

## Energy in Ecosystems (SC.B.1.2.1, SC.B.2.2.1)

Every organism needs energy in order to survive. When food is eaten, **energy** is transferred from one organism to another by food chains or food webs. **Food chains** help us see how animals depend on plants and sometimes on other animals to get energy. **Energy transfer** in a food chain always begins with the Sun. The Sun provides energy to the next link of the chain, **producers** (plants). Producers make their own food through the process of photosynthesis.

Following the producers we have **consumers**. Consumers eat other organisms. Consumers can be **herbivores** (plant eaters), **carnivores** (animal eaters), or **omnivores** (plant and animal eaters). **Decomposers** are the last link in the food chain. Whenever something dies, decomposers break down the remains and return the nutrients back into the soil. Decomposers also play an important role in recycling by making the nutrients and minerals in waste or dead organisms available to producers.

Name an organism that is a producer: \_\_\_\_\_

Name an organism that is an herbivore: \_\_\_\_\_

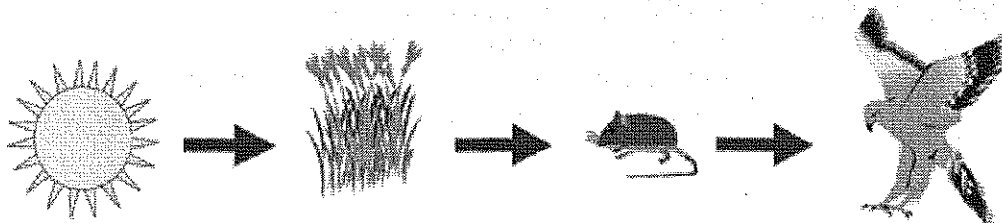
Name an organism that is a carnivore: \_\_\_\_\_

Name an organism that is an omnivore: \_\_\_\_\_

Name an organism that is a decomposer: \_\_\_\_\_

When plants get energy to make food from sunlight, this energy can be used by other animals. When an animal eats the plant, the energy stored in the plant is passed on to the animal. The animal uses some of that energy as it moves around. Some of the energy is also stored in the animal. If a different animal eats the first animal, the energy stored in the first animal is passed on to the second animal. Energy in a food chain flows from the Sun to the producers to the consumers to the decomposers. Arrows in a food chain show how energy can flow from one organism to the next. The diagram does not include an example of a decomposer.

Look at the following food chain:



1. In the drawing above, explain how animals depend on plants.

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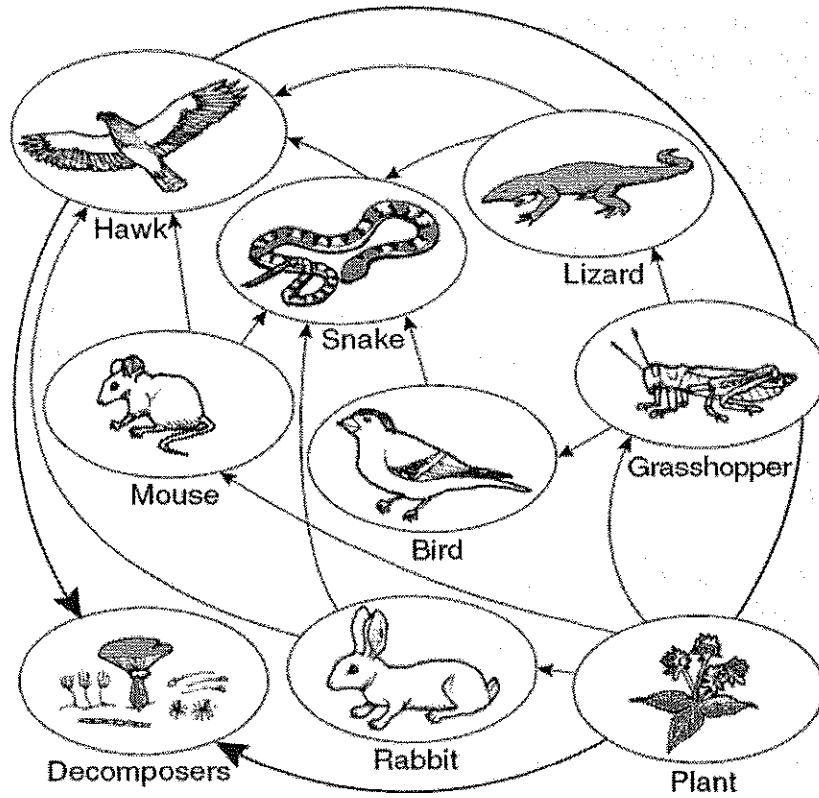
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2. What would happen if there were no plants on Earth? Why?

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Most animals are part of more than one food chain. This is because most animals eat more than one kind of food. Different food chains interconnect to form a **food web**. A food web consists of different overlapping food chains.



Meadow Food Web

Using the food web above, identify the missing organisms in the food chain.

plant → grasshopper → \_\_\_\_\_ → \_\_\_\_\_ → hawk

Can you make a different food chain using the same food web? Try it.

plant → grasshopper → \_\_\_\_\_ → \_\_\_\_\_ → hawk

Now let's see if you can create your own food chain from a specific ecosystem.

### **Activity 1: How Do Food Chains Connect to Food Webs?** (SC.B.1.2.1, SC.B.2.2.1, SC.H.1.2.5)

To do this activity your teacher will use the following materials:

- 2 balls of different colored yarn (green and black)
- Ecosystem cards (picture cards showing producers, consumers, and decomposers)

#### **Food Chain**

Together with your class you will follow the procedures:

1. All the students form a circle.
2. Each student receives a picture card from the teacher showing a producer, a consumer, or a decomposer. Remember, consumers can be herbivores, carnivores, or omnivores.
3. The teacher gives the ball of green yarn to a producer.
4. While holding on to the yarn, the student representing the producer passes the ball of yarn to one of the herbivores. Passing the ball of yarn means that energy is being transferred from the producer to the herbivore (1<sup>st</sup> consumer).
5. While holding on to the yarn, the student representing the herbivore passes the ball of yarn to one of the carnivores (2<sup>nd</sup> consumer). Discuss what passing the ball of yarn means.
6. The carnivore follows a similar step and passes the ball of yarn to an omnivore.
7. The omnivore follows a similar step and passes the ball of yarn to a decomposer.
8. The student representing the decomposer passes the ball of yarn to another producer.
9. Continue passing the ball of yarn until each student is part of a food chain.

**Note: Do not pass the ball of green yarn to a student who is already holding a piece of the yarn.**

#### **Food Web**

You have now created several food chains demonstrating how the energy from a producer is transferred to a consumer and a decomposer. But can organisms from one food chain belong to another food chain? To find out you will follow the next steps.

10. The teacher gives the black yarn to one of the omnivores. The omnivore selects an organism from which energy can be obtained, and passes the ball of yarn. Once the two organisms are connected, the teacher cuts the yarn.
11. The teacher repeats step 10 with other organisms until sufficient connections between the food chains are made.

At this point everybody is part of a food web. Notice that organisms are interconnected by the transfer of energy. Producers transfer their energy to herbivores, omnivores, and decomposers. Herbivores transfer their energy to carnivores, omnivores, and decomposers. Carnivores transfer their energy to omnivores and decomposers. Omnivores transfer their energy to carnivores and decomposers.

In any ecosystem changes impact the flow of energy and lives of organisms. Discuss what would happen if one of the organisms in your food web disappeared.

12. The teacher picks one organism from the food web.
13. Everyone representing that organism drops the yarn.
14. Everyone who depends on the energy from the dropped yarns also drop the yarn.
15. Discuss how the food web is affected by the disappearance of one organism.

Plants are important to animals in an ecosystem. What would happen if a drought lasts more than six months and kills all the plants?

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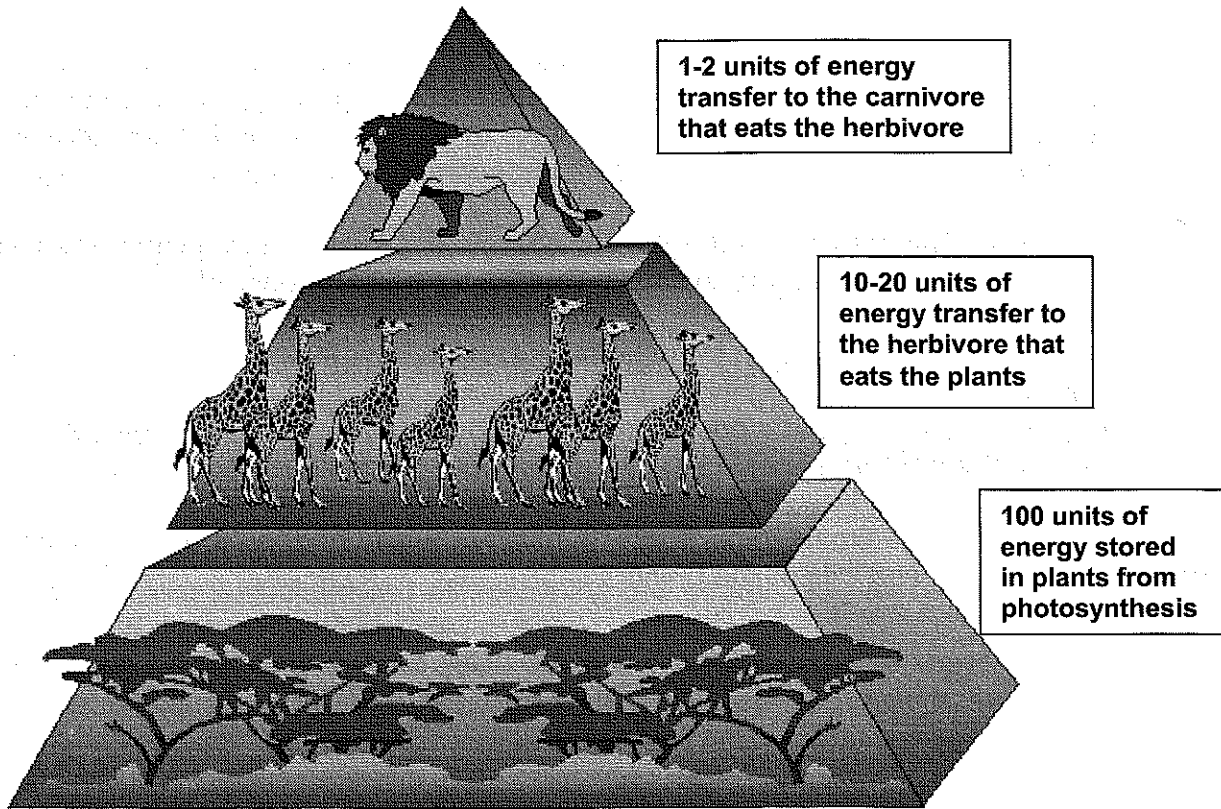
16. All producers drop their yarns.
17. Everyone connected to the producers drops the yarn.
18. Everyone who depends on the organisms that dropped their yarns also drops the yarn.
19. Discuss what happens to the food web and the ecosystem.

In this activity, you constructed several food chains to form a food web. Organisms can play more than one role in an ecosystem. For example, when a mouse eats grass and seeds, it is a primary consumer. However, when the mouse eats a grasshopper, it is a secondary consumer.

The yarn represented the transfer of energy between each organism. Some animals eat plants and some animals eat other animals to get their energy. Organisms are interconnected and the death of one organism affects the food web.

### **Energy Transfer in Food Chains (SC.B.1.2.1, SC.B.2.2.1)**

No transfer of energy is ever 100% successful. In a food chain, only about 10-20% of the energy is passed from one link to the next link. The organism uses up the other 80-90% of the energy before it is transferred or released as either heat energy or waste.



Use the food web you created with your classmates and the picture above to answer the following questions:

1. Describe the role that the Sun plays in the formation of your food web.

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2. Describe the flow of energy in your food web.

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3. Why will herbivores die if some plants die?

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4. What will happen to the organisms that depend on herbivores if the herbivores die?

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5. How will the lion be affected if half of the plants in his ecosystem die?

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The energy pyramid shows that a lot of producers (trees, shrubs) provide food and energy to herbivores (rabbits, giraffes). As you go up the energy pyramid, there are fewer and fewer consumers. This means that it takes a large number of consumers to support a few at the top. In other words, many herbivores are needed to support a few carnivores.

When an organism dies, the size of the population changes. Changing the size of one population in a food chain affects other populations. This is because populations within a food chain depend on other populations to help them survive. What do you think would happen if there were too many giraffes? There would not be enough plants for them to eat. That means that many giraffes will starve and die.