



6.1

A Changing Landscape

Key Questions

 **How do our daily activities affect the environment?**

 **What is the relationship between resource use and sustainable development?**

Vocabulary

monoculture
renewable resource
nonrenewable resource
sustainable development

Taking Notes

Outline As you read, create an outline using the green and blue heads in this lesson. As you read, fill in key words, phrases, and ideas about each heading.

MYSTERY CLUE

Easter Island's first colonists brought with them banana trees, taro root, and chickens—and possibly some small mammalian “stowaways.” What impact might these new organisms have had on the island’s ecosystems?



FIGURE 6-1 The Lesson of Hawaii Kalalau Valley along the Na Pali coast of Kauai looks almost untouched by humans. In contrast, Waikiki Beach on the island of Oahu is surrounded by built-up areas that support tourism.

THINK ABOUT IT The first humans to settle Hawaii came from Polynesia about 1600 years ago. These island people had customs that protected the natural resources of their new home. For example, they were prohibited from catching certain fish during spawning season and, for every coconut palm tree cut down, they had to plant two palms in its place. But Hawaiians did not treat their islands entirely like nature reserves. They cut trees to plant farms, and they introduced nonnative plants, pigs, chickens, dogs, and rats. This combination drove many native plant and animal species to extinction. Yet for centuries Hawaii’s ecosystems provided enough fresh water, fertile soil, fish, and other resources to keep the society self-sufficient. What happened next is a lesson on managing limited resources—a lesson that is as important today as it was over 1000 years ago.


The Effect of Human Activity

 **How do our daily activities affect the environment?**

Beginning in the late 1700s, new waves of settlers arrived in Hawaii. These people did not seem to understand the limits of island ecosystems. They imported dozens more plants and animals that became invasive pests. They cleared vast tracts of forest to grow sugar cane, pineapples, and other crops that required lots of water. And as the island’s human population grew, they converted untouched land for other uses, including housing and tourism, as shown in **Figure 6-1**. The effect of these activities on Hawaii’s ecosystems and its human inhabitants offers a window onto a globally important question: What happens when a growing human population does not adequately manage natural resources that are both vital and limited?



Living on Island Earth Humans, like all forms of life, rely on Earth's life-support systems. And like all other organisms, we affect our environment when we obtain food, eliminate waste products, and build places to live. The effects of these activities can be most obvious on islands such as Hawaii because of their small size. Living on an island also can make people aware of limited resources and of an area's carrying capacity for humans because anything not available locally must be brought in from far away.

Most of us who live on large continents, however, probably don't think of land, food, and water as limited resources. In the past, environmental problems were local. There was always new land to settle and new sources of food and water. But today human activity has used or altered roughly half of all the land that's not covered with ice and snow. Some people suggest that as the global population reaches 7 billion people, we may be approaching the carrying capacity of the biosphere for humans.  **Humans affect regional and global environments through agriculture, development, and industry in ways that have an impact on the quality of Earth's natural resources, including soil, water, and the atmosphere.**

In Your Notebook *Explain how Earth is like an island.*

Agriculture Agriculture is one of the most important inventions in human history. A dependable supply of food that can be stored for later use enabled humans to gather in settlements that grew into towns and cities. Settlements, in turn, encouraged the growth of modern civilization—government, laws, writing, and science. Modern agricultural practices have enabled farmers to double world food production over the last 50 years. **Monoculture**, for example, is the practice of clearing large areas of land to plant a single highly productive crop year after year, like the soybeans in **Figure 6–2**. Monoculture enables efficient sowing, tending, and harvesting of crops using machines. However, providing food for nearly 7 billion people impacts natural resources, including fresh water and fertile soil. Fertilizer production and farm machinery also consume large amounts of fossil fuels.

FIGURE 6–2 Monoculture Soybean fields dominate this landscape.
Apply Concepts *How has agriculture helped shape civilization?*

QuickLab

GUIDED INQUIRY

Reduce, Reuse, Recycle

- 1 Collect one day's worth of dry trash.
- 2 Sort the trash into items that can be reused, recycled, or discarded because they can't be reused or recycled.

Analyze and Conclude

1. **Analyze Data** Look at the trash you've sorted. Roughly what percentage of the total does each type represent?
2. **Predict** What do you think happens to the trash you produce? Think of at least three ways trash can impact living things.
3. **Evaluate** List three ways you can reduce the amount of trash you produce.

BUILD Vocabulary

PREFIXES The prefix *mono-* in **monoculture** means "one, alone, single." Monoculture is the practice of planting a single productive crop, year after year.

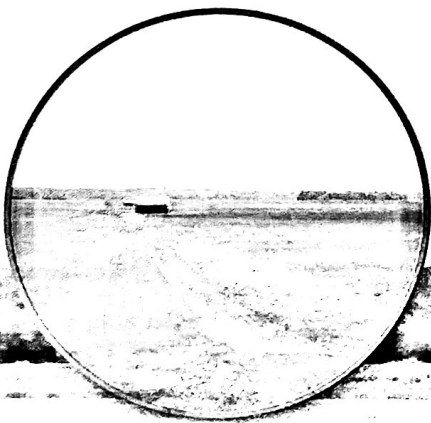


Development As modern society developed, many people chose to live in cities. In the United States, as urban centers became crowded, people moved to, and built up, suburbs. The growth of cities and suburbs is tied to the high standard of living that Americans enjoy. Yet this development has environmental effects. Dense human communities produce lots of wastes. If these wastes are not disposed of properly, they affect air, water, and soil resources. In addition, development consumes farmland and divides natural habitats into fragments.

Industrial Growth Human society was transformed by the Industrial Revolution of the 1800s. Today, industry and scientific know-how provide us with the conveniences of modern life—from comfortable homes and clothes to electronic devices for work and play. Of course these conveniences require a lot of energy to produce and power. We obtain most of this energy by burning fossil fuels—coal, oil, and natural gas—and that affects the environment. In addition, industries have traditionally discarded wastes from manufacturing and energy production directly into the air, water, and soil.

FIGURE 6-3 Ecosystem Services

The Hennepin and Hopper Lakes wetland is managed by The Wetlands Initiative—an organization dedicated to protecting and restoring Illinois's wetlands. The area, originally drained and leveed for farming in 1900, is shown in the inset before its 2003 restoration. **Apply Concepts** What ecological services do wetlands provide?



Sustainable Development


What is the relationship between resource use and sustainable development?

In the language of economics, *goods* are things that can be bought and sold, that have value in terms of dollars and cents. *Services* are processes or actions that produce goods. Ecosystem goods and services are the goods and services produced by ecosystems that benefit the human economy.

Ecosystem Goods and Services Some ecosystem goods and services—like breathable air and drinkable water—are so basic that we often take them for granted. Healthy ecosystems provide many goods and services naturally and largely free of charge. But, if the environment can't provide these goods and services, society must spend money to produce them. In many places, for example, drinkable water is provided naturally by streams, rivers, and lakes, and filtered by wetlands like the one in **Figure 6-3**. But if water sources or wetlands are polluted or damaged, water quality may fall. In such cases, cities and towns must pay for mechanical or chemical treatment to provide safe drinking water.

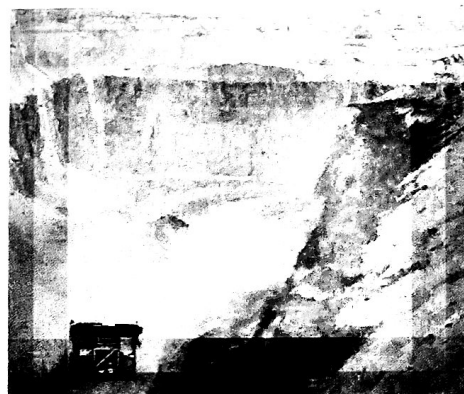
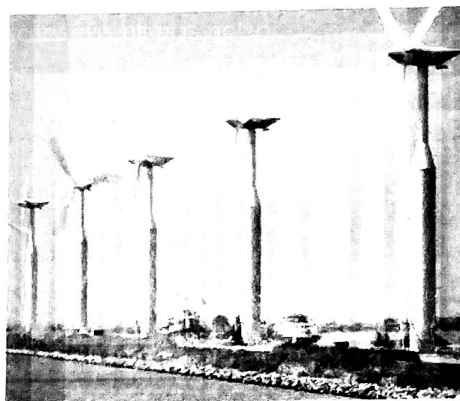
In Your Notebook Describe three ecosystem goods and services you've used today.

Renewable and Nonrenewable Resources Ecosystem goods and services are classified as either renewable or nonrenewable, as shown in Figure 6-4. A **renewable resource** can be produced or replaced by a healthy ecosystem. A single southern white pine is an example of a renewable resource because a new tree can grow in place of an old tree that dies or is cut down. But some resources are **nonrenewable resources** because natural processes cannot replenish them within a reasonable amount of time. Fossil fuels like coal, oil, and natural gas are nonrenewable resources formed from buried organic materials over millions of years. When existing deposits are depleted, they are essentially gone forever.

Sustainable Resource Use Ecological science can teach us how to use natural resources to meet our needs without causing long-term environmental harm. Using resources in such an environmentally conscious way is called **sustainable development**.  **Sustainable development provides for human needs while preserving the ecosystems that produce natural resources.**

What should sustainable development look like? It should cause no long-term harm to the soil, water, and climate on which it depends. It should consume as little energy and material as possible. Sustainable development must be flexible enough to survive environmental stresses like droughts, floods, and heat waves or cold snaps. Finally, sustainable development must take into account human economic systems as well as ecosystem goods and services. It must do more than just enable people to survive. It must help them improve their situation.

FIGURE 6-4 Natural Resources Natural resources are classified as renewable or nonrenewable. Wind and coal are both natural resources that can provide energy. But wind is renewable, while coal—like other fossil fuels—is not.



6.1 Assessment

Review Key Concepts

1. **a. Review** List the three primary types of human activities that have affected regional and global environments. For each, give one benefit and one environmental cost.
b. Relate Cause and Effect How might more productive agricultural practices affect a developing nation's population? Its environmental health?
2. **a. Review** What is sustainable development? How can it help minimize the negative impacts of human activities?
b. Explain Explain why energy from the sun is a renewable resource but energy from oil is a nonrenewable resource.

- c. **Apply Concepts** In addition to filtering water, wetlands provide flood control by absorbing excess water. Explain how society would provide these services (for a cost) if the ecosystem could not.

WRITE ABOUT SCIENCE

Description

3. What signs of growth do you see in your community? Write a paragraph telling how this growth might affect local ecosystems.