

Getting Ready...

- How can we grow more food to feed the growing human population?
- How do human activities affect the nitrogen and carbon cycles?
- In what ways does technology negatively affect the environment?
- What happens to the things you throw in the garbage?

**Science Log**

Recall what you know about protecting the environment. Try to answer the Getting Ready questions. When you finish this chapter, review your answers. Make any changes based on what you learn.

Throughout this unit, you have seen photographs of life in early Alberta. You may have noticed that fewer people lived in the province 100 years ago. At that time, Alberta seemed to have huge amounts of natural resources. Wastes seemed to disappear. Today, this is no longer true.

In the past 100 years, the human population has increased dramatically. More people require more food, but there is no more land suitable for farming. More people use more energy. In Alberta, we burn fossil fuels such as natural gas, oil, and coal

for our energy. More people demand more goods, so our modern technology produces and invents more.

As we use more energy and food, we destroy natural habitat, which affects other organisms. Our energy use and our technology have also changed the environment in ways that people could not have predicted.

In this chapter, you will see how human activities have changed the flow of matter and energy in the environment. You will also realize that we now discard too much waste.

Environment



What You Will Learn

In this chapter you will learn:

- that some waste items are biodegradable while others are non-biodegradable
- how technologies designed to produce more food and energy have affected the environment
- how technologies designed to improve human lives have affected the environment
- how reducing waste also reduces the amount of energy we use

Why It Is Important

- As our population grows, it makes greater demands on Earth's environment. We need more food and energy. We demand more products and produce more wastes. By learning about how humans affect the environment, you will discover how you can help planet Earth.

Skills You Will Use

In this chapter you will:

- investigate to determine if wastes are biodegradable
- investigate to determine if fertilizer affects plant growth
- examine the relationships among fossil fuels, carbon dioxide in the atmosphere, and global warming
- determine how technology can affect the environment
- investigate the importance of recycling waste products

Starting Point



Biodegradable vs. Non-biodegradable Materials

A **biodegradable** material is anything that can be broken down by organisms in the environment. Biodegradable substances include anything that was once living, for example, food wastes and paper.

Non-biodegradable materials break down very slowly or not at all. Non-biodegradable materials include plastics, glass, and metals.

Safety Precautions



- Use only items provided by or approved by your teacher.
- Wash your hands and clean up the work area when you complete this activity.

What You Need

assorted items from household and school waste provided by teacher

What to Do



1. As a class, examine the items displayed by the teacher.
2. Use the information provided by your teacher to categorize each item.

What Did You Discover?

1. Explain how biodegradable substances affect the environment.
2. Explain how non-biodegradable substances affect the environment.
3. Describe how your life might be different if your family were personally responsible for taking care of its own garbage.

15.1 Producing More Food

As discussed in Unit C, food provides us with the energy and nutrients we need to live and grow. As the human population increases, more and more food is needed.

Farmers try to grow as much food as they can each year. Since Earth has a limited amount of land suitable for agriculture, farmers have turned to technology to help them grow more food. However, there can be a cost that goes with the benefit of more food.

Scientists have developed two major types of chemicals to help increase food production:

- pesticides and
- synthetic fertilizers.

Pesticides

Pesticides are chemicals that kill or control organisms that humans consider to be pests. These chemicals are grouped according to the kind of organisms they kill. For example, an **insecticide** kills insects. A **herbicide** kills weeds.

Farmers and homeowners use pesticides to kill organisms that eat or compete with their crops or the grass on their lawns. However, pesticides also have negative effects.

READING Check

What is the difference between an insecticide and a herbicide?

Figure 15.1 Scientists estimate that pests destroy 30 percent of the world's food crops. Insecticides can help protect human food supplies by killing pests such as this grasshopper.

Many years ago, people used an insecticide called DDT. It controlled the populations of many harmful insects. Later, people began to notice that the numbers of peregrine falcons, hawks, and ospreys were decreasing. Scientists discovered that the cause was DDT.

Grasshoppers ate grass with DDT on it and they became sick. Mice and rats ate the sick grasshoppers, and the DDT was stored in their bodies. Birds of prey ate the mice and rats, getting the DDT too. The DDT moved through the food chain: from the producers, to the primary consumers, into the secondary consumers, and so on. This process is called **biological magnification**.





Figure 15.2 Weeds such as thistles compete with food crops for water and nutrients. Farmers can increase crop yields by using herbicides to eliminate weed pests from their fields. People living in cities also use herbicides on their lawns to kill dandelions. When people invented pesticides, they did not know that some would be linked to various forms of cancer in humans.



Figure 15.3 The Colorado potato beetle is the most destructive insect pest of potatoes. Farmers control it mainly with insecticides. However, a few insects have a natural **resistance** to the insecticide — it does not kill them. These individuals pass this characteristic on to their offspring, and soon all the pests are resistant. As a result, chemical companies develop new, stronger pesticides to combat resistant pests.

Synthetic Fertilizers

Synthetic **fertilizer** contains plant nutrients such as nitrates. By applying fertilizer to the soil, farmers increase the yield of food crops. They can grow more food on the same amount of land.

On page 250, you examined the nitrogen cycle. Fertilizer, which contains nitrates, can affect the nitrogen cycle. In the following investigation, you will measure how fertilizer affects plant growth.

READING Check ✓

Why do chemical companies create new and stronger pesticides?

Did You Know?

A weed is a plant growing where people do not want it. People have identified over 30 000 species of weeds worldwide.

Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

What are the benefits and costs of using pesticides to control insect pests? To answer these and other questions, go to the above web site, then to **Internet Connects**, **Unit D, Chapter 15**, and then to **Pros and Cons of Pesticides**.

READING Check ✓

Identify one nutrient added to the soil when synthetic fertilizers are applied.

- ☀ Initiating and Planning
- ☀ Performing and Recording
- ☀ Analyzing and Interpreting
- ☀ Communication and Teamwork

Fertilizers and Plant Growth

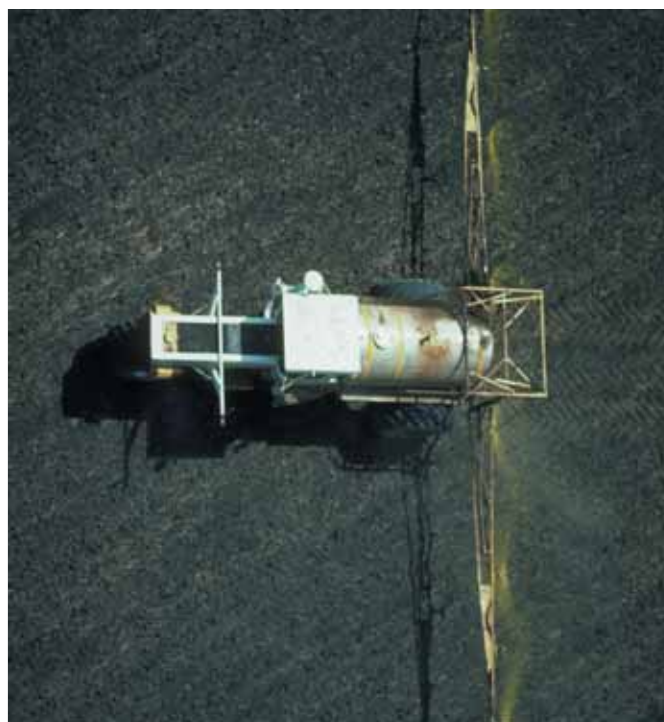
Does more fertilizer *always* improve plant growth? In this investigation, you will compare the growth of algae that are given different amounts of fertilizer. Algae are microscopic producers usually found in aquatic ecosystems. In nature, they are affected by synthetic fertilizers that run off farms, lawns, gardens, and golf courses into ponds and streams.

Problem

How does fertilizer affect plant growth?

Hypothesis

Read the procedure for this investigation and then develop your own hypothesis.



Many farmers use manure as a fertilizer. Manure contains the same nutrients as synthetic fertilizer.

Safety Precautions



- To avoid skin irritation, use rubber gloves when handling fertilizers.
- Follow your teacher's instructions to dispose of fertilizers.
- Clean up spills immediately and inform your teacher.

Apparatus


balance
scoopula
50 mL graduated cylinder
1 L measuring cup
small funnel
grow lamp or bright light source


Materials


5 plastic bottles, such as 2 L soft drink bottles
weighing papers
colourless fertilizer that contains high levels of nitrogen
algae culture or pond water
water
labels
marker

Procedure

- 1 Number the bottles 1 through 5.
- 2 Add 1 L of water to each bottle.
- 3 Use the balance, scoopula, and weighing papers to measure the following amounts of fertilizer. Use the funnel to help you pour them into the appropriate bottle.
 - Bottle 1 is the control — do not add any fertilizer to this bottle.
 - Add 1 g of fertilizer to Bottle 2.
 - Add 3 g of fertilizer to Bottle 3.
 - Add 5 g of fertilizer to Bottle 4.
 - Add 10 g of fertilizer to Bottle 5.
- 4 Rinse the funnel thoroughly with water.
- 5 Gently swirl the contents of each bottle to dissolve the fertilizer.
- 6 After the fertilizer has dissolved, add 10 mL of algae culture to each bottle. Use the cleaned funnel to get the algae culture into each bottle.

 **7** Draw a chart in your Science Log or notebook similar to the one shown below.

 Set the open bottles in a bright location. Observe them every second day for 10 days. Record your observations in your chart.

 Wash your hands and clean up the work area after setting up this investigation.

Bottle	Amount of Fertilizer	Colour on Day 0	Colour on Day 2	Colour on Day 4	Colour on Day 6	Colour on Day 8	Colour on Day 10
1 (control)	0						
2	1 g						
3	3 g						
4	5 g						
5	10 g						

Analyze

1. Which bottle showed the most growth of algae? Which showed the least change?
2. Why is Bottle 1 important for this investigation?

Conclude and Apply

3. From your observations, write a general statement about the effect of fertilizer on plant growth.
4. Read the ingredients on the labels of several different containers of fertilizer. Which three elements are present in the greatest amounts?
5. Suppose someone added a large amount of fertilizer to a lake ecosystem. Suggest what might happen to the populations of
 - (a) producers,
 - (b) consumers, and
 - (c) decomposers.
6. A ranch has a pond in a meadow where cattle graze. Explain why the pond turns green in spring.

READING

Check

What human activity can increase the growth of algae in a lake or river?

How Humans Affect the Nitrogen Cycle

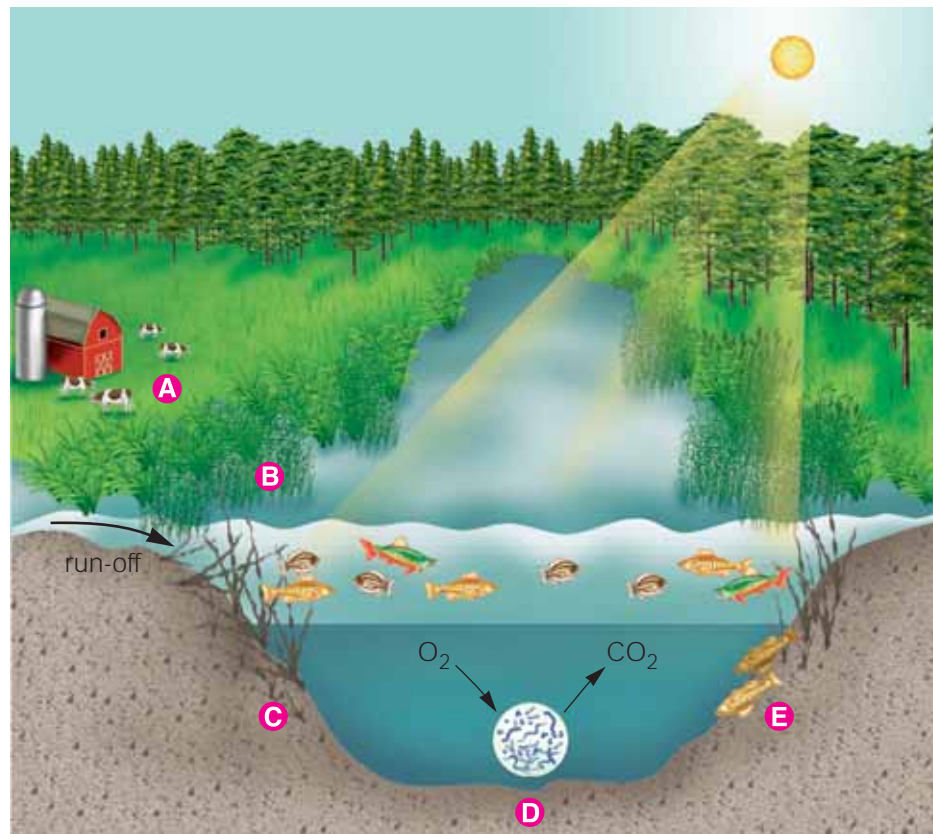
In the natural nitrogen cycle (see page 250), the different parts of the cycle are balanced. Some of the nitrogen is in the producers, some in the consumers, and some in the soil. The nitrogen in the soil is in the form of nitrates, which are easily absorbed by producers. Human activities can disrupt the natural cycle.

Sometimes, algae and plants grow rapidly in a lake or stream. As you saw in Conduct an Investigation 15–A, this increase in growth may be due to nitrates from fertilizers. The nitrates are washed into waterways from farms, golf courses, and lawns.

The buildup of nutrients in an aquatic ecosystem is called **eutrophication** of the body of water. Figure 15.4 shows the process of eutrophication.

Figure 15.4 How eutrophication occurs

- A. Rain carries nitrates (nitrogen) from farms and lawns into water ecosystems.
- B. The surface plants grow quickly, blocking the sunlight from deeper waters.
- C. Deep-water plants get no sunlight, so they cannot carry out photosynthesis. When they die, they stop producing oxygen.
- D. As the plants die, decomposers have lots of food. The populations of decomposers increase rapidly. The decomposers use up oxygen during their cellular respiration.
- E. The lack of oxygen in the water kills fish and other aquatic animals. Too much nitrate in the water ecosystem has caused eutrophication.



Key Terms

biodegradable
non-biodegradable
pesticide
insecticide
herbicide
biological
magnification
fertilizer
resistance
eutrophication

Check Your Understanding

1. How does adding nitrates to an ecosystem affect plant growth? Does it matter how much nitrate is added?
2. Read the label on a household pesticide. What precautions should you take when using it? Why?
3. Explain why carnivores can have herbicides in their body tissues even though they do not eat plants.
4. Read the captions with Figures 15.1, 15.2, and 15.3 on pages 292–293. Compare the costs and benefits of using pesticides. Based on your chart, should pesticides be banned?

15.2 Producing More Energy

As the human population increases, so does the demand for energy. More people means more cars and trucks on roads. More people need more electricity and heat for more homes and businesses. Where do we get all this energy?

In Alberta, most of the energy we use is produced from **fossil fuels**. Coal, oil, and natural gas are all fossil fuels formed from the remains of organisms that lived millions of years ago. Figure 15.5 shows how they formed.

Throughout Earth's history, the amount of carbon dioxide produced by cellular respiration in all organisms was about equal to the amount used by producers for photosynthesis. In other words, the environment was in balance. Today we burn fossil fuels, which releases excess carbon dioxide into the air. This changes the balance in the environment.



Figure 15.5 How fossil fuels are formed

- A. About 300 million years ago, swamps slowly filled with decaying plant and animal matter.
- B. Thick layers of sediment covered this matter. It was partially broken down by decomposers. The animal and plant matter was compressed under the heavy sediment and slowly changed into coal, crude oil, or natural gas.

Carbon Dioxide and Global Warming

Normally, carbon dioxide and other gases form a blanket around Earth. This blanket traps heat, keeping it from escaping into space. This is the **greenhouse effect**. Excess carbon dioxide from burning fossil fuels makes the blanket thicker. This thicker blanket keeps more heat in the atmosphere.

Scientists predict that excess carbon dioxide in the atmosphere could lead to an increase in Earth's average temperatures. This is called **global warming**. Global warming could have serious consequences, such as:

- melting the polar ice caps,
- causing drastic changes to weather systems, and
- causing droughts on agricultural lands.

DidYouKnow?

Without the carbon dioxide in the atmosphere, Earth's average temperature would be -18°C — too cold to sustain life.

READING check ✓

How might global warming affect Earth?

The Carbon and Oxygen Cycles and Global Warming

From 1850 to 1990, carbon dioxide production from burning fossil fuels increased by about 500 times. In this activity, you will compare changes in carbon dioxide production with changes in the concentration of carbon dioxide ($\text{CO}_{2(g)}$) in the atmosphere, and changes in the average global temperature. (Concentration is discussed in Chapter 3.)

What to Do

- Write a hypothesis about how burning fossil fuels might affect amounts of $\text{CO}_{2(g)}$ in the atmosphere.
- Write a second hypothesis about how increased $\text{CO}_{2(g)}$ concentrations might affect the average global temperature.
- Use the data table provided by your teacher to make three separate line graphs. Use the same scale on each x -axis for "year." Show the relationships between:
 - year and $\text{CO}_{2(g)}$ production,
 - year and $\text{CO}_{2(g)}$ concentration in the atmosphere, and
 - year and average global temperature changes.

- Use terms such as "trend," "increase," "decrease," and "constant" to describe the pattern of change over time in:
 - the quantity of $\text{CO}_{2(g)}$ produced by burning fossil fuels,
 - the concentration of $\text{CO}_{2(g)}$ in the atmosphere, and
 - the average global temperature change.

What Do You Think?

- Do the patterns of changes support or reject your two hypotheses? Explain.
- Make a list of all the activities you do regularly that require fossil fuels.
- What is the link between the fossil fuels you use and $\text{CO}_{2(g)}$ released into the atmosphere?
- How could you change your lifestyle to help slow down the production of carbon dioxide?

Key Terms

fossil fuels
greenhouse effect
global warming

Check Your Understanding

- Why has the demand for energy increased?
- How have we responded to the demand for more energy?
- Explain how the level of carbon dioxide has been affected by the increased burning of fossil fuels.
 - Based on what you have learned, should the Alberta government increase gasoline taxes in order to limit the number of vehicles on the road each day?
- Describe the relationship between burning fossil fuels and global warming.
- List three problems that scientists think will occur as a result of global warming.

15.3 Producing More Products

Imagine life without ice cream, fresh fruit, cold drinks, and air conditioning! All of these products depend on the technology of refrigeration.

Before refrigeration, people dried food, canned it, preserved it in salt, or stored it in cold cellars, wells, or streams to keep it cool. Drying, canning, and cold storage kept some fruits and vegetables through the winter. Meat and fish were salted. But these processes did not work well on all foods. They did not always prevent food bacteria from growing. Food spoilage was common. Many people died from food poisoning.

The Refrigerator

Consumers wanted a better technology to prevent food spoilage. Engineers invented the refrigerator. See Figure 5.20 on page 101 for an explanation of how refrigerators work. These appliances use a compressor, a motor, and a liquid called a **refrigerant** to remove heat.

In the 1920s, scientists discovered a group of refrigerants called chloro-fluorocarbons (**CFCs**). CFCs contain the elements carbon, fluorine, chlorine, and hydrogen. Industries used these chemicals in refrigerators because they thought they were stable, harmless, and non-combustible.

In the next investigation, you will discover what scientists have found out about CFCs and how they affect a layer in the atmosphere called the **ozone layer**.

DidYouKnow?

The refrigerator was invented in 1803 but did not appear as a household appliance until the twentieth century

READING Check

What group of chemicals did industries use that scientists thought was a safe and harmless refrigerant?



Figure 15.6 Until the 1950s, people delivered blocks of ice door-to-door. The householder put the ice in an ice-box, which kept food from spoiling. Iceboxes could not keep ice cream frozen, however.



Figure 15.7 An early refrigerator. The compressor is on the top.

Refrigeration Has a Down Side

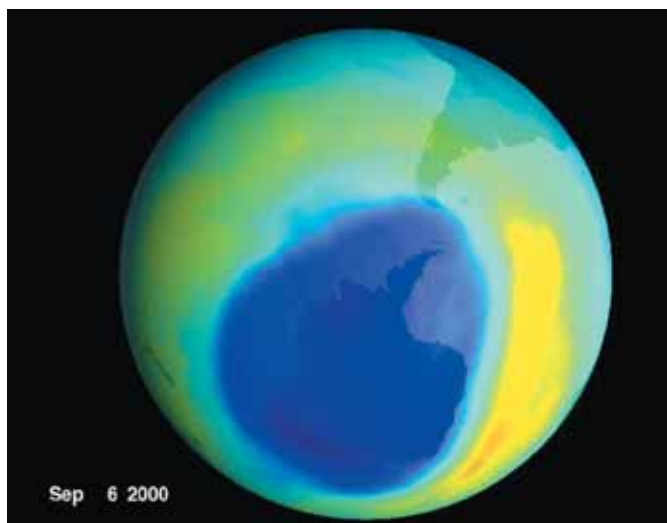
Think About It

The ozone layer is an invisible layer of gas in the atmosphere about 15 to 35 km above Earth's surface. The chemical formula for ozone is $O_{3(g)}$. It is a close chemical relative of oxygen ($O_{2(g)}$).

The ozone layer protects living things on Earth. Ozone absorbs harmful ultraviolet (UV) radiation from the Sun. If you have ever had a sunburn, you have had first-hand experience with the Sun's ultraviolet radiation!

In the 1970s, scientists discovered that some of the ozone layer was thinner than normal. In recent years, a large "hole" in the ozone layer has opened over the Antarctic each spring. The ozone layer is also becoming thinner over the Arctic.

Scientists have discovered that CFCs destroy ozone molecules. Atoms of chlorine combine with ozone molecules. A chemical reaction changes the ozone to oxygen. Although oxygen is needed by living things in the lower atmosphere, it takes ozone in the upper atmosphere to protect living things from harmful radiation.



Satellite image of the Antarctic. The Dobson Unit (DU) is the unit used to express ozone concentration.

What to Do

- 1 Use the image here, the information on pages 299 and 301 of this book, and the information about the destruction of the ozone layer provided by your teacher to answer the following questions.

Analyze

1. Describe what happened to the ozone layer over the Antarctic between 1979 and 1996.
2. Identify one human technology that has been linked to the thinning of the ozone layer.
3. Scientists predict that the thinning of the ozone layer will allow more UV radiation to reach Earth. Explain how this will affect humans.
4. Discuss the following statement: "Technology is developed to improve conditions for society. However, technology can have unforeseen consequences."
5. The use of CFCs has now been banned or restricted in many countries. Use your library and/or electronic sources to find information on the chemicals that have been developed to replace CFCs in refrigerators and air conditioners.

Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

For more information on ozone and refrigeration, go to the above web site, then to **Internet Connects, Unit D, Chapter 15**, and then to **Refrigeration and the Ozone Layer**.

The Thinning Ozone Layer

Many scientists think that if the ozone layer becomes thinner, living organisms will be seriously harmed. Study the following photographs and list the problems that could result from the thinning of the ozone layer.



Figure 15.8 Scientists expect that more people will develop skin cancer due to increased exposure to ultra-violet radiation. They also think more people will suffer eye damage.



Figure 15.9 High levels of UV radiation can slow the growth of major food crops. This could reduce food supplies.

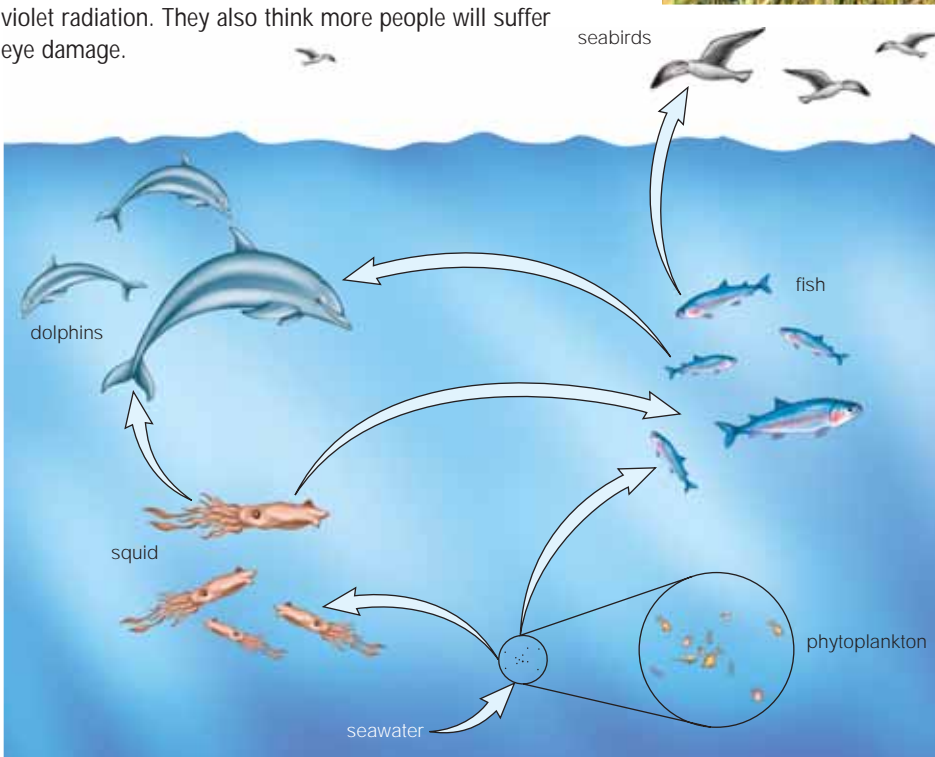


Figure 15.10 Phytoplankton are the main producers in the ocean ecosystem. High levels of UV radiation can kill phytoplankton. Fewer producers will affect marine food chains and webs.

READING check ✓

What might happen on Earth as the ozone layer in the atmosphere becomes thinner?

Check Your Understanding

1. What is the ozone layer and how does it protect living things on Earth?
2. What are CFCs? How do they affect the ozone layer?
3. Describe four ways that increased UV rays might affect living organisms.
4. In this section, you saw how one form of technology (refrigeration) harmed the environment in unforeseen ways. Describe two other technologies that have affected the environment in ways that were not foreseen.

Key Terms

refrigerant
CFCs
ozone layer

15.4 Why So Much Waste?

READING
check ✓

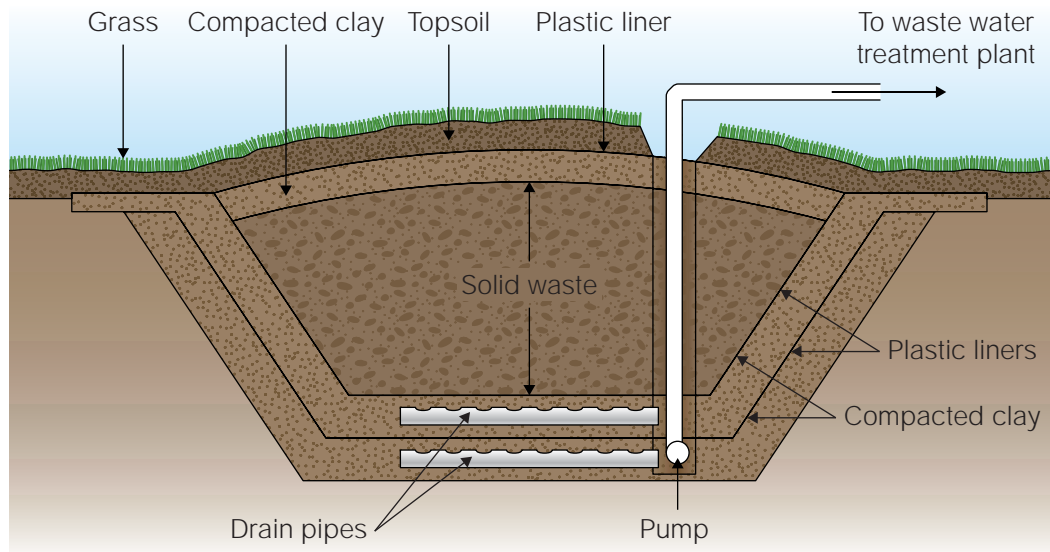
What is a landfill site?

Canadians throw out a lot of garbage every day. Waste disposal raises some important issues, including:

- What is in our garbage?
- What happens to the garbage after it is picked up at our homes and businesses?
- How does garbage affect our environment?

Figure 15.11 Every day, each Canadian discards about 2.2 kg of garbage. Much of our garbage ends up in **landfill** sites like this one. A landfill is a site that has been developed to prevent waste materials from harming the environment.

Building new sites is expensive. It is hard to find places for them because few people want a landfill near their homes. When they are full, landfills are sealed to try to prevent toxic chemicals from accidentally entering the ground-water.



Find Out **ACTIVITY**

Saving Energy

It takes a lot of electrical energy to manufacture a pop can from bauxite (aluminum ore). It takes much less energy to make a new pop can from recycled aluminum cans. The amount of energy saved by recycling one aluminum can will power your television for 2 hours!

What to Do

1. Calculate the following:

- (a) The number of pop cans in the garbage if everyone in your class threw away one can today.
- (b) How long you could keep your television going with the energy saved by recycling these cans.

SKILLCHECK

Initiating and Planning

Performing and Recording

✶ Analyzing and Interpreting

✶ Communication and Teamwork

- (c) The number of pop cans going to the landfill if everyone in your class discarded a can a day for one week.
- (d) How long you could keep your television on with the energy saved by recycling these cans.

What Did You Discover?

1. How does recycling pop cans help reduce the amount of waste entering a landfill?
2. How does recycling pop cans reduce the amount of electricity we use?

Garbage Delight

Think back to what you learned about waste packaging in Unit A. Canadians throw away more waste per person than most other nations in the world. This probably happens because of our high standard of living.

Do you and your family buy some things, use them once, and then throw them in the garbage? When you get take-out food, how much of the packaging goes in the garbage? These factors, plus many others, contribute to the huge volumes of waste that we discard every day. Study the following photographs and list what you can do to reduce your own garbage.

READING
Check ✓

What items can be recycled? Which ones are recycled in your community?



Figure 15.12 By composting food wastes and buying in bulk, you can **reduce** the amount of waste you produce.



Figure 15.13 Look for different uses for things you would normally throw away. **Re-use** glass jars and plastic bags. Share magazines with friends. We can re-use many different products.



Figure 15.14 Recycle glass, cans, juice boxes, paper, plastic, and cardboard to reduce the amount of waste entering landfills. Recycling also saves energy.

Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

How is aluminum recycled? What processes are involved? Go to the above web site, then to **Internet Connects**, Unit D, Chapter 15, and then to **Recycling Aluminum**.

DidYouKnow?

Recycling 1 tonne of newspapers saves about 17 trees.

Check Your Understanding

1. Trace the path of a piece of garbage you throw out. Where does it go?
2. Identify four things you can do to reduce the amount of waste entering the local landfill site.
3. Can recycling help reduce environmental problems such as global warming? Explain.

Key Terms

- landfill
- reduce
- re-use
- recycle

15.5 What Can We Do?

So far, this chapter has focussed on the negative impacts of human activities. However, many people and groups are working to reverse these problems. One of these people is Dave Matheson, a habitat specialist with Ducks Unlimited in Grande Prairie. The text and photographs on these two pages show you the kind of work that people are doing to restore the environment.



Figure 15.15 Dave Matheson

Many environmental groups are concerned about wetlands. **Wetlands** are marshy areas that remain moist throughout the year. Wetlands have many benefits, including:

- providing valuable habitat for plants and animals;
- acting like huge water filters to remove chemicals and sediment from the water; and
- helping to prevent flooding by trapping water and releasing it slowly.

Many years ago, settlers drained wetlands to farm the land. Dave Matheson talks to today's farmers. He asks them to restore some of those drained areas to wetlands. He also asks them to maintain and protect existing wetlands on their farms.

During **restoration**, the drainage ditches are blocked and small dams built. This allows the land to flood. Ponds and lakes form as the land returns to its more natural state. Within one year, birds and other wildlife return to the wetland.

Dave believes that everyone can help wildlife. You do not need special training or money to help clean up the environment in your area. For example, encourage people to leave natural areas undisturbed. Volunteer for projects such as the nest box program with Ducks Unlimited. Re-use or recycle your garbage. Walk or ride a bicycle instead of driving.

Figure 15.16 (A) A former wetland before restoration. (B) The restored wetland.





Figure 15.17 Wetland areas are drained by digging ditches. The ditches take excess water from the area. To restore the wetland, drainage ditches are filled in. Melting snow and rainwater can no longer flow away. This photo shows runoff collecting in a wetland.

Figure 15.18
Bufflehead and common goldeneye ducks are found on woodland lakes and ponds. These birds build nests in holes in trees. However, when wetlands are drained and the trees cut down, these ducks cannot find nesting sites. Dave and a group of volunteers from Grande Prairie built nest boxes near the water. The ducks use the boxes to lay their eggs and look after their young.



Figure 15.19 Great blue herons had few nesting sites in the Grande Prairie region. To help, Dave put up large poles with nesting platforms coming off the sides. In the very first year, great blue herons built nests on seven of the 12 nesting platforms.

Try This!

In northern Alberta, many wetlands are bogs because of the cold, wet climate. Vegetation in bogs decomposes very slowly and forms peat instead of soil. Peat holds water like a sponge.

Measure the amount of water that 500 g of peat can hold. How does this explain why some gardeners add peat to their soil?

Did You Know?

In the past 100 years, 60 percent of the wetlands in populated parts of Canada have disappeared.



How is farmland restored to a wetland?

Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

For more information on Ducks Unlimited Canada, go to the above web site, then to **Internet Connects, Unit D, Chapter 15**, and then to **Ducks Unlimited Canada** to find out more about the work of one environmental organization and how you can get involved.

Check Your Understanding

1. Why are wetlands important to the environment?
2. Why are programs such as the nesting box program in Grande Prairie important to the wildlife in the area?

Key Terms

wetlands
restoration

15 Review

Key Terms

biodegradable	fertilizer	refrigerant	recycle
non-biodegradable	resistance	CFCs	wetlands
pesticide	eutrophication	ozone layer	restoration
insecticide	fossil fuels	landfill	
herbicide	greenhouse effect	reduce	
biological magnification	global warming	re-use	

Reviewing Key Terms

If you need to review, the section numbers show you where these terms were introduced.

- In your notebook, indicate whether each statement is true or false. Correct each false statement by replacing the italicized term with another term.
 - An item that is *biodegradable* takes a long time to break down in the environment. (CO)
 - Many people try to control the population of insects by spraying them with *herbicides*. (15.1)
 - Insects can become *resistant* to chemical pesticides. (15.1)
 - Applying fertilizer to a lawn or a field can lead to *biological magnification* in a pond or lake. (15.1)
 - Many scientists have linked the burning of fossil fuels to the environmental problem of *global warming*. (15.2)
 - The *nitrogen cycle* protects living things on Earth from harmful UV radiation. (15.3)
 - CFCs* are chemicals that are destroying the ozone layer. (15.3)
 - Using a re-useable plate over again can *reduce* the amount of waste and protect the environment. (15.4)
 - One way to decrease the volume of waste entering landfills is to *recycle* paper, glass, and plastic. (15.4)
 - Landfill* sites are sealed to prevent toxic chemicals from accidentally entering the water cycle. (15.4)

- Wetlands* can be restored by blocking drainage ditches and allowing land areas to fill with water. (15.5)

Understanding Key Ideas

Section numbers are provided if you need to review.

- List the following items in your Science Log or notebook. Indicate which items you think are biodegradable and which are non-biodegradable. (CO)
 - aluminum can
 - newspaper
 - plastic bottle
 - potato skins
 - dry-cell battery
- Refer to the five items in question 2. Describe how you could minimize the amount or number of each that ends up in a landfill site. (15.4)
- Describe, in point form, how using fertilizer can cause the eutrophication of a pond. (15.1)
- High levels of UV radiation may damage phytoplankton in the oceans. How is this problem linked to the use of CFCs in refrigerators and air conditioners? (15.3)
- Describe at least four ways in which Albertans are helping to repair the damage to the environment. (15.4)

7. Examine the photograph shown below. Which of these people are helping to protect the environment? Explain. (15.4)



10. Chemical companies are researching new products to replace CFCs. A Canadian company has found that a new chemical (HCFC-123) can do the same job and eliminates 98 percent of the threat to the ozone layer. The new chemical costs several times more than CFCs do. Would you be willing to pay more for products if they were environmentally friendly? Explain. (15.3)

11. Suppose you had \$100 to spend.
 (a) Give an example of a purchase that might benefit the environment. Explain why you might choose this purchase.
 (b) Give an example of a purchase that might harm the environment. Explain why you might make this choice. (15.3)

12. How do alternative sources of electricity generation (such as solar energy) help to reduce the amount of carbon dioxide that enters the atmosphere? (15.2)

Developing Skills

8. Alberta Environment has determined the sources of wastes produced by households across the province. Copy this chart into your notebook and develop a bar graph to illustrate the data. Which type of waste could you help to reduce? (15.4)

Source of Waste	Percentage by Weight
paper	25
food and yard waste	35
metals	5
plastics	7
glass	3
other waste (such as diapers, household hazardous materials, clothing)	25



Photovoltaic cells convert energy from the Sun into electricity without burning fossil fuels.

Problem Solving/Applying

9. Do you think people should spray their lawns with herbicides to kill dandelions and other weeds? Explain. (15.1)

Pause & Reflect

1. Your daily activities affect the environment. You use resources and you discard wastes. In what other ways do you and those around you affect the environment? Can your activities affect someone living in another country? Explain.
2. Go back to the beginning of the chapter on page 290. Check your original answers for the Getting Ready questions. How has your thinking changed? How would you answer these questions now that you have investigated the topics in this chapter?

- ☀ Initiating and Planning
- ☀ Performing and Recording
- ☀ Analyzing and Interpreting
- ☀ Communication and Teamwork

So, What Can We Do?



People of all ages across Canada and around the world are doing something to protect the environment. Some study the populations of grizzly bears and wolves, and some protect sections of unspoiled wilderness. Others breed captive animals to help increase the populations of different species, or rescue injured birds of prey.

Here is your chance to help. This activity will help you contribute to your community and to the planet. By getting involved, you can improve the environment for both people and wildlife.



Many groups have projects for volunteers around the country. Some projects help restore wildlife

Volunteers for Environment Canada's *Frog Watch* program collect information on different frog species across Canada.

The Canadian Nature Federation sponsors *Project FeederWatch*. From November through March, volunteers count the birds at their bird feeders and send the data to Bird Studies Canada.



habitat; others monitor the current status of different plants and animals.

You can do some activities in warm weather. Others are done when the countryside is covered with snow. Each project will get you outside and give you an opportunity to do something interesting that will also benefit the environment. You decide on the project that interests you!

What to Do

- 1 Working with a partner, locate a web site devoted to environmental projects. Find a project you think your science class might be interested in doing.
- 2 Once you have located an interesting project, answer the following questions in your Science Log or notebook.
 - What is the name and purpose of the project?
 - Who is sponsoring or organizing it?
 - Why does this project interest you?
 - Can you do this project at this time of year and with only a small amount of class time?
 - How does this project help the environment?
 - What problems, if any, might you face in doing this project?

- Are any costs involved? If so, how will you raise the money you will need?
- Can your school apply for funding from the sponsoring organization?
- Who must be contacted for permission to do this project?
- Are there lasting benefits from this project? Explain.

3 Discuss your project idea with the rest of the class. Decide which project or projects your class will do.

Implement your project. Be sure to take pictures of your work in progress.



The Prairies were once living carpets of green and gold, speckled with wildflowers and inhabited by millions of birds and animals. Countless sloughs, potholes, and slow-moving streams were home to waterbirds. The Canadian Wildlife Federation's *Protect Prairie Potholes and Streams* project can help restore these wetlands to a more natural state.



Worm Watch Canada is a program co-sponsored by Agriculture and Agri-Foods Canada and Environment Canada. Volunteers across Canada survey the local soil, so scientists can learn more about the biodiversity in soil.

Evaluate

1. Did things work out the way you thought they would?
2. If you collected information for an organization, how will they use it?
3. Did you have any problems? What were they? How might you deal with such problems in the future?
4. The next time, how could you make a project like this more effective?

Extension

5. Showcase your project to other classes or to parents. You could display your photographs or develop a multimedia presentation.

Computer CONNECT

Design a multimedia presentation or a web site to showcase your project or your contribution to the project.

Internet CONNECT

www.mcgrawhill.ca/links/science.connect1

To find out about environmental projects in Canada and how you can get involved, go to the above web site, then to **Internet Connects**, **Unit D**, **Closer**, and then to **Make a Difference**. Use the information you find to locate a project that you would like to do in your school or community.



Organizations such as *Trout Unlimited Canada* help to rescue fish. This member holds a trout that was trapped in an irrigation canal. He will return it to the Bow River in Calgary.