What Is This Module About?

Look around you. What do you see? Life is all around you! You can see other people. You can hear birds chirping and dogs barking. You can see plants and their colorful flowers. You can see bees and other animals. Life abounds in this planet. You may not notice it but all living creatures are ultimately interrelated. The food that you eat may have come from an animal that ate plants. All living things are related to one another as well as to their environment. Have you ever wondered what these relationships are and how they work?

Human beings are blessed with the ability to understand, think and manipulate the world they live in. Other creatures do not have the same capabilities humans have. Nevertheless, each one is an important part of the mysterious yet wonderful phenomenon called life.

In this module, you will learn about the different kinds of relationships in an ecosystem and discover how organisms are interrelated. You will know the structures that determine each organism's role in life. You will also learn more about the flow of energy among organisms and the flow of nutrients between organisms and their environments.

This module is divided into four lessons. These are:

Lesson 1 — *Relationships Among Organisms in an Ecosystem*

Lesson 2 — *Trophic Structure*

Lesson 3 — *The Flow of Energy*

Lesson 4 — *The Flow of Nutrients*

What Will You Learn From This Module?

After studying this module, you should be able to:

- describe the different relationships among living organisms;
- identify a trophic structure and its levels;
- differentiate a food chain from a food web;
- explain the flow of energy; and
- describe the flow of nutrients through biogeochemical cycles.

Let's See What You Already Know

Before you proceed to studying this module, let's find out what you already know about the topics to be discussed. Write your answers in the blanks.

A. Define the following terms:

1. ecosystem

   _____

   _____

2. predation

   _____

   _____

3. symbiosis

   _____

   _____

4. commensalism

   _____

   _____

5. mutualism

   _____

   _____

B. Give an example of each of the following levels in a trophic structure:

1. producer

   _____

2. primary consumer

   _____

3. secondary consumer

   _____

4. tertiary consumer

   _____

5. decomposer

_____

C. Explain the food pyramid.

_____

_____

_____

_____

_____

D. Enumerate the four important nutrient cycles.

1. _____
2. _____
3. _____
4. _____

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on page 30.

If all your answers are correct, very good! This shows that you already know much about the topics in this module. You may still study the module to review what you already know. Who knows, you might learn some more new things.

If you got a low score, don't feel bad because this module is for you. It will help you understand some important concepts that you can apply in your daily life. If you study this module carefully, you will learn the answers to all the items in the test and a lot more! Are you ready?

You may go now to the next page to begin Lesson 1.

LESSON 1

Relationships Among Organisms in an Ecosystem

Our planet abounds with life. Among organisms, relationships are important. These relationships determine the accomplishment of functions necessary for survival and the continuance of life.

In this lesson, you will study the different kinds of relationships among organisms. It is important to find out what these relationships are for you to understand how life works. We human beings have relationships with one another, and so do other organisms. Do you want to know more about the interesting relationships among different organisms? Study this lesson carefully.

Let's Try This

Have you ever thought of your own relationships? If you live with your family, describe your relationship with your father and mother. Think of the kind of relationship you have with your brothers and sisters. Some of these relationships may be beneficial to you. You may enjoy having these relationships, because they provide you with things you need. But have you ever noticed that some of these relationships are not exactly the ones you like to have? A relationship with a brother or sister with whom you often fight is an example.

Why do you think you need these relationships? How does each relationship benefit you? Fill up the following table.

Name of Family Member	Benefits	Disadvantages	Assessment
Father			
Mother			
Brother 1			
Brother 2			
Sister 1			
Sister 2			

Under the **Benefits** column, think of the benefits you get from each member of your family. These could be material like money or intangible like love, cooperation and support. In the next column, write the disadvantages associated with the family member. For example, your elder sister might not allow you to go out with your friends to watch a movie. Under the **Assessment** column, write *favorable* or *unfavorable*, depending on how you view your relationship with the person concerned.

What can you say about your relationship with each member of your family? What can you do to make unfavorable relationships work and favorable relationships continue?

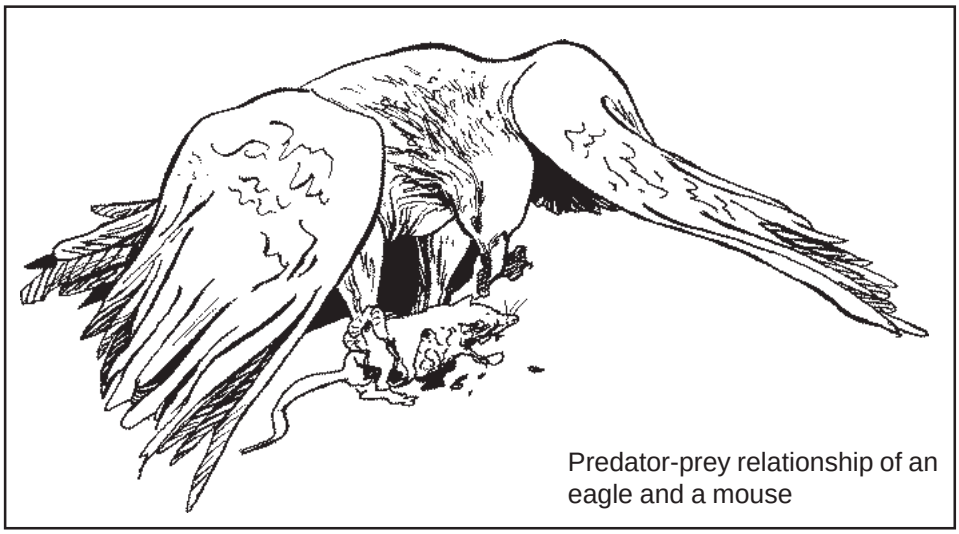
Let's Learn

In nature, organisms have different relationships with one another. These relationships determine the kind of life they live and their survival. When two different kinds of organisms live close to each other, their relationship is called **symbiosis**. Symbiosis is classified into predation, parasitism, commensalism and mutualism. These relationships range from mutually beneficial to harmful, or even fatal for one of the species.

Predation

This relationship is characterized by one organism killing another for food. The one who benefits is called the **predator** and the one used for food is the **prey**. An example would be the relationship between eagles and mice. Eagles eat mice for food. The eagle is the predator and the mouse is the prey. Can you think of other

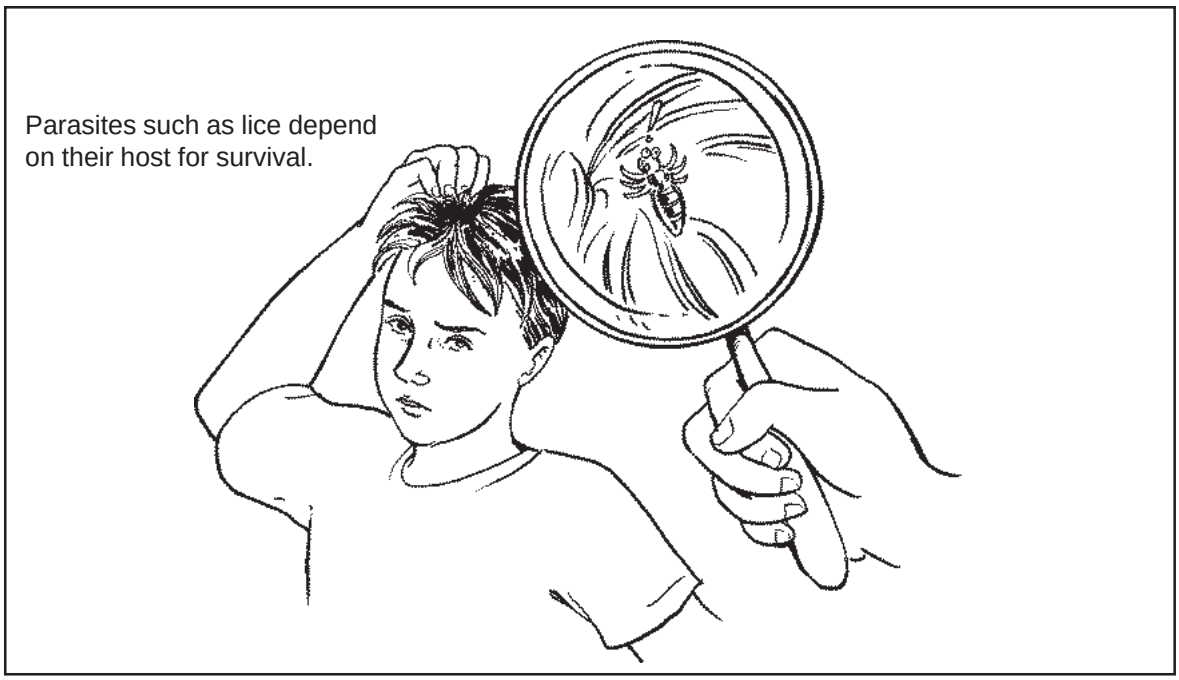
organisms that an eagle sees as prey? There are a lot. Usually, preys are smaller and weaker than their predators.



Predator-prey relationship of an eagle and a mouse

Parasitism

This relationship occurs when one organism benefits at the expense of another. A **parasite** is an organism that depends on the host for its survival. The host is the organism that loses something because of the presence of parasites. Human beings can be hosts to parasites such as intestinal worms and lice. Intestinal worms feed on food in the intestines of human beings. Human beings with worms suffer from malnutrition or indigestion, although they do not necessarily die. Lice depend on the blood in your scalp for survival. Do you like to have parasites in your body? Hosts do not like parasites. Human beings take medicines and use medicinal shampoos to get rid of these parasitic organisms from their bodies.



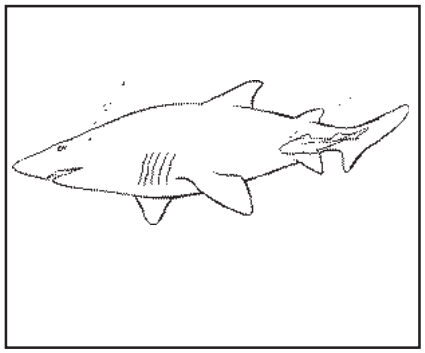
Parasites such as lice depend on their host for survival.

Have you heard of somebody being called a parasite? Can you think of somebody you know who acts like a parasite? It could be a neighbor who keeps borrowing things without returning them. Parasites are annoying, aren't they?

Commensalism

This is a kind of relationship where one of the partners benefits while the other is neither helped nor harmed. Commensalism exists among orchids and fruit trees. Orchids cling to and grow on the trunks of trees. The trees are not harmed by the orchids but they don't get any benefit either. Another example of a commensal relationship is that between a remora and a shark. The remora is also known as janitor fish. It attaches itself to the shark to partake of the many organisms that live on the shark's skin. The remora is ignored by the shark who neither gets benefits nor is harmed by the remora's presence.

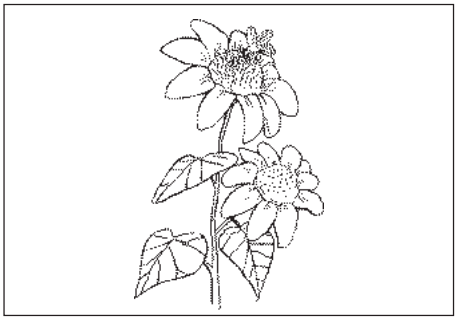
Orchids and trees



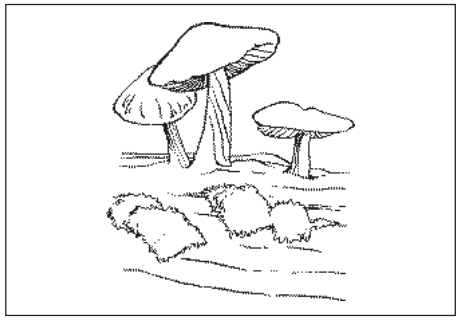
Remora and shark

Mutualism

Mutualism is characterized by two organisms living together and both benefiting from the relationship. In some cases, the mutual relationship becomes so important that neither can live without the other.



Bees need flowers for their food—the nectar. Flowers, in turn, need bees for fertilization, because bees spread the flower's seeds.



Lichens consist of fungi and algae. The algae receive shelter from the fungi. The fungi, on the other hand, get food from the algae.

This relationship implies peaceful coexistence. Neither one benefits or loses. It just so happened that they live in the same environment and are near each other. Most often, paths of symbiotic organisms cross, but no effects are exchanged. An example of a symbiotic relationship would be different species of flowering plants in the same garden.

Let's Try This

Now go back to the table you filled up in the "Let's Try This" section on page 5. Try to classify your relationship with each member of your family as parasitism, commensalism or mutualism. What did you learn about your relationships with your family in this activity?

Would you like to try assessing your relationships with your friends? Make a table similar to that on page 5. Evaluate your relationships with five of your friends. What did you find out about these people and your relationship with them? Did you have fun doing the activity?

Let's See What You Have Learned

Write in the blank the correct relationship between the two organisms listed.

1. _____ hawk and snake
2. _____ lizard and mosquito
3. _____ birds and flowers
4. _____ mosquitoes and humans
5. _____ amoeba and humans
6. _____ carabao and heron
7. _____ birds and trees
8. _____ fish and worms
9. _____ snake and chicken
10. _____ mites and dogs

After answering this exercise, check your answers against the *Answer Key* found on page 31. If your score is 7 and above, well done! You learned a lot from this lesson. You may proceed to the next page. If your score is 6 or below, it's okay. But you need to review this lesson before proceeding to the next.

Let's Remember

- The symbiosis between two organisms can be characterized as any of the following:

    1. Predation—one kills the other for food
    2. Parasitism—one benefits at the expense of the other
    3. Commensalism—one benefits, the other is not affected
    4. Mutualism—both organisms benefit from the relationship

Trophic Structure

Feeding is a very important activity for all living organisms. Organisms such as insects and animals have to get energy in order to survive. They get this energy from the food sources present in their environment. Food sources may be plants or other animals. It is interesting to study how energy is transferred from one organism to another through the cycle of eating and being eaten. That's how life works. Organisms, including yourself, must eat to survive.

In Lesson 1, you learned about the many different types of relationships among organisms. These relationships are important in order for life to go on.

In this lesson, you will learn about **trophic structure**, which is the order by which nourishment is gained by organisms in an ecosystem. You will also learn about food chains and the more complicated food webs. Human beings are also part of this complex relationship of food production and energy transfer. Are you ready to gain new knowledge?

Let's Think About This

Go to a garden and observe the plants and animals in it. Think about the role each of these plants and animals plays in the cycle of food production and energy transfer. Note what the living things eat in your garden. Imagine where all this food ultimately goes.

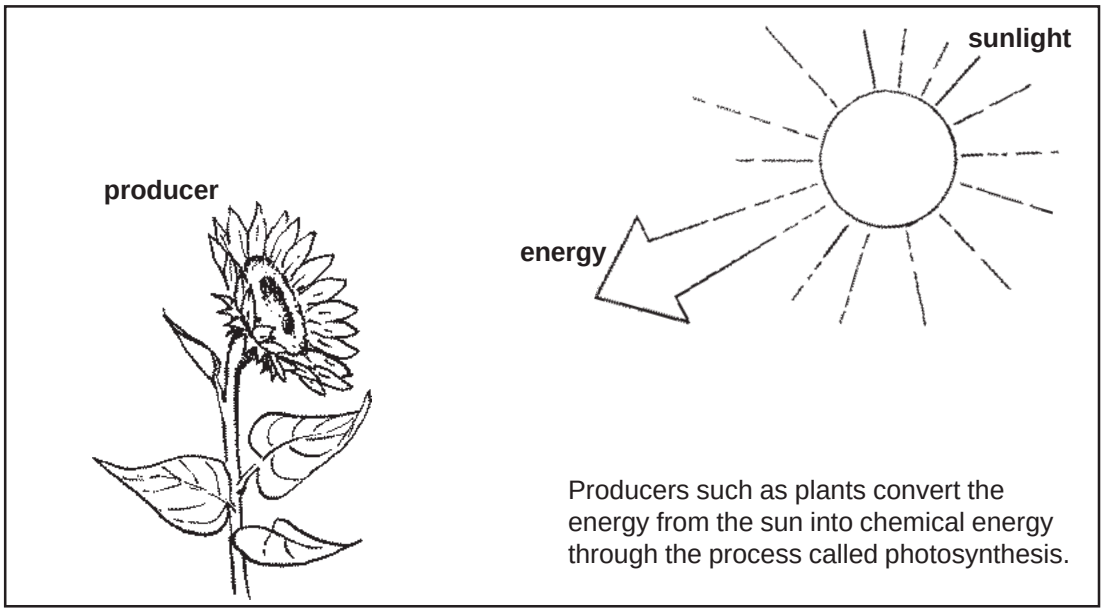
Let's Learn

Nature, in all its complexity and wonder, follows certain patterns in getting things done. One of these patterns is that of feeding, called a **trophic structure**. The word **trophic** comes from *troph* which means "nourishment." Trophic structure implies that there is an order to how the organisms in an ecosystem gain their nourishment. Each organism has a role to play in the general scheme of things.

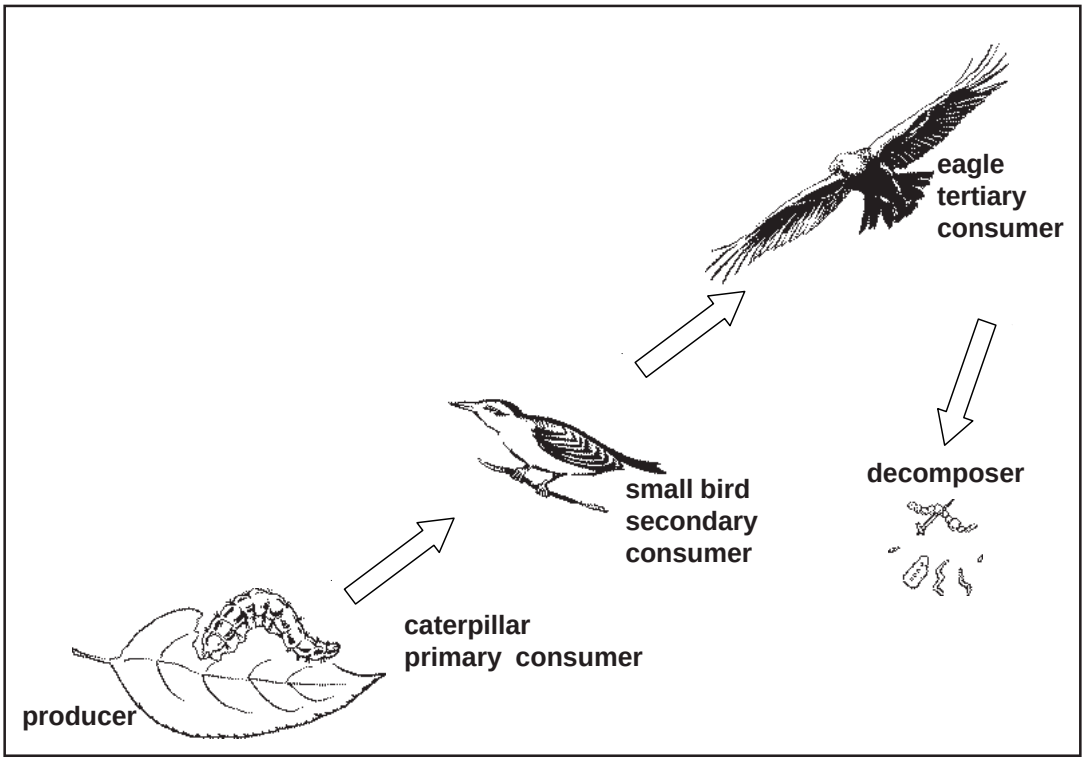
Before food gets transferred, it must first be produced. Plants are the food producers and they are called **autotrophs**. **Auto** means "self," hence **autotroph** refers to an organism that can produce its own food. Animals including human beings cannot

produce their own source of energy. They have to get this from other organisms. Animals are called **heterotrophs**, *hetero* meaning "different." This implies that animals need to get food from a species different from their own.

Plants are **autotrophs** because they have the capability to produce food by utilizing energy from sunlight. This food-making process is called **photosynthesis**. This is a complex process in which the leaves of plants use light energy from the sun to produce chemicals that can be utilized as food. Because of this ability, plants are referred to as the **producers** in the trophic structure. They are found at the bottom of the structure, implying that everything starts from them.



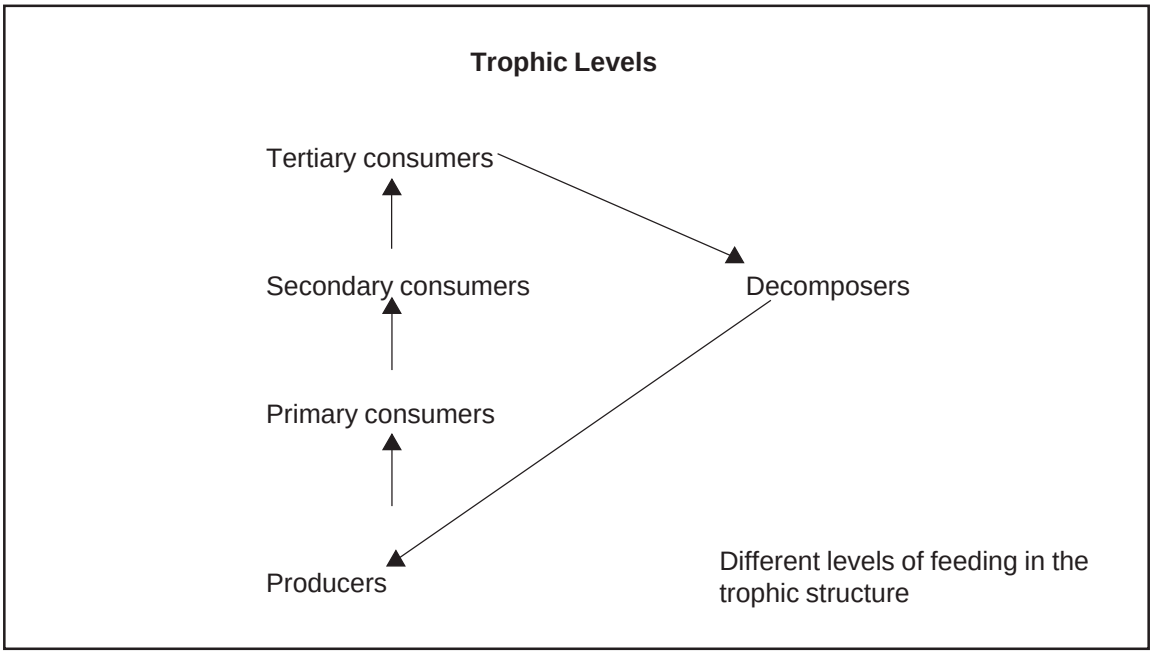
Study the figure below.



Caterpillars feed on plants. They belong to the group of autotrophs which in the trophic structure are called **consumers**. Consumers partake of the energy produced by plants. They are divided into different levels. Caterpillars are the first to partake of the bounty of energy provided by plants. Hence they are called **primary consumers.** These caterpillars are eaten by small birds. Since the birds eat primary consumers, they are called **secondary consumers**. Eagles and other big birds sometimes eat the small birds. Since they eat the secondary consumers, they are called **tertiary consumers**.

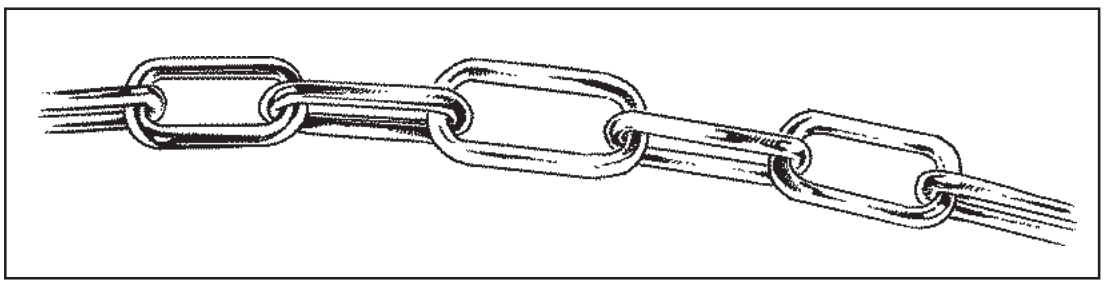
When eagles eventually die, their bodies are broken down by bacteria called the **decomposers**. In this way, energy is returned to the soil which plants use as anchor and as a source of nutrients. Thus, the cycle of food production and consumption continues.

We can conclude from the given example that the trophic structure is composed of different levels, the producers, primary consumers, secondary consumers, tertiary consumers and decomposers. The trophic structure therefore shows how food is produced, consumed and produced again. It shows the order of feeding and nourishment among living things.



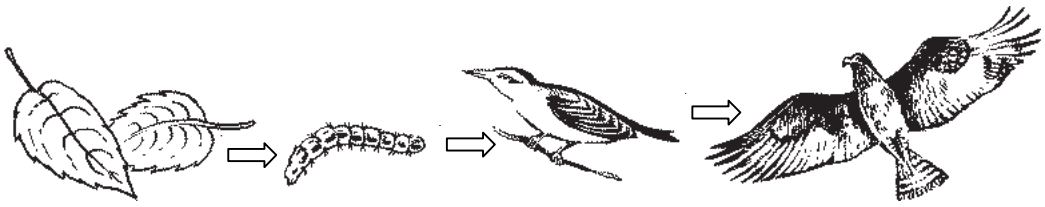
Different levels of feeding in the trophic structure

The example we used illustrates a food chain. A **food chain** shows how energy is transferred from one organism to another. Look at the chain below.



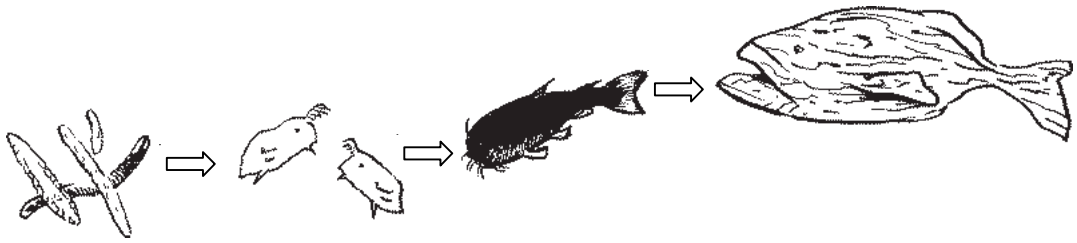
Do you see how each part of the chain is linked to another part?

A food chain shows how energy from food is transferred from one organism to another.



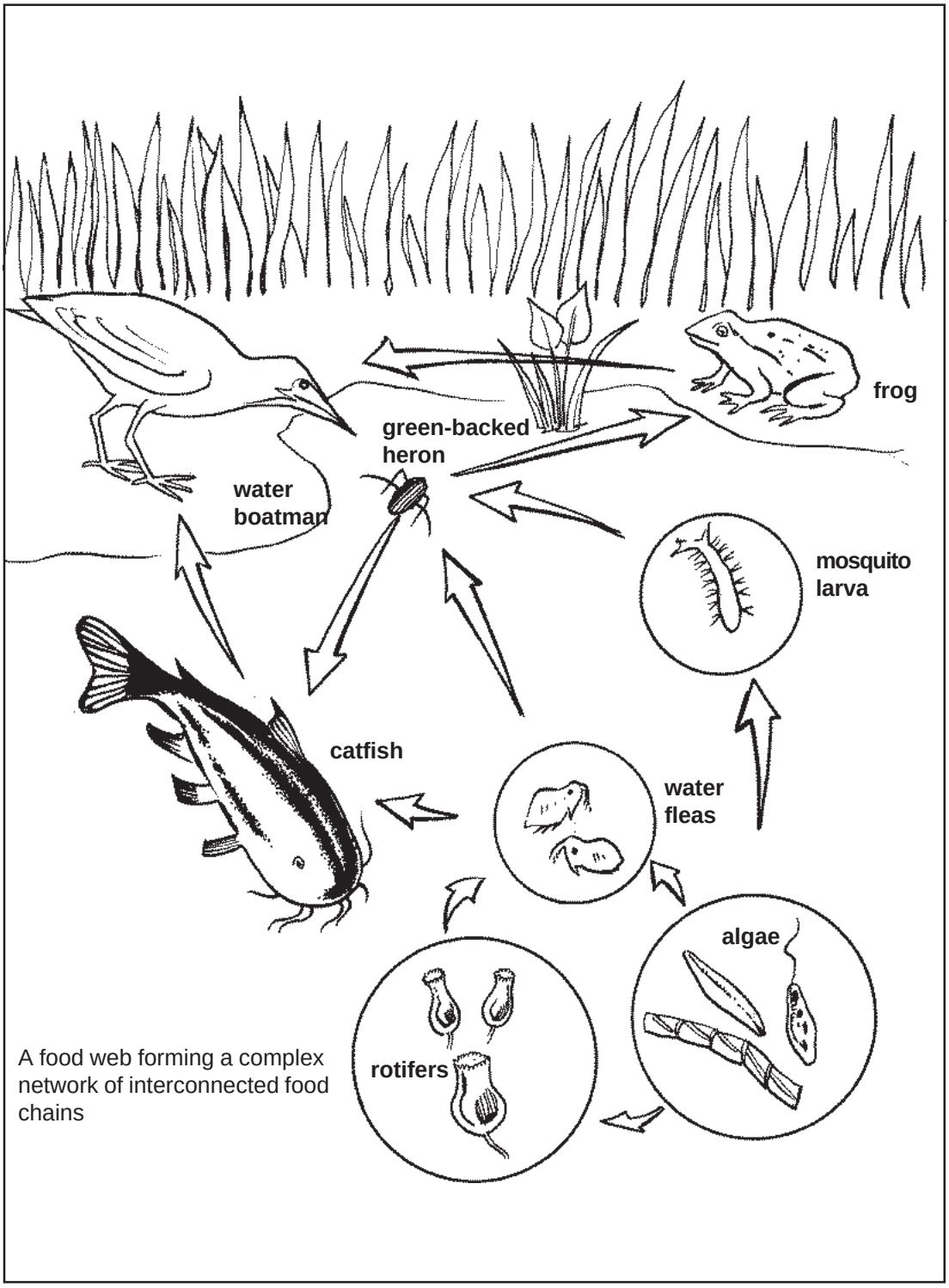
Model of a food chain in three trophic levels. The arrows show how chemical energy in food flows through the different levels.

Food chains can also be found in aquatic ecosystems.



Model of an underwater food chain

A **food web** is a group of food chains linked together. A food web is formed from single food chains when the primary consumer, like the caterpillar, can be eaten not only by birds but by other animals as well. Thus, the food web shows a more complex illustration of how energy is transferred in nature. Look at the food web below.



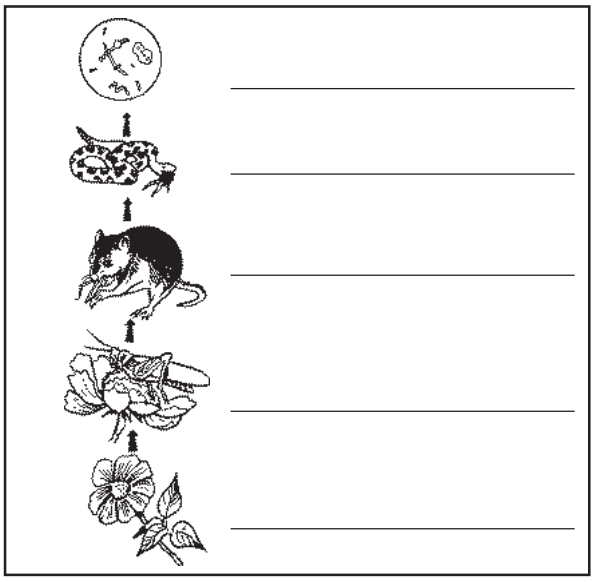
A food web forming a complex network of interconnected food chains

Let's Try This

On a separate sheet of paper, draw a food chain. Identify the role of each organism in the trophic structure. Afterwards, make a food web based on your original food chain.What did you learn from this activity?

Let's See What You Have Learned

The illustration below shows a food chain. Identify the producer and consumers indicating the level of consumer. Next, make the structure more complicated by turning it into a food web. You can add other organisms to do this. Show their trophic relationships.



After answering this exercise, compare your answers with those in the *Answer Key* on pages 31 and 32. If your score is 4 and above, well done! You now know more about trophic structures. You may proceed to the next lesson. If your score is 3 or below, that's okay. But you need to study the lesson again before moving on to the next.

Let's Remember

- Trophic structure is the order by which organisms in an ecosystem gain nourishment.
- A food chain shows a simple and direct relationship among producers and consumers.
- A food web illustrates several interconnected food chains. Food webs reflect what happens in nature, where organisms have complex feeding relationships.

The Flow of Energy

You have learned about trophic structures. You discovered how important trophic structures are in determining the flow of food and energy. But what is this energy that is transferred from one organism to another?

In this lesson, you will learn more about the transfer of energy in nature. You will learn how energy is produced and how it is transferred from one organism to another.

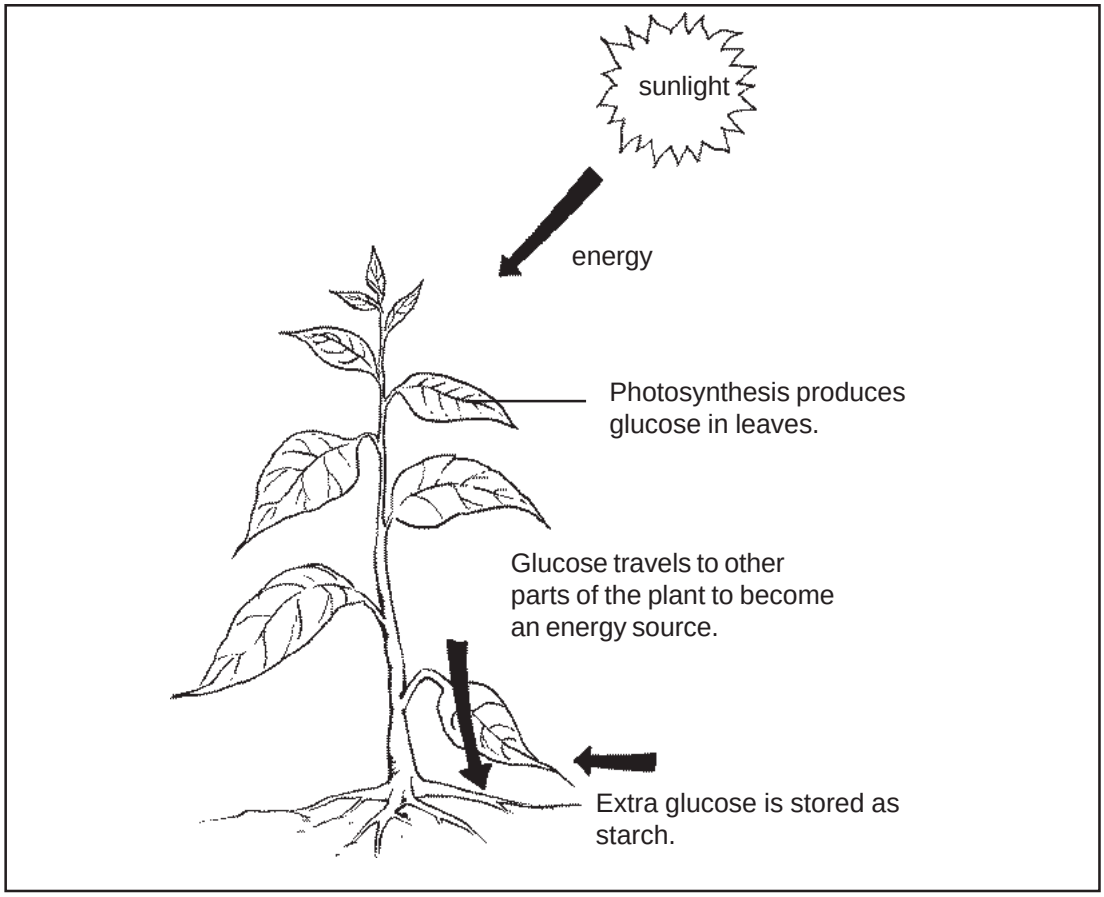
Let's Think About This

Why do you eat? Do you need to eat in order to survive? What is it in food that is necessary for your survival?

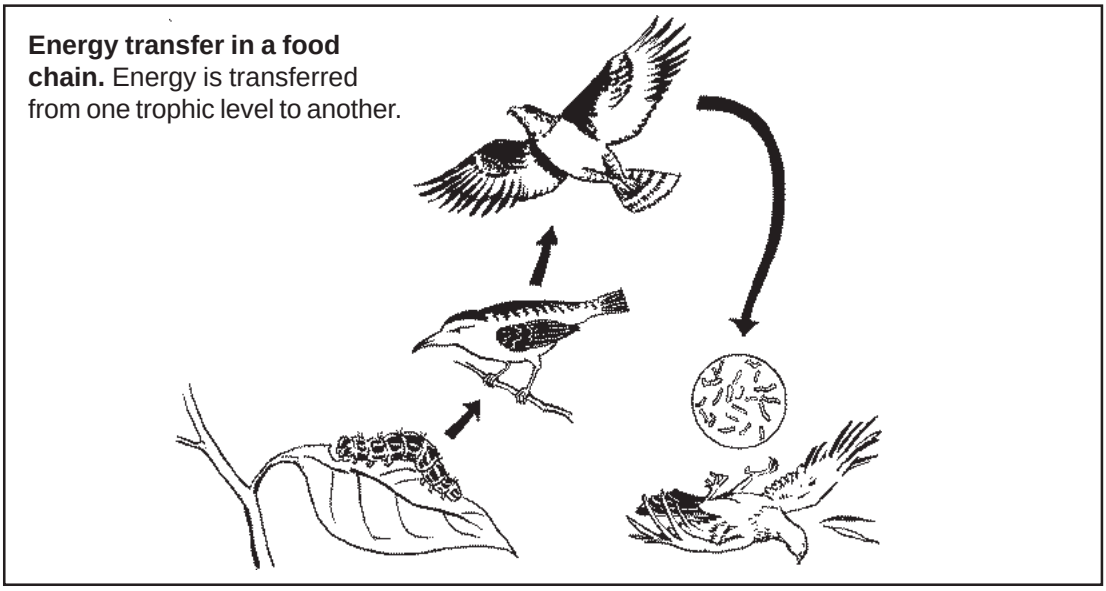
Let's Learn

The flow of energy starts with plants. Plants produce food through the process of **photosynthesis**. *Photo* means "light" and *synthesis* means to "produce." The leaves of a plant use energy from sunlight to produce **glucose**, the food of plants. Glucose is ultimately stored as **starch**. When needed, starch can be transformed back to glucose. Glucose is then used to power the other chemical reactions inside the plant. These processes make the plant live and grow.

Photosynthesis in Plants



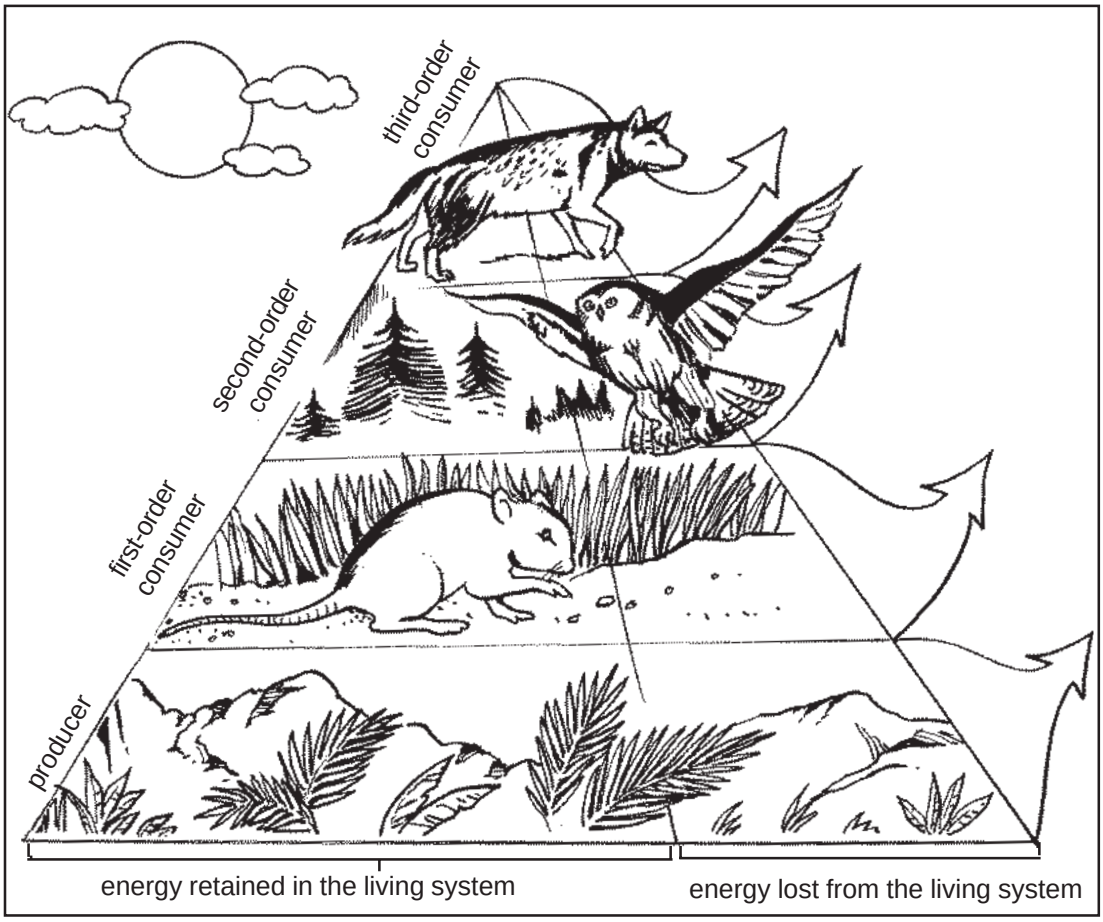
When a primary consumer like a caterpillar eats the leaves of a plant, energy is transferred from the plant to the caterpillar. When a small bird eats the caterpillar, energy is transferred from the caterpillar to the bird. This energy is in turn transferred to the eagle that eats the small bird. Decomposers then break down the body of the eagle when it dies and the nutrients are returned to the soil to be used by plants to produce new food. In this way, the cycle is repeated. Study the transfer of energy from one organism to another as shown below.



Energy transfer in a food chain. Energy is transferred from one trophic level to another.

Do you know what happens to the energy from food as it is transferred from one organism to another?

For you to understand this you have to know first two very important principles. These are the **laws of thermodynamics**. The first law states that energy is neither produced nor destroyed, it is only transformed. Understanding the second law is more important. It states that when energy is transferred or transformed from one form to another, some usable energy is always lost. The most common form of energy loss is the liberation of heat. All living organisms generate heat from the energy they get from plants. Heat is in fact considered a sign of life. This signifies that our bodies are using up the energy we acquire from food. Study the energy flow in an ecological pyramid as shown below.



An **ecological pyramid** shows how energy is lost in each step. The higher you go up the pyramid, the less original energy from plants remains. At each step, an appreciable portion of energy originally trapped by the producer is lost as heat. Accordingly, the organisms in each succeeding trophic level passes on less energy than it received. This explains why organisms higher up in the trophic structure need to eat more than those in the preceeding levels.

Less energy is found in each succeeding trophic level because:

1. of the food available, only a certain amount is captured and eaten by the organism in the next trophic level.
2. some of the food that is eaten cannot be digested and exits the digestive tract as waste.
3. only a portion of the food that is digested is stored in the organism's body. The rest is lost as heat.

Let's Think About This

At what level do you think human beings come in the trophic structure? Are you a primary consumer, a secondary or a tertiary consumer? What is the implication of your trophic level on how you eat food and how you utilize energy from food?

Let's See What You Have Learned

Read each statement. Write **True** in the blank before each correct statement and **False** before each incorrect statement.

_____ 1. Energy is neither produced nor destroyed, it is only transformed.

_____ 2. Energy increases as it is transferred from one organism to another.

_____ 3. Energy loss is often manifested as heat.

_____ 4. Producers are usually animals.

_____ 5. Plants are autotrophs.

_____ 6. An ecological pyramid illustrates the flow of energy from one organism to another.

_____ 7. The bigger the consumers the more they eat.

_____ 8. Consumers utilize energy without wasting any of it.

_____ 9. Heat is a sign of life.

_____ 10. Heterotrophs produce heat.

After answering this exercise, check your answers with the *Answer Key* on page 32. If your score is 8 and above, congratulations! You have learned about the flow of energy in nature. You may already proceed to the next lesson. If your score is 6 or below, you need to study this lesson again before proceeding to the next.

Let's Remember

- An ecological pyramid follows the laws of thermodynamics. It is pyramidal in shape to illustrate energy loss as the trophic level goes higher. .
- Energy transfer is not perfectly efficient. As energy is transferred from one trophic level to the next, some energy is lost as heat.

The Flow of Nutrients

In the previous lesson, you learned how energy is transferred from producers to consumers. Although energy is an absolute necessity for life, it is not the only thing needed by organisms to function well. Organisms also need nutrients that are essential for life. Like energy, nutrients also undergo transformations before they can be fully utilized by the tissues of the body.

In this lesson, you will learn about how nutrients flow in nature. Four **biogeochemical cycles** will be discussed, namely the water cycle, carbon dioxide-oxygen cycle, nitrogen cycle and phosphorus cycle. These cycles and processes provide the nutrients that make life possible.

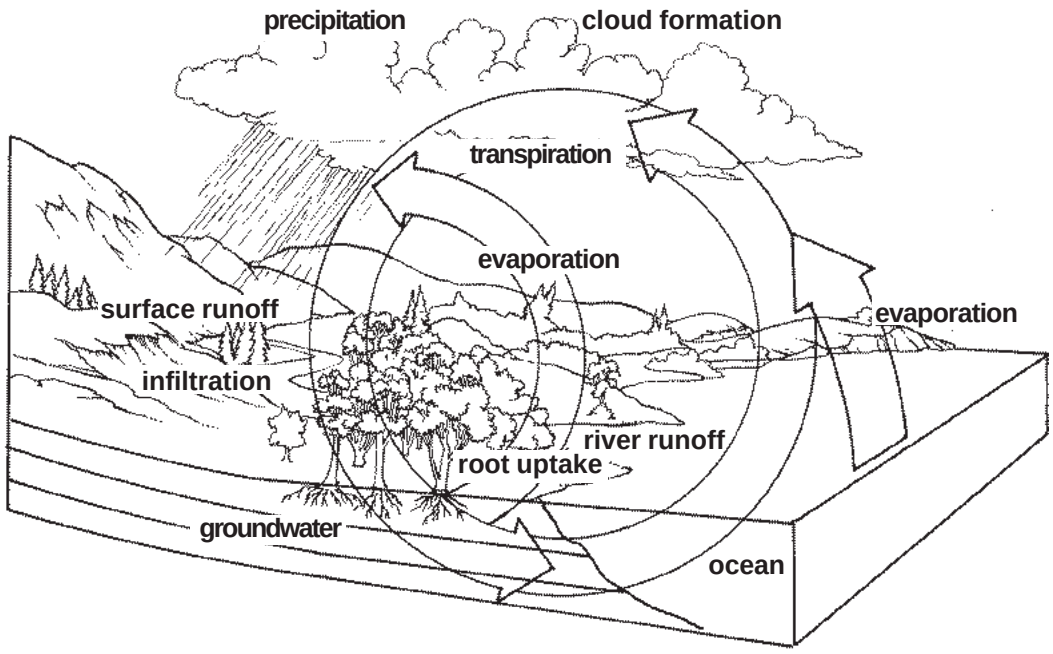
Let's Think About This

Did you know that the earth is the only planet that is capable of sustaining life? What is it about this planet that makes life possible? Make a list of characteristics of Mother Earth. Study this list and analyze how important these are for life.

Let's Study and Analyze

One magnificent thing that characterizes nature is efficiency. As you have learned from the previous lesson, energy is cycled or reused so that waste would be minimal. This is also true for other substances that are needed for life. These substances are generally called nutrients, because they provide organisms with the building blocks to make life possible. One of these nutrients is water.

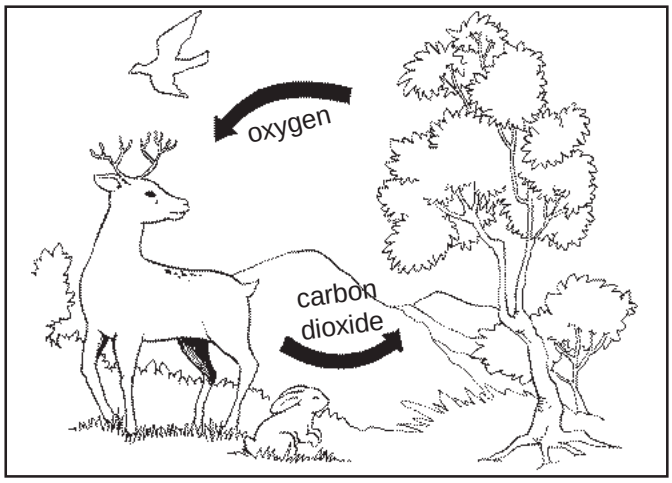
Water is very important for life. About 75% of our planet is covered with water. It may even surprise you to find out that your own body is 80% water! Because of this, nature has devised a way to conserve water. This is achieved through the **water cycle.**



Water Cycle
Water is evaporated from the ground and from bodies of water. Water vapor in the air condenses, and this results in rain. Rain falls to the ground and enters the soil or flows to bodies of water as runoff. Then, water undergoes evaporation again, and the cycle is repeated.

Water is everywhere. It is continuously being released from and absorbed by the earth's atmosphere. Water maintains the temperature of our planet. When the sun heats up the earth, water is evaporated. **Evaporation** is the process by which water is taken up into the atmosphere in the form of a gas called **water vapor.** Water vapor then condenses or goes back to liquid form and falls back to the ground. This is how water is regenerated and cycled.

Another important nutrient needed for life is **oxygen.** Like water, oxygen is all around us. It is used by the body to transform energy from food into a form that can be utilized by the cells of the body. Oxygen enters the body of animals through breathing. Without oxygen, life would not be possible. Like water, oxygen is also cycled. The cycle undergone by oxygen is called the **carbon dioxide-oxygen cycle.**



Carbon Dioxide-Oxygen Cycle
Plants release the oxygen needed by animals while animals release the carbon dioxide need by plants.

Oxygen is the gas that you inhale. When you exhale, carbon dioxide is released. It is another gas that plants need to produce their own energy. In return, plants give off oxygen. This is the same oxygen animals and human beings need to survive. In a sense, plants and animals have a **mutual** relationship, where both organisms benefit. Plants need animals and animals need plants.

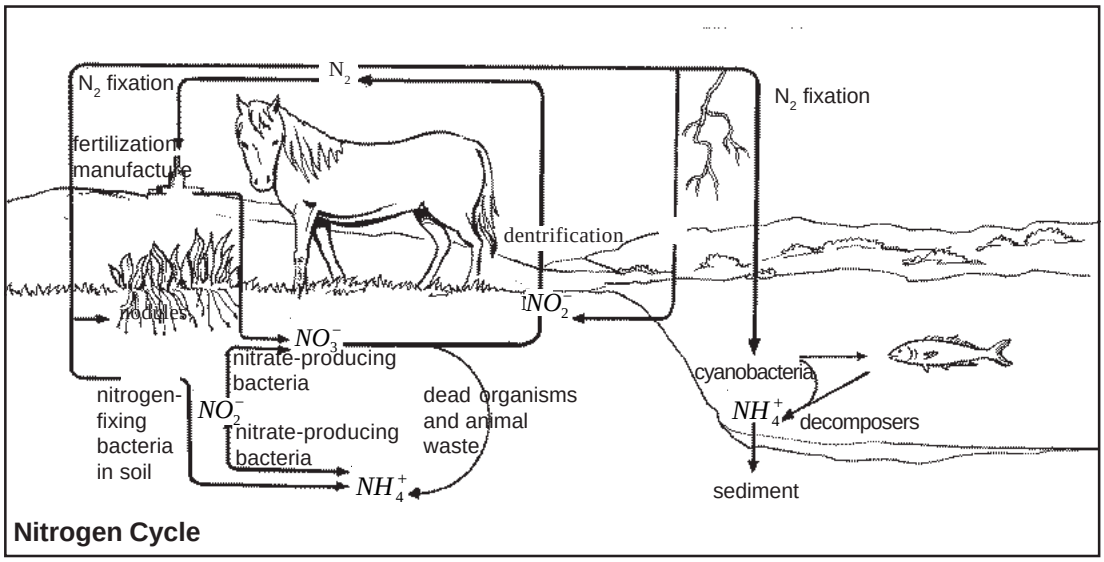
Let's Think About This

You have just learned that animals, including human beings, need plants because plants provide the oxygen that they breathe. But how useful are human beings to plants? People cut down trees. Forests are being cleared and converted for housing, agriculture and business purposes. Sooner or later, all forests will be gone. What do you think would be the effect of this on human beings?

Let's Learn

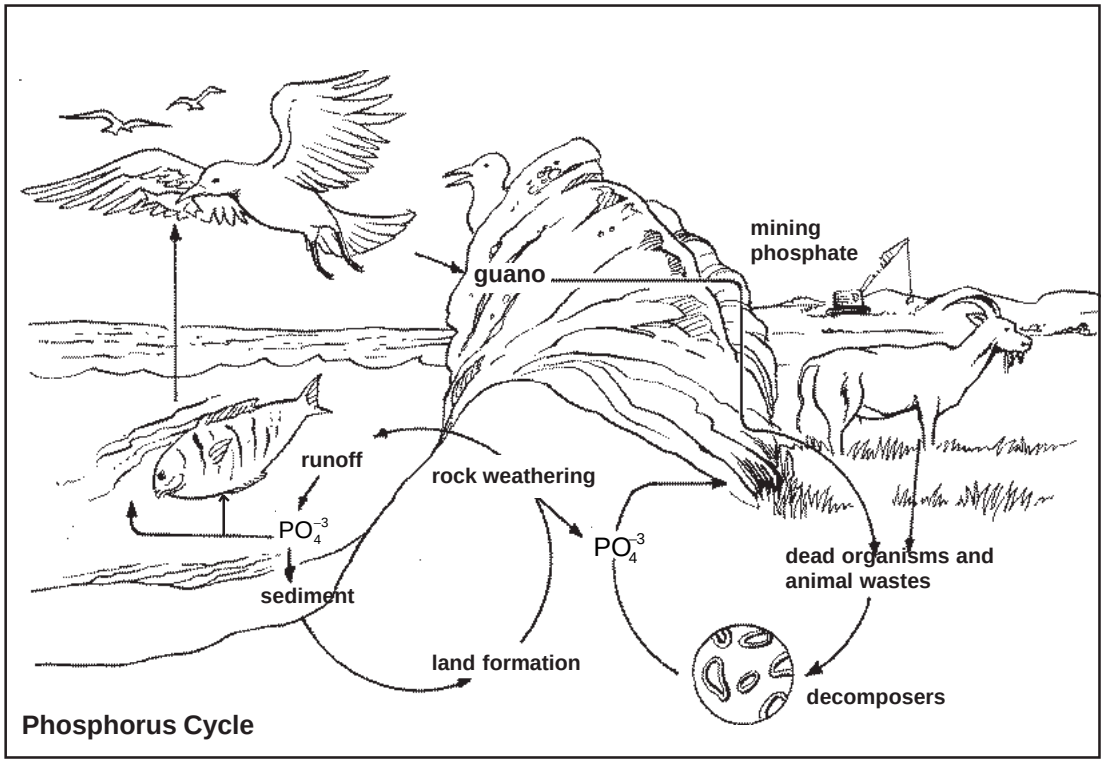
Another important nutrient for life is **nitrogen.** Nitrogen is an element that plants and animals need to produce proteins and other materials needed to maintain the various structures and functions of cells. Nitrogen is present in the air in great abundance. In fact, about 79% of air is nitrogen. However, the nitrogen present in air is not in the form that the cells of plants and animals can utilize. It must first be transformed into nitrates.

It's a good thing that **nitrogen-fixing bacteria** are present in the soil and in roots of legumes. Peanuts and beans are examples of legumes. These bacteria transform the nitrogen in the air into nitrates, which can be used for protein synthesis by plants and are later transferred to animals. The nitrogen used by plants and animals eventually goes back to the soil when plants and animals decompose. The nitrogen-fixing bacteria act on it and transform it into a usable form of nitrogen.



Nitrogen Cycle

Lastly, we have the **phosphorus cycle.** The phosphorus that is available for organisms comes from rocks on land and from sediments in lakes and oceans. The weathering of rocks creates phosphates. These phosphates are taken up by organisms to be incorporated into molecules needed for life. Animals that eat the producers use the phosphate in the formation of teeth, bones and shells that do not easily decompose. Later on, however, when the animals decompose the phosphates are returned to the soil. The phosphorus cycle continues.



Phosphorus Cycle

Let's See What You Have Learned

Explain the importance of the water, carbon dioxide-oxygen, nitrogen and phosphorus cycles in the blanks.

Water cycle

_____

_____

_____

Carbon dioxide-oxygen cycle

_____

_____

_____

Nitrogen cycle

_____

_____

_____

Phosphorus cycle

_____

_____

_____

After answering, compare your answers with those in the *Answer Key* on pages 32 and 33. If you got everything right, that means you learned a lot about the nutrient cycles in nature. If you got a lower score, study again the parts of the lesson that you did not understand.

Let's Remember

- The water cycle refers to the transfer and transformation of water through the processes of evaporation and condensation.
- The carbon dioxide-oxygen cycle illustrates mutualism between plants and animals. Animals breathe in oxygen and exhale carbon dioxide. Plants use up carbon dioxide and release oxygen into the air.
- The nitrogen cycle describes how nitrogen in the air is transformed by nitrogen-fixing bacteria into the more usable nitrates that cells need to make proteins and other compounds. This nitrogen eventually returns to the ground when plants and animals decompose.
- The phosphorus cycle describes how phosphates from the weathering of rocks gets incorporated into the soil and absorbed by plants. Later, it is used by animals in the formation of their bones, teeth and shells. The decomposition of animals returns phosphorus to the soil.

You have reached the end of the module. Congratulations! Did you enjoy studying this module? Did you learn a lot from it? The following is a summary of the module's main points to help you remember them better.

Let's Sum Up

This module tells us that:

- The relationship between any two kinds of organisms is called symbiosis.
- Symbiosis is classified into mutualism, commensalism, parasitism and predation.
- Trophic structure refers to the order by which organisms in an ecosystem gain nourishment. It indicates the number of levels in a food chain, which is a grouping of organisms in an ecosystem according to what they eat.
- As energy is transferred from one organism to another, some of it is lost to the atmosphere as heat. This flow and loss of energy among trophic levels is represented in an ecological pyramid.
- Water, oxygen, nitrogen and phosphorus are essential for life. These are continuously supplied to organisms through biogeochemical cycles. These cycles transport and transform materials among organisms and the environment.

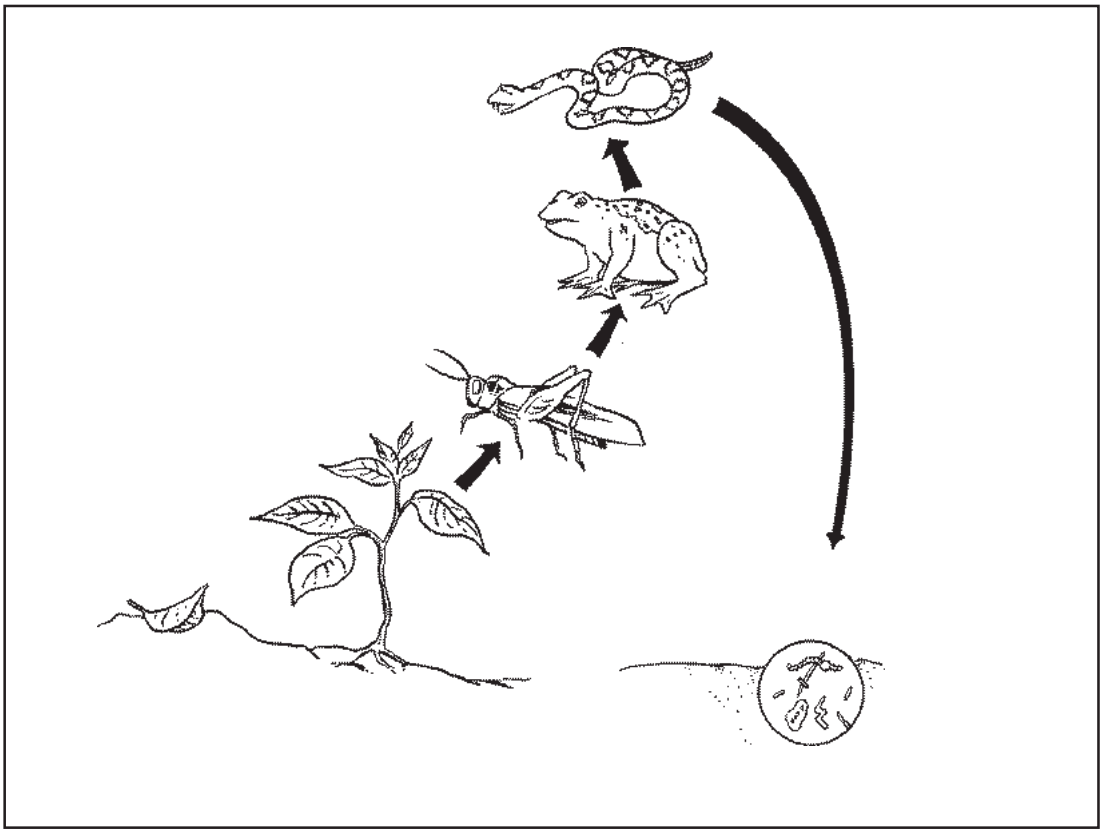
What Have You Learned?

A. Fill in the blanks and choose the correct answers in the box.

symbiosis	predation
nitrogen cycle	photosynthesis
food web	biogeochemical
decomposers	trophic structure
ecological pyramid	consumers

1. _____ is the relationship between two different kinds of organisms that live close to each other.
2. The ultimate task of breaking down the remains of organisms are performed by _____ .
3. A symbiotic relationship in which one organism kills another for food is called _____.
4. The _____ shows how food is produced and transferred from producers to consumers.
5. Energy flow in food chains and food webs is represented by an _____.
6. Nitrogen-fixing bacteria are important to the _____.
7. Animals are the _____in a food chain.
8. _____refers to the food-making process in plants.
9. Multiple food chains linked together make up a _____.
10. The nutrient cycles are _____ cycles.

B. Indicate the level to which each organism in the trophic structure below belongs. Write the label beside the picture of the organism.



Compare your answers with those in the *Answer Key* on pages 33 and 34.

If you got a score of

0–4	You need to study the module again more carefully.
5–6	You may go back to the parts of the module that you did not understand very well.
7–12	Well done! It would be better to review some of the items you missed.
13–15	Congratulations! You learned a lot from this module. You are now ready for the next module.

Answer Key

A. Let's See What You Already Know *(pages 2–3)*

A. Answers will vary according to how the learners state them. However, they should be similar to the following:

1. Ecosystem refers to a group of living and nonliving things in a particular area.

2. Predation is the relationship where one organism kills another for food.

3. Symbiosis is the relationship between two different kinds of organisms that live near each other.

4. Commensalism is a relationship where an organism benefits while the other is neither harmed nor benefitted.

5. Mutualism is a relationship in which both organisms benefit.

B. Answers will vary. The following are possible answers.

1. plants

2. caterpillars that feed on plants

3. small birds that eat caterpillars

4. eagles that eat small birds

5. bacteria that break down the dead bodies of eagles

C. A food pyramid is a graphic representation of how energy is produced and transferred in nature. Each level of the pyramid becomes wider going down the base. Producers are found at the base and have the most fixed energy. The energy being transferred decreases when an organism eats another. This is because some of the energy is lost as heat in the process.

D. 1. water cycle

2. carbon dioxide-oxygen cycle

3. nitrogen cycle

4. phosphorus cycle

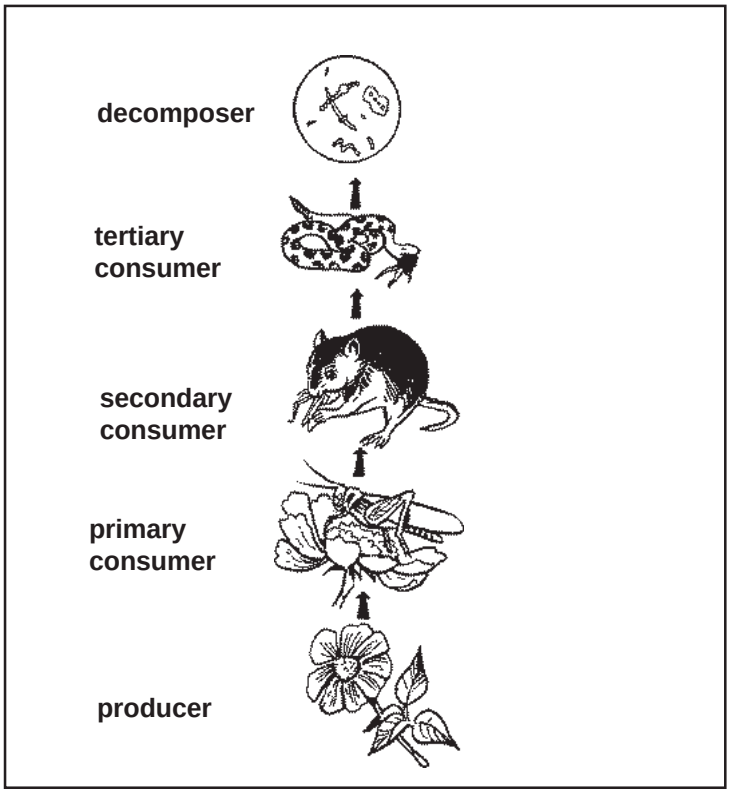
B. Lesson 1

Let's See What You Have Learned (page 8)

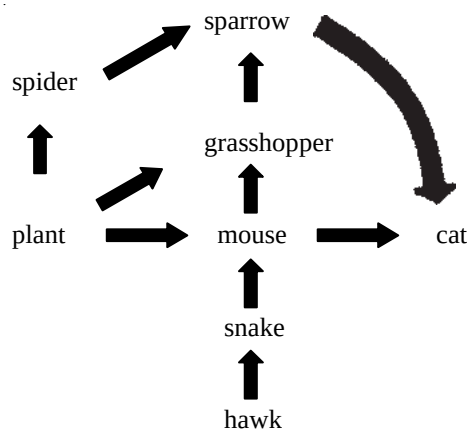
1. predation
2. predation
3. mutualism
4. parasitism
5. parasitism
6. commensalism
7. mutualism
8. predation
9. predation
10. parasitism

C. Lesson 2

Let's See What You Have Learned (page 15)



Food webs will vary. The following is a sample answer:



D. Lesson 3

Let's See What You Have Learned (page 20)

1. True
2. False. Energy decreases as it is transferred from one organism to another because of energy loss.
3. True
4. False. Plants are the producers.
5. True
6. True
7. True
8. False. Some energy is lost or wasted as heat.
9. True
10. True

E. Lesson 4

Let's See What You Have Learned (page 26)

Water cycle

Water is needed by all living things. The water cycle ensures us a continuous supply of water through the processes of evaporation and condensation.

Carbon dioxide-oxygen cycle

Oxygen, like water, is needed for life. Most of the oxygen animals breathe comes from plants. Carbon dioxide is exhaled by animals. Plants utilize carbon dioxide during photosynthesis and release oxygen as a by-product. The carbon dioxide-oxygen cycle ensures a continuous supply of oxygen for animals and carbon dioxide for plant.

Nitrogen cycle

Nitrogen is needed in the formation of proteins and other chemicals needed for life. Nitrogen from air is transformed by the nitrogen-fixing bacteria found in legumes and soil into nitrates, a chemical form of nitrogen that animals can consume. When animals die and decompose, nitrogen is returned to the soil. The nitrogen cycle maintains a steady supply of nitrogen for use by all living things.

Phosphorus cycle

Phosphates from rocks and sediments are needed by animals to build up their bones, teeth and shells. The phosphorus cycle assures a steady supply of phosphates needed in maintaining important functions for life.

F. What Have You Learned? *(pages 28–29)*

A. 1. symbiosis

2. decomposers

3. predation

4. trophic structure

5. ecological pyramid

6. nitrogen cycle

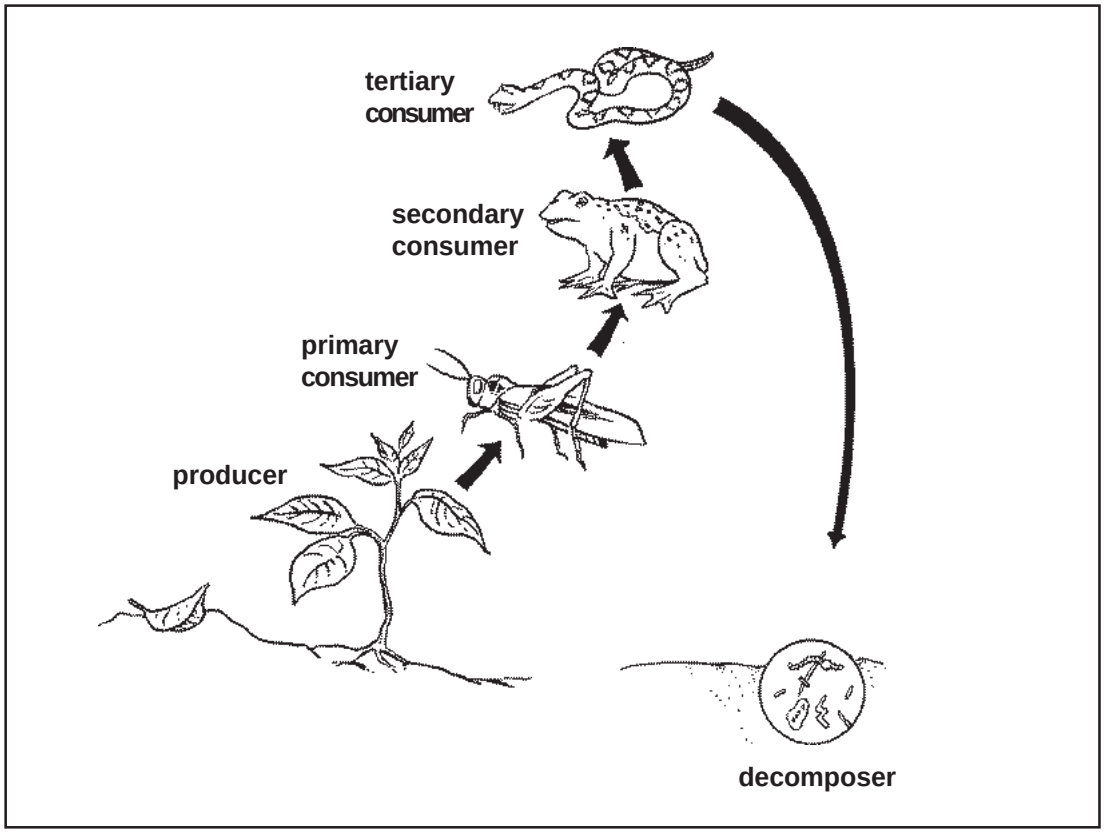
7. consumers

8. photosynthesis

9. food web

10. biogeochemical

B.


tertiary
consumer
secondary
consumer
primary
consumer
producer
decomposer

Glossary

Autotroph An organism which has the ability to produce its own food.

Biogeochemical cycles The continuous transport and transformation of materials such as water, oxygen, nitrogen and phosphorus in the environment.

Carbon dioxide-oxygen cycle The continuous flow of oxygen and carbon dioxide to and from plants and animals.

Commensalism A symbiotic relationship in which one organism benefits from the other while the other one neither is benefitted nor harmed.

Consumer An organism that depends on another organism for food.

Decomposer An organism that breaks down the bodies of dead organisms.

Ecological pyramid A graphic representation of the flow of energy from one organism to another.

Food chain A hierarchy of organisms in an ecosystem, which depends on how they get their food.

Food web A group of food chains linked together.

Glucose A sugar that is the primary product of photosynthesis.

Heterotroph An organism that relies on other organisms for food.

Host In parasitism, the organism that harbors the parasite.

Mutualism A symbiotic relationship in which both organisms benefit from the relationship.

Nitrogen cycle The cyclic movement of nitrogen in different chemical forms from the environment to the organisms and then back to the environment.

Parasitism A symbiotic relationship in which one organism benefits at the expense of the other.

Phosphorus cycle The transformation and flow of phosphorus among plants, animals and the environment.

Predation A symbiotic relationship in which one organism kills the other for food.

Predator An organism that kills another for food.

Prey An organism that serves as food for another organism.

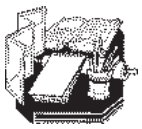
Producer The starting point or base of a trophic structure; an organism that can make its own food.

Starch A complex form of sugar that is derived from glucose.

Symbiosis The relationship between two different kinds of organisms that live close to each other.

Trophic structure The order by which organisms in an ecosystem gain nourishment.

Water cycle The transport and transformation of water in the environment.



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