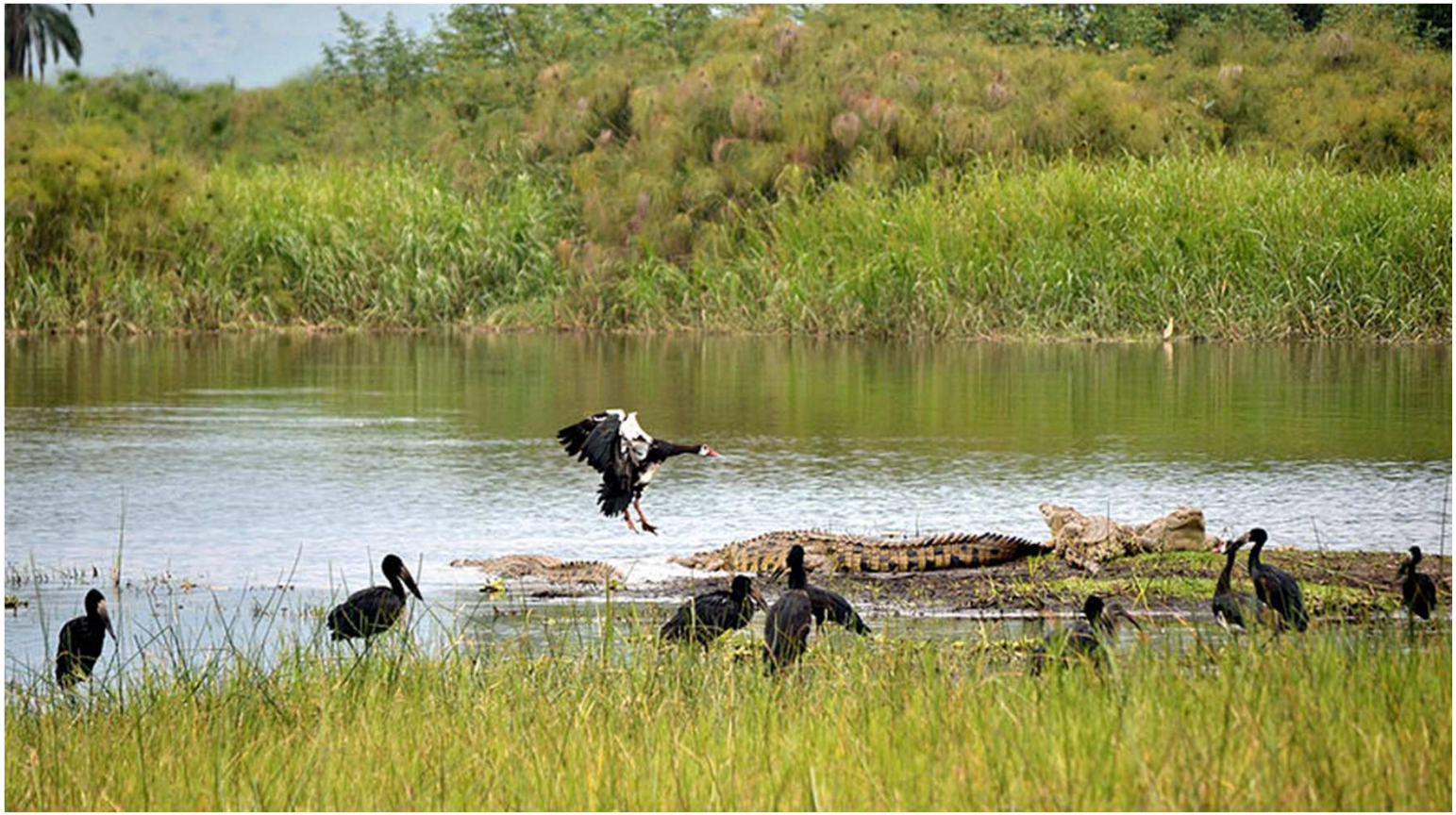
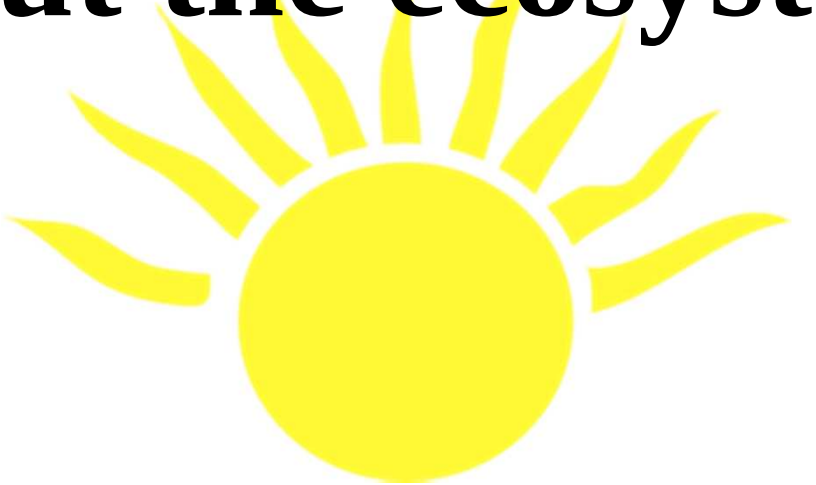
ECOLOGY

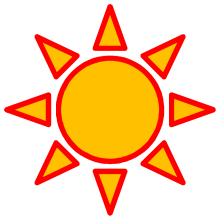


Energy Flow in Ecosystems

EQ: How does the energy flow throughout the ecosystem?



Energy



Recall that all of life's energy comes from the sun.

Primary productivity- the rate at which producers make energy (from sunlight).

Factors that affect primary productivity include

- Amount of water available to the plant
- Amount of sunlight available
- Carbon dioxide
- Trace elements (nitrogen, potassium)

Living things can fall into two categories in how they obtain energy:

Producers (AKA autotrophs) - produce energy by capturing sunlight or using chemicals (plants, algae, some bacteria).

Consumers (AKA heterotrophs) - organisms that consume other organisms for food.

Most autotrophs obtain energy from the sun through photosynthesis. The energy from sunlight is used to power chemical reactions to make sugar.

Consumers can be further divided into specific categories-

Herbivore- organism that eats plants

Carnivore- eats meat

Omnivore- eats both plants + animals


Herbivore


Carnivore


Omnivore

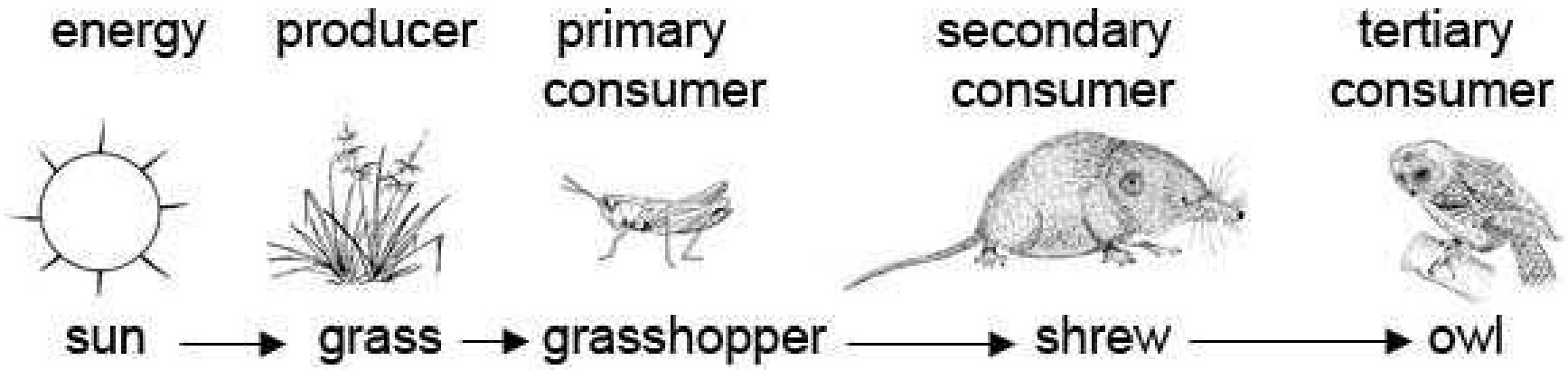
Detritivores- organisms that obtain their energy from dead matter or waste (Ex- vultures, crabs, earthworms)

Decomposer- cause decay and release nutrients back into the environment; crucial for the "circle of life" (Ex- bacteria, fungi)

Energy flows through an ecosystem in one direction, from the sun to autotrophs and then to various heterotrophs.

Trophic levels- an assigned level in a food chain based on how an organism gets energy; first trophic level always assigned to a producer.

Food chain- the path of energy through the trophic levels (energy flow depicted with arrows)



Typically, there are 4-5 available trophic levels

Trophic Level	Type of Organism	Example
FIRST	Producer	Sunflower seeds
SECOND	Primary Consumer	Mouse
THIRD	Secondary Consumer	Snake
FOURTH	Tertiary Consumer	Hawk
FIFTH	Quaternary Consumer	Fox

Food chain= grass → mouse → snake → hawk→ fox

(arrows point in direction of energy flow).

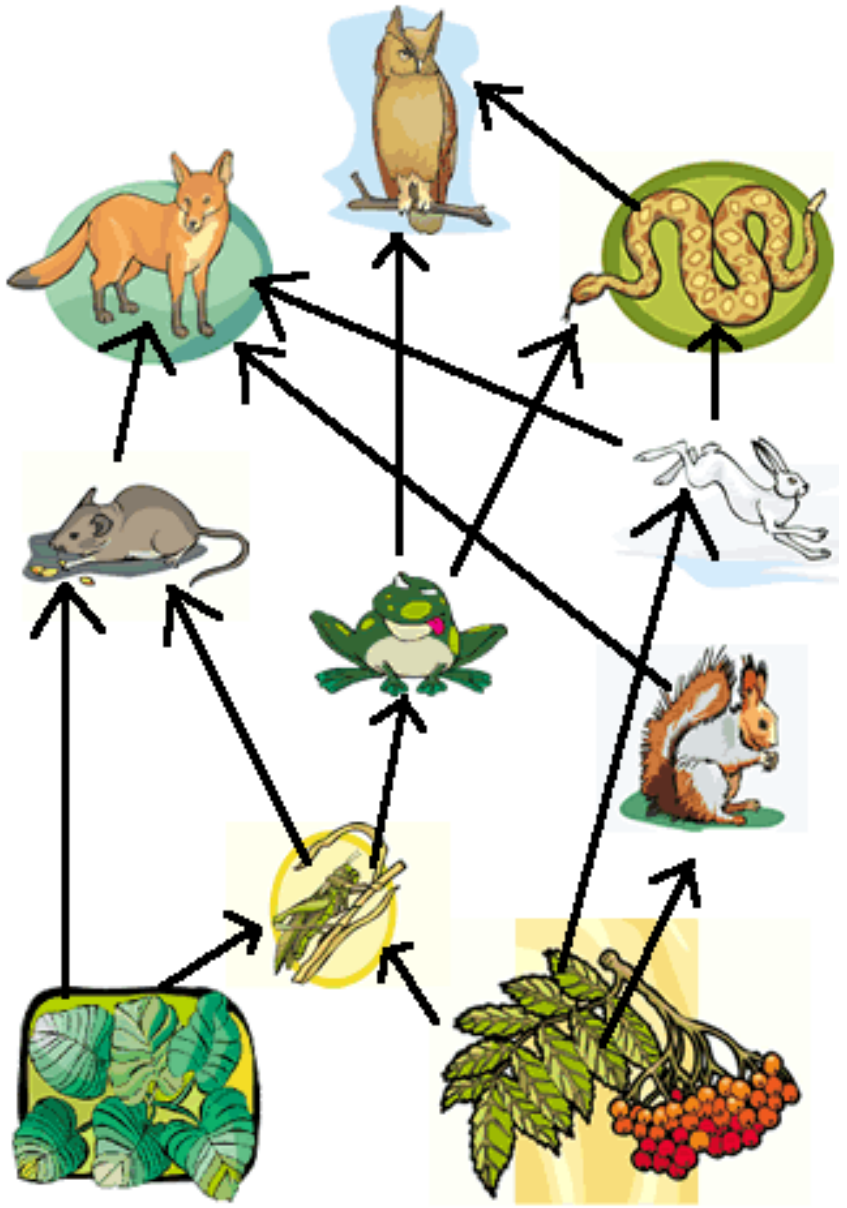
Food web- multiple connected food chains showing the complex interactions within an ecosystem.

What does the owl feed on?
What does the grasshopper feed on?

There are 10 food chains in this one food web. How many can you find?

Name one primary consumer, one secondary consumer, one tertiary consumer.

Are the any quaternary consumers? (4th level consumer?)

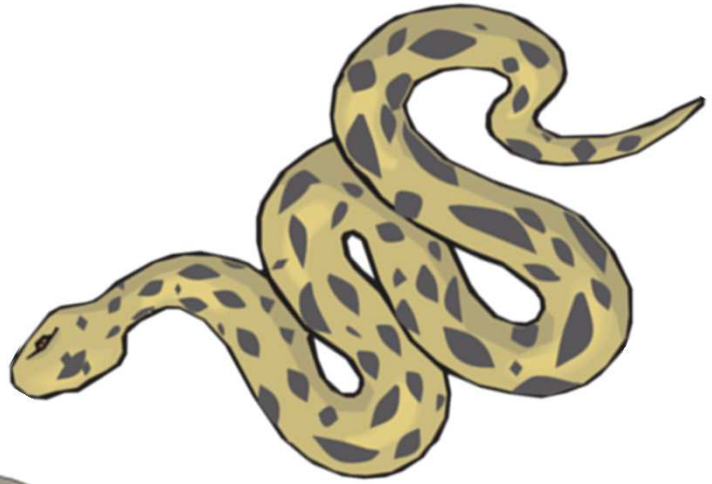


When an organism eats another, they are only consuming a small part of the energy that is stored.

This is because so much energy is used for life processes such as movement and reproduction, and some energy is released as body heat.

Seeds are using lots of energy for growth- much of the energy it has stored has been spent.

Whatever energy the mouse gets from the seeds, it will use up quickly for movement, growth, etc.

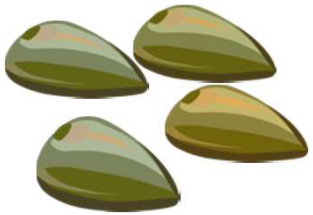


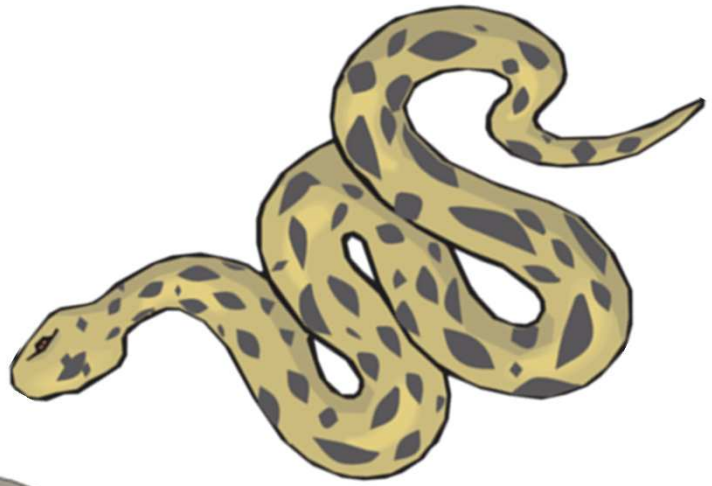
The snake will gain energy from the mouse, but will again also use the energy it needs for life.

Ten-percent-law: only 10% of energy is passed on from trophic level to trophic level.

-Energy is typically measured in calories or Joules.

(1 kilocalorie [kcal]= 1,000 calories)





Seeds= 10,000 kcal

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Mouse= 1,000 kcal

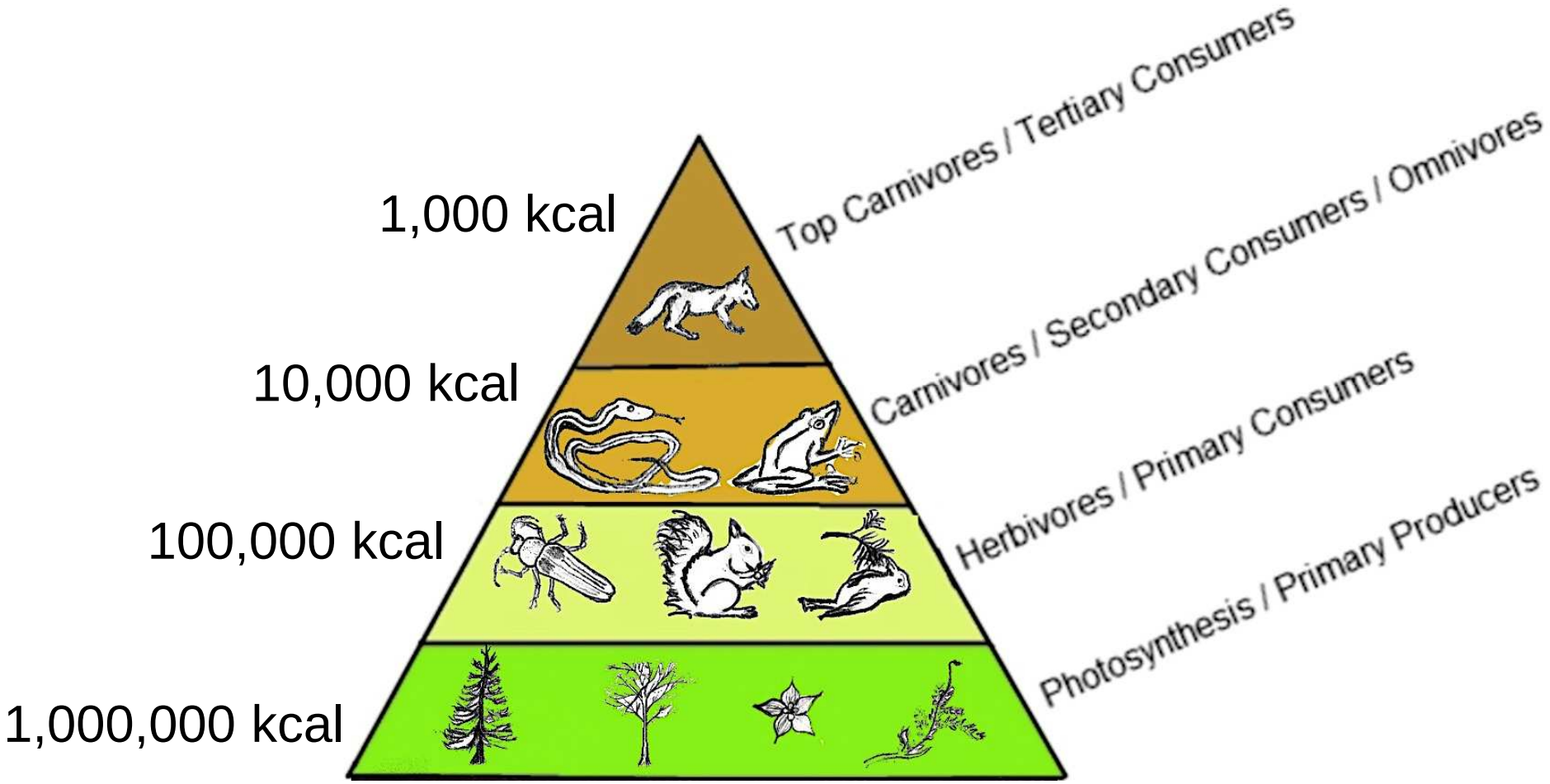
Snake=100 kcal

How much energy is passed on to each trophic level?

TEN PERCENT

Energy pyramid- depicts the ten-percent law. Producers are on the bottom- most of the energy is found at the first trophic level.

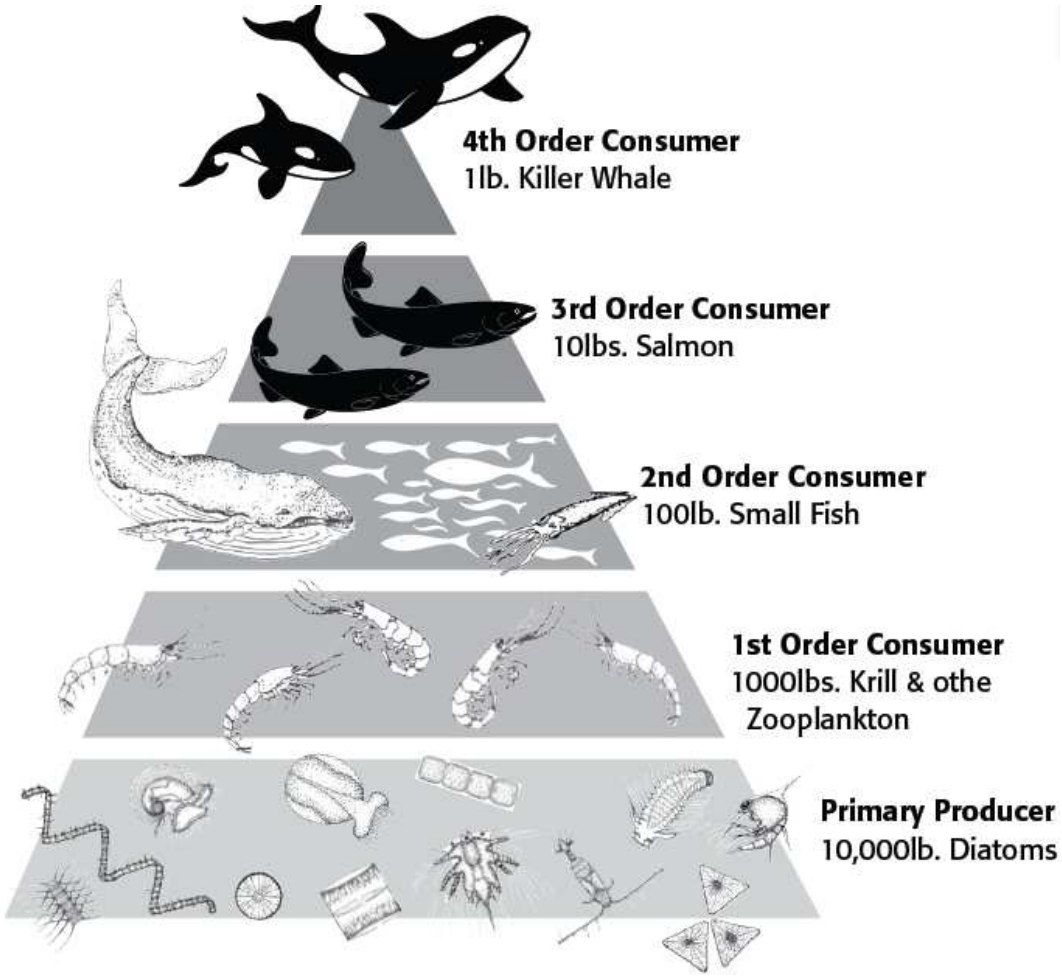
As the pyramid moves up through the trophic level, less energy is available. *The more levels found between a producer and top-level consumer, the less energy remains*.



Biomass- total amount of living tissue (organic matter) found within a trophic level. Typically measured in grams of organic matter per unit area.

Most of an ecosystem's dry organic matter is found in the first trophic level (producers). There must be LOTS of producers (algae, plants, etc) in order to support an ecosystem with higher-level carnivores.

A biomass pyramid represents the amount of potential food available for each trophic level.



Left Side Activity

- Draw a food web