

## Ecosystem Ecology

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*How do living organisms interact with their environment and with other organisms?*

## Ecology

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Used to describe the study of organisms and where they live, with the emphasis on the inter-relationships between organisms and their environment. (Haeckel, 1869)

Derived from the Greek word *Oikos*  
Meaning house or place to live.

## Ecosystem

The way that the living and nonliving parts of our world interact

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Sustained by ongoing inputs of energy and nutrients (open system)

## Ecological Models

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Every model has inherent strengths and weaknesses. The goal of a useful model is to simplify and explain. The natural environment is quite complex.

Types:

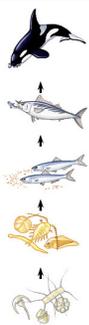
- 1) Food Chains
- 2) Food Webs
- 3) Energy Pyramids
- 4) Biomass Pyramids

## Energy Flow

- ✓ Food Chain: direct transfer of food from one organism to the next.
- ✓ Plant → grasshopper → mouse → snake → hawk
- ✓ Energy enters as sunlight.



Land Based



Marine

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## The Participants

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### I. Primary producers (autotrophs)

- Obtain energy from nonliving sources (sunlight)
- Build organic compounds from CO<sub>2</sub> and water

### II. Consumers (heterotrophs)

- Get energy and carbon from organic sources
- Carnivores, herbivores, parasites, omnivores

## Productivity

**Primary Productivity:** Production by autotrophs, normally green plants.

**Gross Primary Productivity:** (GPP) Production before respiration/heat losses are accounted for.

**Net Primary Productivity:** (NPP) Productivity after Respiration/heat losses are subtracted.

## Trophic Levels

Hierarchy of *feeding relationships* in which energy is transferred when one organism eats another

## The Flow of Energy

**Producers:** Autotrophic organisms that convert solar energy into complex high-energy molecules. E.g. Plants and Cyanobacteria

**Primary Consumers:** Herbivores e.g. Deer

**Secondary Consumers:** Carnivores e.g. Birds that eat insects, foxes that eat mice.

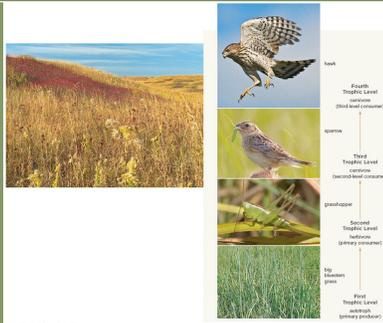
**Tertiary Consumers:** Carnivores that eat other carnivores e.g. Wolves eat coyotes

## Recycling

**Detritivores**, such as earthworms and crabs, eat small particles of organic matter (detritus)

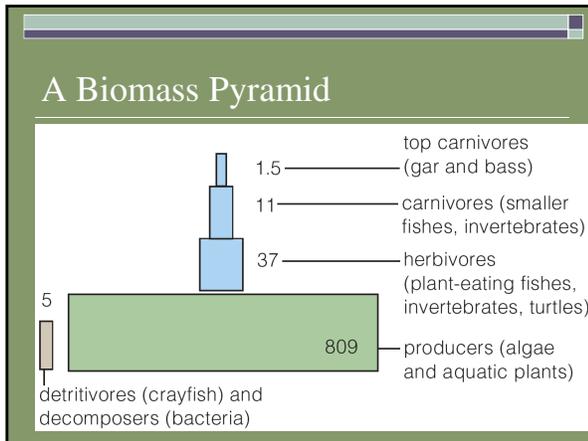
**Decomposers**, such as bacteria and fungi, feed on organic wastes and remains and break them down into inorganic building blocks

## Food Chain



## Food Webs

- *Food chains cross-connect as food webs*
- *Most energy that enters a food web returns to the environment, mainly as metabolic heat*
- *Nutrients are recycled within the food web*



- ### Food Webs
- **Food webs**
    - Multiple interconnecting food chains, including grazing and detrital food chains
  - **Grazing food chain**
    - Energy stored in producers flows to herbivores, which tend to be large animals
  - **Detrital food chain**
    - Energy in producers flows to decomposers and detritivores, which tend to be small

### Competition

The interaction of individuals among individuals who attempt to utilize a resource that is limited relative to the demand for it.

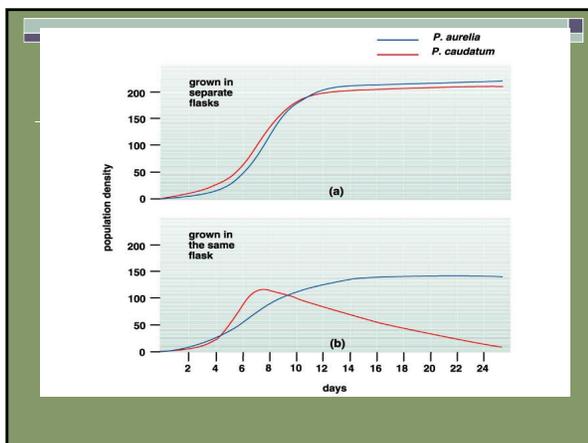
Resources that might be limiting include:

- Space
- Food
- Water
- Territories

### Competitive Exclusion

The concept that no two species can simultaneously and continuously occupy the same ecological niche.

The following figure shows that when two species of Paramecium are raised together and occupy the same niche that one species out competes the other species.



### Resource Partitioning

The coexistence of two species with similar requirements, each occupying a smaller niche than either would if it were by itself; a means of minimizing their competitive interactions.

On the following slide five insect-eating species of North American warblers searches for food in different regions of a spruce tree.

