

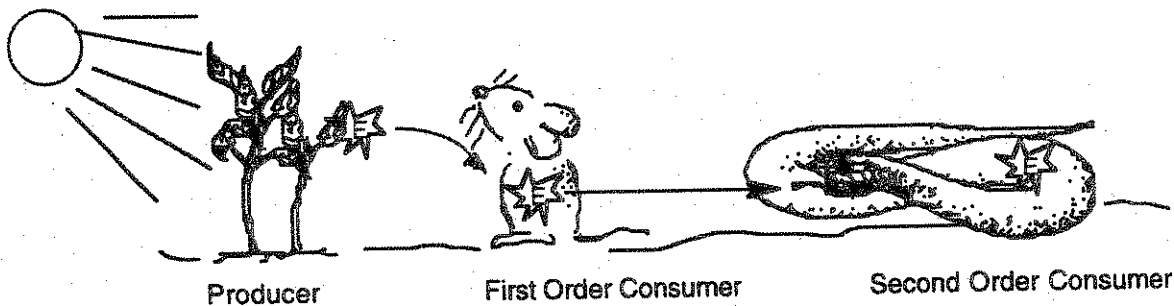
47-2 Ecological Pyramids

1. If you had all the food you ate throughout one year in a room, approximately how much would it weigh? (Estimate how much an average day's breakfast, lunch, dinner and snacks would weigh and multiply by 365 and you have your answer. Don't include liquids.)

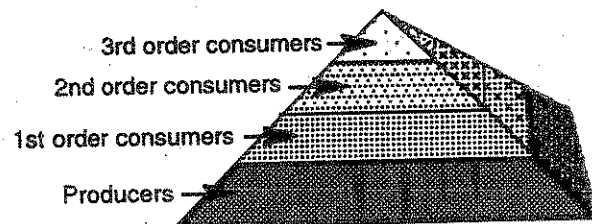
Objective

You will be expected to describe how three types of ecological pyramids are used to describe food chain feeding relationships. You will be expected to apply your understanding to common food chain problems.

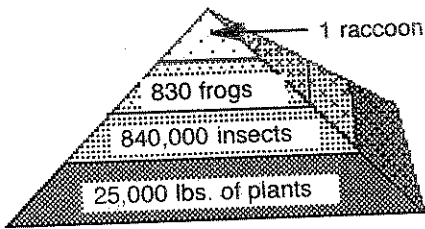
Plants (producers) absorb the sun's light energy. This energy is used during photosynthesis to produce glucose, which can be converted to other food molecules. The light's energy is transformed and is stored in the plant tissues. This energy is transferred to the first order consumers when they eat the plants. As glucose is used in animal respiration, the energy is released for use for the organism. Much of this energy is used by the consumers for moving and cell metabolism. Through growth, some of the energy becomes stored in the animals' body tissues. This energy is transferred to second and third order consumers as they eat their prey.



Ecologists use **ecological pyramids** to represent how food and energy are transferred from each feeding level to another. The general pyramid at the right shows producers forming the foundation for the pyramid. The first order consumers feed on the producers, etc. Three different types of pyramids are commonly used: numbers pyramid, energy pyramid and biomass pyramid.



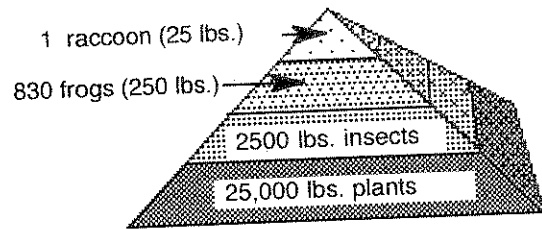
Numbers Pyramid



A numbers pyramid shows the total numbers of individuals in an ecosystem at each feeding level during one year. The example at the left is based upon the ecosystem simulation from Lab Investigation 47-1. If the raccoon were to eat only frogs during one year, it would require about 830 of them. Those 830 frogs must eat about 840,000 insects. This number of insects require about twenty-five thousand pounds of plants to sustain them for the year.

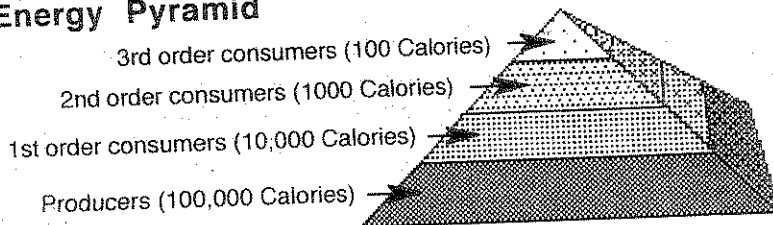
Biomass Pyramid

A biomass pyramid shows the mass of consumer tissue supported by each level below it. One 25 pound raccoon requires 250 pounds of frogs per year. The 250 pounds of frogs need 2500 pounds of insects which require 25,000 pounds of plants. Notice that the raccoon indirectly would require 25,000 pounds of plants to sustain it if it eats only frogs, which eat only insects, which eat the plants. If the raccoon ate only plants, it would only require 250 pounds of plant material. Notice that each level of the pyramid varies by a factor of 10. This is a generalization and not always true.



- Raccoons can and will eat large insects. If one raccoon ate only insects, how many pounds of plants would be required to sustain one raccoon?

Energy Pyramid

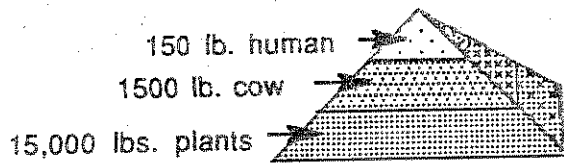


Energy pyramids are used to show the transfer of energy from one level to another in a food chain. When first order consumers eat producers, only about 10 % of the energy taken in by the organism becomes stored in the organism's tissues.

Ninety percent of the energy is lost as heat and used during metabolism at each level.

Study the energy pyramid above and answer the questions that follow:

- Could a wolf be both a second order consumer and a third order consumer? Explain.
- The flesh of a hundred pound wolf has a caloric value of about 68,000 calories. If the wolf eats only raccoons for one year, how many calories must the wolf eat?
- If the raccoons in question 4 eat only small birds and the small birds eat grain, how many calories of grain are required to sustain one wolf?



A common food chain for developed nations is illustrated by the pyramid at the left. Humans eat beef (cows). Cows graze on plant material. Study the pyramid and answer the questions that follow.

6. Which type of ecological pyramid is this?
7. Who is the second order consumer in this food chain? The first order consumer? The producer?
8. During this time period (one year), a 150 pound person would eat one cow of what weight? (Assume the person ate only beef.)
9. How many pounds of plants were needed to sustain the person who ate only beef?
10. If this same person were to shift his diet to eat only plants, how many pounds of vegetables and fruits would be needed to keep him alive for the year?
11. What percent of the plants are spared when people eat plants directly rather than eating a cow which ate the plants?
12. In underdeveloped nations, people eat diets composed of a greater portion of plant foods when compared to developed nations. Very little meat is available. Use the above principles to explain why this is the case.
13. Why must a person eat about ten times his weight in food?
14. If the snake below weighs 7 pounds and eats only mice, how many pounds of mice must the snake eat in a year? How many pounds of grain are required to sustain this many pounds of mice in the same period?
15. Answer question 1 again applying ecological pyramid principles. How close were you to the correct answer when you initially answered question 1?

