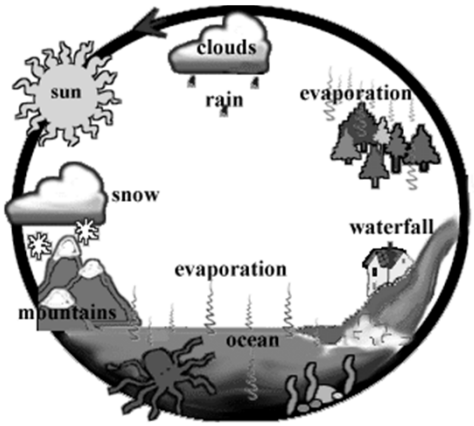
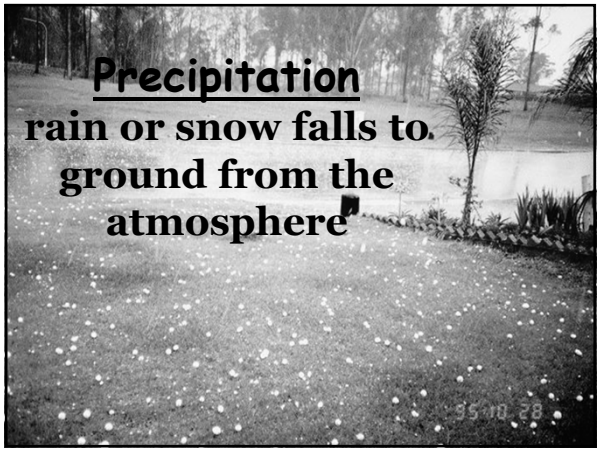
Cycles of Matter

- **Matter does not flow in one direction like energy… it is recycled**
- **<u>Biogeochemical</u> <u>Cycles</u>**– Movement of a particular chemical through the biological (living) and geological (nonliving) parts of an ecosystem
- **5 Cycles:**
  - **Hydrologic Cycle**
  - **Oxygen Cycle**
  - **Carbon Cycle**
  - **Nitrogen Cycle**
  - **Phosphorus Cycle**

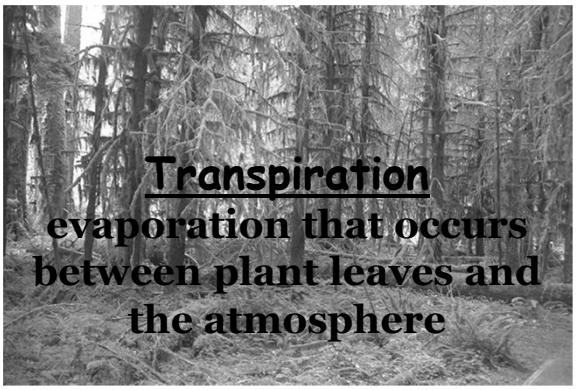
Hydrologic Cycle (Water Cycle)





Evaporation

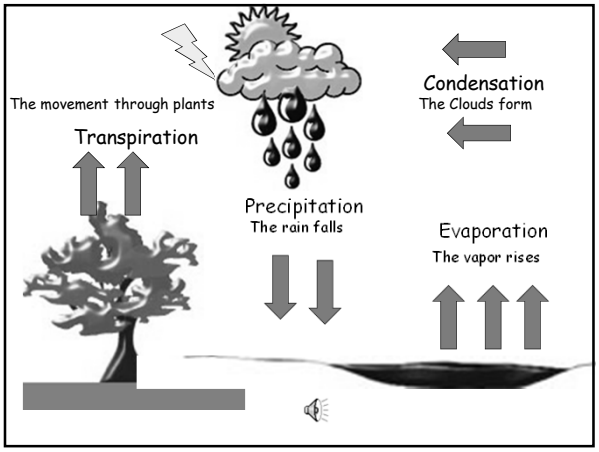
water reenters the atmosphere



Condensation

water vapor condenses and forms clouds which return water back to the surface

Source of Energy



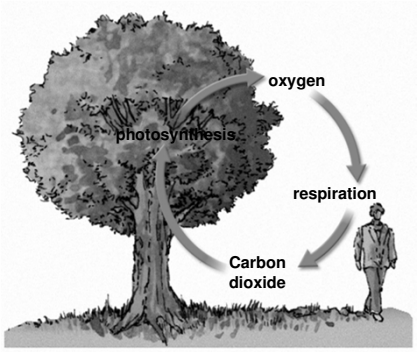
Nutrient Cycles

Oxygen Cycle

- Oxygen cycles indirectly through an ecosystem by the cycling of other nutrients
- The main processes involved in the oxygen cycle are photosynthesis and respiration

- Plants release oxygen as a waste product during photosynthesis
- Humans & other organisms take oxygen in and release it as CO_2 through respiration

Oxygen Cycle



Carbon Cycle

- Carbon is the building block of life—it is an essential component of carbohydrates, proteins, fats, & other organic molecules in our bodies
- Carbon moves from the atmosphere through photosynthesis then through the food web

- Carbon is returned to the atmosphere as CO_2 by respiration or the decomposition of dead organisms
- The burning of fossil fuels also adds carbon to the atmosphere

Carbon Cycle

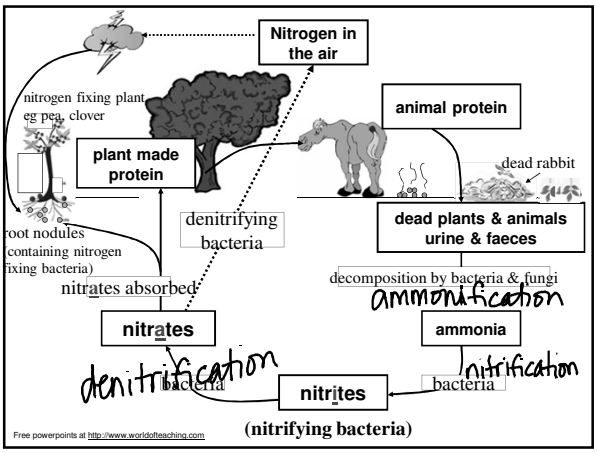
- Carbon is found in all living organisms.
- Carbon is cycled through:
  - Process of photosynthesis, respiration, and decomposition
  - The release of carbon dioxide by volcanoes
  - Conversion of carbon from dead organisms into fossil fuels
  - Human activity (mining, burning fossil fuels, cutting/burning forests)

Nitrogen Cycle

Nitrogen Cycle

- Most of the nitrogen cycle takes place underground
- Nitrogen fixation: bacteria convert gaseous nitrogen from the atmosphere into ammonia NH_3

- Some nitrogen fixing bacteria live on the roots of plants while others live in the soil
- Denitrifying bacteria release nitrogen gas back into the atmosphere

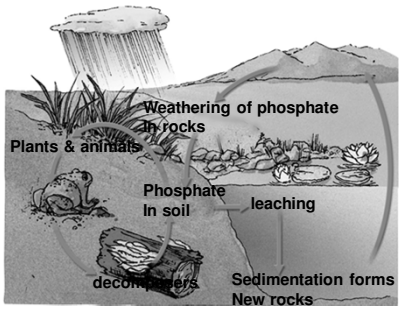


- Nitrogen makes up 78% of atmosphere.
- Nitrogen fixation (bacteria)—converting nitrogen gas into ammonia (ammonification), then nitrite (nitrification), then nitrate (denitrification)--which is the usable form for plants
- Nitrogen gas is then put back into the atmosphere.
- Most of the nitrogen cycle takes place underground
- Where do these bacteria live?

Phosphorus Cycle

- **Takes place at & below ground level—does not include the atmosphere**
- **Phosphate is released by the weathering of rocks**
- **Phosphorous moves through food web and returns to soil during decomposition**

- **Phosphorus leaches into groundwater from the soil and is locked in sediments**



Nutrient Limitation

- Primary productivity—the rate at which matter is created by producers.
- Limiting nutrients—nutrients that are scarce in an ecosystem and lowers productivity.
  - Ex. Oceans are nutrient-poor (nitrogen) compared to land
  - Ex. Freshwater is nutrient-poor (phosphorus)