

NOTES: CH 3- The Biosphere

VOCABULARY:

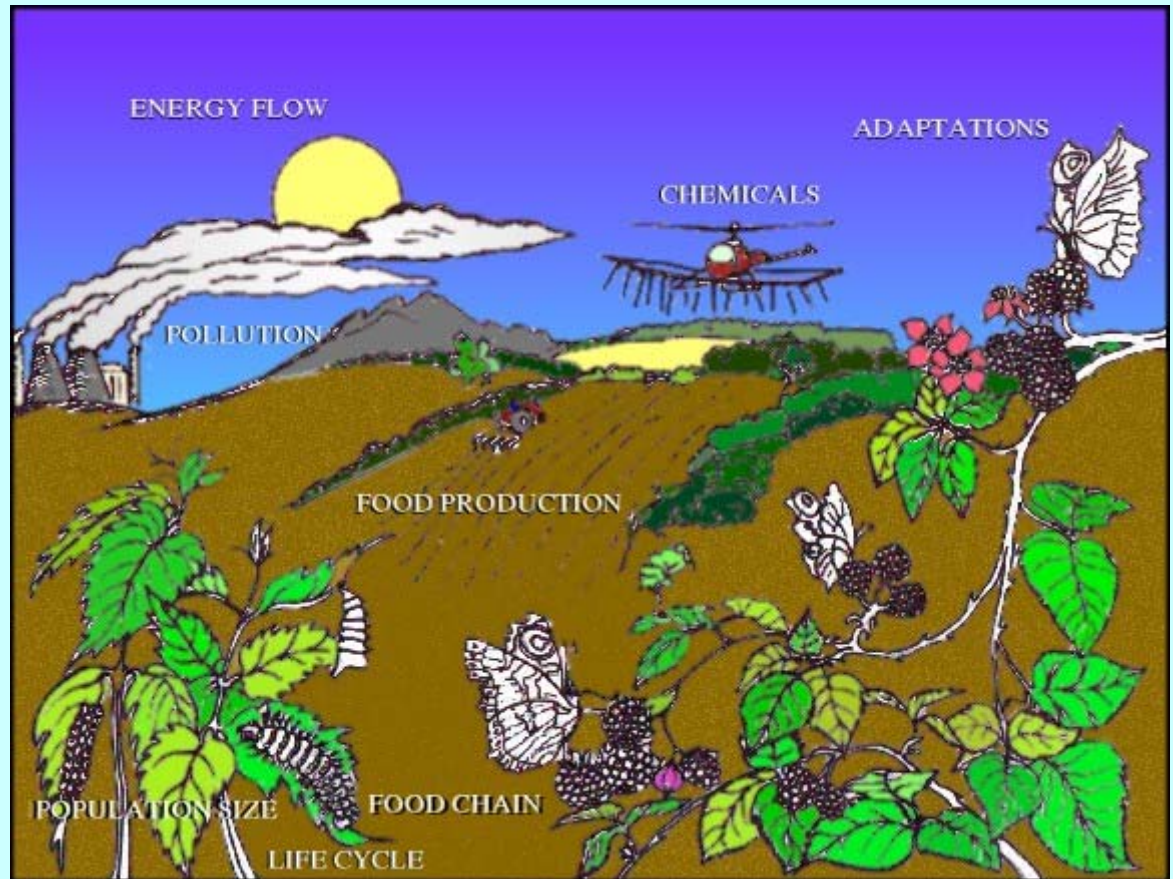
Ecology

Biosphere

Population

Community

Ecosystem



3.1 What is Ecology?

- ecology studies the interactions of organisms with one another & with their physical surroundings
- "ecology" comes from the Greek word ***oikos*** which means "house"



- the Earth is a single living system; it is a **biosphere**, or living globe which includes all the areas of land, air, & water where life exists
- the biosphere extends approximately 8 km above the Earth's surface as well as 8 km below the Earth's surface



Ecosystems

- Are interactions among populations and their communities
- Are shaped by 2 things: abiotic and biotic factors



- Abiotic factors are all the **nonliving components** in an organisms environment
 - Examples rocks, temperature, light, humidity
- Biotic factors are all the **living** organisms that live in an environment
 - Grass, moles, fungi, bacteria



What are some biotic and abiotic factors in this picture?

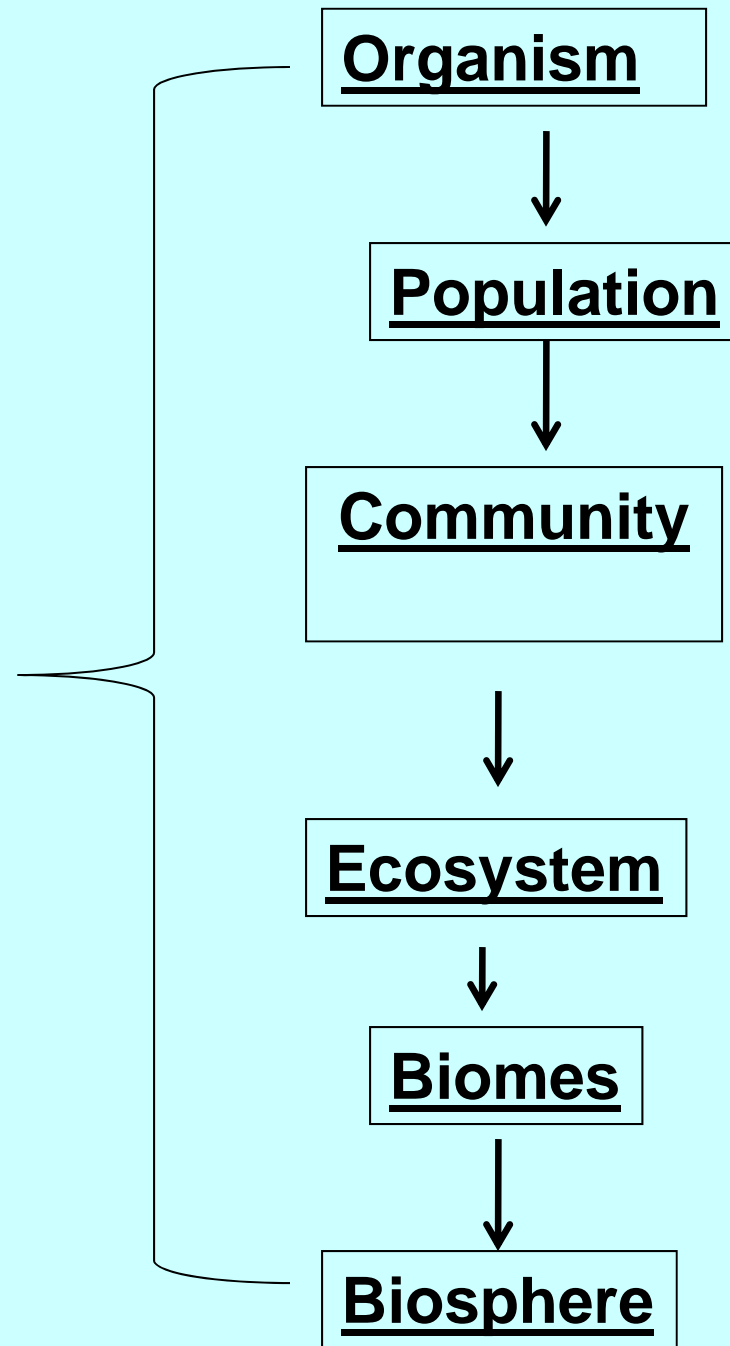
Biotic and abiotic factors determine...

- the survival and growth of an organism
- the productivity of the ecosystem in which the organism lives

Ecological Hierarchy

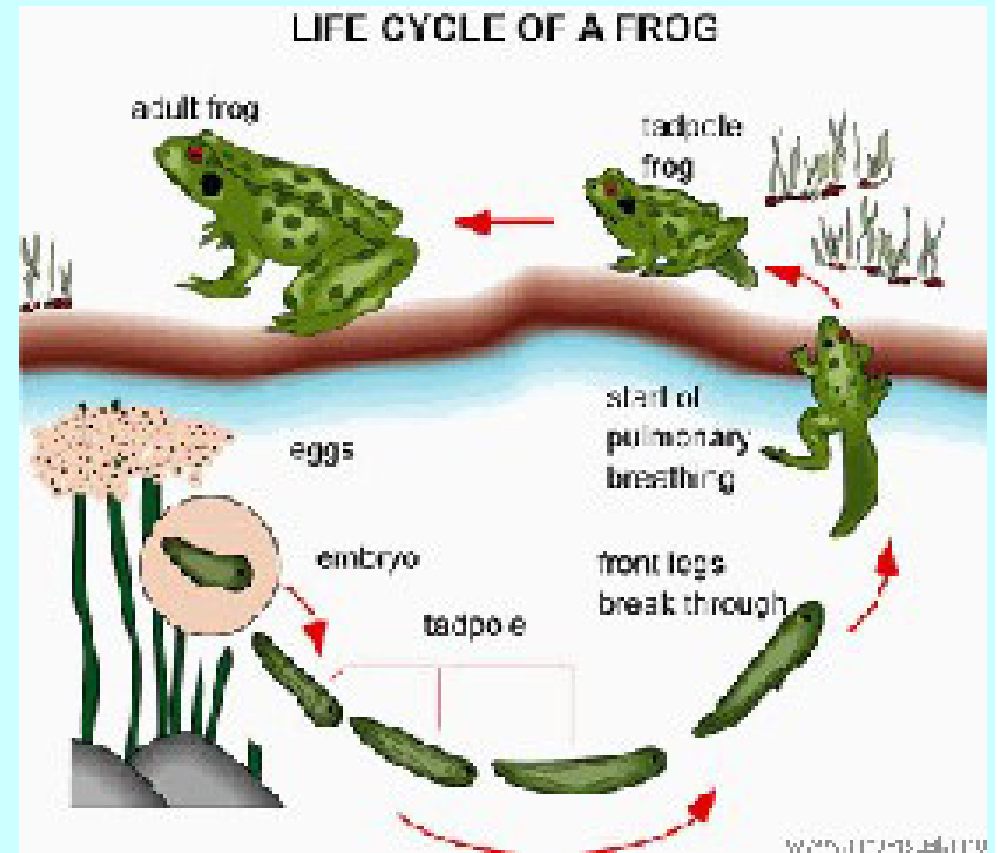
- Ecologists study interactions of organisms at a variety of levels
 - Individual organism, where it lives, its prey/predators, interactions with similar/different individuals, etc...

Summary of Ecological Hierarchy



- Interactions among populations

- Populations: group of organisms of one species that interbreed and live in the same area
- Compete with each other when resources are limited
- Species adapt so they can coexist with each other
 - Frog life cycle



- Interactions within communities

- Community: all organisms living in an area

- A change within 1 population in a community can cause change with another in the same community

- Wolf and moose populations on Isle Royale



- Interactions with biotic and abiotic factors

- How does everything in an ecosystem affect another?

- 3 kinds of ecosystems

- Terrestrial (land)
 - Freshwater
 - Saltwater



3.2 Nutrition and Energy Flow

VOCABULARY:

Producers

Consumers

(primary, secondary, tertiary)

Decomposers

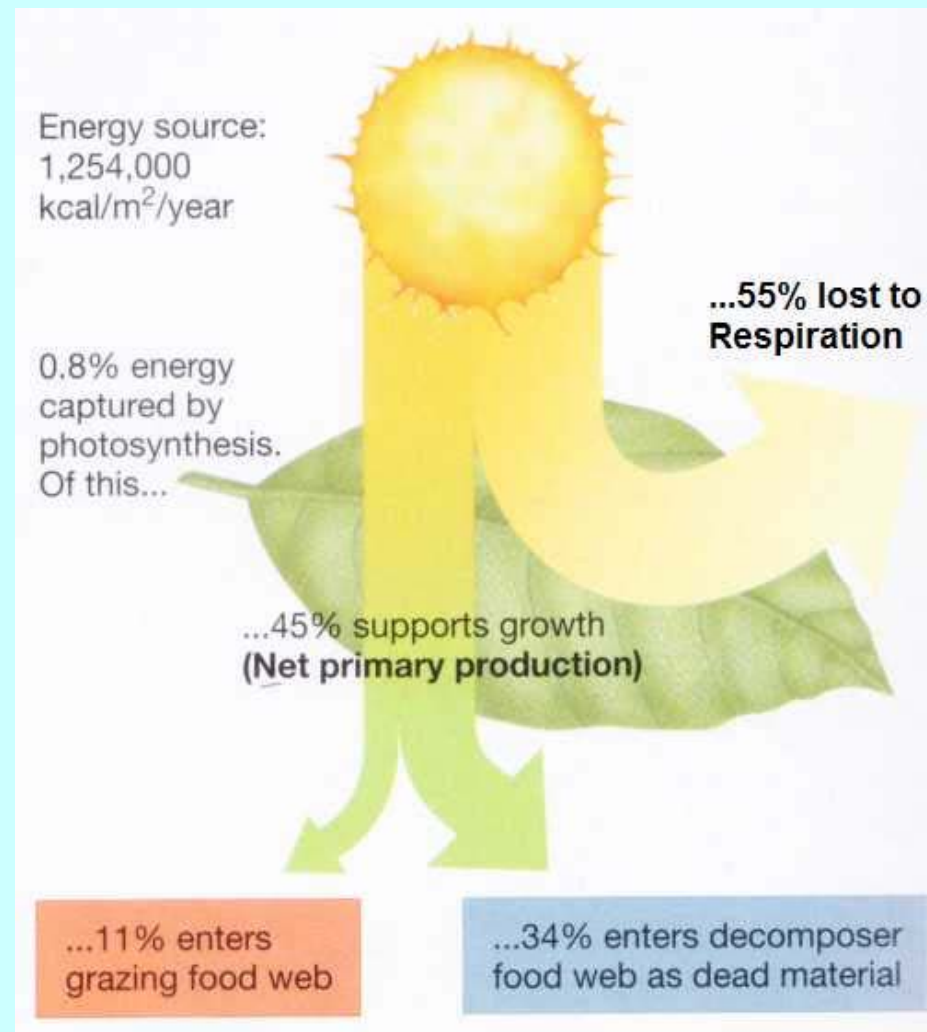
Trophic level

Nutrient cycles

Herbivore

Carnivore

Omnivore



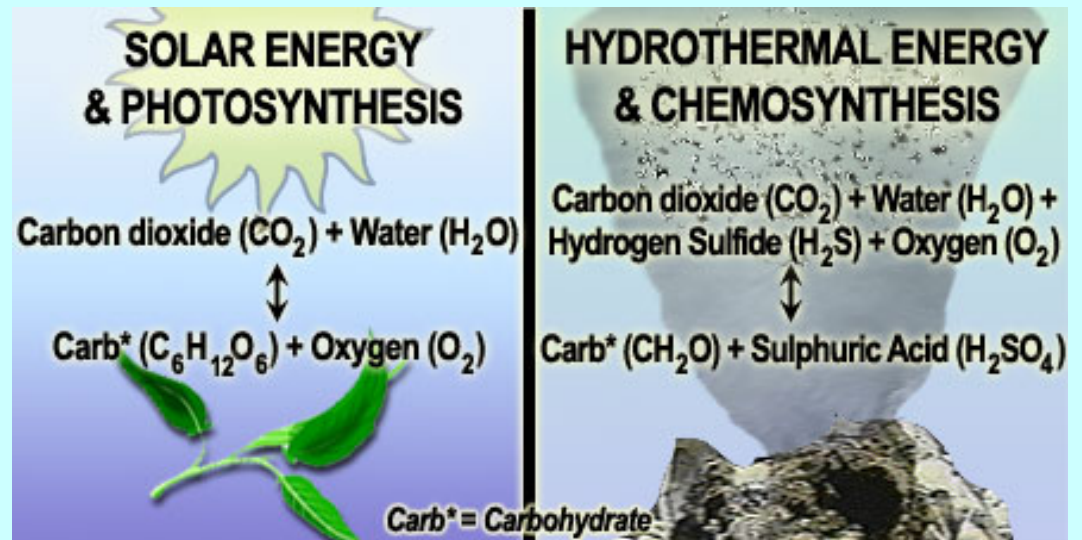
THE FLOW OF ENERGY

- ✓ All organisms need and use energy
- ✓ the sun is the ultimate source of all energy on Earth
- ✓ organisms that use the sun's energy to make food are called: producers
 - ✓ ex: plants

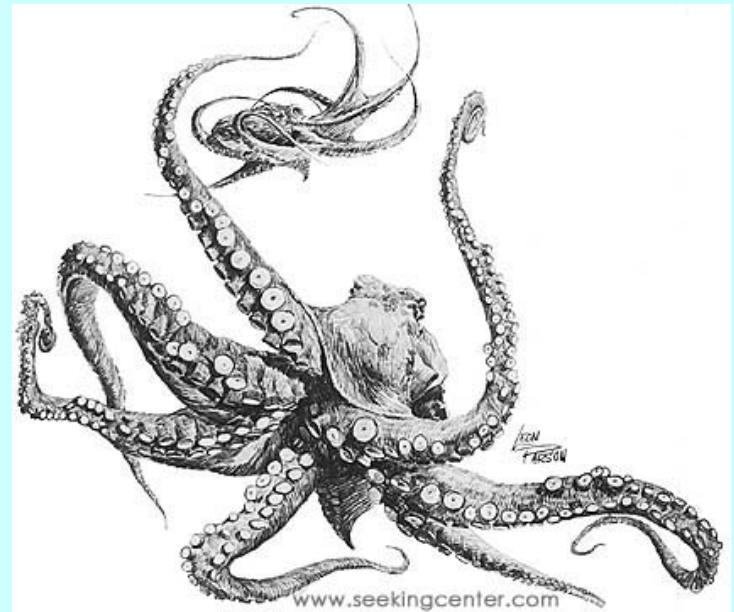


Review

- Autotrophs—capture energy from sunlight or chemicals and use that energy to produce food
 - AKA producers
 - Photosynthesis
 - Plants
 - Chemosynthesis
 - Bacteria



- Animals are consumers → they get their energy either directly or indirectly from producers
 - primary consumers: animals that eat plants
 - secondary consumers: animals that eat plant-eating animals
 - there can be tertiary & quaternary consumers as well
 - ex: If you eat a hamburger (cow), what kind of consumer are you?



Heterotrophs : organisms that cannot make their own food and must feed on other organisms to get nutrients and energy

Examples

- Herbivores (plants)
- Carnivores (animals)
- Omnivores (both)
- Detritivores
 - Feed on plant and animal remains
 - Mites, earthworms, snails
- Decomposers
 - Break down organic matter
 - Bacteria and fungi

- What happens when an organism dies? Their remains are broken down by **decomposers**.
 - ex: bacteria and fungi
 - ***imagine the earth if there weren't any decomposers!!*



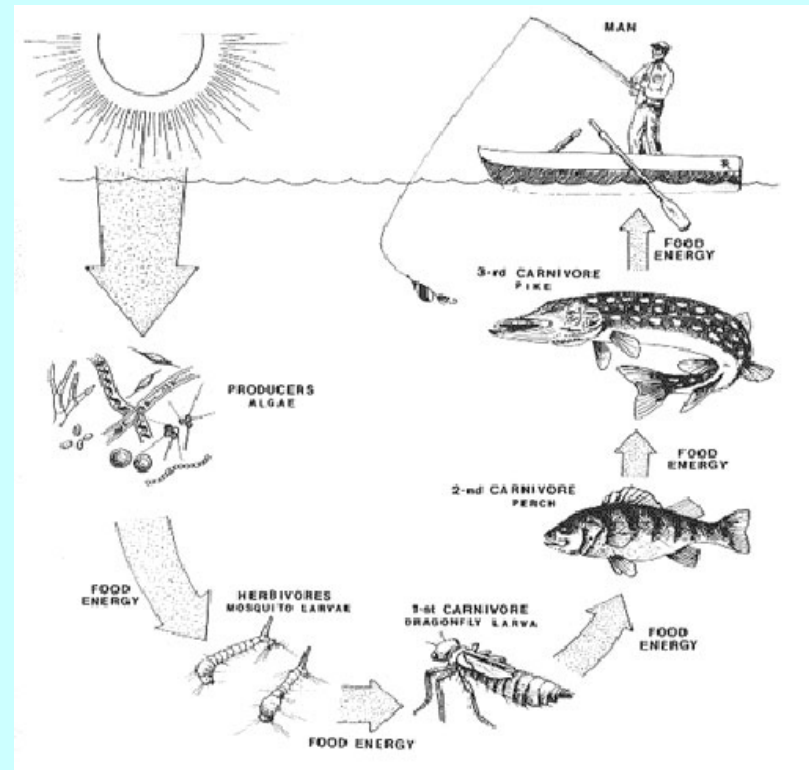
Flow of Energy

Energy flows through an ecosystem (a section of the biosphere) from the sun, to producers, to consumers

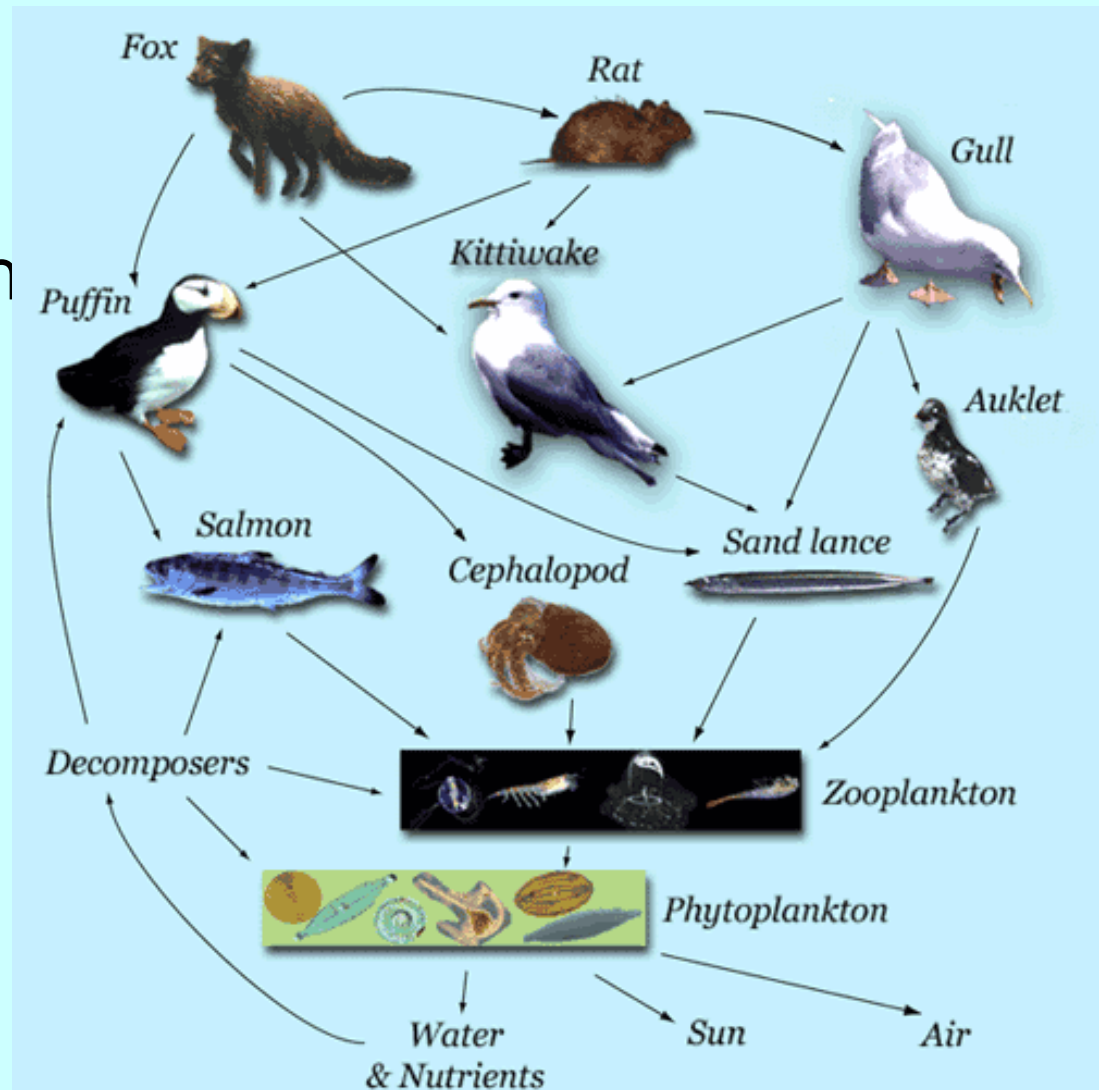
IN ONE DIRECTION!!!

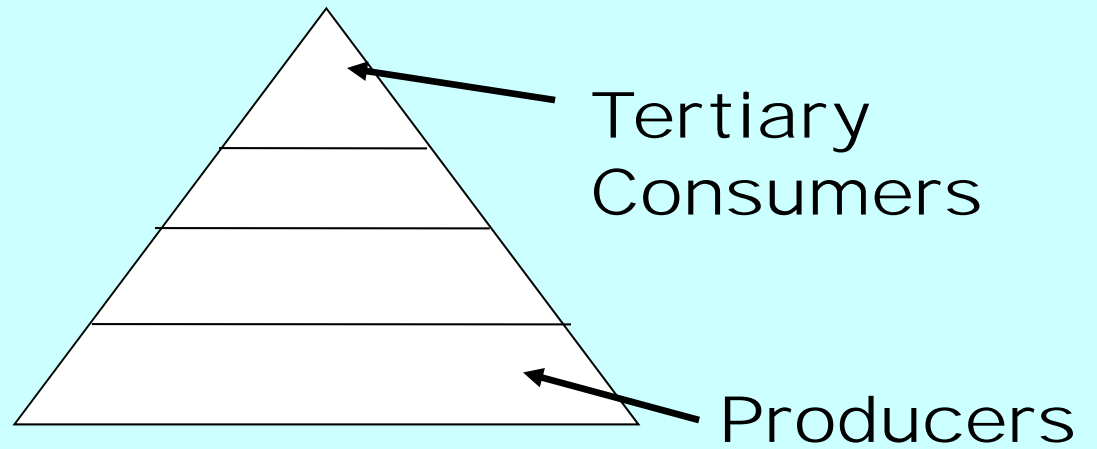
Food Chains

- Food Chain—transfer of energy by eating and being eaten



- Food Web— describes complex relationships of in an ecosystem
 - A food web links together all the food chains in an ecosystem

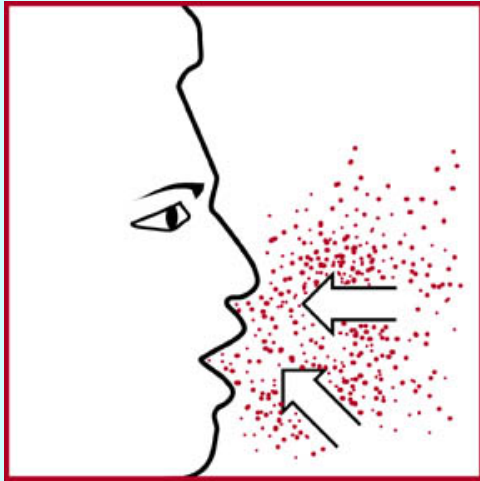




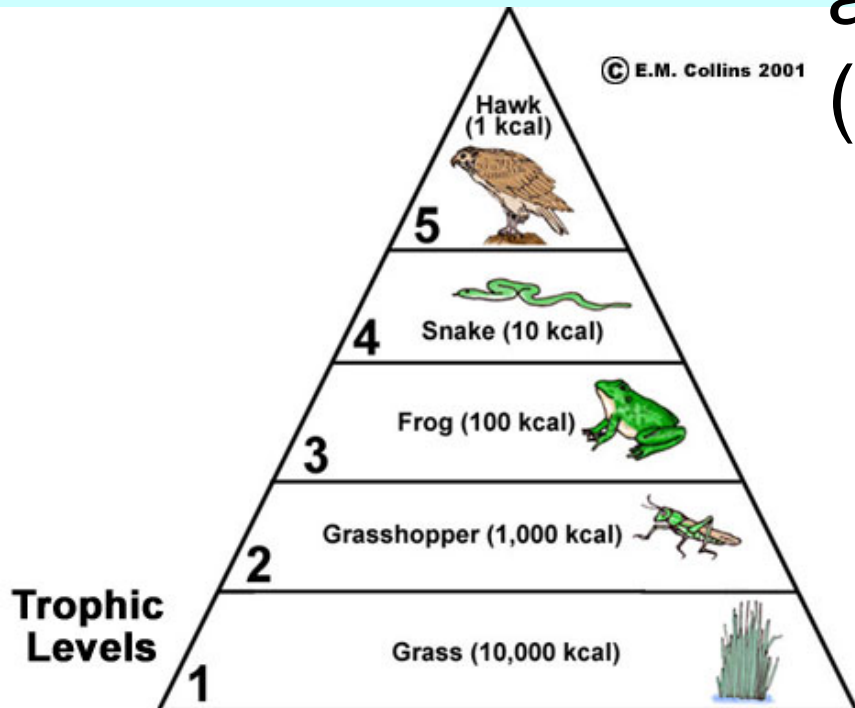
- each step of an organism eating another organism is called a **trophic level** (*trophe* means food in Greek)
- Shown in an energy pyramid

Ecological Pyramid

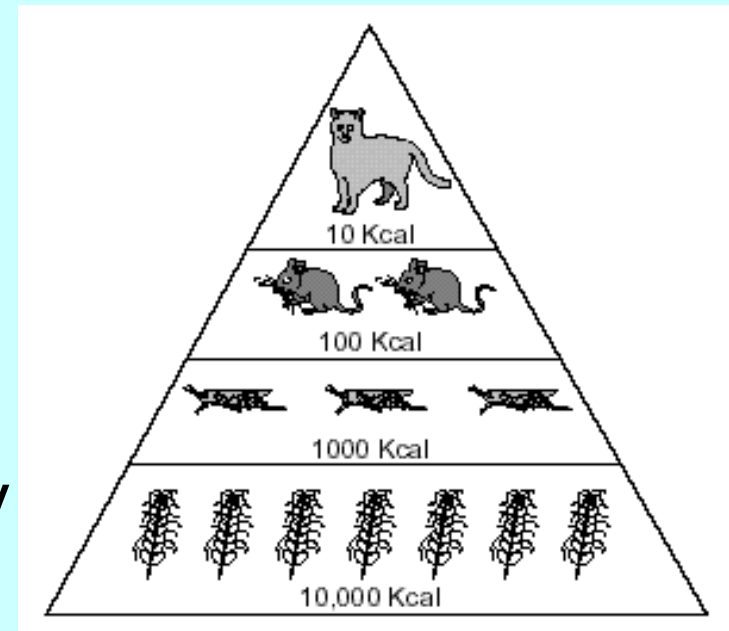
- Shows the relative amounts of energy contained within each trophic level in a food chain or food web
- Only part of the energy that is stored in one trophic level is passed on...(10%)



- at each higher trophic level, less and less of the original energy captured by producers is available
- **WHY?** Because some of the energy is used by the animal in daily activities (growth, breathing, etc.)

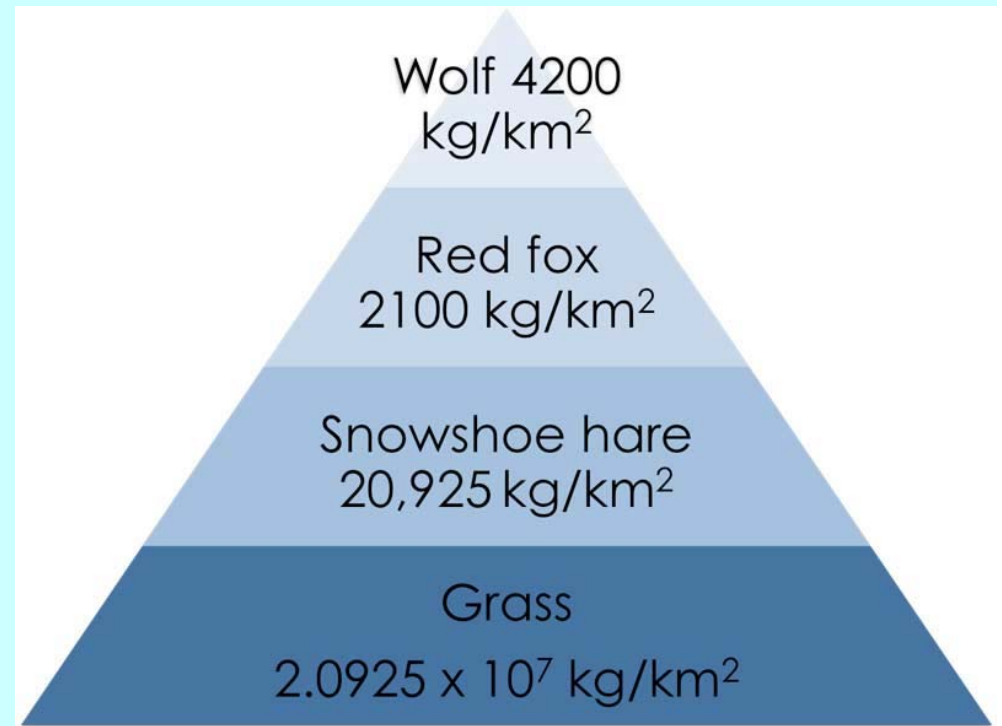


- approximately 10% of the energy at one trophic level can be used by animals at the next trophic level
 - ex: 10% of the plant's energy is stored in the tissues of **herbivores** (plant eating animals) & 10% of the energy is herbivores is stored in the tissues of **carnivores** (animal's that eat other animals)



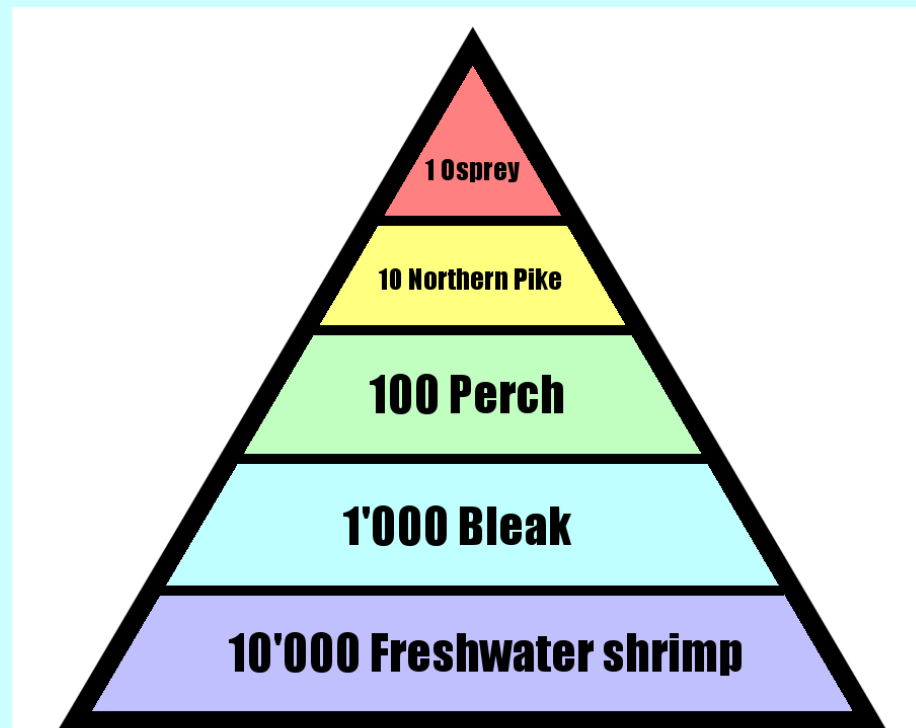
Pyramids of Biomass

- Biomass measures the amount of living tissue within a trophic level
 - Measured in grams of organic matter per unit area

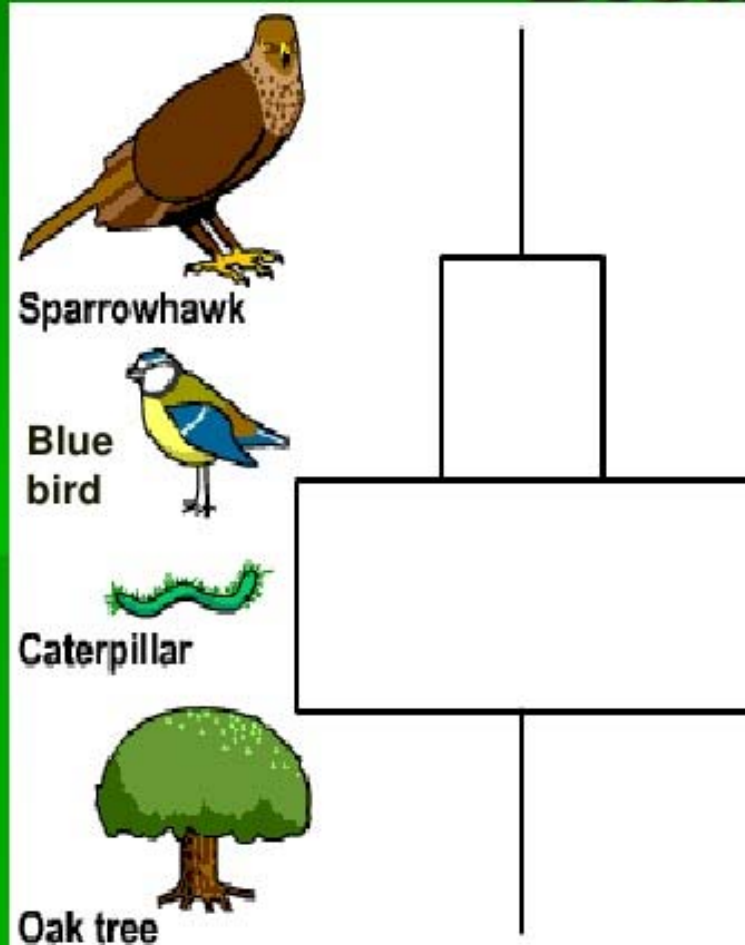


Pyramids of Numbers

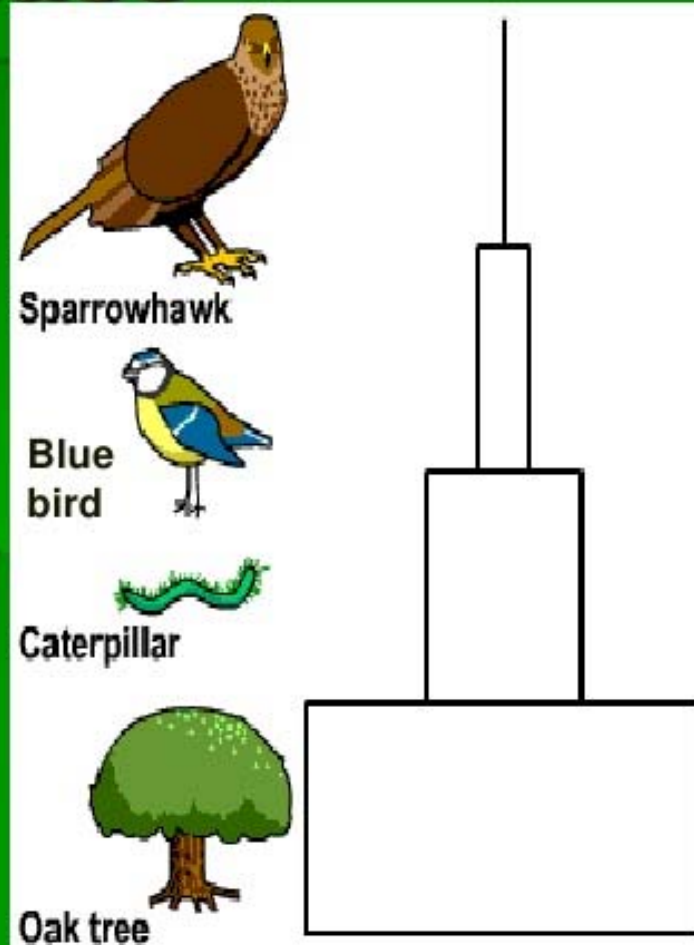
- Shows the relative number of individual organisms at each trophic level



Pyramid of Numbers vs. Biomass

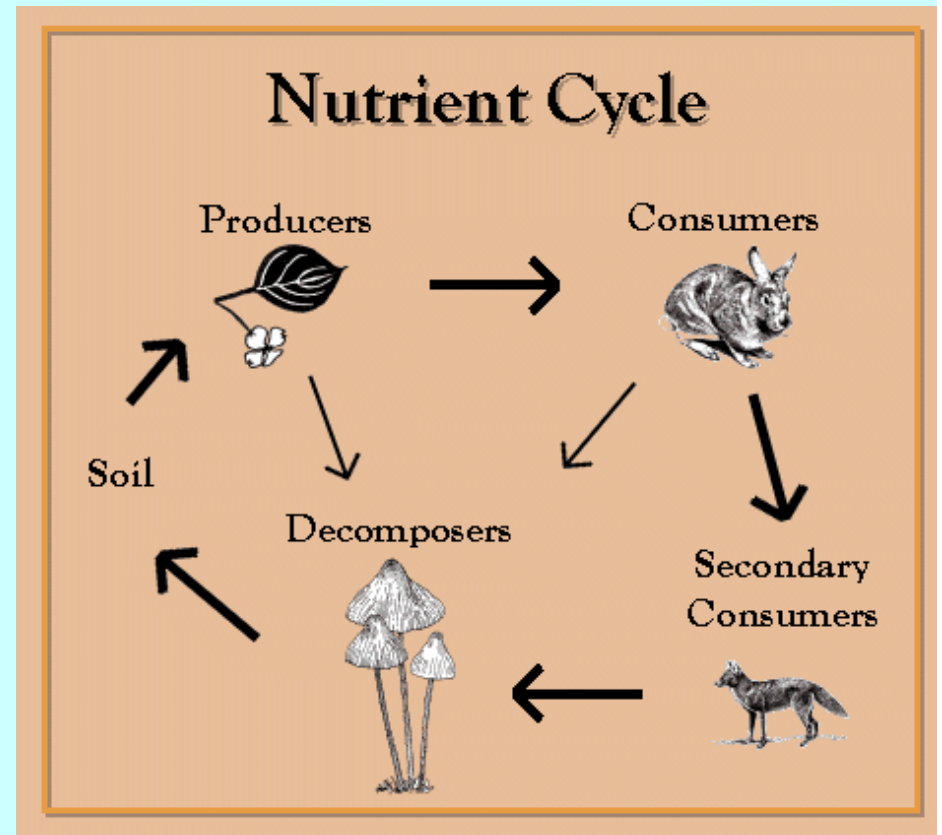


Numbers



Biomass

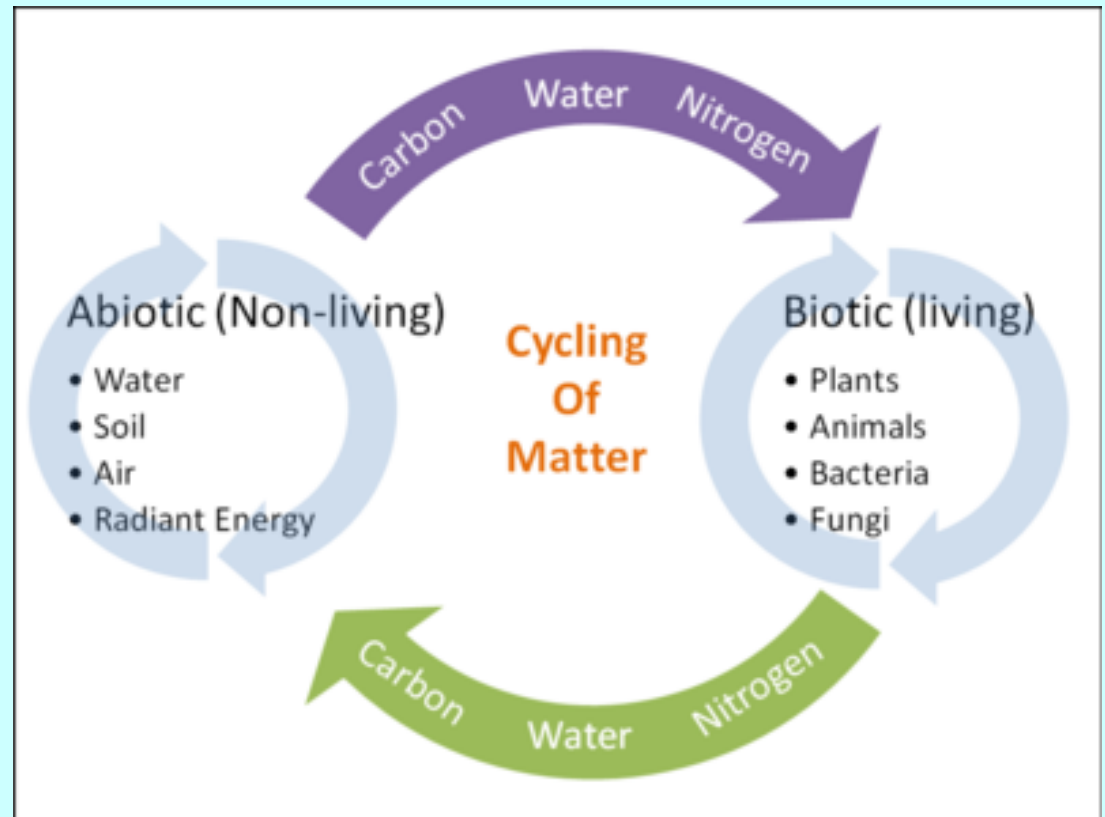
- more energy efficient to eat producers
- although energy moves in a one-way direction through an ecosystem, nutrients are recycled



3.4 Cycles of Matter

Vocabulary

- Infiltration
- Combustion
- Assimilation
- Denitrification
- Nitrogen Fixation



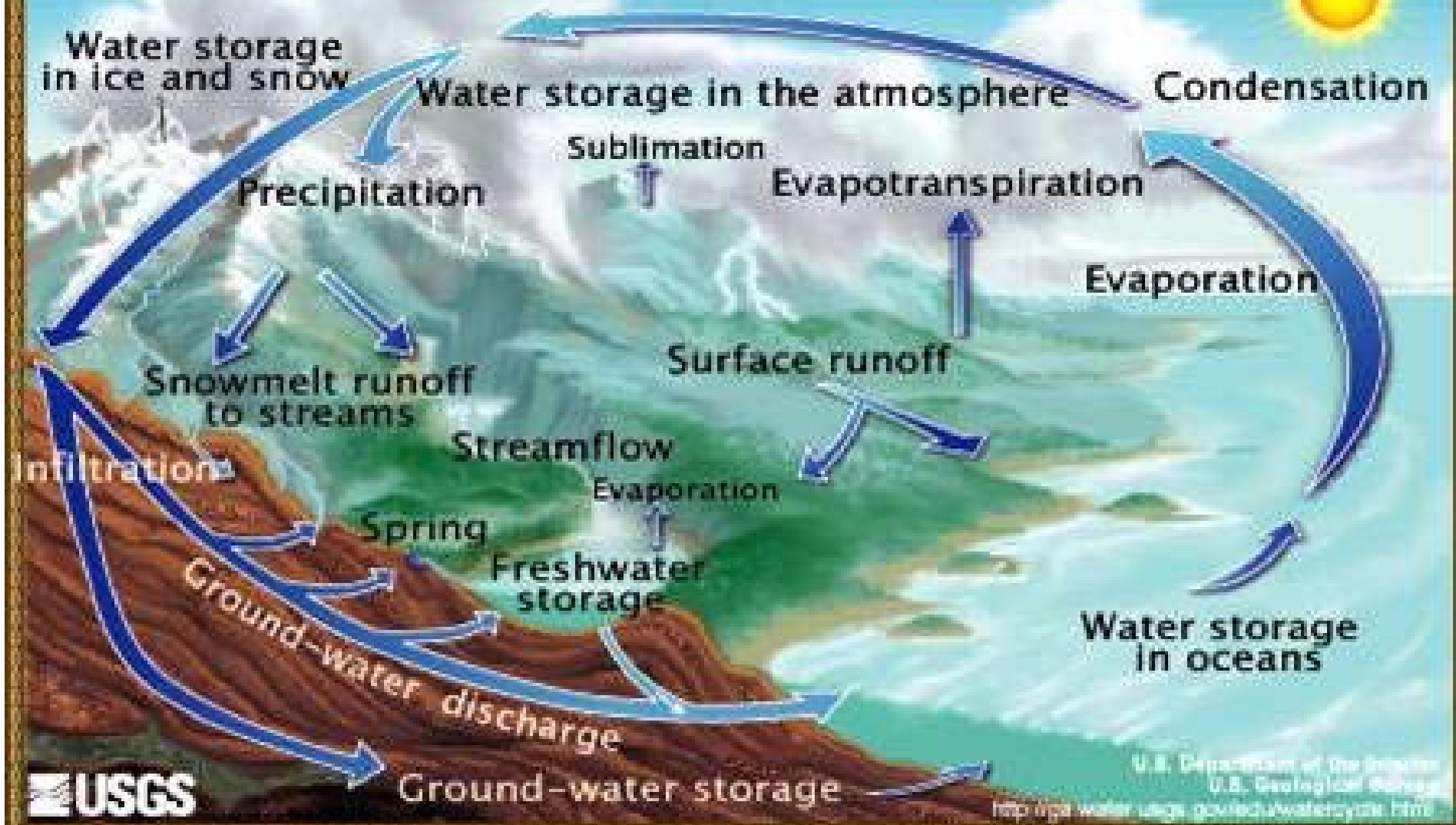
- Energy flows in one direction and can be replenished by the sun
- Minerals are also moved through trophic levels but they cannot be replenished by the sun...
 - Therefore minerals need to be recycled which is done by
 - Water cycle
 - Carbon cycle
 - Nitrogen cycle
 - Phosphorus cycle (we will not be going over this one)

Water Cycle

- Life depends on water
- 6 steps to the water cycle
 - Precipitation
 - Evaporation
 - Transpiration
 - Condensation
 - Infiltration
 - Runoff



The Water Cycle



- Precipitation
 - falling products of condensation in the atmosphere
 - 4 types
 - Rain
 - Hail
 - Sleet
 - Snow

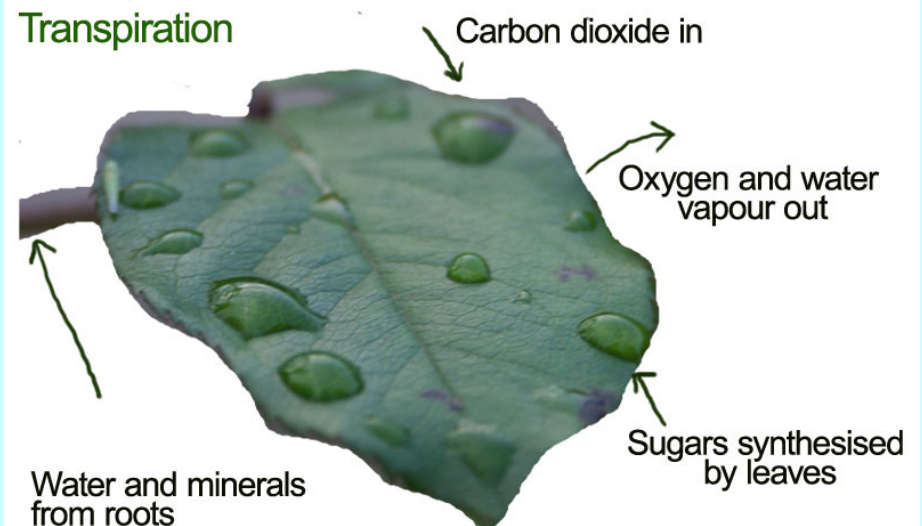


- Condensation
 - Process where water vapor liquefies to form clouds or fog



- Evaporation
 - Changing from a liquid to a gas (water vapor)

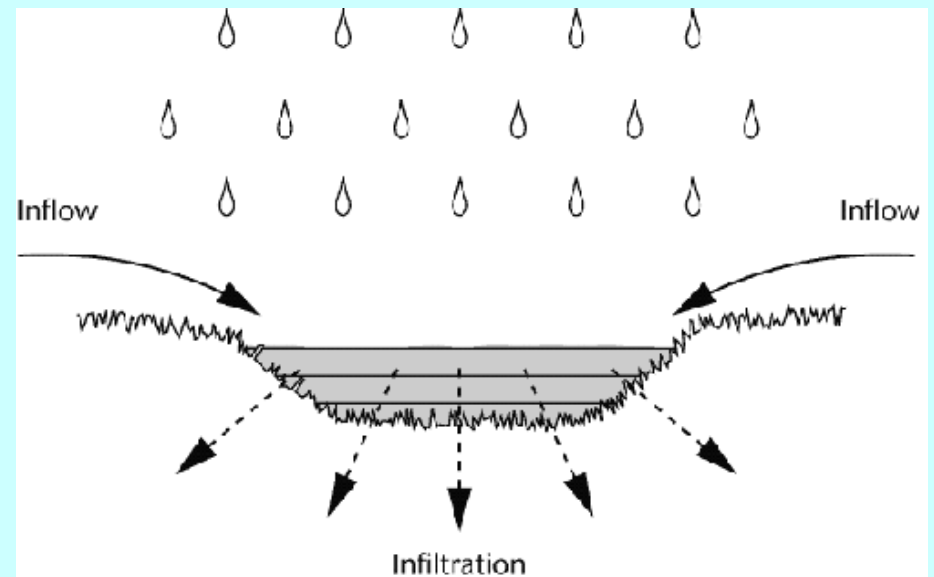
- Transpiration
 - Passage of water from plant leaf to atmosphere



Is this evaporation?

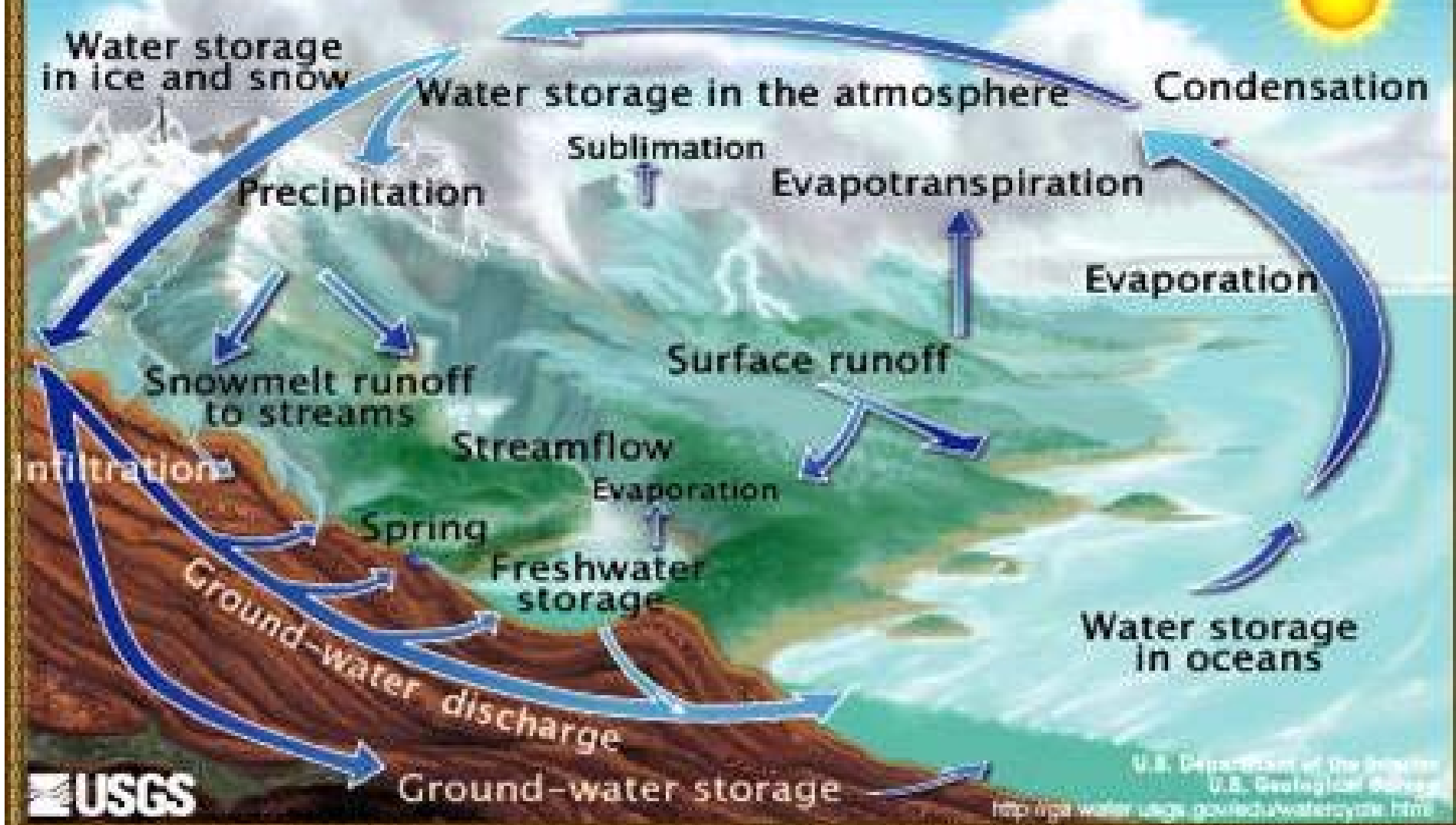


- Infiltration
 - Seepage of water into rock or soil
 - How water gets back into the ground
- Runoff
 - Water that drains for flows into streams or other bodies of water



- Where does the water cycle start?
 - At any of the 6 stages
- Does the water cycle go in the same order?
 - No....
 - some water droplets stays frozen for years (glaciers, snow capped mountains)
 - Some water droplets may evaporate then condensate repeatedly
 - Some water may stay in the ground for year (aquifers)
 - etc...

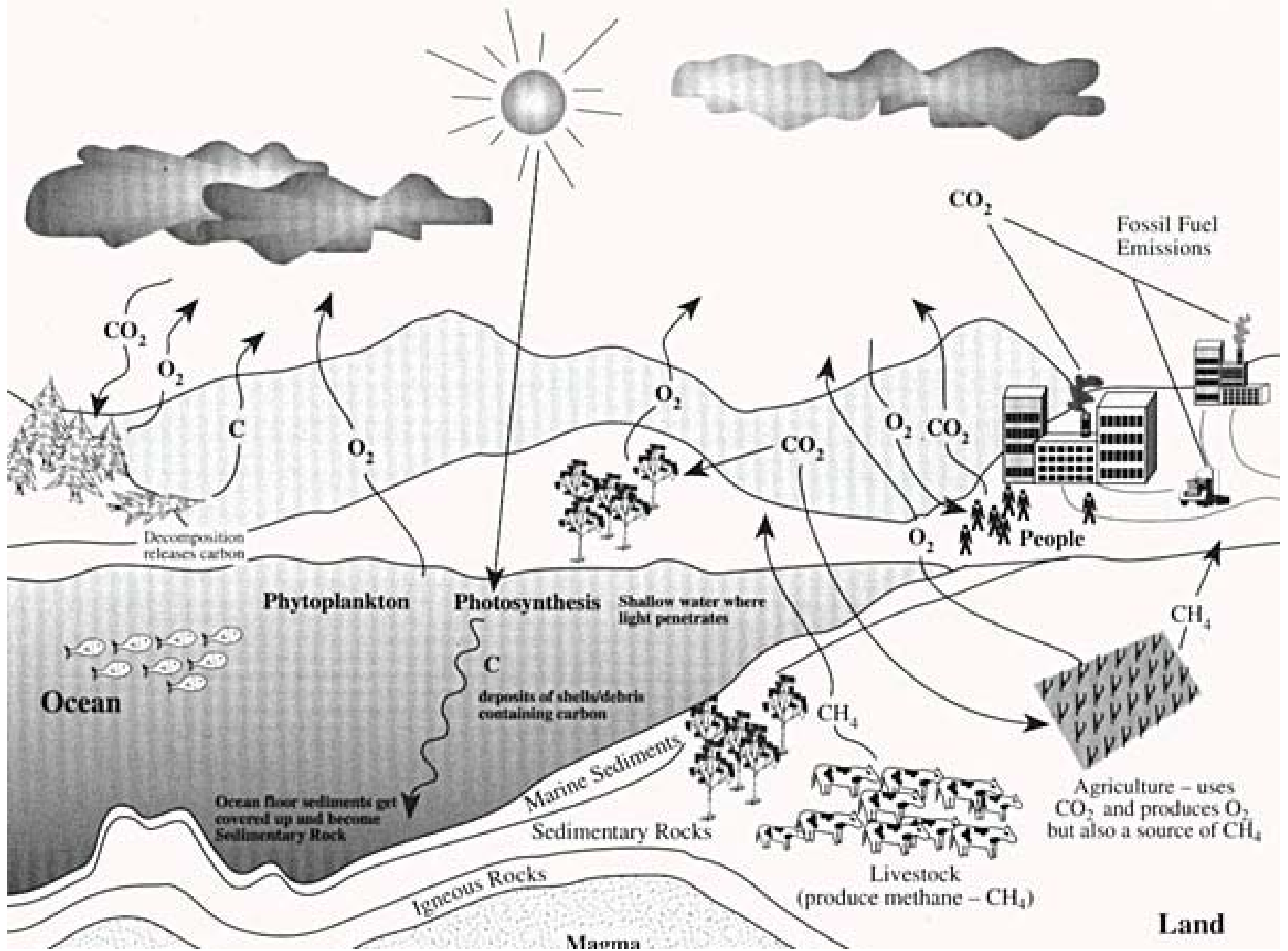
The Water Cycle



U.S. Department of the Interior
U.S. Geological Survey
<http://ga.water.usgs.gov/edu/watercycle.html>

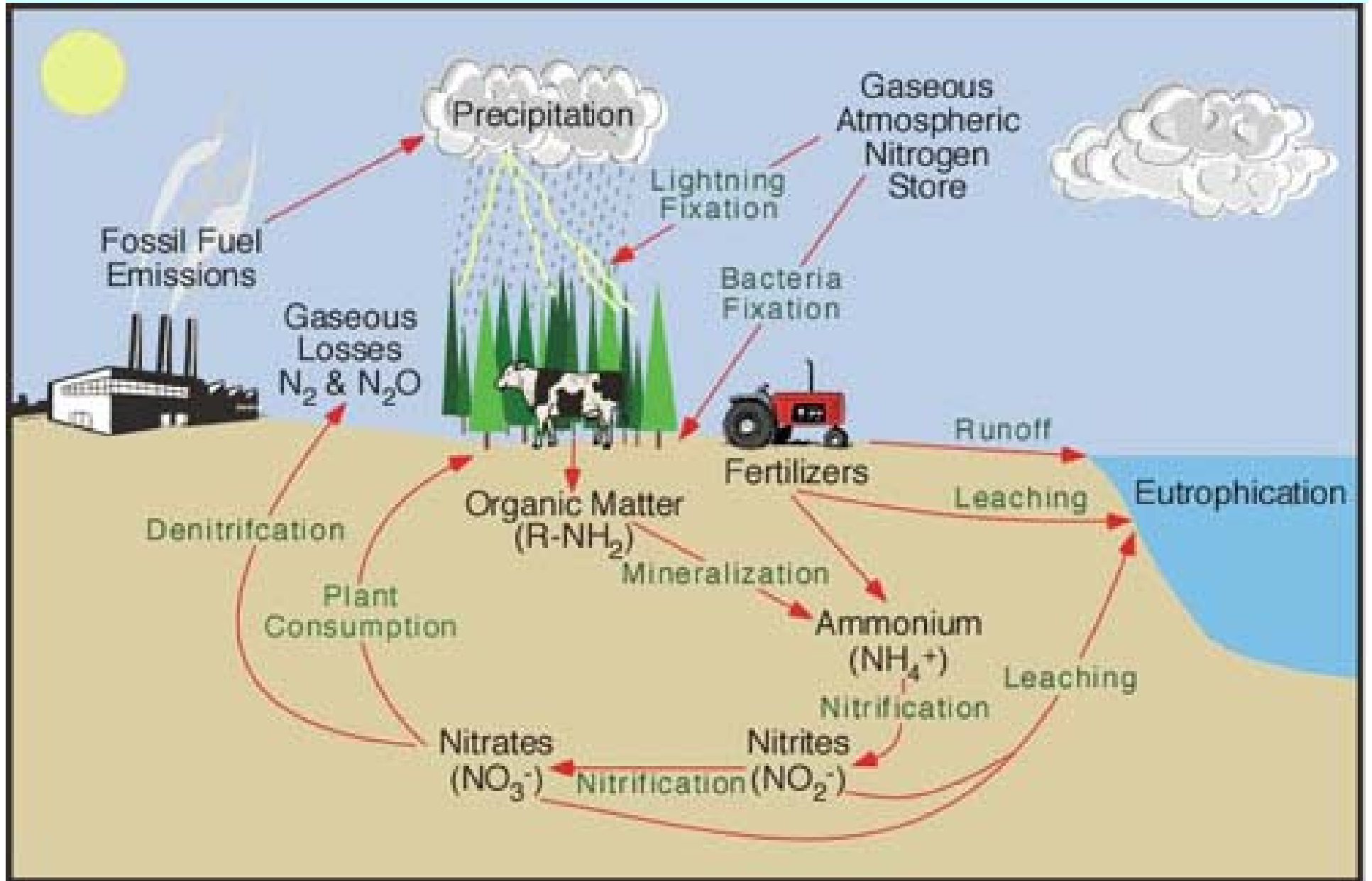
The Carbon Cycle

- Carbon is the 4th most abundant element
- All organisms need carbon
- Not including water, people are about half carbon
- 3 ways carbon is moved through an ecosystem
 - Photosynthesis (Ch 8)
 - Respiration (Ch 9)
 - Combustion (burning)



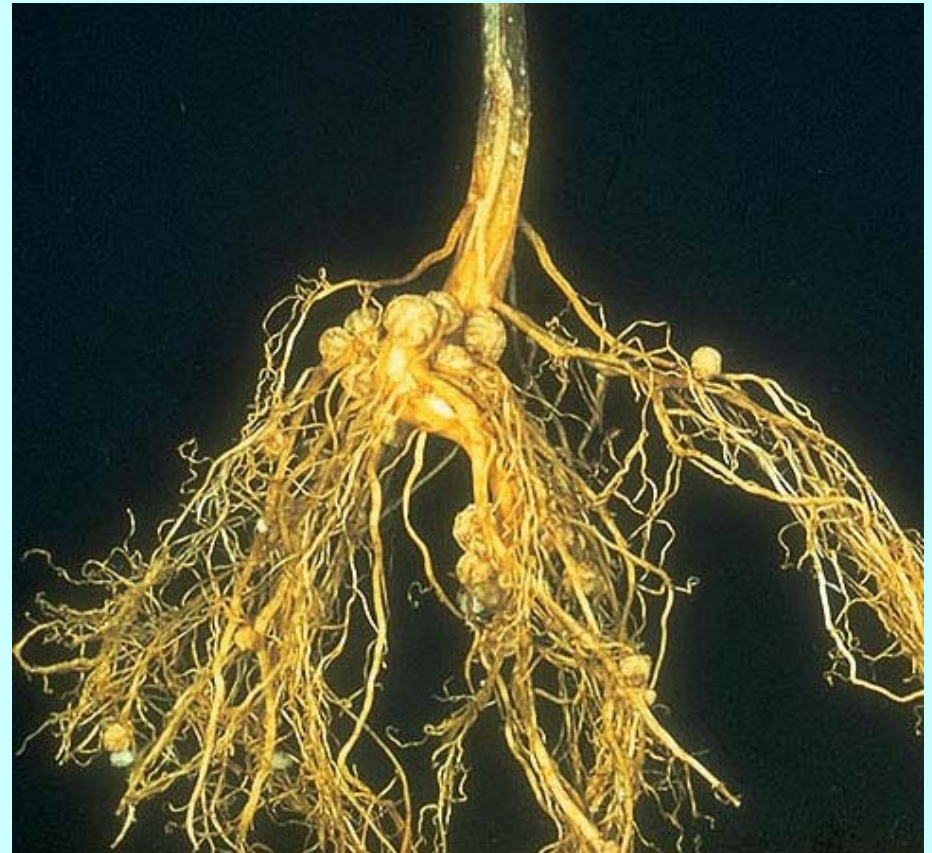
The Nitrogen Cycle

- 78% of the air is nitrogen
- All organisms need nitrogen for structure and function but this form of nitrogen is not useable
- So how do organisms get the nitrogen they need?



3 processes that recycle nitrogen

- **Assimilation**: process of absorbing raw material (i.e. minerals)
- **Nitrogen Fixation**: Process where bacteria can make nitrogen available to plants
 - Bacteria found in plant root nodules
 - Fertilizers (nitrates, nitrites, ammonia, ammonium)
 - Lightning
- **Denitrification**: releasing nitrogen into the atmosphere
 - Bacteria in soil



- Other ways to get nitrogen back into the cycle
 - Animal wastes
 - Organisms decaying

