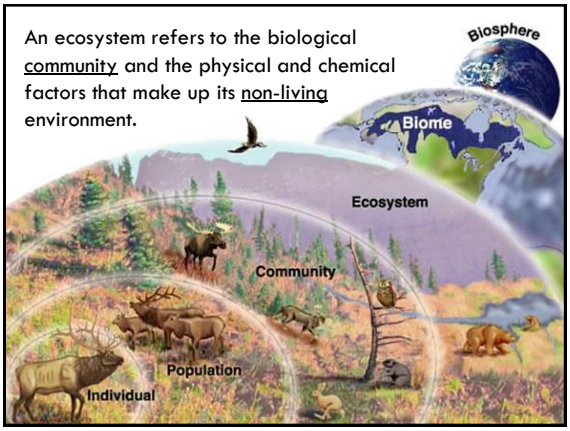
Introduction to Ecosystems & How They Work

An ecosystem refers to the biological community and the physical and chemical factors that make up its non-living environment.



The biological community is the sum of and interactions between all the different species (biotic factors) within a specific location.

While the non-living environment refers to the rocks, soil, air, temperature, and sunlight (abiotic factors).

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Ecosystems

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- Can be as small as a log or as large as the largest lakes – what matters is that they represent the combination of biotic and abiotic factors.

Energy Flow in Ecosystems

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- All living things require energy to grow, move, reproduce, and maintain tissues.
- Energy flows through ecosystems according to the Law of Thermodynamics.

First Law of Thermodynamics

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Energy cannot be created or destroyed, although it can change from one form to another.

- An organism cannot create the energy it needs to live; but instead must somehow capture that energy from the environment.

First Law of Thermodynamics

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- The source of energy for ecosystems is the sun.
- Sunlight is captured by green plants during photosynthesis.
- In photosynthesis, plants absorb light energy from the sun and convert it into chemical energy.

First Law of Thermodynamics

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- Energy from plants is transferred to the plant-eating animals (herbivores), plant- and meat-eating animals (omnivores), and then the animal-eating animals (carnivores).
- In this way, chemical energy may transform into mechanical energy needed to walk, run, fly, or swim.

Food Chains and Food Webs

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- Energy transfers can be represented using:
  1. Food chains: show the linear flow of energy in an ecosystem.
  2. Food webs: represent interconnected food chains.

Food Chains

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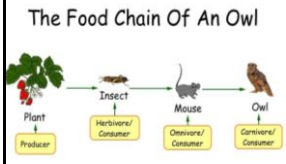
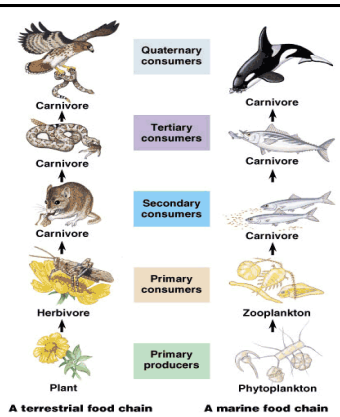


- Because green plants convert the sun's energy into chemical energy, they are producers.
- Organisms that eat producers are primary consumers.
- Organisms that eat primary consumers are secondary consumers, with tertiary and quaternary consumers at the top.



Food Chains

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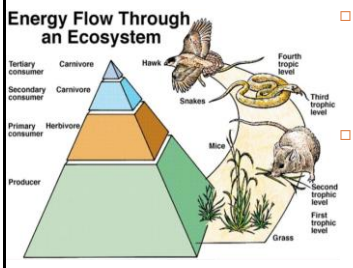

- Each level, or 'link', in a food chain is a trophic level.
- Producers make up the first trophic level, primary consumers the second, secondary consumers the third, and so on.

Food Chains

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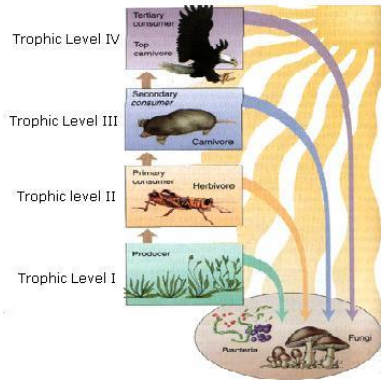
- At every trophic level there are also detritivores and decomposers.
  - Detritivores eat dead plants and animals.
  - Decomposers break down organic matter.



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Food Webs

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- Most organisms are part of many food chains; thus a food web is a better representation.
- Arrows in a food web represent the flow of energy and nutrients.
- Following the arrows leads to the top consumers.

Second Law of Thermodynamics

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When energy is converted from one form to another, some of it is degraded into heat, a less usable form that disperses into the environment.

- Most of the energy obtained by organisms goes into keeping the organism alive or escapes as heat.
- This leaves only a very small percentage (~10%) to be stored as body tissues and it is this energy that gets passed on to the next trophic level.

Energy Pyramids

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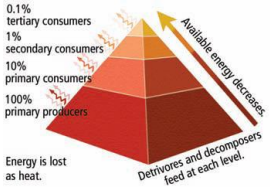

- An energy pyramid shows how energy moves through the trophic levels.
- The producers are on the bottom with the most energy.

Energy Pyramids

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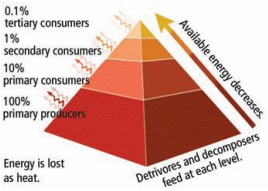
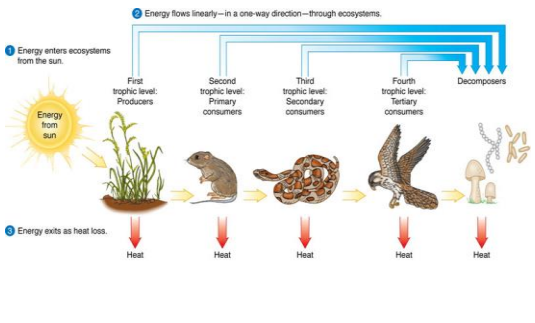
- As trophic level increases, available energy decreases.
- This is due to the Law of 10%: Only 10% of energy is stored in body tissues and available to be passed to the next trophic level.




2 Energy flows linearly—in a one-way direction—through ecosystems.
1 Energy enters ecosystems from the sun.
Energy from sun
First trophic level: Producers
Second trophic level: Primary consumers
Third trophic level: Secondary consumers
Fourth trophic level: Tertiary consumers
Decomposers
3 Energy exits as heat loss.
Heat
Heat
Heat
Heat
Heat

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