Nutrient Cycles

Carbon Cycle

* Carbon EXISTS in abiotic environment as:
  1. Carbon dioxide [CO₂] in the atmosphere → dissolves in H₂O to form HCO₃⁻
  2. Carbonate rocks (limestone & coral = CaCO₃)
  3. Deposits of coal, petroleum, and natural gas → derived from once living things
  4. Dead organic matter (humus in the soil)

* Carbon ENTERS biotic environment through:
  1. Photosynthesis: changes light energy to chemical energy

* Carbon RETURNS to atmosphere by:
  1. Respiration → CO₂
  2. Decomposition / Decay
  3. Burning

* Carbon Cycle and Humans:
  1. Removal of photosynthesizing plants
  2. Combustion of fossil fuels

Nitrogen Cycle

* ~79% of air is N₂ gas
* N is essential to plants and animals
* Plants and animals can’t use N₂ gas
* Usable N: ammonia (NH₃) or nitrate (NO₃⁻)

* Conversion of atmospheric N₂ to NH₃ and NO₃⁻:
  → Nitrogen fixation
  1. Aquatic ecosystems: blue-green algae
  2. Terrestrial ecosystems: bacteria on root nodules of legumes (peas, beans, alfalfa, clover)
  3. Lightening

* Nitrogen RETURNS to soil by:
  1. decomposition of once living things → ammonifying bacteria + fungi
  2. exists in soil as nitrate (NO₃⁻), nitrite (NO₂⁻), and ammonia (NH₃)

* Nitrogen returns to atmosphere by:
  1. denitrifying bacteria

Nitrogen Cycle and Humans:
  1. Nitrogen required for genetic materials (DNA, RNA, amino acids)

Phosphorus Cycle

* Major environmental reservoir: rocks

1. Leaching: water dissolves phosphates in rocks and carries to lake, stream, etc.
2. Dissolved phosphate: used by plants and passed through food chain
3. Animals return phosphorus to environment by:
   * excretion
   * death and decay

Phosphorus Cycle and Humans:
  1. Phosphates mined for fertilizers → returns P to soil
  2. Erosion: P in soil and rocks washed away into water systems