In all things there is a law of cycles.
- Publius Cornelius Tacitus

AP ENVIRONMENTAL SCIENCE

UNIT 2: THE LIVING WORLD (PART B)

TOPICS INCLUDE:
- Biodiversity
- Biogeochemical Cycles

II. THE LIVING WORLD (10-15%)

A. **Ecosystem Structure** – biological populations and communities, ecological niches, interactions among species, keystone species, species diversity and edge effects, major terrestrial and aquatic biomes

B. **Energy Flow** – photosynthesis and cellular respiration, food webs and trophic levels and ecological pyramids

C. **Ecosystem Diversity** – biodiversity, natural selection, evolution, and ecosystem services

D. **Natural Ecosystem Change** – climate shifts, species movement and ecological succession

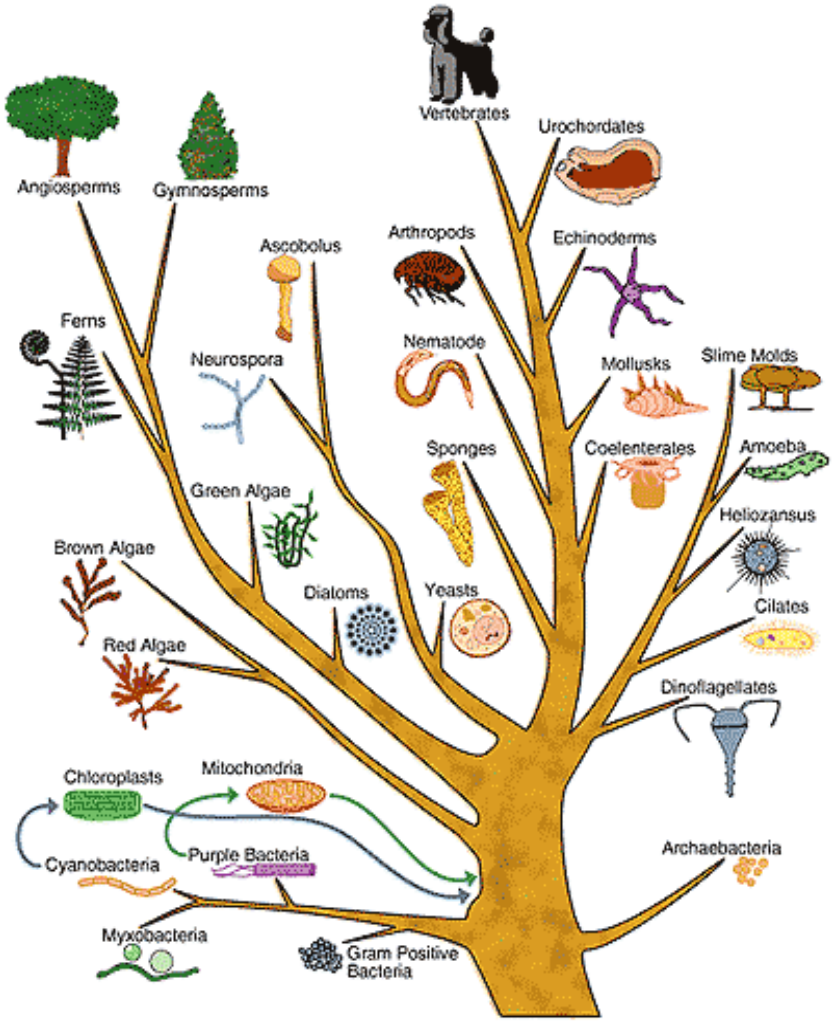
E. **Natural Biogeochemical Cycles** – carbon, nitrogen, phosphorus, sulfur, water, and conservation of matter

ECOSYSTEM DIVERSITY

- biodiversity: number & variety of organisms found within an ecosystem

DIVERSITY INCREASERS	DIVERSITY DECREASERS
Diverse habitats	Environmental stress
Disturbance in the habitat (e.g. fire, storms)	Extreme environments
Environmental conditions w/low variation	Extreme limitations in the supply of a fundamental resource
Trophic levels w/high diversity	Extreme amounts of disturbance
Middle states of succession	Introduction of species from other areas
Evolution	Geographic isolation

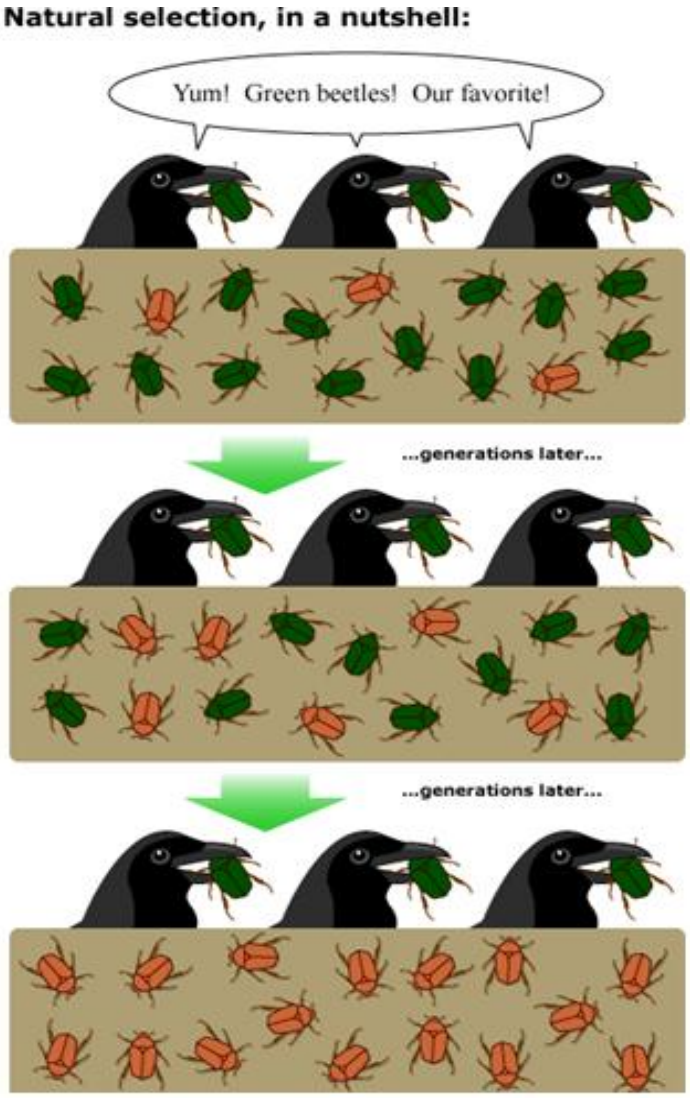
EVOLUTION



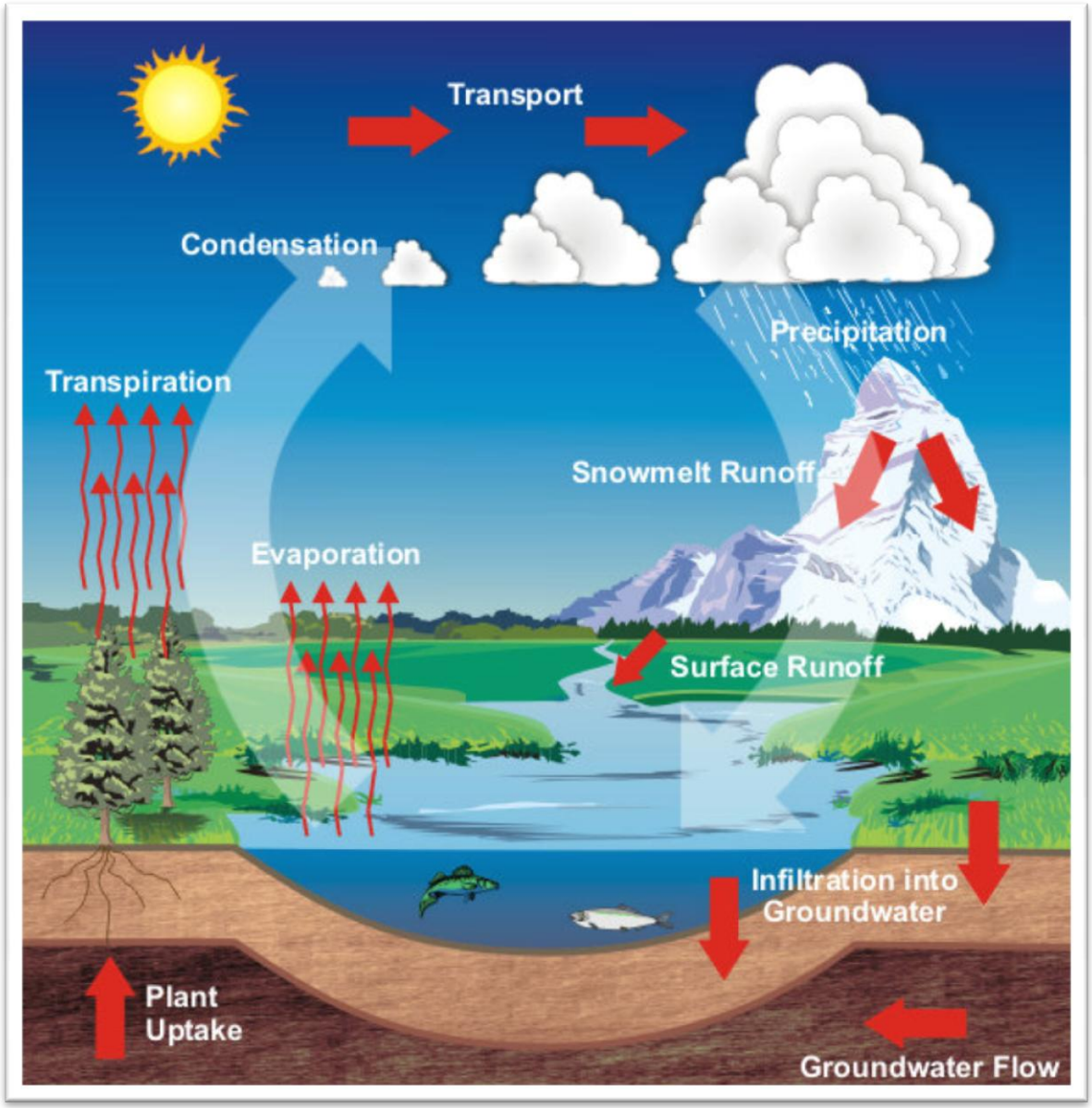
- change in the genetic composition of a population during successive generations as a result of natural selection acting on the genetic variation among individuals and resulting in the development of new species

NATURAL SELECTION

- mechanism how organisms evolve
- works on the individual by determining which individuals have adaptations that allow them to survive, reproduce and pass on those adaptive traits to their offspring
- survival of the “fittest”; fittest means ability to reproduce and pass on genes to offspring

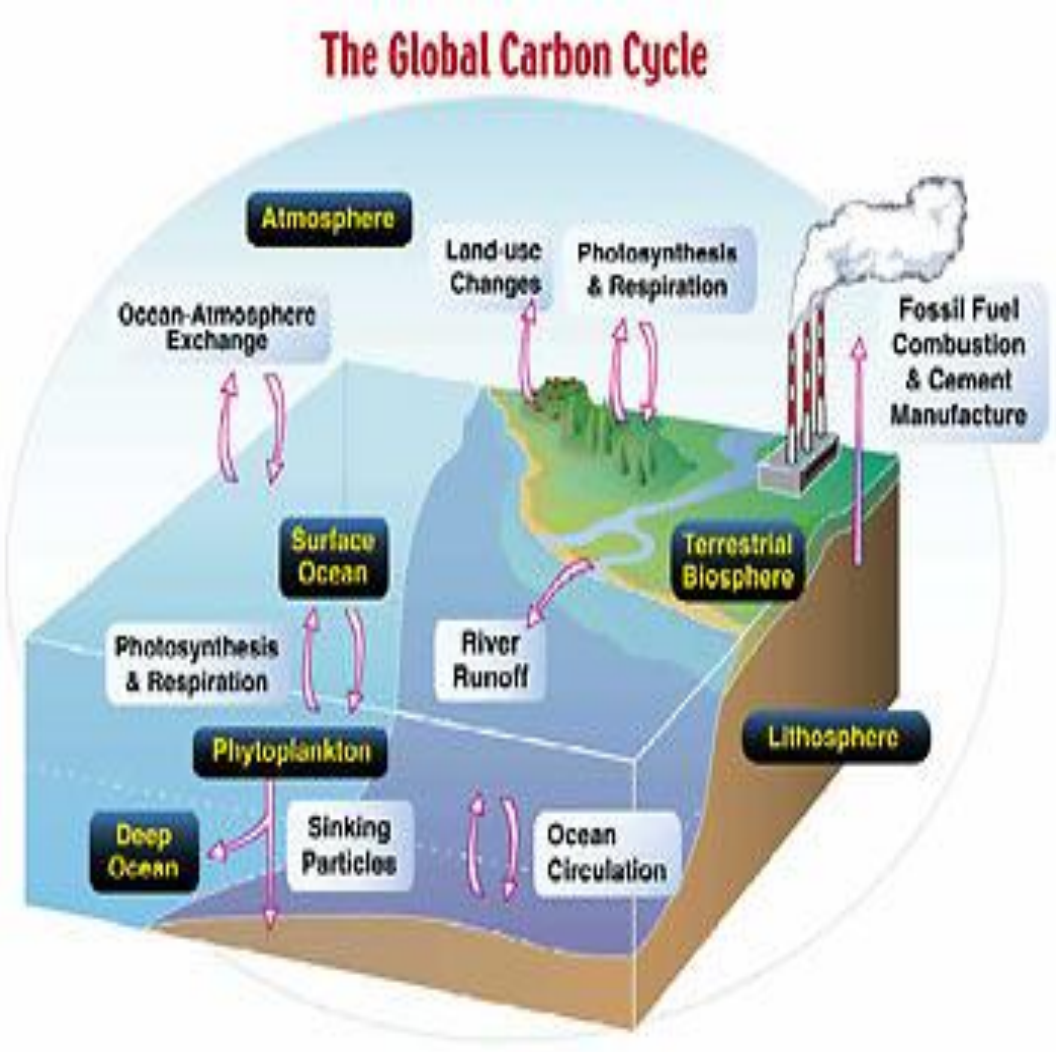


WATER CYCLE


Transport
Condensation
Precipitation
Transpiration
Snowmelt Runoff
Evaporation
Surface Runoff
Infiltration into Groundwater
Plant Uptake
Groundwater Flow

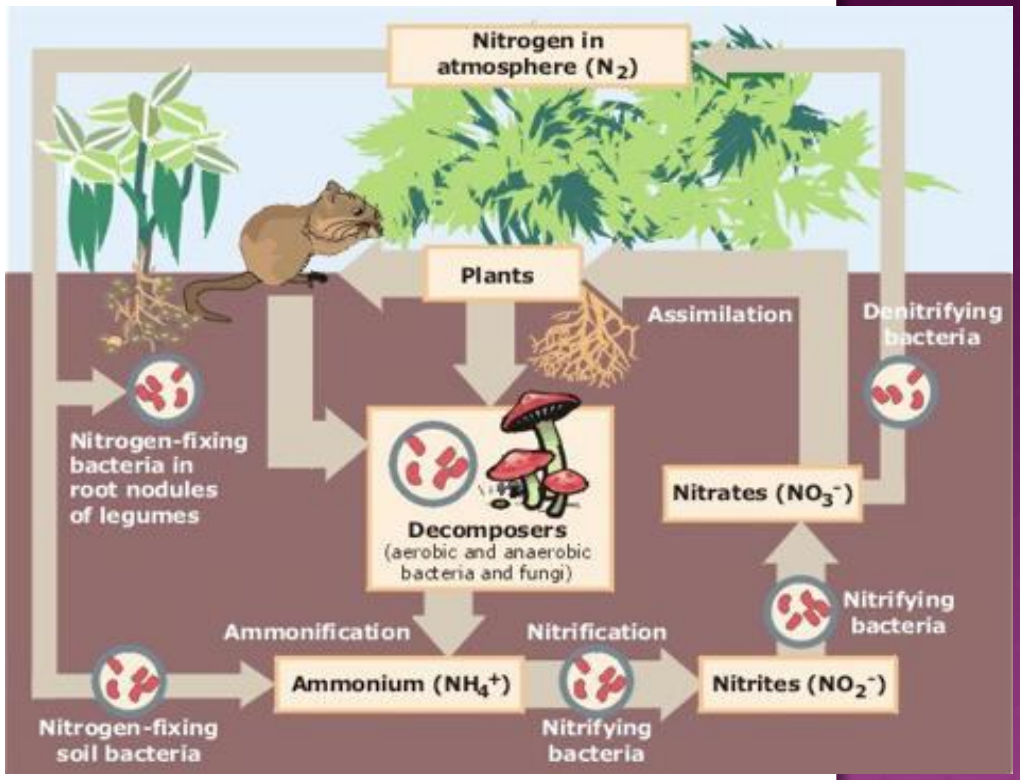
CARBON CYCLE

- key events: photosynthesis & respiration (living things are exchange pools for carbon)
- organisms die get buried and subjected to extreme heat & pressure →organic matter converts to oil, gas and coal (fossil fuels)
- carbon reservoirs: oceans (CO_2 soluble in water) & earth's rocks (calcium carbonate)



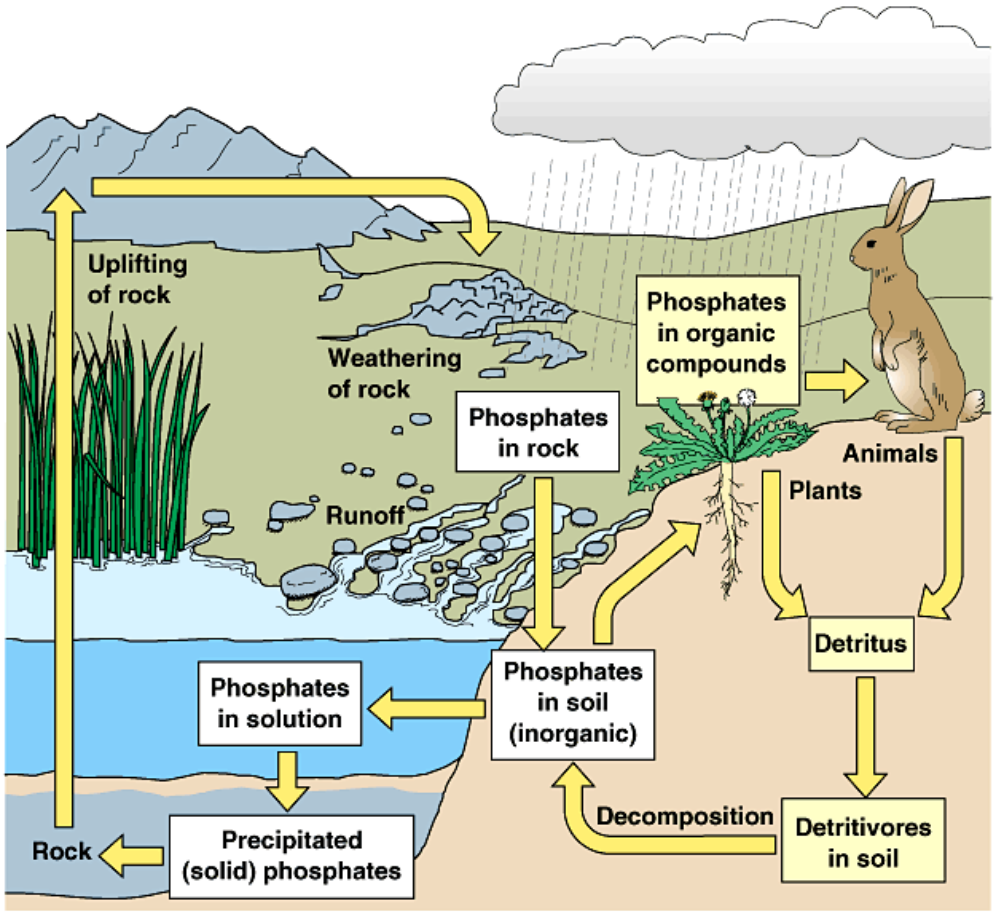
NITROGEN CYCLE

- **STEP 1: NITROGEN FIXATION**
  - → Nitrogen must be converted (fixed) into ammonia (NH_3) or nitrates (NO_3^-) to be used by living organisms
  - → Occurs as result of *Rhizobium* (soil bacteria) found in roots of legumes (beans/clover) and/or atmospheric effects (lightning)
- **STEP 2: NITRIFICATION**
  - → Soil bacteria converts ammonium ions (NH_4^+) into one of the forms used by plants; nitrate (NO_3)
- **STEP 3: ASSIMILATION**
  - → plants absorb ammonium (NH_3) ammonium ions (NH_4^+) & nitrate ions (NO_3^-) through their roots (heterotrophs obtain N by consuming plants)



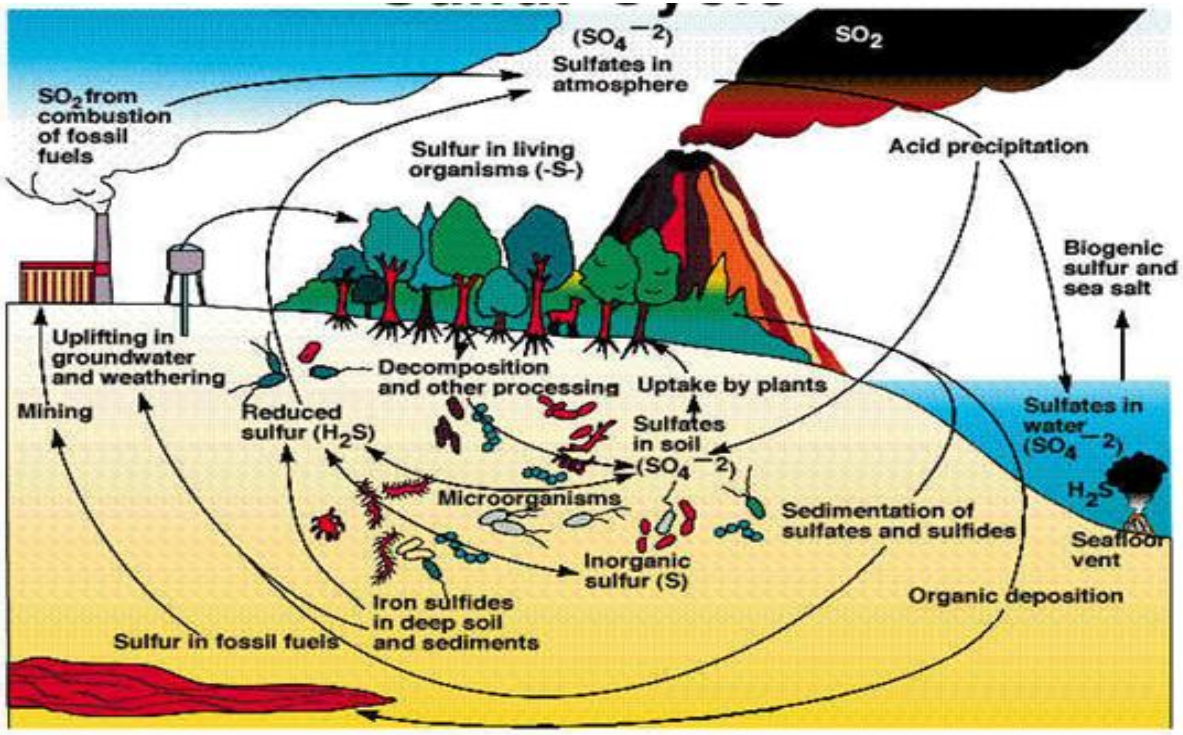
- **STEP 4: AMMONIFICATION**
  - → decomposing bacteria convert dead organisms & other waste to ammonia (NH_3) or ammonium ions (NH_4^+) (reused by plants
- **STEP 5: DENITRIFICATION**
  - → specialized bacteria convert ammonia to NO_3^-, NO_2, and N_2 (release it back to atmosphere)

PHOSPHORUS CYCLE



- only exists in atmosphere as dust particles
- P is major component of nucleic acids
- found in soil, rock & sediments (released through weathering)
- released in the form of phosphate (PO_4^{3-}) ; soluble and absorbed though soil by plants
- often limiting factor in plant growth

SULFUR CYCLE



- makes up proteins and vitamins
- plants absorb S when dissolved in water; animals obtain it by consuming plants
- most found in rocks & salts or buried in ocean sediment
- enters atmosphere through volcanic eruptions, bacterial functions, decay of organisms, human activity