

# BASIC ECOLOGY

## Lect. #3

3<sup>rd</sup>

Chemistry-Zoology

Group



# FACTORS LIMITING DISTRIBUTION

## Biogeochemical cycles

**Bio** = “life

**Geo** = “Earth”

**Chemical** = “elements – as C, O, N, P, S

- Biogeochemical cycles refers to a cycling of nutrients from the abiotic components (water, carbon, oxygen, nitrogen, phosphorus, sulphur) of the ecosystem (water, air, soil, rock) through the biotic components (plants, animals, fungi, bacteria)

# FACTORS LIMITING DISTRIBUTION

## Water cycle



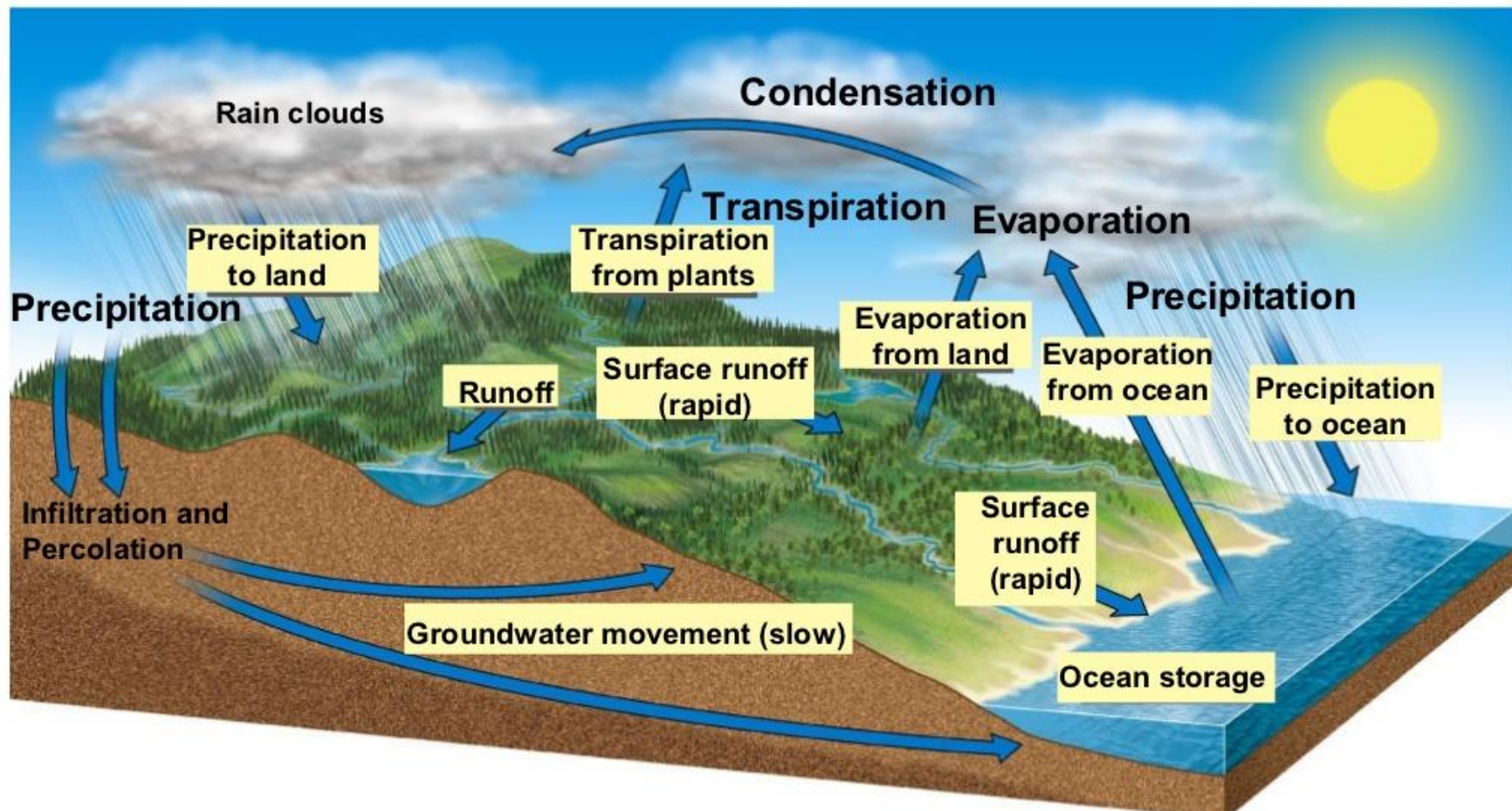
- **Water accounts for 70% of the Earth surface.**
  - Salt water (oceans) is the main source of water on earth, about 97.2%.
  - 2.2% of earth water is frozen as ice caps & glaciers.
  - 0.001% as water vapor in atmosphere.
  - 0.017% found as inland seas, freshwater.

**Waters are in a dynamic cycle known as “Hydrological cycle”**

# FACTORS LIMITING DISTRIBUTION

## Water cycle

### THE HYDROLOGIC (WATER) CYCLE



# شرح دورة الماء – معلومات لفهم الدورة-

- The water cycle is driven by the Sun's energy as it warms the oceans and other surface waters. This leads to evaporation (liquid water to water vapor) of liquid surface water and sublimation (ice to water vapor) of frozen water, thus moving large amounts of water into the atmosphere as water vapor.
- Over time, this water vapor condenses into clouds and eventually leads to precipitation (rain, snow), which returns water to Earth's surface.
- Rain reaching Earth's surface may evaporate again, flow over the surface, or percolate into the ground. Runoff can make its way through streams and lakes to the oceans.
- In most natural terrestrial environments rain encounters vegetation before it reaches the soil surface. A significant percentage of water evaporates immediately from the surfaces of plants. What is left reaches the soil and begins to move down. Surface runoff will occur only if the soil becomes saturated with water in a heavy rainfall.
- Water in the soil can be taken up by plant roots. The plant will use some of this water for its own metabolism and some of that will find its way into animals that eat the plants, but much of it will be lost back to the atmosphere through a process known as transpiration.
- Water in the soil that is not taken up by a plant and that does not evaporate is able to percolate into the subsoil and bedrock where it forms groundwater.
- Groundwater is a significant, subsurface reservoir of fresh water. It exists in the pores between particles in dirt, sand, and gravel or in the fissures in rocks. Groundwater can flow slowly through these pores and fissures and eventually finds its way to a stream or lake where it becomes part of the surface water again.
- Some groundwater is found very deep in the bedrock and can persist there for millennia. Most groundwater reservoirs, are the source of drinking or irrigation water drawn up through wells. In many cases these aquifers are being depleted faster than they are being replenished by water percolating down from above.
- Rain and surface runoff are major ways in which minerals, including phosphorus and sulfur, are cycled from land to water.

# Water cycle

- Water enter our bodies as **food** and **drinks** and eliminated as **urine, sweat, exhalation** and in **feces**.
- All of **biochemical reaction** within cells occur in **water as intermediate medium** that **does not interfere** in the reaction.
- It is believed that **Life evolved in Ocean** and moved to land.
  - **Most** of the animals found in water.
  - **Majority** of phyla representatives found in water.
  - **Few** animals that **life on land** have to **adapted** to prevent **loss of water**.

# Water cycle

Examples for adaptation to live on land:

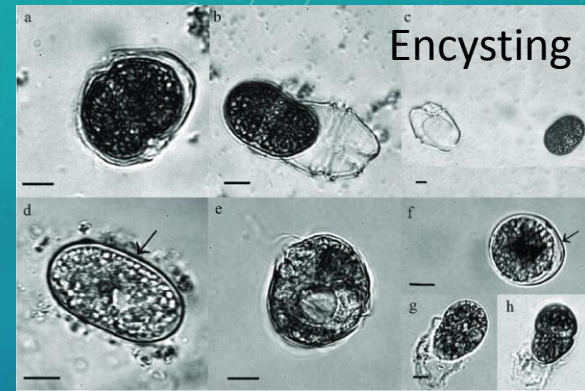
**Horned lizard** = has waterproof integument and can survive for 4 months in drying chamber.

**Camal** = store water in its reticulum (2<sup>nd</sup> stomach) and can live for 1 week on dry food, for 1 month or more on green food.



# Water cycle

- Some animals can withstand a considerable desiccation as:
- **Protests, Rotifers, minute crustaceans** = encysting & put eggs with heavy shells.
- **Tardigrade** = withstand desiccation for several years.
- **Lungfishes, some bats & birds** = estivate during hot seasons.





# Water cycle

- **Majority** of small animals live on land **seek** for moisture places to stay.
- However, **much moisture may be hazard** to them as **drowning**.
- Earthworm **flooded** out of their burrows by heavy rains.

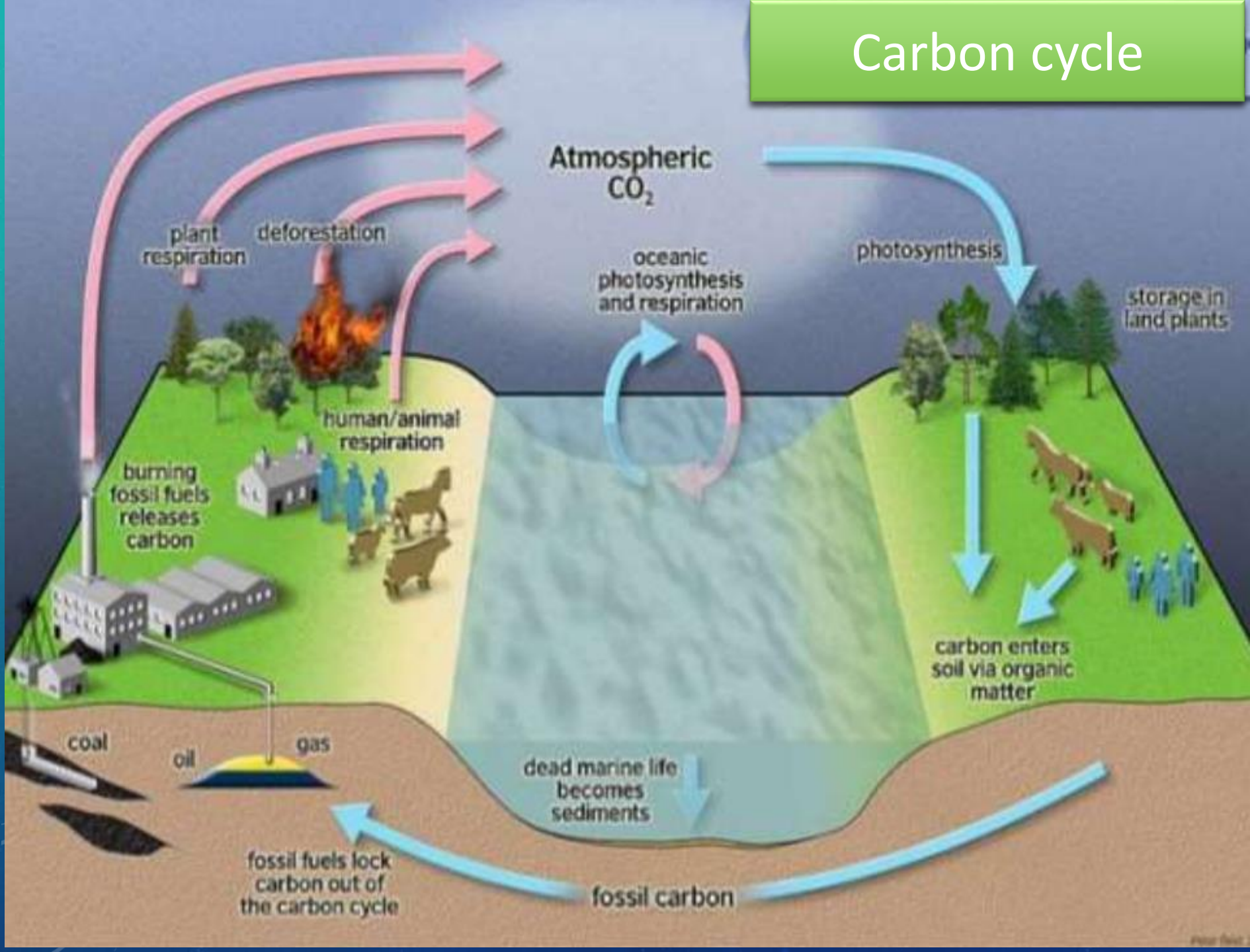


# Carbon cycle



- Carbon atoms are important because:
  - It is a component of various organic compound.
  - **C** moves from the atmosphere to plants.
  - In atmosphere, **C** is attached to Oxygen forming **CO<sub>2</sub>**.
  - With the help of the Sun, through the process of photosynthesis, CO<sub>2</sub> is pulled from the air to make plant food.
  - The energy from the Sun is used by plants to form the covalent bonds that link carbon atoms together.
  - These chemical bonds store this energy for later use in the process of respiration.

# Carbon cycle



# Carbon cycle

- Carbon moves from plants to animals. Through **food chains**, the Carbon that is in the **plants moves to the animals that eat them.**
- **Animals that eat other animals** get the Carbon from their food too.
- When plants and animals die, their bodies, wood and leaves decay (by fungi & bacterial decomposition) bringing the **Carbon into the ground.**
- Some become buried miles underground and will become **fossil** fuels in millions and millions of years.



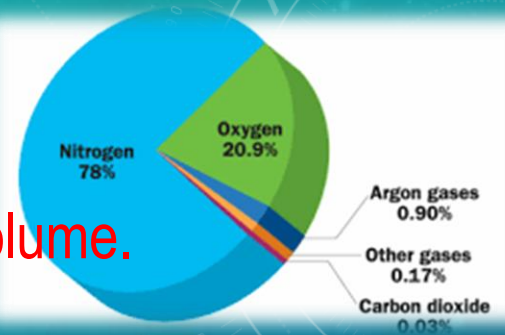
# Carbon cycle

- Carbon is back to the atmosphere by:
- Each time you exhale, you are releasing CO<sub>2</sub> Gas into the atmosphere.
- Animals and plants get rid of the CO<sub>2</sub> Gas through respiration.
- From fossil fuels when fuels are burned.

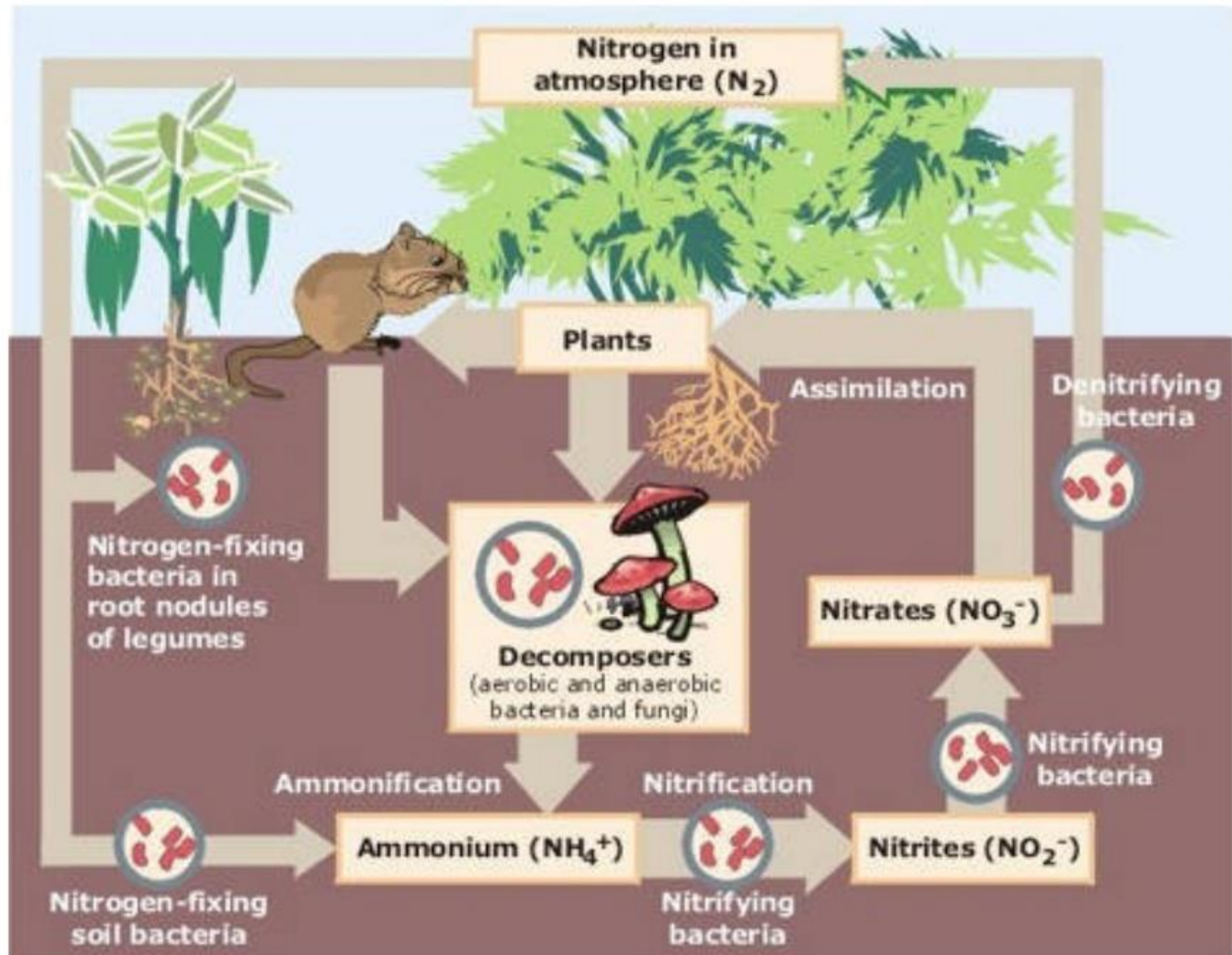


# Nitrogen cycle (N)

- Nitrogen composes 78% of earth's atmosphere **volume**.
- **N** composes 3.5% of living organisms weight.
- It is found as a component of Amino acids and nucleotides.
- Nitrogen exist in atmosphere and animals inhale it, then exhale it without use.
- Animals got **N** as nitrogenous organic compound from plants or other animals.
- Plants take nitrogen from the soil, by absorption through their roots in the form of their nitrate ions or ammonium ions.

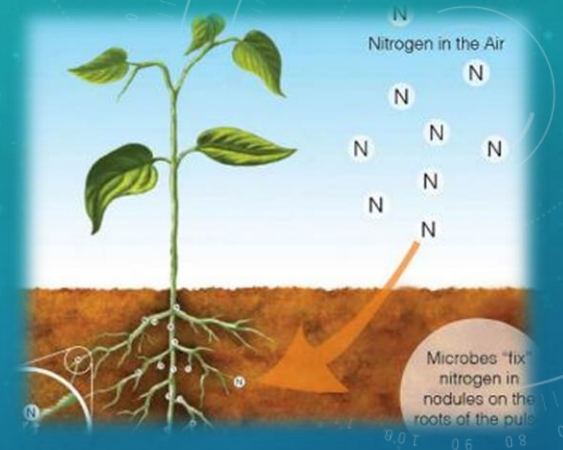


# THE NITROGEN CYCLE



# Nitrogen cycle (N)

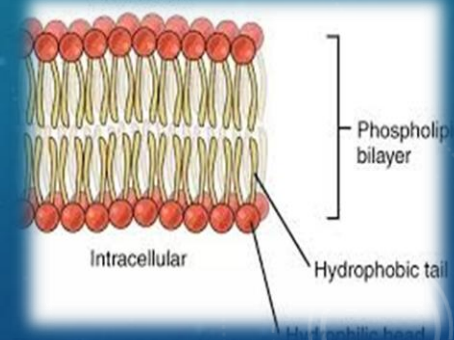
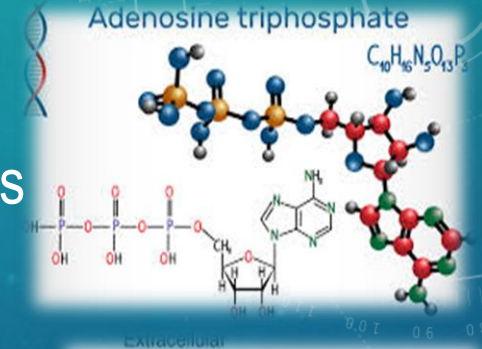
- **How N enter the soil?**
- Nitrogen enter the soil as nitrates & nitrites and fixed by micro-organisms as **bacteria** found in the **root nodules** of some plants.
- Nitrogen enter the soil through the decomposition of **dead plants** and **animals** and their **excretory products**.





# Phosphorus cycle (P)

- **There is No phosphorus in atmosphere.**
- Phosphorus is important for animals & plants because:
  - It's a part ATP
  - It enter in composition of DNA & RNA
  - It is a component of Cell membrane (as phospholipids)
  - It is important for Calcium absorption in vertebrates.
  - Insufficient phosphorus in the soil can result in a decreased crop yield.

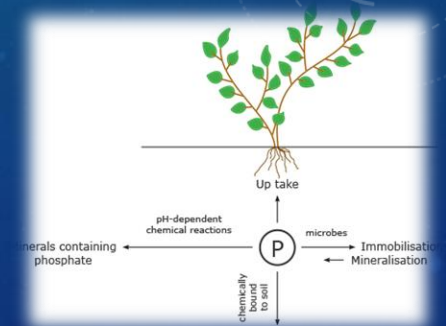


# Phosphorus cycle (P)

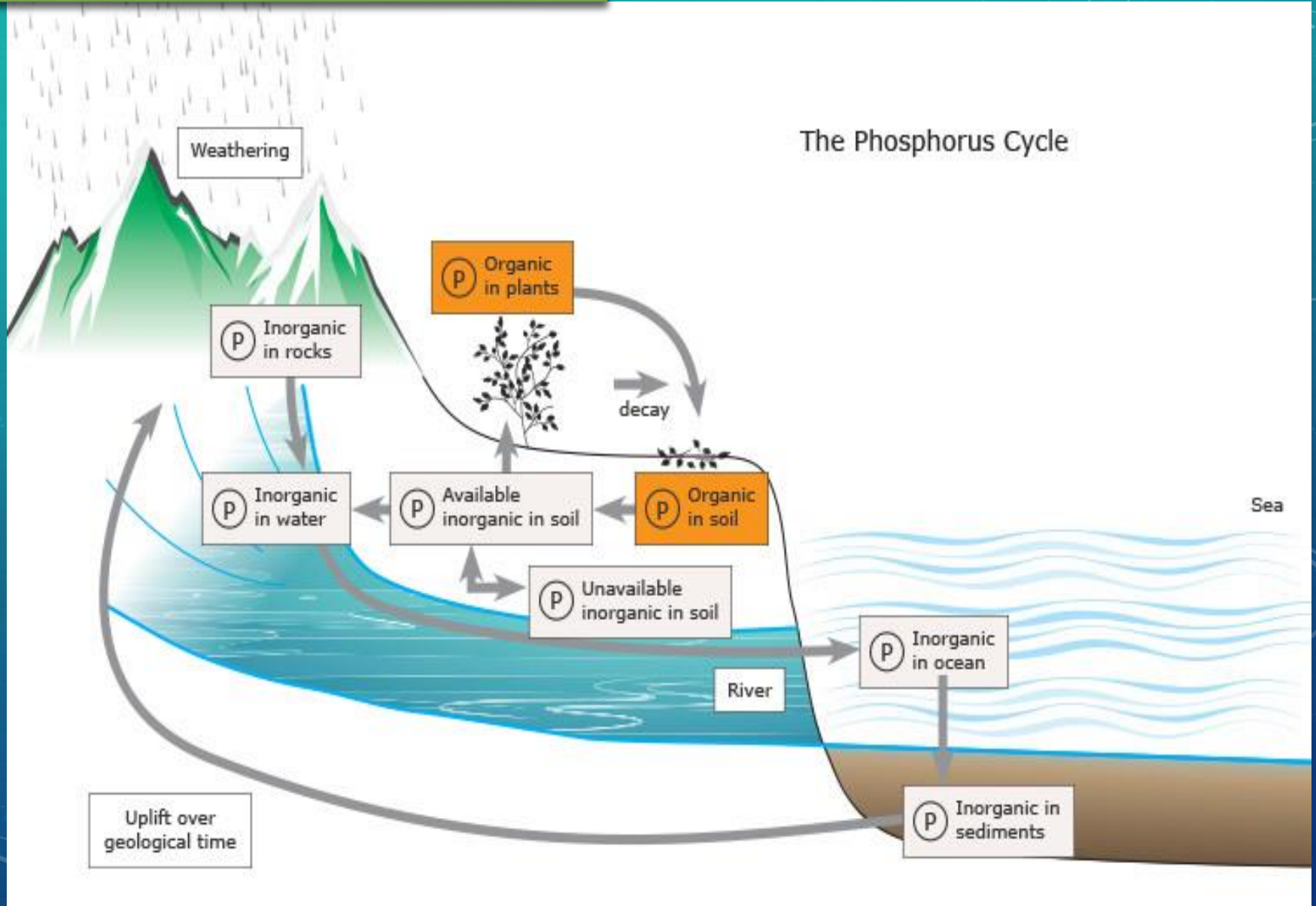
- **How phosphorus enter the Soil?**
- **Phosphorus found in the Rocks of Soil.**
- Over time, rain and weathering cause rocks to release phosphate ions and other minerals.  
This inorganic phosphate (insoluble) is then distributed in soils and water.
- Plants **absorb** inorganic phosphorus through roots and incorporated into **Organic molecules** such as **DNA**.

# Phosphorus cycle (P)

- **Phosphorus enter food web when animals eat plants.**
- When the plant or animal dies, it decays, and the **organic phosphate is returned to the soil.**
- Within the soil, **organic forms of phosphate** can be made available to plants by bacteria that break down organic matter to **inorganic forms of phosphorus**. This process is known as mineralisation.
- Phosphorus in soil can end up in waterways and eventually oceans. Once there, it can be
- incorporated into sediments over time.



# Phosphorus cycle (P)



# Phosphorus cycle (P)

## Other chemical elements

- Primary producers (green plant) need a number of minerals to produce organic molecules in addition to N & C.
- These are: K, Ca, S & Mg.
- Sea water contains 40 elements, the most abundant among them are Cl & Na ions, while Ca, Mg, K, CO<sub>3</sub>, SO<sub>4</sub> & Br are minors.

