

Energy Flow in an Ecosystem

LINKING TO LITERACY

Summarize

Summarizing will help you check your understanding of the information in this section. Read the subsection “Energy Use within an Organism” on this and the following page. Before moving onto the next part of the section, stop and think about what you have read. Work with a partner to summarize, in your own words, how energy is used within an organism. Refer to Figure 1 to explain your thinking.

Food chains and food webs show how energy moves from one organism to another. They do not show how each organism uses the energy or how much is used. Different organisms need different amounts of energy. This can depend on what the energy is being used for. For example, we eat more food when we have been very active because we need energy. The energy comes from the food.

To understand how energy flows in an ecosystem, you need to know how each organism in a food chain uses the energy it obtains. You also need to understand how much energy passes between levels in the food chain or food web. In this section, you will learn how ecologists study energy flows within and between organisms.

Energy Use within an Organism

An organism obtains energy when it makes its own food or eats a plant or animal. Some of the energy fuels the organism’s normal life functions and is used up and released as heat. Some of the energy is stored in the organism for growth, maintenance, and repair. Finally, some of the energy is not useable. Unused energy passes out of the organism as waste. Only the energy stored in the organism is available to the next organism in the food chain. Figure 1 shows the breakdown of energy. In general, only about 10 % of the energy that an organism eats is passed on to the next organism in the food chain.

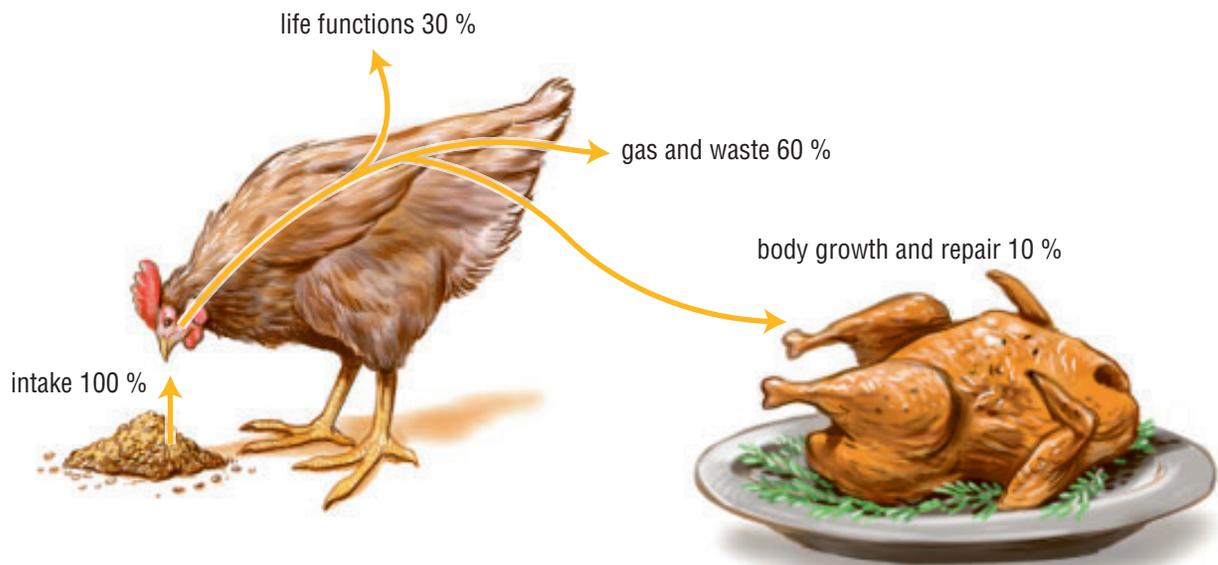


Figure 1 Only a small portion of the energy that the chicken receives from consuming the grain ends up on our plates.

At each level in a food chain or food web, the amount of available energy is much smaller than in the level below it. The amount of energy left for the top consumers in a food web is just a tiny portion of the energy that was in the producers. As a result, there are usually no more than four levels in a food chain or food web. There is not enough energy left to feed consumers at higher levels.

Pyramid of Numbers

An ecological pyramid shows the effects of energy loss at each level in a food chain. Ecologists use ecological pyramids to show this energy loss in a visual way. Each level in the pyramid represents a level in the food chain or food web. One way that ecologists measure the amount of energy available at different levels is by comparing the total mass of all organisms at each level. As you move higher in the food web, there is less mass and, therefore, less energy. The levels in the energy pyramid get smaller.

Another way to show the amount of energy available at each level of a food web is by constructing a pyramid of numbers.

A **pyramid of numbers** shows the total number of organisms at each level of a food chain or food web (Figure 2). In a healthy ecosystem, there are usually more producers than consumers. The producers form a broad base, while the number of consumers at each level above gets smaller. This gives the diagram its “pyramid” shape. Each level of consumers above the producers has fewer individuals because there is less energy available. For example, in a lake ecosystem, hundreds of tadpoles need to eat thousands of duckweed plants to get enough energy to survive and grow. These tadpoles only provide enough energy to support one or two snapping turtles. 🌍

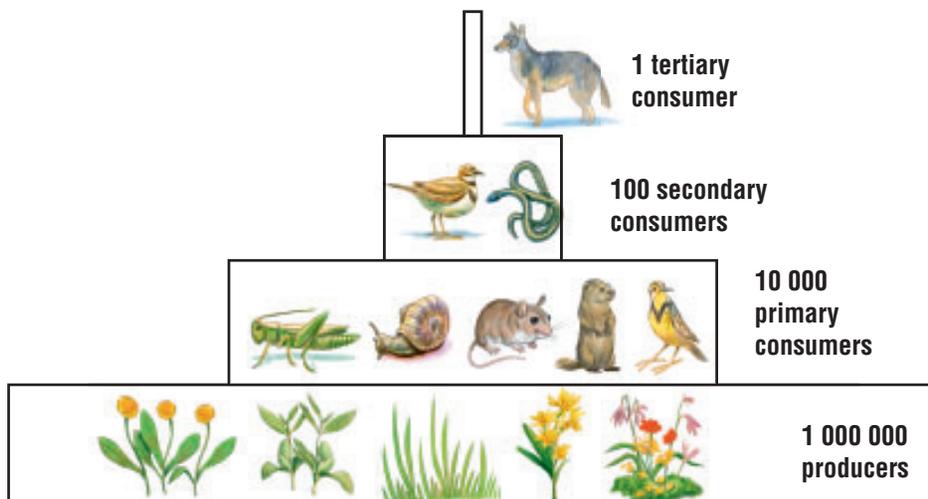


Figure 2 A pyramid of numbers for a grassland food web

LINKING TO LITERACY

Summarize

Read the subsection called “Pyramid of Numbers.” Before moving onto the next section, work with a partner to summarize how and why numbers are different from one level of the pyramid to the next. Refer to Figure 2 to help explain your thinking.

pyramid of numbers: a model that shows the number of individuals at each level in a food chain or food web

To learn more about pyramids used by ecologists,

[Go to Nelson Science](#)





TRY THIS: Dealing Out a Pyramid of Numbers

SKILLS MENU: performing, observing, analyzing, evaluating

A pyramid of numbers illustrates the number of different organisms at each level of a food chain or food web. In this activity, you will make your own pyramid of numbers using playing cards to represent organisms.

Equipment and Materials: playing cards; field guide (optional); paper; pencil

1. Write down the name of a plant or animal on a piece of paper. Do not show it to anyone.
2. As a class, collect all the papers and classify them as producers, primary consumers, secondary consumers, or tertiary consumers. Create a tally for each category. If you are unsure about which category an organism should be in, use a field guide to determine what that organism eats.
3. For each category, deal out the same number of playing cards as the tally number for that category. For example, if the tally showed four tertiary consumers, there should be four playing cards in that pile.
4. Use the four piles of cards to build a card tower. Use only the producer cards for the bottom level, only the primary consumer cards for the next level, only the secondary consumer cards for the next level, and the tertiary consumer cards for the top level.
5. If you cannot build a stable tower from the piles, start again using as many cards as you need to create a stable tower with four levels.
6. As you build, count the number of cards you use for each level. Record the numbers for each level in your notebook.
 - A. Were you able to create a card tower using the tally totals? Discuss the reasons why or why not.
 - B. In step 5, what adjustments had to be made to the numbers of cards at each level before a stable tower could be created?
 - C. If the cards in the card tower represent individual producers and consumers in a pyramid of numbers, what does the card tower tell you about the number of individuals at each level?
 - D. Does a card tower adequately represent the idea of a numbers pyramid? Explain why or why not.

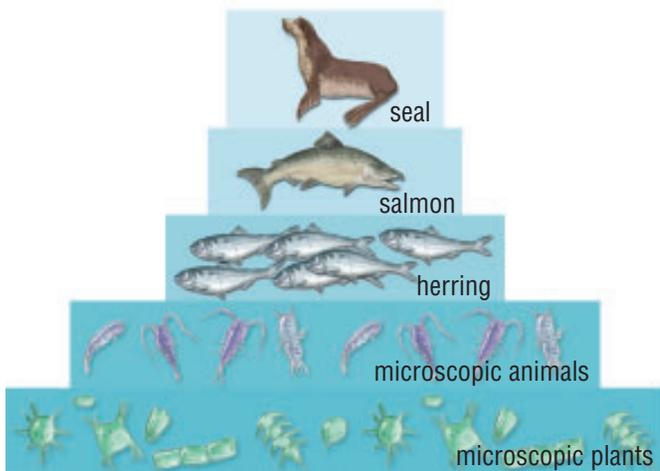


Figure 3 A pyramid with a wide base can support a stable population of consumers.

To maintain stable populations in an ecosystem, there must be a large number of producers to provide enough food energy for primary, secondary, and tertiary consumers. The wider the base of the pyramid, the more consumers can live in the ecosystem. Now, consider Figure 3. What do you think would happen if the microscopic plants level of the pyramid was only half the width it is in the diagram? What would happen to the microscopic animals level? Changes to the number of organisms at any level in the pyramid will affect the number of organisms at other levels.



CHECK YOUR LEARNING

1. A chicken eats some grain. In your own words, describe what happens to the energy in the food once the chicken eats it.
2. What is a pyramid of numbers? How does it relate to a food chain?
3. How is a pyramid of numbers different from an ecological pyramid?
4. (a) What happens to the total number of organisms at each level of a pyramid of numbers?
(b) Explain in your own words why this occurs.
5. What type of organisms always occupy the first level of an ecological pyramid or a pyramid of numbers?