



What Is This Module About?



Look at the left side of the picture above. What do you see? Do you know how birds reproduce? A single mother bird can lay many eggs so you can just imagine how many eggs 20 mother birds can produce.

Now, look at the right side of the picture. Just like birds, a single mother rat can have more than one baby at a time. In just a short time, there can be millions of birds and rats then.

How can this happen? How can nature control the rapid increase of a particular species. Nature has a way of balancing everything. And this is what we will discuss in this module.

This module is made up of two lessons:

Lesson 1 – *Biotic and Abiotic Factors in the Balance of Nature*

Lesson 2 – *Man as a Factor in the Balance of Nature*



What Will You Learn From This Module?

After studying this module, you should be able to:

- ◆ describe the roles of biotic and abiotic factors and man in maintaining balance in nature;
- ◆ formulate ways to avoid ecological imbalance; and
- ◆ devise a plan and use this in taking care of your community and maintaining balance in nature.



Let's See What You Already Know

Before you start studying this module, take this simple test first to find out how much you already know about the topics in this module.

Write **True** if the sentence is correct. If the statement is false, change the underlined word/s to make it true.

- _____ 1. When you eat chicken, you are considered its prey.
- _____ 2. The biosphere is that part of the earth's surface and atmosphere in which living organisms are known to exist.
- _____ 3. Man is an example of a producer in a food chain.
- _____ 4. The cycle which involves organisms eating other organisms in a complicated pattern is known as a food chain.
- _____ 5. Kaingin system and illegal logging can lead to forestation.
- _____ 6. The monkey-eating eagle is an endangered species.
- _____ 7. The practice of cutting down trees in forests without replacing them can lead to erosion.
- _____ 8. Flooding in areas near rivers is due to desalination of these rivers.
- _____ 9. Cases of radiation leaks in other countries hamper the operation of the nuclear plant in our country.
- _____ 10. Eutrophication is the process wherein a body of water becomes overenrich with nutrients due to pollutants resulting in overgrowth of algae and depleted oxygen levels killing fishes and other aquatic resources.

Well, how was it? Do you think you fared well? Compare your answers with those in the *Answer Key* on page 45 to find out.

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

If you got a low score, don't feel bad. This means that 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.

Biotic and Abiotic Factors in the Balance of Nature



Look closely at the vast sea in the picture above.

Do seas dry up? Have you ever seen or heard of a dried-up ocean or sea?

Nature has a way of replacing the water that evaporates. Because of this too, the nutrients and materials on earth do not run out. This way, the organisms don't die at the same time. These phenomena and more are what this lesson is all about.

After studying this lesson, you should be able to:

- ◆ describe the different material cycles (carbon dioxide-oxygen, nitrogen, water);
- ◆ differentiate a food chain from a food web;
- ◆ explain feeding relationships among organisms;
- ◆ differentiate prey from predators; and
- ◆ use acquired knowledge in preserving nature.



Let's Think About This

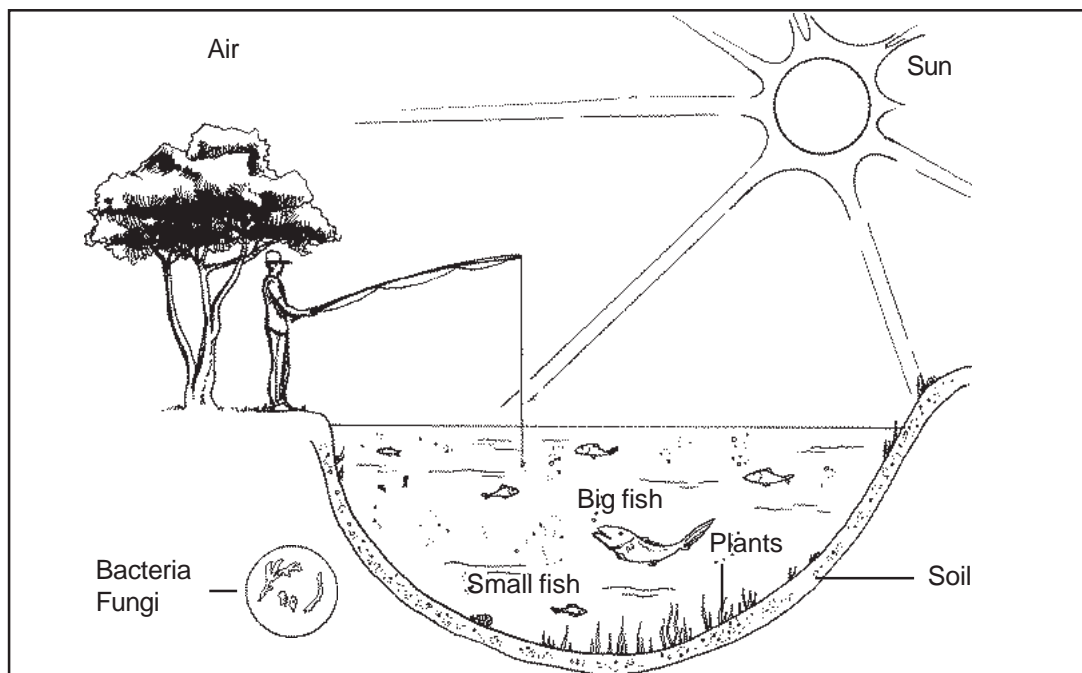
Do you still remember what an ecosystem is? What are its components? To which component do you belong?



Let's Learn

An **ecosystem** refers to a community of living things and their relationships to their surroundings. It can be small like a flowering plant in a pot or big like the vast ocean.

Look at the following diagram of a pond ecosystem. It shows all the functional components—biotic and abiotic—of an ecosystem. **Biotic** refers to the living organisms like plants and animals. **Abiotic** refers to the nonliving things like air, water and soil. The pond has enough materials to maintain its existence. It can therefore provide for the needs of all the organisms found there. It is a balanced ecosystem.



A pond ecosystem



Let's Try This

1. Look closely again at the diagram of a pond ecosystem.
2. Identify its different components.
3. Classify the components as to:
 - a. abiotic
 - b. producers
 - c. primary consumers
 - d. secondary consumers
 - e. tertiary consumers
 - f. decomposers

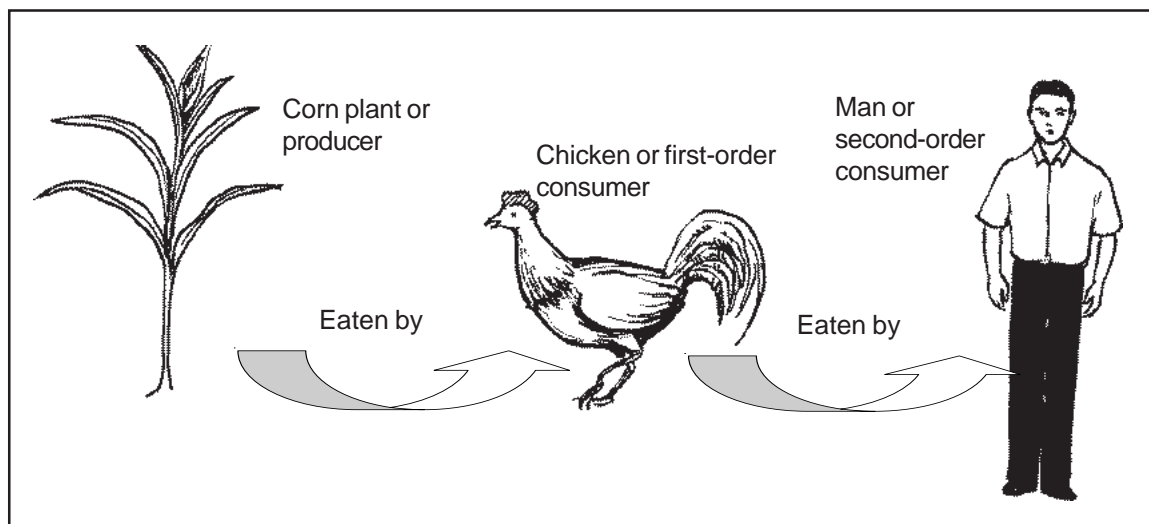
Compare your answers with those in the *Answer Key* on page 45. How well did you do?

A balanced ecosystem is key to the survival of all the organisms living in it.



Let's Learn

The organisms in an ecosystem depend on each other for survival. Look at the diagram below.



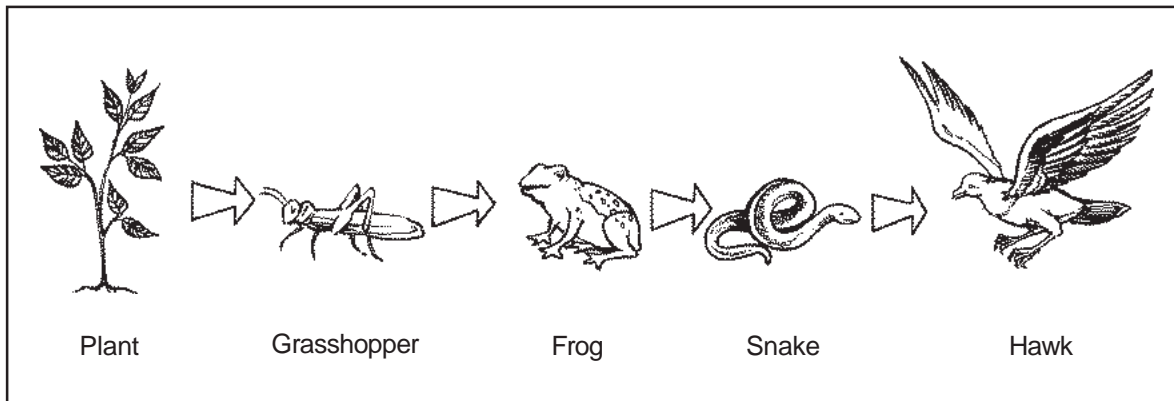
A food chain

The chicken (first-order consumer) feeds on the corn plant (producer). Then the man (second-order consumer) eats the chicken (first-order consumer). And the cycle goes on and on. This diagram shows an example of a simple food chain. A **food chain** is a sequence of organisms arranged in such a way that each feeds on the organisms before it in the chain.

Food chains differ in length. Look at another sample food chain on the next page.



Let's Study and Analyze



A longer food chain

Answer the following questions briefly.

1. Which is the producer in the food chain?

2. Which is the first-order consumer? What is it called?

3. Which is the second-order consumer?

4. Which is the third-order consumer?

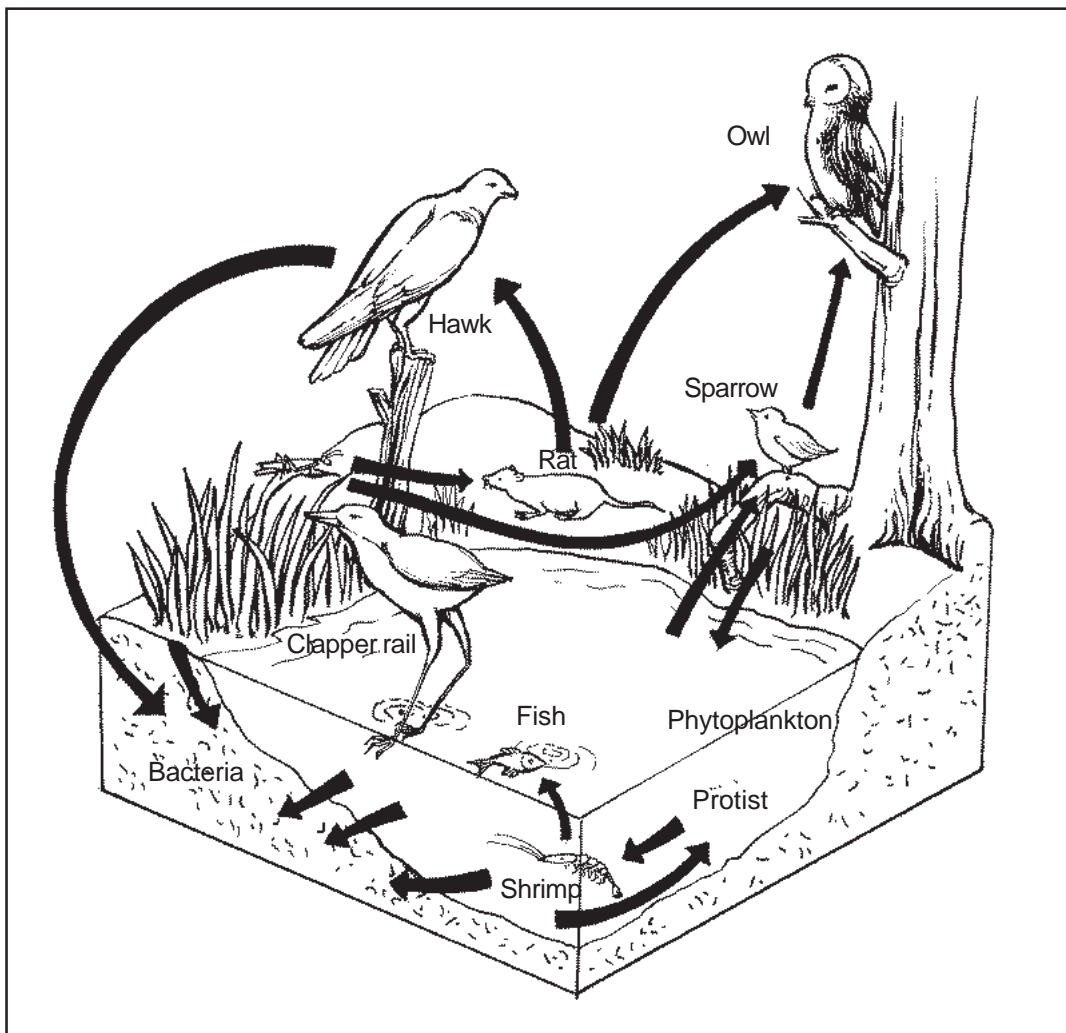
5. Which is the fourth-order consumer?

Compare your answers with those in the *Answer Key* on page 45. Did you get a perfect score? If you did, that's very good! If you didn't, don't worry. Just review the parts you did not understand very well before going to the next part of the lesson.



Let's Learn

Most of the time, an organism may belong to several food chains in nature. Refer to the diagram below. Let us consider one of the food chains in it. The shrimp (first-order consumer) eats phytoplanktons (producer). The small bird (second-order consumer) eats the shrimp. The owl (third-order consumer) eats the small bird (second-order consumer). When the animals and plants die, bacteria decompose them. A protist eats the bacteria and the cycle repeats itself. The interlocking pattern formed by a series of interconnected food chains is called a **food web**. Cutting out even a single part of the web can have dangerous effects.



A food web



Let's Read

Read the article below to find out how missing a step in a food chain can adversely affect the organisms in a particular ecosystem.

The World Health Organization (WHO) tries to eliminate malaria from Borneo by spraying the insecticide, dichlorodiphenyltrichloroethane (DDT). The spray did indeed kill the mosquitoes that carried malaria. But there was a problem. The spray also affected the cockroaches which when eaten by the insect-eating lizards caused them nerve damage. This slowed down the lizards which were then easily caught and eaten by the cats.

Because of this, the caterpillars which ate the roofs of people's houses increased in number. The roofs started to collapse. Meanwhile, the cats which ate the contaminated lizards were also dying from DDT poisoning and so the rats from the forest moved in. With the rats came the fleas carrying bacteria that caused a plague. WHO stopped spraying DDT. In an attempt to remedy the problem, they parachuted large numbers of healthy cats into the jungle. They learned a very expensive lesson.

Source: "Food Web Pattern and Their Consequences." *Nature Magazine*, April 1991.

Did you learn something from the story? What lesson did you learn?

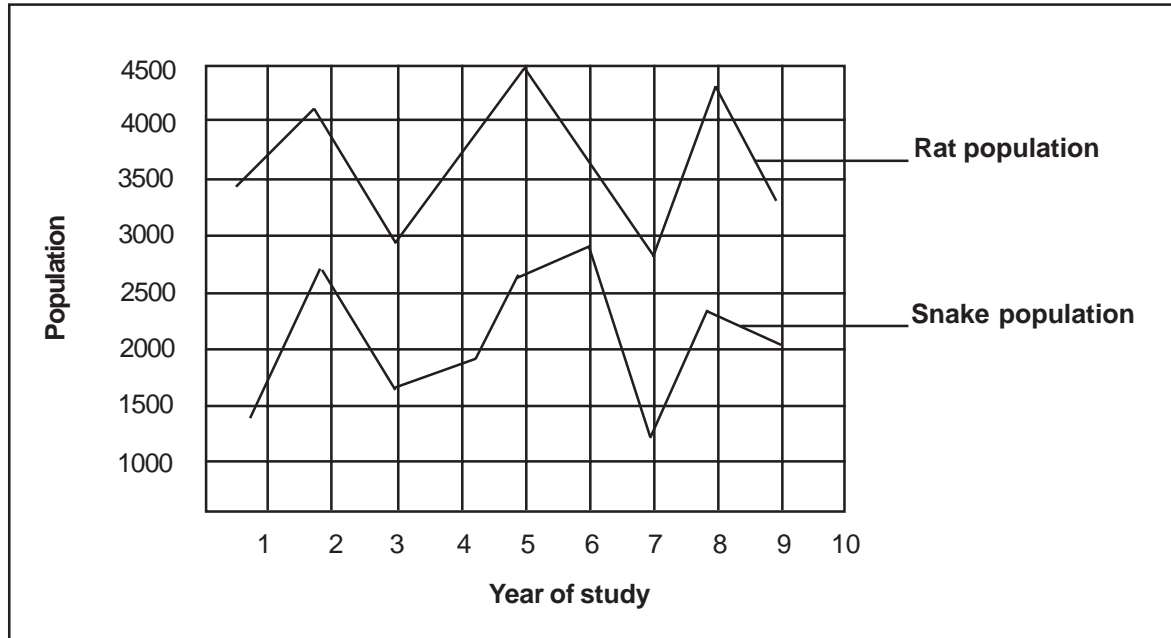
In the article above, what is the relationship between the rats and the cats? The rats are the _____ and the cats are the _____. The rats are the prey and the cats are the predators. **Prey** refers to an animal/s hunted as food by another/other animal/s. **Predators**, on the other hand, are animals that obtain food by killing and eating other animals.

Ask your Instructional Manager or Facilitator to check your work.



Let's Try This

Look closely at the graph below showing the rat and snake population data in ten years' time. Then answer the questions that follow.



Rat and Snake Population in Ten Years

1. What do you notice about the snake population when there is an increase in the rat population? Why is this so?

2. In Year 6, what happened to the snake population with a change in the rat population? Why is this so?

Compare your answers with those in the *Answer Key* on page 46. How well did you do?



Let's Think About This

Rats are generally considered pests at home and in rice fields. Is it therefore advisable to kill all of them? Why/Why not?

No, it isn't. Killing all the rats would disrupt the food chain and may cause adverse changes that can result in an imbalance in nature.

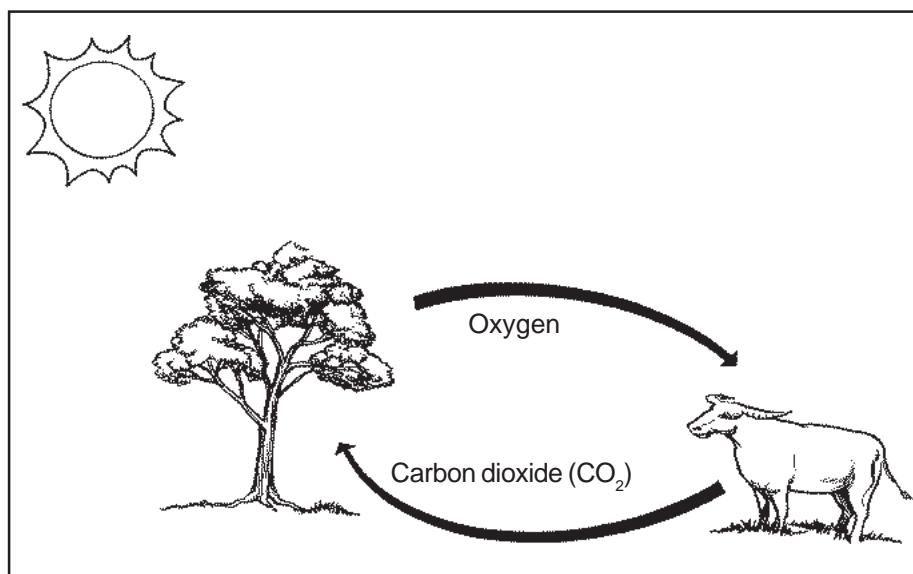


Let's Learn

After learning about the biotic factors that affect the balance in nature, you will now learn about the effects abiotic factors have on it.

All organisms need raw materials and nutrients for survival. But will the earth ever run out of these? What do you think? Read on to find out.

Are you familiar with the different natural cycles that occur around us every day? These cycles provide us with fresh air, raw materials for food production in plants and provide the soil with the nutrients plants need to produce food. In short, they help maintain the balance in nature.



The carbon dioxide-oxygen cycle

The living organisms in a certain ecosystem need six elements in large amounts and ten elements in small amounts to survive. Refer to the table on the next page.

Elements Needed by Living Organisms for Survival

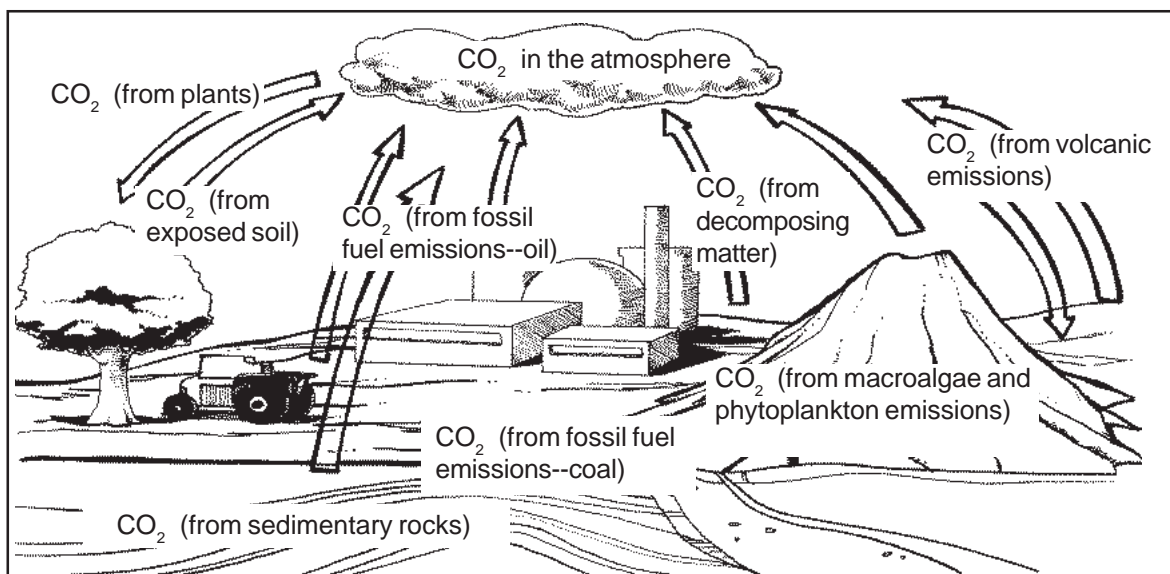
Major Elements	Minor Elements
1. carbon	1. sodium
2. hydrogen	2. potassium
3. oxygen	3. manganese
4. phosphorus	4. calcium
5. nitrogen	5. iron
6. sulfur	6. magnesium
	7. chlorine
	8. iodine
	9. cobalt
	10. boron

All these elements can be found in our surroundings. They are present in rocks, in the atmosphere and in the other parts of the biosphere. They are released for the use of the biotic factors through processes such as weathering and erosion. They undergo various cycles so they can be used and reused over and over for continued survival. These cycles include the carbon dioxide-oxygen cycle, nitrogen cycle and water cycle.

Let's take a close look at each of these cycles.

The Carbon Dioxide-Oxygen Cycle

The **carbon dioxide-oxygen cycle** is also called the “cycle of life.” Carbon dioxide and oxygen are the two most important gases necessary for the survival of all living things.



Carbon is available for life processes as carbon dioxide and as organic carbon. The two major carbon reservoirs are the oceans and the atmosphere. Carbon is converted into organic compounds through **photosynthesis**, the process wherein green plants produce carbohydrates from carbon dioxide and water using light energy from sunlight and **chlorophyll** (the green pigment found in the leaves of plants). This occurs in **terrestrial** (relating to dry land) plants and in the **macroalgae** (large algae) and **phytoplankton** (microscopic plants) found in both freshwater and salt water bodies. Carbon is then returned to the atmosphere in three ways:

1. direct diffusion in the air and water;
2. combustion of fossil fuels such as oil and coal which are the remains of organic deposits laid down some 300 million years ago; and
3. **respiration**, a biological process in which carbohydrates are broken down in the presence of oxygen into carbon dioxide and water and in which chemical energy is released.



Let's Try This

Based on the diagram on the preceding page, answer the following questions briefly.

1. What organisms take in carbon dioxide?

2. What do you call the process by which carbon dioxide and water are changed into food for plants with the help of sunlight and the chlorophyll in their leaves?

3. What organisms take in oxygen?

4. What do you call the process of taking in oxygen and releasing carbon dioxide?

5. What gas is also important in the combustion of fossil fuels?

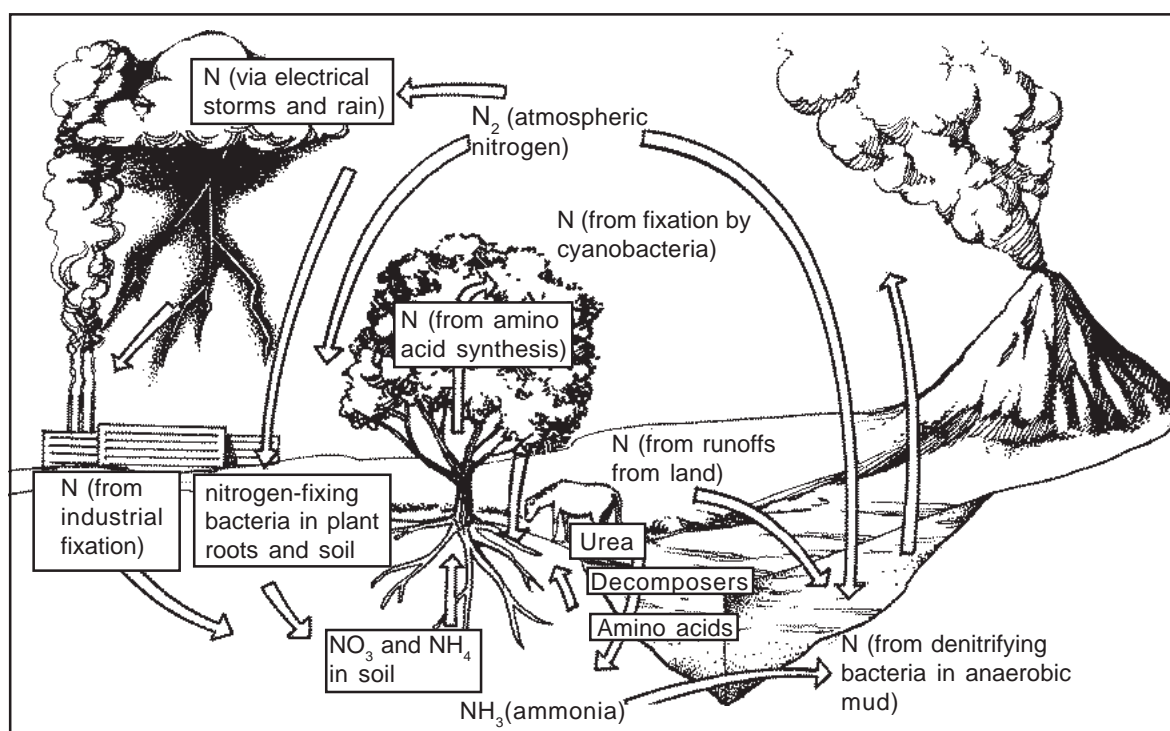
Compare your answers with those in the *Answer Key* on page 46. Did you get a perfect score? If you did, that's very good! If you didn't, don't worry. Just review the parts of the lesson you did not understand before going to the next part.



Let's Learn

The Nitrogen Cycle

Nitrogen is the basic component of all proteins and nucleic acids.



The nitrogen cycle

In the **nitrogen cycle**, nitrogen moves in a large atmospheric cycle. Our atmosphere is about 80% gaseous nitrogen (N_2). Nitrogen has a very strong **covalent bond** (a chemical bond in which two atoms are held together by sharing a pair of electrons between them) which can only be broken by certain bacteria, volcanic action and lightning. After the bond breaks, it enters the food webs.

Nitrogen atoms move through the ecosystem by nitrogen **fixation** (the conversion of a chemical substance into a form that does not evaporate), **assimilation** and **biosynthesis** (in green plants and certain bacteria: the manufacture of complex organic compounds from simple molecules obtained from the environment), **decomposition** (decay), **ammonification** (the process of converting nitrogenous residues to ammonia) and **nitrification** (the process of converting or being converted into nitrates or nitrites through the action of bacteria).

During nitrogen fixation, the ammonia will dissolve and become ammonium (NH_4^+). Then the nitrogen becomes fixed in water by **cyanobacteria** (blue-green algae). Nitrogen becomes fixed on land by certain animals. Then plants assimilate and use fixed nitrogen in the biosynthesis of amino acids, proteins and nucleic acids. Plant tissues are the only source of nitrogen for animals.

During decomposition and ammonification, fungi and bacteria break down wastes containing nitrogen and the remains of organisms. The decomposers use some of the released proteins and amino acids for their metabolism. Plants absorb the nitrogen that is left in decay such as ammonia or ammonium. Nitrifying bacteria then absorb ammonia or ammonium. During nitrification, they strip the ammonium or ammonia of their electrons. As a result, nitrite (NO_2^-) develops.

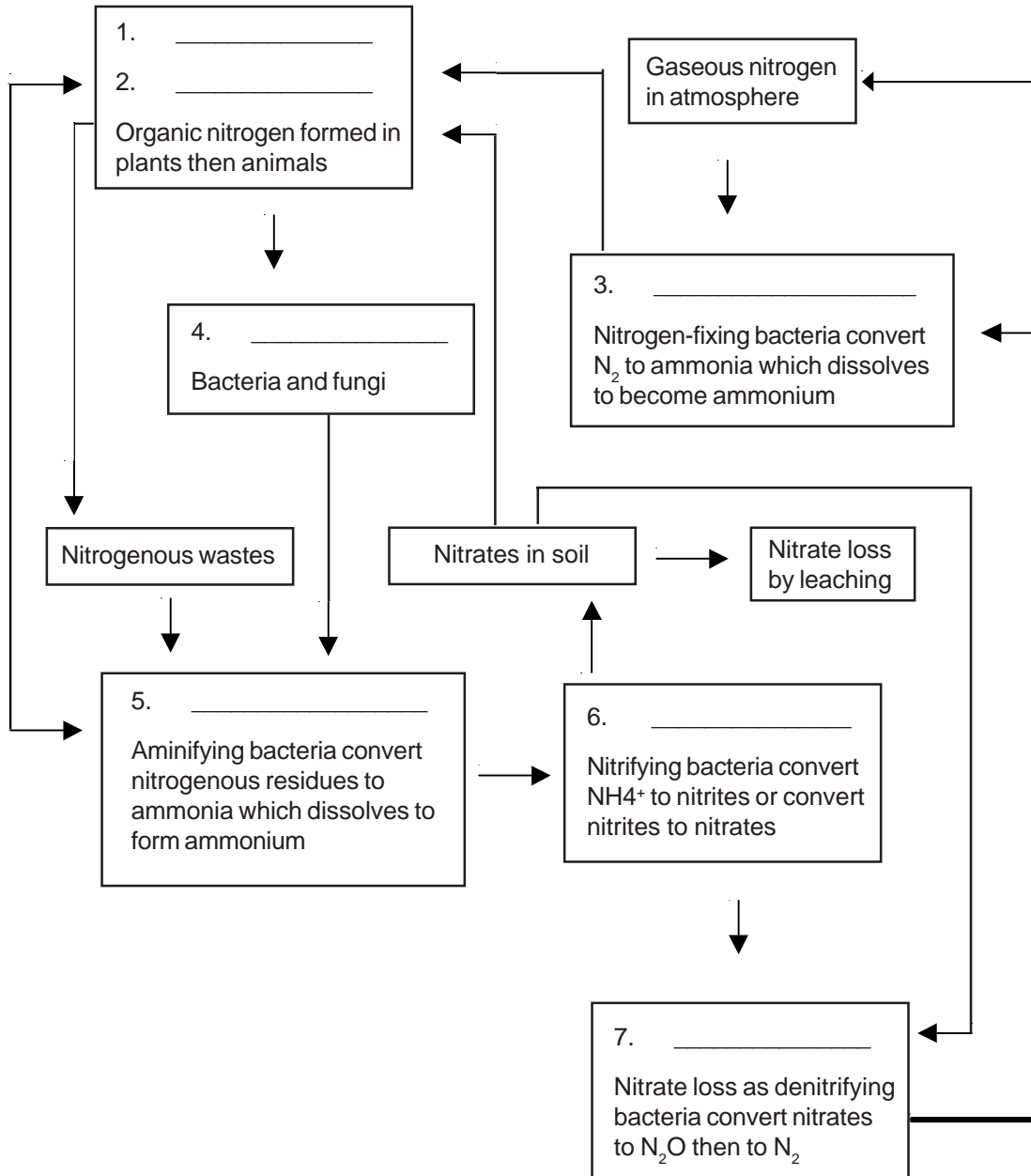
All of the compounds, ammonia, nitrites and nitrates, are sensitive to **leaching** (washing a soluble substance out of a solid by allowing a suitable liquid solvent to percolate through it) and runoffs. When nitrogen is lost to the air, **denitrification** occurs. During denitrification, bacteria convert nitrates or nitrites to N_2 and some nitrous oxides (N_2O).

People can also affect the nitrogen cycle through pollution. Nitrogen-containing fertilizers and fossil fuels release pollutants that increase soil acidity. This affects the root absorption of magnesium, calcium and potassium ions. As a result, the cycle loses more nitrogen.



Let's Try This

Complete the diagram below by identifying the stages being described. Write your answers in the blanks provided.



Compare your answers with those in the *Answer Key* on page 46. Did you get a perfect score? If you did, that's very good! If you didn't, don't worry. Just review the parts that you did not understand before going to the next part of the lesson.



Let's Learn

The Water Cycle

Water is an integral part of life on this planet. It is constantly being cycled between the atmosphere, the ocean and the land. This cycle is a very important process that helps us sustain life on earth.

Precipitation, evaporation and transpiration are all terms that sound familiar yet may not mean much to you. They are all part of the **water cycle**, a complex process that not only gives us water to drink and fish to eat but also weather patterns that help us grow crops.

There are six important processes that make up the water cycle, namely:

1. **Evaporation**—the process where a liquid like water changes from its liquid state to a gaseous state. Liquid water becomes water vapor. Although lower air pressure helps promote evaporation, temperature is still the primary factor.

During the water cycle, some of the water in the oceans and freshwater bodies such as lakes and rivers is warmed by the sun and evaporates. During the process of evaporation, impurities in the water are left behind. As a result, the water that goes into the atmosphere is cleaner than when it was still on earth.

2. **Condensation**—the opposite of evaporation. Condensation occurs when a gas is changed into a liquid. It occurs when the temperature of the vapor decreases.

When the water droplets formed from condensation are very small, they remain suspended in the atmosphere. These millions of droplets of suspended water form clouds in the sky or fog at ground level. Water condenses into droplets only when there are small dust particles present, around which the droplets can form.

3. **Precipitation**—occurs when the temperature and atmospheric pressure are right and the small droplets of water in clouds form larger droplets. The raindrops then fall to earth.

As a result of evaporation, condensation and precipitation, water travels from the surface of the earth, goes into the atmosphere and returns to earth again.

4. **Surface runoff**—much of the water that returns to earth as precipitation runs off the surface of the land and flows downhill into streams, rivers, ponds and lakes. Small streams flow into larger streams then into rivers and eventually flows into the oceans.

Surface runoff is an important part of the water cycle because through it, much of the water returns again to the oceans where a great deal of evaporation occurs.

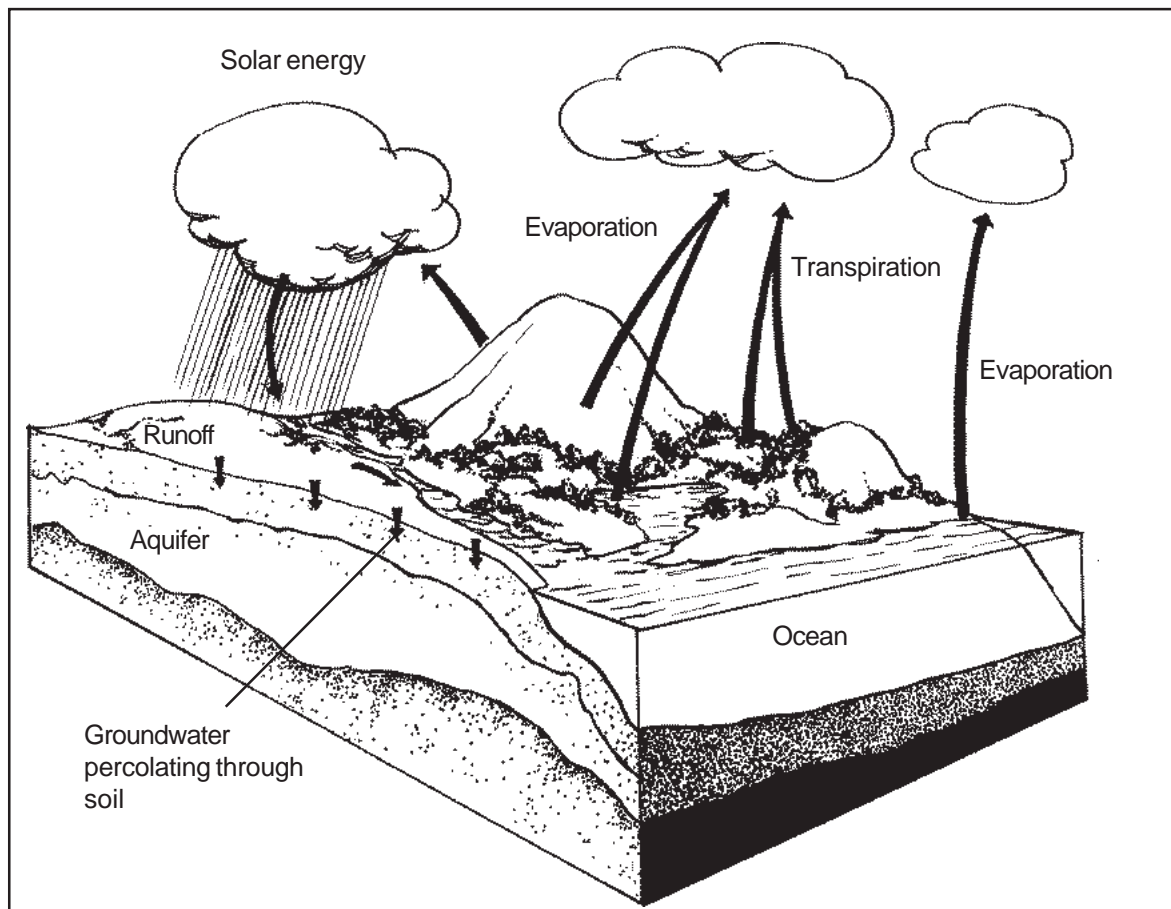
5. **Infiltration**—an important process where rainwater soaks into the ground through the soil and underlying rock layers. Some of this water ultimately returns to the surface as springs or flows downhill. Some of the water remains underground and is then called **groundwater**.

As the water infiltrates through the soil and rock layers, many of the impurities in the water are filtered out. This filtering process helps clean the water.

6. **Transpiration**—as plants absorb water from the soil, the water moves from the roots through the stems to the leaves. Once the water reaches the leaves, it evaporates adding to the amount of water vapor in the air. This process of evaporation through plant leaves is called **transpiration**. In large forests, an enormous amount of water transpire through the plant leaves.

Observe how the water cycle works below.

Notice that as the water evaporates, vapors rise and condense into clouds. The clouds move over the land and precipitation falls in the form of rain, ice or snow. The water fills streams and rivers and eventually flows back into the oceans where evaporation starts the process anew.



The water cycle



Let's Review

Match the terms in Column A with their definitions/descriptions in Column B. Write the letters of the correct answers only in the blanks before the numbers.

Column A

- _____ 1. Evaporation
- _____ 2. Condensation
- _____ 3. Precipitation
- _____ 4. Surface runoff
- _____ 5. Infiltration
- _____ 6. Transpiration

Column B

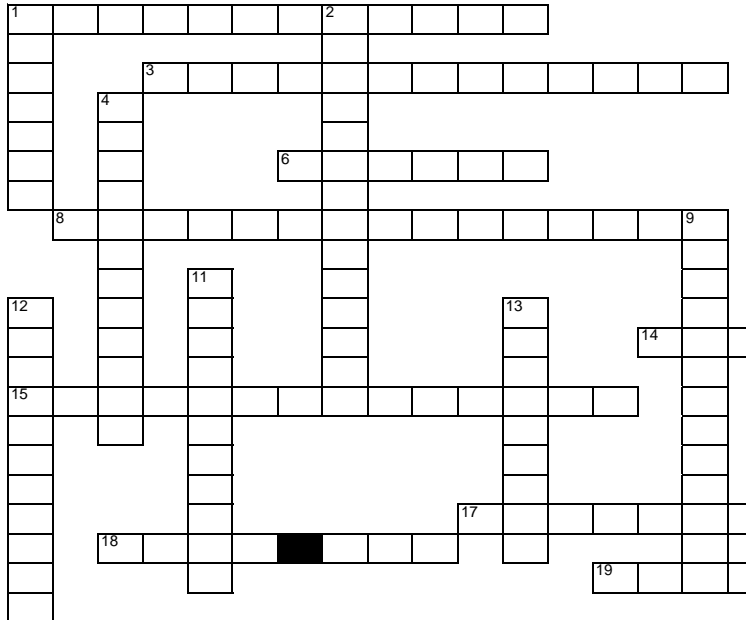
- a. The process wherein rainwater soaks into the ground, through the soil and into underlying rock layers
- b. The process wherein the small droplets of water in clouds form larger droplets with the right temperature and atmospheric pressure
- c. The process wherein water changes from its liquid state to a gaseous state
- d. The process of evaporation through plant leaves
- e. The process that occurs when a gas is changed into a liquid
- f. The process wherein precipitation runs off the surface of the land and flows downhill into streams, rivers, ponds and lakes

Compare your answers with those in the *Answer Key* on page 46. Did you get a perfect score? If you did, that's very good! If you didn't, don't worry. Just review the parts of the lesson that you did not understand before going to the next part.



Let's See What You Have Learned

Complete the crossword puzzle below using the given clues.



Across

1. Along with biosynthesis, is the process of manufacturing complex organic compounds from simple molecules obtained from the environment
3. Decay
6. Living organisms like plants and animals
8. The process wherein bacteria convert nitrates or nitrites to N_2 and some nitrous oxides (NO_2^-)
14. The process of converting a chemical substance into a form that does not evaporate
15. The process wherein green plants produce carbohydrates from CO_2 and water using light energy from sunlight and chlorophyll

Down

1. Nonliving factors in an ecosystem
2. The process of converting nitrogenous residues to ammonia
4. The process wherein a gas is changed into a liquid
5. The process wherein the small droplets of water in clouds form larger droplets
7. The process of evaporation through plant leaves
9. The process of converting or being converted into nitrates or nitrites through the action of bacteria
10. The process wherein rainwater soaks into the ground, through the soil and into underlying rock layers

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| 16. A sequence of organisms arranged in such a way that each feeds on the organism before it in the chain | 11. The process wherein water in its liquid state turns to gas |
| 17. Washing a soluble substance out (of a solid) by allowing a suitable | 12. The biological process in which carbohydrates are broken down in the presence of oxygen into carbon dioxide and water |
| 18. An interlocking pattern formed by a series of food chains | 13. A community of living things and their relationships to their surroundings |
| 19. The water that returns to earth as precipitation that runs off the surface of the land and flows downhill into streams, rivers, ponds and lakes | |

Compare your answers with those in the *Answer Key* on page 47. Did you get a perfect score? If you did, that's very good. You can now go to the next lesson. If you didn't, don't worry. Just review the parts of the lesson you didn't understand very well before going to Lesson 2.



Let's Remember

- ◆ An **ecosystem** refers to a community of living things and their relationships to their surroundings.
- ◆ **Biotic** refers to the living organisms in an ecosystem while **abiotic** refers to the nonliving things in it.
- ◆ A **food chain** is a sequence of organisms arranged in such a way that each feeds on the organism before it in the chain while a **food web** is an interlocking pattern formed by a series of food chains.
- ◆ **Photosynthesis** is the process wherein green plants produce carbohydrates from carbon dioxide and water using light energy from sunlight and chlorophyll.
- ◆ **Respiration** is the biological process in which carbohydrates are broken down in the presence of oxygen into carbon dioxide and water.
- ◆ **Fixation** refers to the conversion of a chemical substance into a form that does not evaporate.

- ◆ **Assimilation** and **biosynthesis** are responsible for the manufacture of complex organic compounds from simple molecules obtained from the environment.
- ◆ **Ammonification** is the process of converting nitrogenous residues to ammonia.
- ◆ **Nitrification** is the process of converting or being converted into nitrates or nitrites through the action of bacteria.
- ◆ **Leaching** refers to washing a soluble substance out (of a solid) by allowing a suitable liquid solvent to percolate through it.
- ◆ **Denitrification** is the process wherein bacteria convert nitrates or nitrites to N_2 and some nitrous oxides (NO_2^-).
- ◆ **Evaporation** is the process wherein water changes from its liquid state to a gaseous state.
- ◆ **Condensation** is the process wherein a gas is changed into liquid.
- ◆ **Precipitation** occurs when the small droplets of water in clouds form larger droplets.
- ◆ **Surface runoff** refers to the water that returns to earth as precipitation that runs off the surface of the land and flows downhill into streams, rivers, ponds and lakes.
- ◆ **Infiltration** is the process wherein rainwater soaks into the ground, through the soil and into underlying rock layers.
- ◆ **Transpiration** is the process of evaporation through plant leaves.

Man as a Factor in the Balance of Nature



A flooded area during the rainy days

Is the scene depicted above a common sight in your place? Do you know of places that are always flooded? Were they always so?

Many of the cities and towns in our country get flooded even after an ordinary rain. Do you have any idea what causes this? Do you realize that we are responsible for disasters like this? That we are responsible for upsetting the balance in nature. This is what we will talk about in this lesson.

After studying this lesson, you should be able to:

- ◆ analyze and discuss the effects of pollution, forest denudation, erosion, siltation, eutrophication, destruction of wildlife, radiation fallouts and leaks and biological magnification;
- ◆ discuss the role of man in maintaining the balance of nature;
- ◆ formulate ways to avoid ecological problems; and
- ◆ devise a plan on how to take care of your community and avoid ecological imbalance.



Let's Study and Analyze

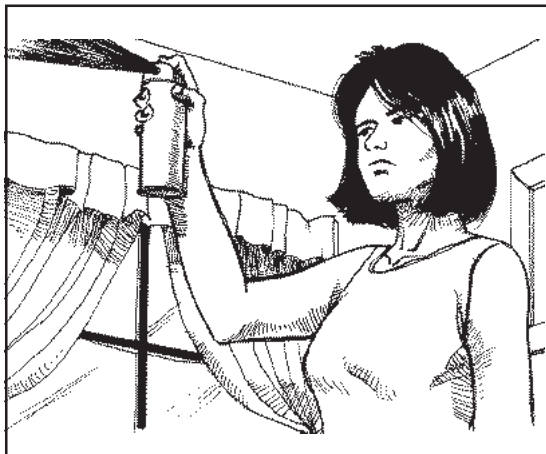
Look at the pictures given below. They are just some of man's activities that adversely affect our surroundings.



Kaingin system



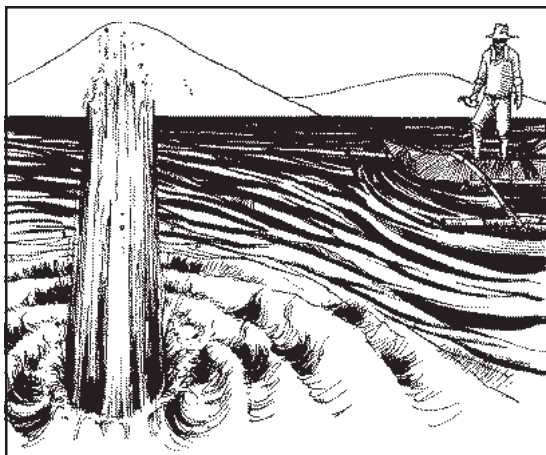
Illegal logging



Using harmful insecticides at home



Using harmful pesticides in farming



Dynamite fishing



Improper garbage disposal

Have you ever gotten involved in any one of these activities? Do you know how they can affect our environment? Why don't you read on and learn about all this and more.



Let's Learn

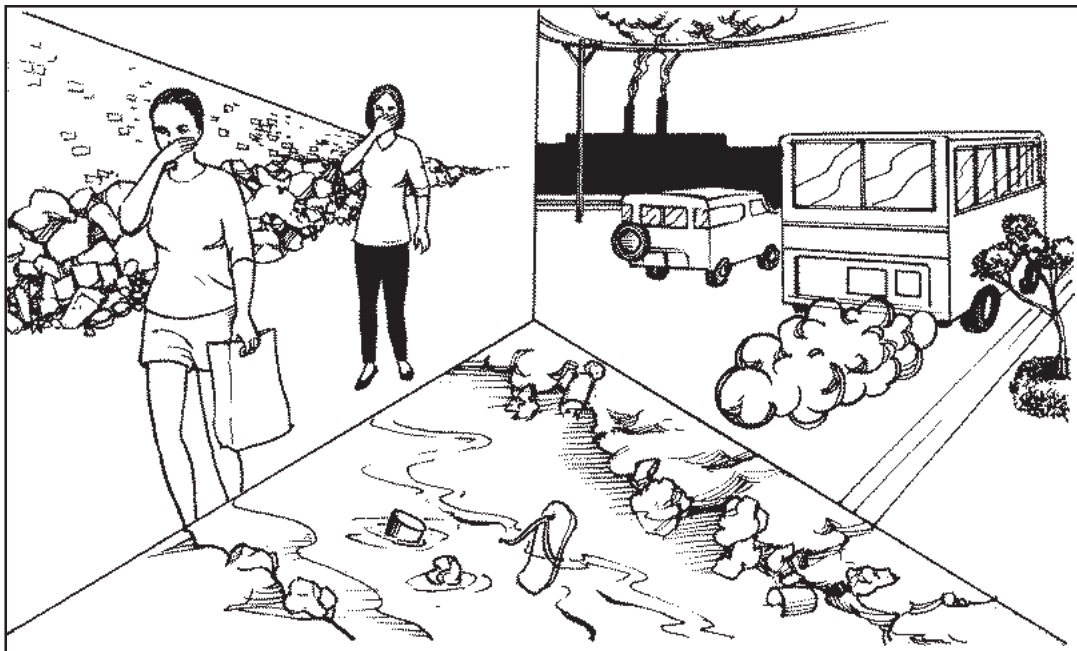
Do you know the different activities of man that adversely affect the environment?

A list of some of these activities is given below. Read on to find out.

Pollution

Pollution is defined as the adverse effect on the natural environment including human, animal or plant life of a harmful substance that does not occur naturally (industrial and radioactive waste) or the concentration to harmful levels of a naturally occurring substance (nitrates).

The illustration below shows a typical scene in various urban areas in our country today. What can you say about it?



A typical scene in various urban areas today

There are three types of pollution. These are:

1. **Air pollution**—the contamination of the air with noxious substances such as vehicle exhaust fumes, by-products from industrial processes, etc.

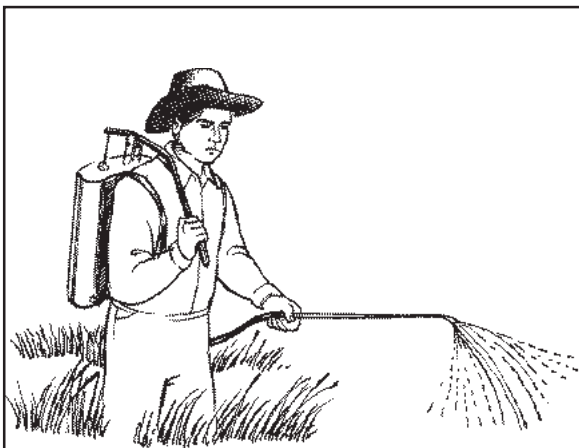
The following are some causes of air pollution:

a.



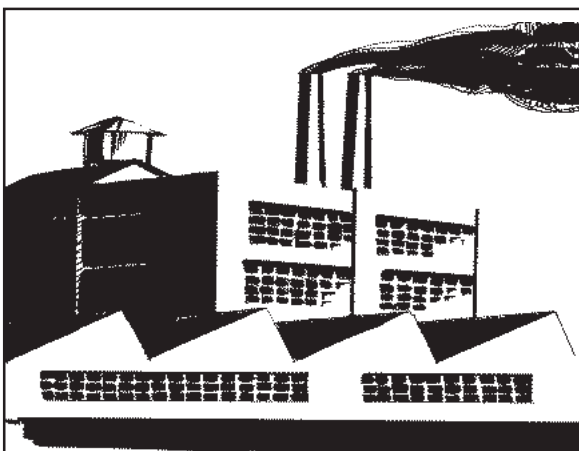
Smoke from vehicles

b.



Chlorofluorocarbons or **CFCs** (chemical compounds composed of chlorine, fluorine and carbon formerly widely used as aerosol propellants and refrigerants but now banned by many countries as a result of concern about the damaging effects on the ozone layer)

c.



Smoke from factories and other industrial plants

Air pollution can lead to even greater problems. These include ozone depletion and global warming.

The **ozone layer** is a layer of the upper atmosphere between 15 and 30 km above the earth's surface where ozone filters harmful ultraviolet radiation from the sun and prevents it from reaching the earth is formed. Using harmful chemicals like CFCs can deplete the ozone layer and thus cause numerous environmental problems. It can even lead to **global warming**, a gradual increase in the average temperature of the earth's surface and its atmosphere which has been attributed to the greenhouse effect. The **greenhouse effect** refers to the warming of the earth's surface as result of the trapping of long-wave radiation by carbon dioxide, ozone and certain other gases in the earth's surface. Global warming can cause radical climatic and temperature changes which can ultimately lead to the melting of the polar ice caps and flooding in low-lying areas.

2. **Land pollution**—refers to the contamination of land with harmful substances.

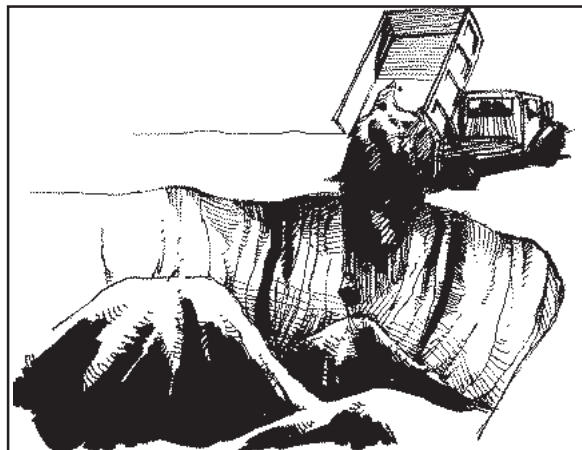
The following are some causes of land pollution:

a.



Dumping of toxic waste materials

b.

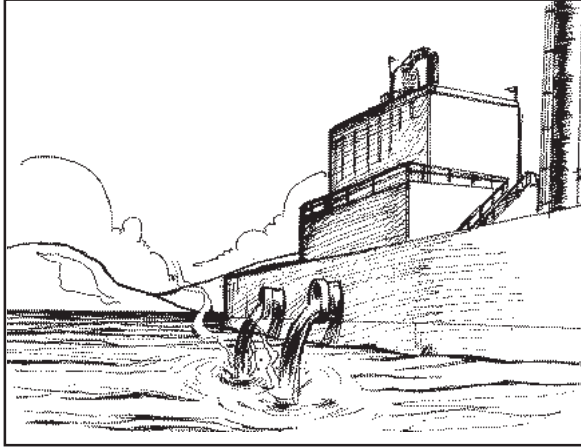


Landfill seepage

3. **Water pollution**—refers to the contamination of any body of water with industrial wastes, sewage and other materials that are considered to be detrimental to living organisms.

The following are some of the causes of water pollution:

a.



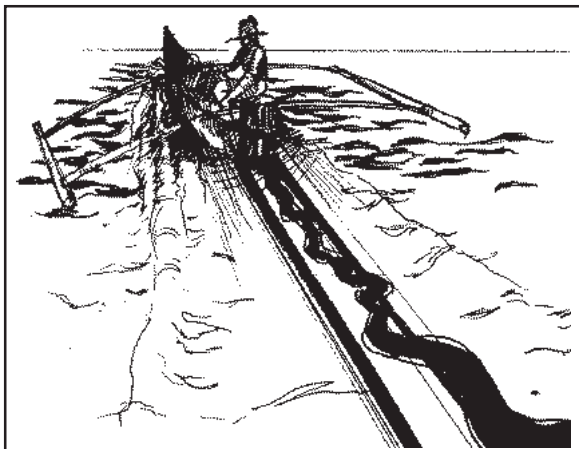
Dumping of industrial wastes

b.



Improper disposal of garbage

c.



Oil from defective water vehicles

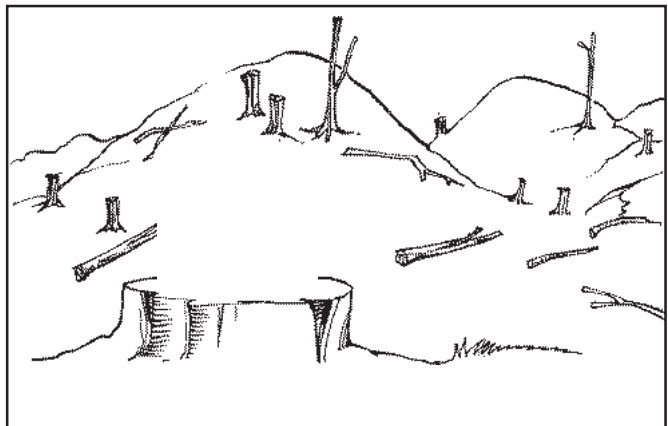
Forest Denudation

Forest denudation or **deforestation** can be caused by the following practices:

1. **Kaingin farming**—also known as slash-and-burn farming involves cutting down trees then replanting crops on the land where the trees were once planted.



2. **Illegal logging**—the practice of cutting down lots of trees without replacing them.

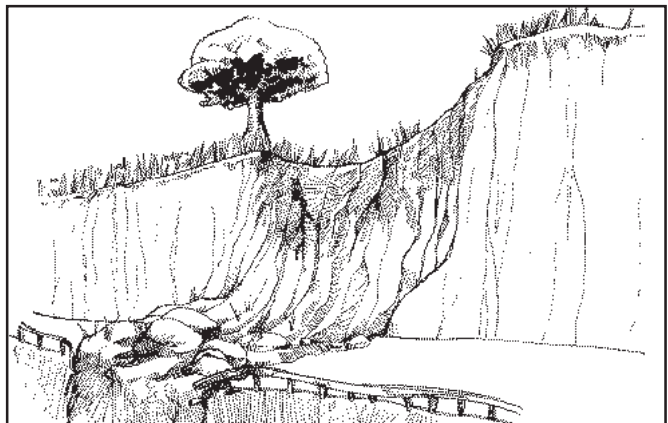


Erosion

Erosion is the loosening, fragmentation and transport of rock materials by water, wind, ice, gravity or living organisms including human activity from one place to another.

This can be caused by the following:

1. Forest denudation or deforestation;
2. Conversion of agricultural lands into residential subdivisions, commercial sites, etc.;
3. Mining activities; etc.

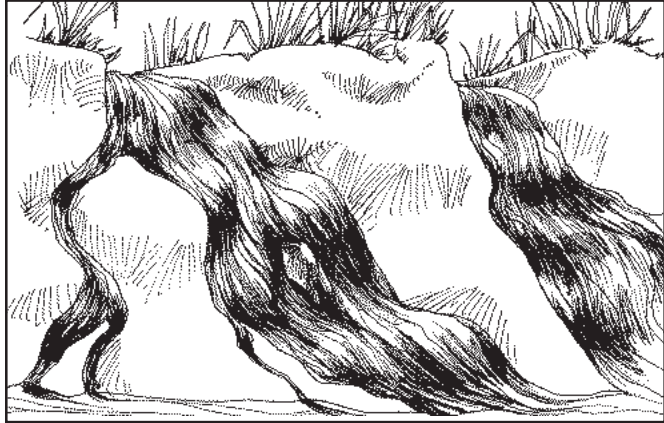


Siltation

Siltation is the process that contributes tiny soil particles to water bodies through natural and human-induced erosion.

The following are some of the causes of siltation:

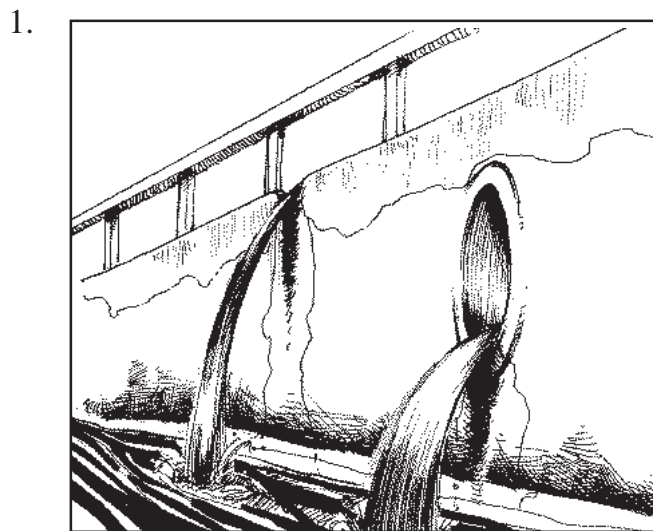
1. **agriculture**—The processes involved in farming can loosen the topsoil of agricultural lands which can lead to erosion and later on siltation;
2. natural sources, for example, runoff;
3. **channelization**—the process of building dams and waterways; and
4. mining.



Eutrophication

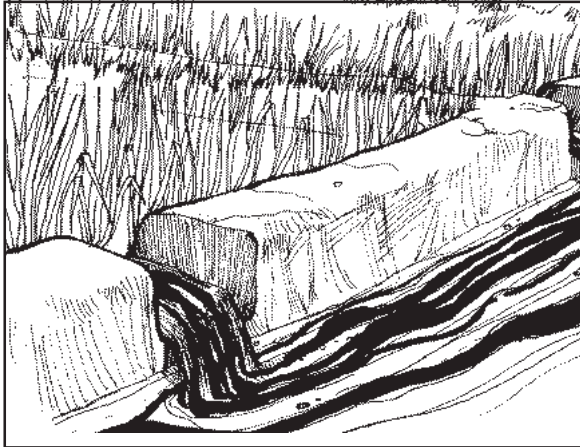
Eutrophication is the process wherein a body of water becomes overenrich with nutrients from sewage disposal and runoff of agricultural fertilizers, etc. which results in overgrowth of algae and depleted oxygen levels in the water leading to the death of aquatic animals.

The following are some of the causes of eutrophication:



improper sewage disposal; and

2.



runoff of agricultural fertilizers.

Wildlife Destruction

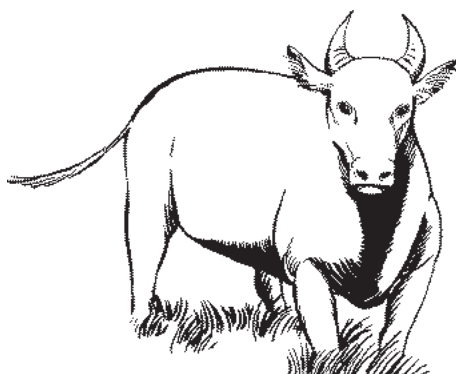
Are you familiar with the animals in the illustration below? Have you ever seen any one of them before?



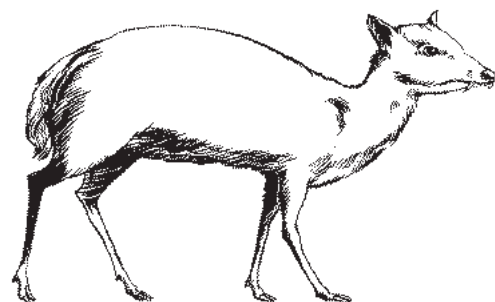
Pawikan



Philippine eagle



Tamaraw



Mouse deer

Near-extinct wildlife in the Philippines

What does “wildlife” mean?

Wildlife refers to wild animals, birds and plants in general.

Do you know what “endangered species” are?

Endangered species are plant and animal species that are in danger of extinction in the near future either because their populations have fallen to very low levels or because they only occur naturally in a few restricted areas. Examples of these include the pawikan, Philippine or monkey-eating eagle, tamaraw and mouse deer.

The following are some of the causes of widespread wildlife destruction:

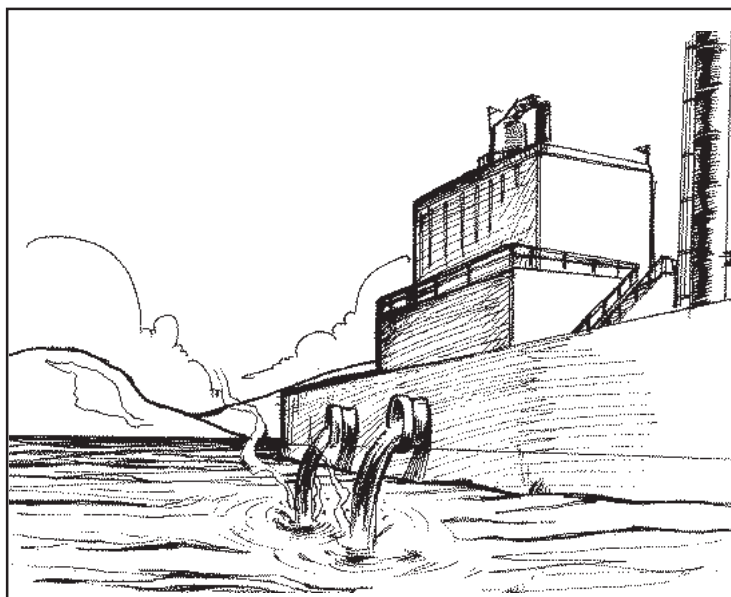
1. transforming their natural habitat into parks and sites for commercial centers;
2. game hunting; and
3. deforestation.

Radiation Fallouts and Leaks

A **radiation fallout** occurs when a cloud of radioactive dust scatters to nearby places after a nuclear explosion. An example of this is the Chernobyl accident in Russia. This fallout caused incidences of gastrointestinal diseases and thyroid cancer.

Radiation leaks, on the other hand, occur when a liquid, gas, etc. passes in or out of a/an chemical/industrial plant accidentally. An example of such occurrence is the radiation leak in Samut, Prakan, Thailand on February 27, 2000. Hundreds of people were diagnosed with immune system syndrome. They developed white blood cell deficiency.

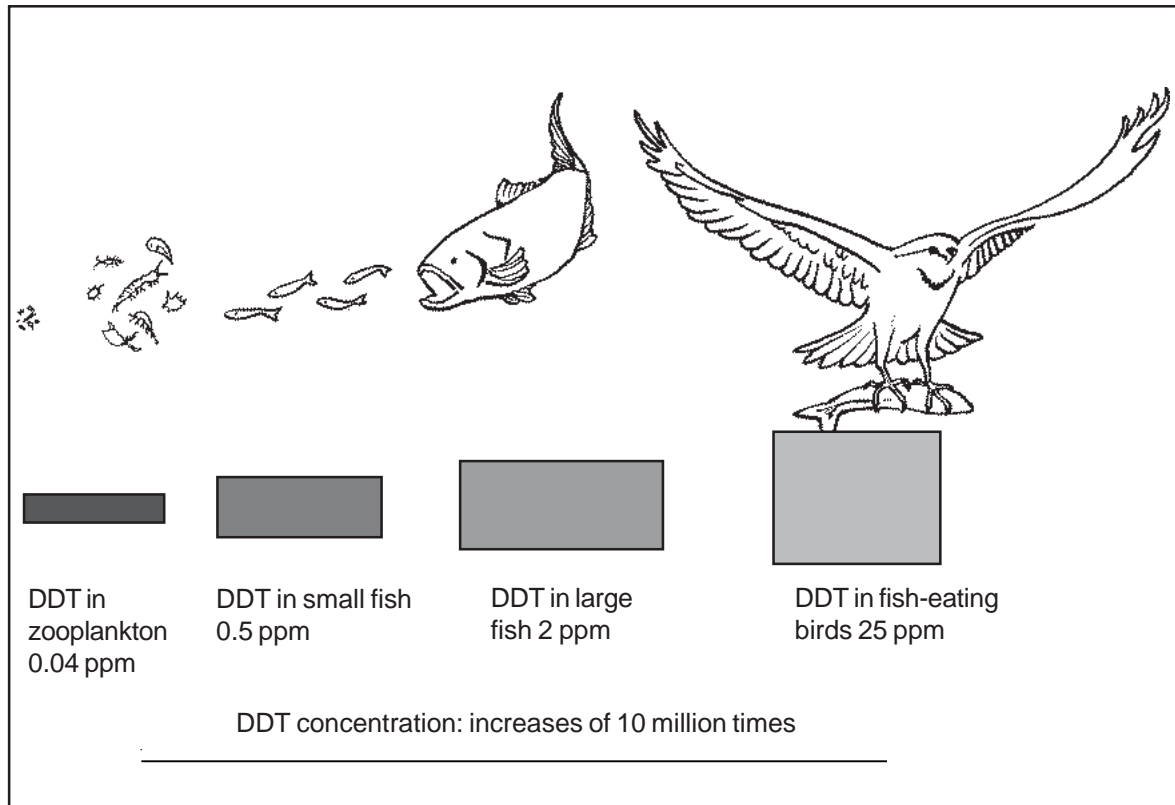
Radiation fallouts and leaks include poor maintenance of nuclear plants and improper disposal of wastes.



Biological Magnification

Biological magnification is the process by which substances such as pesticides or heavy metals become concentrated as they move up the food chain.

Look at the following food chain then the explanation given below to understand how biological magnification occurs.



Biological magnification of DDT in a food chain

Source: Campbell, et al. *Biology*. California U.S.A., Addison, Wesley, Longman, Inc.

Based on the diagram above, what can you infer about biological magnification?

The given diagram shows us how **DDT** (dichlorodiphenyltrichloroethane) can affect the organisms in a food chain. DDT is a highly toxic chemical compound formerly widely used as an insecticide. But use of it has been banned in most countries due to extensive pollution of the environment resulting from its use. DDT-containing pesticides that somehow made it to a body of water magnifies in terms of effects as it moves from a lower-order consumer to a higher-order consumer and so on up the food chain. As can be seen, the DDT concentration in the first-order consumer (zooplankton) is lower (0.04 ppm) than that in the second-order consumer (small fish—0.5 ppm). And that of the second-order consumer is lower than that of the third-order consumer (large fish—2 ppm). Then finally, that of the third-order consumer is lower than that of the fourth-order consumer (fish-eating bird—25 ppm). This implies that the effects of DDT on each level of consumer will be magnified in value as you go up the food chain—that the higher the consumer is in the food chain, the worse off it will be.



Let's Think About This

After reading about the causes of the ecological problems that we may experience, give at least three ways on how you think people can affect their surroundings.

Compare your answers with the samples given in the *Answer Key* on page 47. Did you get similar answers? If you did, that's good! If you didn't, don't worry. Just consult your Instructional Manager or Facilitator if you are not sure of your answers.



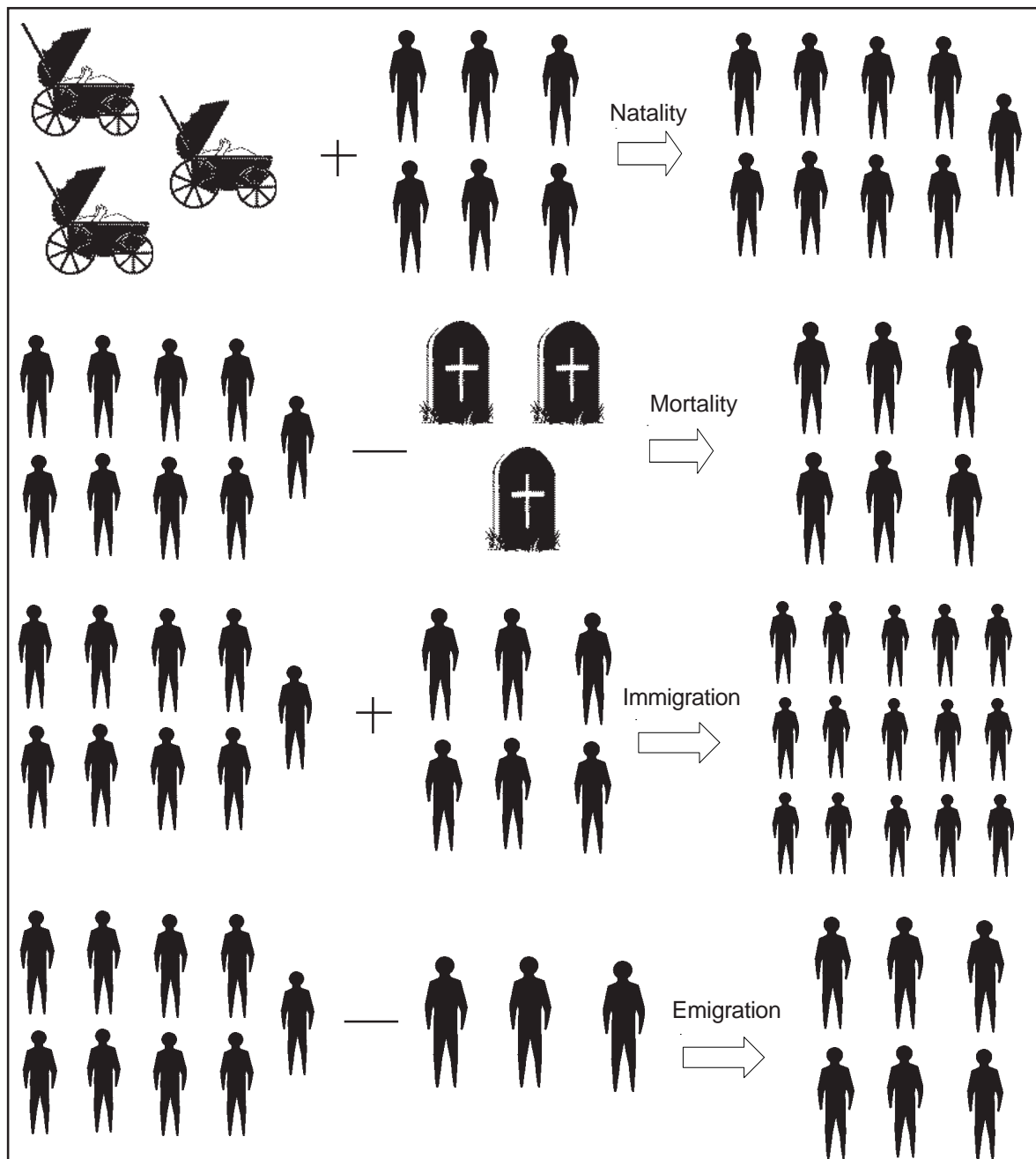
Let's Learn

Do you know how we can affect our environment? What does the term “population” mean?

Population refers to all the people/organisms living in a particular country/area, etc. It can be affected by four different factors:

1. **Natality rate**—refers to the number of organisms being born at a given period of time in a certain locality.
2. **Mortality rate**—refers to the number of organisms that die at a given period of time in a certain locality.
3. **Immigration rate**—refers to the number of organisms that move into a certain locality at a given period of time.
4. **Emigration rate**—refers to the number of organisms that move out of a certain locality at a given period of time.

Look at the following diagram to get a clearer idea on how these four can affect a locality's population.



Factors that affect population

Based on the given diagram, natality and immigration add to the population of a certain place at a given time. On the other hand, mortality and emigration reduce the population of a certain place at a given period of time.

What does this imply then? Does this have any effect on our environment at all?

Of course, it does! Remember our lesson on biological magnification? If the population of a certain place increases, there will automatically be an increase in the demand for food as well. And as the demand for food increases, the supply should also increase. As the producers of food adjust to keep up with the demand, they will be forced at times to engage in activities that may cause an imbalance in nature.



Let's Think About This

What do you think is the best way for us to help maintain the balance in nature? List down at least three ways to do this below.

Compare your answers with the sample answers in the *Answer Key* on page 47. Did you get similar answers? If you did, that's good! If you didn't, don't worry. The answers to this activity may vary. You may consult your Instructional Manager or Facilitator if you are not sure of your answers.

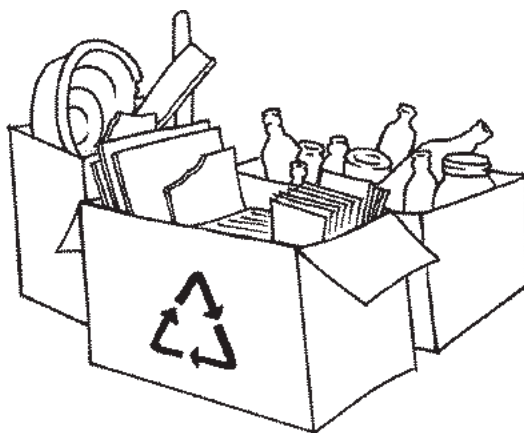
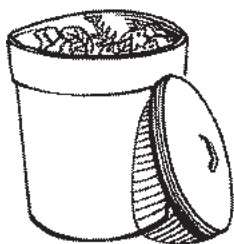


Let's Study and Analyze

Are you familiar with the most recent project of the Environmental Management Bureau on recycling?

Observe the sample poster on page 37. Then answer the following questions briefly.

Reduce Wastes—Learn How t



BIODEGRADABLE

Put the following in a covered container:

- fruit and vegetable peelings
- food leftovers
- eggshells
- animal manure
- grass, tree branches, etc.

RECYCLABLE

Put the following in a separate container (not necessarily covered):

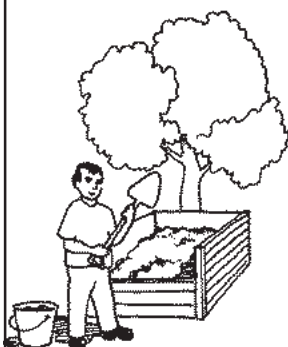
- pieces of paper and cardboard
- scrap metal and old plastic containers, etc.

DISPOSABLE

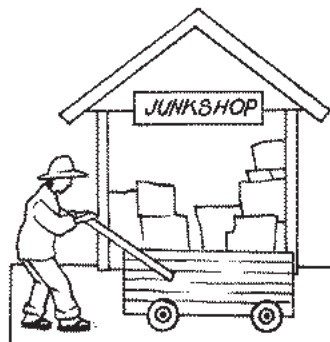
Put the following in a plastic bag or separate container:

- sanitary napkins
- diapers
- pieces of cloth (old rags)
- old figurines
- candy wrappers, Styrofoam containers, etc.

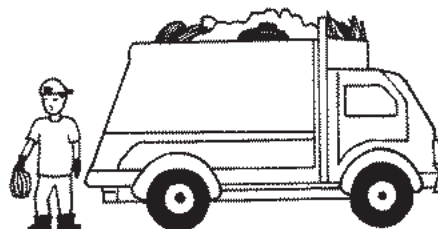
Make your own compost pit in your own backyard where you can bury these.



Sell these to junk shops through *bote-diyaryo* collectors.



Wait for a garbage truck which will take your trash to a designated dumpsite.



The recycling program of the Environmental Management Bureau

1. What are biodegradable wastes? Why are they better composted instead of being carted off to designated dumpsites?

2. What are recyclable materials? Why are they brought to recycling centers instead of being thrown in dumpsites?

3. What are disposable wastes? Why are they dumped in landfills instead of being composted or recycled?

Compare your answers with those in the *Answer Key* on page 48. Did you get similar answers? If you did, that's good! If you didn't, don't worry. The answers to this activity may vary. If you are not sure if your answers are right, consult your Instructional Manager or Facilitator.



Let's Try This

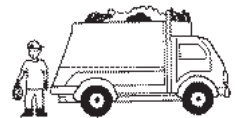
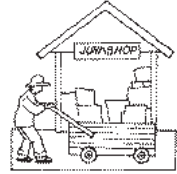
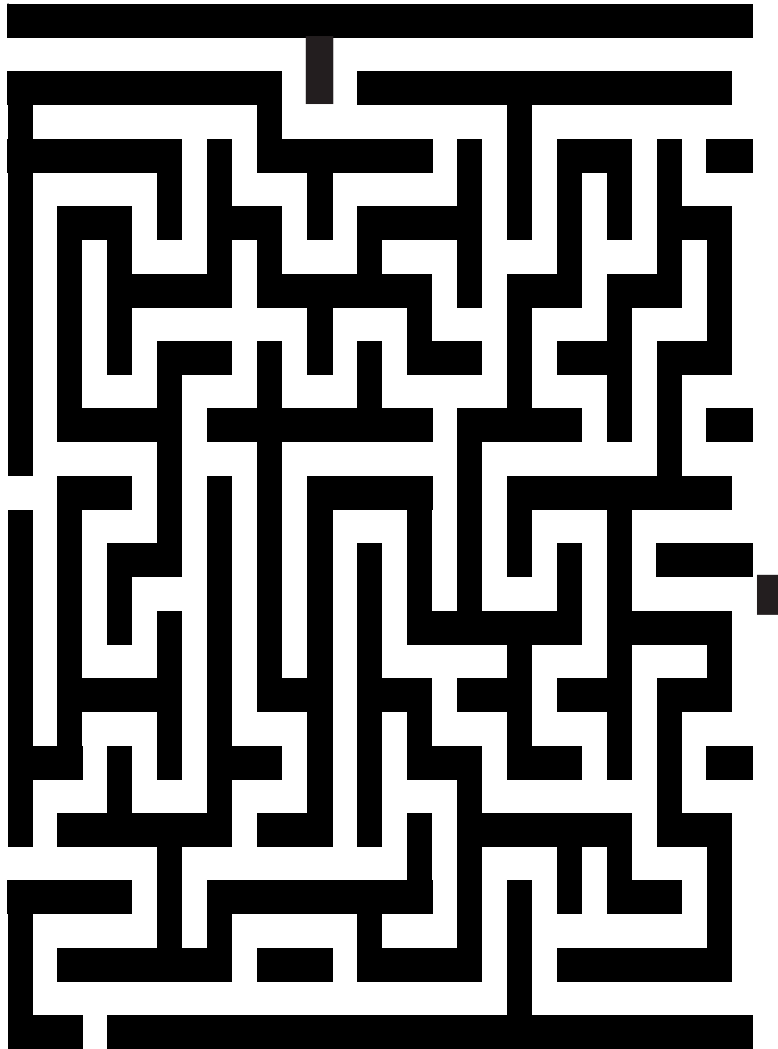
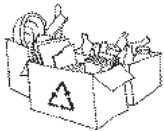
Recall the ways you suggested on how you can maintain balance in nature. Then together with your family or friends make an action plan based on this. Try as much as possible to carry out your plan.

Afterward, tell your Instructional Manager or Facilitator or one of your co-learners about the outcome of your project. Encourage other people in your community to do the same. This way, you will be able to contribute in maintaining a well-balanced ecosystem for future generations.



Let's See What You Have Learned

Complete the maze below by putting the different kinds of wastes in their proper containers.



Compare your completed maze with the one given in the *Answer Key* on page 48. Were you able to put things where they belong? If you did, that's very good. That means you learned a lot from the lesson. If you didn't, don't worry. That means you need more practice in classifying wastes properly. Just review the parts of the lesson you didn't understand very well before going to the next part of the module.



Let's Remember

- ◆ **Pollution** is the adverse effect on the natural environment including human, animal or plant life of a harmful substance that does not occur naturally or the concentration to harmful levels of a naturally occurring substance.
- ◆ **Chlorofluorocarbons** are chemical compounds composed of chlorine, fluorine and carbon formerly widely used as aerosol propellants and refrigerants but now banned by many countries as a result of concern about the damaging effects on the ozone layer.
- ◆ The **ozone layer** is a layer of the upper atmosphere between 15 and 30 km above the earth's surface where ozone which filters harmful ultraviolet radiation from the sun and prevents it from reaching the earth is formed.
- ◆ **Global warming** is the gradual increase in the average temperature of the earth's surface and its atmosphere which has been attributed to the greenhouse effect.
- ◆ The **greenhouse effect** refers to the warming of the earth's surface as a result of the trapping of long-wave radiation by carbon dioxide, ozone and certain other gases in the earth's surface.
- ◆ **Erosion** refers to the loosening, fragmentation and transport of rock materials by water, wind, ice, gravity or living organisms including human activity from one place to another.
- ◆ **Siltation** is the process that contributes tiny soil particles to water bodies through natural and human-induced erosion.
- ◆ **Eutrophication** is the process wherein a body of water becomes overenriched with nutrients from sewage disposal and runoff of agricultural fertilizers, etc. which results in overgrowth of algae and depleted oxygen levels in the water leading to the death of aquatic animals.
- ◆ **Biological magnification** is the process by which substances such as pesticides or heavy metals become concentrated as they move up the food chain.

Well, this is the end of the module! Congratulations for finishing it. Did you like it? Did you learn anything useful from it? A summary of its main points is given on the next page to help you remember them better.



Let's Sum Up

This module tells us that:

- ◆ An **ecosystem** refers to a community of living things and their relationships to their surroundings.
- ◆ **Biotic** refers to the living organisms in an ecosystem while **abiotic** refers to the nonliving things in it.
- ◆ A **food chain** is a sequence of organisms arranged in such a way that each feeds on the organism before it in the chain while a **food web** is an interlocking pattern formed by a series of food chains.
- ◆ **Photosynthesis** is the process wherein green plants produce carbohydrates from carbon dioxide and water using light energy from sunlight and chlorophyll.
- ◆ **Respiration** is the biological process in which carbohydrates are broken down in the presence of oxygen into carbon dioxide and water.
- ◆ **Fixation** refers to the conversion of a chemical substance into a form that does not evaporate.
- ◆ **Assimilation** and **biosynthesis** are responsible for the manufacture of complex organic compounds from simple molecules obtained from the environment.
- ◆ **Ammonification** is the process of converting nitrogenous residues to ammonia.
- ◆ **Nitrification** is the process of converting or being converted into nitrates or nitrites, through the action of bacteria.
- ◆ **Leaching** refers to washing a soluble substance out (of a solid) by allowing a suitable liquid solvent to percolate through it.
- ◆ **Denitrification** is the process wherein bacteria convert nitrates or nitrites to N_2 and some nitrous oxides (NO_2^-).
- ◆ **Evaporation** is the process wherein water changes from its liquid state to a gaseous state.
- ◆ **Condensation** is the process wherein a gas is changed into liquid.
- ◆ **Precipitation** occurs when the small droplets of water in clouds form larger droplets.

- ◆ **Surface runoff** refers to the water that returns to earth as precipitation runs off the surface of the land and flows downhill into streams, rivers, ponds and lakes.
- ◆ **Infiltration** is the process wherein rainwater soaks into the ground, through the soil and into underlying rock layers.
- ◆ **Transpiration** is the process of evaporation through plant leaves.
- ◆ **Pollution** is the adverse effect on the natural environment including human, animal or plant life of a harmful substance that does not occur naturally or the concentration to harmful levels of a naturally occurring substance.
- ◆ **Chlorofluorocarbons** are chemical compounds composed of chlorine, fluorine and carbon formerly widely used as aerosol propellants and refrigerants but now banned by many countries as a result of concern about the damaging effects on the ozone layer.
- ◆ The **ozone layer** is a layer of the upper atmosphere between 15 and 30 km above the earth's surface where ozone which filters harmful ultraviolet radiation from the sun and prevents it from reaching the earth is formed.
- ◆ **Global warming** is the gradual increase in the average temperature of the earth's surface and its atmosphere which has been attributed to the greenhouse effect.
- ◆ The **greenhouse effect** refers to the warming of the earth's surface as a result of the trapping of long-wave radiation by carbon dioxide, ozone and certain other gases in the earth's surface.
- ◆ **Erosion** refers to the loosening, fragmentation and transport of rock materials by water, wind, ice, gravity or living organisms including human activity from one place to another.
- ◆ **Siltation** is the process that contributes tiny soil particles to water bodies through natural and human-induced erosion.
- ◆ **Eutrophication** is the process wherein a body of water becomes overenriched with nutrients from sewage disposal and runoff of agricultural fertilizers, etc. which results in overgrowth of algae and depleted oxygen levels in the water leading to the death of aquatic animals.
- ◆ **Biological magnification** is the process by which substances such as pesticides or heavy metals become concentrated as they move up the food chain.



What Have You Learned?

Answer the following questions briefly.

1. Give three biotic processes/practices that can upset the balance in nature. Then explain how each of them does this.

- a. _____

- b. _____

- c. _____

2. Give three abiotic processes/practices that can upset the balance in nature. Then explain how each of them does this.

- a. _____

- b. _____

- c. _____

3. Give three ways by which man can upset the balance in nature. Then explain how each is done.

- a. _____

- b. _____

- c. _____

4. List down three ways by which you can help avoid upsetting the balance in nature.

- a. _____

- b. _____

- c. _____

Compare your answers with those in the *Answer Key* on page 49. Did you get a perfect score? If you did, that's very good! If you didn't, don't worry. The answers to the activity above may vary. If you are not sure if your answers are right, just consult your Instructional Manager or Facilitator.



Answer Key

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

1. predator
2. True
3. consumer
4. True
5. deforestation
6. True
7. True
8. siltation
9. True
10. True

B. Lesson 1

Let's Try This (page 6)

- a. Abiotic components: soil, sun, air
- b. Producers: plants
- c. Primary consumers: small fish
- d. Secondary consumers: big fish
- e. Tertiary consumer: man
- f. Decomposers: bacteria and fungi

Let's Study and Analyze (page 7)

1. plant
2. grasshopper
3. frog
4. snake
5. hawk

Let's Try This (page 10)

1. The snake population increases as the rat population increases. This is because an increase in the rat population means more food for the snakes and so the snake population also increases.
2. Because there was a decrease in the rat population, there was also a decrease in the snake population. A decrease in the rat population would mean less food for the snakes and therefore there is also a decrease in its population.

Let's Try This (pages 13–14)

1. tree
2. photosynthesis
3. carabao
4. respiration
5. carbon dioxide

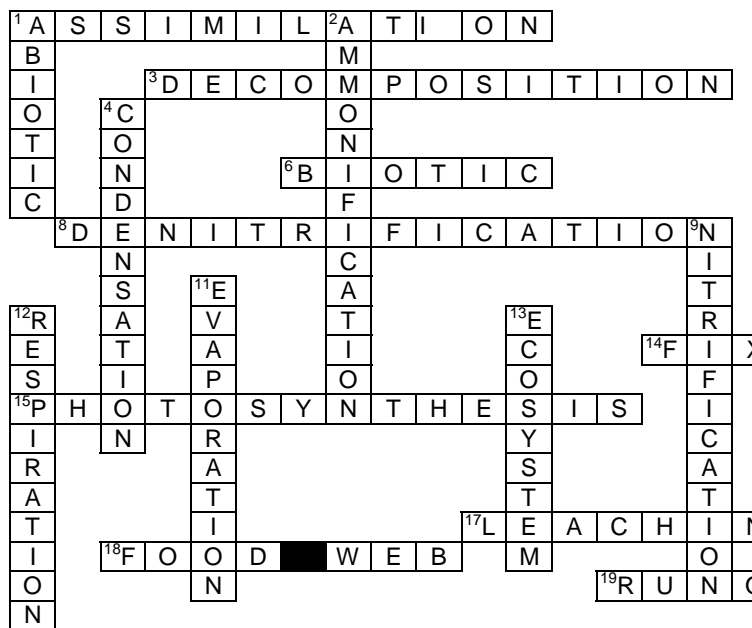
Let's Try This (page 16)

1. assimilation
2. biosynthesis
3. fixation
4. decomposition
5. ammonification
6. nitrification
7. denitrification

Let's Review (page 19)

1. **(c)**
2. **(b)**
3. **(e)**
4. **(f)**
5. **(a)**
6. **(d)**

Let's See What You Have Learned (pages 20–21)



C. Lesson 2

Let's Think About This (page 34)

Possible answer:

People can affect their surroundings in many ways both positively and negatively. They can affect it positively by keeping their surroundings clean and green so that they wouldn't disturb the balance in nature. They can disturb the balance in nature, on the other hand, by engaging in practices such as illegal logging, kaingin farming, improper waste disposal and so on.

Let's Think About This (page 36)

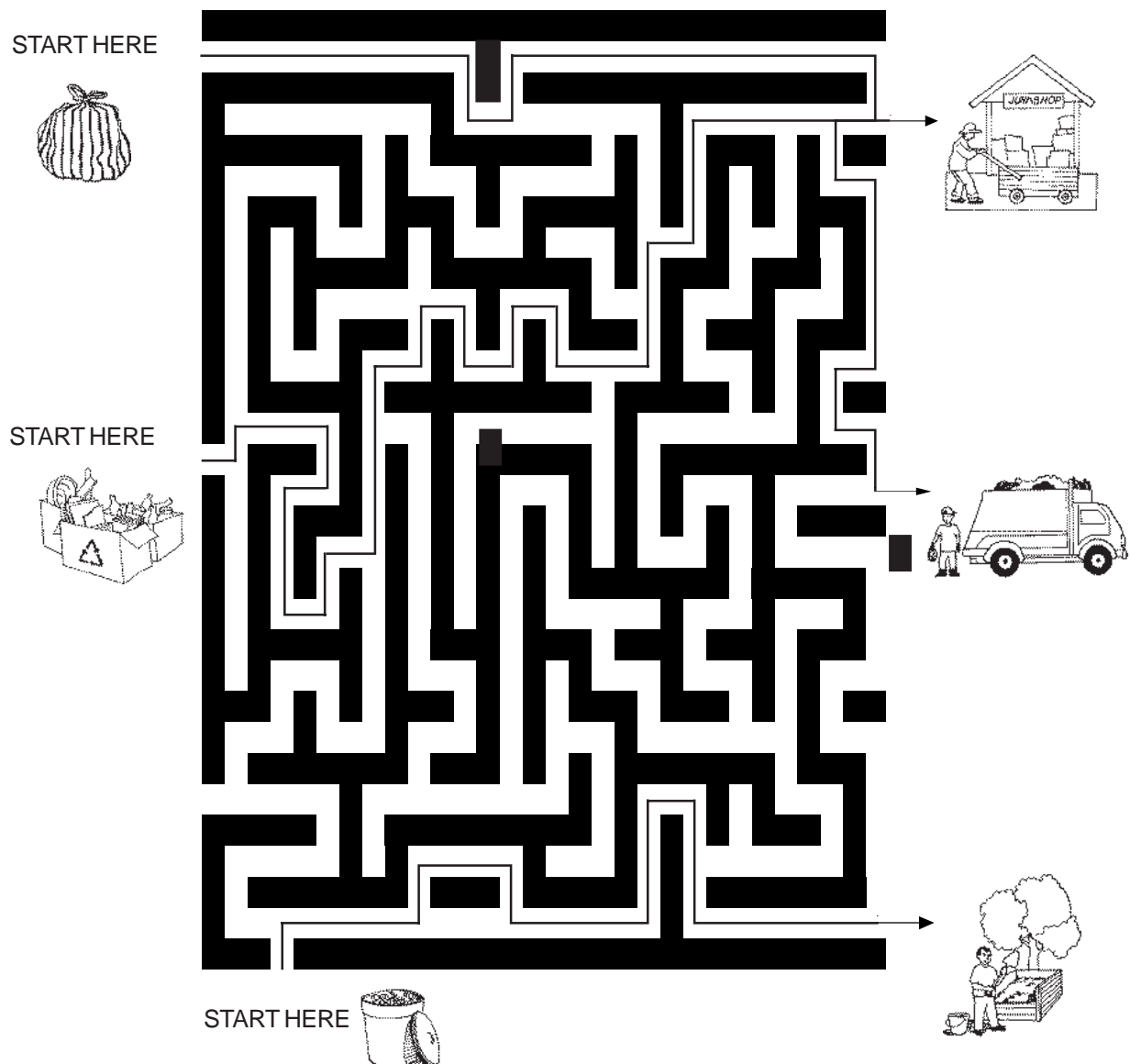
Possible answers:

1. Keeping our surroundings clean.
2. Planting trees and other plants in our yards or in vacant lots.
3. Engaging in projects like "Piso Para sa Pasig," etc.

Let's Study and Analyze (pages 36–38)

1. Biodegradable wastes are wastes that are capable of being broken down by bacteria, fungi or other living organisms so that its constituents are released and can be recycled. They are composted instead of being brought to dump sites because they would just add to the garbage pile otherwise.
2. Recyclable materials are materials that can be reused. They are brought to recycling centers instead of dump sites so that they would not add to the constantly worsening garbage problem we are already facing at present.
3. Disposable materials are nonbiodegradable materials and those that cannot be recycled or reused. They are taken to landfills so that they would not accumulate in the streets. These can neither be put in compost pits nor recycled.

Let's See What You Have Learned (page 39)



C. What Have You Learned? (pages 43–44)

Possible answers:

1.
 - a. Overpopulation—The more organisms there are in an ecosystem, the less food each will have thereby forcing them to engage in practices that can adversely affect the balance in nature.
 - b. Eutrophication—An overgrowth of algae in a pond, for example, can cause an imbalance in nature.
 - c. Improper disposal of garbage—This results in pollution which can also adversely affect our environment.
2.
 - a. Erosion—This can change the composition of soil in certain areas and thereby cause an imbalance in nature.
 - b. Siltation—This can cause changes in bodies of water that can further on lead to an imbalance in nature as well.
 - c. Global warming—This can lead to temperature and even climatic changes and later on to an imbalance in nature as well.
3.
 - a. Improper disposal of garbage—This can clog our drainage systems and lead to flooding in low-lying areas.
 - b. Using pesticides in farming—This can kill harmless organisms as well as pests resulting in an imbalance in nature.
 - c. Using insecticides that contain CFCs—This can damage our ozone layer and cause even worse problems.
4.
 - a. Keep my surroundings clean.
 - b. Segregate wastes.
 - c. Engage in environmental projects like tree-planting activities.



Glossary

Abiotic Refers to nonliving things such as the air, sunlight, etc.

Air pollution The contamination of the air with noxious substances.

Ammonification The process of converting nitrogenous residues to ammonia.

Assimilation Along with **biosynthesis**, is the manufacture of complex organic compounds from simple molecules obtained from the environment.

Biological magnification The process by which substances such as pesticides or heavy metals become concentrated as they move up the food chain.

Biotic Refers to living things like plants and animals.

Channelization The process of building dams and waterways.

Chlorofluorocarbon More commonly known as **CFC**, a chemical compound composed of chlorine, fluorine and carbon formerly widely used as an aerosol propellant and refrigerant but now banned by many countries as a result of concern about its damaging effects on the ozone layer.

Chlorophyll The green pigment found in the leaves of plants.

Condensation The process wherein a gas is changed into liquid.

Covalent bond A chemical bond in which two atoms are held together by sharing a pair of electrons between them.

Cyanobacteria Blue-green algae.

Decomposition The process wherein materials/substances decay.

Denitrification The process of releasing nitrogen into the air.

Dichlorodiphenyltrichloroethane Also known as DDT, a highly toxic chemical compound formerly widely used as an insecticide but use of which is now restricted or banned in most countries due to extensive pollution of the environment resulting from its use.

Ecosystem A community of living things and their relationships to their surroundings.

Emigration rate The number of organisms that move out of a certain locality at a given period of time.

Endangered species Plant and animal species that are in danger of extinction in the near future either because their populations have fallen to very low levels or because they only occur naturally in a few restricted areas.

Erosion The loosening, fragmentation and transport of rock materials by water, wind, ice, gravity or living organisms including human activity from one place to another.

Eutrophication The process wherein a body of water becomes overenrich with nutrients from sewage disposal and runoff of agricultural fertilizers, etc. which results in overgrowth of algae and depleted oxygen levels in the water leading to the death of aquatic animals.

Evaporation The process where a liquid changes from its liquid state to a gaseous state.

Fixation The conversion of a chemical substance into a form that does not evaporate.

Food chain A sequence of organisms arranged in such a way that each feeds on the organism before it in the chain.

Food web The interlocking pattern formed by a series of interconnected food chains.

Forest denudation Deforestation.

Global warming A gradual increase in the average temperature of the earth's surface and its atmosphere which has been attributed to the greenhouse effect.

Greenhouse effect The warming of the earth's surface as a result of the trapping of long-wave radiation by carbon dioxide, ozone and certain other gases in the earth's surface.

Groundwater Water that remains underground.

Illegal logging The practice of cutting down lots of trees without replacing them.

Immigration rate The number of organisms that move into a certain locality at a given period of time.

Infiltration The process wherein rainwater soaks into the ground, through the soil and into underlying rock layers.

Kaingin farming Also known as **slash-and-burn farming**, which involves cutting down trees then replanting crops on the land where the trees were once planted.

Land pollution The contamination of land with harmful substances.

Leaching Washing a soluble substance out of a solid by allowing a suitable liquid solvent to percolate through it.

Macroalgae Large algae.

Mortality rate The number of organisms that die at a given period of time in a certain locality.

Natality rate The number of organisms being born at a given period of time in a certain locality.

Nitrification The process of converting or being converted into nitrates or nitrites through the action of bacteria.

Ozone layer A layer of the upper atmosphere between 15 and 30 km above the earth's surface where ozone which filters harmful ultraviolet radiation from the sun and prevents it from reaching the earth is formed.

Photosynthesis The process wherein green plants produce carbohydrates from carbon dioxide and water using light energy from sunlight and chlorophyll.

Phytoplankton Microscopic plants.

Pollution The adverse effect on the natural environment including human, animal or plant life of a harmful substance that does not occur naturally or the concentration to harmful levels of a naturally occurring substance.

Population All the people/organisms living in a particular place.

Precipitation The process wherein the small droplets of water in the clouds form larger droplets.

Predator An animal that obtains food by killing and eating other animals.

Prey An animal hunted as food by another animal.

Radiation fallout Occurs when a cloud of radioactive dust scatters to nearby places after a nuclear explosion.

Radiation leak Occurs when a liquid, gas, etc. passes in or out of a chemical/ industrial plant accidentally.

Respiration A biological process in which carbohydrates are broken down in the presence of oxygen into carbon dioxide and water and in which chemical energy is released.

Siltation The process that contributes tiny soil particles to water bodies through natural and human-induced erosion.

Surface runoff When water returns to earth as precipitation then runs off the surface of the land and flows downhill into streams, rivers, ponds and lakes.

Terrestrial Relating to dry land.

Transpiration The process of evaporation through plant leaves.

Water cycle A complex process that not only gives us water to drink and fish to eat but also weather patterns that help us grow crops.

Water pollution The contamination of any body of water with industrial wastes, sewage and other materials that are considered to be detrimental to living organisms.

Wildlife Refers to wild animals, birds and plants in general.



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