CHAPTER 6

LESSON 1

Habitats, Niches, and Species Interactions

READING TOOL **Compare and Contrast** For each section in this lesson, you will be comparing and contrasting key elements. Fill in the graphic organizer as you read. The first one has been started for you.

Elements	Similarities	Differences
Microhabitat vs. Microbiome	Both are very small.	Microbiome is microscopic; microhabitats are larger than that.
Habitat vs. Niche		
Predator-Prey Relationship vs. Herbivore-Prey Relationship		
Commensalism vs. Mutualism		

Lesson Summary

As you read, circle the answers to each Key Question. Underline any words you do not understand.

BUILD Vocabulary

habitat area where an organism lives including the biotic and abiotic factors that affect it

tolerance ability of an organism to survive and reproduce under circumstances that differ from their optimal conditions

niche full range of physical and biological conditions in which an organism lives and the way in which the organism uses those conditions

resource any necessity of life, such as water, nutrients, light, food, or space

competitive exclusion principle principle that states that no two species can occupy the same niche in the same habitat at the same time

Related Words As you learned previously, a biome is a large area with broadly similar environmental conditions that can house a variety of different ecosystems. ☑ **How is a habitat related to a biome?**

_____

_____

READING TOOL

Make Connections

Think of the yard at your home or the sports fields at your school.

☑ **How many different microhabitats can you name?**

_____

_____

_____

_____

Habitat and Niche

KEY QUESTION *What factors determine and describe habitats and niches?*

A **habitat** is an area with a particular combination of physical and biological environmental factors that affect which organisms live within it. Simply put, it is an organism's "ecological address."

Microhabitats Examining environmental conditions on a smaller scale will reveal the microhabitats for organisms.

Microbiomes Microbiomes are microscopic communities too small for our eyes to comprehend. The organisms existing in these tiny habitats perform various functions.

Tolerance Each species has a range of **tolerance**, or variety of environmental conditions in which it can survive and reproduce.

The Niche A species' **niche** describes where an organism lives and what it does "for a living," including the way it interacts with biotic and abiotic factors.

Resources, Physical Aspects, and Biological Aspects of the Niche A **resource** is any necessity a species needs to live, and differs for each species. Each niche offers a special blend of resources allowing organisms living within it to thrive. The abiotic, or physical, factors that a species needs are also included in a specie's niche. The niche also encompasses the biotic, or biological, factors needed to survive. Examples of a species' biotic factors include the food it eats, the way it obtains food, and how it reproduces.

Competition

KEY QUESTION *How does competition shape communities?*

Competition Competition occurs when two species attempt to use the same limited ecological resources in the same place at the same time. Competition among members of the same species is known as intraspecific competition.

Competitive Exclusion Principle The **competitive exclusion principle** states that no two species can occupy exactly the same niche in exactly the same habitat at exactly the same time. When this happens in nature, one species wins and the other dies out.

Dividing Resources Because of the competitive exclusion principle, species inhabiting the same niche within the same habitat can find success by dividing resources.

Predation and Herbivory

KEY QUESTION *How does herbivory shape communities?*

Food webs identify which organisms feed on which other organisms, often distinguishing predator from prey. These relationships powerfully influence each other and are important in shaping communities. Any natural or human-caused environmental change that affects one population (predator or prey), will also greatly affect the other.

READING TOOL

Apply Prior Knowledge

Many people think that, by definition, predators must be large, powerful carnivores. ☑ **Explain how both predators and prey can be carnivores (meat-eaters), omnivores (meat-and-plant-eaters), or herbivores (plant-eaters).**

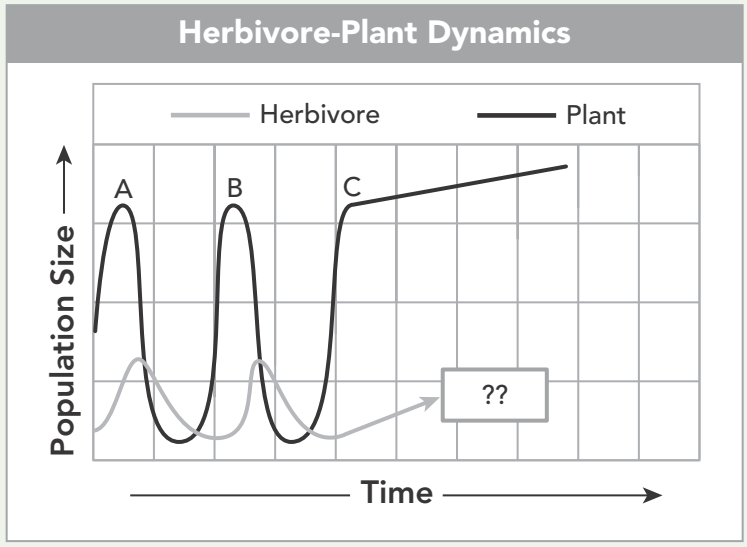
Predator-Prey Relationships

The relationship between predators and their prey are tightly intertwined. This is especially true in areas where each prey species has only one predator and vice versa.

Herbivore-Plant Relationships

Herbivores and the plants they eat share a similar relationship to predator and prey, though the plants can't run away from their predators. Herbivores affect how many plants will survive in an area, as well as how widespread they are in that area. When specific plants grow especially well in a location, they are sure to attract higher numbers of herbivores.

Visual Reading Tool: Analyzing Herbivore-Plant Relationships



Study the graph. Using what you have learned, explain what is happening at Point C and list three things that might happen at that time.

Explain Point C:

Three Things:

As you read, circle the answers to each Key Question. Underline any words you do not understand.

BUILD Vocabulary

keystone species single species that is not usually abundant in a community yet exerts strong control on the structure of a community

symbiosis (sim by oh sis) relationship in which two species live close together

commensalism (kuh men sul iz um) symbiotic relationship in which one organism benefits and the other is neither helped nor harmed

mutualism symbiotic relationship in which both species benefit from the relationship

parasitism a symbiotic relationship in which one organism lives on or inside another organism and harms it

Using Prior Knowledge Humans have symbiotic relationships with many organisms. Some live inside of our own bodies, and some we interact with externally. ☑ **Which type of symbiosis do pets have with their humans and why?**

Keystone Species

KEY QUESTION *How do keystone species shape communities?*

A **keystone species** plays a vital and unique role in maintaining structure, stability, and diversity in an ecosystem. These single species have a powerful influence on a community habitat. Changes in their population size can have dramatic effects on the entire ecosystem. If a keystone species is removed from an area, it can cause the ecosystem in that area to collapse entirely. Once an ecosystem has been changed in this way, returning the keystone species to the area may or may not help return it to its original condition.

Symbioses

KEY QUESTION *What are the three primary ways that organisms depend on each other?*

A particularly close, interdependent relationship between two species is called **symbiosis**. There are three types of symbiotic relationships among organisms: commensalism, mutualism, and parasitism.

Commensalism

Commensalism is a symbiotic relationship in which one organism benefits and the other is neither helped nor harmed. This type of relationship occurs among a wide variety of large and small species. Many organisms living together in biomes share commensal relationships with each other and larger organisms.

Mutualism

Mutualism is a symbiotic relationship between two species in which they both benefit. Another way to say it is that the relationship is mutually beneficial to both organisms. An example is the clownfish and sea anemone. The clownfish hides among the anemone's tentacles when threatened, and is immune to the painful stings from its tentacles that kill other fish. In return for protection, the clownfish will scare away anemone-eating predators, even if they are much bigger. Mutualism is also very common in microbiomes, like the human body or the Earth's soil. Their competition and other interactions help keep everything regulated.

Parasitism

Parasitism is a symbiotic relationship in which one organism lives inside of or on another organism and harms it. The parasite takes what it needs from its host, and make the host sick or kill it.

CHAPTER 6

LESSON 2

Succession

READING TOOL **Cause and Effect** Identify the effects of the elements listed below. Use the headings in your text as a guide. Be specific in your explanations. The causes are filled in for you.

Elements	Causes	Effects
Primary Succession	volcanic eruptions glaciers retreating	
Secondary Succession	natural disturbance human-caused disturbance	
Succession After Natural Disturbances	hurricane forest fire tsunami flood	
Succession After Human-Caused Disturbances	population expansion deforestation mining	

Lesson Summary

Primary and Secondary Succession

KEY QUESTION *How do communities change over time?*

As you read, circle the answers to each Key Question. Underline any words you do not understand.

Ecological succession is a series of somewhat predictable events that occur in a community over time. Ecosystems are constantly evolving, and experience major change after disturbances. New species move in, populations change, and other species die out. The diversity among species in an ecosystem increases as succession progresses.

BUILD Vocabulary

ecological succession series of gradual changes that occur in a community following a disturbance

primary succession succession that occurs in an area in which no trace of a previous community is present

pioneer species first species to populate an area during succession

Primary Succession Succession beginning on newly-formed rock or areas with no remnants of older communities is called **primary succession**. This typically happens after volcanic eruptions or as glaciers retreat, causing new, barren rock to be exposed. Ecological succession begins when **pioneer species**, or the first species to colonize barren areas, move in. They create an environment suitable for other organisms to move in and for the area to sustain growth.

secondary succession type of succession that occurs in an area that was only partially destroyed by disturbances

Using Prior Knowledge
Secondary succession is quicker than primary succession because there are still some members of a community left in the affected area.

☑ **Name two events that could cause secondary succession.**

_____

_____

_____

READING TOOL

Applying Prior Knowledge

Secondary succession from human-caused disturbances can have a profound effect on an ecosystem.

☑ **Describe an example of an area around the world that has suffered devastating consequences from human-caused disturbances.**

_____

_____

_____

_____

Secondary Succession

Secondary succession occurs when a disturbance affects an existing community but doesn't completely destroy it. This process happens faster than primary succession because parts of the original community still exist. Possible disturbances include: natural disasters like wildfires, hurricanes, and tsunamis, as well as human created disturbances.

Why Succession Happens

Succession happens in different ecosystems for multiple reasons. Pioneer species prepare the area for other organisms to move in. Each new species makes the ecosystem more habitable for those species already there, as well as for additional species that would benefit the area. These processes become more complex over time as species diversity increases.

Climax Communities

KEY QUESTION *How do communities recover after a disturbance?*

Scientists understand that succession follows different paths, and that the communities that are the end results of succession, or climax communities, may not always be uniform or stable.

Succession After Natural Disturbances

When natural disturbances happen in healthy ecosystems, the events and processes that occur during secondary succession often, but not always, reproduce the original climax community. Since natural disasters, like fires or floods, can happen to only a small part of a community, each community could be experiencing different stages of succession at the same time.

Succession After Human-Caused Disturbances

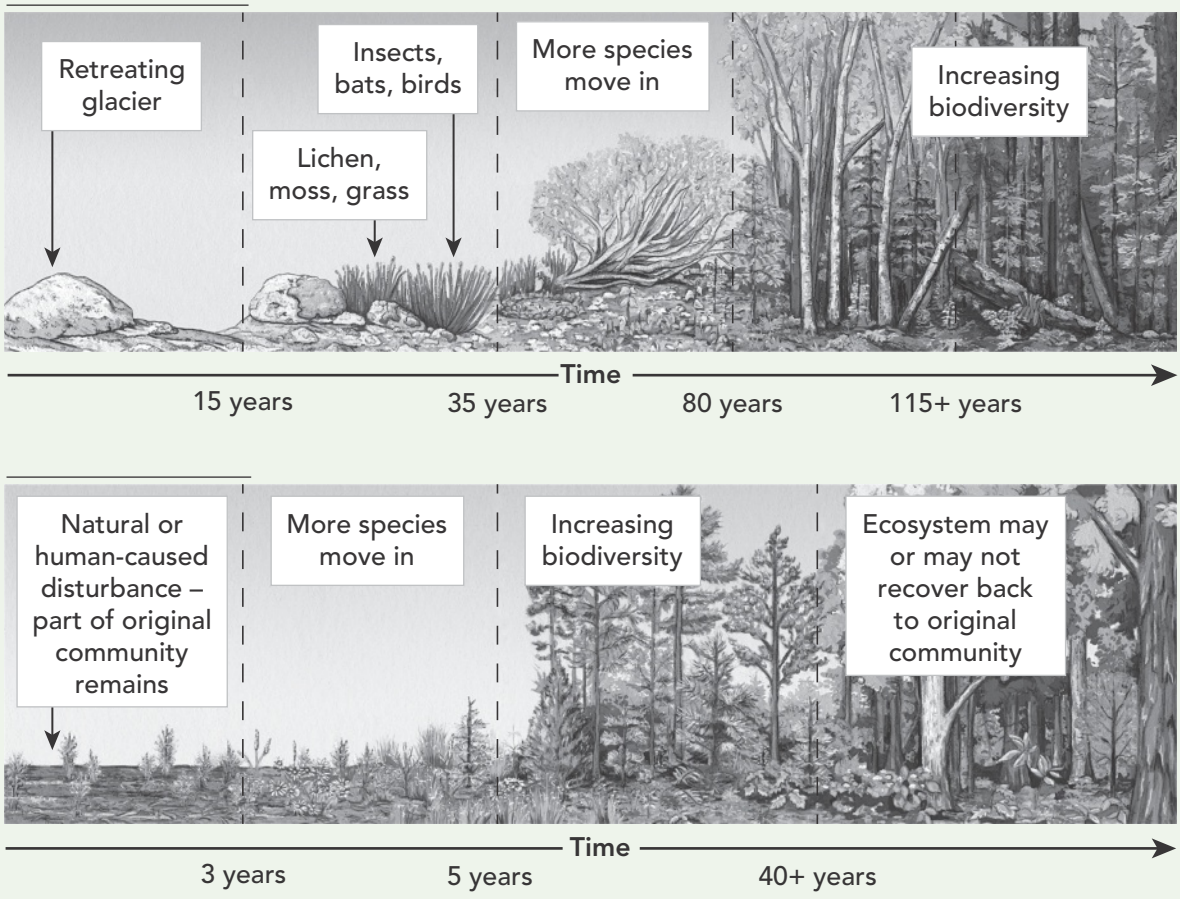
Secondary succession can take different paths and produce many different communities. This all depends on the kind of disturbance, the season in which the disturbance occurs, and other factors. Sometimes this causes a change that prevents the regrowth of the original community. From some human-caused disturbances, ecosystems may or may not fully recover.

Studying Patterns of Succession

Ecologists study succession by comparing different cases and looking for similarities and differences. For example, they learned that at both Mount Saint Helens and Krakatau, primary succession proceeded through stages. Pioneer species arrived via seeds, spores, or adult stages that traveled over long distances.

The pioneer species are important because they help stabilize loose volcanic debris. This allowed later species to take hold. Historical studies in Krakatau and ongoing studies on Mount Saint Helens confirm that early stages of primary succession are slow, and that chance can play a large role in determining which species colonize at different times.

Visual Reading Tool: Explaining Succession



Study the images, then label each as primary succession or secondary succession. How is each type of succession different than the other? Use the details provided in each photo in your answers.

Think about an area in your neighborhood or city that has changed. Maybe a shopping center was built over what was once tree-filled land. Maybe a park was put in where an empty lot once stood. Explain the change and whether you think the area is going through primary succession or secondary succession at this time. Why?

CHAPTER 6

LESSON 3

Biodiversity, Ecosystems, and Resilience

READING TOOL **Active Reading** As you read, list the many benefits that are gained when there is rich biodiversity within an ecosystem. Fill in the table below.

Benefit	Explanation
Biodiversity and Medicine	
Biodiversity and Agriculture	
Biodiversity and Ecosystem Resilience	

Lesson Summary

As you read, circle the answers to each Key Question. Underline any words you do not understand.

Types of Biodiversity

KEY QUESTION *What kinds of biodiversity exist?*

Biodiversity is short for biological diversity, and is defined as the variety and variability of animals, plants, and microorganisms. This also includes ecosystem diversity, species diversity, and genetic diversity.

Community/Ecosystem Biodiversity

Ecosystem diversity refers to the variety of habitats, communities, and ecological processes in the biosphere.

Species Diversity

Species diversity is the number of different species in a particular area, or biosphere. So far, scientists have identified over 1.2 million eukaryotic species. Much more diversity exists among single-celled organisms.

Genetic Diversity

Genetic diversity refers to the total of all different forms of genes present in a particular species. It is responsible for the variations within each species, as well as variations among species within different ecosystems. Diverse genes are what allow organisms to adapt to changing external forces. Consider all the species of birds, for example. Each one has genetically adapted based on the ecosystem in which it lives, and you can find a wide selection of variations among each species.

Biodiversity Benefits

KEY QUESTION *What are the benefits of biodiversity?*

Biodiversity's benefits include offering invaluable contributions to medicine and agriculture, and enabling organisms and ecosystems to adapt to environmental change.

Biodiversity and Medicine A wide variety of plants and other organisms have long been used as medicines. Painkillers like aspirin and antibiotics like penicillin were among those first created from nature. Plant compounds are used to treat everything from depression to cancer.

Biodiversity and Agriculture Food or crop plants have closely-related versions in the wild. These wild plants may carry genes that promote disease resistance, pest resistance, or other useful traits. These genes could be transferred to crop plants through breeding to increase sustainability.

Biodiversity and Ecosystem Resilience An ecosystem's structure, stability, and function can be affected by changes to the biological diversity of an ecosystem. If you remember, the loss or reduction of a keystone species can dramatically affect the biodiversity and stability of an area. Additionally, some research shows that a decrease in species diversity in an ecosystem can also affect its **resilience**, or natural ability to recover after a disturbance.

Ecosystem Services and Biodiversity

KEY QUESTION *What are some important ecosystem services?*

Humans depend on healthy ecosystems in many ways. **Ecosystem services** are the benefits provided by ecosystems to humans. Important ecosystem services include production of food, cycling of nutrients, purifying water, storing carbon, regulating pests, pollinating crops, and buffering the effects of extreme weather events.

Food Production Diversity within ecosystems helps provide a resilient mix of food for livestock, while wild species preserve genes that may improve crops or livestock.

BUILD Vocabulary

biodiversity the total of the variety of organisms in the biosphere; also called biological diversity

ecosystem diversity variety of habitats, communities, and ecological processes in the biosphere

species diversity number of different species that makes up a particular area

genetic diversity sum total of all the different forms of genetic information carried by a particular species, or by all organisms on Earth

resilience a natural or human system's ability to recover after a disturbance

ecosystem services the benefits provided by ecosystems to humans

Related Words Another way to explain diversity is by calling it "variety." ☑ **Explain how biodiversity is different from genetic diversity.**

READING TOOL

Make Connections

Keystone species are important because they keep an entire ecosystem in balance. ☑ **What are two things that could happen to humans if keystone species died off and the Earth's biodiversity was significantly reduced?**

_____

_____

_____

_____

Nutrient Cycling and Soil Structure A resilient soil microbiome is one that nutrients are cycled through. This maintains soil fertility and structure as conditions change.

Purifying Water Soil microbiomes and other organisms play primary roles in filtering and purifying water.

Storing Carbon Healthy ecosystems with lots of plant life help remove carbon dioxide from the air. The healthier the ecosystem, the better it does this.

Regulating Pests and Pollinating Crops Diverse and resilient ecosystems keep the balance between predators and prey, and offer food and shelter to both.

Buffering Effects of Extreme Weather Events Diverse and resilient coastal wetlands or forests protect against erosion and shield shorelines from storms.

Visual Reading Tool: Ecosystem Services

Review the ecosystem services listed on the left side of the chart. List two benefits for humans for each ecosystem service.

Services Provided	Benefits to Humans
Purifying water	_____ _____ _____
Buffering effects of weather	_____ _____ _____
Pollinating	_____ _____ _____
Regulating pests	_____ _____ _____
Food production and Nutrient cycling	_____ _____ _____

6 Chapter Review

Review Vocabulary

Match the vocabulary term to its definition.

1. _____	occurs in an area that was only partially destroyed by disturbances	a.	primary succession
2. _____	occurs in an area in which no trace of a previous community is present	b.	secondary succession
3. _____	where an organism lives and what it does "for a living"	c.	niche

Fill in the blanks with the correct terms.

4. _____ is a symbiotic relationship in which one organism benefits and the other is neither helped nor harmed. _____ is a symbiotic relationship in which both species benefit from the relationship.

Review Key Questions

Provide evidence and details to support your answers.

5. Explain the similarities and differences between intraspecific competition among species and interspecific competition.

Similarities:

Differences:

6. Explain how pioneer species arrive in an area undergoing primary succession.

7. Explain what happens to species with lower resilience as compared to species with higher levels of resilience.