

Ecology:

Part 2: Energy and Biomass

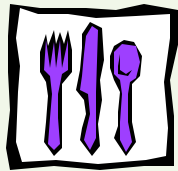
Energy in Ecosystems:



- The main source of energy in most ecosystems is...sunlight.
 - What is the amount of energy from the sun?
 - 100 W/ft²
- The energy gets transferred through ecosystems from one organism to another through feeding relationships (food webs and food chains.)
- Sun energy is continually replenished...

Classification of organisms (in ecosystems):

- Organisms get classified into 3 main groups.
- How? The classification comes from the way they get their food:
 - Producers
 - Consumers
 - Decomposers



Producers:

- Organisms that can make their own food.
- Organisms that use energy from the sun or energy stored in chemical compounds to manufacture food.
- AKA: Autotrophs
- Green plants, algae, chemosynthetic bacteria.
- Belong to the First Trophic Level

Consumers:

- Organisms that get their own food by eating other organisms.
- Organisms that are dependant on autotrophs as a source of energy and nutrients.
- Can not make their own food
- AKA: Heterotrophs

Consumers:

- There are various types of Consumers:
 - Herbivores
 - Carnivores
 - Omnivores
 - Detritivores
- Consumers are grouped into multiple trophic levels.
 - A consumer may occupy more than one trophic level.
 - (If they feed at more than one trophic level.)

Herbivores:

- A Consumer that feeds on plants and chemosynthetic bacteria.
- Eat only producers.
- From:
 - Herba: Latin word for “grass”
 - Vorare: Latin word for “to devour”
- ie: Deer, Bison
- First Order Consumers (C_1); Primary Consumers
- Belong to the Second Trophic Level

Carnivores:

- A Consumer that feeds on other consumers.
- Kill and feed on only other animals.
- From:
 - Caro: Latin word for “Flesh”
 - Vorare: Latin word for “to devour”
- ie: Cougars, Wolves

Carnivores Continued:

- Can be Second Order Consumers (C_2); Secondary Consumers and belong to the Third Trophic Level
 - Eat (C_1) Organisms
- Can be Third Order Consumers (C_3); Tertiary Consumers and belong to the Fourth Trophic Level
 - Eat (C_2) Organisms

Omnivores:

- A Consumer that feeds on both producers and other consumers.
- Feed on plant and animal material.
- From:
 - Omnis: Latin word for “all”
 - Vorare: Latin word for “to devour”
- ie: People, Bears, Turtles
- May occupy several trophic levels!

Detritivores:

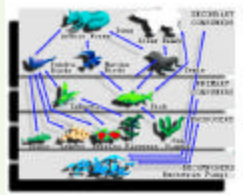
- A Consumer that feeds on carion, refuse, etc.
- They do not kill their food.
- Feed on organisms that are already dead (detritus).
- Use organic wastes as food sources.
- AKA: Scavengers
- From:
 - Detritus: Latin word for “rubbed or worn away”
 - Vorare: Latin word for “to devour”
- ie: People

Decomposers:

- Organisms that break down and absorb dead organisms (organic matter) and return nutrients to the soil.
- Organisms that break down complex compounds of dead decaying materials into simpler molecules that can be absorbed.
- Ie: Bacteria and fungi

Trophic Levels:

- Feeding levels or steps in a food chain.
- The position that an organism occupies in a food chain.



Food Chain:

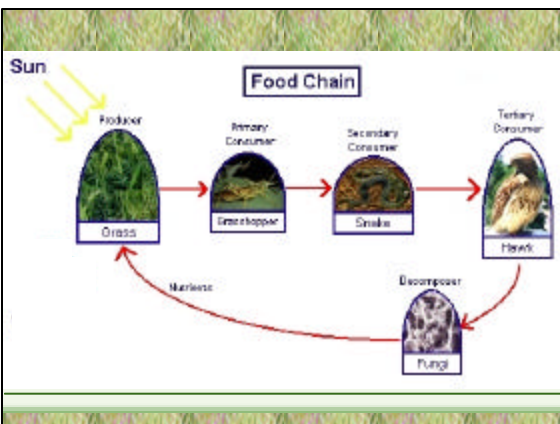
- Simple model used to show how matter and energy move through an ecosystem.
- Series of steps in which organisms transfer energy by eating or being eaten.
- Representation of how nutrients and energy flows from the sun to an autotroph to a heterotroph and finally to decomposers.
- Each organism in a food chain represents a feeding step or trophic level.

Food Chain:

- Model of the flow of energy through organisms of an ecosystem.
- Source of energy for food chains is usually the sun.
- Arrows are used to represent the flow of energy .
 - The arrows always point in the direction energy is flowing or transferred.
- Energy flowing through an ecosystem is not recycled; sunlight must flow to supply energy for food chains.

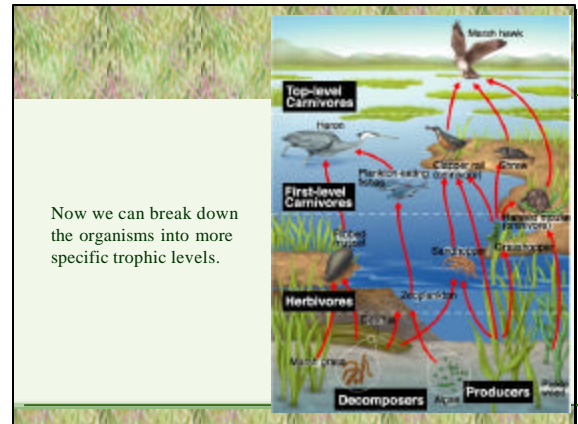
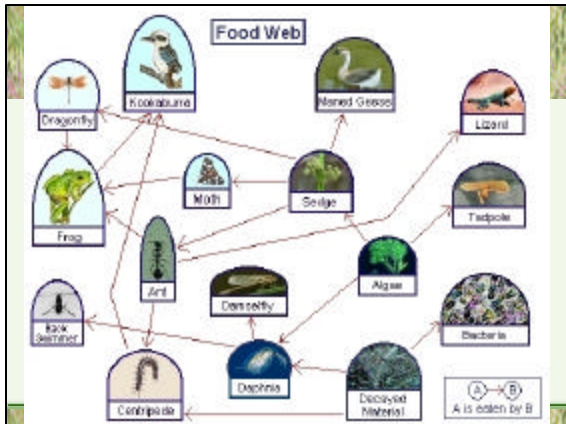
Food Chains:

- Have anywhere from 3 to 5 links as only a small portion of what energy was first available.



Food Web:

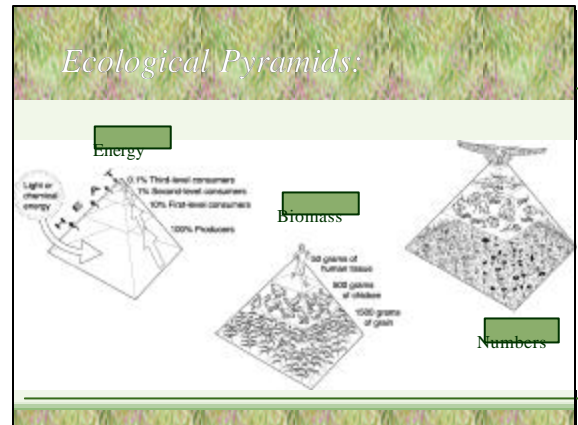
- Multiple food chains that combine and overlap.
- Links “all” food chains of an ecosystem together.
- Expresses “all” possible feeding relationships at each trophic level in a community.
- Shows more information about energy flow in an ecosystem than food chains.
- More natural than food chains because most organisms depend on more than one other species for food.



Now we can break down the organisms into more specific trophic levels.

Ecological pyramids:

- Diagrams showing relative amounts of energy or matter within each trophic level of a food chain or food web.
- There are three types:
 - Energy Pyramid
 - Biomass Pyramid
 - Numbers Pyramid

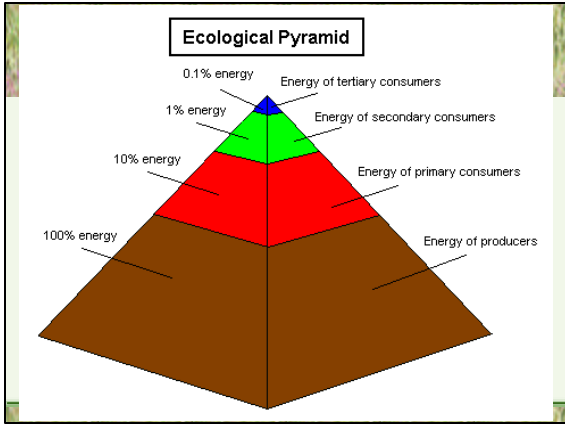


Energy Pyramids:

- Illustrates that the amount of energy in the ecosystem decreases at each trophic level.
- Depicts energy conversions in an ecosystem.
- The base is always the producers or the 1st trophic level, higher order trophic levels layer on top of one another.

Energy Pyramids:

- The total energy transfer from one trophic level to the next is only about 10%.
 - Not all organisms of a trophic level are captured and eaten.
 - Not all parts of organisms that are captured and eaten get digested.
 - Organisms use some digested food (for respiration, movement, reproduction etc.) and so the energy gets used before it gets to the next trophic level.
 - Energy is given off as heat to the environment.



Biomass Pyramids:

- What is Biomass?
 - The amount of living tissue within a trophic level.
 - Measured in grams of organic material per unit area.
- Calculate the biomass by:
 - Find the average mass of an organism of each species within a trophic level.
 - Then multiply the average mass by the estimated number of organisms in each population.

Biomass Pyramids:

- Express the mass of living material at each trophic level.
- Represent the potential food at each trophic level.

The diagram shows a pyramid with three levels. The top level is a small box labeled 'ECCELABOBEA (10g/m²)'. The middle level is a larger box labeled 'GRASSHOPPER (50g/m²)'. The bottom level is the largest box labeled 'GRASS (400g/m²)'.

Pyramid of Numbers:

- Shows the number of individual organisms at each trophic level.
- For some food chains it is the same as the biomass pyramids, but not always.
 - There are fewer producers than consumers in forests.
 - One tree has a large biomass.

