3.2 Redirecting Water Flow

Humans often use technologies to change ecosystems in order to meet their own needs. For example, the people in a community might benefit from damming a nearby river. What might be the positive effects for the community? Figures 3.9 and 3.10 show the effects of damming a river.

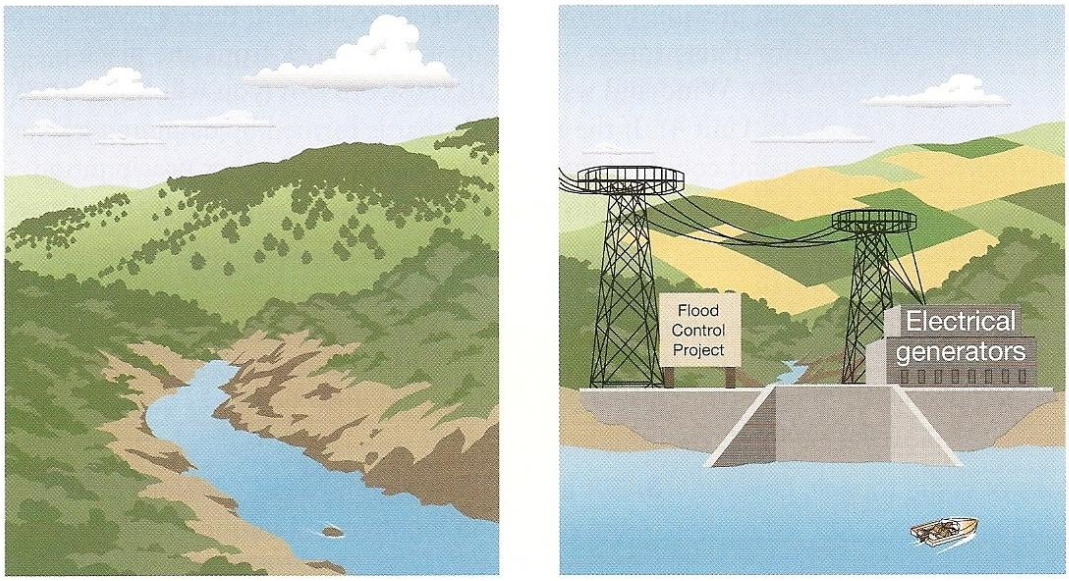
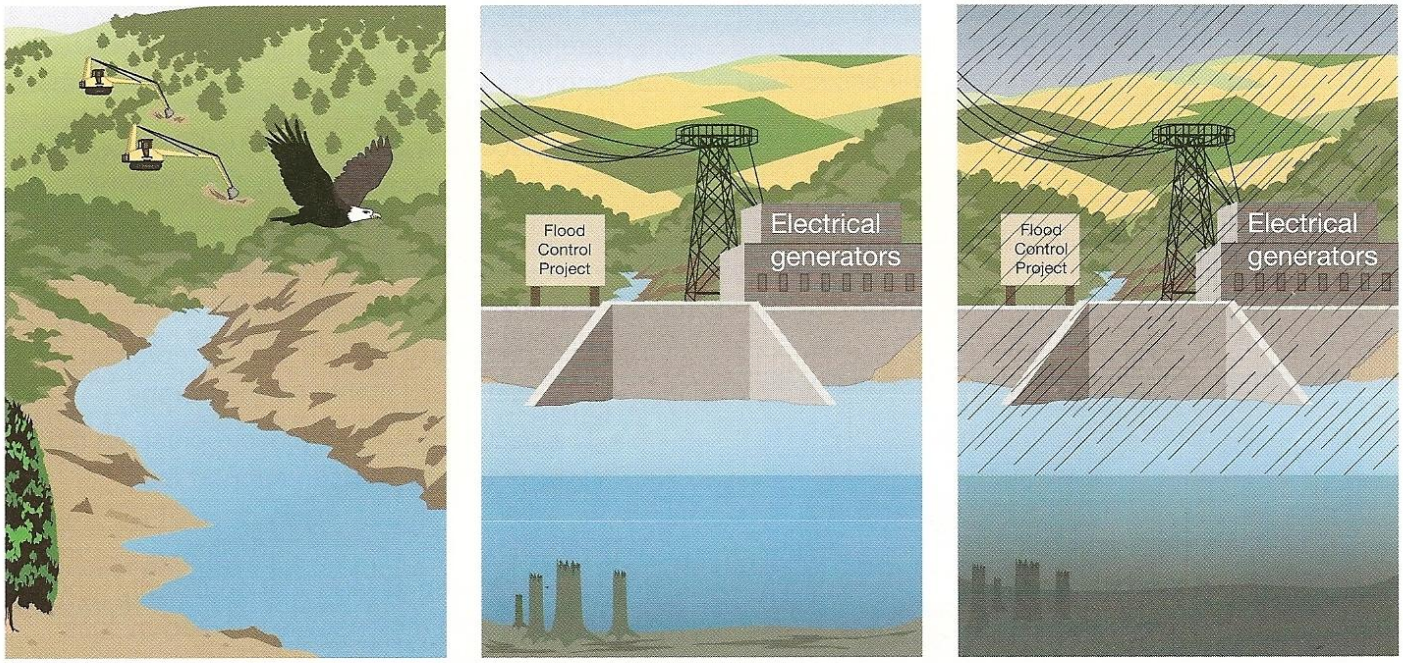


Figure 3.9 These diagrams show a river before and after it is dammed.



A The forested hills around the dam site were bulldozed to make room for farming. Birds and large animals were forced to flee. Insects and small animals fled or were destroyed.

B Machines destroyed some plants in the flooded area. Other plants "drowned" in the water.

C Wind and water eroded the soil on the newly bare hills around the reservoir. The soil slowly washed down into the reservoir, making it muddy.

Figure 3.10 Long-term effects of a dam

DidYouKnow?

Schistosoma is an internal parasite that afflicts 300 million people worldwide. The eggs of this parasite mature inside snails, hatch, and then burrow into humans. The occurrence of this very painful disease has increased in tropical countries because irrigation and damming have created more habitats for the snails.

How might a dam affect an area's ecosystems? Redirecting water flow can have major effects not only on a moving fresh-water ecosystem and the ecosystems immediately surrounding it, but also on ecosystems that are farther away. For example, when birds, animals, and other organisms are forced to leave an area because a dam is built, they must try to survive elsewhere. When the animals leave, they move to an ecosystem where food and other resources may be scarce. They must compete with the birds, animals, and other organisms that are already living there.

When areas that were previously covered by trees are cleared, the soil can be washed away by run-off. This process of moving soil and rock from one place to another is called **erosion**. Wind and water both cause erosion (you will learn more about these processes in Unit 4). If the reservoir that is formed by damming a river is large, an area downwind could receive more rain, snow, and other precipitation. This occurs because there is a larger accumulation of water to evaporate, condense, and fall.

Find Out ACTIVITY

Save the Soil

If erosion results in the loss of some topsoil, how much does that matter? In this activity, you will use an apple to represent Earth.

What You Need

cutting board
apple
knife

Safety Precautions

The knife is sharp and may cause cuts if not handled properly.

What to Do

1. Carefully cut the apple into four quarters.
2. Set aside three quarters. Cut the fourth quarter lengthwise into two equal pieces (each piece is one eighth of the apple.)
3. Set aside a one-eighth piece. Carefully cut the other one-eighth piece into four equal pieces. (Each piece is one thirty-second of the apple.)
4. Set aside three thirty-second pieces. Carefully peel the skin from the last thirty-second piece.
5. Each piece of apple represents the following:
   - The three quarters represent the part of Earth covered by oceans.
   - The one-eighth piece represents land that is unsuitable for human life.
   - The three thirty-second pieces represent land that is unsuitable for food crops.
   - The peel from the last piece represents the layer of topsoil that can support life.

What Did You Find Out?

1. Suppose a crop of food that could only grow in fairly limited regions was affected by loss of topsoil. What might be the effect on this food supply? What might be the effect on other species?
2. Aside from the loss of food crops, what other long-term effects can be caused by loss of topsoil?

Fossil Fuels, Carbon, and Air

Canadians use plants in agriculture, forestry, and other plant-based economic activities (see Figure 3.11). We use plant products when we burn coal to make electricity, and we use natural gas or oil to heat our homes. We also use plant products when we drive cars, trucks, or farm machines, because gasoline comes from oil. Coal, oil (petroleum), and natural gas are fossil fuels. **Fossil fuels** are fuels that originated from plants and other organisms that died and decomposed millions of years ago and were preserved deep under the ground (see Figure 3.12).

Fossil fuels are products of plankton that lived millions of years ago. **Plankton** are microscopic plants, algae, and other organisms that float in seas and other bodies of water. **Phytoplankton** are plankton, such as algae, that use sunlight to make their own food through photosynthesis. Millions of years ago, decomposing plankton were repeatedly buried under layers of mud and silt that, with time and pressure, became rock. You will explore this topic in more detail in Unit 4.

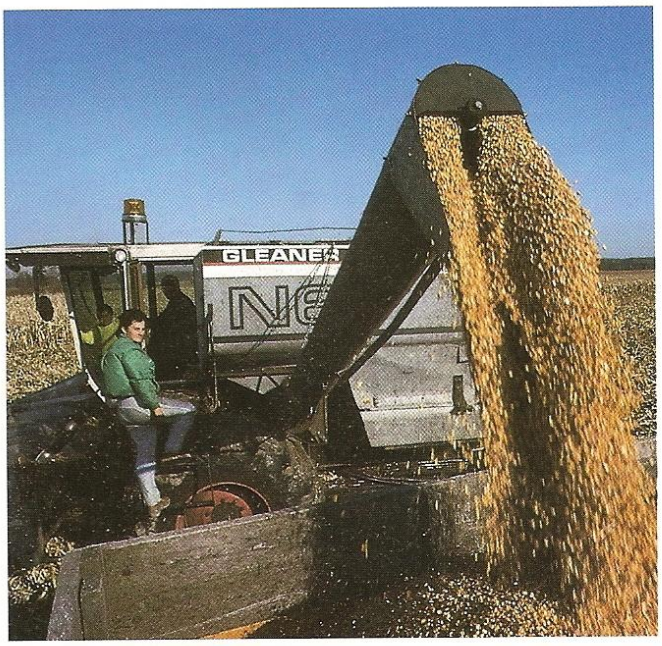


Figure 3.11 In what two ways is the farmer in the photograph using plants?

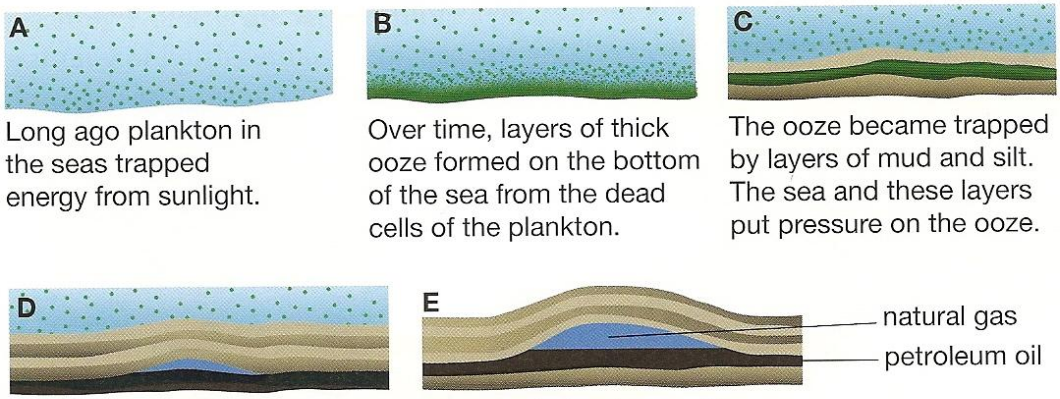


Figure 3.12 Scientists hypothesize that oil and natural gas are formed as shown in this diagram.

The Carbon Cycle

Carbon is necessary for all life to exist. Plants use carbon dioxide from the air for photosynthesis, and moose, mice, and other organisms eat the plants. They respire, releasing carbon dioxide into the air. Wolves, foxes, and other organisms eat the moose and mice, and they also respire, releasing carbon dioxide into the air. In this way, carbon cycles around and around in an ecosystem. Figure 3.13, on the next page, shows the carbon cycle.

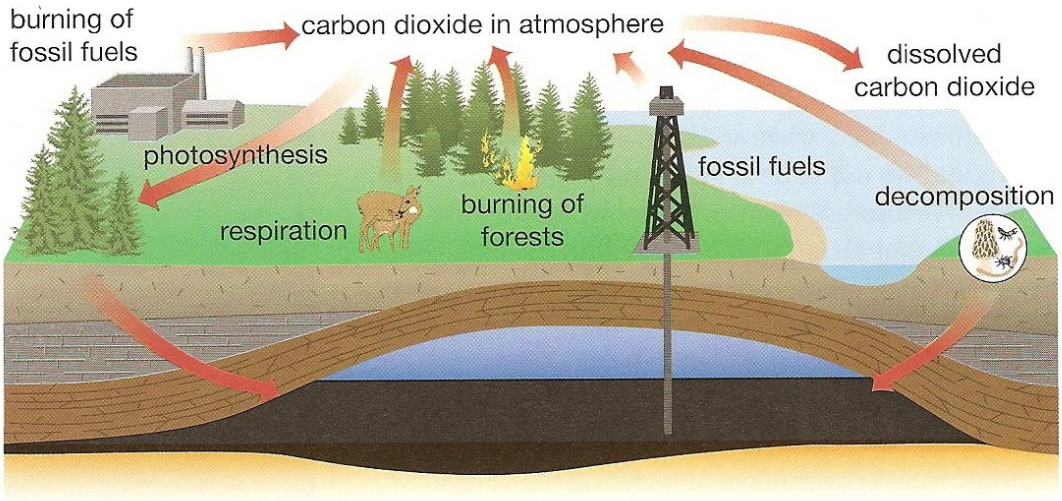


Figure 3.13 This diagram shows the carbon cycle. The oil derrick is pumping oil from deep under the ground.

Figure 3.14 shows the carbon cycle in balance. Many things might upset this balance. Fossil fuels burn, and this releases carbon dioxide into the air. The amount of carbon dioxide released into the atmosphere has greatly increased over the past 100 years. This is mostly because people are burning more and more fossil fuels. As well, people have produced large amounts of carbon dioxide by the widespread burning of tropical rain forests to clear areas for farming. The destruction of rain forests also reduces the number of photosynthesizing organisms, making the cycle more unbalanced.

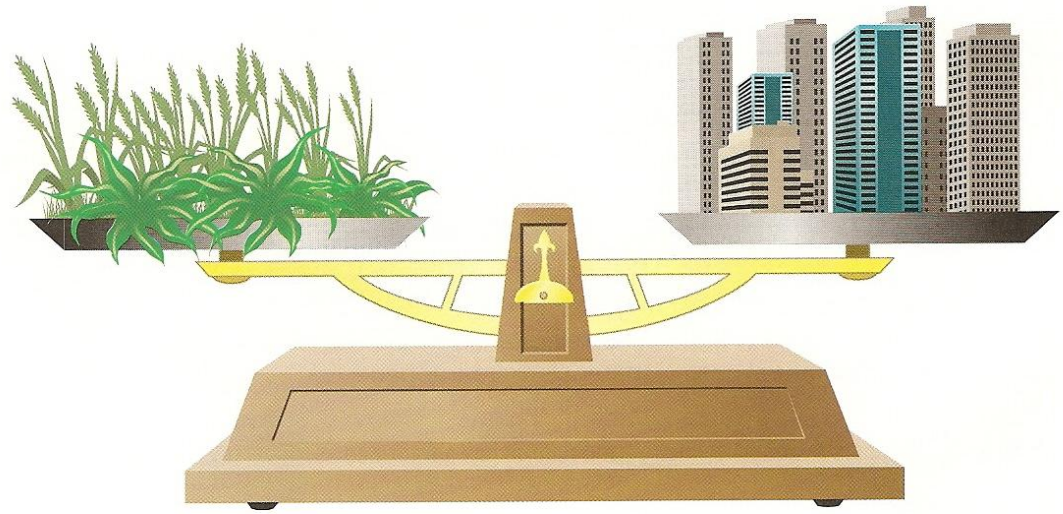


Figure 3.14 As long as there is not more carbon than plants can use, the carbon cycle works well and the system stays in balance.

Pause& Reflect

As you have learned, fossil fuels are non-renewable resources. If the carbon cycle is really a cycle, like the water cycle or the oxygen and carbon dioxide cycle, why is there concern about using up all of the fossil fuels? Write your answers in your Science Log.

Greenhouse Gases

Imagine stepping into a greenhouse on a sunny but cool day. The air inside the greenhouse is much warmer than outside because most parts of the Sun's rays pass through the glass walls of the greenhouse. These rays are taken in by the soil and plants. Energy released by the soil (called heat radiation) travels back up to the top of the greenhouse, but this type of energy cannot easily pass through the glass. The trapped energy warms the air in the greenhouse. (You will find out more about radiation in Chapter 9.)

The atmosphere surrounding Earth acts like the glass walls of a greenhouse. It allows sunlight to pass through to Earth's surface, and prevents much of the returning heat radiation from passing back out into space. This is one reason why Earth is warm enough for life to exist. Without the atmosphere, Earth would be too cold to support most species.

The glass of a greenhouse prevents some of the heat radiation from escaping, so the air in the greenhouse warms up. If another covering were added to prevent the loss of more heat radiation, the air in the greenhouse would get even warmer. This same effect is occurring in our atmosphere (see Figure 3.15). **Greenhouse gases** are gases, such as carbon dioxide, that result from the burning of fossil fuels as well as other fuels, such as wood. These gases add to the heat-trapping effect of the atmosphere, forming a "covering." This "covering" causes the atmosphere to hold in more heat radiation than it would naturally. Many scientists think that the result over time is **global warming**: a gradual warming of Earth's atmosphere. Scientists still disagree about many aspects of global warming, including how much Earth's atmosphere will warm.

Skill POWER
For tips on using the Internet effectively, see page 497.

INTERNET CONNECT
www.school.mcgrawhill.ca/resources/
Some scientists consider greenhouse gases to be a real threat to life on Earth; others maintain that the current warming trend is simply part of a much larger pattern. Record-keeping of Earth's temperature is fairly recent and does not allow scientists to observe long-term trends very readily. Do some research on this issue by going to the web site above. Go to **Science Resources**, then to **SCIENCEPOWER 7** to learn where to go next.

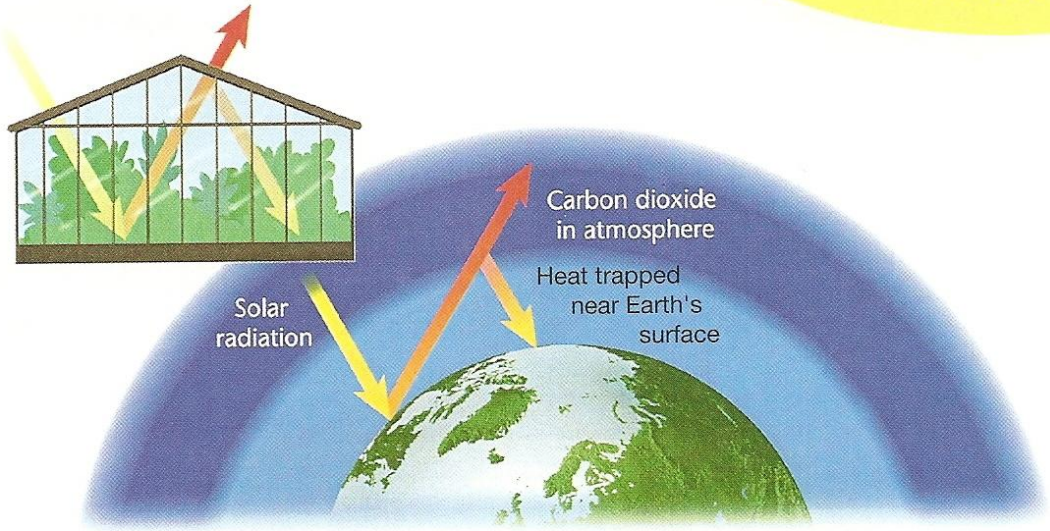


Figure 3.15 This is a model of how many scientists believe the greenhouse effect takes place.