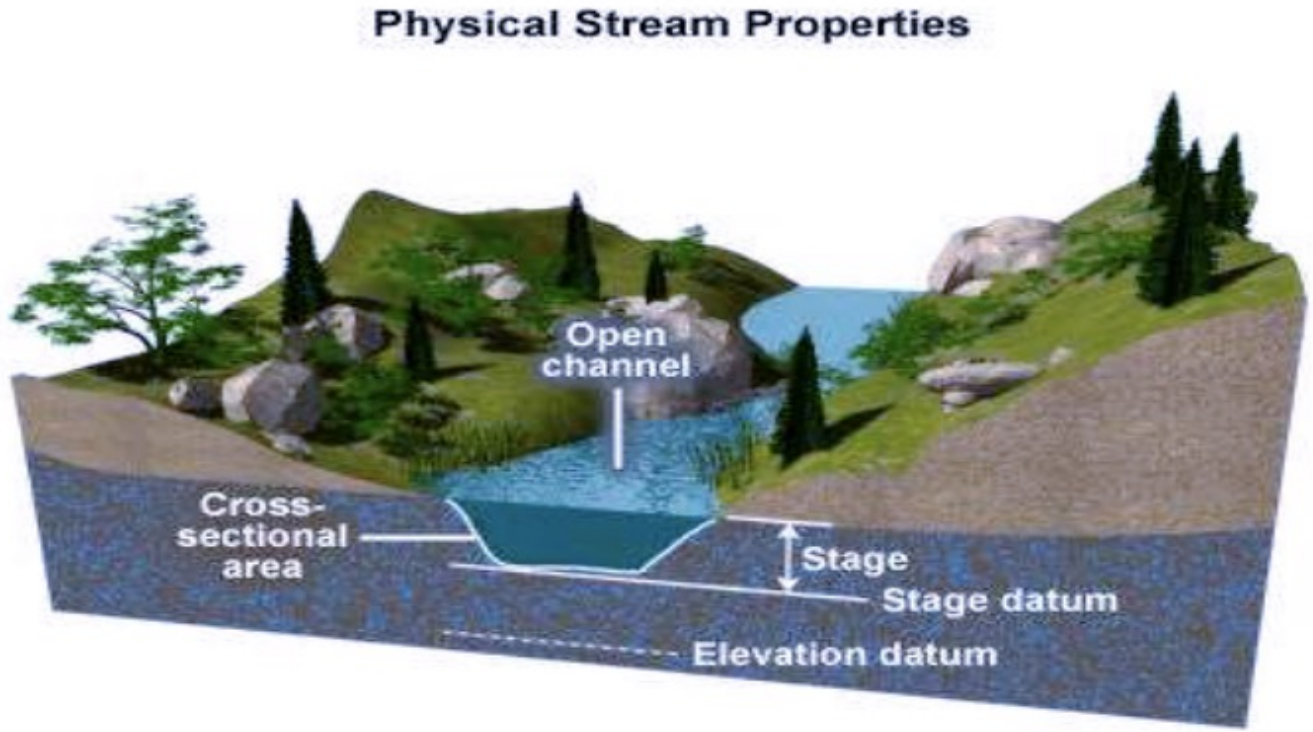
Body of water with current moving in one general direction

Stream

- Thin body of water which has a continuous flow of water; also often referred to as a creek or a brook



Stream flow


Physical Stream Properties
Open channel
Cross-sectional area
Stage
Stage datum
Elevation datum
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Regions or Subhabitats in Streams

1. Rapid Zone – shallow water where velocity of the current is great
2. Pool zone – deeper water where velocity of current is reduced.

Stream Transport

Types of Stream Loads

Dissolved load – sediments dissolved in solution; much of this contributed by groundwater.

Suspended load – sediments in suspension; greatest part of stream load.

Bed load – sediment at the bottom of the stream; smallest portion pf the stream’s load.

Stream's Ability to Transport Solid Particles

Stream Capacity – refers to the maximum load of small particles that a stream can carry

Stream Competency – refers to the maximum particle size a stream can transport which depends on stream velocity of the speed of the water in the stream

Stream Velocity

Measure of the downstream distance travelled per unit of time

Factors that determine a stream's velocity:

- gradient – slope of the stream channel
- shape, size and roughness of the channel
- stream's discharge – amount of water passing a given point measured in cubic feet per second

As the width, depth, discharge and stream velocity increase, the gradient and roughness of a stream decrease the downstream. Stream deposits sediment when velocity slows and competence os reduced.

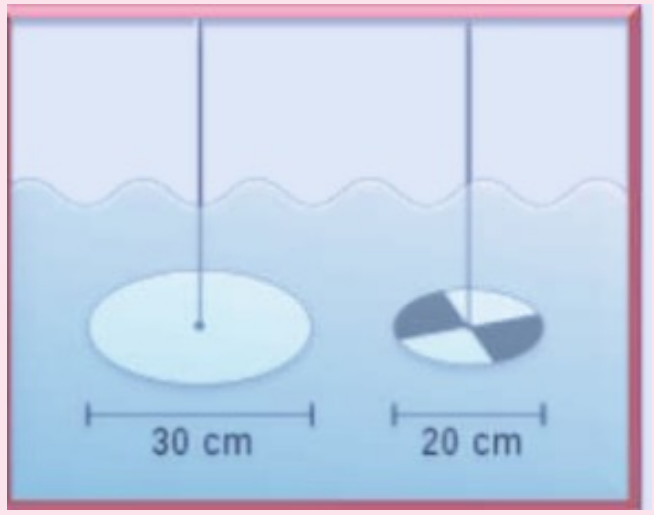
Stream Deposition

Process where the sediments carried by stream are laid down or dropped

Different types of stream deposits

- bars deposit
- floodplain deposit
- delta deposit
- alluvial fan deposit

Factors Influencing Freshwater Habitats



- 1. Temperature – water thermal properties work together to minimize temperature change.
- 2. Current – especially current direction largely determines the distribution of vital gases, salts and small organisms
- 3. Transparency – turbidity of the water can be caused by clay and silt particles; can be measured using an instrument called Secchi disk.

Factors Influencing Freshwater Habitats

4. Concentration of respiratory gases – oxygen and carbon dioxide concentrations are often limiting in the freshwater environment

5. Concentration of biogenic salts

- Nitrates and phosphates may be limiting in freshwater environment.
- Calcium and other slats are likely to be limiting in soft water lakes and streams.

Major Groups of Freshwater Organisms: According to Niche

- Autotrophs – or producers
- Phagotrophs – or macroconsumers
- Saprotrophs – or microconsumers/decomposers

Major Groups of Freshwater Organisms: According to Habitat

Benthos – resting or living on the bottom of the water body such as clams and snails. They could be filter feeders or deposit feeders.

Periphyton – living on the stems or leaves of rooted plants like algae and cyanobacteria

Planktons – floating organisms whose movement is dependent on the currents. Classified into zooplanktons, netplanktons, nannoplanktons

Nekton – swimming organisms able to navigate at will like fishes

Neuston – organisms resting or swimming on the surface like protozoans and bacteria

Groundwater

Groundwater

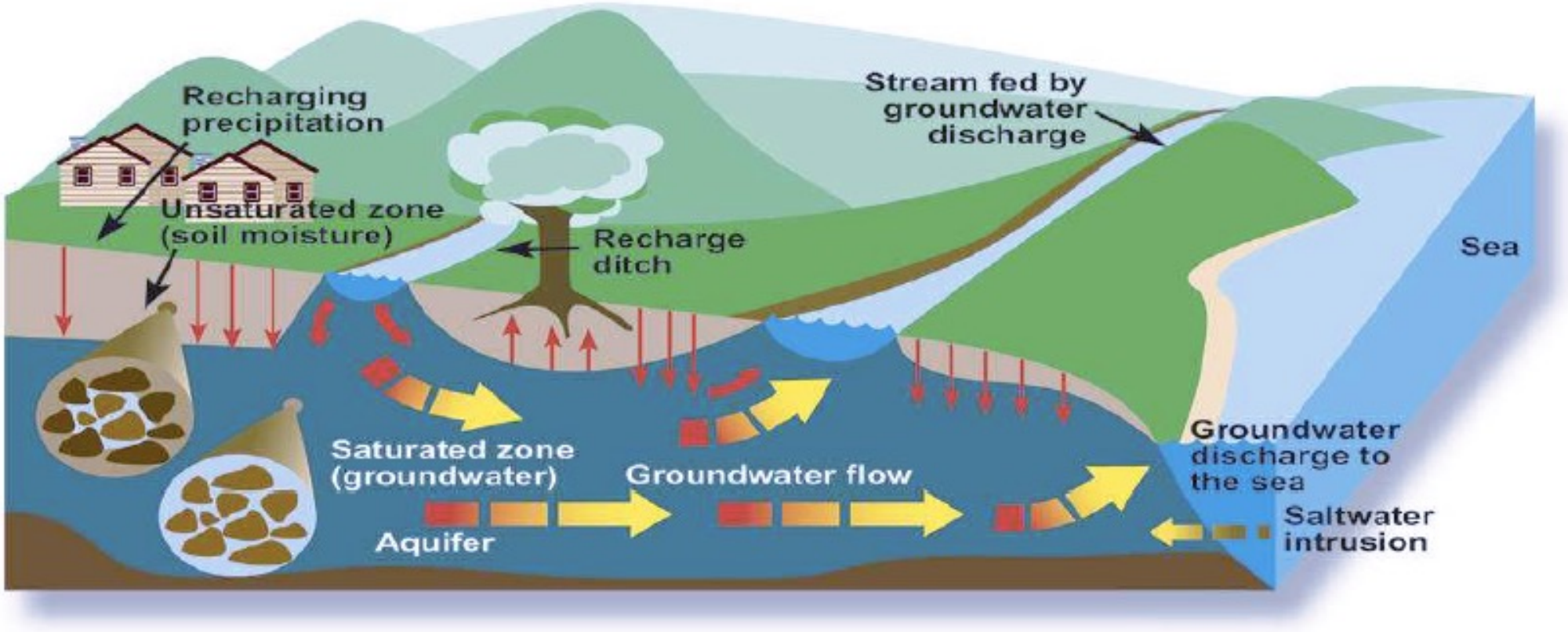
Largest reservoir of freshwater that is readily available to humans

Occupies the pore spaces in sediments and rocks in a zone beneath the surface called the zone of saturation.

Upper limit of this zone is called the water table.

Above the water table is the zone of aeration where the soil, sediment and rock are not saturated.

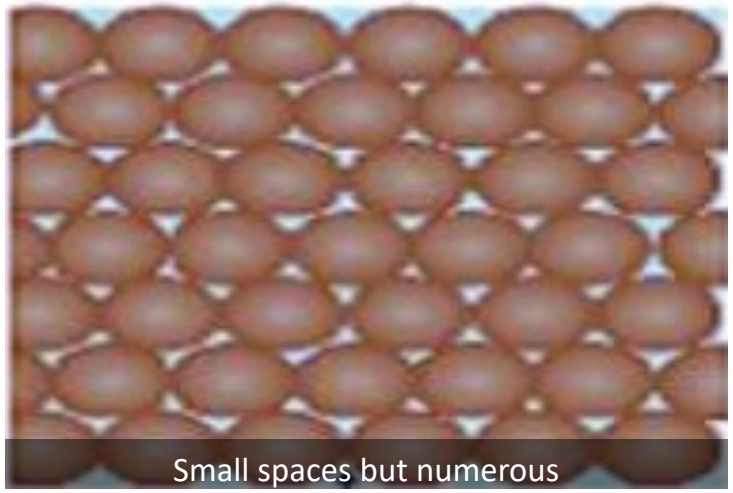
Groundwater flow



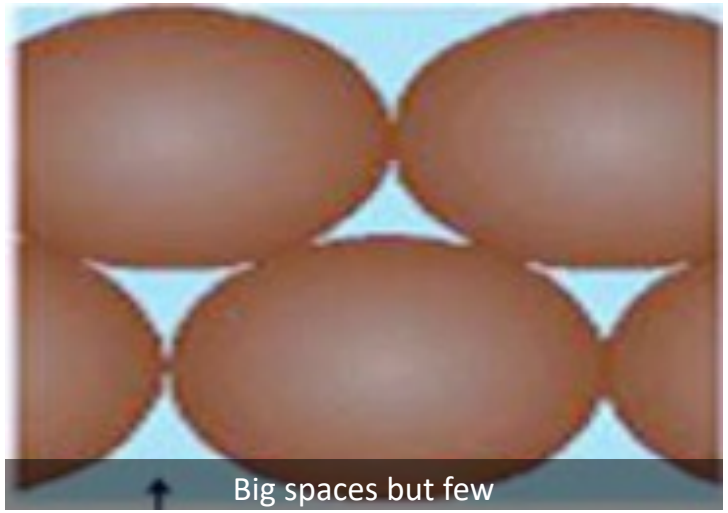
Two Properties of Rock that Control the Flow of Groundwater

1. Porosity refers to the volume of open spaces in the rock.

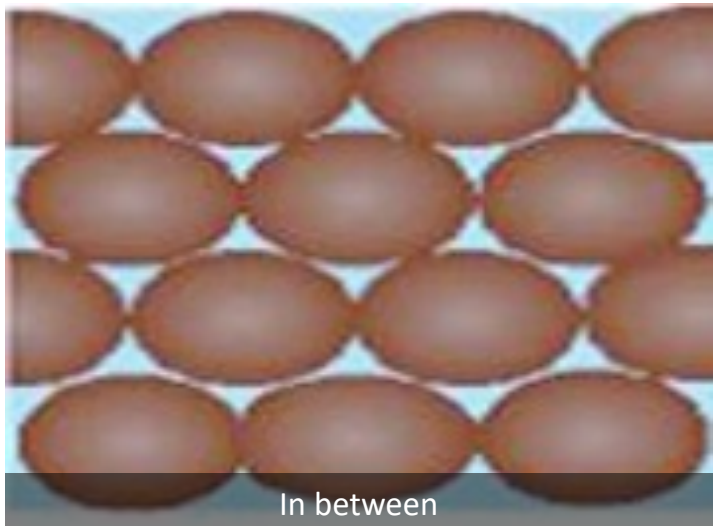
2. Permeability refers to how rocks or sediments are able to allow water to get through the spaces.



Small spaces but numerous



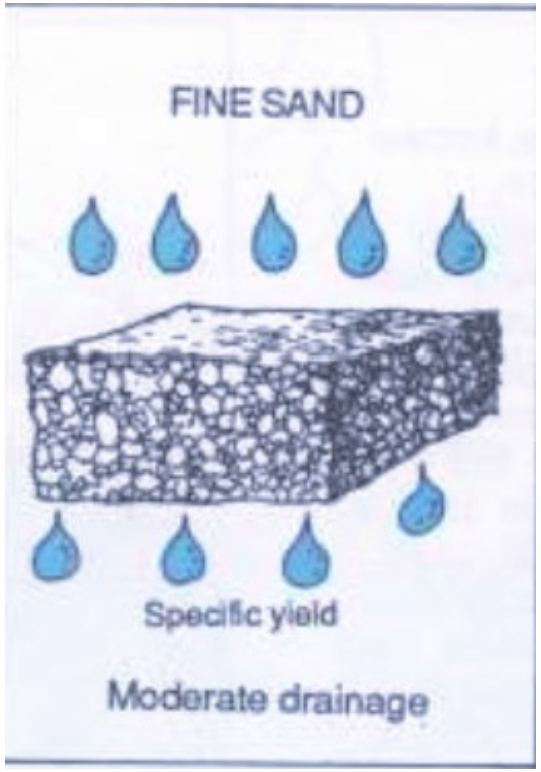
Big spaces but few

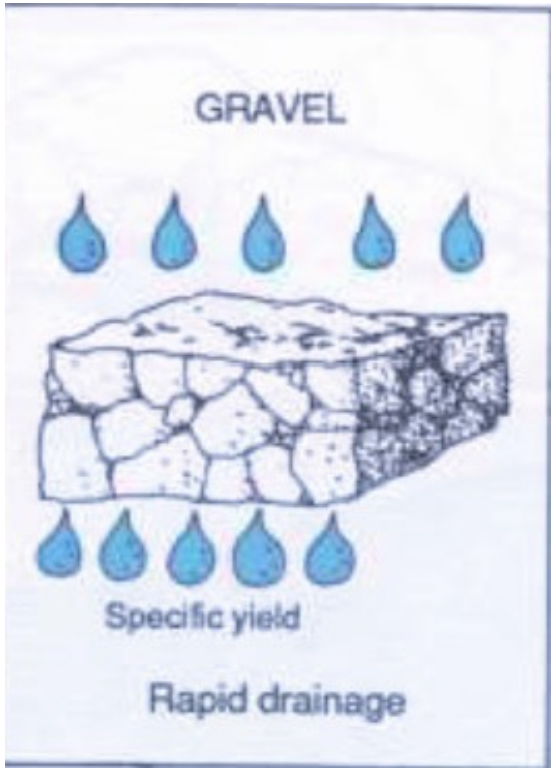


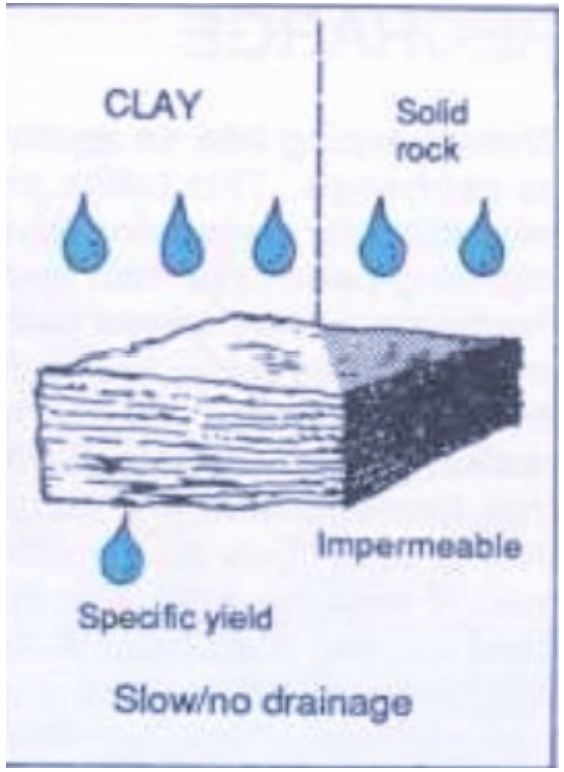
In between

Porosity

- Percentage of open spaces between grains in rock or sediment







Permeability

- The bigger the particles, the more rapid the drainage. The smaller the particles, the higher is the water retention.

Acknowledgement

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Thank you.