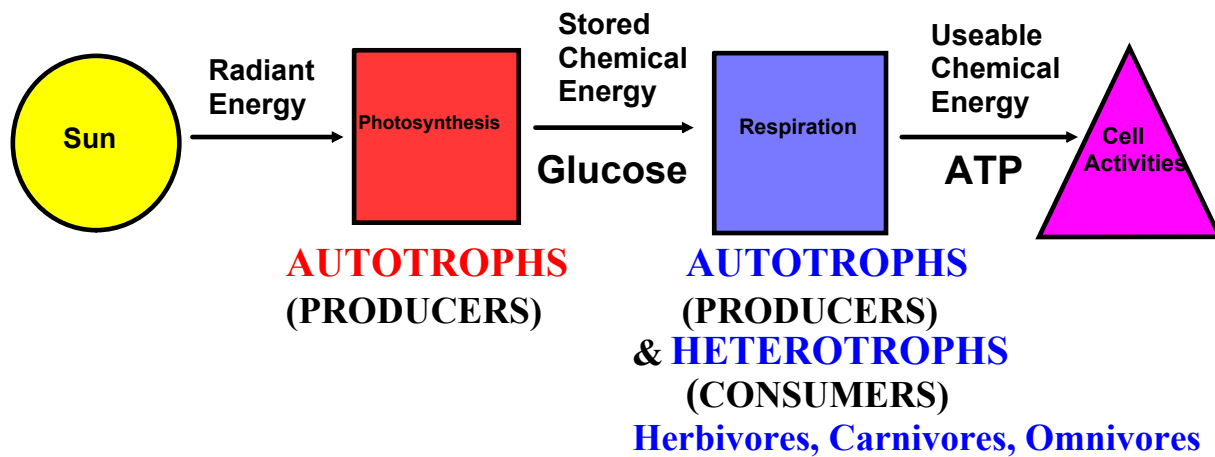


FLOW OF ENERGY



Chapter 13: Principles of Ecology

I. Sharing the World

- Studying nature
 - List ways one can study or observe nature: *ID* plants and animals, keep records of *rainfall and temperature*, where things *grow*, who *eats* them, time of year for mating



II. What is Ecology?

- **Ecology** = the study of interactions that take place between organisms and their environment.
 - Ecological research combines information and techniques from scientific fields, including **mathematics, chemistry, physics, geology**, etc.



III. The Biosphere

= **the portion of Earth that supplies living things.**

- It extends from high in the atmosphere to the bottom of the oceans.
- Living things are affected by both living and nonliving.



A. The nonliving environment or Abiotic factors include *air currents, temperature, moisture, light, soil content, pH*, etc.

B. The living environment or Biotic factors include organisms depending on others *directly or indirectly* for food, *shelter, reproduction*, or *protection*.



IV. Levels of Organization

A. Interactions within populations

1. **Population** = a group of organisms, all of the same specie, which interbreed and live in the same area.
2. Members of the same population may compete with each other for *food, water, mates*, or other resources.
3. **Competition** increases when resources are in short supply.
4. Some species have *adaptations* that reduce competition.

B. Interactions within communities

1. **Biological community** = interacting populations in a certain area.
2. There are ecological levels of organization:
 - a. **Organism**
 - b. **Population**
 - c. **Biological community**
 - d. **Ecosystem**
 - e. **Biome**
 - f. **Biosphere**

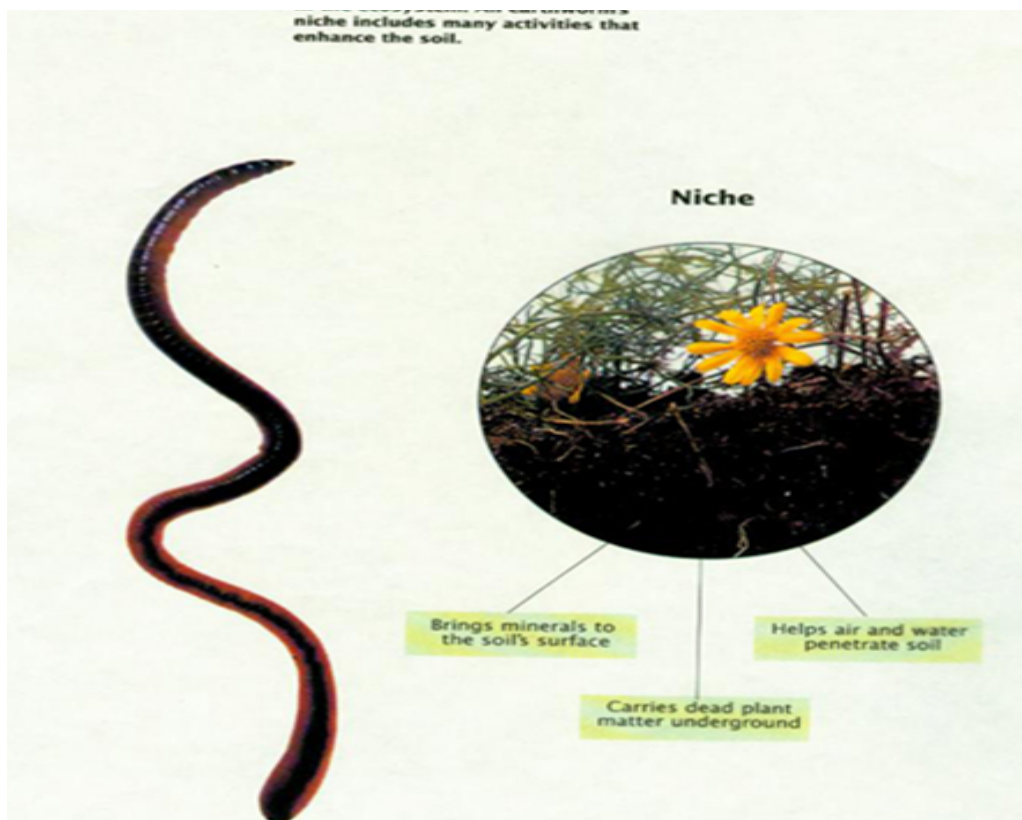
C. Biotic and Abiotic factors form ecosystems

- **Ecosystem** = interacting populations in a biological community along with its abiotic factors.




III. Organisms in Ecosystems

- **Habitat** = *the place where an organism lives out its life.*
- **Niche** = all the *strategies and adaptations* a species uses in its environment - *how it meets* specific needs for food and shelter, *how and where* it survives, and *where and when* it reproduces.
- No two species can occupy the same niche for very long, one will have *to move or it will become extinct.*



HOLT
BIOSOURCES
TEACHING TRANSPARENCIES

Effect of Competition on an Organism's Niche **87**



a The barnacle *Chthamalus stellatus* can live in both shallow and deep water on a rocky coast. These areas are its fundamental niche.

b The barnacle *Balanus balanoides* prefers to live in deep water, which is its fundamental niche.

c When the two barnacles live together, *Chthamalus* is restricted to shallow water, its realized niche. What is the realized niche of *Balanus*?

IV. Symbiosis

= The close or permanent association between organisms of different species (*meaning living together*).

- There are three kinds of symbiosis: mutualism, commensalism, and parasitism.

A. Mutualism

= relationship in which both species *benefit*.

Ex: Ants and acacia trees



B. Commensalism

= relationship in which one species *benefits* and the other species is *neither harmed nor benefited*.

Ex: Spanish moss growing on a tree



C. Parasitism

= relationship in which a member of one species *benefits at the expense of* another species (the host). Ex: Ticks



I. How organisms Obtain Energy

A. The Producers

1. **Autotrophs** = An organism that uses light (radiant) energy stored in chemical compounds to make energy-rich compound.
EX: **glucose**
2. The ultimate energy source for autotrophs is the **sun**.
EX: trees, grasses, shrubs, algae, etc.

B. The Consumers

1. **Heterotroph** = An organism that can't make its food and feeds on other organisms. EX: consumers.
2. Some feed on autotrophs and some feed on other heterotrophs.
3. Herbivore - **plant eaters**
Carnivore - **animal eaters**
Omnivore - **plant and animal eater**

4. ***Detritivores*** -obtain nutrients by consuming ***detritus*** (decomposing plant and animal parts as well as feces)

Ex: Scavengers, like buzzards & earthworms

Term interchanges (but shouldn't), with

Decomposers = organisms that ***break down*** dead decaying plants and animals.

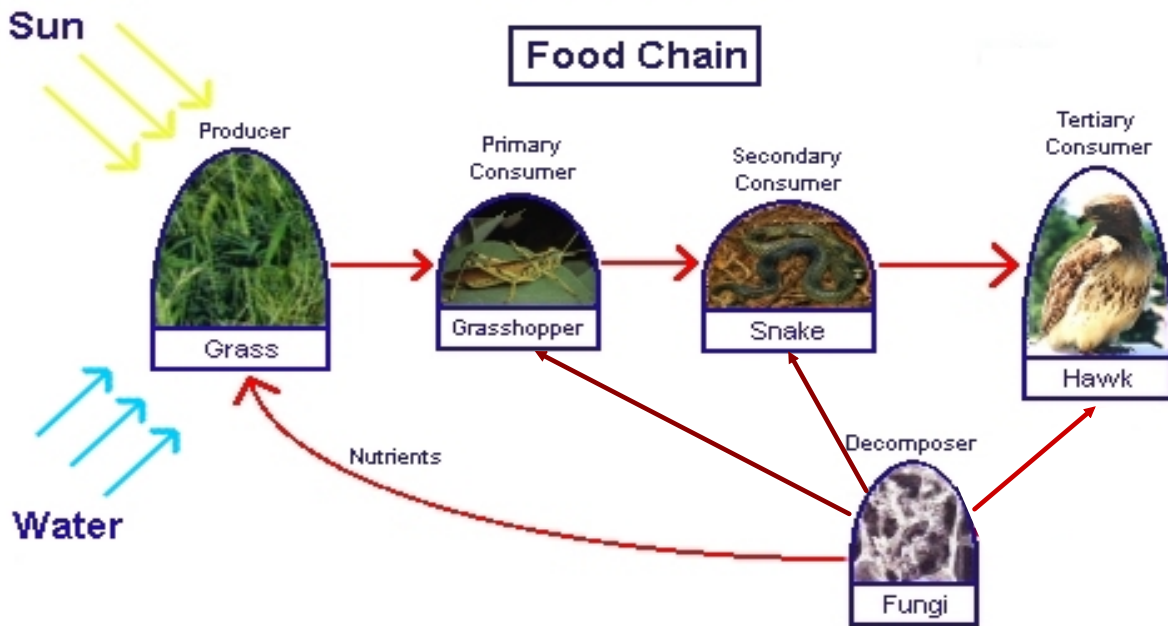
EX: some bacteria, some protists, and most fungi

II. Flow of Matter and Energy

- Matter, in the form of carbon, nitrogen, and other elements, flows through the levels of an ecosystem from ***producers*** to ***consumers***. In doing so, the ***matter is cycled***.

A. Food Chains: Pathways for matter and energy.

1. ***Food chain*** = a simple model that shows how matter and energy move through an ecosystem.
2. EX: berries → mice → black bear
3. The amount of energy remaining in the final transfer is only a portion of what was available at the first transfer. Most energy is given off as ***heat energy***.

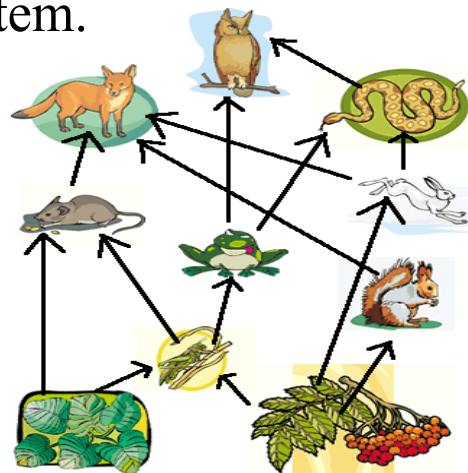


B. Trophic levels represent links in the chain

Trophic level = an organism that represents a feeding step in the movement of energy and materials through an ecosystem.

C. Food Webs

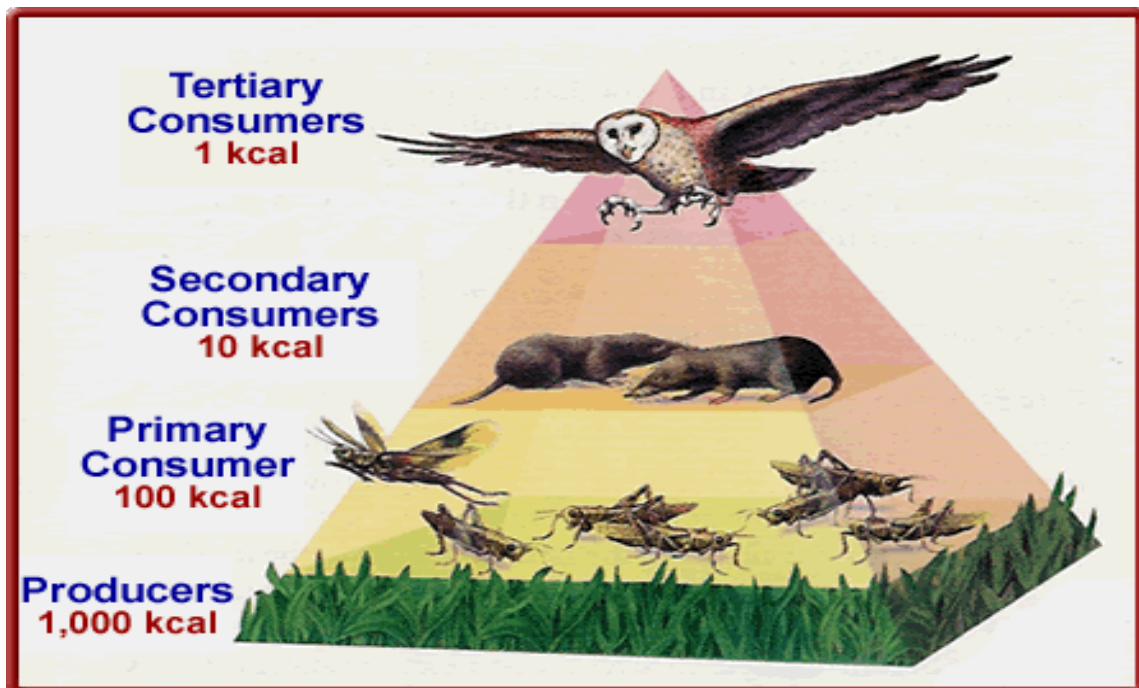
= a model that shows all the possible **feeding relationships** at each trophic level in a community.



D. Energy and trophic levels: Ecological pyramids

1. **Ecological pyramids** = a model that shows how energy flows through an ecosystem.
2. Only **10%** of the energy present at each level is transferred to the next higher trophic level.

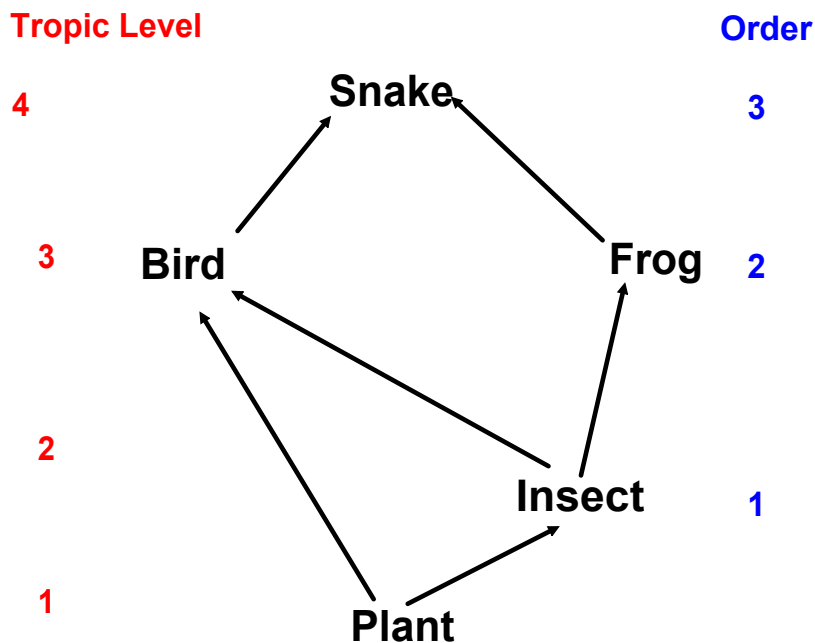
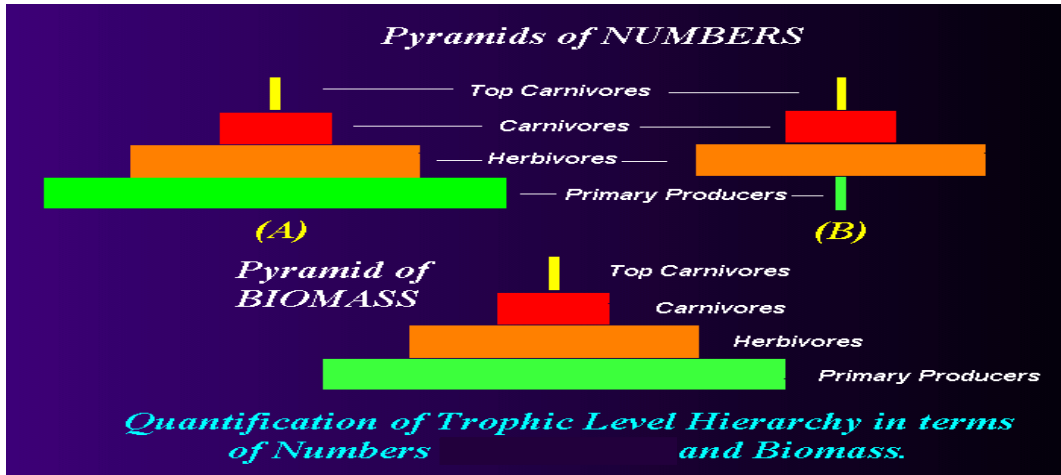
The rest is given off as **heat** or used by the organism itself for **metabolic use** (building body tissue, enzymes, etc).



3. **Biomass** = the total weight of living matter at each trophic level.

ADD TO NOTES:

4. **Number pyramid-** (can also be inverted, i.e. a tree)

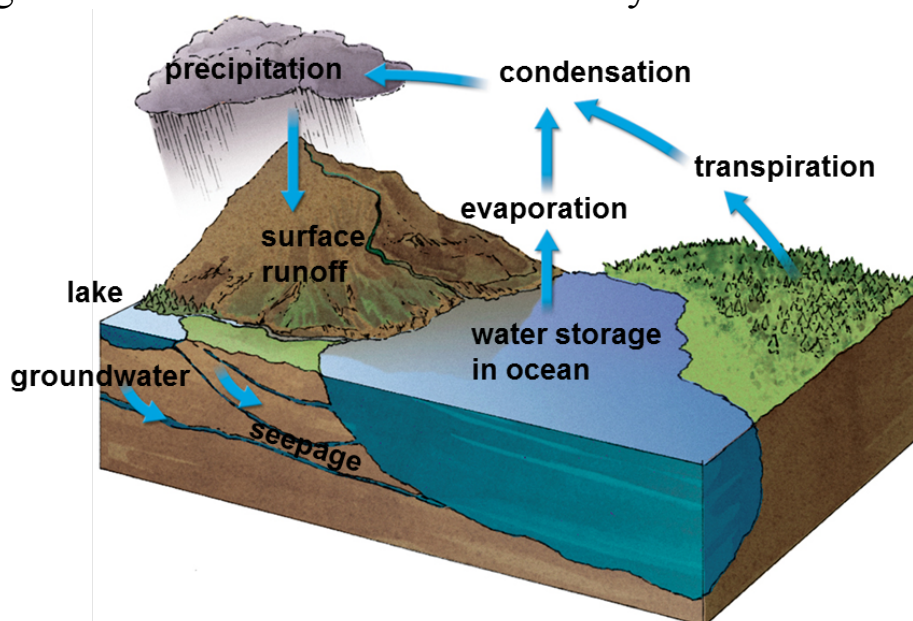


Section 13.5 Cycles in Nature

- Matter, in the form of *nutrients*, moves through, or is part of, all organisms at each trophic level.
- Matter, as well as energy, is *cycled* and is not *replenished*. (Cannot be created or destroyed, just recycled in different forms.)

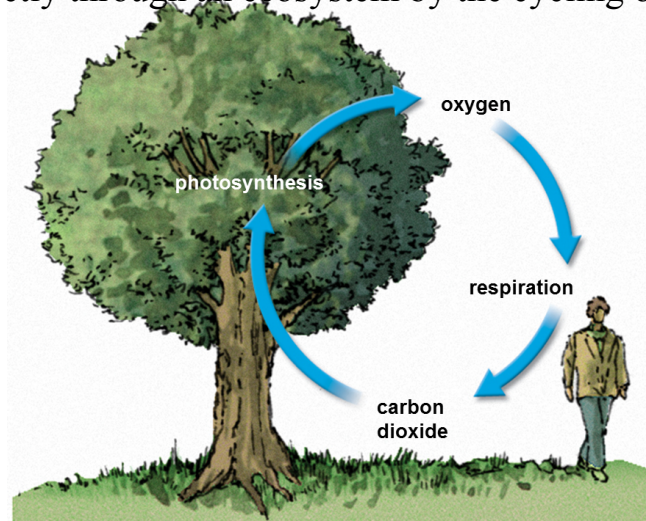
A. The water cycle

- The *hydrologic*, or water, cycle is the circular pathway of water on Earth.
- Organisms all have bodies made mostly of water.



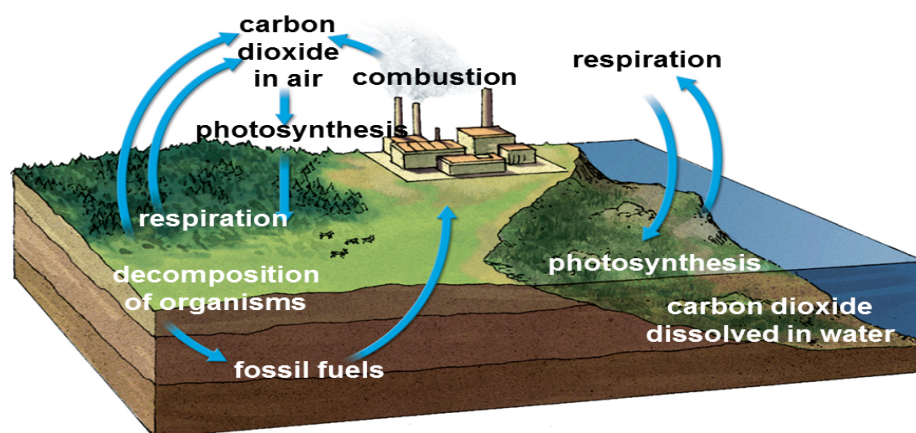
Elements essential for life also cycle through ecosystems.

- A **biogeochemical** cycle is the movement of a **particular chemical** through the biological and geological parts of an ecosystem.
- The main processes involved in the oxygen cycle are **photosynthesis and respiration**.
- **Oxygen** cycles indirectly through an ecosystem by the cycling of other nutrients.



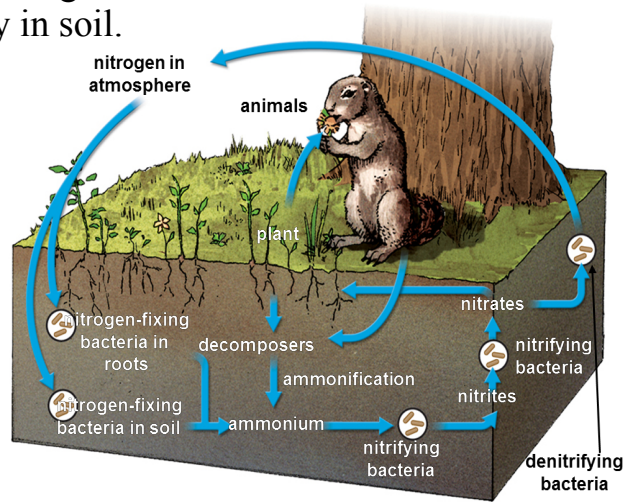
B. The carbon cycle - Carbon is the building block of life.

- The **carbon** cycle moves carbon from the atmosphere, through the food web, and back to the atmosphere.
 - > Carbon is emitted during the **burning of fossil fuels**.
 - > Some carbon is stored for long periods of time in areas called **carbon sinks**.

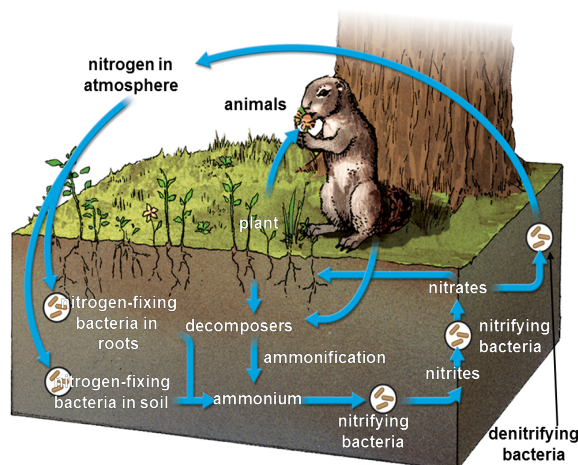


C. The nitrogen cycle - The nitrogen cycle mostly takes place underground.

- > Some bacteria convert gaseous nitrogen into ammonia through a process called **nitrogen fixation**.
- > Some nitrogen-fixing bacteria live in nodules on the **roots** of plants; others live freely in soil.

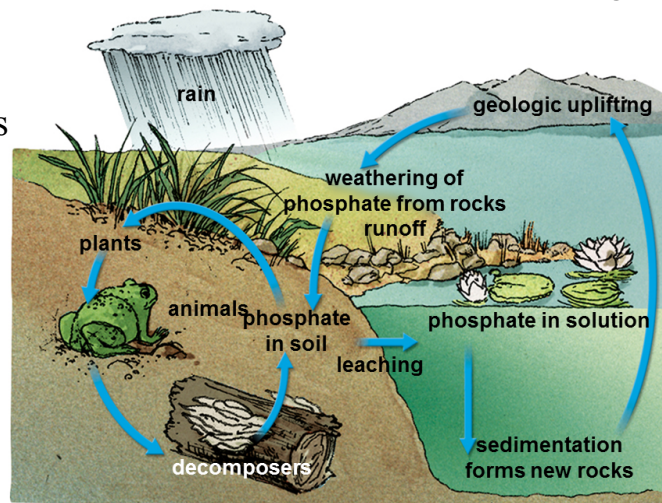


- > **Ammonia** released into the soil is transformed into ammonium.
- > Nitrifying bacteria change the ammonium into **nitrate**.
- > Nitrogen moves through the food web and returns to the soil during **decomposition**.



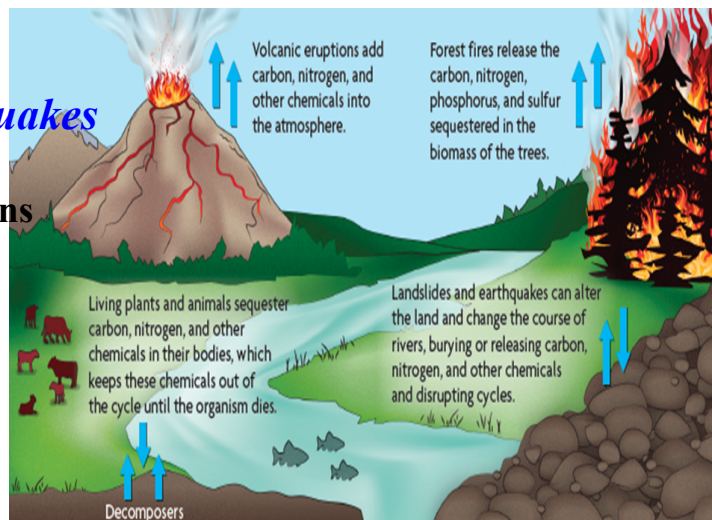
D. The phosphorous cycle - The phosphorus cycle takes place at and below ground level.

- > Phosphate is released by the *weathering of rocks*.
- > Phosphorus moves through the food web and returns to the soil during *decomposition*.
- Phosphorus *leaches* into groundwater from the soil and is locked in sediments.
- Both *mining and agriculture* add phosphorus into the environment.

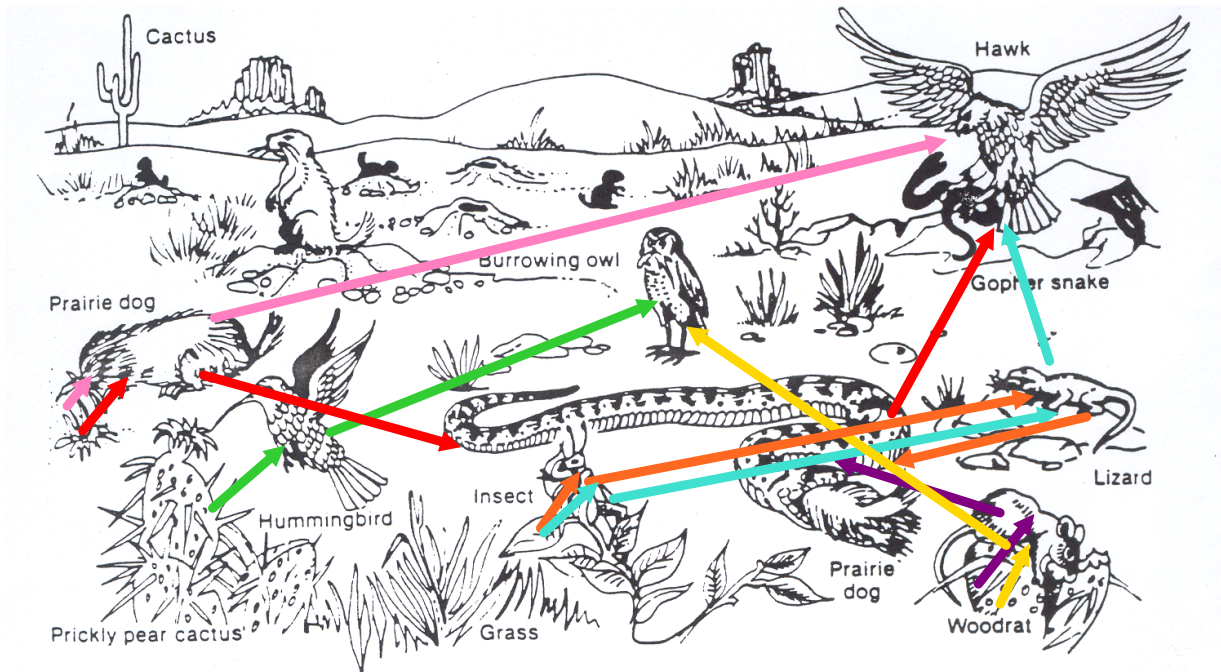
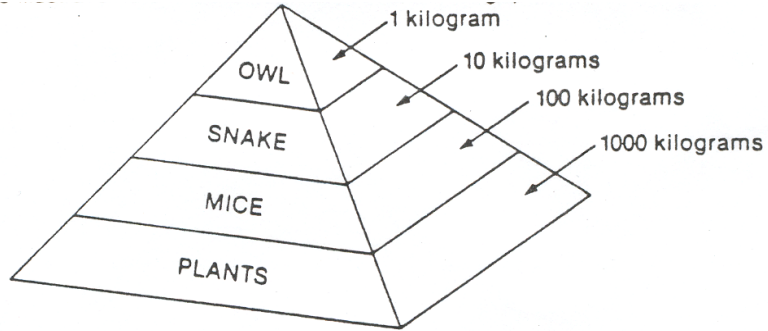
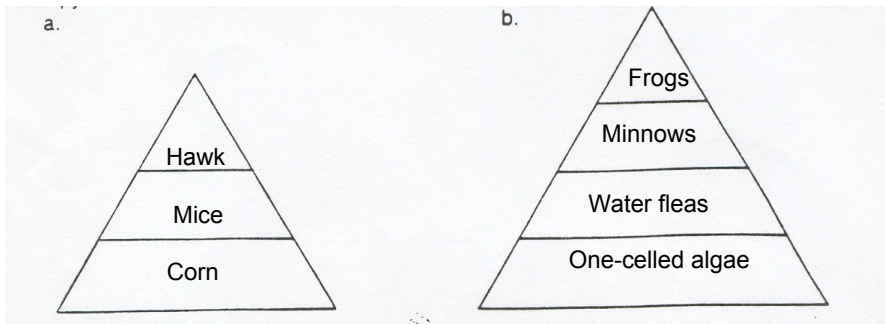


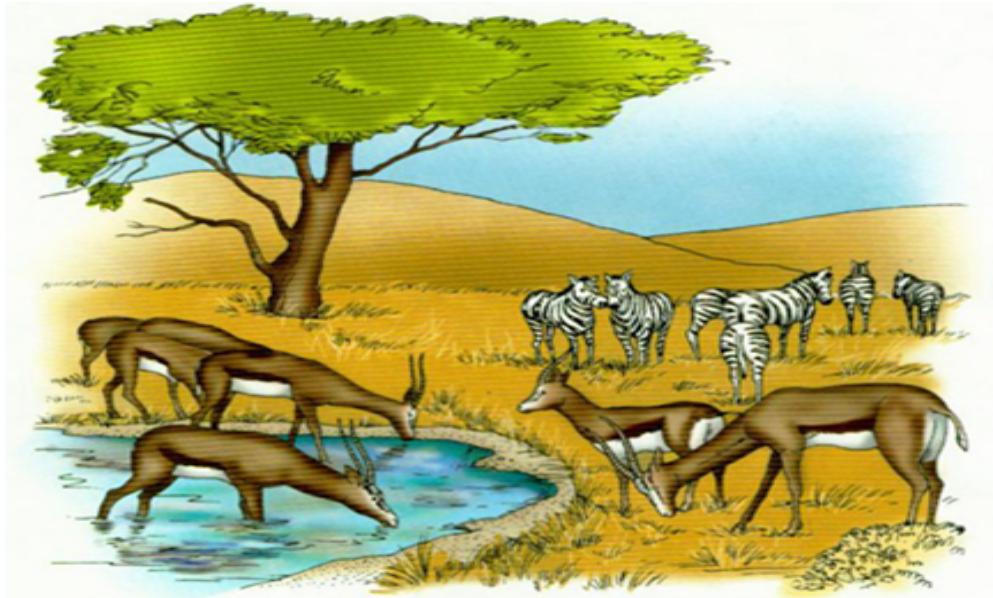
E. Natural and human activities can disrupt biogeochemical cycles and ecosystems.

- **Natural disruptions**
 - > *volcanic eruptions*
 - > *forest fires*
 - > *landslides and earthquakes*
 - > *living organisms*
- **Disruptions caused by humans**
 - > *poor farming practices*
 - > *burning fossil fuels*

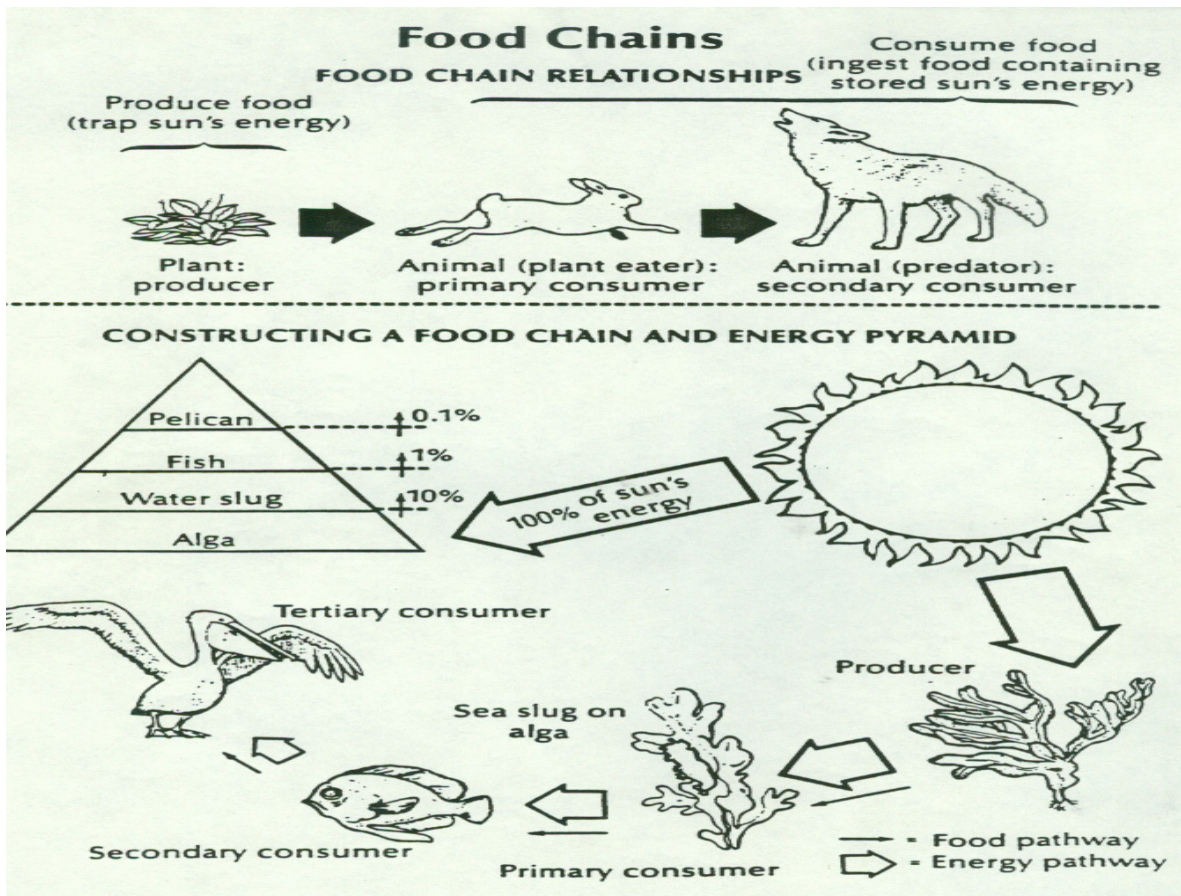


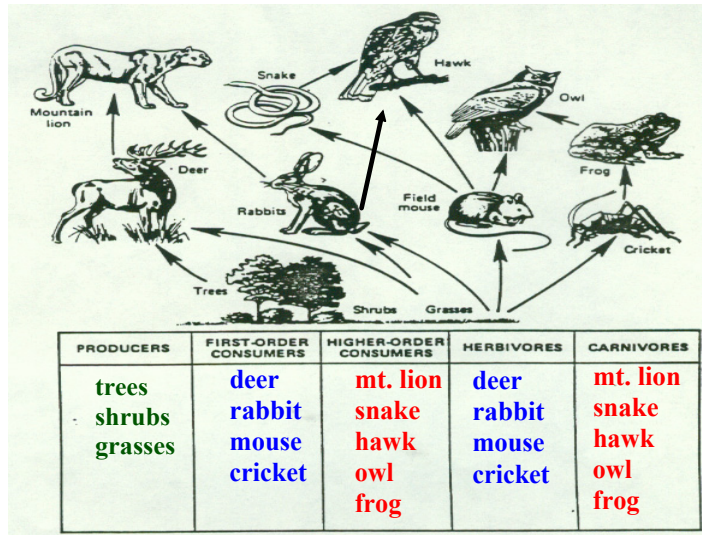
STOP





- 1 How do these organisms interact with one another and with the nonliving parts of the environment?
- 2 What might happen if the zebras were removed?





Food Webs

Use the food web below to answer questions 1-5.

- When the hawk is the third-order consumer, the number of second-order consumers is _____.
- The food chain that includes insect-eating birds is _____.
- The animal that consumes the largest number of different types of first-order and second-order consumers is the _____.
- All the animals that are herbivores are _____ consumers.
- If there were no snakes in this food web, the squirrels and rabbits could still be eaten by the _____.