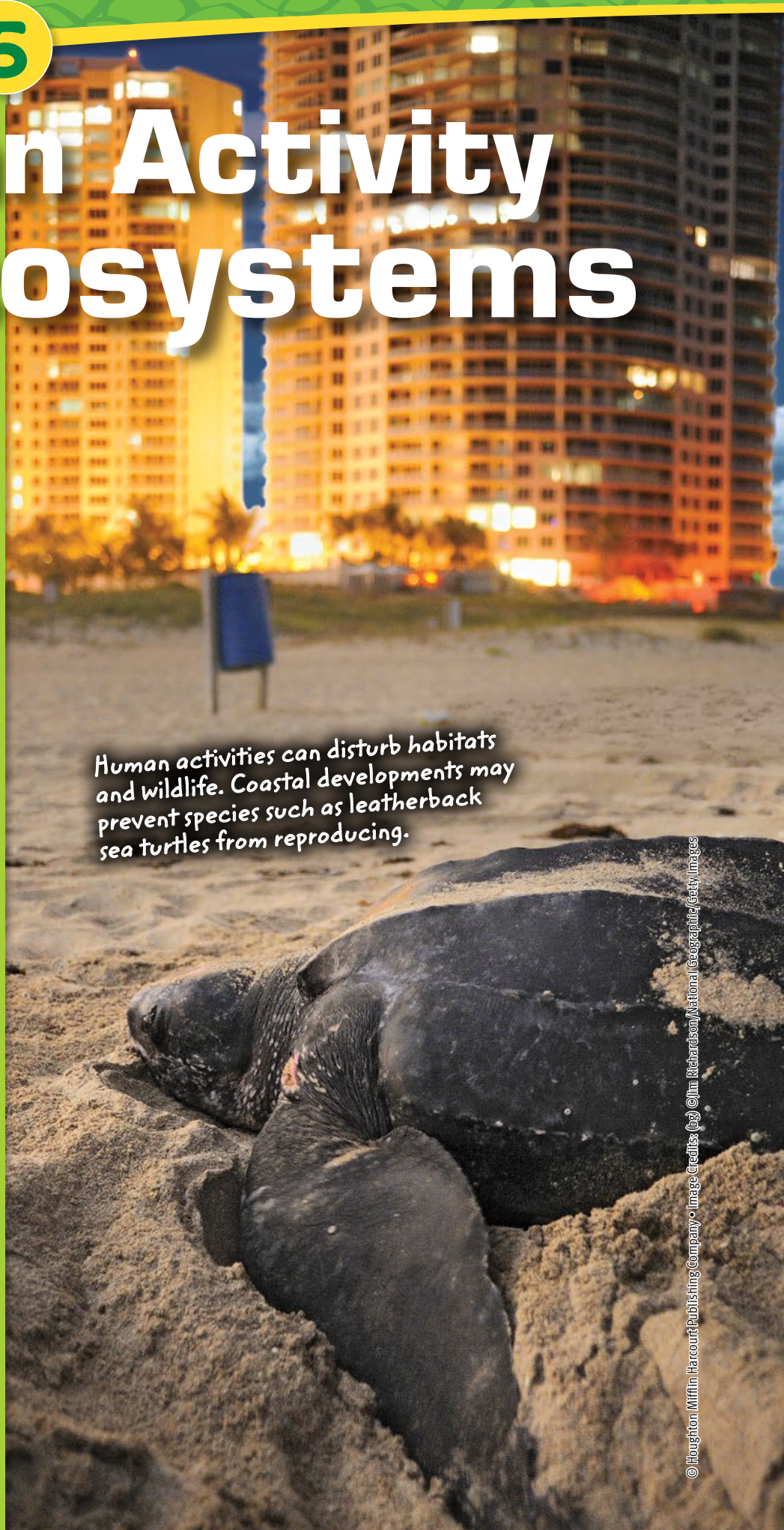
Lesson 5

Human Activity and Ecosystems

ESSENTIAL QUESTION

How do human activities affect ecosystems?

By the end of this lesson, you should be able to describe the effects of human activities on ecosystems, and explain the role of conservation in protecting natural resources.



Human activities can disturb habitats and wildlife. Coastal developments may prevent species such as leatherback sea turtles from reproducing.

S7L4.c Factors affecting ecosystems

Lesson Labs

Quick Labs

- Biodiversity All Around Us
- Investigate the Acidity of Water

Field Lab

- Field Investigation of Plant Quantity and Diversity

Engage Your Brain

1 Explain Think about what you see as you go to and from school. What is one example of human activity that you would change if you could?

Why and how would you make this change?

2 Describe Write your own caption to this photo.

Active Reading

3 Synthesize Many English words have their roots in other languages. Use the Latin words below to make an educated guess about the meaning of the words *urbanization* and *biodiversity*.

Latin word	Meaning
urbanus	city
divertus	diverse
bio	life

Example sentence

The population of Los Angeles increased during the 20th century because of urbanization.

urbanization:

Example sentence

The biodiversity of our food crops has decreased over the last several decades.

biodiversity:

Vocabulary Terms

- **urbanization**
- **biodiversity**
- **eutrophication**
- **stewardship**
- **conservation**

4 Identify As you read, place a question mark next to any words that you don't understand. After you finish reading the lesson, go back and review the text that you marked. If the information is still confusing, consult a classmate or your teacher.

Growing Pains

How do humans negatively affect ecosystems?

Human activities can change and even harm ecosystems. An *ecosystem* is all of the living and nonliving things within a given area. Changing one thing in an ecosystem can affect many other things, because everything in an ecosystem is connected.

Humans can affect ecosystems through pollution. *Pollution* is caused by any material or condition that harms the environment. For example, factories and automobiles burn fossil fuels. This releases harmful chemicals into the environment. Farms that produce our food may also burn fossil fuels and release chemicals, such as pesticides or fertilizers, into the environment.

Even simple actions can harm ecosystems. For example, the trash we throw out may end up in a landfill. Landfills take up space and may contain harmful materials like batteries. Toxic metals in batteries can leak into soil or groundwater, with drastic consequences for organisms and ecosystems.

5 Relate Identify a form of pollution that you observe in your community. How does it affect the people and animals living there?

Tons of garbage are put into landfills every day.

As cities and suburbs expand closer to natural areas, wildlife may wander into our backyards and onto our streets.

By Depleting Resources

Earth's population has increased from 1 billion to more than 7 billion people in the last 200 years. The growing human population has created a greater need for natural resources. This need has created problems for ecosystems. Cutting down trees removes a resource that many organisms need for food and shelter. The loss of many trees in an area can affect shade and local temperatures. These changes can disturb ecosystems.

The overuse of resources causes them to be depleted, or used up. *Resource depletion* occurs when a large fraction of a resource has been used up. Fresh water was once a renewable resource. But in some areas, humans use fresh water faster than it can be replenished.

By Destroying Habitats

Human population growth in and around cities is called **urbanization** (er•buh•nih•ZAY•shuhn). Urban growth often destroys natural habitats. Roads can divide habitats and prevent animals from safely roaming their territory. If animals cannot interact with each other and their surroundings, the ecosystem will not thrive.

An ecosystem may be converted into housing and shopping areas that further shrink habitats. This can bring humans and wildlife into contact. Deer, raccoons, and even coyotes have become common sights in some suburban areas.

Every habitat has its own number and variety of organisms, or **biodiversity**. If a habitat is damaged or destroyed, biodiversity is lost. Because living things are connected with each other and with their environment, loss of biodiversity affects the entire ecosystem.

Think Outside the Book Inquiry

6 Apply Do research to find out what the environment around your school looked like 100 years ago.

An open-pit mine like this one is one way that humans remove minerals from the ground. Minerals are nonrenewable resources.

Cutting down forests destroys habitats and affects the physical features of the ecosystem.

Disease is largely an environmental issue. Sixty percent of infectious diseases that affect humans are zoonotic—they originate in animals. And more than two thirds of those originate in wildlife. The table below lists some of these zoonotic diseases.

7 Synthesize How might the destruction of animal habitats through urbanization and deforestation affect human populations? Provide specific data from the table.

Disease	Main Hosts	Usual Mode of Transmission
Lyme Disease	Deer (deer tick)	Tick bites
Rabies	Bats, foxes, raccoons	Bite of infected animal
West Nile Fever	Mosquitoes	Mosquito bite
Zika	Mosquitoes	Mosquito bite

Sources: www.gov.uk; Yale School of Forestry & Environmental Studies, 2016

Water, Water Everywhere?

How do humans impact oceans?

Active Reading

8 Identify As you read, underline the sources of ocean pollution.

Oceans support a variety of ecosystems that together contain nearly half of Earth's species. Pollution from human activities damages ocean ecosystems and threatens marine biodiversity.

Point-source pollution comes from one source. Oil spills, such as the one shown above, are an example of this. Spilled oil pollutes open waters and coastal habitats. *Nonpoint-source pollution* comes from many sources. For example, chemicals such as fertilizers and pesticides may be washed into oceans, where they harm many marine organisms.

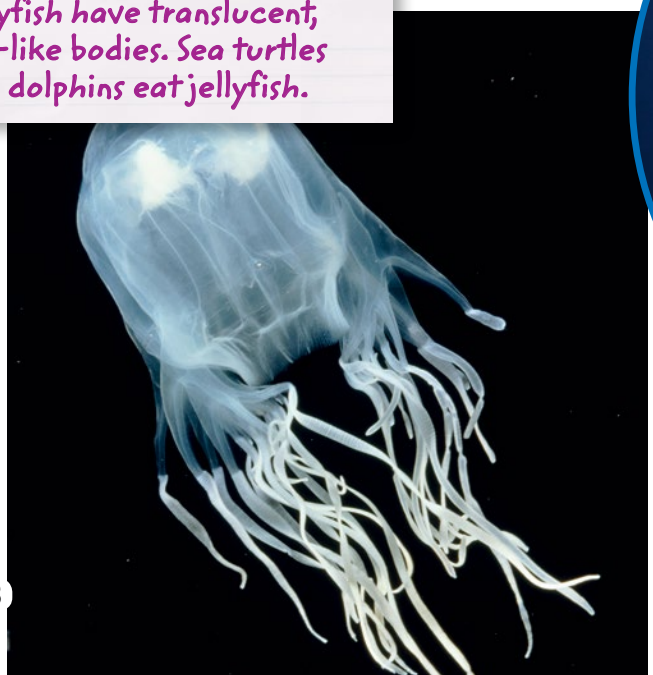
Raw sewage and trash are frequently dumped into marine habitats. Plastic bags and packaging are dangerous to marine animals. Some animals mistake bags for food or become tangled in packaging. Dumping trash in the ocean is illegal. Many people and agencies work hard to enforce laws that protect the oceans.

Visualize It!

9 Predict Compare these pictures. What is one problem that could arise if a sea turtle sees the plastic bag underwater?

Underwater, plastic bags look like jellyfish.

Jellyfish have translucent, sac-like bodies. Sea turtles and dolphins eat jellyfish.



Through Fishing and Overfishing

A greater demand for seafood from the growing human population has led to *overfishing* of some ocean species. Many fish species cannot reproduce fast enough to replace individuals that are harvested for food. When large numbers of a single fish population are caught, the remaining population may be too small to successfully reproduce. If the population cannot replace itself, it can become locally extinct. The local loss of a species can disturb ocean food webs and threaten ecosystem stability.

Overfishing means that the rate at which fish are caught exceeds the rate at which the species can reproduce.

Through Coastal Development

The growing human population also has led to increased coastal development. That means building homes and businesses on and near beaches and wetlands. Sadly, this can destroy the very coastlines we want to be near. Roads and shopping centers divide habitats. Increased human activity increases pollution both on shore and in coastal waters.

In some places, development has almost completely replaced natural coastlines. For example, construction of new homes and businesses is rapidly destroying mangrove forests. Mangroves are unique trees found only in certain coastal regions. Mangrove forests play a key role in maintaining coastlines. The thick roots stabilize the sandy soil and prevent erosion. The trees are home to a wide range of species.

Human activity has also damaged coral reefs, but people and scientists are working to correct this damage. Coral reefs are vital ecosystems because so many species live in or around them. To replace this lost habitat, scientists have created artificial reefs. First, different fish species will find safety in the structures. Next, algae and soft corals begin to grow. Over time, hard corals grow and other sea life can be seen. Artificial reefs preserve the reef food web and stabilize the ecosystem.

10 List What are three ways that human activities affect ocean ecosystems?

Artificial reefs, such as sunken ships or other human-made objects, are being used to make up for the loss of natural coral reefs.

How do humans affect freshwater ecosystems?

Active Reading

11 Identify As you read, number the steps involved in the formation of acid rain.

Human activities have decreased the amount of water, or *water quantity*, in many river ecosystems. Dams and river channelization are two examples of this. Dams block the flow of river water. That means there is less water downstream of the dam. Channelization is used to straighten rivers to improve travel and other activities. However, changing the natural course of a river also changes the amount of water in it. Differences in water levels can change water temperature and chemistry. These changes can affect the reproduction and survival of many river species.

Human activities can also decrease *water quality*, or change how clean or polluted the water is, in ecosystems. Pollution disturbs water quality. Animal waste and fertilizer from farms contain nutrients that can enter ponds and lakes as runoff. An increase in the amount of nutrients, such as nitrates, in an aquatic ecosystem is called **eutrophication** (yoo•trohf•ih•KAY•shuhn). The extra nutrients cause overgrowth of algae. The excess algae die and decompose, using up the pond's dissolved oxygen. As dissolved oxygen levels decrease, fish begin to die. If eutrophication continues, the pond ecosystem will not recover.

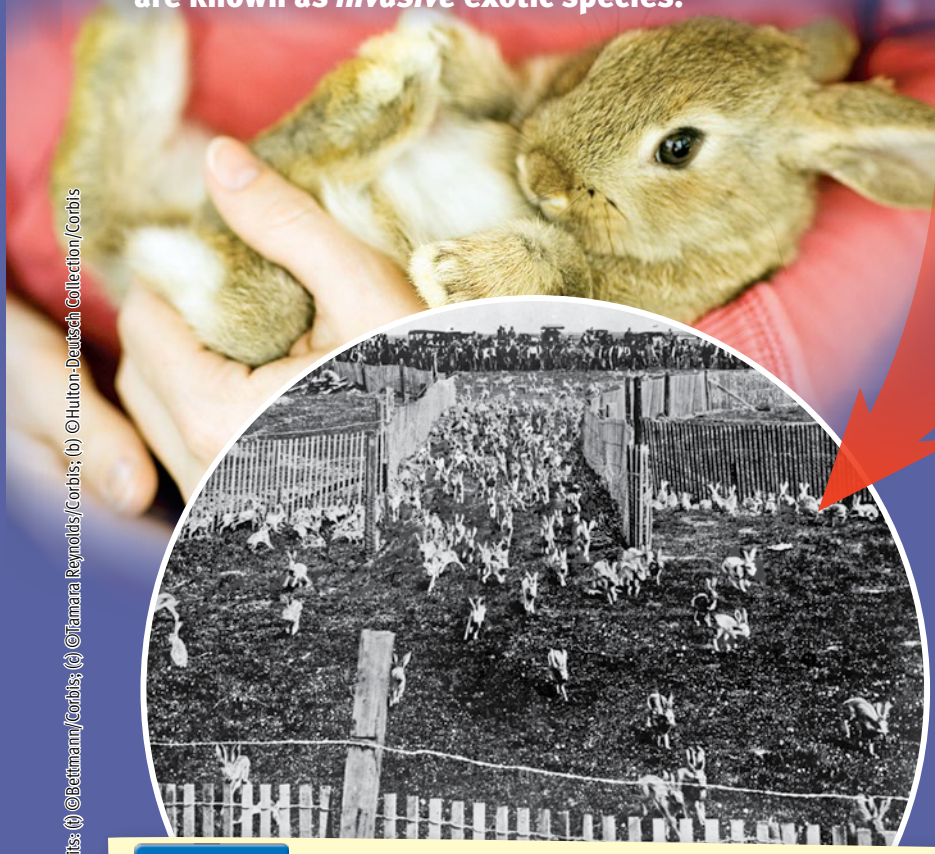
Water quality is also affected by air pollution. For example, some freshwater ecosystems are affected by acid rain. Burning fossil fuels releases chemicals into the air. Some of these combine with rain to form acids. Small amounts of acid in rain cause its pH to fall below its normal value of 5.6. Acid rain can damage both aquatic and terrestrial ecosystems.

Why It Matters

Exotic Species

EYE ON THE ENVIRONMENT

An organism that makes a home for itself in a new place outside its native home is an *exotic species*. Exotic species often thrive in new places because they are free from the predators found in their native homes. Exotic species that outcompete native species for resources, such as food or space, are known as *invasive* exotic species.



European rabbits were introduced into Australia by human activity. They were brought into this country in 1859 for sport hunting. With plenty of space and food—and no predators—Australia's rabbit population exploded.

The rabbits threatened the survival of many native Australian animals and plants. Many efforts were made to control the rabbit population. Their dens were poisoned. Rabbit-proof fences were built. Rabbits were even "herded" by cowboys.

So far, all efforts to remove rabbits have failed. There are still more than 200 million rabbits in Australia.

Extend

Inquiry

12 Explain Based on the data presented on the page, how does human activity such as the introduction of exotic species contribute to habitat destruction?

13 Hypothesize Form a hypothesis about a method that might be effective in controlling an invasive exotic species. Gather evidence to support the reasoning for your hypothesis.

14 Research Identify a non-native plant species that has been introduced into the United States. Explain where the species came from, how or why it was brought to the United States, and how it has affected the ecosystem.

Save It!

How do humans protect ecosystems?

Active Reading

15 Identify As you read, underline the definition of stewardship.

There are many ways that humans can protect ecosystems. One way is by using Earth's resources in a careful manner. The careful and responsible management of a resource is called **stewardship**. The resources of an ecosystem include all of its living and nonliving parts.

By Maintaining Biodiversity

The organisms in an ecosystem depend on each other and interact with each other in a vast interconnected food web. Each species has a place in this web and a role to play. The loss of a species or introduction of an exotic species creates gaps in the web. This can disrupt species interactions. Protecting habitats and helping species survive protects the biodiversity in an ecosystem. The greater the biodiversity, the healthier the ecosystem.

16 State What are two ways that humans can help maintain biodiversity in ecosystems?

You can reduce pollution by participating in a local cleanup project.

You can protect habitats by staying on marked trails when visiting national parks and forests.

By Conserving Natural Resources

Humans can protect ecosystems through conservation. **Conservation** is the protection and wise use of natural resources. Practicing conservation means using fewer natural resources and reducing waste. It also helps prevent habitat destruction.

The "three Rs" are three ways to conserve resources.

- *Reduce* what you buy and use—this is the first goal of conservation.
- *Reuse* what you already have. For example, carry water in a reusable bottle and lunch in a reusable lunch bag.
- *Recycle* by recovering materials from waste and by always choosing to use recycling bins.

You can practice conservation every day by making wise choices. Even small changes make a difference!

17 Synthesize Suppose you wanted to stop eating fast food to cut down on excess fat and sodium. How might this benefit the environment as well?

You can help prevent water shortages by turning off the water as you brush your teeth.

You can reduce pesticide use by supporting responsible agriculture.

You can reduce the use of fossil fuels by turning off lights and supporting alternative energy sources.

Visual Summary

To complete this summary, fill in the blanks with the correct word. Then use the key below to check your answers. You can use this page to review the main concepts of the lesson.

Human Activity and Ecosystems

Human demand for resources and land can destroy habitats and disturb ecosystems.

18 Habitat destruction can lead to a loss of _____.

Dumping trash and chemicals into waterways can damage aquatic ecosystems.

19 Materials that cause unwanted changes in the environment cause _____.

Conservation and stewardship help protect ecosystems.

20 The protection and wise use of natural resources is called _____.

Answers: 18 biodiversity; 19 pollution; 20 conservation

21 Claims • Evidence • Reasoning Imagine that everyone in the United States chose to ride bicycles rather than drive cars. What effect would this have on your local ecosystem? State your claim and provide evidence to support your reasoning.

Lesson Review

Vocabulary

In your own words, define the following terms.

1 eutrophication

2 stewardship

3 urbanization

Key Concepts

4 Illustrate Name two ways that humans affect terrestrial ecosystems.

5 Describe Explain the difference between an *exotic species* and an *invasive exotic species*.

6 Summarize What is pollution?

7 Identify What are two ways to practice conservation?

Critical Thinking

Use this table to answer the following questions.

Human Population Growth

Human population	Year
1 billion	1804
2 billion	1927
3 billion	1960
4 billion	1974
5 billion	1987
6 billion	1999
7 billion	2011
Projected	
8 billion	2026

8 Calculate How many years did it take for the population to double from 1 billion to 2 billion?

9 Calculate How many years did it take for the population to double from 3 billion to 6 billion?

10 Hypothesize If Earth's population continues to increase without limit, how might this affect natural ecosystems? Explain your reasoning.

11 Synthesize Some detergents contain phosphates, chemicals that act like fertilizers. If wastewater from washing machines enters a local lake, will the fish population increase or decrease? Explain your answer.

My Notes