Ecology - Interactions in Communities

Symbiotic Relationships ("living together")

- *symbiosis* - dissimilar organisms living together

  symbiont lives in /on a second species, host

- parasitism and mutualism influence community structure the most

Ecology - Symbiotic Relationships

Parasitism

- one organism benefits at the expense of another

  parasite obtains nutrients from living in/on host species

- specialized form of predation
- many parasites have adapted to a specific host

Ecology - Symbiotic Relationships

Parasitism

- endoparasites (internal)
  ex. tapeworms, hookworms

- ectoparasites (external)
  ex. mosquitoes

Ecology - Symbiotic Relationships

Mutualism

- symbiosis that benefits both organisms

Trophic mutualism

- plants and nitrogen-fixing bacteria

  N_2 --> bacteria --> NH_3 --> used by plants

- animals and intestinal microbes

  termites, cows, humans

Ecology - Symbiotic Relationships

Trophic mutualism

- between animals -- cleaner fish

Dispersive mutualism.

- Plant pollinators (birds, insects and bats)

plants get gametes dispersed <---> pollinator gets energy

Ecology - Symbiotic Relationships

Defensive mutualism

- Ant and the swollen thorn Acacia

--> Acacias have thorns and foliar nectaries

--> Ants use acacias as nests and for food

--> Ants defend acacia against herbivores and competing plants

Ecology - Symbiotic Relationships

Commensalism

- one organism benefits with no harm to the other

ex. “hitchhiker” species
(whale and the barnacle)
(algae growing on shells or backs of species)

Ecology - Interactions in Communities

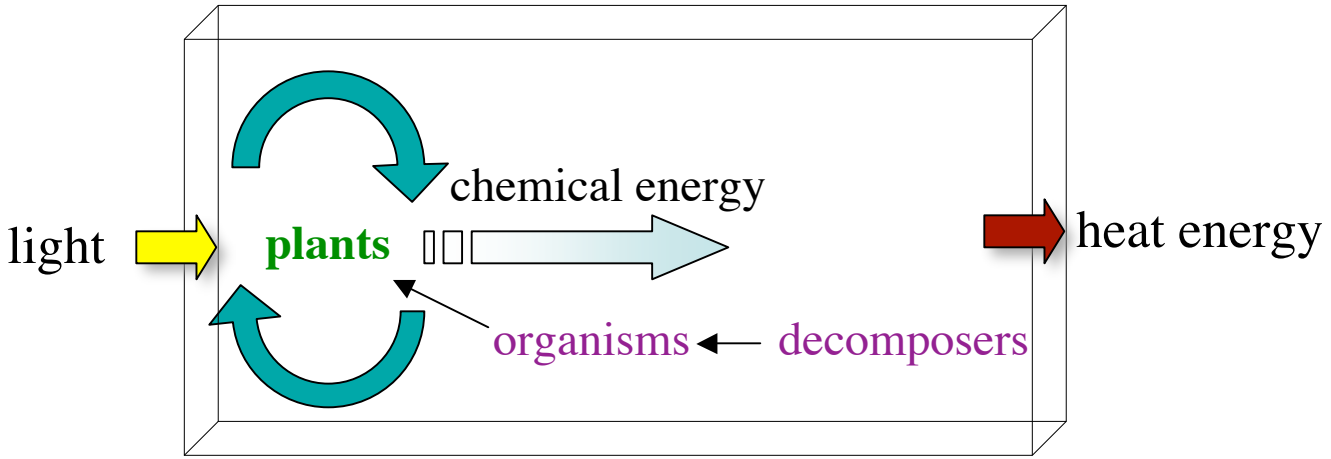
Summary Interspecific Interactions

Interaction	Effect on Species	Effect on Population Density
Competition	**- / -**	Detrimental to both species
Predation (parasitism)	**+ / -**	Beneficial to predator, harmful to prey
Mutualism	**+ / +**	Beneficial to both species
Commensalism	**+ / o**	One species benefits the other is unaffected

Ecology - Ecosystem Ecology

Two major processes sustain all ecosystems:

- *energy flow* - exchange of energy through ecosystem



- *chemical cycling* - use and reuse of chemical elements
- organism interaction

Ecology - Ecosystem Ecology

Trophic Structure

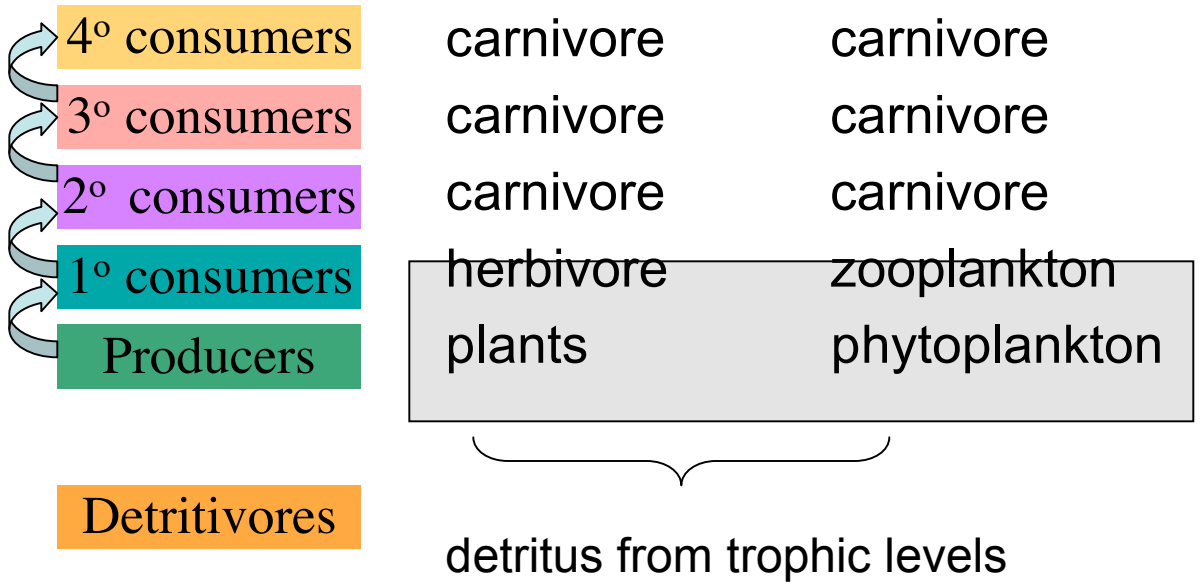
- determines path of energy flow and chemical cycling

Trophic levels - a step in the transfer of food or energy

Food chain - transfer of energy between trophic levels

Ecology - Ecosystem Ecology

Food chains



Ecology - Ecosystem Ecology

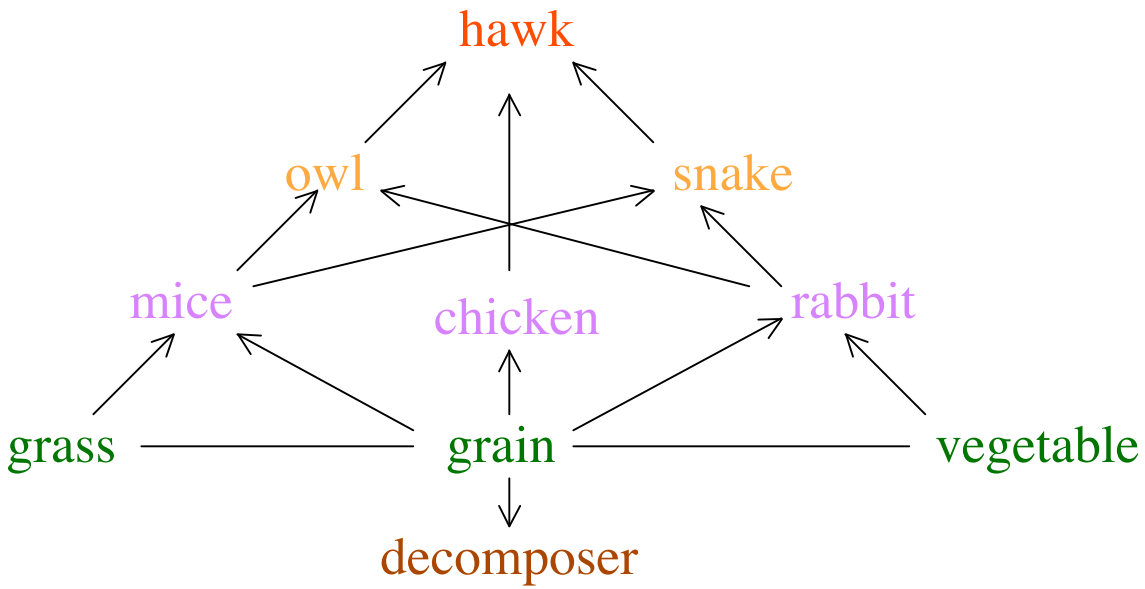
Types of heterotrophs

- *herbivore* - obtains energy by feeding on primary producers
- *carnivore* - flesh-eating organism
- *omnivore* - feed on both plants and animals

Ecology - Ecosystem Ecology

Food webs

- species usually have alternate food source
- this relationship is expressed with a web diagram



Ecology - Energy Flow in Ecosystem Ecology

Efficiencies of ecosystems

solar radiation 35% reflected back into space

14% absorbed by atmospheric gases

51% absorbed by earth's surface

Infrared absorption ("greenhouse effect")

- the effect of heat retention in the lower atmosphere as a result of absorption and re-radiation of terrestrial radiation by clouds and gases

Ecology - Energy Flow in Ecosystem Ecology

photosynthesis efficiency

energy of sunlight captured = 1.5% solar energy available

- this low efficiency is do to:
  - reflection
  - low efficiency of chemicals (chlorophyll)

Ecology - Energy Flow in Ecosystem Ecology

Biomass

- the amount of living organic material in an ecosystem

Primary Productivity

- the rate at which biomass is produced by plants in the form of organic substances

Ecology - Energy Flow in Ecosystem Ecology

Eltonian Pyramids

- a graphical representation of the trophic structure and function of an ecosystem
- the first trophic level of producer organisms (usually green plants) forms the base of the pyramid
- three types: of numbers, of biomass, and of energy

Ecology - Energy Flow in Ecosystem Ecology

Energy Pyramids

- efficiency of energy transfer between trophic levels

Ecological efficiency (Lindemann's efficiency)

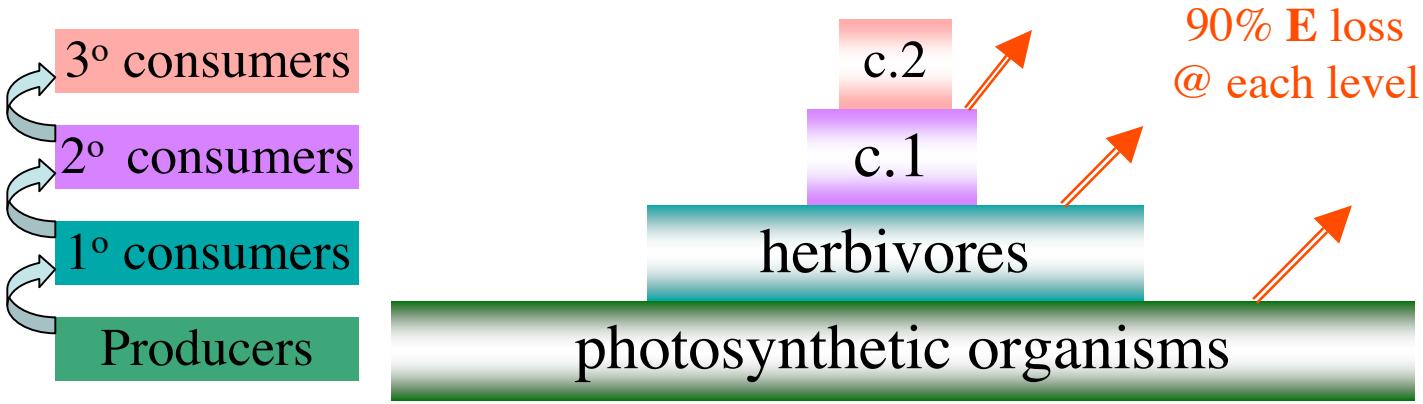
$$\frac{\text{energy assimilated by trophic level (N)}}{\text{energy assimilated by the next lower trophic level (N-1)}}$$

= 10%

Ecology - Energy Flow in Ecosystem Ecology

Energy Pyramids

- this cumulative loss of energy from a food chain can be represented by an energy pyramid



Ecology - Ecosystem Ecology

Biomes

- major types of ecosystems that cover large geographic areas
- characterized by distinctive vegetation, organisms and climate

Aquatic Biomes

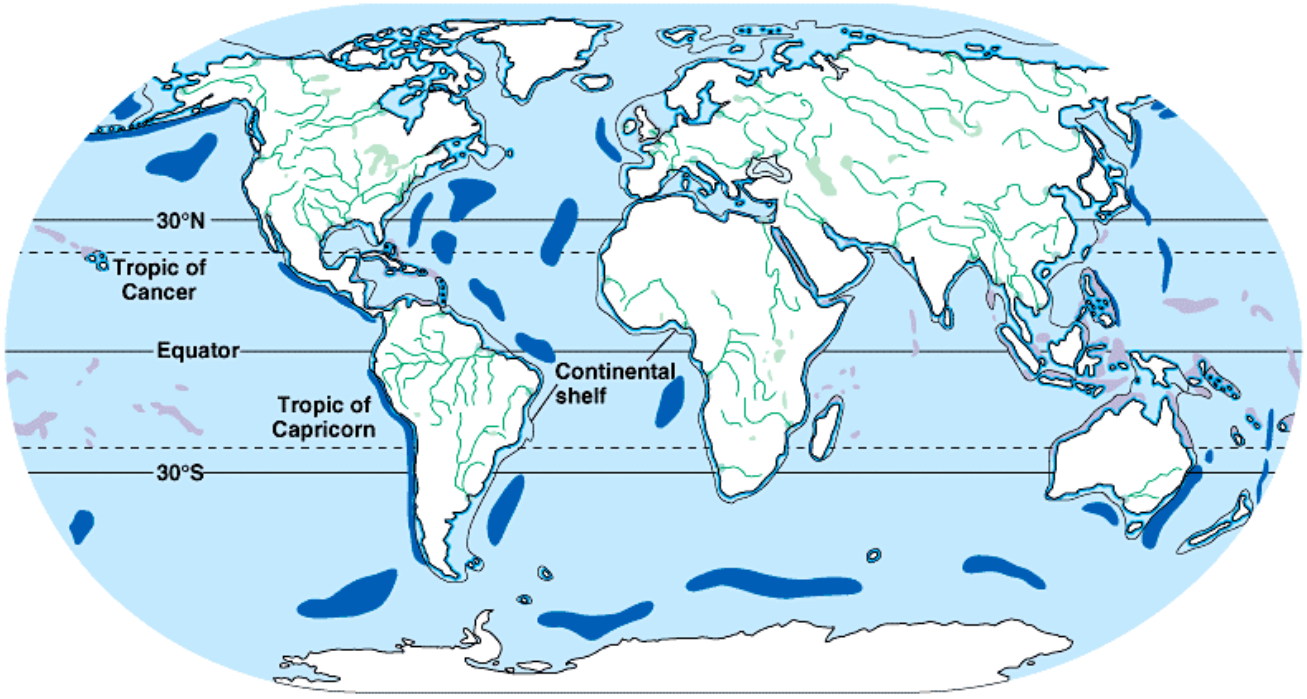
- occupy the largest part of the biosphere

Freshwater biomes	
lakes	ponds
rivers	streams

Marine biomes
estuaries
oceans
coral reefs

Ecology - Ecosystem Ecology

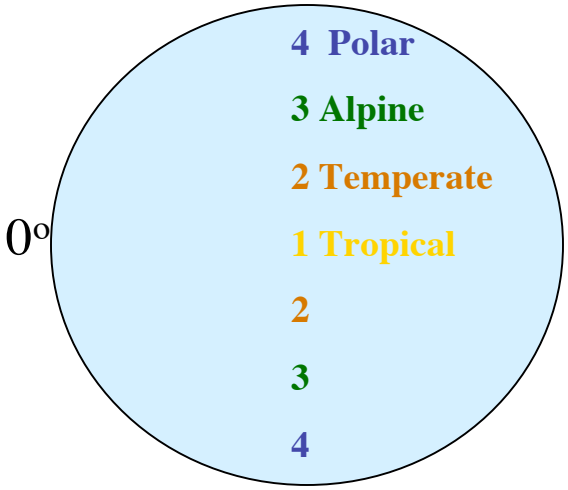
Aquatic Biomes



Ecology - Ecosystem Ecology

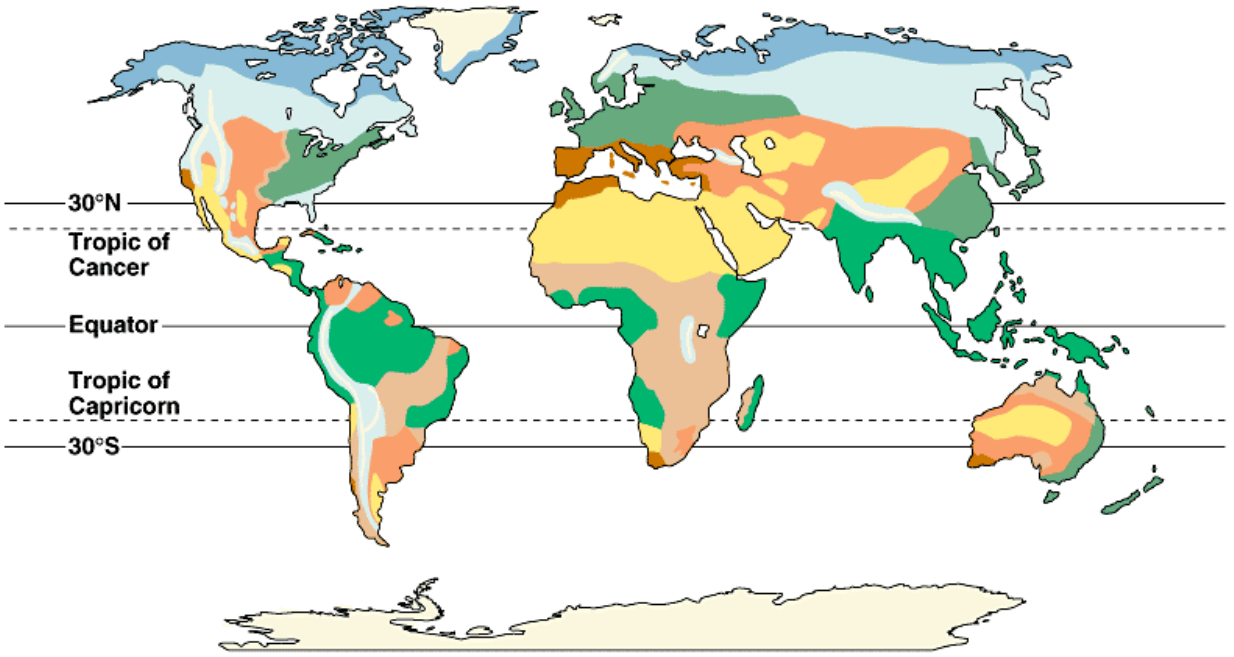
Terrestrial Biomes

- distribution by latitude and / or altitude



Ecology - Ecosystem Ecology

Terrestrial Biomes



Ecology - **Defining our Biome**

Temperate deciduous forest

- deciduous trees (shed leaves)
- moderate rain and temperature
- mid-latitudes

Ecology - **Defining our Biome**

Wetlands / Estuaries

- *estuary*
  - a coastal body of water
  - free connection to the open sea
  - ocean water is diluted by fresh water