Biology
Ms. Ye

Name _____
Date _____ Block _____

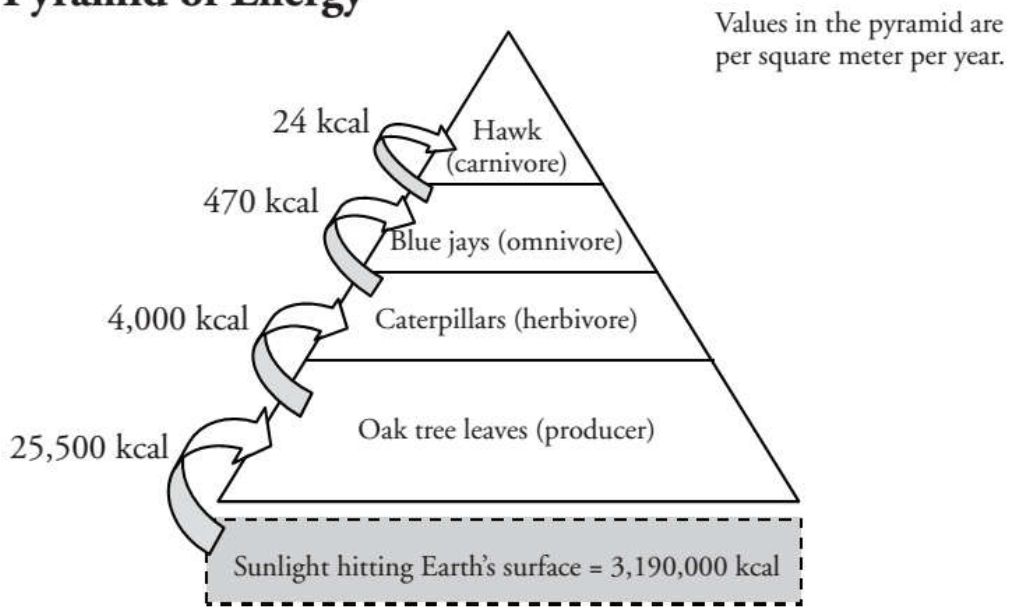
Ecological Pyramids

How does energy flow through an ecosystem?

Why?

Every organism in an ecosystem is either eating or being eaten. When cows eat grass, they obtain some of the energy that the grass transferred from the sunlight it absorbed. If cows could carry out photosynthesis, would they have access to more energy than they get as herbivores? Which organisms in an ecosystem require the most energy to sustain life?

Model 1 – Pyramid of Energy



1. A unit used to measure energy is the **kcal (kilocalorie)**. What is the source of all energy in the pyramid in Model 1?

2. Label the pyramid levels in Model 1 with the following (listed in order from bottom to top starting with oak tree): ***primary producers, primary consumers, secondary consumers, and tertiary consumers.***

3. The arrows in Model 1 represent the energy available to the next level of the pyramid.
   a. What process do oak leaves use to harness energy from the sun?

   b. Describe the pattern of energy transfer among consumers within a pyramid of energy. In other words, does the **amount of energy that is transferred** from one level of the pyramid to the next *stay the same, increase, or decrease* as you move up the pyramid?

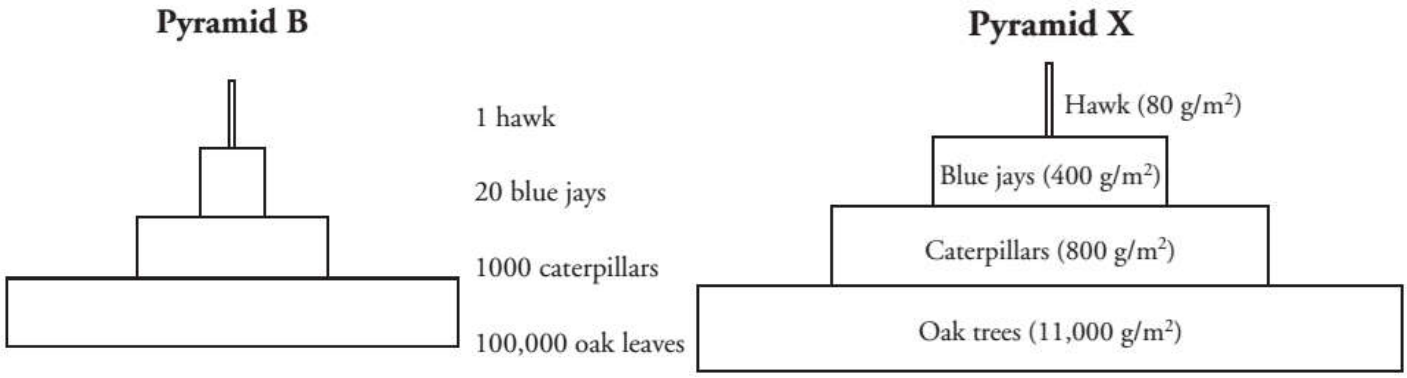
Read This!

Each level in the pyramid in Model 1 is a **trophic level**. The word "trophic" refers to feeding or nutrition. Model 1 shows one example of one organism that would be included in each level, but each level in an ecosystem includes many species of organisms.

4. Explain why the oak trees are considered **autotrophs.**

5. Explain why the caterpillars, blue jays, and hawks are considered **heterotrophs.**

Model 2: Pyramid of Numbers and Biomass

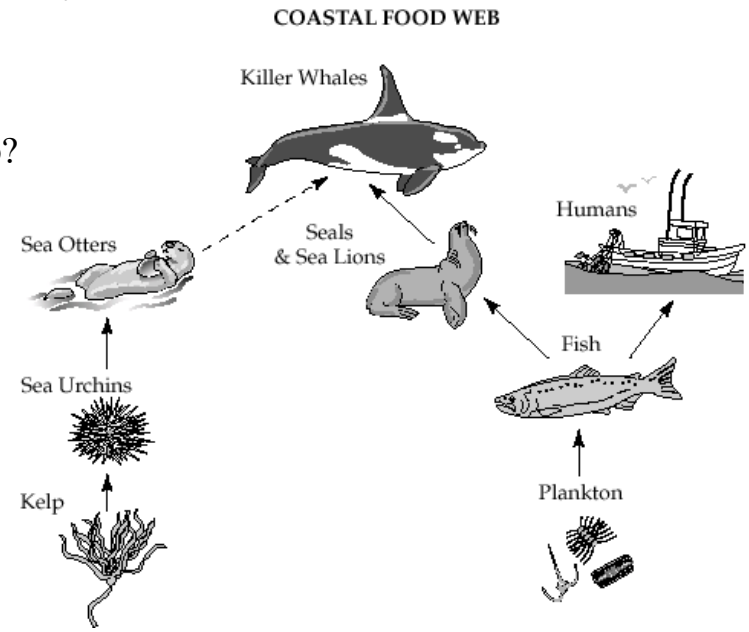


6. Examine the two pyramids above.
   a. In general, do the number of organisms *increase or decrease* as you move up the levels?

   b. Why do you think this pattern is necessary for an ecosystem to be sustainable? Why would it not be feasible to have the opposite pattern be true?

Energy Flow in Ecosystems Practice

A. Examine the coastal food web at right.



1. What do the arrows indicate in the food web?

2. Identify all **producers**:

3. Identify all **primary consumers**:

4. Identify all **secondary consumers**:

5. Identify all **tertiary consumers**:

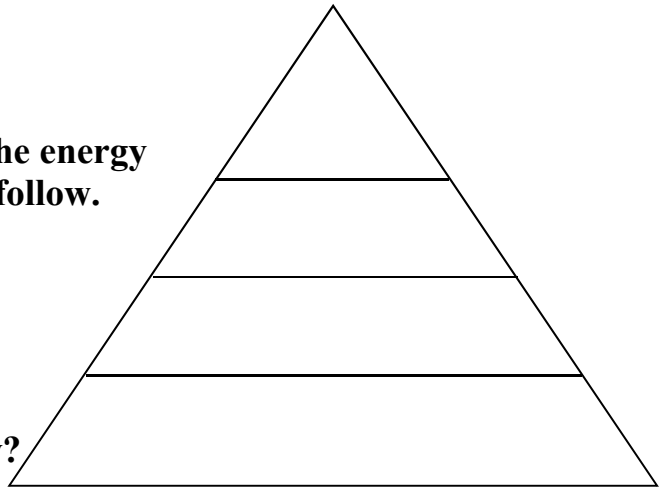
B. Describe how over-fishing by humans would affect the populations of:

1. Plankton:

2. Seals and Sea Lions:

3. Sea Otters:

C. Insert the organisms from the food web into the energy pyramid at right, and answer the questions that follow.



1. Which level contains the most **biomass?**

2. Which level represents the most available **energy?**

Analysis of Energy Flow in Food Chains **Name_____**
Biology **Date _____ Block___**

Background

Energy is an important commodity for living things. The flow of energy through a system can be shown by a food chain, or a food web. This transfer of biological energy is governed by the laws of thermodynamics. The **first law** states that energy can neither be created nor destroyed, only transferred, while the **second law** states that as energy flows in a closed system, it spreads out and becomes decentralized. These two laws can be seen in a simple food web: energy is not created, it is transferred from the sun to organisms through the processes of photosynthesis (performed by autotrophs/producers) and cell respiration (performed by both auto- and heterotrophs/consumers). Energy then, does not stay centralized: it spreads out, either getting used or being given away or lost mostly as heat energy (which cannot be regained). **Organisms obtain only 10% of the available energy from organisms which they consume** (the rest having been either used or lost), so energy is continually lost as it moves through a food chain.

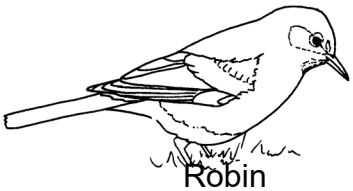
Procedure

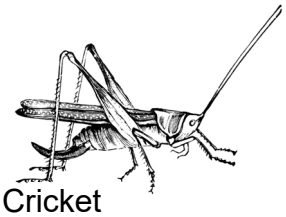
1. Use the food chains below to complete the food web on the next page. Use a different color for each food chain.

Plant Parts——> Land Snail ——->Mouse ——-> Raccoon
Plant Parts——> Sparrow ——> Hawk
Plant Parts——> Rabbit ——> Fox
Plant Parts——> Mouse ——> Fox
Plant Parts——> Earthworm ——> Robin ——> Snake
Plant Parts——> Raccoon ——> Fox
Plant Parts——> Rabbit ——> Snake
Plant Parts——> Cricket ——> Robin ——> Fox
Plant Parts——> Earthworm ——> Snake ——> Hawk ——> Fox
Plant Parts——> Rabbit ——> Hawk
Plant Parts——> Small Insects ——> Mouse ——> Owl
Plant Parts——> Rabbit ——> Owl ——> Fox
Plant Parts——> Cricket ——> Mouse ——> Hawk
Plant Parts——> Mouse ——> Snake ——> Owl

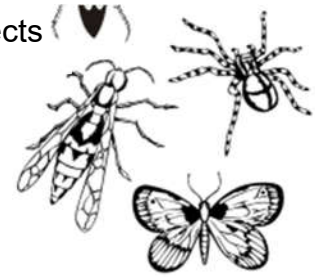
Use the information in the food chains to complete the diagram below. Draw an arrow from each living thing below to each thing that eats it to show the flow of energy from the source to the recipient. **The arrow points in the direction that the energy is going**.

Use different colors for different food chains. Be sure to **work in order** so you can tell when you have all the given food chains in the food web. Also **draw your lines so they bend** around the animal images. This will make our food web easier to read when you finish.

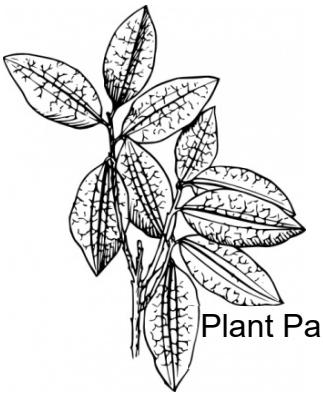

Robin


Cricket

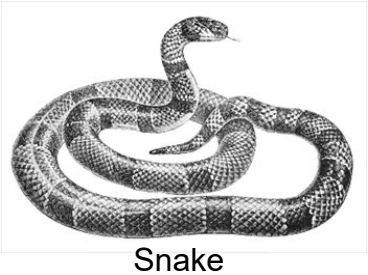
Small Insects

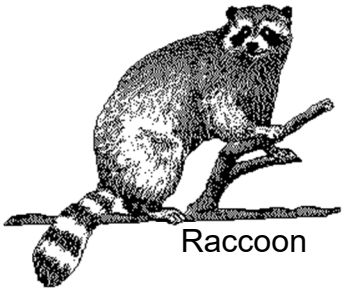


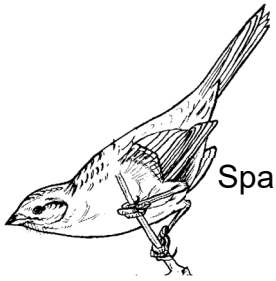

Earth worm


Plant Parts

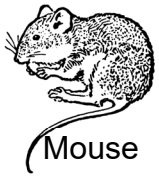

Land Snail

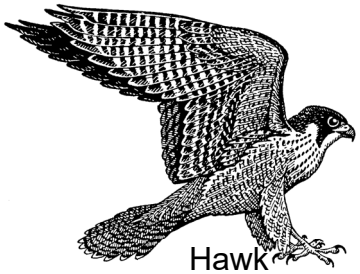

Snake

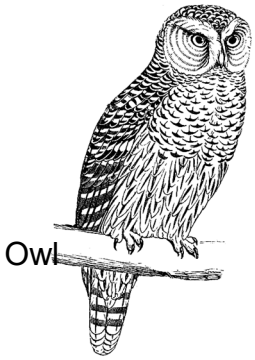

Raccoon

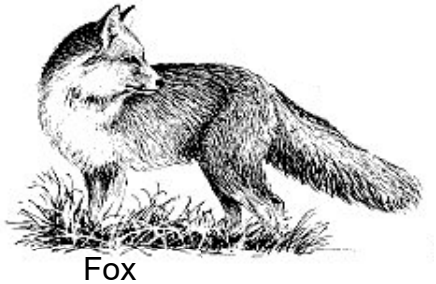

Sparrow


Rabbit


Mouse


Hawk


Owl


Fox

Analysis

1. What do the arrows in the food chain represent?

2. In how many food chains do plants appear? Why?

3. List the names of the things in the forest ecosystem that are producers.

4. List those things that are primary consumers.

5. Which organisms in the food web would be strict herbivores? Why?

6. What would happen to the food chain if all the plants were removed? Why?

7. How is the **first law of thermodynamics** applied to a food chain?

8. Use the following food chain and illustrate a trophic pyramid. Be sure to label each trophic level. Plant Parts——> Rabbit ——> Owl ——> Fox

9. How is the **second law of thermodynamics** illustrated in the trophic pyramid?

10. If 250 Calories were stored in the plant parts, how much of that energy will be available for the Owl in the food chain in question 8? Why?