

Module 2: Principles of Ecology

Lesson 3: Cycling of matter

Again, nutrients cycle and energy flows.

- The law of conservation of mass states that matter is not created nor destroyed.
- All new life on the Earth is built from existing atoms.

Matter: anything that takes up space and has mass

Nutrient: a chemical substance that an organism must obtain from its environment to sustain life

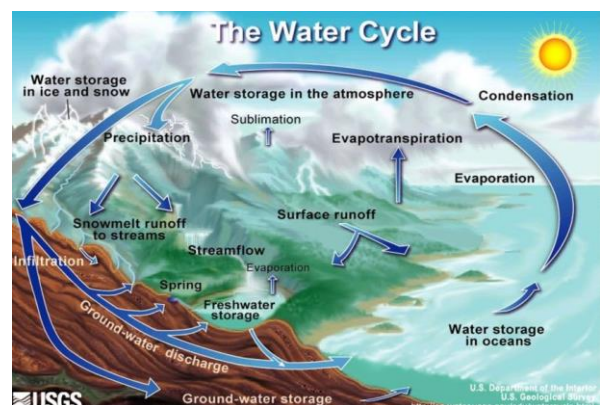
- All organisms contain water and nutrients such as carbon, nitrogen, and phosphorus.

Biogeochemical cycle: the exchange of matter through the biosphere

- These cycles involve living organisms (*bio*), geological processes (*geo*), and chemical processes (*chemical*)
 - Chemical elements pass through food webs and biogeochemical cycles combining and recombining in different ways.
 - Remember, some matter reacts to release energy for life functions, some is stored, and much is discarded.

The Water Cycle

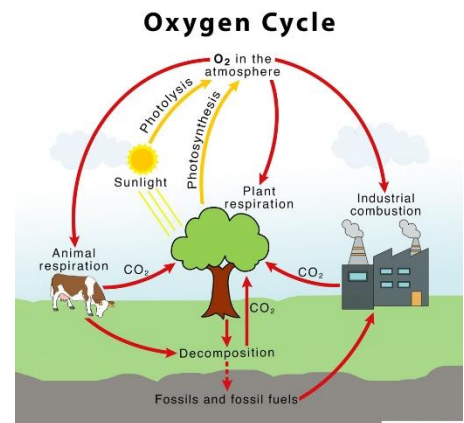
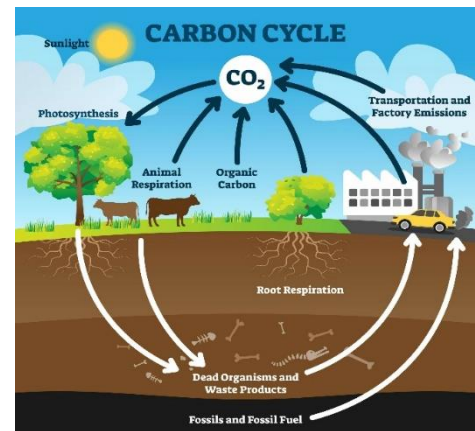
- The Sun causes water to *evaporate* from Earth's surface.
- Water enters the atmosphere called *water vapor*.



- Water evaporates from the surface of plants called *transpiration*.
- Clouds form when water vapor rises, cools, and *condenses* as precipitation.
- Water can *infiltrate* into the ground or flow on the Earth's surface as *runoff*.
- [The Water Cycle](#)

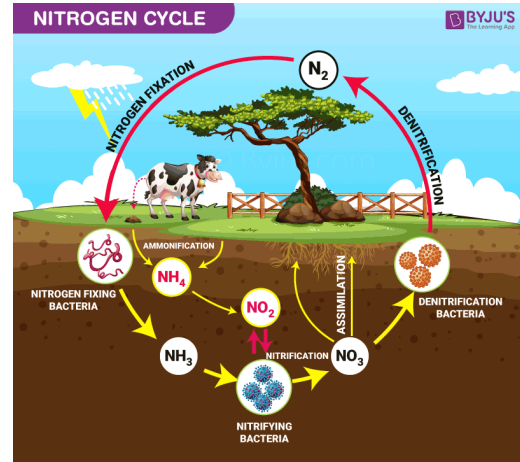
The Carbon Cycle and Oxygen Cycle

- Carbon and oxygen combine to form molecules for life like carbon dioxide (CO₂) and sugars.
- Photosynthesis – plants and algae
 - Carbon dioxide + water → sugar + oxygen (O₂)
- Cellular respiration – animals and other living organisms
 - Sugar + oxygen → carbon dioxide + water
- Carbon dioxide enters the atmosphere as dead organisms decay and enters the soil through the decomposition of plant and animal matter and waste.
- Carbon enters the cycle when organic matter is buried underground and converted to fossil fuels.
- Carbon returns to the atmosphere when those fossil fuels burn.
- Carbon and oxygen enter the cycle when they combine with calcium to form calcium carbonate which are found in shells of marine organisms then deposits into the ocean floor in limestone rock.
- [The Carbon and Oxygen Cycle](#)



The Nitrogen Cycle

- Most of Earth's nitrogen is found in the atmosphere.
- **Nitrogen fixation:** the process of converting nitrogen gas (N_2) into ammonium (NH_4^+)
 - Bacteria and other microorganisms perform this process.
- Nitrification is the chemical process that turns ammonium into nitrogen-oxygen compounds.
 - Plants use these compounds to make proteins.
- **Denitrification:** process in which nitrogen-oxygen compounds are converted back into nitrogen gas and returned to the atmosphere
- High nitrogen content in runoff from fertilizers can create algae overgrowth called algae blooms.
- Nitrogen-oxygen compounds from factories combine with water to form acid rain.
- [Nitrogen and Carbon cycles](#)



The Phosphorous Cycle

- Essential for growth and development of organisms
- Phosphates contain phosphorus in solution and are cycled from the soil to producers then to consumers.
- When organisms die, decomposers return the phosphorus back to the soil.
- Phosphorus moves through precipitation and sedimentation to form rocks.
- Human use from mining, sewage treatment, and fertilizer can increase the amount of phosphorus cycling.
- [Nitrogen and Phosphorus cycles](#)

