

CYCLING OF MATTER

Earth: Matter does not come and go

Earth is a
Closed
System
to Matter



Cycles of Matter

- Unlike the one-way flow of energy, matter is recycled within and between ecosystems.
- These cycles are the water cycle, Nutrient Cycle, Carbon Cycle, nitrogen cycle and phosphorus cycle.

Key Concepts

- Matter is what all things are made of. By matter we mean: elements (carbon, nitrogen, oxygen) or molecules (water).
- Matter is neither created nor destroyed. All matter cycles through the earth cycles.

Key Concepts - Biogeochemical cycles

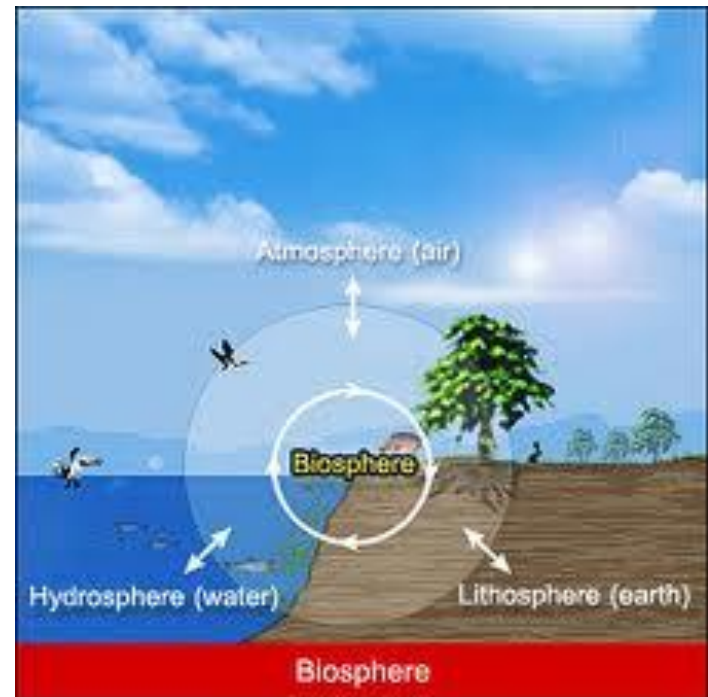
- the movement (or cycling) of matter through a system.
- we can subdivide the Earth system into the atmosphere, hydrosphere, lithosphere, and biosphere.
- Biogeochemical cycles are part of the larger cycles that describe the functioning of the whole Earth (not just the surface parts).

Layers of the Earth

Hydrosphere- water layer.
Liquid, Ice, Vapor.

Lithosphere- Earth's crust
and upper mantle.
Fossil fuels, minerals,
soil chemicals.

Biosphere- biotic &
abiotic factors.



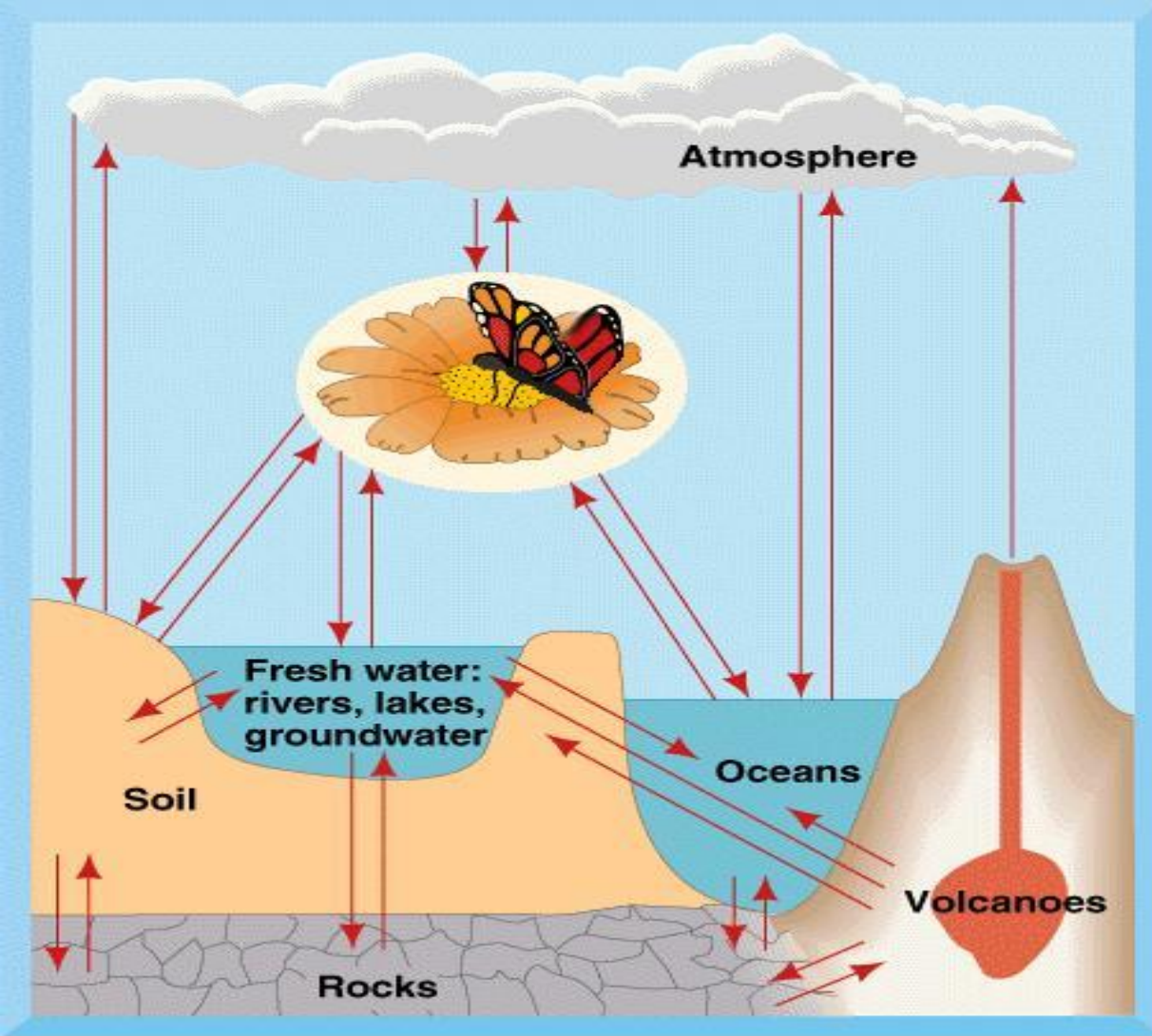
What is biogeochemical?

BIO: Biology. Life. Living things. These cycles all play a role in the lives of living things. The cycles might limit the organisms of Earth or they might happen along side, changing the environment.

GEO: Earth. Rocks. Land. This refers to the non-living processes at work. Oxygen cycles through many systems. It's in you and plants for the 'bio' part of the cycle. Oxygen might also wind up in rocks... The 'geo' part of its cycle.

CHEMICAL: Molecules. Reactions. Atoms. All cycles include these small pathways. Complete molecules are not always passed from one point to the next. Sometimes chemical reactions take place that changes the molecules and locations of the atoms. Think about oxidation as an example of the 'chemical' part of these pathways.

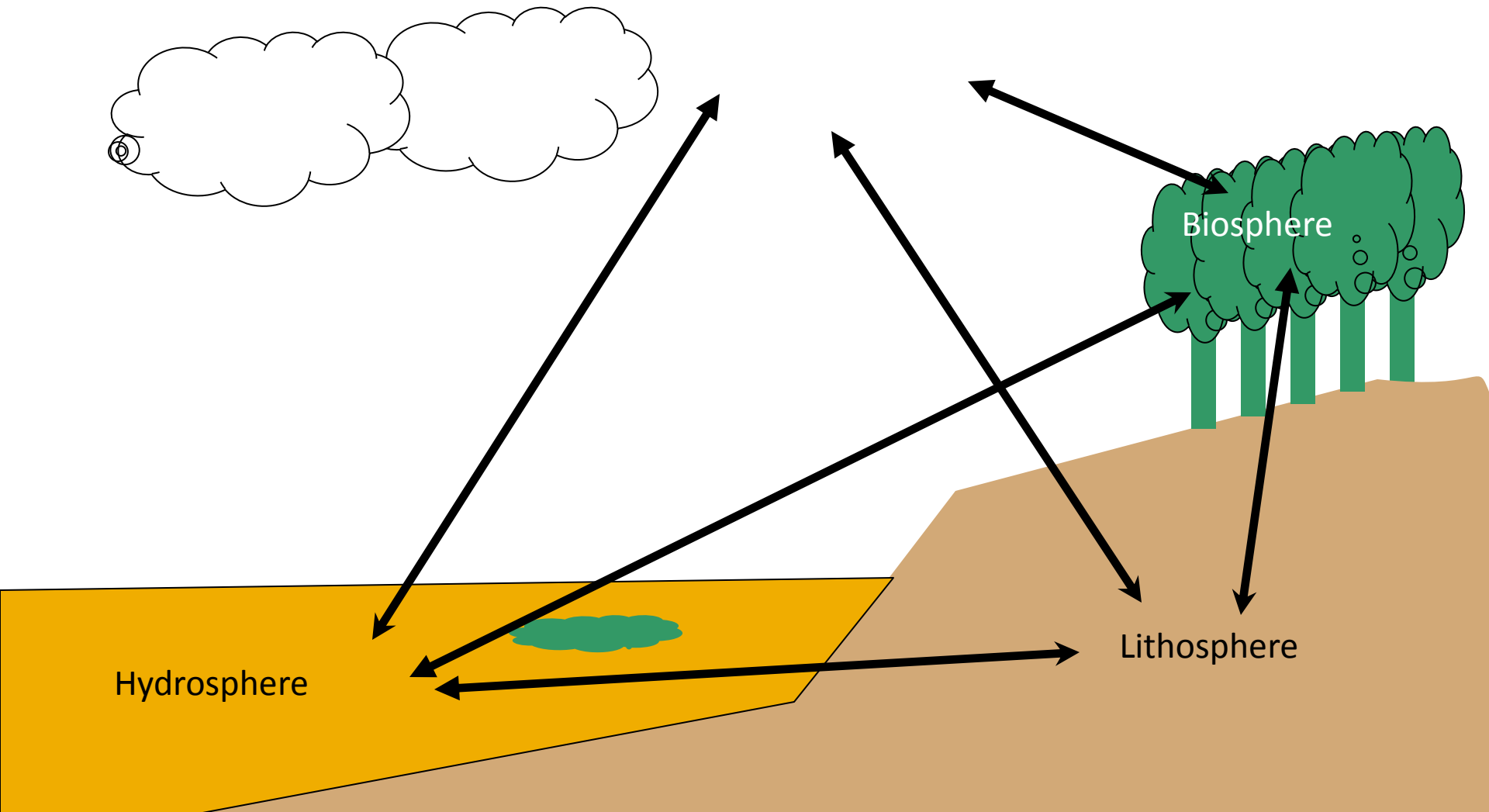
To sum it up, these pathways are all made of different biological, geological, and chemical processes that help make the world go 'round and life exist on Earth.



Generalized Biogeochemical Cycle

Generalized biogeochemical cycle. The major parts of the biosphere are connected by the flow of chemical elements and compounds. In many of these cycles, the biota plays an important role. Matter from the Earth's interior is released by volcanoes. The atmosphere exchanges some compounds and elements rapidly with the biota and oceans. Exchanges of materials between rocks, soils, and the oceans are generally slower by comparison.

Biogeochemical Cycles: Reservoirs & Pathways



Some Major Cycles of Matter

- Water Cycle
- Rock Cycle
- Chemical Cycles
 - Carbon
 - Nitrogen
 - Phosphorous
 - Sulfur

Nutrient Cycle

- **nutrient:** any atom, ion, or molecule an organism needs to live, grow, or reproduce.
 - **macronutrients** needed in relatively large amounts
e.g., C, O, H, N, P, S, K, Ca, Mg, Fe
 - **micronutrients** needed in relatively small amounts
e.g., Na, Zn, Cu, Cl,
 - **nutrient cycles** (= biogeochemical cycles) involve continual flow of nutrients from nonliving (air, water, soil, rock) to living organisms (biota) & back again.
 - nutrient cycles driven directly or indirectly by solar radiation & gravity.
 - Major cycles: hydrologic (water), carbon, oxygen, nitrogen, phosphorus and sulfur.

Matter cycles within ecosystems

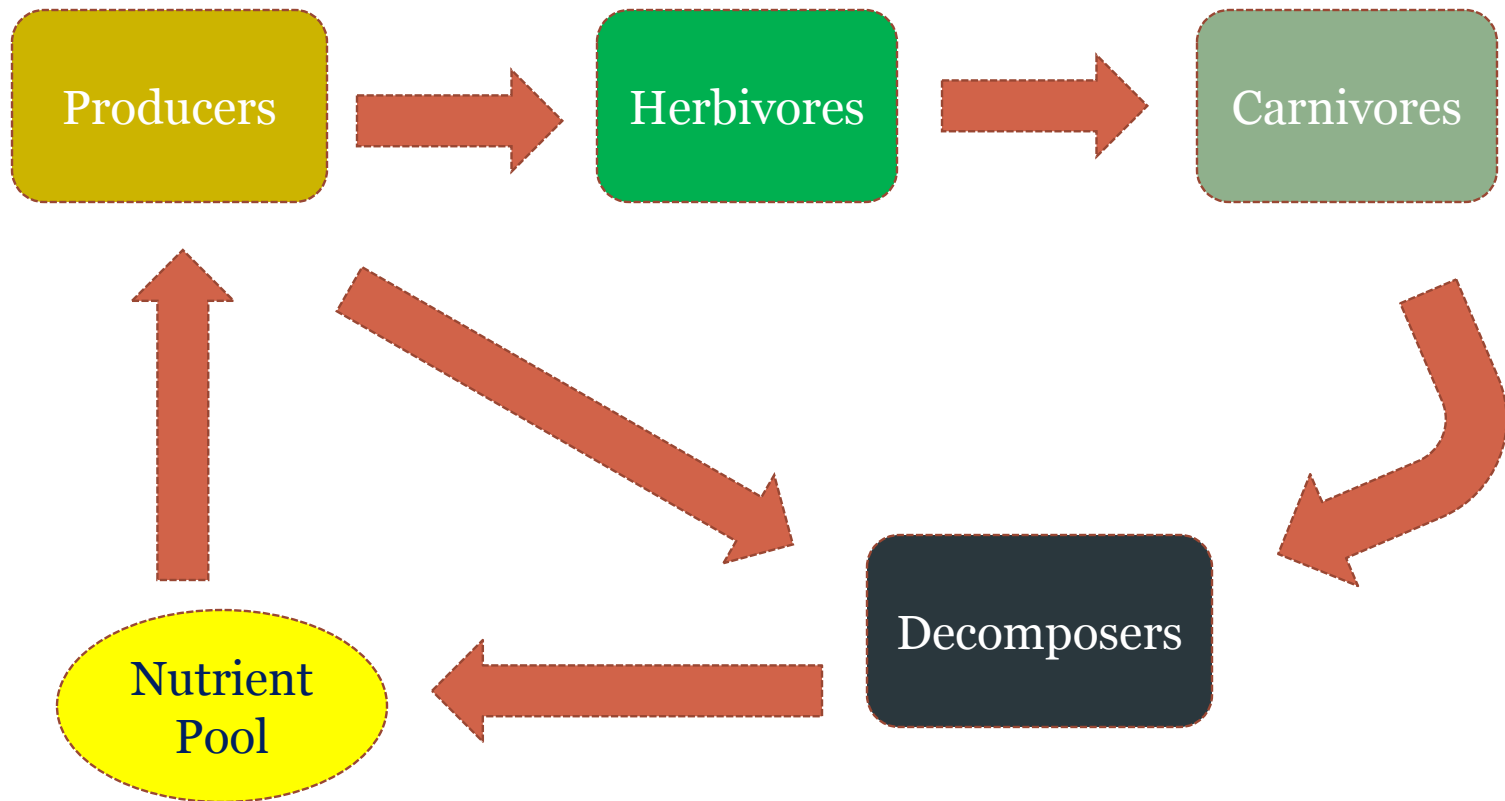
- In any ecosystem, the various organisms depend for survival on other organisms and on their surroundings.
- Organisms obtain the matter that they need to build their organic substance from other organisms and from their surroundings.

Matter cycles within ecosystems

- Unlike energy, matter cycles within any ecosystem and is reused.
- Matter, such as water, carbon, nitrogen and phosphorus, continually cycles within an ecosystem.

Matter cycles within ecosystems

- These elements are sometimes found in producers and consumers.
- At other times these elements are found in non-living components – rocks, soil, dissolved in water.



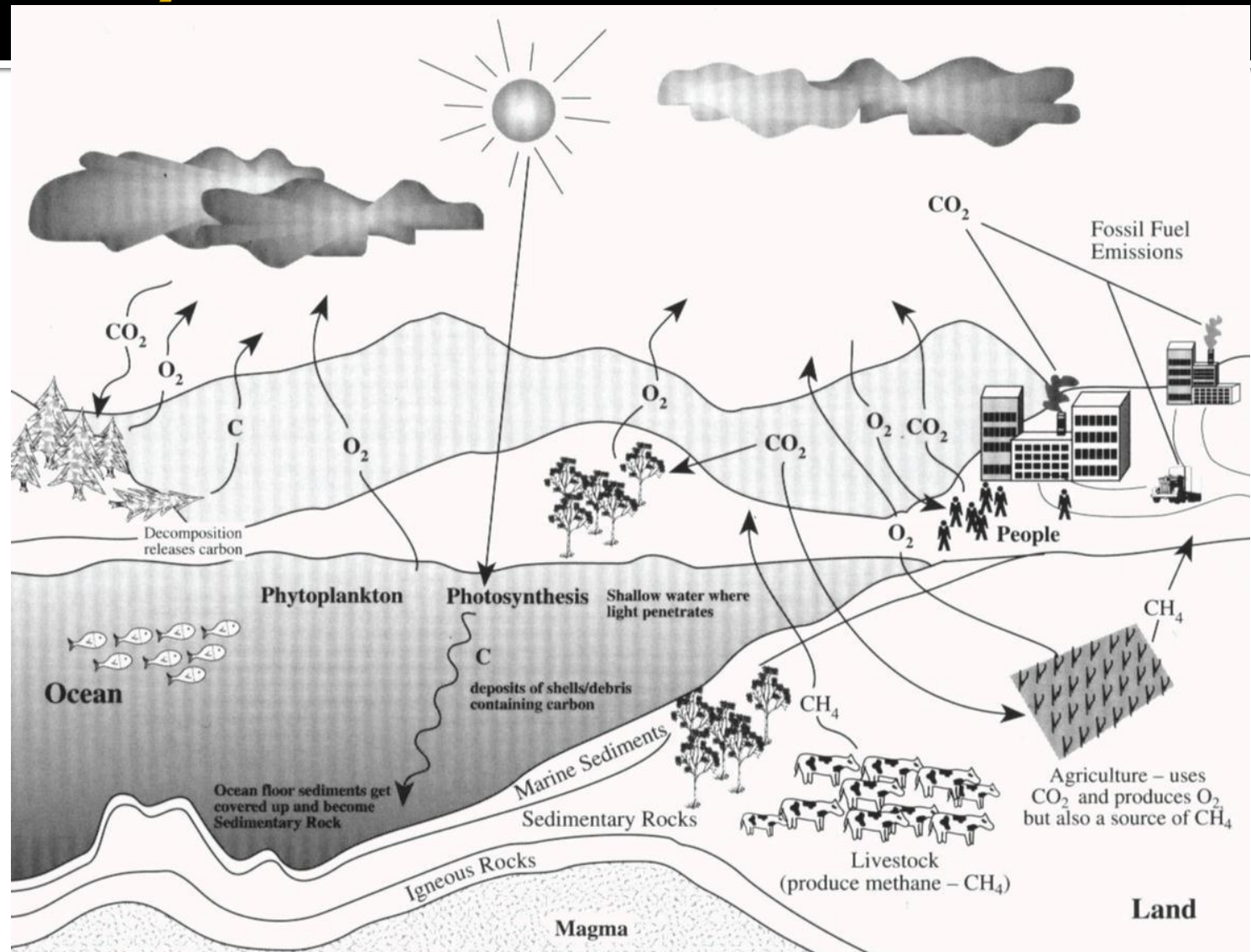
The Cycling of Matter

Key Concepts -The Carbon Cycle

- one of the most important to humans because it is important to our existence:
 - --one of the primary elements forming human tissues.
 - --necessary to plants, the basis of human food and because it is important to the climate system which sets the background for our environment:
 - -- carbon dioxide (CO_2) and methane (CH_4) are greenhouse gases which help set global temperatures.

Carbon cycle

- See p 313 Biozone for diagram of Carbon cycle

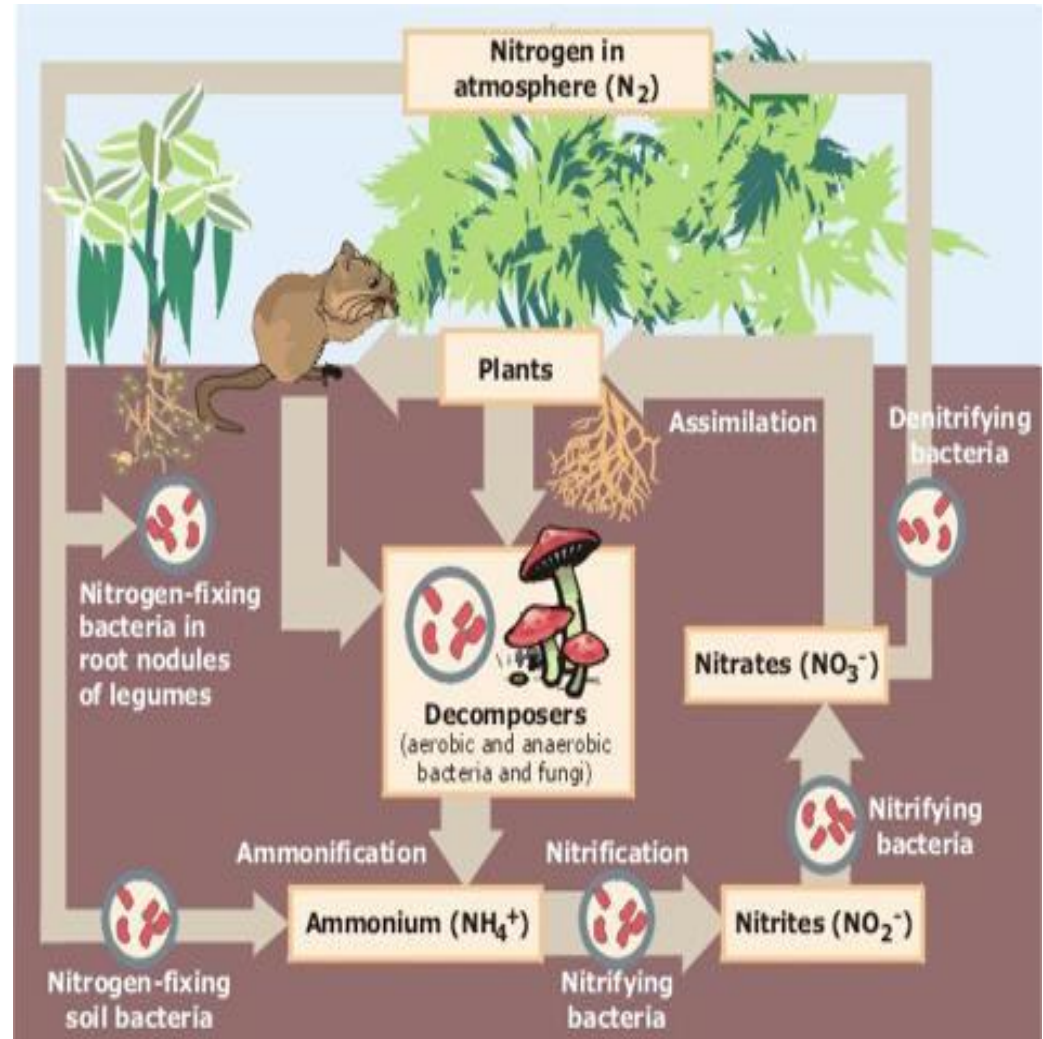


MATTER CYCLES WITHIN ECOSYSTEMS

1. Explain how elements can be cycled and exchanged between living and non living parts of an ecosystem.
2. What might happen to a carbon atom from a glucose molecule in the blood of a human?

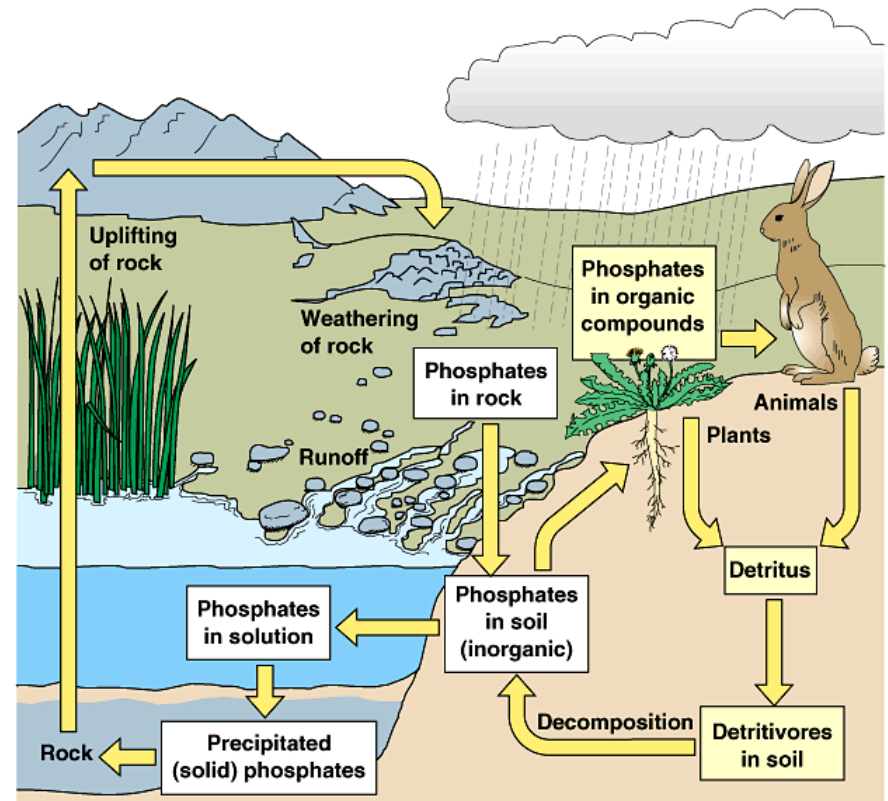
Nitrogen Cycle

- Nitrogen is an essential part of proteins and nucleic acids
- Earth's atmosphere about 80% Nitrogen
- Molecular N so stable that in short supply in biological systems
- Bacteria play an important part in transferring nitrogen between abiotic and biotic systems
- See p 317 Biozone for diagram of Carbon cycle



Phosphorus cycle

- The atmosphere does not play a significant role in the movement of Phosphorus because P and P-based compounds are usually solids at the typical ranges of temperature and pressure found on Earth
- P is required by organisms at greater amounts than Nitrogen.
- Of all the nutrients P is most likely to limit growth of plants.
- Cycles slowly through ecosystems released into soil and water by weathering of rocks.
- P dissolved in soil absorbed by plant roots into food chain.



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Water Cycle

Water moves around by the following processes

- Precipitation
- Evaporation
- Transpiration
- Surface run off
- Infiltration
- Percolation

It is found in the following states

- Ice (at the poles)
- Water (in sea and rivers)
- Gas (clouds)
- See p 319 Biozone for diagram of Carbon cycle
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