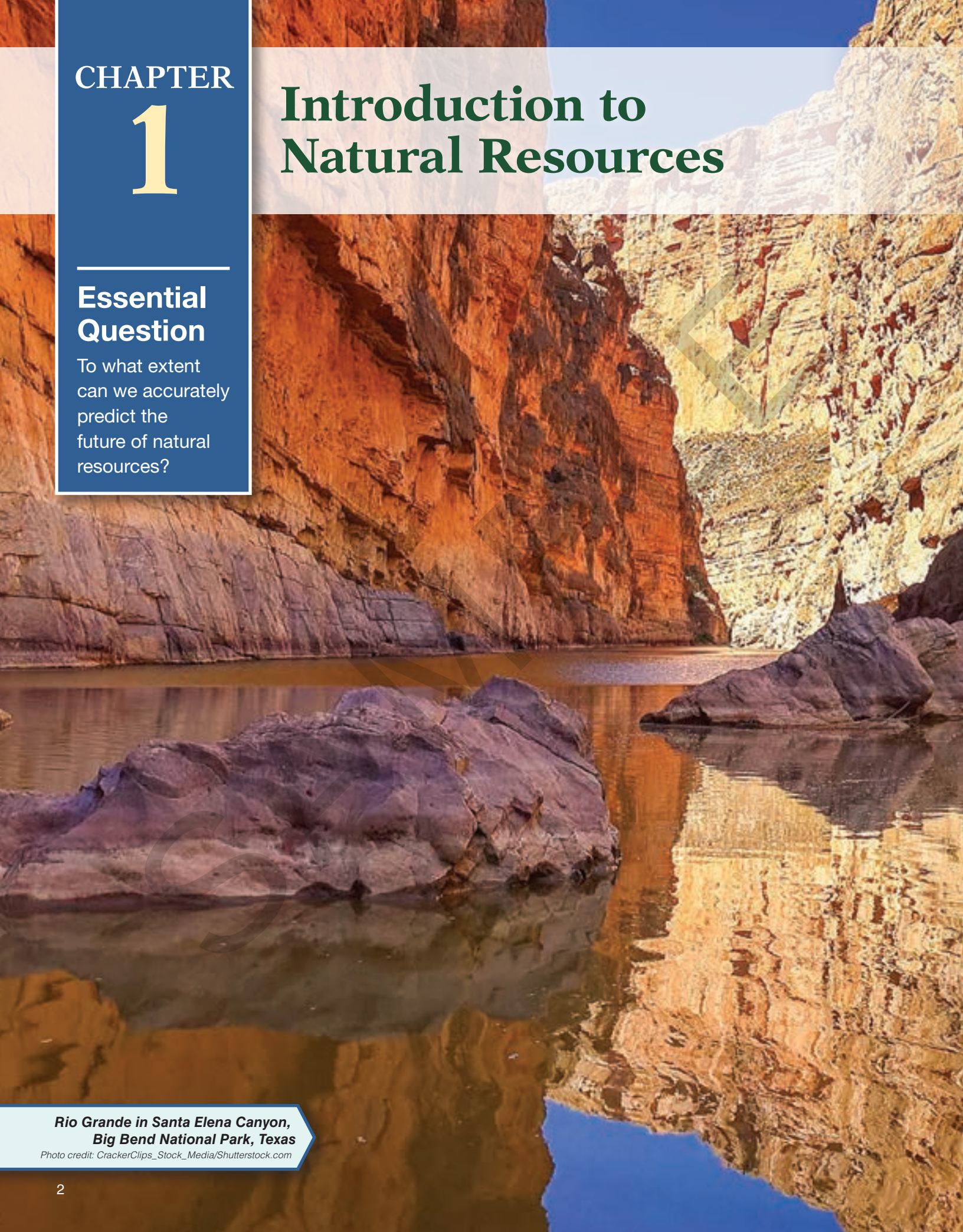
CHAPTER
1

Introduction to Natural Resources

Essential Question

To what extent can we accurately predict the future of natural resources?



Rio Grande in Santa Elena Canyon, Big Bend National Park, Texas

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LEARNING OUTCOMES

After studying this chapter, you should be able to:

- Identify types of natural resources.
- Determine which natural resources are limited and explain why they are limited.
- Explain biotic and abiotic natural resources.
- Explain stewardship of our natural resources.
- Compare and contrast conservation and preservation of natural resources.
- Explain why natural resources are important.

KEY TERMS

abiotic
abiotic natural resource
biodiversity
biofuel
biomass
biomass energy
biotic
biotic natural resource
conservation
conservationist
environmental stewardship
exhaustible resource
fauna
flora
fossil fuel
inexhaustible resource
kinetic energy
natural resource
nonrenewable resource
organism
preservation
preservationist
renewable resource
solar energy
solar power
uranium
wind energy

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Before You Read

Read the chapter title and tell a classmate what you have experienced or already know about the topic. Write a paragraph describing what you would like to learn about the topic. After reading the chapter, share two things you have learned with your classmate.

Introduction

A ***natural resource*** is defined as one of the many things found in our environment that we depend on for life, such as air, water, and soil, **Figure 1-1**. Animals, plants, and even the sun are also natural resources necessary for our survival on Earth. Additionally, resources that may not seem natural, such as petroleum and other fossil fuels, are natural resources. (Fossil fuels were formed by the decay of plants and animals over millions of years.) Some of our natural resources seem relatively abundant, but they may still be in limited supply. Other resources are definitely limited in supply and cannot be replaced. Let us take a deeper look at natural resources and the intimate relationships that humans have with these resources.

Renewable or Nonrenewable?

The two primary classifications of natural resources are renewable and nonrenewable. ***Renewable resources*** (***inexhaustible***) are resources that are plentiful and replenished naturally in a relatively short period. ***Nonrenewable resources*** (***exhaustible***) are those that cannot be replenished or require a long time to be replenished. Scientists and professionals in the natural resources fields also classify natural resources into additional categories, such as ***biotic*** (living) or ***abiotic*** (nonliving). Renewable resources include the sun (solar energy), air (wind energy), biomass, timber, and water. Geothermal energy is also considered renewable because Earth constantly produces heat within its core. The following is a brief introduction to the types of renewable resources we use.

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Figure 1-1. Humans have always used natural resources to sustain their lives and many of us take our natural resources for granted. It is evident, however, that as a global community we must continue to seek methods of sustainable management of our natural resources to ensure their availability now and well into the future.

Solar Energy

The sun is considered a limitless, renewable resource because it cannot be entirely consumed. The sun provides natural light, heat, and energy that we can harness to produce electricity. ***Solar energy*** is radiant energy emitted by the sun and ***solar power*** is power obtained by harnessing this energy. Solar energy is the cleanest form of energy we use. It produces no air or water pollution. Solar panels and solar thermal technology are the two most common systems used to harness the sun's energy.

Solar energy is a clean form of energy; however, the photovoltaic cells, solar panels, batteries, and other system components are manufactured using processes that may not be green. The solar panels also require a great deal of space and full exposure to the sun. Small systems are often installed on roofs of residential and commercial buildings. However, a system that is large enough to provide power to a community requires acres of open land, **Figure 1-2**.

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Figure 1-2. The sun's radiant energy is the only resource that is truly unlimited. A single home does not require a great number of solar panels; however, the systems used to collect the energy for a community may require a large expanse of land to be efficient. *What are some of the challenges with collecting and using solar power?*

Wind Energy

Wind energy is the kinetic energy of air in motion. (***Kinetic energy*** is the energy possessed by an object or system because of its motion.) As Earth's surface is heated by the sun and then cooled, wind is created as air moves because of differing atmospheric pressures across the land. Air is cooled over the poles, by the shadows of clouds, or by changes in elevation and it is heated by the sun. Differences in temperature create differences in pressures. Warmer air generally has higher pressure and cool air has lower pressure.

Human beings have used wind energy for thousands of years for tasks such as moving boats, grinding grain, pumping water, and generating electricity. Today, we use wind or air turbines to convert kinetic wind energy into mechanical power or electricity, **Figure 1-3**. Wind energy is a clean energy source that does not generate pollution. Air is considered a renewable resource because it goes through constant processing or cycling that cleanses and purifies it.

As with solar power systems, the components of wind turbines are produced using manufacturing processes that may not be green. There are also negative environmental consequences to wind power systems. Birds, bats, and other flying wildlife that nest in areas near the turbines may be killed by turning blades. Many people living near the turbines feel the turbines are unattractive, noisy, and that property values decrease when turbines are constructed.

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Figure 1-3. Wind farms are typically constructed on farmland because of the openness of the fields. *Do the disadvantages outweigh the advantages of harnessing wind energy?*

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Figure 1-4. Geothermal energy plants are located in areas where geothermal energy sources are close to Earth's surface. *Where in the United States is geothermal energy close to Earth's surface?*

Geothermal Energy

Geothermal power is generated from heat energy that is harnessed from the natural supply of heat beneath Earth's surface, **Figure 1-4**. Geothermal energy may be heat found in shallow ground, hot water, and hot rock found miles beneath Earth's surface or even deeper in molten rock called magma. Geothermal energy can be used to generate electricity on a commercial scale, heat and cool individual homes or businesses, or power individual systems in remote locations.

Geothermal power plants use the hot water or steam from geothermal reservoirs to generate electricity. There are several types of power generation systems; some are considered more "green" than others. The system used by an open geothermal plant, for example, releases some air pollutants, including hydrogen sulfide, trace amounts of arsenic, and various minerals. In comparison, a geothermal heat pump does not release any pollutants. There are some questions as to whether geothermal energy is a renewable resource because water sources may be depleted. It is also expensive to install and requires deep drilling, which may disturb the local environment and affect the stability of the land. Additionally, there is potential for gases to migrate to the ground surface and into the atmosphere.

Did You Know?

Geothermal electricity generation is currently used in 24 countries and geothermal heating is used in 80 countries.

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Figure 1-5. Swine producers may use the liquid waste from open manure pits as spray-on fertilizer for crop fields. Technologically advanced operations may use the methane released by the decomposing manure to fuel equipment or provide power to the facilities. *What are potential hazards of manure pits? What percentage of power produced with biomass is used in the United States?*

Biomass Energy

Biomass is any organic material used to produce fuel. ***Biomass energy*** is the energy harnessed from organic matter as it decomposes, when it is burned, or when it is treated with chemicals. Organic materials used as biomass include wood chips, corn, crop residue, manure, recycled vegetable oils, and animal fats, **Figure 1-5**. ***Biofuels***, such as ethanol, methanol, and biodiesel, are liquid fuels made from organic materials.

Many biomass materials are by-products that would become waste added to landfills or be burned at or near the source. Biomass is converted into energy through a thermal or biochemical process. Biomass fuels are not a green power source because they are typically burned to produce power, which releases carbon into the atmosphere. A great deal of research is dedicated to developing these types of fuels with the hope of reducing our dependency on fossil fuels.

Water Energy

Water is considered renewable because it goes through constant processing or cycling that cleanses and purifies it. Potable (safe to drink) water may seem to be in abundant supply, but of all the water on Earth, less than 3% is usable by freshwater aquatic organisms, humans, and terrestrial plants, and only 1% is easily accessible. Oceans contain the other 97%, which is hundreds of millions of cubic miles of nonpotable saltwater. (A cubic mile contains about as much water as flows over Niagara Falls in a month.) Our freshwater supplies come from groundwater, lakes, rivers, and streams, which are commonly fed by aquifers (underground reservoirs).

Aquifers

In the United States, we depend on several major aquifers for a great deal of our freshwater supply, especially for crop irrigation. While natural processes do cleanse and replenish water, the groundwater in some aquifers is considered nonrenewable because it originally came from melting glaciers during the last ice age some 2.6 million years ago, **Figure 1-6**. The natural water cycle cannot replenish the aquifers anywhere near the same rate that we are consuming it.

Hydroelectric Power

Hydroelectric power is power produced by water as it flows through a system of turbines. Most hydroelectric power plants use water that is diverted from major rivers into constructed dams. The generation of power is clean and does not pollute the air, land, or water, but there are many environmental issues associated with this type of power production.

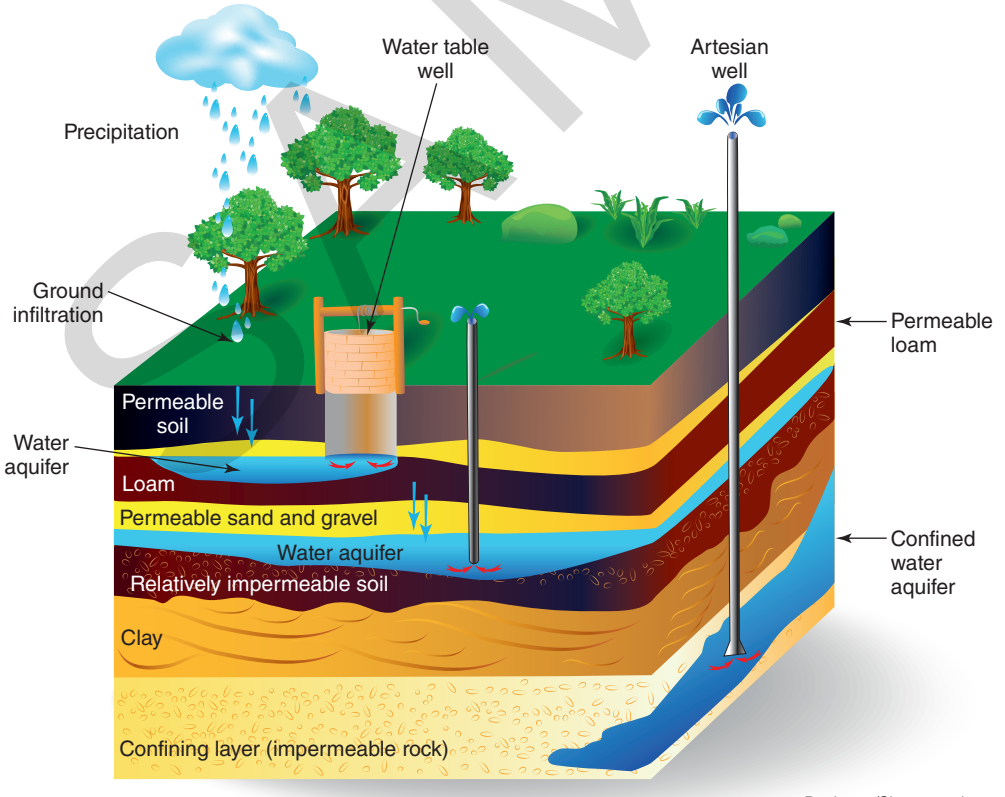

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Figure 1-6. Underground water was deposited with the melting of glaciers during the last ice age. Most freshwater used for drinking and irrigating agricultural cropland comes from underground aquifers. *Can an aquifer become contaminated? If so, how?*

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Figure 1-7. Fish ladders on the Columbia River at the Bonneville Dam in Oregon divert salmon from the dam and enable them to return upstream to spawn (lay eggs).

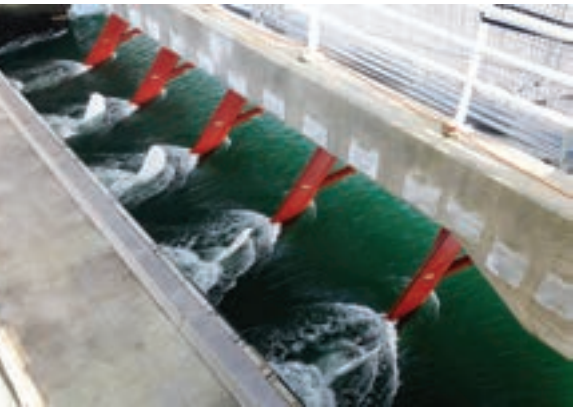

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Figure 1-8. Tidal turbines turn to produce power. These turbines are built in inlets and on coastlines where changing water levels force the blades to turn.

The construction of major dams, such as the Hoover Dam on the lower Colorado River and Grand Coulee Dam on the Columbia River, changed the landscape and have major impacts on wildlife and human populations. The land area where the water is diverted and the reservoir is created is flooded, which destroys existing wildlife habitats and displaces wildlife and humans living on the land. The diversion of the river also disrupts migratory pathways for fish that return to spawning locations. Aquatic animals are also caught and drowned in the drag produced by the spinning blades. See **Figure 1-7**.

Tidal and Wave Energy

Power can also be generated using the water movement of incoming and outgoing tides. As the tides rise and fall, water turbines turn and generate electricity, **Figure 1-8**. These turbines are most active when water levels are rising and falling, but small shifts in water movement between the tides also generate electricity.

Tidal power generation is clean and considered green power production. It has great potential for use in coastal regions around the world. However, marine species swimming close to the turbines are often caught in the drag produced by the spinning blades.

Timber Resources

Timber is considered a renewable resource because trees can be planted to replace those harvested for lumber, **Figure 1-9**. However, some trees take as many as 50 years to reach a size that is useful for fuel, paper, or lumber. Fifty years may seem to be a long time, but it is a relatively short period when compared to the millions of years needed to produce crude oil. Tree farms plant nursery-grown seedlings rather than seeds to reduce the

Figure 1-9. Although trees may take 10 or 20 years to grow to this size, the trees from which these logs were harvested are renewable natural resources.

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time needed to grow trees to a harvestable size. The practice of growing trees for production is referred to as *silviculture* or *forestry*. Wood by-products from harvesting and processing lumber may be used as fuel for heating. Even though timber resources are renewable, sustainable forestry practices must be used to maintain our timber resources.

"The best time to plant a tree was 20 years ago and the second-best time to plant a tree is now."
—**old Chinese proverb**

Nonrenewable Natural Resources

The primary nonrenewable resources are soil, minerals, and fossil fuels, such as coal, petroleum, and natural gas. The following is a brief introduction to the types of nonrenewable resources we use. Each of the topics is covered in more detail in later chapters of the textbook.

Soil

Soil is considered a nonrenewable resource because of the amount of time necessary to create soil from weathering and erosion. Natural soil formation requires nearly 500 years to form one inch of topsoil. Soil can be lost through erosion caused by moving water or the wind. Soil erosion results in the loss of valuable topsoil and leads to sedimentation of rivers and streams that kills fish and other aquatic life. Efforts by conservationists and farmers to prevent soil erosion include conservation tillage practices, maintaining vegetative plant cover, and planting grassed waterways and buffer strips that absorb runoff water.

Did You Know?

Scientists estimate that trees over 50 years of age sequester more carbon than younger trees.

STEM Connection

Does Your Lifestyle Depend on Fossil Fuels?

What would happen if all the petroleum (crude oil) on the planet were consumed? How much of an impact would it have on your life? Make a list of every activity you did yesterday from the time you woke up until the time you went to bed. Once you have your list, identify all the material goods you used. Include everything from the materials and energy used to make your toothpaste to the power consumed by your cell phone. Now see if you can identify which actions and materials required petroleum at some point in their production.

Consider This

1. How long is your list?
2. Does your list include clothing, food, soap, and water?
3. How about your mode of transportation? Do you ride the bus or get a ride to school?
4. Are you surprised to find how much your lifestyle depends on this fossil fuel?

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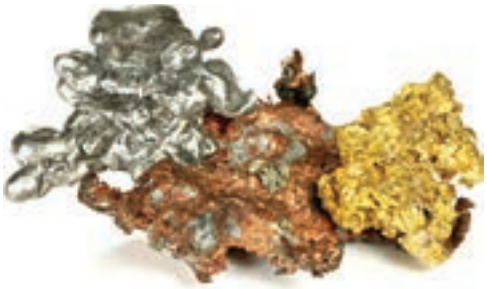

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Figure 1-10. Silver, copper, gold, and uranium are mineral resources that are nonrenewable. Deposits of these minerals were laid down when Earth was formed.

Minerals

Commonly used minerals include both metals and nonmetals. Gold, silver, copper, iron, uranium, and aluminum are some of the most commonly mined metals. Calcium, phosphorous, and potassium are nonmetal minerals that are mined for use in many manufactured products. Minerals are considered nonrenewable because they were created when the planet was created and cannot be replaced or renewed, **Figure 1-10**. We can extract minerals when we recycle metals and other objects containing them, but we cannot create these metals through any synthetic means.

Nuclear Energy

Nuclear energy is considered nonrenewable because it requires uranium. ***Uranium*** is a naturally occurring radioactive metal used as fuel in nuclear reactors. The uranium is mined from the ground in a process similar to coal mining, **Figure 1-11**. Mine workers' health, as well as that of those living nearby, may be compromised due to dust and radon exposure, noise, and water contamination.

Using nuclear energy to generate electricity is a very clean way to produce power. It does not emit carbon dioxide or other greenhouse gases. However, as with all industrial processes, nuclear power generation does have waste products. Much of the waste is low-level radioactive waste, such as the tools, protective clothing, and disposable items used in the plant that have been contaminated with radioactive particles. These materials are disposed of under special regulations. Of greater concern are the radioactive spent fuel assemblies. These are stored in specially designed water pools or dry storage containers. Radioactive waste materials remain radioactive and dangerous to the environment and its inhabitants for thousands of years. Nuclear power plants are also subject to natural disasters and accidents that can contaminate the surrounding environment and make it uninhabitable.

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Figure 1-11. An open uranium mine emits radiation in addition to producing other mining waste. *What effects do leaks from nuclear power plants have on the local and global environments? Are retired nuclear power plants a hazard?*

Fossil Fuels

Fossil fuels are considered nonrenewable because they can only be formed through the decay of plants and animals over millions of years. ***Fossil fuels*** are buried combustible deposits of organic matter that have been converted by heat and pressure to crude oil, coal, and natural gas. We use these organic compounds to generate power for heating and cooling and to power vehicles and equipment. Our dependence on fossil fuels, the pollution they generate, and

Career Connection

Careers in Natural Resources

According to the *Occupational Outlook Handbook*, nearly half a million people work in natural resources careers. Their incomes range from $50,000 to $60,000 annually. Most professionals in the industry have education beyond high school, including bachelor's and master's degrees. They enjoy working outdoors and also enjoy encouraging others in stewardship, preservation, and conservation of resources.

Specific careers include natural resources managers, ecosystem and sustainability scientists, fish and wildlife conservation officers, geoscientists, restoration ecologists, conservation scientists, and park rangers, among many others. We will explore several of these and other natural resources careers in this textbook. Consider doing a bit of research on your own with the *Occupational Outlook Handbook* on the Bureau of Labor Statistics website.

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the depleting supplies are the main reasons alternative fuel sources are being researched and developed.

Biotic and Abiotic Natural Resources

Natural resources can also be divided into two other categories: living and nonliving. ***Biotic natural resources***, such as fungi, protists, bacteria, animals, and all types of plants, including trees, are living resources, **Figure 1-12**. ***Abiotic natural resources*** are resources that are not living organisms. Fossil fuels and minerals are examples of nonliving natural resources. Living and nonliving resources naturally interact in environments around the world. We depend on the availability of these resources, as well as this natural interaction, to sustain our way of life.

Water and Soil

Water and soil are both considered nonliving natural resources. Although they are often referred to as *living seas* and *living soil*, they are not living organisms. (An ***organism*** is an individual form of life, such as an animal, plant, or bacterium.) However, they both contain habitats for millions of plant and animal species

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Figure 1-12. Brown bears, aspen trees, and the fish swimming in the lake are all examples of biotic natural resources.

A Paul S. Wolf/Shutterstock.com

B Maryna Pleshkun/Shutterstock.com

Figure 1-13. A—Humpback whales depend on microscopic organisms in the *living seas* for their survival. B—Earthworms are some of the visible living organisms found in the *living soil*. *How do earthworms affect soil?*

who depend on them for survival, **Figure 1-13**. Some of these plants and animals are large enough to be seen with the naked eye while others, such as bacteria, fungi, and protists, are microscopic. Water and soil also provide minerals and other nonliving resources needed for these living plants and animals to survive.

Flora and Fauna

Living natural resources are also divided into the categories of flora and fauna. ***Flora*** refers to the plant life and ***fauna*** refers to animal life. Flora and fauna interact in all environments. While we do consume or use some flora and fauna for sustaining life, other flora and fauna simply contribute to the aesthetics of our environment, which enhances the quality of our lives. For example, deer are hunted to provide meat and syrup is harvested from maple trees in the fall to use on food, such as pancakes. The deer are also enjoyed by people observing them while they graze in a meadow and many people travel to see the maple trees as their leaves magnificently change colors in the fall, **Figure 1-14**.

Flora and fauna also contribute to biodiversity in ecosystems. ***Biodiversity*** is the variety of organisms living in an ecosystem. This biodiversity fosters healthy ecosystems and offers opportunities for discovery of new species. Further, new natural chemicals may be found in areas of high biodiversity. These may be used for medical advances or organic pest management.

A Tony Campbell/Shutterstock.com

B Marina Zezelina/Shutterstock.com

Figure 1-14. A—Many people enjoy seeing wild animals when they visit a national park. B—People often travel to areas where there is an abundance of trees changing color in the fall.

Environmental Stewardship

> "The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased; and not impaired in value."
> —**Theodore Roosevelt,** US President

To maintain our natural resources, everyone, including agriculturists, scientists, and policy makers, must become environmental stewards. ***Environmental stewardship*** is the responsible use of natural resources and the protection of those resources that are in short supply. Conservation, preservation, sustainable practices, and recycling are all methods used by people to protect and preserve natural resources responsibly.

Agriculturists, including farmers, ranchers, foresters, producers, and growers, are generally considered good stewards of natural resources. Agriculturists depend on natural resources, such as healthy soil, clean air and water, and bountiful forests for their livelihoods. Modern agriculturists constantly seek to reduce their impact on the environment through improved production practices, reduction in inputs, and use of cultural practices to improve yields. With abundant natural resources, farmers, ranchers, and foresters can produce the food, fiber, and other products that human beings use on a daily basis. Agriculturists spend considerable time and effort installing natural resources conservation structures and practices in their operations to ensure sustainable use of natural resources. Environmental stewardship practices employed by agriculturists are discussed in more detail in later chapters of this textbook.

Conservation and Preservation

Conservation and preservation of natural resources are two fundamental ideas that people often confuse. ***Conservation*** is the wise use of natural resources and ***preservation*** is the protection and nonuse of natural resources. Some key Americans began conservation efforts in the late 1800s and early 1900s when they realized the importance of dedicating and preserving some of our forests and prairies in their natural states. Hence came the role of conservationists. ***Conservationists*** are people whose careers focus on educating others and implementing programs to conserve resources.

Conservationists understand that humans must consume natural resources and because these resources are limited, they must be used wisely to prevent their complete consumption. Conservationists also agree that some resources are so precious that they should not be consumed. Although many people think we should preserve or not use our natural resources, it would not be feasible to do so because pure preservation would mean that we could not use *any* resources. While preservation of all resources is not possible, pure preservation is necessary for some resources, such as endangered species. Endangered species exist in such low numbers that they are on the verge of extinction, **Figure 1-15**.

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Figure 1-15. Endangered species, such as this hawksbill sea turtle, are the focus of preservation efforts to help establish sustainable populations. *Why has the hawksbill sea turtle become an endangered species?*

Galyna Andrushko/Shutterstock.com

Figure 1-16. It is possible to visit places such as Zion National Park in Utah because of the foresight and efforts of many people to preserve state and national parks.

Preservationists work to ensure that the habitats and food sources of endangered species remain stable to allow them to increase their numbers. (***Preservationists*** are people who work as supporters or advocates of natural resources and the nonuse of those resources.) Preservationists also support efforts to keep areas such as our state and national parks in their natural states. These parks are preserved for our enjoyment and to help maintain natural ecological cycles, **Figure 1-16**.

Conservationists and preservationists support laws and public acts to protect our environment. These laws ensure that future visitors will have an opportunity to view scenery, hike trails, and learn about the wildlife of the area. For example, there are laws that forbid taking anything, even a stone or stick, from a state or national park. Imagine if each visitor took just one stone from a national park, millions of stones would eventually be removed. The only things you can take with you after visiting a state or national park are your memories, photographs, and trash, **Figure 1-17**.

T. Park

Figure 1-17. This hiker on the Appalachian Trail will take nothing but memories, photographs, and his trash with him when he leaves the national park.

While some people choose to make a career of conservation or preservation, we should all be conservationists in practice. Small actions, such as turning off unused lights or power strips, greatly reduce power consumption. Other conservation practices we can engage in include fixing leaky faucets, not running the water as you brush your teeth, and taking advantage of natural daylight to light a room. Recycling materials and using a compost bin for food scraps are also conservation practices.

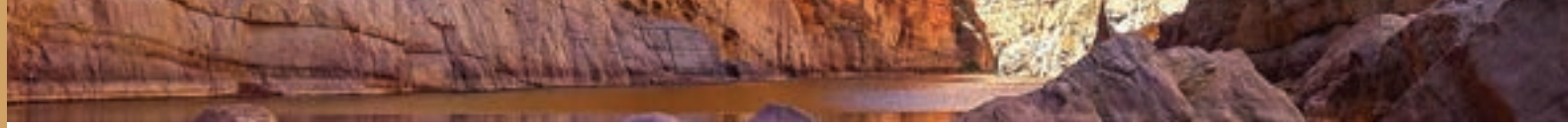
Why Are Natural Resources Important?

Natural resources are important because all living things require them to survive. No other planet in our solar system has the unique blend of temperature, light, water, soil, and energy to support life as we know it. As our global population increases, more and more people and industries will rely on our renewable and nonrenewable natural resources. In other words, the same amount of land, water, and air we have now will have to support billions more people. It will be only through wise conservation and preservation efforts on a global scale that we can sustain our use of natural resources well into the future.

We must be good stewards of our natural resources to maintain them for future generations, and ourselves. We will learn more about our environment, how human beings make an impact on Earth, and methods of good stewardship of natural resources throughout the remainder of the book.

Summary

- Natural resources are the things found in our environment that we depend on for life, such as air, water, soil, plants, animals, and the sun.
- Renewable resources are resources that are plentiful and replenished naturally in a relatively short period.
- Renewable resources include the sun (solar energy), air (wind energy), geothermal energy, biomass, timber, and water.
- Nonrenewable resources are those that cannot be replenished or require a long time to be replenished.
- Nonrenewable resources include soil, minerals, and fossil fuels, such as coal, petroleum, and natural gas.
- Natural resources are also classified as biotic (living) or abiotic (nonliving).
- Environmental stewardship is the responsible use of natural resources and the protection of those resources that are in short supply.
- Conservation is the wise use of natural resources and preservation is the protection and nonuse of natural resources.
- Natural resources are important because all living things require them to exist.



Chapter Review and Assessment

Vocabulary Review

Match the key terms from the chapter to the correct definition.

A. biofuel
B. biomass
C. conservation
D. conservationist
E. environmental stewardship
F. fauna
G. flora
H. fossil fuels
I. living natural resource
J. natural resource
K. nonliving natural resource
L. nonrenewable resource
M. organism
N. preservation
O. preservationist
P. renewable resource
Q. solar energy
R. solar power
S. wind energy

1. A resource that cannot be replenished or requires a long time to be replenished.
2. The wise use of natural resources.
3. Power obtained by harnessing radiant energy emitted by the sun.
4. A term that refers to plant life.
5. A person whose career focuses on educating others and implementing programs to use resources wisely.
6. A term that refers to animal life.
7. The organic material used to create fuel and energy, including wood chips, corn, manure, vegetable oils, and animal fats.
8. Buried combustible deposits of organic matter that have been converted by heat and pressure to crude oil, coal, and natural gas.
9. One of the many things found in our environment that we depend on for life, such as air, water, soil, plants, animals, fossil fuels, and the sun.
10. The radiant energy emitted by the sun that can be harnessed and used to create power.
11. A person who works as a supporter or advocate of natural resources and the nonuse of those resources.
12. A resource that breathes, moves, and reproduces.
13. A liquid fuel, such as ethanol, methanol, and biodiesel, which is made from organic materials.
14. The responsible use of natural resources and the protection of those resources that are in short supply.
15. A resource that does not breathe, move, or reproduce.
16. The kinetic energy of air in motion that can be converted into mechanical power or electricity.
17. The protection and nonuse of natural resources.
18. A resource that is plentiful and replenished naturally in a relatively short period.
19. An individual form of life, such as an animal, plant, or bacterium.

Know and Understand

Answer the following questions using the information provided in this chapter.

1. Humans use natural resources for _____.
   A. food
   B. shelter and clothing
   C. entertainment
   D. All of the above.
2. Which type of natural resource can be replenished in a relatively short period?
   A. A renewable resource
   B. A nonrenewable resource
   C. A synthetic resource
   D. All of the above.

3. Which natural resource is considered unlimited?
   A. Geothermal energy
   B. Photovoltaic energy
   C. Nuclear energy
   D. Solar energy
4. *True or False?* The kinetic energy of wind has been used for grinding grain, pumping water, and generating electricity.
   A. True
   B. False
5. *True or False?* An open geothermal plant does *not* release any pollutants.
   A. True
   B. False
6. *True or False?* Many biomass materials are by-products that would become waste added to landfills or be burned at or near the source.
   A. True
   B. False
7. What percentage of Earth's water is usable by freshwater aquatic life and terrestrial plants and animals?
   A. 2%
   B. 3%
   C. 5%
   D. 10%
8. Some water is classified as a nonrenewable natural resource because _____.
   A. water that is contaminated in oceans cannot be cleaned and purified
   B. seawater cannot be desalinated and used on crops or for human purposes
   C. water in aquifers that came from glaciers cannot be replaced quickly
   D. water in aquifers cannot be purified if it is contaminated
9. *True or False?* Most hydroelectric power plants have little impact on the surrounding environment.
   A. True
   B. False
10. *True or False?* The water movement of incoming and outgoing tides can be used to generate power.
    A. True
    B. False
11. *True or False?* Timber is considered a nonrenewable resource.
    A. True
    B. False
12. Soil is a nonrenewable natural resource because it _____.
    A. can never be renewed
    B. was laid down by glaciers and cannot be renewed
    C. contains living organisms that once killed, cannot repopulate
    D. requires 500 years to be replenished, too long to be renewable
13. Conservation practices that farmers use to control soil erosion include _____.
    A. grassed waterways
    B. buffer strips
    C. contour tillage
    D. All of the above.
14. Minerals are a nonrenewable resource because _____.
    A. minerals were created when Earth was created
    B. minerals can only be made in laboratory settings
    C. scientists can only create small amounts of minerals
    D. All of the above.
15. Which of the following applies to the use of nuclear energy as a power source?
    A. It is a renewable resource
    B. It is a clean way to produce power
    C. There are no waste products
    D. All of the above.
16. Of the following, which are nonliving natural resources?
    A. Fossil fuels, soil, and minerals
    B. Water, flora, and fauna
    C. Timber, minerals, and water
    D. Flowers, fauna, and minerals
17. What purpose do flora and fauna serve in our environment?
    A. Aesthetic beauty
    B. Biodiversity
    C. Sustaining life
    D. All of the above.

18. *True or False?* Conservation, preservation, sustainable practices, and recycling are all methods used by people to protect and preserve natural resources responsibly.
    A. True
    B. False
19. Conservation is the _____.
    A. nonuse of natural resources
    B. wise use of natural resources
    C. preservation of resources for future generations
    D. All of the above.
20. Where in the United States can we find preservation practices in action?
    A. Farmland and ranches
    B. Cities and towns
    C. State and national parks
    D. Museums
21. What items can you legally remove from a state or national park?
    A. Rocks and sticks
    B. Plant and animal species
    C. Rocks, minerals, and stones
    D. Photographs, memories, and your trash
22. Natural resources are important to humans because _____.
    A. humans cannot recreate them
    B. humans depend on natural resources for life
    C. natural resources provide beauty in our world
    D. natural resources are abundant and inexhaustible

Thinking Critically

1. Why do people sometimes refer to soil as "living soil"? What features of soil make it come alive?
2. Why would agriculturalists want to be good stewards of their natural resources? List ways in which agriculturists can be good stewards of natural resources.
3. Why would preservation of all natural resources not be feasible?
4. What are several consequences (related to natural resources) of a growing global population?
5. Are hydrogen fuel cells a viable source of energy? Where has this technology been applied?
6. Consider three things that you disposed of in the past 24 hours. How could you have reduced, reused, or recycled those products? List the products and ways in which each could be recycled or reused.

STEM and Academic Activities

1. **Science.** Can you identify other natural resources not explained in the chapter? Are they renewable or nonrenewable?
2. **Science.** Inventory the trees in your yard or your schoolyard. Which trees do you think were planted more than 50 years ago? Why?
3. **Science.** What are the water sources for your home and school? Are these water sources renewable or nonrenewable? How do you know?
4. **Technology.** Conduct a natural resources inventory analysis of a day in your life. Can you list and categorize all the natural resources that you use in a day?

5. **Social Science.** Conduct a conservation mindset action plan in your home. Determine how you and your family can reduce your use of natural resources. If possible, track any changes in utility bills that are a result of your efforts.
6. **Social Science.** Research the movement of radiation and chart the geographic distribution of the radioactive cloud produced during the Chernobyl nuclear disaster for 18 days following the incident. How does this movement of radiation connect to the concept of a global airshed and what could be done to prevent such a disaster in the future?

FFA and SAE for ALL Opportunities

1. **FFA.** Several FFA Career Development Events relate directly to natural resources, including the Environmental and Natural Resources CDE and the Forestry CDE. Participate in the individual and/or group activities.
2. **Foundational SAE.** Create a supervised agricultural experience related to natural resources that qualifies for one of several FFA proficiency areas. Visit the FFA website and review the following categories: Agriscience Research Integrated Systems, Environmental Science and Natural Resources Management, Forest Management and Products, Outdoor Recreation, and Wildlife Production and Management.

Communicating about Natural Resources

1. **Writing.** Prepare a short article for your local newspaper, school newspaper, or social media about the need to conserve natural resources. What can you and your peers do to conserve natural resources?
2. **Speaking.** Prepare a public presentation about natural resources in your area. Which are in danger of becoming nonexistent? Which have economic value? What can be done to conserve these resources?
3. **Reading and Speaking.** Contact your local power company and speak with their customer service representative to determine what types of fuels are commonly used to produce the power in your area. If possible, trace back where the sources of these fuels are located and discuss with your class added costs of transportation that increase overall fuel costs in your area.