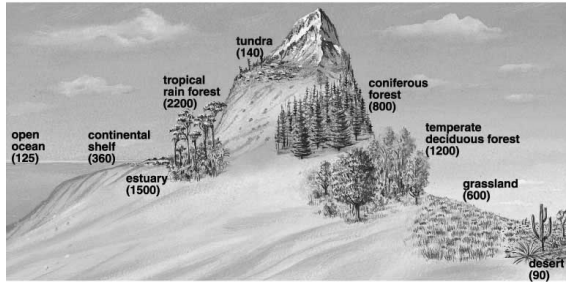


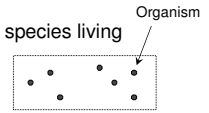
Chapter 28: How Do Ecosystems Work?



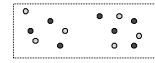
Introduction to Ecology

Ecology - Increasing Levels of Complexity:

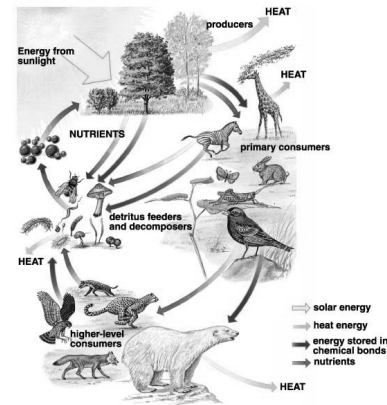
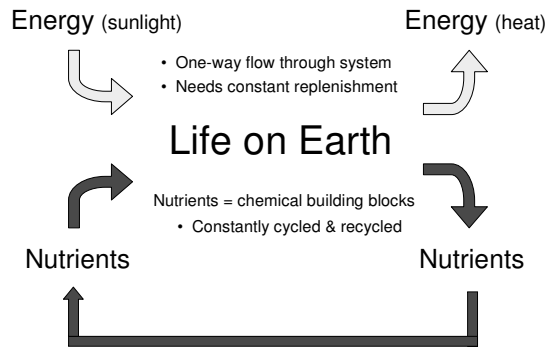
Population: All members of a particular species living within a defined area



Community: All interacting populations of species within a defined area



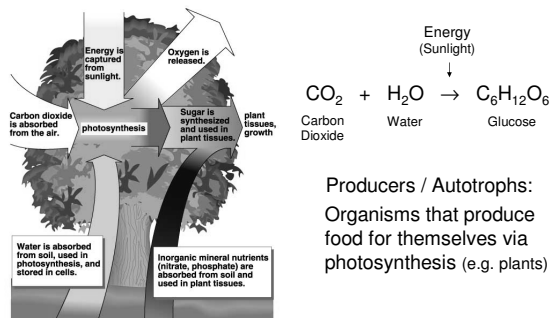
Ecosystem: All living organisms and the non-living environment within a defined area



(Figure 28.1)

Energy Flow Through Communities:

- Energy enters communities through photosynthesis:

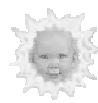


Energy Flow Through Communities:

- The amount of life an ecosystem can support is determined by the energy captured by the producers in the system.

Factors Affecting Productivity:

- Nutrients / water available to producers
- Sunlight available to producers
- Temperature



0.03% of sun's energy



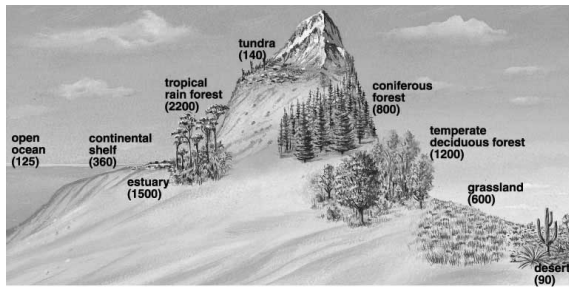
Biomass:

Dry weight of organic material (weight / unit area / unit time)

Net Primary Productivity:

Energy available to other organisms from the producers (calories / unit time)

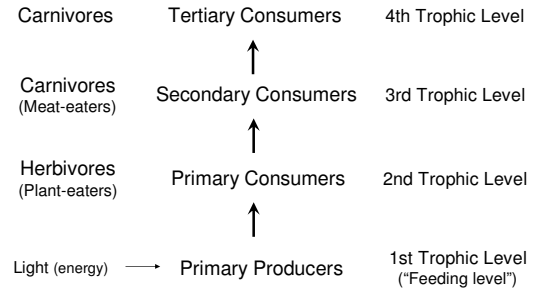
Ecosystem Productivity:



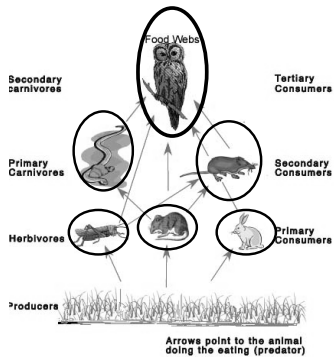
(Figure 28.3)

Energy Flow Through Communities:

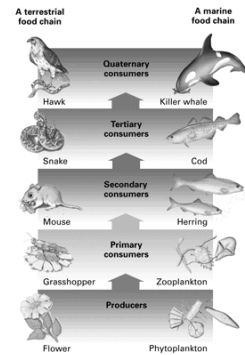
Consumers / Heterotrophs: Organisms which acquire energy by eating other organisms



Examples of trophic levels



A more complicated example



Energy Flow Through Communities:

Biological Magnification:

Process where toxic substances accumulate in higher trophic levels

- not biodegradable
- fat soluble (stored in fat)

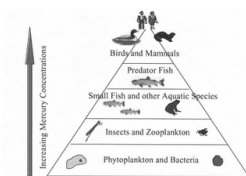
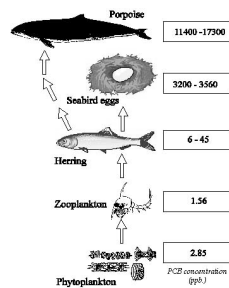


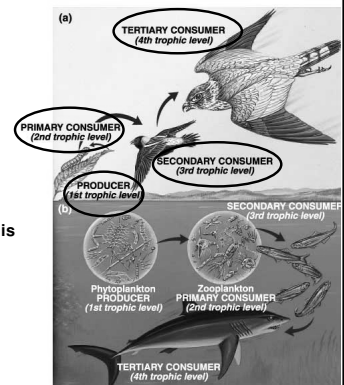
Figure 1. Accumulation of mercury in the food chain.



The concentration of PCB's tends to increase in the tissues of organisms at higher levels in the marine food chain, a phenomenon termed 'biomagnification'. (From: Percy, Wells and Evans MS, 1996: see Further Reading)

- Food Chain:
 - ❖ A linear feeding relationship in a community

- ❖ a single representative from each trophic level is used.



Energy Flow Through Communities:

Omnivore ("eaters of all"):
Organisms that may interact at multiple trophic levels (e.g. bears)

Food Web:

A complex feeding relationship showing the various interactions between all organisms from all trophic levels in a community



Energy Flow Through Communities:

How are Nutrients Recycled Once Used?

Answer: Via Detritus Feeders & Decomposers

Detritus ("Debris") Feeders:

- Organisms that consume dead organic matter and excrete it in a further decomposed state
 - Protists, earthworms, vultures

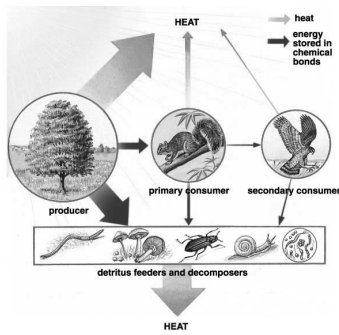
Decomposers:

- Organisms which digest food outside their bodies by secreting digesting enzymes into the environment
 - Fungi, bacteria

Although Critters are Small, Activity is Essential for Life

Energy Flow Through Communities:

Energy Transfer Through Tropic Levels is Inefficient:



(Figure 28.6)

Energy Flow Through Communities:

Energy Transfer Through Tropic Levels is Inefficient:

10% Law: Energy transfer between trophic levels is approx. 10% efficient

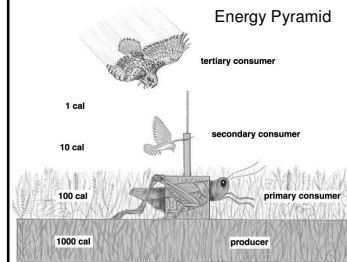
Results in:

- 1° Producers = most abundant
- 3° Consumers = least abundant

Human Implications:

The lower trophic level we utilize, the more food energy available

Do vegetarians have it right?



(Figure 28.7)

Nutrient Flow Through Communities:

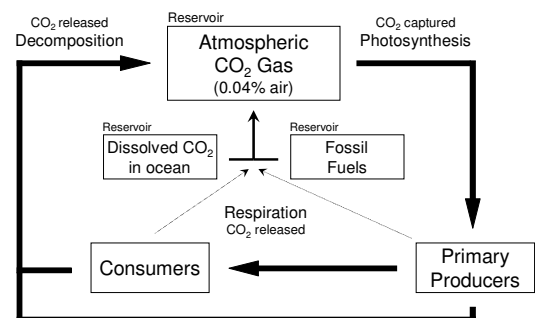
Nutrients: Elements / small molecules that form all the chemical building blocks of life

- Macronutrients: Nutrients required in large quantities
 - carbon, nitrogen, oxygen, hydrogen
 - phosphorus, sulfur, calcium
 - water
- Micronutrients: Nutrients required in small quantities
 - iron, zinc, iodine

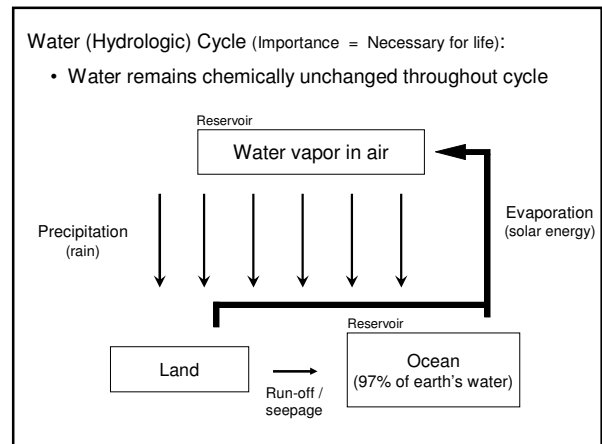
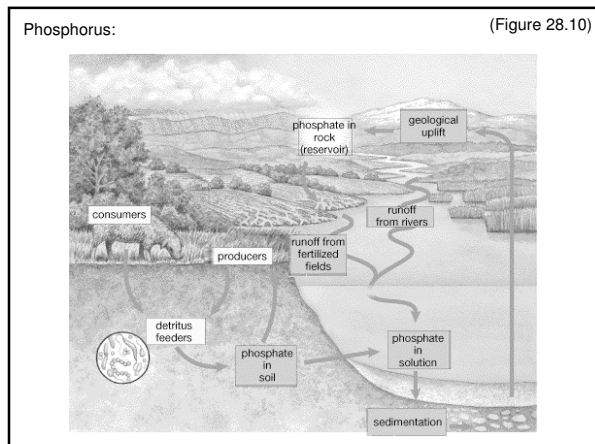
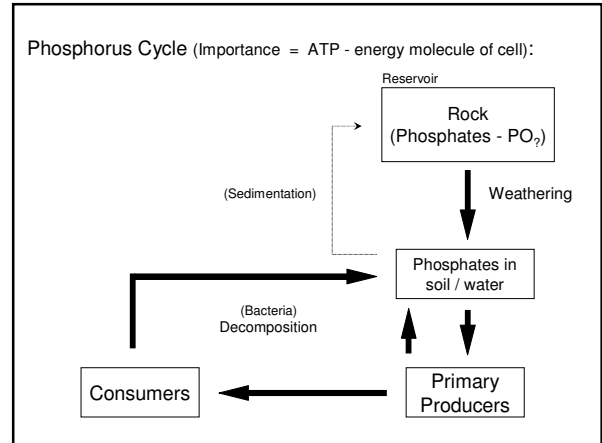
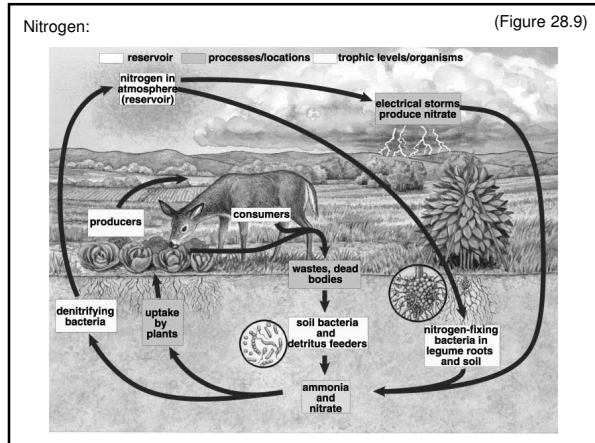
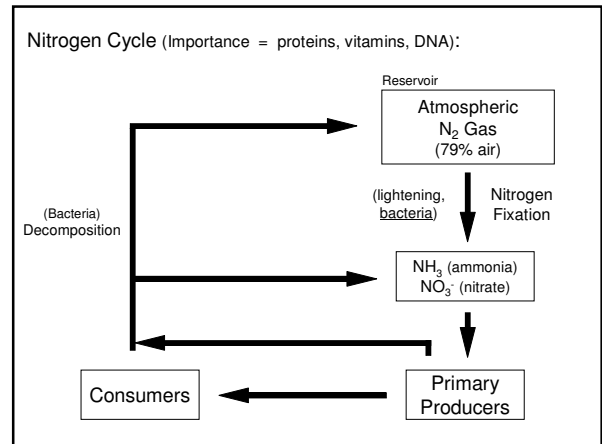
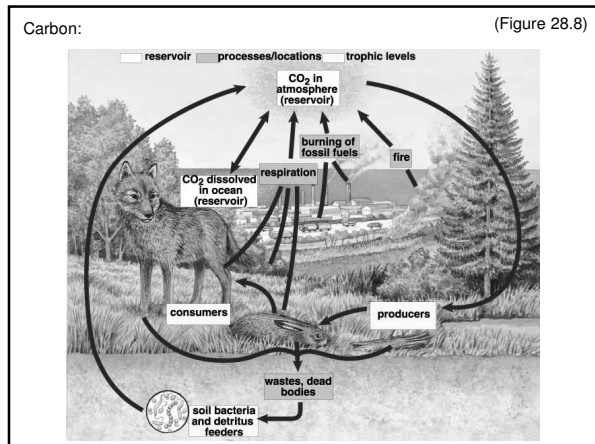
Nutrient Cycles: Pathway nutrients follow from communities to the environment and back to communities

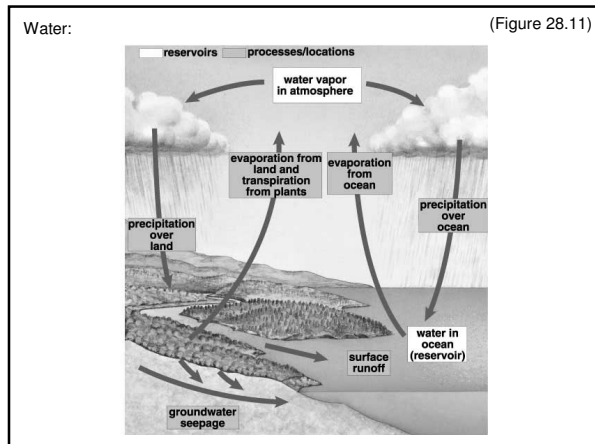
- Reservoirs: Storage sites of nutrients (usually abiotic)

Carbon Cycle (Importance = organic molecules):



Fossil Fuels: Coal, oil & natural gas

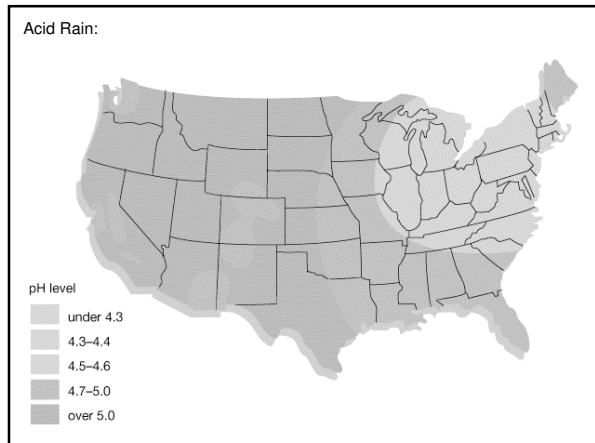




How Humans Seem to Muck Up the System:

1) Acid Deposition ("acid rain"):

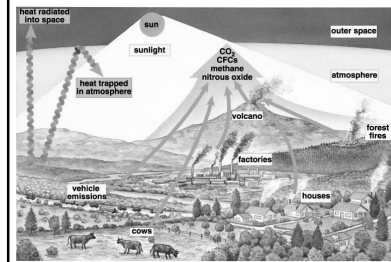
- Acidification of water due to excess nitrogen and sulfur in the atmosphere (e.g. power plants, vehicles)
- Sulfuric acid / nitric acid (corrosive)



How Humans Seem to Muck Up the System:

2) Global Warming:

- Gradual increase in ambient temperature due to increased CO_2 levels in atmosphere



Greenhouse Effect:
Gases trap sun's energy in atmosphere as heat (normal process)

Greenhouse effect on another planet

• Venus

- ❖ Earth's sister planet
 - Similar in size and mass
- ❖ Clouds of carbon dioxide & sulfuric acid
 - The dense clouds prompted the idea that it rained constantly on Venus
- ❖ Russian probes discovered that it was mostly volcanic

