Core Knowledge® SCIENCE

Habitats and Change

Conserving habitats

Teacher Guide

Extinction

Adaptations

Habitat change and survival

Habitats and Change

Teacher Guide

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Habitats and Change

Table of Contents

Habitats and Change

Teacher Guide

Core Knowledge Science™ 3

UNIT 3

Introduction

About this Unit

The Big Idea

This unit focuses on how organisms are adapted to the habitats in which they live.

A guiding principle in biology helps account for the amazing diversity of life forms on Earth: living things look and behave as they do because they are adapted to their environments. The polar bear's white coloring is an adaptation that allows it to survive in its mostly white snowy environment. The sleek feathers and flattened flippers of emperor penguins are adaptations that help them live in cold ocean waters. Similarly, prairie dogs match the soil they burrow in, and they live in groups to help detect and defend against predators. In short, things are adapted to where they live.

Environments, however, can change. A fire, a flood, rising temperatures, or the arrival of a new predator can change a habitat. When change occurs, organisms may find that adaptations are no longer helpful. Some members of a population may die. Environmental change may also allow new organisms to thrive.

Evidence from the past supports the idea that living things adapt to changes in their environment. The fossil record shows that species that lived for millions of years went extinct when some aspect of the environment changed and their traits no longer allowed them to survive while other organisms managed to survive.

Note to Teachers and Curriculum Planners

This unit introduces Grade 3 students to real-world examples and fundamental concepts that will be explored in greater depth in later grades. Students will learn about the observable effects of change affecting habitats, describe and predict patterns of changes, and explore possible solutions to harmful changes to habitats.

- At this grade level, examples of appropriate fossil data could include the type, size, and distribution of fossilized organisms. Examples of fossils could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms. Assessment does not include the identification of specific fossils.
- Conceptualization of the ages of fossils is limited to relative ages, not to any specific distinctions of the geologic time scale.
- When students construct arguments in this unit, examples of evidence could include needs, primarily food and shelter, and characteristics of the organisms and habitats involved.
- Assessment should be limited to a single environmental change at a time. At this grade level, assessment does not include the complex dynamics of the greenhouse effect or climate change.

Note to Core Knowledge Teachers

Thanks to ongoing research in the field, our understanding of how children learn continues to evolve. In the subject area of science, in particular, students benefit from not just reading about concepts and ideas, but also hands-on experiences. Following the release of the Next Generation Science Standards (NGSS), the Core Knowledge Foundation used this opportunity to update and enhance the science portion of the *2010 Core Knowledge Sequence*™. The result of this effort is the revised *2019 Core Knowledge Science Sequence*.

While there have been some shifts in the grade levels at which certain topics are recommended, the fundamental principles of pedagogy inherent to the Core Knowledge approach, such as the importance of building a sequential, coherent, and cumulative knowledge base, have been retained.

Online Resources

To download the *2019 Core Knowledge Science Sequence*, use the links found in the Online Resources Guide.

www.coreknowledge.org/cksci-online-resources

This science unit, aligned to the *2019 Core Knowledge Science Sequence* and informed by NGSS, embodies Core Knowledge's vision of best practices in science instruction and knowledge-based schooling, such as the following:

- building students' knowledge of core ideas in life, physical, and Earth sciences, as well as engineering design
- developing scientific practices that give students firsthand experience in scientific inquiry, engineering, and technology
- connecting scientific learning to concepts across various disciplines, such as mathematics and literacy

To see how you can continue to use your current Core Knowledge materials with the 2019 CKSci™ curriculum, please see below an example of how this unit compares to the *2010 Core Knowledge Sequence*.

Examples of content retained from the *2010 Core Knowledge Sequence*	**Examples of Core Knowledge content in this CKSci Unit**
Ecology (Grade 3) • Habitats, interdependence of organisms and their environment • The concept of a "balance of nature" (constantly changing, not a static condition) • The food chain: producers, consumers, decomposers • Ecosystems: how they can be affected by changes in environment (for example, rainfall, food supply, etc.), and by man-made changes	**Living Things and Their Environments** • Organisms have traits that indicate they are adapted to live in their environment. • Adaptation using various habitat examples: Tundra; Seashore; Desert; Underground **Ecosystems and Environmental Change** • Ecosystems undergo both natural and human-induced changes over time. • When an ecosystem changes, some organisms survive while others may not. • Fossils provide evidence that, as a past environment changed, so did the organisms that live there.
For a complete look at how CKSci relates to the 2010 *Sequence*, please refer to the full Correlation Charts available for download using the Online Resources Guide for this unit: **www.coreknowledge.org/cksci-online-resources**	

What are the relevant NGSS Performance Expectations for this unit?*

This unit, *Habitats and Change*, has been informed by the following Grade 3 Performance Expectations for the NGSS topic *Interdependent Relationships in Ecosystems: Environmental Impacts on Organisms*. Students who demonstrate understanding can

3-LS2-1 Construct an argument that some animals form groups that help members survive.

3-LS4-1 Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.

3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Online Resources

For detailed information about the NGSS references, follow the links in the Online Resources Guide for this unit. Use the following link to download any of the CKSci Online Resources Guides:

www.coreknowledge.org/cksci-online-resources

*NEXT GENERATION SCIENCE STANDARDS (NGSS) is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of this product, and their endorsement is not implied.

Sources:

NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.

National Research Council. 2012. *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Committee on a Conceptual Framework for New K–12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

What Students Should Already Know

The concept of progressions, articulated in the National Research Council's *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*, is very much aligned to the Core Knowledge principle of building new knowledge on prior knowledge. According to the NRC, students build "progressively more sophisticated explanations of natural phenomena" over the course of many years of schooling. "Because learning progressions extend over multiple years, they can prompt educators to consider how topics are presented at each grade level so that they build on prior understanding and can support increasingly sophisticated learning." In schools following NGSS recommendations, teachers can build on the "prior understandings" captured in the following summaries of NGSS Disciplinary Core Ideas:

LS2.A: Interdependent Relationships in Ecosystems

Grades K–2

- Animals depend on their surroundings to get what they need, including food, water, shelter, and a favorable temperature. Animals depend on plants or other animals for food. They use their senses to find food and water, and they use their body parts to gather, catch, eat, and chew the food. Plants depend on air, water, minerals (in the soil), and light to grow. Animals can move around, but plants cannot, and they often depend on animals for pollination or to move their seeds around. Different plants survive better in different settings because they have varied needs for water, minerals, and sunlight.

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

Grades K–2

- Organisms obtain the materials they need to grow and survive from the environment. Many of these materials come from organisms and are used again by other organisms.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Grades K–2

- The places where plants and animals live often change, sometimes slowly and sometimes rapidly. When animals and plants get too hot or too cold, they may die. If they cannot find enough food, water, or air, they may die.

LS2.D: Social Interactions and Group Behavior

Grades K–2

- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.

LS4.A: Evidence of Common Ancestry and Diversity

Grades K–2

- Some kinds of plants and animals that once lived on Earth (e.g., dinosaurs) are no longer found anywhere, although others now living (e.g., lizards) resemble them in some ways.

LS4.C: Adaptation

Grades K–2

- Living things can survive only where their needs are met. If some places are too hot or too cold or have too little water or food, plants and animals may not be able to live there.

LS4.D: Biodiversity and Humans

Grades K–2

- There are many different kinds of living things in any area, and they exist in different places on land and in water.

What Students Need to Learn

For this unit, the *Core Knowledge Science Sequence* specifies the following content and skills. Specific learning objectives are provided in each lesson throughout the unit. NGSS References, including Performance Expectations, Disciplinary Core Ideas, and Crosscutting Concepts, are included at the start of each lesson as appropriate.

A. Living Things and Their Environments

LESSONS 1–6

- Present an argument with evidence demonstrating that, in a specific habitat, some animals or plants are adapted to survive and reproduce while other organisms cannot survive.
- Explain the concept of adaptation by showing how specific traits help an organism survive in its specific habitat.
- Identify traits of plants and animals and describe how these specific traits help the organisms survive in at least two of these habitats: tundra, seashore, desert, or underground.
- Provide evidence of how some animals form social groups, which is an adaptation to help them survive in their habitat.

B. Ecosystems and Environmental Change

LESSONS 7–12

- Describe specific evidence that shows what a habitat and a specific organism in that habitat were like before and after a significant environmental change.
- Debate the merits of solutions for reconstructing an ecosystem after a significant environmental change.
- Compare two different ecosystems by describing major features of how they are alike and how they differ.
- Cite examples of natural changes in an ecosystem over time.
- Cite examples of human-induced changes in an ecosystem over time.
- Explain with examples how some adaptations that were once helpful can be less helpful if an ecosystem changes.

C. Evidence of How Organisms and Environments Have Changed over Time

LESSONS 13–16

- Analyze and interpret data from fossils for evidence that as a habitat changes over time, so do the animals and plants in that habitat.

What Teachers Need to Know

Supportive information on the content standards and the science they address is provided throughout the lessons at points of relevance:

Know the Standards: These sections, found later in this Teacher Guide, explain what to teach and why, with reference to NGSS and Core Knowledge expectations.

Know the Science: These sections provide supporting, adult-level, background information or explanations related to specific examples or Disciplinary Core Ideas.

Using the Student Reader

Student Reader

The *Habitats and Change* Student Reader has ten chapters and a student Glossary providing definitions to Core Vocabulary words. Engaging text, photographs, and diagrams encourage students to draw upon their own experiences and the world around them to understand scientific concepts. In addition to Core Vocabulary, the Student Readers include a feature called Word to Know, which provides background information to help students understand key terms, and may sometimes include additional informational boxes, such as Think About.

Explore, then read: In the CKSci program, lessons are sequenced to provide active engagement before reading. First, students explore phenomena through hands-on investigations or teacher demonstrations, accompanied by active questioning

and analysis; then, students study the informational text provided in the Student Readers. The icon shown on page 6, will signal Core Lesson segments that focus on Student Reader chapters.

CKSci Student Readers extend, clarify, and confirm what students have learned in their investigations. The text helps students develop a sense of the language of science, while images, diagrams, charts, and graphs deepen conceptual understanding. Use of the CKSci Student Readers supports the Science and Engineering Practice "Obtaining, Evaluating, and Communicating Information" as described in *A Framework for K–12 Science Education*.

Independent reading or group read-aloud: While the text in the Student Readers is written for independent reading, we encourage group read-alouds and engagement with the text. The Teacher Guide provides Guided Reading Supports to prompt discussion, clarify misconceptions, and promote understanding in relation to the Big Questions.

Using the Teacher Guide

Pacing

The *Habitats and Change* unit is one of five units in the Grade 3 CKSci series. To meet NGSS Performance Expectations we encourage teachers to complete all units during the school year. To be sure all NGSS Performance Expectations are met, each Core Lesson should be completed, and each requires thirty to forty-five minutes of instruction time. The time it takes to complete a lesson depends on class size and individual circumstances.

Within the Teacher Guide, the Core Lessons are divided into numbered segments, generally five or six, with approximate times listed per segment. The final segment is always a Check for Understanding, providing the teacher with an opportunity for formative assessment.

At the end of this Unit Introduction, you will find a Sample Pacing Guide on page 14 and a blank Pacing Guide on pages 15–16, which you may use to plan how you might pace the lessons, as well as when to use the various other resources in this unit. We strongly recommend that you preview this entire unit and create your pacing guide before teaching the first lesson. As a general rule, we recommend that you spend no more than twenty-three days teaching the *Habitats and Change* unit so that you have time to teach the other units in the Grade 3 CKSci series.

The Core Lessons

- Lesson time: Each Core Lesson constitutes one classroom session of up to forty-five minutes. Understanding that teachers may have less instructional time, we show a time range of thirty to forty-five minutes per lesson. Teachers may choose to conduct all Core Lesson segments, totaling forty-five minutes; may choose to conduct a subset of the lesson segments; or may choose to spend less time per segment.
- Lesson order: The lessons are coherently sequenced to build from one lesson to the next, linking student engagement across lessons and helping students build new learning on prior knowledge.

PART	LESSON	BIG QUESTION
A. Living Things and Their Environments (3-LS4-3, 3-LS2-1)	**1.** Where Organisms Live	What is a habitat?
	2. Habitats	What do all habitats have in common?
	3. Investigating Traits and Adaptations	How do specific traits benefit an organism in a particular habitat?
	4. Adaptations in Living Things	What are adaptations?
	5. Living Things in Groups	How do organisms work together for survival?
	6. Suited for Survival (three class sessions)	What are some examples of successful adaptations of organisms to their habitats?
B. Ecosystems and Environmental Change (3-LS4-4, 3-LS4-3)	**7.** Beaver Dam Case Study (two class sessions)	How do habitats change?
	8. Nature and Changing Ecosystems	How do natural changes to an environment affect the organisms that live there?
	9. Humans Cause Ecosystem Change	How do people change environments in ways that affect the organisms that live there?
	10. Living Things Respond to Change	How do living things survive changes in their habitats?
	11. Ecosystem Problems and Solutions (two class sessions)	What are some solutions to problems in habitats and ecosystems?
	12. Local Environmental Project (two class sessions)	How is my community helping solve problems of habitat change?
C. Evidence of How Organisms and Environments Have Changed over Time (3-LS4-1)	**13.** Hidden Clues About Earth's Past	What do age and layering of earth materials tell us about past habitats?
	14. Fossils and How They Form	What can fossils tell us about ancient habitats?
	15. Fossil Clues About Changing Habitats	What do fossils reveal about organisms, habitats, and change?
	16. Solving a Fossil Mystery	What do fossils reveal about organisms, habitats, and change?
Unit Review and Assessment	Habitat Changes and Extinction	How do changes in habitats lead to the extinction of a species?
	Unit Assessment	What have I learned about habitats and change?

Activity Pages and Unit Assessment

Activity Pages

AP 1.1
AP 2.1
AP 3.1
AP 4.1
AP 5.1
AP 5.2
AP 6.1–6.15
AP 6.16
AP 6.17
AP 7.1
AP 7.2
AP 8.1
AP 9.1
AP 10.1
AP 11.1
AP 11.2
AP 12.1
AP 12.2
AP 13.1
AP 14.1
AP 14.2
AP 15.1
AP 16.1
AP 16.2
AP UR. 1

Black line reproducible masters for Activity Pages and a Unit Assessment, as well as an Answer Key, are included in Teacher Resources on pages 129–180. The icon shown to the left appears throughout the Teacher Guide wherever Activity Pages (AP) are referenced.

Students' achievement of the NGSS Performance Expectations is marked by their completion of tasks throughout the unit. However, a combined Unit Assessment is provided as a summative close to the unit.

Lesson 1—The Needs of Bluebirds (AP 1.1)

Lesson 2—What Lives in a Grassland Habitat? (AP 2.1)

Lesson 3—What Is the Advantage of the Adaptation Called Blubber? (AP 3.1)

Lesson 4—What's My Adaptation? (AP 4.1)

Lesson 5—Advantages of Living in Groups (AP 5.1)

Lesson 5—How Big Are Animal Groups? (AP 5.2)

Lesson 6—Organism Fact Sheets (AP 6.1–6.15)

Lesson 6—Getting to Know You (AP 6.16)

Lesson 6—Survival Conference (AP 6.17)

Lesson 7—The Effects of Beaver Dams on Living Things (AP 7.1)

Lesson 7—How Do Beavers Change the Environment? (AP 7.2)

Lesson 8—Coral Reef (AP 8.1)

Lesson 9—Surviving Change in the Environment (AP 9.1)

Lesson 10—Cause-and-Effect Diagram (AP 10.1)

Lesson 11—Problems-and-Solutions Table (AP 11.1)

Lesson 11—Thinking About What Makes Solutions Good (AP 11.2)

Lesson 12—Local Conservation Project (AP 12.1)

Lesson 12—Take-Home Letter (AP 12.2)

Lesson 13—Let's Dig! (AP 13.1)

Lesson 14—Analyzing Fossils (AP 14.1)

Lesson 14—How a Fossil Is Made (AP 14.2)

Lesson 15—Rock Layers (AP 15.1)

Lesson 16—A Fossil Mystery (AP 16.1)

Lesson 16—Solving a Fossil Mystery (AP 16.2)

Unit Review—When Living Things Cannot Survive Habitat Change (AP UR.1)

Online Resources for Science

Online Resources

For each CKSci unit, the Teacher Guide includes references to online resources (including external websites and downloadable documents) to enhance classroom instruction. Look for the icon on the left.

Use this link to download the CKSci Online Resources for this unit:

www.coreknowledge.org/cksci-online-resources

Teaching Strategies

Start with the familiar.	Lead with an experience. Begin each lesson with a demonstration, activity, or question about a phenomenon to engage students and focus their attention on the topic. Start with the familiar. Every science topic introduced to students relates in some way to their known world and everyday experiences. The purpose of every lesson is to build a bridge between what is familiar to students and broader knowledge about the way the world works.
Ask the Big Question.	At the beginning of each Teacher Guide lesson, you will find a Big Question and Core Lesson segment devoted to encouraging students to think about this question as they are introduced to new science content. Use this opportunity to engage students in conversation, to think about how their own real-world experiences relate to the topic, or to participate in a demonstration that relates to the Big Question.
Encourage scientific thinking.	Approach the lessons with students not as learning about science but as learning about the world with a scientific mind. Science learning models science practice. Throughout the lessons, encourage students to ask questions about what they observe, do, and read. Record relevant questions in a prominent place in the classroom. Guide students back to these questions as opportunities to answer them emerge from readings, demonstrations, and activities.
Use continuous Core Vocabulary instruction.	As a continuous vocabulary-building strategy, have students develop a deck of vocabulary cards, adding a card for each Core Vocabulary term as it is introduced. Students can add illustrations and examples to the cards as their comprehension of terms expands. During instruction, emphasize Core Vocabulary terms and their meanings in context rather than relying on isolated drill for memorization of definitions. Students will be given the opportunity to preview Core Vocabulary words early in the lessons and to engage in Word Work activities toward the end of the lessons. Encourage students to come up with definitions in their own words and to use the words in their own sentences. Core Vocabulary words for each lesson, as well as other key terms teachers are encouraged to use in discussing topics with students, are provided at the start of each lesson. You can find Core Vocabulary definitions in the Word Work lesson segments, as well as in the Glossary on pages 183–184.

Emphasize observation and experience.	Lessons employ various ways for students to learn, including watching, listening, reading, doing, discussing, and writing. To meet the NGSS Performance Expectations, which are multidimensional standards, students must not only gain factual knowledge associated with Disciplinary Core Ideas, but also *use* the content knowledge they acquire.
Use science practices.	Give students opportunities to discover new content knowledge through investigation and to use their new knowledge both in problem-solving exercises and as evidence to support reasoning. Students learn what science and engineering practices are by engaging in those same practices as they learn. Core Lesson segments are designed to reinforce the idea of science as an active practice, while helping students meet NGSS Performance Expectations. Each lesson segment is introduced by a sentence emphasizing active engagement with an activity.
Make frequent connections.	Use a combination of demonstrations and reading materials, rich with examples, to help students recognize how the science concepts they are learning apply in their everyday lives. Prompt students to relate lesson content to their own experiences, to relate the new and unfamiliar to the familiar, and to connect ideas and examples across disciplines. Refer to the Crosscutting Concepts cited in the lessons, often included in the NGSS References listed at the start of each lesson.
Monitor student progress.	Use verbal questioning, student work, the Check for Understanding assessments at the end of each lesson, and the Unit Assessment at the end of the unit (see pages 173–177) to monitor progress during each lesson and to measure understanding at the conclusion of the unit. Many lessons provide tips to help you support students who need further explanations or clarifications.

Effective and Safe Classroom Activities

Conducting safe classroom demonstrations and activities is essential to successful elementary science education. The following resources provide Core Knowledge's recommendations for developing effective science classroom activities.

These resources, included at the back of the Teacher Guide on pages 185–189, consist of the following:

- Classroom Safety for Activities and Demonstrations
- Strategies for Acquiring Materials
- Advance Preparation for Activities and Demonstrations
- What to Do When Activities Don't Give Expected Results

Online Resources

These resources may also be accessed within the CKSci Online Resources Guide for this unit, available at

www.coreknowledge.org/cksci-online-resources

Materials and Equipment

The unit requires a variety of materials to support various ways of learning (including doing, discussing, listening, watching, reading, and writing). Prepare in advance by collecting the materials and equipment needed for all the demonstrations and hands-on investigations.

Part A: Living Things and Their Environments

Lesson 1

- poster-size paper for student diagrams (1 per group)
- markers or crayons for student diagrams (1 set per group)
- index cards for student vocabulary deck (3 per student)
- internet access and the means to project images/video for whole-class viewing

Lesson 2

- world map or globe
- internet access and the means to project images/video for whole-class viewing

Lesson 3

- medium-sized cups of cold water (2 per pair of students)
- ice cubes
- vegetable shortening
- plastic wrap or non-latex disposable gloves (1 8-inch square or glove per student)
- small disposable cup (1 per pair)
- plastic spoon (1 per student)
- timer (1 per pair)

Lesson 4

- paper towels
- waxed paper
- small cups of water
- eyedropper
- index card for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing

Lesson 5

- index card for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing (animal groups)

Lesson 6

- Online Image Library
- name tags
- internet access and the means to project images/video for whole-class viewing

Part B: Ecosystems and Environmental Change

Lesson 7

- internet access and the means to project video for whole-class viewing
- library or internet resources for gathering information

Lesson 8

- index cards for student vocabulary deck (2 per student)
- internet access and the means to project video for whole-class viewing

Lesson 9

- index cards for student vocabulary deck (2 per student)

Lesson 10

- plastic plant
- clear glass
- water
- internet access and the means to project video for whole-class viewing

Lesson 11

- index card for student vocabulary deck (1 per student)

Lesson 12

- timer

Part C: Evidence of How Organisms and Environments Have Changed over Time

Lesson 13

- sand
- soil
- pebbles
- seashells
- large craft beads
- craft feathers
- aluminum 9- by 13-inch pans (10)
- paper towels
- paintbrushes
- index card for student vocabulary deck (1 per student)
- internet access and the means to project video for whole-class viewing

Lesson 14

- scissors
- glue sticks
- seashell
- modeling clay

Lesson 15

- index card for student vocabulary deck (1 per student)
- internet access and the means to project video for whole-class viewing

Lesson 16

- internet access and the means to project video for whole-class viewing

Unit Review

- index cards (1 per student)
- timer (optional)

Sample Pacing Guide

The sample Pacing Guide suggests use of the unit's resources across a twenty-three-day period. However, there are many ways that you may choose to individualize the unit for your students, based on their interests and needs. You may elect to use the blank Pacing Guide on pages 15–16 to reflect alternate activity choices and alternate pacing for your class. If you plan to create a customized pacing guide for your class, we strongly recommend that you preview this entire unit and create your pacing guide before teaching the first lesson.

Online Resources

For a yearlong pacing guide, please use the link found in the Online Resources Guide for this unit. This yearlong view of pacing also includes information about how this CKSci unit relates to the pacing of other programs, such as CKLA and CKHG in the *Core Knowledge Curriculum Series*™.

www.coreknowledge.org/cksci-online-resources

TG–Teacher Guide; SR–Student Reader; AP–Activity Page

Week 1

Day 1	Day 2	Day 3	Day 4	Day 5
Where Organisms Live TG Lesson 1 AP 1.1	*Habitats* TG Lesson 2 SR Chapter 1 AP 2.1	*Investigating Traits and Adaptations* TG Lesson 3 AP 3.1	*Adaptations in Living Things* TG Lesson 4 SR Chapter 2 AP 4.1	*Living Things in Groups* TG Lesson 5 SR Chapter 3 AP 5.1, 5.2

Week 2

Day 6	Day 7	Day 8	Day 9	Day 10
Suited for Survival DAY 1 TG Lesson 6 AP 6.1–6.16	*Suited for Survival* DAY 2 TG Lesson 6 AP 6.17	*Suited for Survival* DAY 3 TG Lesson 6 AP 6.17	*Beaver Dam Case Study* DAY 1 TG Lesson 7 AP 7.1	*Beaver Dam Case Study* DAY 2 TG Lesson 7 AP 7.1, 7.2

Week 3

Day 11	Day 12	Day 13	Day 14	Day 15
Nature and Changing Ecosystems TG Lesson 8 SR Chapter 4 AP 8.1	*Humans and Ecosystems Change* TG Lesson 9 SR Chapter 5 AP 9.1	*Living Things and Changing Ecosystems* TG Lesson 10 SR Chapter 6 AP 10.1	*Ecosystem Problems and Solutions* DAY 1 TG Lesson 11 SR Chapter 7 AP 11.1	*Ecosystem Problems and Solutions* DAY 2 TG Lesson 11 SR Chapter 7 AP 11.1, 11.2

Week 4

Day 16	Day 17	Day 18	Day 19	Day 20
Local Environmental Project DAY 1 TG Lesson 12 AP 12.1, 12.2	*Local Environmental Project* DAY 2 TG Lesson 12 AP 12.1	*Hidden Clues About Earth's Past* TG Lesson 13 AP 13.1	*Fossils and How They Form* TG Lesson 14 SR Chapter 8 AP 14.1, 14.2	*Fossil Clues About Changing Habitats* TG Lesson 15 SR Chapter 9 AP 15.1

Week 5

Day 21	Day 22	Day 23		
Solving a Fossil Mystery TG Lesson 16 AP 16.1, 16.2	*Habitat Changes and Extinction* TG Unit Review SR Chapter 10 AP UR.1	Unit Assessment AP Unit Assessment		

Pacing Guide

Twenty-three days have been allocated to the *Habitats and Changes* unit to complete all Grade 3 science units in the *Core Knowledge Curriculum Series*™. If you cannot complete the unit in twenty-three consecutive days of science instruction, use the space that follows to plan lesson delivery on an alternate schedule.

Week 1

Day 1	Day 2	Day 3	Day 4	Day 5

Week 2

Day 6	Day 7	Day 8	Day 9	Day 10

Week 3

Day 11	Day 12	Day 13	Day 14	Day 15

Week 4

Day 16	Day 17	Day 18	Day 19	Day 20

Week 5

Day 21	Day 22	Day 23	Day 24	Day 25

Week 6

Day 26	Day 27	Day 28	Day 29	Day 30

Week 7

Day 31	Day 32	Day 33	Day 34	Day 35

Week 8

Day 36	Day 37	Day 38	Day 39	Day 40

PART A

Living Things and Their Environments

Overview

Lesson	Big Question	Advance Preparation
1. Where Organisms Live	What is a habitat?	Make provisions for internet access and display for whole-class video experience. Gather materials for student projects. (See Materials and Equipment, page 12.)
2. Many Different Habitats	What do all habitats have in common?	Read Student Reader, Chapter 1.
3. Investigating Traits and Adaptations	How do specific traits benefit an organism in a particular habitat?	Gather materials for a student investigation. (See Materials and Equipment page 12.)
4. Adaptations in Living Things	What are adaptations?	Read Student Reader, Chapter 2.
5. Living Things in Groups	How do organisms work together for survival?	Read Student Reader, Chapter 3.
6. Suited for Survival (3 days)	What are some examples of successful adaptations of organisms to their habitats?	Gather materials for student activity. (See Materials and Equipment page 12.)

Part A: What's the Story?

A habitat is the natural environment where an organism lives. Although this may seem simple enough, students may not yet understand the idea that habitats actually provide organisms with the things they need to survive. In this section, students learn all about habitats and how they support life.

In Lesson 1, we start simply by engaging students to look for different kinds of places where organisms live and then helping them understand what a habitat is. The goal is to get students to recognize that there are many different types of habitats.

In Lesson 2, students continue to explore the idea that a habitat is the natural environment where an organism lives and that habitats meet the organisms' needs through food, water, and other resources that allow the organisms to survive there. While students intuitively understand what it means to live in a certain kind of place, the goal here is to emphasize that different organisms need different things in order to survive and that different physical environments support specific types of living things.

In Lesson 3, students are introduced to the concept of adaptations. Specifically, they learn that specific traits of organisms make it possible for the organisms to survive within their habitats. Students investigate examples and discuss a demonstration that shows how specific traits can help an organism survive in a specific environment.

In Lesson 4, students delve more deeply into adaptations and discuss the relationship between an organism's habitat and its observable physical traits that function as adaptations. In the Student Reader, students are exposed to examples of physical adaptations that benefit organisms in particular habitats.

In Lesson 5, building on their understanding of what an adaptation is, students learn about behavioral adaptations that animals exhibit. They read about how some animals form social groups as a means of surviving in their habitats.

In Lesson 6, students use three class sessions to conduct research on animal adaptations and participate in a mock panel discussion in which they present research and answer questions related to physical and behavioral adaptations. Students receive fact sheets on various organisms that they use as a basis for their research to describe how specific traits help organisms survive in particular habitats.

So, to repeat, **habitats are the natural environments in which organisms live, and they provide organisms with the very things they need to survive**. The key concept for students to grasp is that sometimes habitats change and that organisms need to be able to adapt—physically and behaviorally—in order to continue benefiting from their environments.

LESSON 1

Where Organisms Live

Big Question: What is a habitat?

At a Glance

Learning Objectives

- ✓ Compare the characteristics of various habitats.
- ✓ Make claims about the characteristics of a specific habitat.

Lesson Activities

- whole-class discussion
- whole-class observation of online resources
- design plan project

NGSS References

Disciplinary Core Idea LS4.C: Adaptation

Crosscutting Concept: Cause and Effect

Science and Engineering Practices: Engaging in Argument from Evidence

Cause and Effect is important to this lesson as students learn to make the connection between the existence of certain environmental conditions (causes) and the presence of specific traits in organisms that live there (effects). Throughout the habitat-planning investigation, students should be prompted to think, "If we add this feature, how will it affect the bird we are trying to attract?"

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

evidence	needs	**survive**
habitat	**organism**	trait

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in green on the previous page. (Note: Lesson 1 is introductory in nature. These terms and others will be taught within additional context in the subsequent lessons.)

Instructional Resources

Activity Page

AP 1.1

Activity Page
The Needs of Bluebirds (AP 1.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- poster-size paper for student diagrams (1 per group)
- markers or crayons for student diagrams (1 set per group)
- index cards for student vocabulary deck (3 per student)
- internet access and the means to project images/video for whole-class viewing

The Core Lesson 45 min

1. Focus student attention on the Big Question. 5 min

What is a habitat? To build students' understanding, open this lesson with an analogy to the places people live. Use the following questions to prompt discussion:

» What's the address of the place where you live? Have students consider, but not share, their addresses.

» What does your living place offer you that you need to survive?

» What things do people get where they live that they need to stay alive? (*food, water, shelter, and spaces to do things such as sleep and play games*)

» In what ways do organisms, such as alligators, bats, polar bears, and cacti, have "addresses," too? (*Though they do not have houses with numbers and street names, they do have places where they live that meet their needs.*)

Explain that the place where an organism lives is called its habitat. Ask: What does a habitat provide to a plant or animal? (*food, water, shelter, and space*) Have students keep in mind the idea of a habitat as the place where a plant or animal lives as they solve the problem in the investigation.

Preview Core Vocabulary

Write these terms on the board or chart paper. Tell students to pay special attention to these terms throughout today's lesson and discussion.

habitat **organism** **survive**

Have students write each term in the upper left corner of an index card (one term per card). They will revisit the cards later in the unit to add notes about what the words mean.

2. Lead a virtual world tour of habitats. 10 MIN

Online Resources

Arrange the chairs in the classroom in rows and aisles resembling those on an airplane. Have students act as if they are taking an airline trip around the world. Say, "Grab your backpack. Put your binoculars around your neck. Make sure your camera is in your pocket. Now line up, and move to your seat on the plane. Then stow your backpack under your seat."

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

Explain to students that they will take a trip around the world to observe several habitats. Display on a screen one habitat at a time.

- Tell students, "Here's the first stop on our trip." Explain that this habitat is called a deciduous forest. It has trees that will drop all their leaves in the fall. Berry bushes and other smaller plants grow under the trees. There are many places for animals to hide in the deciduous forest, even in winter when snow is on the ground. Trees and other living organisms in this habitat depend on the abundance of water. This means water is available for them to drink and get nourishment from. Ask: What animals might meet their needs in this habitat? What kinds of animals would you find in a deciduous forest? (*bears, owls, raccoons, squirrels, deer*)
- Announce, "Is everyone back on the plane? We are flying to the next habitat." Explain that this habitat is called a tropical rain forest. It has trees, too, but it differs from the previous forest in that it is very wet and shady. A tropical rain forest is also warm year-round, and the trees have leaves all year. Explain that rain forests get a lot of rain, so the availability of water is very good in these habitats, which promotes a lot of lush plants and trees. Point out that some trees are much taller than the others and that a tropical forest floor is often much wetter than the last habitat stop. Ask: If you use your binoculars to look upward, what kinds of animals might you see that can survive in the top branches of those tall trees? (*monkeys, snakes, parrots, butterflies*)
- Tell students, "I hope you brought your swim goggles and swimsuit, because our next stop is underwater!" Display an image of a marine coral reef. Explain that this type of habitat can be found in warm, shallow ocean water. Tiny animals called corals build a rock-hard structure, or reef, that serves as shelter for many other types of animals in addition to the coral animals. Have students look at all the different kinds of coral reefs in this image. Ask: What kinds of animals can meet their needs in this habitat? (*fish, shrimp, seahorses, sea stars*)
- Announce, "I hope you took your photos, because we are off to another habitat." Have students describe what they see in the next image, and explain that this is a desert habitat. The tallest plants in this habitat don't look like trees. They are called cacti (singular, *cactus*). Have students observe that there is not much shade here and lots of sun. Also, the ground is sandy, and it can be easy to dig to make tunnels and burrows. Here, water is scarce, or very hard to find, and animals

that live here have ways to survive. (See **Know the Science 1**.) Ask: What kinds of animals can survive in this hot desert habitat? (*coyotes, jackrabbits, lizards, scorpions, tortoises, roadrunners, woodpeckers, owls*)

As their virtual tour ends, explain to students that they are flying home to solve a habitat problem near their school. (See below, **Know the Science 2**, for support.)

3. Define a problem. 5 MIN

Online Resources

Show students photos of eastern bluebirds, western bluebirds, or mountain bluebirds, depending on which species lives or migrates in your region or the one nearest to your location. (See the Online Resources for a link to a suggested image.)

www.coreknowledge.org/cksci-online-resources

Play an online audio recording of a bluebird singing. (See the Online Resources for a link to a suggested audio file.) Ask: Why might bluebirds make people feel happy? (*They are colorful and pretty. They have a pleasant-sounding song.*)

Discuss with students why people often supplement their environment to attract certain kinds of animals based on their needs. Explain that people often make mini habitats to attract certain kinds of animals that they like to see.

Know the Science

1. Are all deserts hot? *No.* Although most people think of the Sahara or the southwestern United States when they think about the word *desert*, there are actually two different kinds of deserts: hot deserts and cold deserts. Cold deserts are often covered with snow or ice. However, they are still dry regions of land. What makes a habitat a desert is the amount of precipitation it gets. Both hot and cold deserts do not get a lot of precipitation throughout the year.

2. How do habitats, ecosystems, and biomes differ? *It's a matter of perspective.* A habitat is the location where an organism lives. It is from the perspective of a single species. The habitat provides all the conditions the organism needs to survive (food, water, shelter, and space). An ecosystem is a system of interacting components, including the populations of the various species that live there and the nonliving environmental factors that affect those species. Ecosystem thinking helps scientists explore how matter cycles and energy moves within the system, as well as how changes to one component of the system can affect other components. An ecosystem can be very large (one of the Great Lakes) or very small (a tiny pond). *Biome* is a geographical term, but biologists and Earth scientists also use it. A biome is a large area on Earth's surface dominated by characteristic plants and animals and specific climate conditions. Biomes are also associated with certain latitudes on Earth. For example, the temperate grassland biome (including the American prairie) is dominated by wild grasses and is located in temperate latitudes (between the Tropic of Cancer and the Tropic of Capricorn).

Pose a problem to students: What if the principal of our school asked you to find a way to attract bluebirds to our school neighborhood? Ask:

» Where might be a good place to design and make this habitat? (*Answers will vary depending on the school environment but may include a grassy playfield, a nearby park, or a vacant lot in the neighborhood.*)

» What changes in the habitat might need to happen to encourage a bluebird to stay a while? (*Accept all answers, but look for understanding of how effects are related to causes/actions.*) (See **Know the Standards** for support.)

4. Facilitate student research. 10 MIN

Activity Page

AP 1.1

Organize students into small groups.

Explain that it is helpful to learn more about a problem before proposing a solution. Direct each group to ask some questions that will help them understand the problem better. Distribute and review The Needs of Bluebirds (AP 1.1). After students read the Activity Page, have them complete the table to show what they learned about the needs of bluebirds. Encourage students to discuss how to complete the sheet in their groups.

Briefly review the answers as a class to make sure that all groups have the same understanding of the needs of bluebirds.

5. Propose and compare design solutions. 10 MIN

Display the following questions where all students can see them. Direct each group to consider each cause-and-effect question when planning their bluebird habitat.

- In what area near our school should the bluebird habitat be located? (*Sample answer: in the park where there are trees*)
- What will you do to meet the bluebirds' needs for space? (*We can make sure the grassy areas are kept clean and mowed.*)
- What will you do to meet the bluebirds' needs for water? (*We can add a birdbath and check it regularly for water and no dirt.*)

Know the Standards

Engineering Design: The investigation in this lesson is designed to give students practice with the NGSS Science and Engineering Practice for Grades 3–5 requiring students to generate and compare multiple solutions to a design problem. It will also give students an opportunity to build understanding of two of the three engineering core ideas: defining and delimiting engineering problems and developing possible solutions. The long-term goal for students is to reach 3-LS4-3, but this lesson sets the stage to define *habitat* as a concept students can delimit with accuracy regarding an organism's needs.

- What will you do to meet the bluebirds' needs for food? (*We can plant some berries.*)
- What will you do to meet the bluebirds' needs for shelter? (*We can make sure not to harm the trees or mess with the nests.*)

Distribute a poster-sized sheet of paper and drawing tools to each group. Tell students to work as a team to draw a diagram with labels and communicate how they will construct the habitat.

When students are finished drawing, have them display their poster in a designated area of the room. Prompt students to conduct a gallery walk to review each other's diagrams.

SUPPORT—As students conduct a gallery walk, prompt them to think about the best way to attract bluebirds. As needed, challenge students to state the evidence from the Activity Page to support their plan.

SUPPORT—If needed, help students understand what is meant by "using evidence." Evidence is information (data) that supports an argument. Evidence can come from observations students make using their senses, the results of an experiment, or information that comes from researching reliable sources. Students may challenge one another to provide evidence to support their design solutions.

6. Check for understanding. 5 MIN

Activity Page

AP 1.1 and Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 1.1) for correct answers and sample student responses.

- Collect the completed The Needs of Bluebirds (AP 1.1). Scan the poster diagrams that students made. If models contain missing labels, engage in further discussion, emphasizing the needs of the birds that may not be met and why they are important to the survival of the bluebirds.
- Prompt students to ask questions they may still have about habitats in general. Then ask how they would improve their bluebird habitat proposals. Discuss and answer questions as a class.
- To assess Core Vocabulary, display the following fill-in-the-blank sentences for students to complete verbally or in writing: "A bluebird's (*habitat*) is the place where it lives. It has everything the bird needs to (*survive*) there. Seeing bluebirds often in the same area is (*evidence*) that a habitat meets all the needs of this organism."

LESSON 2

Habitats

Big Question: What do all habitats have in common?

At a Glance

Learning Objective

✓ Present an argument with evidence demonstrating that, in a specific habitat, some animals or plants are able to survive and other organisms cannot.

Lesson Activities

- reading
- discussion and writing

NGSS References

Disciplinary Core Idea LS4.C: Adaptation

Crosscutting Concept: Cause and Effect

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is an important part of this lesson that is closely related to the claim-evidence-reasoning (CER) framework popular in teaching writing and social studies. Performance Expectation 3-LS4-3 requires students to construct an argument with evidence. In this lesson, evidence will consist of facts learned from the Student Reader as well as students' prior knowledge and reasoning about the likelihood of an organism's survival in different environments.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

desert	fresh water	**organism**	**survive**
ecosystem	**habitat**	salt water	tundra
forest	interact		

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in green above.

Instructional Resources

Student Reader

Ch. 1

Activity Page

AP 2.1

Student Reader, Chapter 1
"Habitats"

Activity Page
What Lives in a Grassland Habitat? (AP 2.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- world map or globe
- internet access and the means to project images/video for whole-class viewing

The Core Lesson 45 min

1. Focus student attention on the Big Question. 10 min

What do all habitats have in common? To build on what students learned in Lesson 1, ask students to recall the kinds of habitats they saw on their trip around the world. (*deciduous forest, tropical rain forest, desert, coral reef*) This will act both as a refresher for students' prior knowledge and to pique their interest in what they will learn in the Student Reader. Then, use the following questions to make sure students are comfortable with using the term *habitat* correctly:

» What differences did these habitats have? (*Some were on land; others were in water. Some had trees; others did not. Some were in warm places; others were in cold places.*)

» What habitats are near our school? (*Answers will vary. If students cannot think of any, prompt them to think where they have seen animals, such as ants and spiders, and plants, such as grasses and trees, in the school neighborhood.*)

2. Read and discuss: "Habitats." 20 MIN

Student Reader

Ch. 1

Read together or have students read independently "Habitats," Chapter 1 in the Student Reader. This chapter emphasizes that habitats vary in the following ways:

- average temperatures
- amount of water available to living things
- salinity (for water habitats) (See **Know the Science 1**.)

All these factors contribute to cause-and-effect relationships that determine the kinds of organisms that live in a habitat. At the conclusion of the chapter, students are introduced to the concept of an ecosystem.

Preview Core Vocabulary

Before students read, write these terms on the board or chart paper. Encourage students to pay special attention to these terms as they read.

habitat **organism** **survive**

Know the Standards

Adaptation: The Disciplinary Core Idea of LS4.C: Adaptation is addressed by the NGSS in all four grade bands: K–2, 3–5, 6–8, and 9–12. Learning progressions begin in K–2, where students learn that living things can survive only when their needs are met. In Grades 3–5, and during this unit, students learn that for any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. In middle school, the concept of adaptation by natural selection is introduced, connecting the concept of life cycles and reproduction with the concept of an organism's particular traits and ability to survive. In high school, students learn that there are four mechanisms for change in species over time, one of them being genetic variation of traits that results in differences of reproduction rates.

Know the Science

1. How do habitats vary? Environments of different temperatures, different amounts of water, and different amounts of salts in water present organisms with unique challenges to survival. Think about what happens to certain organisms when the temperature changes. If an area becomes too hot or too cold, organisms need to adapt, or they could die. The same goes for the availability of water. When an area that is used to receiving a lot of rain suddenly gets less precipitation one year, organisms will have a hard time surviving. In an opposite example, think about why a cactus dies when it gets too much water. Certain organisms, such as desert cacti, are suited for dry conditions and can drown when overwatered. Salinity has to do with how much salt is present. Marine animals are adapted to certain levels of salinity in the water. When waters become too salty, it can throw off the balance of the environment and cause organisms to die.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts for each page:

Page 1

Focus on the example in the image, and support students as they become comfortable with the terms *habitat* and *survive*. Point out the yellowish tentacles of the sea anemone that surround the clownfish. Explain that the anemone's tentacles have a poison that stings most types of fish, but not clownfish. Ask: How does living with anemones help the clownfish survive? (*Staying near anemones protects the clownfish; other kinds of fish are less likely to come near the clownfish in its home.*)

Next, explain that the clownfish eats small particles of food that the anemone drops from its tentacles as it eats. Ask: What makes a reef with anemones a good habitat for clownfish? (*The reef habitat provides both food and protection* [*shelter*] *for the clownfish.*)

Page 2

Display a world map or a globe. Have one or two students approach the map and point out the North Pole and the equator. Explain that habitats closer to the North Pole are usually colder than those closer to the equator. (Note: the cause of this phenomenon will be explored in greater depth in Grades 6–8.) Ask the following:

- How do you know that arctic hares get all the things they need from their habitat, the tundra? (*because they would not be able to survive there if they did not*)
- There are not any large trees or bushes in the tundra, so what else might arctic hares eat in the tundra habitat? (*tiny plants growing on the rocks and soil*)

Online Resources

SUPPORT—Help students understand that tundra habitats can also be found on high mountains, where it is very cold most of the year. Show an image of an arctic hare from a mountain region to demonstrate diversity and similarity of species. (See the Online Resources for a link to a suggested image: **www.coreknowledge.org/cksci-online-resources**)

Page 3

Help students use the term *desert* accurately as a particular type of habitat. Ask the following:

- What do desert and tundra habitats have in common? (*They are both dry.*)
- How are deserts and tundra habitats different? (*Tundra are much colder than the typical desert.*) (See **Know the Science 2** for support.)

Know the Science

2. What are deserts? Deserts can be hot or cold. Although hot deserts can reach temperatures well over 100 degrees Fahrenheit and cold deserts can reach temperatures that are below freezing, what makes a habitat a desert is the amount of total water available to organisms in the area. Deserts are dry locations that do not receive a lot of precipitation throughout the year.

» How do you know the tall saguaro cactus gets what it needs in the desert? (*If it didn't get what it needs, it could not survive.*)

» Why don't tall trees with many branches and leaves live in this habitat? (*There may not be enough water for them to survive in a desert.*)

Online Resources

SUPPORT—If some students cannot picture trees with leaves or needles, show them images of coniferous versus deciduous trees online. (See the Online Resources for a link to a suggested image.)

www.coreknowledge.org/cksci-online-resources

Have students recall from Lesson 1 the habitats where these types of plants grow. (*forests*)

» Would you expect to find kit foxes living in the ocean or tundra? What is your evidence? (*No, because they cannot get the things they need to survive in those habitats. I know this because the kit fox's features help it meet its needs in a dry, warm habitat.*)

Page 4

Have students think about a forest habitat near their school or one they have visited. Then have one or more students act out for the class a walk through the forest, describing to the class what they observe along the walk. Prompt students by asking the following:

» What do you notice with your eyes? (*lots of shade*)

» How does the air feel on your skin? (*cool and moist*)

» What animals do you see in this habitat? (*Answers will vary depending on the type of forest but may include perching birds in a tree, ants on the ground, and deer.*)

Direct students' attention to the image of the raccoon in their Student Reader. Explain that raccoons often find shelter and reproduce in cavities (holes) in trees. What other needs might raccoons have in a forest habitat? (*getting food, a place to hide*)

Online Resources

SUPPORT—Although students have been introduced to the term *reproduce* before (Unit 2, *Life Cycles*), some may need a refresher on what it means. Show students a video of baby raccoons in a tree. (See the Online Resources for a link to a suggested video.)

www.coreknowledge.org/cksci-online-resources

Point out that the raccoon mother looks for a tree with an opening in it. She gives birth to her offspring there, and the babies stay there until they are old enough to climb down the tree and look for food and water with their parent. Ask: What type of habitats do racoons survive well and reproduce in? (*woods or forest*)

CHALLENGE—Some students may point out that raccoons can also live in urban environments, very close to humans. Challenge students to research how raccoons survive in cities. Students may use books and other media from the media center or search online. Have students report to the class what raccoons living in cities eat, where they find water, where they find shelter, and where they have and care for their young.

Page 5

Make sure students understand that different types of environments support different species of organisms. Point out that the species of turtles that live in pond habitats are different species than those that live in ocean habitats. Ask the following:

- What is one difference between pond and ocean habitats? (*Ponds have fresh water, and oceans have salt water.*)
- What if we were to set up an aquarium in our school? Why would we have to think about the kind of water we put in it? (*because some animals and plants can only survive in salt water or fresh water*)

Page 6

Discuss with students the concept of a system. Help them understand that a system is a group of related parts that make up a whole. In acting as a whole, functions can be carried out that individual parts would not be able to achieve. Ask: How can you describe a system? (*based on its components; based on the interactions of the components*)

Focus student attention on the concept of interactions. (See **Know the Science 3** for support.) Ask:

- What are the living and nonliving things in this photo? (*The bird, worm, and green leaves are living. The brown leaves are nonliving.*)
- How might they interact in this ecosystem? (*The worm that the bird is eating ate decaying material in the soil. The bird eats the worm.*)
- What other interacting parts of this ecosystem cannot be seen in the photo? (*trees, other birds, soil and worms under leaves; animals that eat birds*)

SUPPORT—If necessary, help differentiate *habitat* and *ecosystem* for students. A habitat is the location where an organism lives. It is from the perspective of a single species. The habitat provides all the conditions the organism needs to survive (food, water, shelter, and space). An ecosystem is a system of interacting components, including the populations of the various species that live there and the nonliving environmental factors that affect those species. Ecosystem thinking helps scientists explore how matter cycles and energy moves within the system, as well as how changes to one component of the system can affect other components. Ecosystems exist on a variety of scales. An ecosystem can be very large (one of the Great Lakes) or very small (a tiny pond).

Know the Science

3. What kinds of interactions occur in an ecosystem? *Many kinds!* Species interact in an ecosystem when one species uses another as a food resource, such as in a predator-prey relationship. Feeding interactions can be visualized as graphic representations called food webs. Food webs may also show organisms called decomposers, which feed by breaking down dead organisms. Many bacteria and fungi are decomposers. Decomposition releases nonliving nutrients into the environment, where they can be used by other living things. Plants taking up nitrogen from the soil through their roots is just one example of how living and nonliving things interact in an ecosystem.

3. Teach Core Vocabulary. 5 MIN

Word Work

Return students' attention to the Core Vocabulary cards they prepared in the prior lesson for the following terms:

habitat **organism** **survive**

Instruct students to write a definition for each term in their own words. Encourage students to refer back to the Student Reader chapter as needed for support.

- **habitat:** (n. the natural place where an organism lives) Have students provide a brief description of one organism's habitat. (*Sample answer: A river otter's habitat is an area of river and riverbank.*)
- **organism:** (n. a single living thing) Instruct students to give a couple examples of organisms. (*Sample answers: a cat, a snail, a human girl*)
- **survive:** (v. to stay alive) Have a few volunteers use *survive* in a sentence. (*Sample sentence: Plants need water to survive.*)

4. Check for understanding. 10 MIN

Activity Page

AP 2.1 and Answer Key

Formative Assessment Opportunity

Distribute and review What Lives in a Grassland Habitat? (AP 2.1). See the Activity Page Answer Key (AP 2.1) for correct answers and sample student responses.

- Introduce the assessment activity by discussing claims and evidence. Make sure students understand that when scientists make a claim about the world, they must support it with evidence. Where can students get evidence? Evidence can be the results of an investigation, information they read in a science book, information from an expert, or information from a science website. In this activity, students use the information they have from the Student Reader on organisms to analyze the cause-and-effect relationship between the habitat and the ability of the organism to survive.
- Collect the completed What Lives in a Grassland? (AP 2.1), and use the answer key to evaluate student responses. Students should have made claims based on what they learned in this lesson. Confirm that they understand that evidence is information and facts that can be confirmed by another person. So, an answer such as "I just know it" would not constitute sufficient evidence.

LESSON 3

Investigating Traits and Adaptations

Big Question: How do specific traits benefit an organism in a particular habitat?

At a Glance

Learning Objective

✓ Explain the concept of adaptation by showing how specific traits help an organism survive in its specific habitat.

Lesson Activities

- whole-class discussion
- student investigation (working in pairs)

NGSS References

Disciplinary Core Idea LS4.C: Adaptation

Crosscutting Concept: Structure and Function

Science and Engineering Practices: Engaging in Argument from Evidence

Structure and Function are important to this lesson as students learn to associate the way a living thing is shaped and the way structure and function work together to support growth, survival, and reproduction. Questions such as "How does this plant or animal use this body part to help it survive?" will develop structure/function thinking that is also applicable to Earth science, physical science, and engineering design.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

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Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

adaptation habitat trait

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary term designated in green on the previous page.

Instructional Resources

Activity Page

AP 3.1

Activity Page
What Is the Advantage of the Adaptation Called Blubber? (AP 3.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- medium-sized cups of cold water (2 per pair of students)
- ice cubes
- vegetable shortening
- plastic wrap or non-latex disposable gloves (1 8-inch square or glove per student)
- small disposable cup (1 per pair)
- plastic spoon (1 per student)
- timer (1 per pair)

Advance Preparation

Prepare in advance for the student investigation by doing the following:

- Fill two medium-sized cups halfway with water for each pair of students.
- Place the filled cups on trays or in a place where a spill can easily be wiped up.
- A few minutes before students are ready to test their models, add an equal amount of ice cubes to each cup.
- Scoop a few tablespoons of shortening into each small disposable cup.

The Core Lesson 45 min

1. Focus student attention on the Big Question. 5 min

How do specific traits benefit an organism in a particular habitat? Remind students that in the previous lesson, they read and discussed what habitats have in common. Ask: What does an organism get from its habitat? (*food, water, shelter, and space*)

As you work with students on this section, focus students on supporting their claims and arguments with observations they can make from the photo, rather than speculation. (See **Know the Standards** for support.)

Know the Standards

Engaging in Argument from Evidence: Students should be building their understanding of and skills related to this science and engineering practice throughout Parts A and B of this unit. In the context of this lesson, students should focus on constructing and supporting their arguments with evidence in the form of data from their experiments and models.

Preview Core Vocabulary

- Introduce the term **adaptation**. Explain that an adaptation is an inherited trait an organism uses to survive and reproduce in its habitat. Show students again the photo of the arctic hare from the Student Reader Chapter 1 on page 2. Ask: What adaptations does the hare have that help it survive where it is cold and snowy much of the year? How do you know? (*fur to keep warm, white color to blend in with the snow, big ears to hear things far away, big feet for moving over snow*)
- Reinforce that an adaptation is an inherited trait. If a rabbit runs to shelter to get out of the rain, that is not an adaptation; that is a response.
- Explain that in this lesson, students will investigate one way some animals have adapted to cold ocean habitats. They will use a model to gather evidence about how these animals stay warm in icy cold water. (See **Know the Science** for support.)
- Have students keep the idea of adaptations in mind as they investigate.

2. Facilitate the investigation. 25 MIN

Activity Page

AP 3.1

Organize students into pairs. Explain that there are two roles in each pair: experimenter and timer. Let students know that they will switch roles halfway through the investigation.

- Distribute and review What Is the Advantage of the Adaptation Called Blubber? (AP 3.1). Tell students they will be conducting an experiment to learn about an adaptation that some animals, such as whales, have: blubber! Review the Activity Page together as a class.
- Have the students decide what role they will take first.

  SUPPORT—Some students may find keeping track of who does what confusing. To help them keep track of which procedure steps each student does, have them make name tags saying *Experimenter* or *Timer*. When students switch roles, they can switch name tags, too.

Know the Science

What adaptations do animals have for temperature regulation? *Both physical and behavioral responses function to accomplish temperature regulation.* Temperature regulation is the ability of an organism to maintain a constant internal body temperature that is either lower or higher than the surrounding environment. This is often called being "warm blooded." Such constant temperatures are an adaptation, an inherited advantage for an organism to use energy, for internal chemical reactions to take place, and for muscles to work. Other inherited adaptations are physical traits such as having thick fur or feathers on the outside of their bodies, blubber under their skin, and large, thin ears with many blood vessels that cool the rest of the body. Examples of animal behavioral responses that regulate temperature include moving into the sun or shivering to warm up and moving into the shade to cool off. Note: students were introduced to behavioral traits in Unit 2 and will focus on distinguishing structural from behavioral traits in Lesson 5 of this unit.

- Have the experimenter from each pair come get the two cups of cold water from the materials station. Before students take the water, add an equal number of ice cubes to each cup.
- Then have the experimenter get the cup of shortening and spoon.
- Next, arrange for students acting as timers to use timing devices. A wall clock with a second hand will do. Mobile phones have timer apps that could also be used, or digital stopwatches can be used. If students are unfamiliar with the timer tool, have students practice timing a few activities in seconds.
- Demonstrate Activity Page (AP 3.1) Steps 3 and 4, using a student volunteer as the timer. Include in your demonstration how to record data in the table.

3. Summarize and discuss. 10 MIN

Once students have had time to conduct their investigations and complete their Activity Page, bring the class back together for a whole-class discussion to summarize what students discovered. Students should be able to explain their observations and support them with evidence.

Ask which cup allowed students' fingers to stay warmer. (*the cup with the shortening*) Have students refer to their tables and final arguments in the Activity Page to provide evidence to support this answer.

Elicit from students that blubber is an adaptation that helps animals stay warm and can help animals survive cold temperatures.

4. Check for understanding. 5 MIN

Activity Page

AP 3.1 and Answer Key

Formative Assessment Opportunity

Collect the completed What Is the Advantage of the Adaptation Called Blubber? (AP 3.1).

- Review the completed data tables in Step 5. The number of seconds a finger covered in shortening can be held in icy water should be greater than the number of seconds a bare finger can be held in icy water.
- Then review the written arguments in Step 8. Look for students using the results of their experiment as evidence that blubber helps keep arctic animals warm in cold ocean water.
- Prompt students to ask questions they may still have about adaptations in general. Point out that some of these questions may be answered in the next lesson.

  CHALLENGE—Remind students that animals have many adaptations for survival. Have them look at the ears of the arctic hare in Student Reader Chapter 1 again. Ask: How do you think big ears might help the hare survive? (*The hare might be able to hear danger better than with smaller ears.*) Then ask: How would you test this idea (hypothesis) to find out if big ears can hear sounds better than small ears? (*Encourage students to use paper and scissors to design model ears of various sizes and shapes and a procedure to test their models.*)

LESSON 4

Adaptations in Living Things

Big Question: What are adaptations?

At a Glance

Learning Objective

✓ Explain the concept of adaptation by showing how specific traits help an organism survive in its specific habitat.

Lesson Activities

- reading and discussion
- concept mapping activity
- student investigation

NGSS References

Performance Expectation 3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

Disciplinary Core Idea LS4.C: Adaptation

Crosscutting Concepts: Structure and Function; Cause and Effect

Science and Engineering Practices: Engaging in Argument from Evidence

Adaptation is the NGSS Disciplinary Core Idea foundational for understanding the theory of evolution by natural selection. In this lesson, it is important that students grasp the idea that organisms have many physical and behavioral traits beneficial to their survival and ability to reproduce.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to this term, which is not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

adaptation advantage camouflage dominance

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary term designated in green above.

Instructional Resources

Student Reader

Ch. 2

Activity Page

AP 4.1

Student Reader, Chapter 2
"Adaptations in Living Things"

Activity Page
What's My Adaptation? (AP 4.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- paper towels
- waxed paper
- small cups of water
- eyedropper
- index card for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing

Advance Preparation

In advance, cut the waxed paper and paper towels into small equal-sized squares, about five-by-five centimeters. Have additional paper towels ready for students to wipe up spills, as needed.

The Core Lesson 45 min

1. Focus student attention on the Big Question. 5 min

What are adaptations? Build on what students learned about adaptations through their investigation in Lesson 3. Have students recall how a layer of fat (blubber) can help animals survive in very cold ocean water. This will act both as a refresher for students' prior knowledge and to pique their interest in what they will learn in the Student Reader. (See **Know the Standards**.) Ask the following:

- What evidence did you have that a layer of fat can keep an animal warm in cold water? (*We could hold a finger in ice water for a longer amount of time when it was covered in a layer of fat/shortening than without.*)
- What adaptation does a whale or walrus have that functions like the shortening? (*It has a layer of blubber under its skin.*)
- What other adaptations do animals have to stay warm when their environment is very cold? (*thick fur, fluffy feathers, or locating shelter, such as a nest or cave*)

SUPPORT—This open-ended question may be difficult for some students. If so, give them contextual clues, such as asking, "How do penguins living in large groups stay warm standing on ice?" (*They huddle closely together to share warmth from their bodies and to block the wind.*)

2. Read and discuss: "Adaptations in Living Things." 20 min

Student Reader

Ch. 2

Read together or have students read independently "Adaptations in Living Things," Chapter 2 in the Student Reader. This chapter emphasizes that adaptations serve varied functions, including getting food, getting water, protection, and reproduction. For adaptations that are physical traits, have students focus on the Crosscutting Concept that the structure of a body part is related to its function. The guided reading notes will also focus on cause-and-effect relationships in discussion of what would happen to an organism that did not have a certain adaptation.

Know the Standards

Adaptation: Disciplinary Core Idea LS4.C: Adaptation includes several important subconcepts that are developed over the course of this unit. In Lesson 3, students begin by learning that adaptations enable an organism to survive well in its particular habitat. The Student Reader Chapter 2 focuses on adaptations that help an organism survive well by meeting its needs for food and protection and to produce offspring. In Lesson 4, students begin to consider how well an organism will survive if it does not have those adaptations. Later in the unit, in Lessons 7–11, students will explore how a change in a habitat can result in organisms found there surviving less well or not surviving at all.

Preview Core Vocabulary

Before students read, write **adaptation** on the board or chart paper. Have students write the Core Vocabulary word in the upper left corner of an index card and underline it, and encourage students to use the term frequently as they discuss what they read.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 7

Focus on developing student understanding of the term *adaptation*. Draw a vocabulary concept map for the class. Write the word *adaptation* in a bubble at the top of the map. Draw two more bubbles below it, and connect *eat* to the top bubble.

- Ask students: What are two groups of adaptations described on this page? (*adaptations that are body parts; adaptations that are ways an organism acts*)

  SUPPORT—Use this opportunity to differentiate between a behavioral adaptation and a response to some factor in the environment. An adaptation is something that takes time to evolve, but a behavioral response can occur in the moment.

- Ask: What examples of each group did we read about? How can we add them to our map? Invite one or more students to add bubbles connecting to either body parts or ways an organism acts. (*body parts: duck feet, duck's oily feathers, fish gills, turtle shell; ways an organism acts: turtle hiding inside its shell*)

Page 8

Activity Page

AP 4.1

Distribute and review What's My Adaptation? (AP 4.1). Explain to students that they will use it to take reading notes on the remainder of pages in this chapter. Make sure they know what the heading at the top of each column means. (*Organism* is a living thing; *habitat* is the place in which an organism lives; *adaptation* is a body part or action that helps an organism survive [and ultimately to reproduce]; *advantage* has to do with the benefit that the adaptation offers to the organism.)

- Direct students' attention to the two images on the page, and have them note the names of the two animals in the table on the Activity Page. Then read the page together, and have students record their notes.

  SUPPORT—Point out that there are other kinds of organisms in the images, such as the tree near the giraffes. Ask: What adaptation does the tree have to keep most animals from reaching its leaves? (*a long trunk to keep its leaves high off the ground*) Make sure students understand that plants, as well as animals, have adaptations for survival and reproduction.

Page 9

Students may have learned previously that a predator is an animal that catches another animal for food and that the animal it catches to eat is its prey. As students read, have students think about which is the predator (the owl) and which is the prey (mice).

- Students are likely to ask what kinds of animals owls eat for food. Most species of owls eat small mammals, such as mice and rats, and some insects. Explain that there are many different types of owls. Even though they share many adaptations, they also have differences that affect the foods they eat. (See **Know the Science**.)
- Have students continue to record their reading notes on the Activity Page.

Pages 10–11

Direct students' attention to the heading on page 10, "Adaptations Help Living Things Defend Themselves." Make sure all students know what the word *defend* means. Ask: How do people defend and protect themselves from the rain and sun? (*wear raincoats, carry umbrellas, wear sunglasses, use sunscreen*) Explain that other kinds of living things also have body parts or behaviors to defend or protect themselves.

- Prompt students to think of other examples of organisms that use spines or camouflage for protection by asking the following:
  - » What other kinds of plants have spines for protection? (*rose bushes, blackberry bushes*)
  - » What other kinds of animals use camouflage for protection? (*insects, such as praying mantises and katydids, geckos, and arctic hares*)

  CHALLENGE—Camouflage is a high-interest topic for many students. Challenge those who wish to learn more to do online research to find other examples. Allow students to print images from websites, write captions, and assemble the images into booklets. Then have them present the booklets and share them with the rest of the class.

Online Resources

- Students may benefit from another example of an organism that uses bright colors for protection. Show students online images of monarch butterflies. (See the Online Resources for links to a suggested image.) A monarch larva has brightly colored yellow, white, and black stripes. The larva obtains the toxins that harm some predators by eating milkweed plants. Later, when the larva changes into an adult butterfly, it can make a predator sick enough to vomit. Once a bird has that experience, it is not likely to try to eat another monarch! This doesn't protect the individual, but it does protect others in the species.

Know the Science

Why are some animals nocturnal? ***For a survival advantage!*** There are many species of owls, and most of them are nocturnal. This means they are active at night and rest during the day. Being nocturnal is one aspect of an owl species' ecological niche. A species' niche is often described as its place or job in its community and ecosystem. So, being a nocturnal predator of small mammals describes, in part, an owl's niche. Being nocturnal is an inherited adaptation that provides certain advantages for survival. First, owls that hunt at night can share the same habitat with hawks, birds of prey that hunt mostly during the day. This reduces the dangers of being injured by competing with another dangerous bird over a tasty meal. Also, certain prey might only be awake at night. Another reason owls may have an advantage at night is that those that live in hot, dry habitats conserve water by being active when the air is cooler at night.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

- Direct students to the image of the capybara, and ask: What other kinds of animals protect themselves by swimming, running, or flying away from danger? (*swimming: fish, frogs, dolphins; running: antelopes, wild horses, rabbits; flying: birds, butterflies, bats*)

Have students continue to record their reading notes on the Activity Page (AP 4.1).

Page 12

Make sure students recall the meaning of *reproduction* from Unit 2 (*reproduction* is the process of making a new living thing). Then explain that *reproduce* is a verb. Have students complete the following sentence: "When a plant or animal reproduces, it makes _____." (*new living things, offspring, babies, young*)

- Students may wish to share other examples of behaviors that help an animal find a mate. Get the discussion started by asking if anyone has seen a male peacock show off its tail feathers.

Online Resources

- Show students a suitable online video of male bowerbirds. (See the Online Resources for a link to a suggested video.) These birds put on elaborate displays, build structures, and offer gifts to their potential female mates. The males use sticks, shells, berries, and human-made objects, such as coins and bits of plastic, to make their structures.

Have students complete their reading notes on the Activity Page and then write the answer to the final question.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

3. Teach Core Vocabulary

5 MIN

Word Work

Return students' attention to the Core Vocabulary card they previously prepared for **adaptation**.

- **adaptation:** (n. a body part or behavior that helps a living thing survive) Instruct students to write two examples of adaptations and how they help organisms survive. They should choose one example from the reading or class discussion. Then they should choose a second example that they identify on their own from what they know. (*Sample answers: Webbed feet help a capybara swim well. A duck's webbed feet also help it swim well.*)

4. Gather evidence about water repellency. 10 MIN

In a hands-on activity, give each student a small square of waxed paper, a small square of paper towel, and a small cup of water. Have students dip the dropper into the cup and place one drop of water on the paper towel. Then have them repeat with the waxed paper. Ask:

- » What happened to the water on the paper towel? (*It soaked into the paper and passed through to the other side.*)
- » What happened to the water on the waxed paper? (*It sat on top of the waxed paper. Little to no water passed through.*)
- » How are the results of your investigation evidence to explain how the outer layer of a cactus works? (*Water not passing through waxed paper is evidence that wax on plants may not let water pass through, either. The water stays inside and cannot escape from the plant.*)

Provide students with additional paper towels to clean up as they dispose of the materials.

5. Check for understanding. 5 MIN

Activity Page

AP 4.1 and Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 4.1) for correct answers and sample student responses.

- Collect the completed What's My Adaptation? (AP 4.1). Scan students' reading notes in the table. Look for accuracy and completeness.
- Choose one or two examples that students struggled with to discuss with the class. Use the discussion to reinforce the main ideas and correct misconceptions.
- Discuss the answer to the final question with the class. Make sure students understand that without an adaptation for survival, an individual organism could die and that without an adaptation for reproducing, that type of organism (species) could die out.

LESSON 5

Living Things in Groups

Big Question: How do organisms work together for survival?

At a Glance

Learning Objective

✓ Provide evidence of how some animals form social groups, which is an adaptation to help them survive in their habitat.

Lesson Activities

- reading and discussion
- concept mapping activity
- claim/evidence activity

NGSS References

Performance Expectation 3-LS2-1: Construct an argument that some animals form groups that help members survive.

Disciplinary Core Idea LS2.D: Social Interactions and Group Behavior

Crosscutting Concepts: Cause and Effect; Systems and System Models

Science and Engineering Practices: Engaging in Argument from Evidence

Systems and System Models: Throughout this lesson, look for opportunities to have students use the language of systems and system models to describe the interactions among individuals of social animal groups. Introduce *system* before beginning to read Chapter 3. Then have students complete sentences using the word *system* as they discuss each page in the chapter.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to this term, which is not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

behavioral trait role

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary term designated in green above.

Instructional Resources

Student Reader

Ch. 3

Activity Pages

AP 5.1

AP 5.2

Student Reader, Chapter 3
"Living Things in Groups"

Activity Pages
Advantages of Living in Groups (AP 5.1)

How Big Are Animal Groups? (AP 5.2)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- index card for student vocabulary deck (1 per student)
- internet access and the means to project images/video for whole-class viewing (animal groups)

The Core Lesson 45 min

1. Focus student attention on the Big Question. 10 min

How do organisms work together for survival? In the previous lesson, students learned that adaptations can be body parts (physical traits) or actions that help an organism survive in its habitat. Remind students that the science term for body parts or features of an organism is *physical trait*. Explain that in this lesson, they will learn that the science term for the actions of living things is *behavioral trait*.

- Ask students to recall from Unit 2 what behavioral traits elephants have to take care of their young. (*All the females in the herd help care for any baby elephants that are born.*)

- Explain that in English, there are curious names for many animal groups (a pack of wolves, a pride of lions, a troop of baboons, a gaggle of geese, a cloud of grasshoppers). Show the class a video about the English names for animal groups. (See the Online Resources for a link to a suggested video.) Emphasize that the names are more fun than scientific, explaining that many of them are hundreds of years old and were used by English-speaking wild-animal hunters.

  CHALLENGE—Challenge interested students to research the names of groups in the library or online. Have them print an image of each animal group and caption it with the name of the species and the name of the group. Then have students assemble booklets, ordered alphabetically by the group name. If possible, arrange for your students to share their books with younger students in their school.

Online Resources

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

- Build on what students learned about adaptations in Lesson 4 and in Student Reader Chapter 2. Ask: What adaptations do animals have for getting food? (*Examples from the Student Reader include giraffes' long necks for reaching tree leaves, the shape of the topi's snout for eating grasses, and an owl's large eyes for finding prey in the dark.*)
- Remind students that the ways organisms act can also be adaptations. Ask: How is the time of day an owl hunts for food an adaptation? (*It hunts at night because more prey are out then or because there are fewer predators hunting at night to compete with.*)
- Tell students that, in this lesson, they will learn how living as a group is an adaptation for many kinds of animals. Point out that individuals living in a group is an example of a system. (See **Know the Standards** for support.)

Preview Core Vocabulary

Before students read, write **behavioral trait** on the board or chart paper. Have students write the Core Vocabulary word in the upper left corner of an index card and underline it, and encourage students to use the term frequently as they discuss what they read.

Know the Standards

Systems and System Models: Prior to Grade 3, students will have learned that systems in the natural world have parts that work together. K–2 students also learn that objects and organisms can be described in terms of their parts. In Grades 3–5, students are learning that a system is a group of related parts that make up a whole, and they are developing their ability to recognize the components of a system and their interactions. Social animals (Disciplinary Core Idea LS2.D) are a high-interest topic for learning about systems. Students can identify the parts (individual animals) of the system (the group) and analyze how the parts interact to obtain food, defend themselves, and cope with changes. Students can also compare the sizes of the systems by noting how many individuals are typically in an animal group.

2. Read and discuss: "Living Things in Groups." 30 MIN

Student Reader

Ch. 3

Activity Page

AP 5.1

Prepare to read together or have students read independently "Living Things in Groups," Chapter 3 in the Student Reader. This chapter emphasizes that living in groups can have different functions: helping animals meet their needs for food, protecting the members of the group from predators, and reproducing.

Distribute and review Advantages of Living in Groups (AP 5.1).

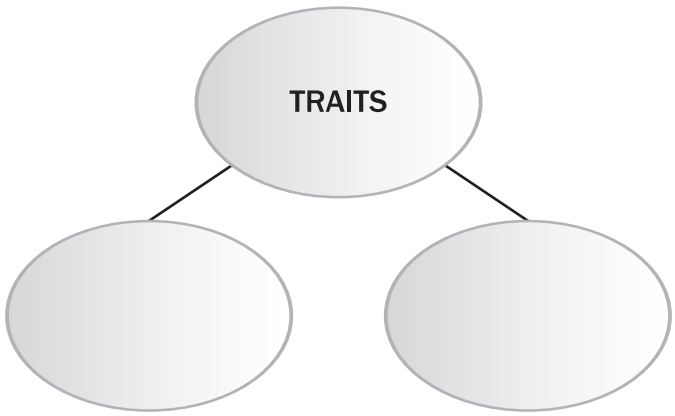
Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Word Work

Page 13

Focus on developing student understanding of the term **behavioral trait**. Draw a vocabulary concept map for the class. Write *traits* in a bubble at the center of the map. Draw two more bubbles below it, and connect them to the top bubble.



Ask: What are two types of inherited traits? (*physical traits and behavioral traits*) Write these terms in the two blank bubbles. Mention that both are types of adaptations that help living things survive.

> **SUPPORT**—Some students may not be familiar with concept maps. Explain that the bubbles are ideas and the lines between the bubbles show how the ideas are connected to each other.

Have students add the definition of *behavioral trait* to their Core Vocabulary card.

- Have students look at the image and caption on the page, and ask: What are some behavioral traits of wolves? (*They live in a family group; the whole group cares for the young.*)
- Ask: What other behavioral traits of wolves do you know about? (*Answers will depend on students' prior knowledge but may include that wolves howl loudly at night, that they hunt other animals for food, and that they run fast.*)

Page 14

Have students refer to Advantages of Living in Groups (AP 5.1). Remind students that a concept map is a diagram that shows how ideas are related. Explain to students that they will add details to the concept map as a way to take reading notes on the remainder of the pages in this chapter.

- Have students complete the following sentence verbally: "Female lions form a system because they _____." (*are parts that work together to catch food*)
- After reading page 14, have students find the bubble on their Activity Page that corresponds to the main idea of page 14. Show students how to add a bubble connected to "to hunt for food" and write the name of the animal and other details they learned from reading.

Page 15

Ask students to think about how dolphins hunt in a group. Discuss possible answers to the question in the caption: How does this behavior make it easier for dolphins to get enough food? (*When the fish are gathered into a tight group, a dolphin can eat more fish in one gulp. If they were spread out, the dolphin would have to find and eat one fish at a time.*)

- Point out to students that animal species differ in their group behavior. Some species cooperate within their group in more ways than others. (See **Know the Science**.)
- Based on their reading, have students add more bubbles and notes to their concept map on the Activity Page (AP 5.1).

Pages 16–17

Discuss the sentry behavior of meerkats. Students may assume that the sentry on duty forgoes eating and that this might mean sentries will starve. However, scientists have evidence that a meerkat does not take its turn as a sentry until it has a belly full of food.

- Then, discuss the following question: Do you think it is dangerous to be the sentry who stands tall while the others in the group are low to the ground or inside their burrow? What evidence would support your answer? (*Students should acknowledge that strong evidence would come from observing meerkats in the wild. There, they would see that the sentry is the first member of the group to see a predator and also the first member to dive into a burrow for safety.*)

Know the Science

How do animal species compare in their degree of sociality? *There is a wide range of cooperative social behavior across species.* Scientists often classify social animals on a continuum. The least social species are called solitary and only form temporary social groups to mate (some frogs, tigers, bears, foxes, owls, spiders). Other species are moderately social and form year-round social groups (elephants). At the extreme end of the social group continuum are the eusocial species that live in complex groups having several generations and exhibit social behaviors for mating, cooperate to raise their own offspring, allow some members to reproduce and others not, and have division of labor beyond that for reproduction. Most eusocial species are invertebrates, such as ants and honeybees. Scientists have also identified two species of mammal, both naked mole rats, as eusocial. Living in social groups can have disadvantages as well as advantages. Individuals in a large group may have to compete more for food than solitary animals, may also pass diseases to members of the group easily, and may be easier for predators to find.

CHALLENGE—Focus students on identifying cause-and-effect relationships by asking them to complete the following sentence: "Moving so that older wildebeests are on the outside of the group and young wildebeests are on the inside of the group _____ (*causes, results in*) the younger wildebeests being protected." Then discuss which is the cause and which is the effect.

Based on their reading, have students add more bubbles and notes to their concept map on Advantages of Living in Groups (AP 5.1).

Activity Page

AP 5.2

After reading the page, point out that animal groups vary in the number of individuals in the group. Distribute and review How Big Are Animal Groups? (AP 5.2).

- Go over the data in the table, making sure that students understand place value enough to know that numbers with more places are larger than numbers with fewer places. Read the numbers with students.
- Then, have students answer the questions under the table. Some students may need reminders about what the words *claim* and *evidence* mean.

Page 18

Make sure students understand that reproduction is needed for survival of the population or species. Ask: How do helper meerkats increase the survival of their species? (*Even if the helpers do not reproduce, the group does, and these offspring are needed for the species to survive.*)

- Ask: Where is the calf in this photo? Allow students to share the location of the calf with a reading partner. Ask: Was the calf hard for you to see? How does hiding the calf in a group of larger elephants protect it? (*It makes the calf hard for a predator to see or to attack.*)
- Point out to students that they have just used evidence to support an argument. Ask: What was your argument to explain how the calf is protected? (*It is protected because predators cannot see it.*) What evidence supports your argument? (*Evidence came from looking at the photo and realizing that it was hard to find the calf.*)
- Based on their reading, have students add more bubbles and notes to their concept map on Activity Page 5.1.

3. Check for understanding. 5 MIN

Activity Pages

AP 5.1

AP 5.2

Answer Key

Summative Assessment Opportunity

See the Activity Page Answer Key (AP 5.1 and 5.2) for correct answers and sample student responses.

- Collect the completed Advantages of Living in Groups (AP 5.1). Scan the students' concept maps based on information from reading. Look for accuracy and completeness.
- Choose one or two examples that students struggled with to discuss with the class. Use the discussion to reinforce the main ideas and correct misconceptions.

- Discuss the answer to the final question with the class. If students answered that there is usually one advantage, have them review the lesson and add to their concepts maps. Make sure students understand that living in groups usually provides several survival advantages for a species.
- Collect the completed How Big Are Animal Groups? (AP 5.2). Review students' answers. For the first question, students should select that animal groups vary greatly in size. For the second question, students should explain that some numbers in the table have more digits than others. The animals with the smallest size group are bottlenose dolphins. The animals with the biggest group are leaf-cutter ants.

LESSON 6

Suited for Survival

Big Question: What are some examples of successful adaptations of organisms to their habitats?

At a Glance

Learning Objective

✓ Compare the physical and behavioral traits of organisms of varied habitats.

Lesson Activities (3 days)

- research and analysis activity
- science conference modeling activity
- self-evaluation task

NGSS References

Performance Expectations 3-LS2-1: Construct an argument that some animals form groups that help members survive. **3-LS4-3:** Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

Disciplinary Core Idea LS2.D: Social Interactions and Group Behavior

Disciplinary Core Idea LS4.C: Adaptation

Crosscutting Concept: Cause and Effect

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence: In this performance task, students have two opportunities to construct arguments with evidence. Using Getting to Know You (AP 6.16), students who are becoming experts in a social animal will make a claim about how living in a group helps the animals meet their needs. Using Survival Conference (AP 6.17), all students will make claims about what could happen to their organism if it were moved to another habitat.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. No new Core Vocabulary terms are introduced during this lesson.

adaptation habitat survive trait

Instructional Resources

Activity Pages

AP 6.1–6.15
AP 6.16
AP 6.17

Activity Pages
Organism Fact Sheets: Snowy Owl, Caribou, Reindeer Lichen, Purple Sea Star, Turban Snail, Surfgrass, Saguaro Cactus, Gila Monster, Kangaroo Rat, Bluegill, White Water Lily, Painted Turtle, Yellow-Banded Poison Dart Frog, Scarlet Macaw, Brazil Nut Tree (AP 6.1–6.15)

Getting to Know You (AP 6.16)

Survival Conference (AP 6.17)

Materials and Equipment

Collect or prepare the following items:

- Online Image Library
- name tags
- internet access and the means to project images/video for whole-class viewing

Day 1: There is a photo associated with each Organism Fact Sheet (AP 6.1–6.15). Access the Online Image Library to display the images as a slideshow when students are ready to work with their fact sheets.

Day 2: Students will wear name tags when they do their conference panel presentations.

Advance Preparation

Prepare the room in advance by setting up tables and chairs to represent a conference panel. Decide how you will assign the fifteen species to the number of students in your class. For example, you may wish to have some students work in pairs. Make sufficient copies for your students prior to conducting the lesson.

The Core Lesson THREE DAYS, 45 MIN EACH

1. Day 1: Focus student attention on the Big Question. 15 MIN

What are some examples of successful adaptations of organisms to their habitats? In Lessons 1–5, students learned that there are different kinds of habitats, that organisms have physical and behavioral traits that are adaptations to those habitats, and that some behavioral traits enable animals of one kind to live in groups.

- Ask students to recall the names of the habitats they learned about in Lessons 1–5. (*ocean, pond, stream, mountain, tundra, desert, temperate forest, grassland, rain forest*)

- Explain that students will use what they learned previously as they become experts in plants and animals that live in five habitats: the Arctic tundra, a Pacific Ocean coastal tide pool, the Sonoran Desert, a freshwater pond, and a tropical rain forest. Ask: Which of these habitats have you seen before in your Student Reader? (*Allow students to quickly look through the Student Reader, where they will find all except the coastal tide pool.*)

Online Resources

Show students online images or videos to introduce them to the Pacific Ocean coastal tide pool habitat. (See the Online Resources for links to suggested images and videos.)

- Ask: How would you describe this habitat? (*It is rocky and very close to the ocean, where waves and tides can cover the rocks.*)
- Make sure students understand that ocean water moves up onto the shore and away from the shore. This motion means that the rocks are covered or uncovered several times a day. Tide pool organisms live in depressions in the rocks where the water is held, even when the tide is low.
- What are some adaptations you noticed? (*Answers will vary with the images and videos used but may include gills for breathing underwater and hard shells for protection from waves and predators.*)

Use this link to download the CKSci Online Resources Guide for this unit, where specific links to these resources may be found:

www.coreknowledge.org/cksci-online-resources

2. Facilitate student research.

30 MIN

Activity Pages

AP 6.1–6.15

AP 6.16

Distribute and review the Organism Fact Sheets (AP 6.1–6.15). Tell students that each student or pair received a different species to focus on. Explain that many of the science vocabulary terms they learned so far in this unit are in the left column. Go over each term with the class to make sure students understand the meanings. Then allow students time to read their assigned fact sheets.

- Next, distribute and review Getting to Know You (AP 6.16). Explain how scientists often begin their investigations by finding out what other scientists have already discovered. Tell students that they will act as scientists who are doing this kind of research. The research will consist of reading their fact sheet to see what they can learn about adaptations.

SUPPORT—Tell students that some of the questions will be about cause-and-effect relationships. Explain that "what happens if" and "how does it relate" types of questions are describing causes and effects. (See **Know the Standards**.)

- Give students time to answer the questions on Getting to Know You (AP 6.16). Circulate among them to troubleshoot roadblocks and field questions.

1. Day 2: Refocus student attention on the Big Question. 5 MIN

What are some examples of successful adaptations of organisms to their habitats? Remind students that in the previous session, they were each assigned a species to focus on.

- Tell students that in today's session, they will present their research findings and the answers to the questions about their species in a form of panel discussion.
- Describe how scientists attending a conference are issued name tags that have information about their expertise. Distribute blank name tags, and have each student write their name and the species they are expert in. Students should wear their name tags today and tomorrow as they role-play conference experts at panel discussions.

2. Model expert panel sessions. 40 MIN

Activity Page

AP 6.17

- Distribute and review Survival Conference (AP 6.17). Explain that students will continue in their roles as scientists. This time, they will be attending a conference where they will have a panel discussion. Tell students that a panel discussion is where several experts sit at a table facing the audience to describe their research and answer questions.
- Arrange chairs and a table, if available, facing the rest of the class. This is for the students with fact sheets related to the Arctic tundra: Snowy Owl Fact Sheet, Caribou Fact Sheet, and Reindeer Lichen Fact Sheet (AP 6.1–6.3). Invite students with these fact sheets to come sit on the panel.
- Preview the Habitat Panel directions of Survival Confrence (AP 6.17) with the class. Make sure students know what is meant by making a claim and using evidence to support the claim.

Know the Standards

Cause and Effect: In Lessons 1–5, cause-and-effect relationships were introduced by linking adaptations of organisms to their survival in a particular habitat. This Crosscutting Concept will become even more important as you teach Lessons 7–13. In that section of this unit, students will describe the effects of specific environmental changes on organisms living there. Students will need to distinguish among a spectrum of effects, ranging from surviving well to not surviving at all. Cause and effect is an essential concept for students learning to develop hypotheses. Confirming or disproving a hypothesis is the goal of scientific experiments. Structuring hypotheses as if/then statements is an effective way to guide students in developing cause-and-effect thinking.

- Next, have students preview the Self-Evaluation Checklist on page 2. Explain that they will complete this checklist at the end of the lesson. The purpose of looking at it now is to keep in mind what is expected of them as they do the activity.
- Allow each student on the expert panel to speak briefly, following the directions on the Activity Page.
- Invite the audience to ask questions for more information or to clarify. Encourage students to speak formally and respectfully. Focus their questions and answers on traits, adaptations, claims, and supporting evidence.
- Once the Arctic tundra panel is completed, repeat the process for each of the other four habitats.

1. Day 3: Refocus student attention on the Big Question. 5 MIN

What are some examples of successful adaptations of organisms to their habitats? Remind students that in the previous session, they participated in a panel discussion. Tell them that today they will focus on social animal panel sessions to continue discussing the various species.

2. Model social animal panel sessions. 30 MIN

Activity Page

AP 6.17

- Have students put their conference name tags back on. Make sure they have Survival Conference (AP 6.17).
- Read the directions under Social Animals Panel with the class. Have students look at their Fact Sheets and determine if their species is a social animal. Explain that social animals form groups for purposes other than to mate. Being part of a social group is a behavioral adaptation that helps an organism survive in its habitat.
- Have the experts in social animals come forward to sit on the panel. Allow each student to give a brief talk about their animal, covering the four questions on Activity Page 6.17.

All students should answer the questions on their Activity Page about one social animal species.

3. Support student self-evaluation. 5 MIN

Once the conference is over, have each student complete the self-evaluation checklist. Explain that you will also use the checklist to evaluate students' work.

4. Check for understanding. 5 MIN

Activity Pages

AP 6.16
AP 6.17
Answer Key

Summative Assessment Opportunity

See the Activity Pages Answer Key (AP 6.16 and 6.17) for correct answers and sample student responses.

- Collect the completed Getting to Know You (AP 6.16). Look at students' answers to the questions for understanding of adaptations, including being part of a group.
- Collect Survival Conference Activity (AP 6.17) and review students' answers. Make sure students understood what claims and evidence are and were able to evaluate the strength of evidence. Also look for understanding of a cause-and-effect relationship between social behavior and survival of social animals.
- Complete the evaluation checklist for each student, and calculate the total scores.

PART B

Ecosystems and Environmental Change

Overview

Lesson	Big Question	Advance Preparation
7. Beaver Dam Case Study (2 days)	How do habitats change?	Make provisions for internet access and display for whole-class video experience. Prepare for library or internet access for student research.
8. Nature and Changing Ecosystems	How do natural changes to an environment affect the organisms that live there?	Read Student Reader, Chapter 4. Make provisions for internet access and display for whole-class video experience.
9. Humans Cause Ecosystem Change	How do people change environments in ways that affect the organisms that live there?	Read Student Reader, Chapter 5.
10. Living Things Respond to Change	How do living things survive changes in their habitats?	Read Student Reader, Chapter 6. Gather materials for a teacher demo. (See Materials and Equipment page 12.)
11. Ecosystem Problems and Solutions (2 days)	What are some solutions to problems in habitats and ecosystems?	Read Student Reader, Chapter 7.
12. Local Environmental Project (2 days)	How is my community helping solve problems of habitat change?	Prepare for at-home student research with help from family members.

Part B: What's the Story?

Changes to the environment and its ecosystems and habitats occur frequently. Some changes occur as the result of natural events that cause sudden changes, such as an earthquake or forest fire. Other natural changes occur over long periods of time, such as the effects of a drought. Some environmental changes occur as the result of human activity. Building roads, buildings, gardens, and parks and draining farm fields are examples of human activities that change the environment and affect the organisms that live in it. People propose solutions to problems created by environmental changes that meet the criteria for restoring or lessening the effects of changes.

In Lesson 7, students research a beaver dam as an example of a natural environmental change. This builds on understanding about habitats and adaptations in Part A of this unit. After watching a video, students research and learn about how different types of organisms are affected by beaver activity and recognize the advantages and disadvantages of the interrelationships that occur in an ecosystem.

In Lesson 8, students read to learn about natural events, including extreme weather, fire, and earthquakes, and how organisms respond, move, or die as a result. They explore the problems of overpopulation of a species if the ecosystem balance of predators and prey is disrupted.

In Lesson 9, students build on their understanding of changes to ecosystems by reading about changes caused by humans. These include building roads and bridges, as well as effects of climate change caused by human activity.

In Lesson 10, students read about how changes to ecosystems cause organisms to respond in specific ways to survive.

In Lesson 11, students shift focus to identifying problems caused by ecosystem changes and developing solutions to those problems. They consider the criteria for a good solution and the constraints that limit the types of solutions that are practical.

In Lesson 12, students apply what they have learned about changes to ecosystems to finding solutions to problems in their local environments. Students work with a family member at home to identify a conservation project that is addressing a problem. They then present their findings to the class, which chooses one of the projects to contribute to.

So, to repeat, **changes to environments and the different ecosystems and habitats in them occur constantly**. They are caused by natural events and by humans. The key concept for students to grasp is that when environments change, the organisms in the environment must respond, move, or die. People can develop solutions to mitigate the effect of changes to the environment.

LESSON 7

Beaver Dam Case Study

Big Question: How do habitats change?

At a Glance

Learning Objective

✓ Cite examples of natural changes in an ecosystem over time.

Lesson Activities (2 days)

- observation
- gathering information
- presenting information
- class discussion

NGSS References

Performance Expectation 3-LS4-4: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

Disciplinary Core Idea: LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Disciplinary Core Idea: LS4.C: Adaptation

Crosscutting Concepts: Systems and System Models; Cause and Effect

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is important to this lesson because students will identify ways that a beaver dam can change an ecosystem. Then they will explain how living things are helped or harmed by beaver dams, using evidence from research.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. No new Core Vocabulary terms are introduced in this lesson.

advantage
disadvantage
ecosystem
ecosystem change
environment
habitat

Instructional Resources

Activity Pages

AP 7.1
AP 7.2

Activity Pages
The Effects of Beaver Dams on Living Things (AP 7.1)

How Do Beavers Change the Environment? (AP 7.2)

Make sufficient copies for your students prior to conducting the lesson. Read the instructional steps on the Activity Pages in advance to prepare to facilitate the gathering of information.

Materials and Equipment

Collect or prepare the following items:

- internet access and the means to project video for whole-class viewing
- library or internet resources for gathering information.

You may wish to gather research materials ahead of time or direct students to specific websites to find out about their assigned organism.

The Core Lesson TWO DAYS, 45 MIN EACH

1. Day 1: Focus student attention on the Big Question. 10 MIN

Online Resources

How do habitats change? Open this lesson with a brief video that shows a beaver building a dam. This will build background knowledge about what a beaver dam is and allow students to observe how it is built. It will also allow students to consider the effects of a beaver dam on a river environment and the living things in it. (See the Online Resources for a link to a suggested video.)

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

After students observe the beaver in the video, use the following questions to prompt discussion:

- Where does the beaver build the dam? (*in the middle of a pond or stream*)
- How does the dam change the water flow? (*It changes the water level, its direction, and the speed at which it flows.*)
- Why might the beaver build the dam in the place where it does? (*because it gives beavers protection from predators, and they move better in water than on land*)

ADDRESS MISCONCEPTIONS—Students may think that beavers build dams to catch fish for food. Beavers, however, are herbivores and eat twigs and roots. Pause the video so students can examine the body features of the beaver. Let them observe how the teeth are specialized to bite through wood. Point out the webbed feet and wide, paddle-shaped tail that help beavers swim well in water.

Have students keep the video in mind as they go through the remainder of the lesson.

2. Support student research. 35 MIN

Activity Page

AP 7.1

- Assign each pair of students an organism living in a beaver pond ecosystem to research. Consider insects, birds, fish, deer, and predators of beavers, such as coyotes, hawks, wolves, and bears. Be sure to assign the same organism to two pairs of students so that students will be able to share and compare the information they gather before presenting their findings to the class.

  SUPPORT—Prompt students to do research to find out where beavers live in North America, as well as around the world. This type of background information can help with their research on organisms that live in beaver ponds.

- Distribute and review The Effects of Beaver Dams on Living Things (AP 7.1). Have students complete the Activity Page as they research the needs of their assigned plant or animal. Tell students that they will be presenting their information to the class in the next session.
- As students conduct their research, circulate among them, asking about the evidence that the organism is affected by the building of a beaver dam. (See **Know the Standards**.)

Know the Standards

What evidence would show that some organisms can survive well, less well, or not at all when there is a change in a habitat? The emphasis of the standard is on the relationships among organisms and the environment that allow living things to find shelter and enough food to survive. Evidence would involve what the needs of the organism are and how those needs are affected by the building of a beaver dam in a habitat. This argument should involve how organisms and the habitat make up a system in which the parts depend on each other. A change in the habitat can be the cause of any number of effects.

SUPPORT—Suggested organisms for research: birch and aspen trees; fish such as trout or salmon; plants such as water lilies or pondweed, predators such as coyotes, hawks, or bears, as well as frogs, deer, otter, raccoon, ducks, muskrats, or different birds.

1. Day 2: Refocus student attention on the Big Question. 5 MIN

How do habitats change? Review the beaver dam video from the previous session, and discuss how the beaver dam can change a habitat for beavers and other organisms, including different plants and animals. Have students cite examples of the changes caused by beaver dams over time.

2. Share and compare. 5 MIN

Activity Page

AP 7.1

Have students take out Activity Page 7.1, which they started in the previous session. Have each set of partners who conducted research on the same organism share and compare their information with one another. This will help fill in any gaps of information that students were unable to find and help students look for patterns in their research.

3. Facilitate student presentations. 10 MIN

- Make two columns on the board or chart paper labeled "Advantages" and "Disadvantages." Have students recall that advantages are benefits, or things that are helpful. A disadvantage is harmful and something that presents a challenge.
- Have each group of students present the information that they have researched about their organism using their Activity Page. After each group makes its brief presentation, ask the class to vote on whether they think a beaver dam provides mostly advantages (thumbs up) or mostly disadvantages (thumbs down) to each organism. Record the names of the organisms on the chart.

4. Lead a discussion. 5 MIN

Lead a discussion about the organisms recorded on the board or chart paper. Explain that some types of changes to the environment can have mostly positive effects and some have mostly negative effects. Ask students to discuss the following questions in each group:

- Do you think that beaver dams provide more advantages or disadvantages to other organisms in the ecosystem?
- Have you ever seen a dam made by people? How do you think a dam built by people might have the same or different effects on the ecosystem?

5. Support student arguments using evidence. 15 MIN

Activity Page

AP 7.2

Distribute and review How Do Beavers Change the Environment? (AP 7.2). Be sure to emphasize that students should write evidence to support their answers. The evidence can be from their own research, from the presentations, or from the chart that you completed together on the board or chart paper.

6. Check for understanding. 5 MIN

Activity Pages

AP 7.1
AP 7.2
Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 7.1 and 7.2) for correct answers and sample student responses. Collect the completed How Do Beavers Change the Environment? (AP 7.2). Scan the answers students wrote to see if they provided evidence for their answers. Determine if students understand how habitats can change. Evaluate if students are able to cite examples of natural changes in an ecosystem over time.

LESSON 8

Nature and Changing Ecosystems

Big Question: How do natural changes to an environment affect the organisms that live there?

At a Glance

Learning Objective

✓ Cite examples of natural changes in an ecosystem over time.

Lesson Activities

- reading and discussion
- vocabulary instruction

NGSS References

Disciplinary Core Idea LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Disciplinary Core Idea LS4.C: Adaptation

Crosscutting Concepts: Systems and System Models; Cause and Effect

Science and Engineering Practices: Engaging in Argument from Evidence

Cause and Effect is important to this lesson because students will be identifying examples of natural changes that occur in ecosystems, as well as the effects that those changes have on the environment and organisms that live there. Students will begin to explore the concept that ecosystems do not stay the same over time. Lessons 1–6 set the stage for students to understand that organisms sometimes have to adapt to the changes that occur around them to survive. Part B of this unit, Lessons 7–12, extends this concept further as students explore the types of ways ecosystems can change and why those changes occur.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

disrupt	interact	native
ecosystem	**invasive species**	overpopulation

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in green above.

Instructional Resources

Student Reader

Ch. 4

Student Reader, Chapter 4
"Nature and Changing Ecosystems"

Activity Page

AP 8.1

Activity Page
Coral Reefs (AP 8.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- index cards for student vocabulary deck (2 per student)
- internet access and the means to project video for whole-class viewing

The Core Lesson 45 MIN

1. Focus student attention on the Big Question. 10 MIN

Activity Page

AP 8.1

How do natural changes to an environment affect the organisms that live there? In the previous lesson, students discussed the ways that ecosystems can change by studying a beaver dam. Tell students that today, they will focus on studying the ways in which ecosystems change due to other natural causes.

- Distribute and review Coral Reefs (AP 8.1). Tell students that they will watch a video about coral reefs and then answer the questions on the page.
- Show the class a video about coral reefs. (See the Online Resources for a link to a suggested video.) After watching, allow students time to work independently on their answers to the questions on the Activity Page.

Online Resources

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

- After students have completed the Activity Pages independently, have them discuss the answers with a partner. As they discuss, circulate around the room, and correct any misunderstandings.

  CHALLENGE—Encourage students to think about a chain of effects caused by changes to coral reefs by using the following prompt (see **Know the Standards** for support):

  - What kind of impact could changes to coral reefs have on people? (*Sample answer: If animals in the ocean die from changes to coral reefs, people cannot consume those animals, and then people have fewer types of food to eat.*)

2. Read and discuss: "Nature and Changing Ecosystems." 20 MIN

Student Reader

Ch. 4

Read together or have students read independently "Nature and Changing Ecosystems," Chapter 4 in the Student Reader. This chapter reviews the natural reasons that ecosystems change, including natural hazards, invasive species, and overpopulation.

Preview Core Vocabulary

Before students read, write these terms on the board or chart paper. Encourage them to use the terms frequently as they discuss what they read.

ecosystem **invasive species**

Know the Standards

Does the death and disappearance of coral reefs in the oceans have a larger, more global impact on the planet? ***Yes!*** The death and disappearance of coral reefs in the oceans has a large-scale impact around the planet. Many organisms depend on coral reefs for shelter, food, and other necessities as part of their natural habitat. Without coral reefs, such organisms are forced to relocate or are unable to find the things they need within their habitats to survive. Eventually, this turns into a snowball effect that creates larger impacts.

The NGSS emphasize that at this level, students should focus on single environmental changes, rather than introducing larger global causes or impacts such as the greenhouse effect and climate change. These single environmental changes can include changes to land characteristics, water distribution, temperature, food availability, and the effects of other organisms.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts for each Student Reader page:

Focus on developing student understanding of the term *ecosystem*. In Part A of this unit, students learned about the term *habitat*. Explain to students that as in the beaver dam, a habitat is a natural home for an organism. An ecosystem is more than just a habitat. It is all the interactions among animals, plants, and the environment that allow organisms to find enough food and shelter to survive. Many habitats can be found within an ecosystem.

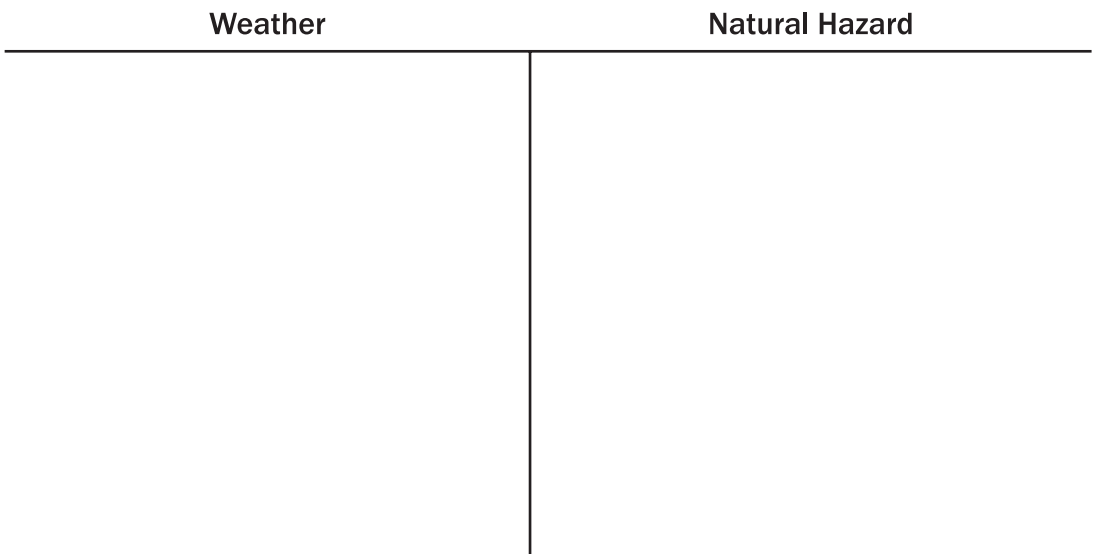
Page 19

Have students look at the image and caption on the page, and then have students answer the question: What might happen to the bird if a change killed all the trees in the forest? (*The bird would need to move and find a new place to live and get its food.*)

> **SUPPORT**—If necessary, help students understand the time scale of "fast" and "slow" as mentioned on the page. Explain that over the course of Earth's history, changes can happen quickly, such as in a matter of minutes, due to a fire or flood, but they can also happen slowly, such as over thousands of years. Tell students that they will learn more about the ways that ecosystems change suddenly on the next page.

Pages 20–21

After reading page 20, check for understanding of hurricanes, earthquakes, and tornadoes, as not all students will be familiar with these events. Ask students to tell why these natural hazards are examples of sudden changes and give an example. (*Sample answer: A flood can wash away parts of the land in a matter of seconds or minutes.*) Use sensitivity when discussing natural hazards, as students may have experienced natural hazards firsthand, which could be traumatizing. These events become a hazard when they are outside the normal range of conditions.



- Draw student attention to the photo and caption on page 20. Call on several volunteers to name one thing that might happen to the beach pictured during a hurricane. (*The beach could flood, the palm trees could be blown down, and the rain could wash away plants or animals*.)

  SUPPORT—If necessary, explain that not all weather is a natural hazard. Help students understand the difference between weather and a natural hazard. Draw a T-chart on the front board or chart paper. Label the left column "Weather." Label the right column "Natural Hazard."

- Have students name the natural hazards identified on the page. Then ask students which column the following should be placed in, making sure students understand the meaning of *drought* and *tsunami*: rain (*weather*), lightning (*weather*), drought (*natural hazard*), tsunami (*natural hazard*), wind (*weather*), snow (*weather*).
- Ask students to study the list on the board or chart paper and explain the difference between a natural event and a natural hazard. (*A natural event is something that occurs, but a natural hazard is something that causes larger changes*.) Ask if a natural event, such as rain, can turn into a natural hazard. (*yes*)

  CHALLENGE—Have students give an example of regular weather that turns into a natural hazard. (*Sample answer: a rainstorm that causes a flood; lightning that causes a fire; snow that turns into a blizzard*)

- After reading page 21, have students recall the meaning of *adaptations*. Ask students whether they think physical or behavioral adaptations, or both, would be able to help organisms survive after a sudden change to their ecosystem. Use the photo of the remains of the forest fire on the page to have students tell how plants and animals could use adaptations to survive those new conditions.

Pages 22–23

After reading page 22, ask students to think about the term *invasive species*. Break the term into two words: *invasive* and *species*. Have students tell what it means when something or someone is invasive. Explain that plants and animals can invade new places and cause a lot of problems for the organisms that already live there. Tell students that although it might seem natural for a species to invade a new habitat, the majority of invasive species are introduced to new habitats by humans.

SUPPORT—If necessary, have students come up with a list of reasons why invasive species cause negative changes to ecosystems. (*They have no predators; they use up resources; they kill native organisms; they take up space*.) Record the list on the board or chart paper for students to see. Emphasize the importance of competing for resources. Explain that resources, such as water and food, are often limited and scarce. When organisms have more competition for the same resources, they may not be able to get what they need to grow and survive.

- After reading page 23, remind students that they just watched a video about coral reefs. Encourage them to think about their responses on Coral Reefs (AP 8.1) and their discussion with their partner based on what they are reading now about the parrotfish and the lionfish.

- Refer students to the photo of the lionfish and its caption. Ask students to explain why the number of lionfish is growing quickly. (*Lionfish do not have any natural predators in their new habitat, so they are not being eaten.*)

  CHALLENGE—If time permits, have students research the natural ways in which invasive species are introduced to new areas. Students may come across human activities that introduce invasive species during their research, but have them focus on the natural causes.

Page 24

After reading the page, remind students that they just read about lionfish and how they do not have any natural predators in the area they are invading, so the number of lionfish is growing. Relate this to the concept of overpopulation.

- Focus on the concept of a red tide. Address any misconceptions, such as that an increase in the number of organisms is a positive thing. Explain that sometimes, too much of something has negative consequences. In the example on the page, the overpopulation of algae is harmful because they cause certain fish to die, which leads to a chain reaction in the ecosystem.

  SUPPORT—As a class, encourage students to think about other examples in which overpopulation is harmful and needs to be controlled by giving them prompts, such as the following:

  » There are many types of bugs that like to eat flowers. If there is a sudden increase in bugs that feed on flowers, what happens to the flowers? (*The flowers will die.*) Now imagine that there are hummingbirds that drink the nectar from the flowers. What would happen to the hummingbirds? (*They would have to find food somewhere else.*)

  CHALLENGE—Focus students on identifying cause-and-effect relationships by using the following sentence: "An overpopulation of organisms in an ecosystem makes it difficult for other organisms to have the resources they need to survive." Then discuss which is the cause and which is the effect. (*The cause is overpopulation of organisms. The effect is that the available food and water decreases until there is not enough for every organism.*)

3. Demonstrate more examples. 5 MIN

Remind students that they read about and discussed different ways in which natural changes can harm ecosystems. They also learned that organisms can either survive well, less well, or not at all when ecosystems change.

Online Resources

- Tell students that they will watch a short video about raccoons. (See the Online Resources for a link to a suggested video.)

  www.coreknowledge.org/cksci-online-resources

- Then, they will participate in a whole-class discussion. (See **Know the Science** for support with the analysis.)
- When the video is over, tell students the following scenario: One year there is a very long drought, and a farmer's crops were not able to grow because they did not get enough water. But a family of raccoons had been feasting on those crops for years. That year, the family of raccoons had to move to another part of the land and look for other sources of food.
- Call on a volunteer to identify the natural change to the ecosystem. (*drought*)
- Call on a second volunteer to tell the effect that this change had on the ecosystem. (*caused raccoons to move and look elsewhere for food*)
- Ask the class if the raccoon seems like an organism that can survive well, less well, or not at all when ecosystems change and one food source is taken away from them. (*Students should be able to tell from the video that raccoons are adaptable when it comes to their food, so they can survive well during natural changes.*)
- Discuss other plants and animals that would survive less well than the raccoon and some that might not survive at all. Prompt students to provide evidence for their statements.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

Know the Science

What determines how well an organism survives the natural changes to an ecosystem?
Adaptability. When organisms are well adapted to the natural changes in their ecosystems, they have a better chance of survival. Organisms that are less well adapted may need to move, or else they may not be able to survive well or reproduce at all in their current environment. Some organisms monitor and react to change more quickly than others. Organisms survive well in environments that fully meet their needs. If an environment partially meets the needs of an organism, the organism may experience a lower survival rate and shorter lifespan. Many organisms are unable to move to new locations. Entire populations may die.

Keep in mind that organisms have traits inherited from their parents that are called adaptations. For example, a butterfly has wings that are an adaptation for flight. This is a separate concept from the idea of running to get out of the rain, which is adapting to a situation. This confusion *must* be resolved in classroom vocabulary discussions.

4. Teach Core Vocabulary. 5 MIN

Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board or chart paper earlier in the lesson). Ask students to write each term in the upper left corner of an index card and underline it (one term per card):

ecosystem **invasive species**

Word Work

- **ecosystem:** (n. all the living and nonliving things in a place and their interactions) Have students add to their Core Vocabulary card a short sentence using the words *ecosystem* and *interact*. (*Living things interact with each other in an ecosystem.*)
- **invasive species:** (n. an organism that causes harm in a place where it does not normally live) Instruct students to describe in their own words why invasive species are harmful. (*because they take resources from native species*)

5. Check for understanding. 5 MIN

Activity Page

AP 8.1 and Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 8.1) for correct answers and sample student responses. Collect the completed Coral Reefs (AP 8.1). Scan students' responses. Look for accuracy and completeness.

- Students should explain that coral reefs are important ecosystems because they are home to many different species and organisms.
- Students should explain that some organisms depend on coral reefs for shelter or a safe habitat.
- Students should be able to explain that if coral reefs change or die, this would have a negative impact on other sea organisms because the organisms that live there and depend on the coral reefs would have to move, find new sources of food, find new shelter, etc.

LESSON 9

Humans Cause Ecosystem Change

Big Question: How do people change environments in ways that affect the organisms that live there?

At a Glance

Learning Objective

✓ Cite examples of human-induced changes in an ecosystem over time.

Lesson Activities

- reading
- observation
- discussion and writing
- vocabulary instruction

NGSS References

Disciplinary Core Idea LS2.D: Biodiversity and Humans

Disciplinary Core Idea LS4.C: Adaptation

Crosscutting Concepts: Systems and System Models; Cause and Effect

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is important to this lesson because students will use evidence to explain how environments can be disrupted by human actions.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to these terms, which are not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

climate construction disrupt **migrate**

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary terms designated in green on the previous page.

Instructional Resources

Student Reader

Ch. 5

Activity Page

AP 9.1

Student Reader, Chapter 5
"Humans Cause Ecosystem Change"

Activity Page
Surviving Change in the Environment (AP 9.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- index cards for student vocabulary deck (2 per student)

The Core Lesson 45 min

1. Focus student attention on the Big Question. 5 min

How do people change environments in ways that affect the organisms that live there? Review what students learned in Lessons 7 and 8 about how natural events, such as beaver dams and natural hazards, can change an environment and affect the living things that are in the habitat.

Discuss student experiences of humans changing an environment. Use the following questions to prompt discussion:

» What ways have you seen that humans have changed an environment? (*building houses, planting a garden, widening a road*)

» What are some things that can cause environments to change? (*too much or too little water, fires, trees being cut down, beaver dams, insect invasion*)

» Which of those changes were caused by people? (*cutting down trees, using water, buildings*)

SUPPORT—Have students consider big changes humans make, such as building a shopping center, a new school, or a new road, as well as smaller changes, such as mowing the lawn, planting a garden, using insecticides, and smashing an ant hill. Emphasize that some people may or may not like the changes. The point is that humans have an effect on the environment.

2. Read and discuss: "Humans Cause Ecosystem Change." 20 MIN

Student Reader

Ch. 5

Read together or have students read independently "Humans Cause Ecosystem Change," Chapter 5 in the Student Reader. The selection gives examples of ways that humans cause ecosystems to change and ways that organisms are affected by these changes.

Preview Core Vocabulary

Prepare students to approach the reading by drawing their attention to terms they will use as they explore ways that animals use to survive when their environment changes. Before students read, write these terms on the board or chart paper. Encourage students to pay special attention to these terms as they read.

climate **migrate**

Have students write just the terms in the upper left corner of new Core Vocabulary cards. They will revisit the cards later in the lesson to add notes about what the words mean.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 25

After students have read the page, ask them to name a change that happens quickly, such as the one shown, and a change that happens slowly in an environment. Ask the following:

» What type of change do you think organisms are better able to survive, and why? (*a change that happens slowly, since they have more time to adapt to the change*)

Pages 26–27

After reading pages 26–27, ask students to brainstorm with a partner to describe a solution that could help keep animals from being injured as they cross busy roads. (*Students may suggest using signs, lowering speed limits, or putting a fence beside the road or a path under or over it.*)

Page 28

Tell students to look at the dam on page 28. Ask the following:

» How can building a dam change the organisms that live in the environment? (*They may have less water to live in, drink, or find food in.*)

» Why do people build dams on rivers even though that can harm the organisms that live in the rivers? (*because people need fresh water to drink*)

Pages 29–30

Discuss how students need water for their daily activities.

- Ask students to guess how much water they use in a day. Tell them that the average household in the United States uses eighty to one hundred gallons per day. Discuss how their use of water changes the environment. (*Reservoirs and wells are built to bring water into homes; pipes are laid to bring water and take water away.*)

- Discuss how changes in the climate caused by human activities can change the environment. Ask: What effect does climate change have on organisms such as polar bears and seals in the Arctic? (*Animals that depend on very cold temperatures may have to move if their climate becomes too warm for them to survive.*)

3. Lead a discussion. 10 MIN

Activity Page

AP 9.1

- Distribute and review Surviving Change in the Environment (AP 9.1). Explain to students that they will complete the Activity Page based on what they have learned in this lesson. Go over the directions with students. Students can work in pairs to complete the table.

  SUPPORT—If needed, help students by providing an answer bank with choices for each environment from the answer key.

- Lead a discussion of student responses and their reasoning about how well organisms can survive when human activity changes an environment.
- Encourage students to construct an argument with evidence of why some organisms can survive well, others not so well, and others not at all in the face of each of the human-caused environmental changes. (See **Know the Science** for support with the discussion.)

4. Teach Core Vocabulary. 5 MIN

Word Work

Have students take out their Core Vocabulary cards for **migrate** and **climate**. Review lesson concepts by discussing the following questions:

- **migrate:** (v. to move from one place to another in different seasons) Make a class list of animals that migrate, such as birds and butterflies flying south or north in different seasons and fish such as salmon that swim to breeding grounds.
- Discuss how migration patterns can be disrupted if humans cause changes to habitats. (*Pollution of air and water, human-caused fires, and trash may make migration difficult.*)

Know the Science

What are effects of human-caused changes to an environment? *Disruption of relationships.* When an environment changes, the interrelationships among organisms and the environment are disrupted. Not all organisms can move to a different place. If a pond dries up, the plants and animals that live in the water may die. The organisms that depend on those living things for food will have to move to find the food they need to survive. A whole new ecosystem of interrelationships will emerge as, for example, grass replaces the pondweed and other living things move into the ecosystem. A change in an environment can be a catalyst for a completely different set of interrelationships that can affect all organisms in a food chain or food web.

- **climate:** (n. the pattern of weather over a long period of time) Discuss how climate change could disrupt migration patterns. (*If some climates become too hot or too cold, the animals that migrate to them may have to travel farther to survive.*)
- Ask students to add examples of migration and different climates to their Core Vocabulary cards.

5. Check for understanding. 5 MIN

Activity Page

AP 9.1 and Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 9.1) for correct answers and sample student responses.

- Collect the completed Surviving Change in the Environment (AP 9.1). Scan the tables to see that they are complete.
- Evaluate student understanding that people can change environments and affect the organisms that live there.

LESSON 10

Living Things Respond to Change

Big Question: How do living things survive changes in their habitats?

At a Glance

Learning Objectives

- ✓ Describe specific evidence that shows what a habitat and a specific organism in that habitat were like before and after a significant change.
- ✓ Explain with examples how some adaptations that were once helpful can be less helpful if an ecosystem changes.

Lesson Activities

- reading and discussion
- vocabulary instruction
- diagram activity

NGSS References

Disciplinary Core Idea LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Disciplinary Core Idea LS4.C: Adaptation

Disciplinary Core Idea LS4.D: Biodiversity and Humans

Crosscutting Concepts: Cause and Effect; Systems and System Models

Science and Engineering Practices: Engaging in Argument from Evidence

Cause and Effect is important to this lesson because students will be reading about how changes to ecosystems cause organisms to adapt in specific ways in order to survive. Completing cause-and-effect diagrams allows students to identify why changes are occurring within habitats and the ways in which organisms are responding to those changes. The lesson begins with watching a short video on changes to an ecosystem. Then students read about specific habitats and how organisms respond to the changes within those environments.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. No new Core Vocabulary terms are introduced in this lesson.

respond

Instructional Resources

Student Reader

Ch. 6

Activity Page

AP 10.1

Student Reader, Chapter 6
"Living Things Respond to Change"

Activity Page
Cause-and-Effect Diagram (AP 10.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- plastic plant
- clear glass
- water
- internet access and the means to project video for whole-class viewing

The Core Lesson 45 min

1. Focus student attention on the Big Question. 5 min

How do living things survive changes in their habitats? In Lessons 8 and 9, students learned that ecosystems change for natural reasons, as well as for reasons that are caused by human activities. Take a moment to review with students examples of the ways in which nature and humans affect ecosystems:

» What are some natural hazards that can cause ecosystems to change? (*earthquake, tornado, hurricane, fire, flood*)

» What are some other natural ways that ecosystems change? (*overpopulation, invasive species*)

» What are some human activities that can change ecosystems? (*pollution, overfishing, overhunting, deforestation, agriculture, resource use/overpopulation*)

Explain that today, students will learn more about how specific organisms respond to changes in the environment, whether the changes are caused by nature or human activities.

Online Resources

Show the class a video about Antarctica. (See the Online Resources for a link to a suggested video.) After watching, use the following prompts to initiate a discussion about what students observed:

» Why is the rate of change the most pressing issue affecting the animals in Antarctica? (*Animals cannot adapt as quickly as the conditions are changing in their environment.*)

» How might the animals shown in the video need to adapt to the changes in Antarctica, such as melting sea ice and warmer weather? (*The animals may need to search in new places for food.*)

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

www.coreknowledge.org/cksci-online-resources

SUPPORT—If necessary, clarify any misunderstandings about adaptation. Students may think that adaptation is a phenomenon that occurs instantly or even quickly. However, this is not an accurate assumption. (See **Know the Science 1**.)

2. Read and discuss: "Living Things Respond to Change." 25 MIN

Student Reader

Ch. 6

Activity Page

AP 10.1

Read together or have students read independently "Living Things Respond to Change," Chapter 6 in the Student Reader. This chapter reviews how living things, such as polar bears and salmon, respond to the changes in their environments.

- Distribute and review Cause-and-Effect Diagram (AP 10.1). Tell students that they will be prompted to work on the diagram as they read pages 32–34 in the Student Reader.
- Review the instructions and the diagram together. This may be the first time that students are seeing a cause-and-effect diagram, so go over how the diagram works and what it is meant to show.
  - Students will write the causes in the left column boxes. Explain that the cause is the change in the ecosystem.
  - Students will write the effects in the right column boxes. Explain that the effect is the way in which the organism deals with (responds to) those changes.
  - Students only need to put one cause and one effect for each row. The top row will be for pages 32 and 33 (the example of the polar bear), and the bottom row will be for page 34 (the example of the salmon).

Know the Science

1. Can animals undergo changes in inherited traits quickly enough to respond to the changes in their environments? *Generally, no.* Traits do not spontaneously adapt to changes in organisms' environments. A polar bear's color doesn't change; a snake remains long and slender. When an environment changes dramatically enough, these individuals respond by changing behaviors or relocating. However, those organisms with certain adaptations will be able to survive and reproduce. And not all organisms are capable of moving to a new location.

SUPPORT—If necessary, explain to students that cause and effect is a type of relationship. Scientists study cause-and-effect relationships to better understand why certain things happen in nature. Knowing how cause-and-effect relationships work can also help scientists predict things that will happen in the future. Give students a simple and relatable example of a cause-and-effect relationship, such as not studying for a test. Ask: What happens if you do not study for a test? (*You will not get a good grade.*) Then ask: What is the cause in this example? (*not studying for the test*) What is the effect in this example? (*not getting a good grade*) Tell students that cause-and-effect relationships happen all the time in everyday life. If more practice is needed, use more examples to help students see the causes and effects in certain scenarios.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 31

Focus on developing student understanding of the term *respond*. Explain that this is a word students probably already know from everyday language. Use the term *respond* in a sentence to enhance understanding, such as, "How do you respond when someone is nice to you? How do you respond when someone asks you to do a favor? Does your dog respond to you when you call its name?" (*Sample answers: I smile when someone is nice. Sometimes I do the favor. My dog sits when I tell him to sit.*)

Draw student attention to the picture and caption on the page. Ask students to tell how the fox responds to the changes in its environment. (*It probably has to move to a new, more natural habitat.*)

SUPPORT—Make sure students understand the difference between responses and adaptations. Responding to changes in the environment and adapting to those changes are two different things. A response is normally a short-term behavior, whereas an adaptation is a longer-term phenomenon that evolves over generations. Organisms can often control responses, but adaptations occur via natural selection.

CHALLENGE—If time permits, challenge students to write a paragraph about various ways that the fox in the picture could respond when its environment is suddenly filled with more humans and the homes that they build. Then have them write another paragraph about the different ways that the fox may adapt to these changes in its environment over time. This activity will help students develop their understanding of response versus adaptation.

Pages 32–33

Ask students to compare the polar bear habitat before the warming climate to that afterward. Then ask volunteers to act out the polar bear's way of finding food in the two different environments. One student should act out standing on ice to grab a seal, and another should act out trying to jump into the water to grab a seal.

- Discuss what adaptations make polar bears survive well in a cold environment. (*lots of fat to keep warm*) Discuss how those adaptations make polar bears survive less well or not at all in a warming environment. (*They need more food and can't get enough without ice to stand on.*)
- Prompt students to fill out the first row of their cause-and-effect diagrams on Activity Page 10.1 based on the example of the polar bear. Explain to students that there are several ways that polar bears are responding to the changes in their environment but that students only have to write one example.

  SUPPORT—If necessary, work on the cause-and-effect diagram as a whole class. Invite students to call out the cause. (*warmer climate*) Then invite them to call out the ways that the polar bears are responding to the changes. (*swimming or walking a long way to find food; not eating during the warmer months; jumping into the ocean to catch seals*)

- Have students think about the video about Antarctica they watched in the beginning of class. Remind them that the narrator in the video said that organisms in Antarctica cannot adapt to the changes as quickly as the changes are happening. Ask: Do you think the polar bears are adapting to the melting sea ice as quickly as the changes are happening? (*no*) Why not? (*because some polar bears are not able to survive*)

  CHALLENGE—If time permits, challenge students to research the changes in the polar bears' environment over the last two or so decades. Have them focus on finding evidence that shows what the habitat and polar bears were like in the past and how they are now after the environmental changes. Examples for evidence include the size of sea ice and how much it has melted over the years, as well as the population of polar bears and whether the population has decreased over time in their habitat.

Page 34

After reading page 34, prompt students to fill out the bottom row of their cause-and-effect diagrams based on the example of the salmon.

SUPPORT—If necessary, work on the cause-and-effect diagram as a whole class. Invite students to call out the cause. (*warmer climate*) Then invite them to call out the way that the salmon are responding to the changes. (*changing the timing of their migration*)

» Ask: Why is it important for salmon to be in cold water? (*It is better for their bodies, growth, and reproduction.*)

» Ask: What do you think would happen if water temperatures in the rivers get warmer and warmer all year round? (*The salmon might not be able to survive.*)

CHALLENGE—If time permits, challenge students to research a species that became extinct because it was unable to adapt to the changes in its environment. As an extension to their research, have students write about the effects of the extinction on the ecosystem, such as whether it caused other animals to have to adapt to finding new food sources.

3. Demonstrate more examples. 10 MIN

Choose one or more of the following examples to stimulate further discussion. Analyze with students 1) the changes that occur in the example, 2) what causes the changes, and 3) the effects of those changes on the organisms (how the organisms respond to those changes). (See **Know the Science 2 and 3** for support with the analysis.)

- Place a plastic plant in a clear glass, and cover it entirely with water. Tell students to imagine that this is a real plant and its habitat was just flooded. Ask students what will happen to the plant.
  - » Do you think the plant will be able to adapt quickly enough to survive the changes to its habitat? (*The plant will die in just a few days if the water is not drained at all.*)
  - » Are there any ways for the plant to respond to the changes that might help it survive? (*The plant roots might adapt by drinking more water than usual.*)

Online Resources

- Show a video of overpopulation. (See the Online Resources for a link to a suggested video.)
  - » Is overpopulation the result of a natural or human-caused change to an ecosystem? (*It could be either.*)
  - » How does overpopulation negatively affect the ecosystem? (*When too many organisms need food to survive, the ecosystem may run out of natural supplies and die.*)
  - » How can other organisms respond when their habitats are taken over by a particular species? (*They can fight for available food, try to kill the harmful organisms, or move away.*)

Use this link to download the CKSci Online Resources Guide for this unit, where specific links to these resources may be found:

www.coreknowledge.org/cksci-online-resources

Know the Science

2. What is the plant in water demonstrating? *Change.* Habitats and ecosystems experience changes. Some organisms thrive during those changes, others struggle, and others do not survive at all. By showing students a model of a plant being flooded in its habitat, students can see that it is not easy for all organisms to respond quickly enough to survive certain types of changes. Plants, for instance, cannot relocate, change their diet, or find new shelter. They are vulnerable to the changes that occur in their environments. Animals, on the other hand, have more options when it comes to responding to environmental changes. But not all animals are able to respond in ways that are suitable to help them survive.

3. How does overpopulation change environments? *In many different ways!* When one type of organism overpopulates an area, it can cause problems for the other organisms that live there. Sometimes overpopulation results in resource competition in which the overpopulated species will use up too many of the same resources that other species need to survive. Overpopulation can also reduce the number of other species in the same area, such as if those species are eaten as food. Finally, overpopulation can crowd out other species, forcing them to relocate to new areas that they are not well suited for.

- Prompt students to link details in this analysis discussion back to the reading selection. (*Students' responses to the questions below will depend on the examples you select for them.*)
  - » Did you read about any examples that are similar to the changes occurring with the plant in the water? How are the examples similar?
  - » Did you read about any situations that are similar to that of the overpopulation of the organism? How are the situations similar?
- Discuss the changing environments that students have learned about. Prompt them to use evidence from the reading or videos to identify organisms that can survive well in the changing environment, organisms that survive less well, and some that cannot survive at all. Discuss organisms that might be able to survive in the changed environment that did not live there before.
  - ◦ Arctic
  - ◦ Antarctic
  - ◦ coral reef

4. Check for understanding. 5 MIN

Activity Page

AP 10.1 and Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 10.1) for correct answers and sample student responses.

Collect the completed Cause-and-Effect Diagram (AP 10.1). Scan students' responses. Look for accuracy and completeness. Students should correctly identify the causes for pages 32–34 and at least one of the effects, or ways in which the animal responded to the changes in the environment.

LESSON 11

Ecosystem Problems and Solutions

Big Question: What are some solutions to problems in habitats and ecosystems?

At a Glance

Learning Objective

✓ Debate the merits of solutions for reconstructing an ecosystem after a significant environmental change.

Lesson Activities (2 days)

- reading, discussion, writing
- vocabulary instruction

NGSS References

Performance Expectation 3-LS4-4: Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Disciplinary Core Idea LS2.D: Biodiversity and Humans

Crosscutting Concept: Interdependence of Engineering, Technology, and Science on Society and the Natural World

Science and Engineering Practices: Engaging in Argument from Evidence

Engaging in Argument from Evidence is important to this lesson because each student will make a claim about the merit of a solution to a problem caused when the environment changes and use evidence to support their claims. Previous lessons have focused on natural and human-caused changes to environments, which addresses Performance Expectation 3-LS4-3. This lesson extends that understanding to finding solutions to problems caused by environmental changes.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to this term, which is not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

conservation **conservationist** conserve restore

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary term designated in green above.

Instructional Resources

Student Reader

Ch. 7

Activity Pages

AP 11.1
AP 11.2

Student Reader, Chapter 7
"Ecosystem Problems and Solutions"

Activity Pages
Problems-and-Solutions Table (AP 11.1)

Thinking About What Makes Solutions Good (AP 11.2)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- index card for student vocabulary deck (1 per student)

The Core Lesson TWO DAYS, 45 MIN EACH

1. Day 1: Focus student attention on the Big Question. 10 MIN

Activity Page

AP 11.1

What are some solutions to problems in habitats and ecosystems? Ask students to recall from previous lessons human-made changes to habitats that have caused disruptions for the organisms that live there; for example, cutting down trees to build a new shopping center. List these changes on the board or chart paper. Explain that in this chapter, students will be reading about some possible solutions to these problems. (See **Know the Standards** for support.)

Distribute and review Problems-and-Solutions Table (AP 11.1). Explain that students will complete the table as they read "Ecosystem Problems and Solutions," Chapter 7 in the Student Reader.

Preview Core Vocabulary

Prepare students to approach the reading by drawing their attention to terms they will use as they explore ways that people try to fix problems in habitats and ecosystems. Before students read, write **conservationist** on the board or chart paper. Encourage students to pay special attention to the Core Vocabulary word as they read.

Have students write the term in the upper left corner of a new Core Vocabulary card. They will revisit the card to add notes during the reading.

2. Read and discuss: "Ecosystem Problems and Solutions." 30 MIN

Student Reader

Ch. 7

Read together or have students read independently "Ecosystem Problems and Solutions," Chapter 7 in the Student Reader. The selection presents several problems in ecosystems and some solutions that people have tried to help restore the habitats.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 35

Ask students to notice the meaning of the word *conservationists*. Have students record a description of a conservationist on their Core Vocabulary card. Ask the following:

- What kind of person can be a conservationist? (*anyone who wants to help plants and animals meet their needs for survival*)
- What traits are important for a conservationist to have? (*creativity to find solutions to problems*)

SUPPORT—Help students understand that effective solutions to problems that conservationists and engineers face involve establishing criteria to evaluate solutions and identifying constraints that limit the options for solutions. For example, the criteria for protecting the rhino would be to ensure they have access to environments that provide enough food and shelter, to control disease, and to protect them from predators, including

Know the Standards

The focus in this lesson is on setting criteria and constraints for a solution to an environmental problem and then evaluating whether the solution meets those criteria within the constraints. Examples of environmental changes can include changes in land characteristics, water distribution, temperature, food, and other organisms. Students will use evidence to evaluate how a change causes a problem for existing plants and animals, propose a solution to the problem, evaluate the effect of the solution, and identify the resulting changes after the solution has been implemented.

hunters. The constraints would include finding resources to protect areas where rhinos can be safe. Lots of solutions may be effective, but they are not practical given the resources, so criteria and constraints are critical to finding solutions to any problem.

Page 36

Check in with students to verify their comprehension of the word *restore*.

Remind students that migration is when animals move from one place to another during certain times of year. Have students note in the first row of the Activity Page the first problem presented: that salmon cannot migrate to lay eggs. Explain that students will come back to complete the solution after reading the chapter.

Page 37

Explain that a wetland is an area of land that is covered with shallow water most of the time. Wetlands are an important habitat where many organisms live.

Discuss the environmental problem that beaver dams help solve, that of drying wetlands.

- Ask students about their experiences in wetlands where they live or in their travels.
- Discuss how and why wetlands support so many different living things.
- Talk about why people want to drain wetlands when they build a housing development, create farmland, or build a shopping center.
- Prompt students to think about how difficult it can be to find solutions to problems caused by draining wetlands. (See **Know the Science**.)

Have students add the next problem to the Activity Page: Wetlands are drying up.

Pages 38–39

Ask students to reread the sentence with the word *conserve*. Have them write three words that mean the same thing, synonyms, on their final index card.

Now, have students add the next problem to the Activity Page: Animals cannot safely cross roads.

Page 40

Ask students to add the problem "sea turtle nests are being disturbed" in the last row of the table.

Ask the following:

- How does fewer sea turtle eggs hatching affect the ocean ecosystem? (*There will be fewer adult sea turtles to eat animals such as jellyfish, and there will be less food for animals like sharks.*)

Know the Science

How do conservationists design solutions to problems? *Conservationists follow the engineering design process.* To find the best solution for problems, conservationists follow the engineering design process to come up with a solution to fit the constraints and criteria to solve problems. For example, if the criteria are that they want to increase the amount of wetland area around a river, conservationists will measure the area, come up with a solution, and test the solution to see if the wetland area increases or if it continues to diminish.

3. Teach Core Vocabulary. 5 MIN

Word Work

- **conservationist:** (n. a person who works to protect plants, animals, habitats, and ecosystems) Read the definition of *conservationist* to students, and relate it to the meanings of *conserve* and *conservation*. Emphasize the problem-solving role of a conservationist. Ask the following:
  - » How can conservationists know which solution to use to solve a problem? (*They have to figure out what would be helpful to the organism or habitat they want to protect.*)
  - » How can conservationists know that the solution is making the problem better? (*They take measurements and observations and compare them.*)

Instruct students to complete the sentence frame: A conservationist might protect a habitat by (*Sample answer: cleaning up pollution*).

1. Day 2: Refocus student attention on the Big Question. 5 MIN

Activity Page

AP 11.1

What are some solutions to problems in habitats and ecosystems? Redistribute the partially completed Problems-and-Solutions Table (AP 11.1). Have students reread the problems on the table. Tell students that today, they will begin by writing solutions for each of the problems discussed in the chapter.

2. Develop solutions. 20 MIN

Model identifying criteria and constraints and proposing a solution for an environmental problem. For example, see the following table:

Problem	Criteria	Constraints	Solution
Animals will be disrupted when trees are cut down for a garden. They may start eating garden produce.	Animals must have access to food and shelter.	Money and resources are limited.	Relocate garden to a place where trees don't have to be cut down.

Have students work as partners to write a solution on the table for each of the problems recorded on the table. Point out that they may think of more than one solution for each problem but that they only need to record one.

SUPPORT—If students need help identifying criteria and constraints and finding the solutions for the problems, you can provide an answer bank or provide the page number where each solution can be found.

3. Make a claim and provide evidence. 15 MIN

Activity Page

AP 11.2

Distribute and review Thinking About What Makes Solutions Good (AP 11.2).

- Ask: Which of the problems on the table do you think is the most important one?
- Form student groups based on which problem they think is most important.
- Review the questions for the Activity Page with students. Explain that students will be evaluating one of the solutions using evidence from the reading. Point out that evidence can be from the photos or information from specific paragraphs on the pages in the chapter.

4. Check for understanding. 5 MIN

Activity Pages

AP 11.1

AP 11.2

Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 11.1 and 11.2) for correct answers and sample student responses. Provide additional guidance for students who need more support. Collect Activity Page 11.2, and check to see that students provided evidence to support the merits of the solution. Evaluate using the following criteria:

1. A problem caused by a change in an environment is identified.
2. Criteria for the solution and constraints are identified.
3. A proposed solution meets given criteria and constraints to reduce the impact of the problem.
4. Evidence is used to explain how the solution affects plants and animals.

LESSON 12

Local Environmental Project

Big Question: How is my community helping solve problems of habitat change?

At a Glance

Learning Objective

✓ Debate the merits of solutions for reconstructing an ecosystem after a significant environmental change.

Lesson Activities (2 days)

- take-home research activity
- student presentations

NGSS References

Disciplinary Core Idea LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Disciplinary Core Idea LS4.C: Adaptation

Disciplinary Core Idea LS4.D: Biodiversity and Humans

Crosscutting Concepts: Systems and System Models; Cause and Effect

Science and Engineering Practices: Engaging in Argument from Evidence

Cause and Effect is important to this lesson on local environmental projects because students have learned about the cause-and-effect relationships between humans and ecosystems in previous lessons. Now, they get to apply what they learned about those dynamics. In this two-day lesson, students begin by researching conservation efforts that are going on in their local communities to better understand how human-related activities have caused changes to habitats and the effects of those changes on the environment. The second day of this project will not continue on the next consecutive classroom day but will take place several days later, as students will need time to complete their research at home. Eventually, students will present their chosen projects to the class, and the class will evaluate each project and vote on the one that they wish to contribute to.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. No new Core Vocabulary terms are introduced in this lesson.

advantage
conservationist
conserve
disadvantage
disrupt
ecosystem
ecosystem change
environment
habitat
restore

Instructional Resources

Activity Pages

AP 12.1
AP 12.2

Activity Pages
Local Conservation Project (AP 12.1)

Take-Home Letter (AP 12.2)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- Day 1: Students will be conducting their research at home.
- Day 2: timer

Advance Preparation

Preparation for this lesson involves scheduling future classroom dates to continue the different parts of this lesson's activities. On the first day, you will review with students their take-home assignments and Activity Pages (AP 12.1 and AP 12.2). The second day of this lesson will not take place on the next consecutive classroom date. It is important to give students three or four days to complete their research at home with family members. Therefore, students will continue this lesson after they have had a chance to work on their take-home research and Activity Page. The second classroom day of this lesson involves students presenting on their chosen environmental projects. Students will evaluate each project and vote on the one that they want to contribute to. After approximately one week, you will evaluate with the class how you have contributed to the environmental project so far.

Use the scheduling tool at the end of this lesson to insert dates for when to conduct the second day of this lesson, as well as when to evaluate the classroom contributions to the projects.

The Core Lesson TWO DAYS, 45 MIN EACH

1. Day 1: Focus student attention on the Big Question. 15 MIN

Activity Pages

AP 12.1
AP 12.2

How is my community helping solve problems of habitat change? Students have learned that habitats change due to natural and human-related causes. Explain to students that for this lesson, they will focus on the changes caused by human activities.

- Ask students to recall some of the ways that humans change habitats and ecosystems. (*pollution, overpopulation, overhunting, overfishing, agriculture, deforestation*)

  SUPPORT—If necessary, review with students the differences between natural and human-related changes to ecosystems so that students do not confuse natural causes with human ones.

- Tell students that humans change ecosystems everywhere and that every community around the world can see traces of changes to the environment caused by human activities. Emphasize that some of these are changes that many people seem to like, such as building a bridge across a stream or a hiking trail along a river. Others may be projects that many people may not like, such as cutting down a forest for a parking lot. But all affect habitats and may cause significant problems.
- Explain that students will use what they learned about changes to habitats as they participate in a take-home activity.
- Distribute and review Local Conservation Project (AP 12.1) and Take-Home Letter (AP 12.2). Tell students that they will share this letter with their family when they get home. Explain that they will work with a family member to find environmental projects that are going on in their community. They will choose a project to focus on (one that interests them the most) and conduct research on it. Then, students will bring back the information they find to share with the rest of the class.

  SUPPORT—Review with students that environmental projects are solutions to problems in the ecosystem. Some projects are very big and span entire countries or continents. Other projects are small and exist on a local level. Have students think back to the debates they did in the previous lesson about problems and solutions. Tell students that many people, groups/clubs, or organizations come up with environmental projects as a way to help restore or bring back habitats in the community. Give students examples of environmental projects (or read—as a class—the list of examples of environmental projects that are on the Take-Home Letter Activity Page):

  - planting gardens of blooming flowers in order to attract more pollinators, such as bees, which are good for the environment
  - water conservation/usage efforts, which can help save limited resources
  - development of more bike paths and carpool lanes in urban areas, which can help reduce pollution

- Review Local Conservation Project (AP 12.1) with students. Tell students that they will fill out this Activity Page at home while they are doing research on their chosen environmental project. Encourage students to use the questions on the Activity Page to guide their research. Read through the questions on the Activity Page with students to ensure understanding. Make sure students understand that they must bring their Activity Pages back to class (on the date that you decide based on the scheduling prompt). They will need to turn in their Activity Pages at the end of the lesson.
- Students will find different types of environmental projects depending on where they live. However, similar types of projects can be found in many communities around the country, including those that involve pollution/litter cleanup, planting trees or gardens, recycling, and conserving land or animals.

2. Preview the investigation. 25 MIN

- Tell students that after they do their at-home research and bring their Activity Pages back in, they will each do a presentation to share what they learned with the class. In their presentations, students will need to describe the environmental project, explain why it was started (based on the human activity that changed the habitat), and tell why the project is important to the community.
- Explain that after all students present their projects, the class will debate, evaluate each one, and take a vote on the one they want to help contribute to. Let students know that an important part of this lesson is actually getting involved in an environmental project that is going on in the community so that students can help contribute to the good efforts that are being made to restore the ecosystem. Tell students that as they evaluate each project, they will talk about ways in which they can get involved and help. They will choose only one project, and it will need to be a project that they can realistically contribute to in some way. (See **Know the Standards** for support.)

Know the Standards

The standard addressed in this lesson focuses on making a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. In their research, students will be gathering data and evidence to support their claims. When they present their research to the class for evaluation, they will be discussing the merits of each claim. The research and evidence they collect will support how well the proposed solution to the environmental problem they select meets criteria and constraints of the solution and reduces the impact of the problem on the environment.

3. Check for understanding. 5 MIN

Formative Assessment Opportunity

Use the Core Vocabulary cards and other Language of Instruction to confirm student understanding of the concept of conservation. Discuss the definition of each word, and relate it to students' upcoming research by asking questions such as the following:

- What is the **advantage** of finding solutions to problems caused by environmental change?
- What role can **conservationists** play in our community?
- What is one way to **conserve** our local habitats?
- What is a **disadvantage** to conserving a local habitat?
- How has a local **ecosystem** changed over time?
- How can a conservation project lead to **ecosystem change**?
- What is the difference between an **environment** and an ecosystem?
- What is the difference between an ecosystem and a **habitat**?
- Is it always good to **restore** an ecosystem after it has changed?

1. Day 2: Refocus student attention on the Big Question. 5 MIN

Activity Page

AP 12.1

How is my community helping solve problems of habitat change? Remind students that they already did the research on their environmental projects, and tell them that today they will present their projects to the class.

Tell students to take out their completed Local Conservation Project (AP 12.1), which they brought back from home.

2. Preview presentations. 5 MIN

Explain that students will use Activity Page 12.1 to guide their presentation. During their presentation, they should talk about the answers to the questions that they wrote on their Activity Pages about their environmental projects. Let them know that the purpose of the presentation is to inform the rest of the class about what the environmental project does, why it is important, and how it can help solve issues in the environment.

3. Facilitate presentations. 15 MIN

Allow each student to present his or her environmental project briefly. Give each student a couple of minutes, and use the timer to make sure students do not talk for too long.

SUPPORT—If students appear stuck, use question prompts to help them talk more about their projects. Examples of questions to ask include the following:

- What did you learn about your environmental project?
- Why is your environmental project important?
- How can your environmental project help the community?
- What kind of human activity changed the environment?
- Do you think this project is a good solution to the problem caused by humans?
- Who is hosting your environmental project (zoo, university, etc.)?

Some students may have mentioned the same projects. If this is the case, come up with different question prompts to ask each student so that there can be a more well-rounded description of the project without too much information being repeated.

As students conduct their presentations, take notes on each of the projects. For instance, write down the name of each project and a quick summary of what it focuses on. You will later use these notes during the debate and evaluation of the projects to see which project makes the most sense for the class to contribute to.

4. Summarize, evaluate, and discuss. 10 MIN

- Explain that students will debate and evaluate each of the projects and vote on the one that they want to contribute to as a class.
- Tell students that you will start by reading aloud the name of the project and a quick summary about it. For instance, you might say, "Ocean cleanup project: removing litter from the sandy beaches," or "Gardens: planting blooming flowers to attract more bees." Then, have students evaluate the project by asking them the following prompts:
  - Is this a project that will solve a problem caused by environmental change?
  - How can we help with this project?
  - Will it be hard or easy to help with this project?

  SUPPORT—Allow students to write down the name of the project(s) they want to vote for. Otherwise, they might not be able to remember which one they think is best to contribute to.
- After you have evaluated the different environmental projects, tell students that you will call the name of each project out loud and that students should raise their hands if they want to work on that project. You will keep count of the votes for each project, and the project with the most votes wins. Tell students that they must vote at least once and that they can vote on more than one project.

  SUPPORT—Encourage students to vote based on their ability to really contribute to the project, rather than voting because the project has to do with their favorite animal (or other reasons).

5. Make an action plan. 5 MIN

Once the class has voted on the environmental project to contribute to, briefly discuss how the class can help with the project. Make a list on the board or chart paper of the ideas or action plans that students come up with.

- Encourage students to think realistically about what they can and cannot do to help with the project. For instance, if students select a project in which they will plant blooming flowers in certain gardens to attract bees, it may not be possible for students to go help in the gardens. However, it may be possible for students to plant flowers or seeds around the school grounds, which is a small way of contributing to the bigger issue. Or it may be possible for students to host a fundraiser in which they use the money to purchase seeds or flowers to plant.

  SUPPORT—It may be necessary to identify some constraints, such as time, money, and resources, that will affect the students' ability to help with the project. Have students come up with ideas for how they can work around those constraints to still contribute to the project.

  SUPPORT—If students are unsure how to help with the project, offer ideas for the action plans, such as hosting fundraisers, cleaning up the school campus, educating other classrooms about the environmental project, planting flowers around the school premises, finding out how much water is used at the school each day/week/month, and promoting the use of more recycling bins in classrooms.

- Discuss with students ways to monitor over time how the class has participated in the environmental project. Tell students that in approximately one week, you will circle back around to this environmental project to see what the class was able to accomplish and evaluate their progress. Make sure students understand that even small efforts are ways of helping make positive changes in the environment. Discuss with students the idea of having regular check-ins to monitor progress, such as once a month.

6. Check for understanding. 5 MIN

Activity Page

AP 12.1 and Answer Key

Summative Assessment Opportunity

See the Activity Page Answer Key (AP 12.1) for correct answers and sample student responses.

Collect the completed Local Conservation Project (AP 12.1). Look at students' answers to the questions for understanding of the project and how it relates to changes in the habitat caused by natural or human activities.

Teacher Scheduling Tool

Schedule the date to hold the second day of Lesson 12. Allow students three or four days to work on their at-home research with their family members.

Day 2 of this lesson will take place on _____.

Schedule dates to remind students about their participation in this action plan, and schedule a time to come back and have students report on what they've done in a whole-class discussion. It is recommended that you give students one week to work on their action plans.

We will circle back to this lesson and evaluate the action plans and classroom progress with the environmental project on _____.

PART C

Evidence of How Organisms and Environments Have Changed over Time

Overview

Lesson	Big Question	Advance Preparation
13. Hidden Clues About Earth's Past	What do age and layering of earth materials tell us about past habitats?	Gather materials, and set up the pans that students will dig through to simulate digging for fossils. (See Materials and Equipment page 13.) Make provisions for internet access and display for whole-class video experience.
14. Fossils and How They Form	What can fossils tell us about ancient habitats?	Read Student Reader, Chapter 8. Gather materials for a student activity. (See Materials and Equipment page 13.)
15. Fossil Clues About Changing Habitats	What do fossils reveal about organisms, habitats, and change?	Read Student Reader, Chapter 9. Make provisions for internet access and display for whole-class video experience.
16. Solving a Fossil Mystery	What do fossils reveal about organisms, habitats, and change?	Read A Fossil Mystery (AP 16.1). Make provisions for internet access and display for whole-class video experience.
Unit Review	How do changes in habitats lead to the extinction of species?	Read Student Reader, Chapter 10.

Part C: What's the Story?

Fossils of ancient organisms have been preserved in rock, in ice in Earth's permafrost and glaciers, and in amber. Some fossils have modern counterparts. Others are extinct animals and plants. Fossil age can be determined by the layer of rock or ice in which the fossils are found. The lowest layers are usually the oldest. All fossils provide clues about the climate and environment in which the organism lived. Seashell fossils found in desert environments are evidence that water was at one time part of the environment.

In Lesson 13, students participate in a fossil dig simulation that emphasizes that the age of fossils is relative to the layer of rock, ice, or earth in which they are found.

In Lesson 14, students read to learn that fossils are remains of organisms that lived long ago and form in different ways. Depending on environmental conditions, bones of animals may be preserved as rock. Other fossils are preserved in ice or resin.

In Lesson 15, students extend their understanding of fossils to recognizing the clues fossils provide about the climate and environment in which the organism lived.

In Lesson 16, students read a fictional story about a fossil find and use evidence to determine the relative age of the fossils and the environment in which the organism lived.

In Unit Review, students read about species that are extinct and endangered to further understand that many fossils are the remains of organisms that were unable to adapt to changing habitats.

So, to repeat, in Part B of this unit, students learned that changes to environments and the different ecosystems and habitats in them occur constantly. In Part C, students recognize that regardless of whether organisms are extinct or have modern counterparts, **fossils provide evidence not only about the types of organisms that lived long ago, but also that environments have changed significantly over time**.

LESSON 13

Hidden Clues About Earth's Past

Big Question: What do age and layering of earth materials tell us about past habitats?

At a Glance

Learning Objective

✓ Explore the concepts of rock layering and relative age.

Lesson Activities

- student investigation
- vocabulary instruction
- discussion

NGSS References

Disciplinary Core Idea LS4.A: Evidence of Common Ancestry and Diversity

Crosscutting Concept: Scale, Proportion, and Quantity

Science and Engineering Practices: Analyzing and Interpreting Data

Scale, Proportion, and Quantity are important to the topic of fossils and relative age because observable phenomena, such as fossils, can exist from very short to very long time periods. Understanding where certain objects fall in the time scale is key to learning about the different periods of Earth's history. In this lesson, students conduct a hands-on investigation in which they dig into layers to understand that the deeper something is buried, the longer ago it was placed there and thus the older it is.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to this term, which is not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

fossil relative

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary term designated in green above.

Instructional Resources

Activity Page

AP 13.1

Activity Page
Let's Dig! (AP 13.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- sand
- soil
- pebbles
- seashells
- large craft beads
- craft feathers
- aluminum 9- by 13-inch pans (10)
- paper towels
- paintbrushes
- index card for student vocabulary deck (1 per student)
- internet access and the means to project video for whole-class viewing

Note: The materials listed above are based on a class size of thirty. For this hands-on activity, students should work in groups of three. If getting enough materials is a challenge, this activity will work just as well if you increase the group number to four or five students.

Substitution Ideas: For this activity, the sand, soil, and pebbles represent layers of earth. The seashells, craft beads, and craft feathers represent the fossils that students will find in the layers. This activity will work just as well if you substituted the sand, soil, and pebbles with other materials (such as whole-wheat flour, chocolate cake mix, and crushed cookies). You can also substitute the seashells, craft beads, and craft feathers with any other type of materials that you want students to dig for during the activity.

Advance Preparation

Prepare for this lesson ahead of time by setting up the pans that students will dig through.

- Make three distinct layers of earth in the pan.
  - Put the pebbles on the bottom of the pan so that this becomes the bottom layer.
  - Put the sand on top of the pebbles so that this becomes the middle layer.
  - Put the soil on top of the sand so that this becomes the top layer.
- Bury specific objects within each of the layers.
  - Bury the craft feathers in the pebbles.
  - Bury the large craft beads in the sand.
  - Bury the seashells in the soil.

Scatter the objects around the pan randomly when you bury them in each layer.

It is important to remember which objects are buried in which layer and to bury these objects consistently for all of the pans. This will allow you to review students' Activity Pages (AP 13.1) to check for correct understanding of relative age of the objects they find.

The Core Lesson 45 min

1. Focus student attention on the Big Question. 10 min

What do age and layering of earth materials tell us about past habitats?
Students have been learning about ecosystems and living things and their environments over the course of this unit. Tell students that now they will start to learn more about how organisms and environments have changed over time.

- Explain to students that Earth is very old and has been around for more than four billion years.
- Emphasize that this is a long time and that many types of changes to environments, ecosystems, and organisms have taken place during those billions of years.

Preview Core Vocabulary

Write the Core Vocabulary word **fossil** on the board or chart paper. Ask students to write the term in the upper left corner of an index card and underline it. Encourage students to pay special attention to the term throughout this lesson. They will do Word Work to complete the Core Vocabulary card in the next lesson. Tell students that we learn about the history of changing habitats on Earth by finding things such as fossils in the ground. Ask students if they can tell you what a fossil is, or have them name types of fossils that can be found. (*dinosaurs*)

> **SUPPORT**—If necessary, explain what fossils are. Students will learn more about fossils in the next lesson, so the information you give them now can be brief.

Ask if students have ever seen a fossil up close, perhaps in a museum.

Show students a video to create excitement about fossils and digging into the earth to find objects that came from long ago. (See the Online Resources for a link to a suggested video.) Read the text in the video for students aloud. After the video, ask the following questions:

- Where did the boy find the dinosaur fossil? (*in the ground; in rock; in earth*)
- What were the people in the video doing with the fossil? (*getting it out of the ground to move it; brushing it off*)
- Why do you think people have to be careful when they dig up fossils? (*because they can break*)
- How does this provide clues about habitats in the past? (*It can tell us what kinds of animals lived a long time ago.*)

Online Resources

Use this link to download the CKSci Online Resources Guide for this unit, where specific links to these resources may be found:

www.coreknowledge.org/cksci-online-resources

2. Preview the investigation. 5 MIN

Activity Page

AP 13.1

- Distribute and review Let's Dig! (AP 13.1). Tell students that they will work in teams to act as scientists that are digging through the earth—like the scientists they saw in the video—to find fossils that were buried there long ago. They will do this to investigate how scientists can tell the age of a fossil based on where it is buried in the ground. This will also tell them how habitats have changed over time. (See **Know the Standards** for support.)
- Students will investigate in the following ways:
  - digging through pans that contain layers of earth
  - setting aside the objects they find
  - dusting off the objects
  - recording their observations
  - analyzing the age of the objects

- Show students the pans that they will be working with for the investigation. Explain that each group will receive one pan with three different layers of earth and fossils buried throughout the layers. Students will need to carefully dig through the layers to find the fossils. Emphasize the importance of not disturbing the layers of earth too much. Explain that they will need to be able to tell which object is found in which layer, so layers should not be mixed haphazardly.

  SUPPORT—If necessary, remind students of the video they watched, and emphasize how careful the scientists were when removing the fossil from the ground. Explain that scientists have to be careful when digging around for fossils so that they do not disturb the things around them. Tell students that all of the things in the earth and around a fossil can be used as clues to tell when an organism lived and what the environment was like back then.

3. Facilitate the investigation. 20 MIN

Divide students into groups of three. Provide each group with the following materials:

- aluminum pans (with layers of earth and fossils already buried)
- several paper towels
- paintbrushes (enough for each student)

Explain that students will be describing the fossils they find relative to each other. For example, they should note which is deeper than another.

- Demonstrate how to use the paintbrushes during this investigation. The pointy tip of the paintbrush (the end without the brush) can be used for moving aside the dirt while looking for fossils. Then, the brush side can be used to dust off the fossils.
- Tell students that the paper towels are for them to lay the fossils on after they brush them off. Paper towels can also be used to wipe off dirty hands at the end of the investigation.

Know the Standards

In this lesson, students will understand that scientists can tell the relative age of a fossil or object based on where it was found in the earth. Students do not need to know this information going into the investigation. Rather, they will explore the concept first by doing and then analyzing what the information means. The investigation will be limited to just three layers of earth, and students will not be required to identify the specific layers, time periods, or types of fossils. Students will use their observations and recordings of where each of the fossils is found in the pan as evidence that different objects are different ages.

This information is necessary for students to understand habitats of the past. By studying types and relative ages of fossils and other buried objects, students can start to understand how habitats have changed over time. For instance, marine habitats thousands of years ago may be land habitats today.

- As students work on their investigations, circulate around the room to ensure groups are taking care not to disturb the layers of earth in the pan too much and following the directions of the investigation.
- As students make their observations, ask them to think about things such as where one fossil was found in relation to the other.

  SUPPORT—Clarify that scientists can often tell which fossils are younger or older based on where they are found in relation to other fossils. For instance, if a fossil is buried beneath another fossil—in another layer of earth—it is probably older. Emphasize the importance of studying the fossils in relation to one another.

- As you circulate around the room, encourage students to think about how habitats change over time. Ask students if they have ever found a seashell in a random place, such as the park, their backyard, or the school ground. Explain that sometimes seashells or other remnants of long ago pop up in unusual places because habitats have changed over time.

Students are not required to find all of the fossils buried in the pans. However, they should be able to find at least one fossil in each of the layers of earth. Give students time to complete the investigation and record observations on their Activity Page (AP 13.1).

4. Summarize and discuss. 5 MIN

Once students have had time to conduct their investigations and complete the Activity Page, bring the class back together for a whole-class discussion to summarize what students discovered. Students should be able to explain observations and support them with evidence. (See **Know the Science** for support with the analysis.) Ask students the following questions:

» Do the fossils come from different times in Earth's history? (*yes*)
» Do you think all of the fossils are the same age? (*no*)
» Which fossil was the oldest? (*feathers*)
» How can you tell? (*It was buried the farthest down in the pan.*)
» Which fossil was the second oldest? (*beads*)

Know the Science

What kind of evidence should students cite in their answers? *Data and relationships.* For this introductory lesson on fossils and relative aging, students should be able to understand that fossils represent organisms that lived long ago. They should also start to be able to tell that older fossils are found deeper in the earth and younger fossils are found closer to the top of the earth. Students can use the data on where the fossils were found (which layers) as evidence that fossils come from different times in history.

- How can you tell? (*We found them between the feathers and the seashells.*)
- Which fossil was the youngest? (*seashells*)
- How can you tell? (*They were found in the top layer of the soil.*)
- What does this tell you about habitats in the past? (*Habitats must have changed over time.*)

Elicit from students that when you dig into the earth and into layers of rock, the deeper something is buried, the longer ago it was placed there and, therefore, the older it is.

Ask if students have any questions about the investigation, and address any misunderstandings.

5. Check for Understanding. 5 MIN

Activity Page

AP 13.1 and Answer Key

Summative Assessment Opportunity

See the Activity Page Answer Key (AP 13.1) for correct answers and sample student responses.

Collect the completed Let's Dig (AP 13.1). Review students' answers to the questions for understanding of the relative ages of the fossils. Students should be able to tell that the fossils buried the deepest in the pan are the oldest and the fossils at the top of the pan are the youngest.

LESSON 14

Fossils and How They Form

Big Question: What can fossils tell us about ancient habitats?

At a Glance

Learning Objectives

- ✓ Identify the types of things that scientists can learn from studying fossils.
- ✓ Describe how a fossil forms.
- ✓ Analyze fossil evidence to describe the living thing and its habitat.

Lesson Activities

- reading and discussion
- observation and analysis
- vocabulary instruction

NGSS References

Disciplinary Core Idea LS4.A: Evidence of Common Ancestry and Diversity

Crosscutting Concepts: Scale, Proportion, and Quantity; Scientific Knowledge Assumes an Order and Consistency in Natural Systems

Science and Engineering Practices: Analyzing and Interpreting Data

Analyzing and Interpreting Data is important to this lesson because students will describe how scientists analyze data to know about organisms that once lived on Earth. Students will also analyze and interpret data to describe the type of habitat that fossil organisms lived in, based on their features.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to this term, which is not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

amber	evidence	preserve
decompose	**fossil**	

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary term designated in green on the previous page.

Instructional Resources

Student Reader

Ch. 8

Activity Pages

AP 14.1
AP 14.2

Student Reader, Chapter 8
"Fossils and How They Form"

Activity Pages
Analyzing Fossils (AP 14.1)

How a Fossil Is Made (AP 14.2)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- scissors
- glue sticks
- seashell
- modeling clay

The Core Lesson 45 min

1. Focus student attention on the Big Question. 5 min

What can fossils tell us about ancient habitats? Relate this lesson to previous lessons on habitats, their stability, and their disruption.

Tell students that in this chapter they will be reading about how fossils form. Explain that students will be looking at pictures of fossils to see what they can tell about the type of living thing a fossil used to be and the type of habitat or ecosystem that it lived in.

Discuss that fossils are the remains of very old organisms that were not completely eaten or did not decompose. (See **Know the Standards** for support.)

Know the Standards

Types of Fossils: Students at this grade are not expected to be able to identify specific fossils, but they should be able to distinguish major fossil types and relative ages of fossils. Student understanding of what fossils are involve these key ideas:

1. Fossils represent plants and animals that lived long ago.
2. There is a relationship between fossils of organisms and the habitats in which they lived.
3. Fossilized plants and animals can be used as evidence that some habitats look very different now than they did a long time ago. Examples include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.
4. Some fossils have modern counterparts. Fossils that do not have modern counterparts are from organisms that are now extinct.

2. Prepare for reading. 5 MIN

Activity Page

AP 14.1

Distribute and review Analyzing Fossils (AP 14.1). Have students work with a partner to observe and analyze each fossil picture shown in Chapter 8 of the Student Reader. As they read, have students fill in the table on Activity Page 14.1 with their analysis.

SUPPORT—You may want to make an answer bank on the board or chart paper for students who are struggling, using the answer key, or complete the table together as a whole class if necessary. Remind students to examine the structures of the fossils, such as wings, tails, or the shape of the teeth, to get clues about the organism and where it lived.

3. Read and discuss: "Fossils and How They Form." 15 MIN

Student Reader

Ch. 8

Read together or have students read independently "Fossils and How They Form," Chapter 8 in the Student Reader. The selection explains how fossils are formed and explains what information scientists can learn from analyzing them.

Preview Core Vocabulary

Before students read, write **fossil** on the board or chart paper. Encourage students to pay special attention to the term as they read.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 41

After students have read the page, have them complete the first section of the Activity Page (AP 14.1). Discuss student experience with fossils. Some may have seen leaf imprints in rocks or bones or teeth of animals, such as dinosaurs, that lived long ago. Ask the following:

- What is the difference between a fossil and an organism that has died? (*Fossils are the remains of organisms that lived long ago.*)

Page 42

After reading this page, have students go back and underline the sentences that describe how fossils form. Discuss what the soft parts of the dinosaur were: skin, muscle, tissue, organs, eyes. Discuss what happened to these parts, and use the word *decompose* to describe how organisms rot and turn into compost or are eaten by other organisms.

Explain that students will return to this page at the end of the lesson.

Page 43 After reading this page, show students a seashell. Ask students to observe as you press the seashell into a piece of modeling clay. (See **Know the Science** for support.) Ask the following:

- » Which of these (the actual shell or the clay impression) looks more like the seashell fossil in the picture? (*the clay*)
- » Explain that an impression is all that is left of seashells when they are fossilized. Ask the following: What does the clay represent? (*mud*)

Page 44 After reading this page, ask the following:

- How are the fossils of the pine cone and the shell similar? (*They were both pressed into a rock formation.*)

Page 45 After reading this page, discuss the following questions:

- » What happens to food you freeze in a home freezer? (*It gets hard and does not decompose.*)
- » Where does permafrost occur? (*at Earth's poles and tops of mountains where snow never melts*)
- » What is the difference between an organism that is preserved and one that is not preserved? (*All parts of the fossil are there, including the soft parts, when it is preserved.*)
- » What happens to permafrost as the climate grows warmer? (*It thaws, and scientists may find more fossils there.*)

Page 46 After reading this page, ask the following:

- » Where can you find resin? (*When you cut a pine tree, you can see it seeping from the wound.*)
- » What sort of fossils would you be most likely to find in amber? (*insects that were living in trees*)
- » Is a tree a habitat? (*yes*) Did these insects live in a tree ecosystem? (*yes*)

Instruct students to complete the remainder of Activity Page 14.1.

Know the Science

What is a seashell? A seashell is not alive, but it was created by the organism that lived in it. It is the home of an animal with a soft body or soft body parts. The shell is formed by the secretions of the organism living inside of it over its lifetime. Shells that are found on the beach are not fossils and could still have an organism living in them. Shell fossils are found buried in layers of deposited sediment and were once the home of living things. They indicate that a habitat was once underwater.

4. Facilitate the activity. 10 MIN

Activity Page

AP 14.2

Have students work individually or in pairs for this activity. Distribute and review How a Fossil Is Made (AP 14.2), and distribute a pair of scissors and a glue stick to each student.

Read the directions on the Activity Page aloud to the class. Explain to students that they are to cut out the steps for how a fossil is made and place them in the correct order in the table.

> **SUPPORT**—Encourage students to look back at page 42 for guidance in placing the steps in order. If necessary, reread page 42 aloud to the class, having them follow along. Tell students that they can raise their hand to check with you that they have the steps in the correct order or that they may check with a partner before gluing the steps onto the page.

5. Teach Core Vocabulary. 5 MIN

Word Work

Have students take out the Core Vocabulary card they previously created for **fossil**.

- **fossil:** (n. the remains of a living thing from long ago, usually formed in layers of rock) Ask students what evidence fossils can provide that habitats were not always like they are today. (*When a seashell* fossil *is found on dry land, it shows that water was once in that habitat.*) Have students write a sentence on their Core Vocabulary card that includes the words *fossil* and *evidence*. (*Fossils are evidence that habitats change.*)

6. Check for understanding. 5 MIN

Activity Pages

AP 14.1
AP 14.2
Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 14.1 and 14.2) for correct answers and sample student responses. Check the steps on the Activity Page (AP 14.2) to see that they were placed in the correct order.

LESSON 15

Fossil Clues About Changing Habitats

Big Question: What do fossils reveal about organisms, habitats, and change?

At a Glance

Learning Objectives

- ✓ Describe how fossils can be used to identify how habitats have changed over time.
- ✓ Explain what scientists know about the order of rock layers and the fossils found within them.

Lesson Activities

- reading and discussion
- observation and discussion

NGSS References

Disciplinary Core Idea LS4.A: Evidence of Common Ancestry and Diversity

Crosscutting Concepts: Scale, Proportion, and Quantity; Scientific Knowledge Assumes an Order and Consistency in Natural Systems

Science and Engineering Practices: Analyzing and Interpreting Data

Analyzing and Interpreting Data is important to this lesson because students will learn how scientists analyze data gathered from fossil evidence to understand how habitats have changed over time.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Core Vocabulary words are shown in green below. During instruction, expose students repeatedly to this term, which is not intended for use in isolated drill or memorization.

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. A Glossary on pages 183–184 lists definitions for both Core Vocabulary and Language of Instruction terms and the page numbers where the Core Vocabulary words are introduced in the Student Reader.

extinct glacier

Core Vocabulary Deck: As a continuous vocabulary instruction strategy, have students develop a deck of vocabulary cards that will be used in various activities across this unit as a part of Word Work. The deck will include the Core Vocabulary term designated in green on the previous page.

Instructional Resources

Student Reader

Ch. 9

Activity Page

AP 15.1

Student Reader, Chapter 9
"Fossil Clues About Changing Habitats"

Activity Page
Rock Layers (AP 15.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following item:

- index card for student vocabulary deck (1 per student)
- internet access and the means to project video for whole-class viewing

The Core Lesson 45 min

1. Focus student attention on the Big Question. 5 min

What do fossils reveal about organisms, habitats, and change? Have students recall that in the previous lesson, they examined fossils to learn more about how that plant or animal once lived. Ask:

» What might the shape of the teeth of a fossil animal tell you about it? (*the type of food it ate*)

» How can you know how an animal moves from one place to another by looking at fossil remains? (*You can see if it has wings, a tail, or limbs.*)

Explain that in Chapter 9, students will learn about how scientists put together evidence from patterns of fossils to get a more complete idea about how certain habitats have changed over time.

2. Read and discuss: "Fossil Clues About Changing Habitats." 20 min

Student Reader

Ch. 9

Read together or have students read independently "Fossil Clues About Changing Habitats," Chapter 9 in the Student Reader. The selection reinforces the idea that scientists use fossils as clues to learn about the past.

Preview Core Vocabulary

Before students read, write **extinct** on the board or chart paper. Encourage students to pay special attention to the term as they read.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 47

Reread the sentence "Fossil clues show that habitats in some places were different than they are today" aloud for the class. Ask the following:

- What clues tell scientists about the type of habitat or how it may have changed? (*the type of animal or plant fossils that they find*)
- Do you know of any animals that are extinct that once lived in the area where you live now? (*dinosaurs, ferns, coral*)

SUPPORT—Students may confuse the word *extinct* with the word *endangered*. If they do, point out that animals that are endangered are still living today but that there are very few of them left. Animals that are extinct are no longer living anywhere on Earth. Explain that there are some species still living today that are very similar to species from the past, such as the crocodile shown in the photo.

Page 48

Review what students read on this page, and prepare for Rock Layers (AP 15.1) by asking the following:

- Which layer of rock is the oldest layer? (*the lowest layers in the photo*)
- How do the fossils in the oldest layers compare with fossils in newer ones? (*The animals are simpler the older the rock layers are.*)

Page 49

After reading this page, ask the following:

- When scientists find fossils of coral in places that are now cold, what does this tell them about how the environment has changed? (*The environment used to be a warm ocean but now is colder.*)

SUPPORT—Students may think that coral is a type of seashell and that they are not alive. Explain that coral are living animals. They get food by filtering tiny microorganisms from the water to get energy to live. Explain that if the ocean becomes too cold or too warm, corals do not survive.

Page 50

After reading, discuss these questions about coal.

- What do you know about coal? (*It is mined in states such as West Virginia. It is burned to create electricity and heat.*)
- What kind of fossil is coal? (*plants, including trees*)
- What clues can people look for to know where to find coal? (*They can find fossils of plants. They can look in places where tropical forests used to grow.*)

Pages 51–52 After reading these pages, ask the following:

- » What evidence has been found of dinosaurs living in the western United States? (*fossil bones and footprints*)
- » What is the oldest layer of a glacier? (*the bottom layer*)
- » How are fossils preserved in glaciers and permafrost? (*They are frozen, so they do not decompose much.*) (See **Know the Science**.)
- » What are some clues other than bones that scientists can look for to know about past climates? (*evidence of glaciers, the body covering or types of nests that animals built*)

Online Resources

Following the reading, show a video to help students understand permafrost and glaciers where fossils can be found. (See the Online Resources for a link to a suggested video.)

Use this link to download the CKSci Online Resources Guide for this unit, where specific links to these resources may be found:

www.coreknowledge.org/cksci-online-resources

3. Teach Core Vocabulary. 5 MIN

Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary word **extinct** (displayed on the board or chart paper earlier in the lesson). Ask students to write the term in the upper left corner of an index card and underline it.

Word Work

- **extinct:** (adj. having no surviving members) Emphasize that extinct species are evidence that Earth's habitats change. Have students add to their cards two examples of organisms that are now extinct, one that became extinct long ago and one that became extinct recently. (*giant sloth, passenger pigeon*)

Know the Science

How are organisms preserved in ice? *They are frozen.* Permafrost is the permanently frozen ground under the Arctic landscape. Glaciers are huge, slow-moving masses of ice formed by layers of frozen snow in mountains or near Earth's poles. Because these areas have never thawed, any animals or plants that died there would have been frozen and hardly ever decomposed. With climate change, ancient organisms are being discovered as they are exposed by melting ice.

4. Observe and discuss. 10 MIN

Activity Page

AP 15.1

Distribute and review Rock Layers (AP 15.1). Tell students that they will be studying a diagram of rock layers to answer questions about the ages of the rocks.

> **SUPPORT**—To help students who are struggling, have them turn back to page 48 in the Student Reader. Reread the page with them. Point out that the older layers of rock are at the bottom and newer layers are at the top of the mountain.

Lead a discussion about examples from the Activity Page. Discuss what people would know about past environments from the fossils they found in each layer. For example, if seashell fossils were found in one layer and bird feather fossils in another, this can tell you which type of organism existed first. Students would also know that at one time the environment was under water and another time it was dry land.

5. Check for understanding. 5 MIN

Activity Page

AP 15.1 and Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP 15.1) for correct answers and sample student responses. Look at the answers to be sure that students labeled the lower layer as the oldest and the top layer as the newest rock.

LESSON 16

Solving a Fossil Mystery

Big Question: What do fossils reveal about organisms, habitats, and change?

At a Glance

Learning Objective

✓ Analyze and interpret data from fossils for evidence that as a habitat changes over time, so do the animals and plants in that habitat.

Lesson Activities

- reading activity
- observation and discussion

NGSS References

Disciplinary Core Idea LS4.A: Evidence of Common Ancestry and Diversity

Crosscutting Concept: Scale, Proportion, and Quantity

Science and Engineering Practices: Analyzing and Interpreting Data

Analyzing and Interpreting Data is important to the topic of fossils because fossils can provide data and clues about what prior environments were like. In this lesson, students will read a fictional scenario about fossils and will look for data that can be used as evidence to explain how a particular environment—including its organisms—changed over time to solve an interesting mystery. In doing so, students will prepare to meet or exceed Performance Expectation 3-LS4-1 as part of Lesson 16. Throughout the reading activity, students will be looking for data to analyze and interpret as part of supporting their claims that as a habitat changes over time, so do the animals and plants in that habitat.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Core Vocabulary

Language of Instruction: The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about and explaining any concepts in this lesson. The intent is for you to model the use of these words without the expectation that students will use or explain the words themselves. No new Core Vocabulary is introduced in this lesson.

fossil extinct evidence

Instructional Resources

Activity Pages

AP 16.1

AP 16.2

Activity Pages
A Fossil Mystery (AP 16.1)

Solving a Fossil Mystery (AP 16.2)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following item:

- internet access and the means to project video for whole-class viewing

The Core Lesson 45 MIN

1. Focus student attention on the Big Question. 5 MIN

What do fossils reveal about organisms, habitats, and change? Remind students that they learned a lot about fossils in the previous two lessons. Quickly review the following concepts:

- Fossils provide clues about past environments.
- Formation of rock in layers reveals relative ages of fossils.
- Fossil clues show that environments in given places used to be different, based on the types of organisms that lived there.
- The fossil record shows how climate and landforms have changed on Earth over geologic time.
- The fossil record also shows that, with habitat changes, innumerable species have continually gone extinct.

SUPPORT—If necessary, remind students what *fossil record*, *geologic,* and *extinct* mean. Clarify any misunderstandings.

Online Resources

Show students a video to reinforce understanding of how organisms can have modern counterparts, or organisms that look and behave similarly to them. (See the Online Resources for a link to a suggested video.) Read the text in the video for students aloud. After the video, ask the following questions:

- What animal today does this dinosaur look like? (*duck*)
- How is the dinosaur similar to a duck, besides its looks? (*It lived in the water.*)
- How do you think scientists were able to tell that the dinosaur lived in the water? (*based on where the fossil was found*)

Use this link to download the CKSci Online Resources Guide for this unit, where specific links to these resources may be found:

www.coreknowledge.org/cksci-online-resources

2. Encourage student questions. 5 MIN

Have students consider questions about fossils and the clues that they provide. Prompt them to work with a neighbor to discuss the kinds of things fossils can tell us based on where they are found. (*where an organism used to live, what the environment was like, how long ago the organism lived*)

3. Preview the activity. 5 MIN

Activity Pages

AP 16.1

AP 16.2

Distribute and review A Fossil Mystery (AP 16.1) and Solving a Fossil Mystery (AP 16.2). Tell students that they will work independently to read a fictional scenario in AP 16.1 and answer questions to solve a mystery about fossils in AP 16.2. Students will solve the mystery by doing the following:

- studying the facts of the scenario
- examining diagrams
- looking for clues or data
- using evidence from fossils

4. Facilitate the activity. 20 MIN

Have students read or read together the Activity Page scenario. Ensure students are able to understand the scenario, the illustrations, and the diagram.

SUPPORT—It may be necessary to clarify for students how big an acre is. An acre is about seventy-five percent of a football field (with end zones). The idea is for students to understand that the fossil in the field and the fossils found in the hillside rock layers were not right next to each other. The purpose in specifying this in the scenario is to emphasize the point that a lot of the land was aquatic at one time in history (not just one small section of the land).

SUPPORT—Ask students independently to tell you what the brachiopod fossil looks like. (*seashell*) Ask them if they see seashells that look similar to this today. (*yes*) Ask if students think this means the brachiopod has modern counterparts, even if brachiopods themselves are extinct. (*maybe*) Ask students to tell what kinds of organisms live inside seashells. (*clams, mussels*)

As students get to the end of the scenario, it may be necessary to help them interpret the diagrams.

SUPPORT—If necessary, walk through the diagram with students. Start at the top by showing them that the diagram shows the two locations where the fossils were found. Explain that there were five acres of land between the two locations (this is a lot of distance!). Study Location 1, which was the field where the first fossil was found. Explain that the layers in the diagram represent layers of the rock in the earth. At the top is the soil that Alex was plowing. Underneath the soil is most likely where the fossil came from. The third (bottom) layer of the earth is unknown, as the story did not go deep down into the earth. Tell students that the important thing is to focus on the top two layers. Then look at Location 2, which was the hillside where the second set of fossils was found. Explain that the layers here also represent layers of the rock in the earth. As you look at the two locations side by side, use the following prompts to check understanding:

- What is similar about the two layers where the fossils were found? (*They are both in the second layer.*)
- Is one of the fossils older than the other? (*no*)
- How can you tell? (*The fossils were found in the same layer.*)
- What can this tell you about when the fossilized organisms existed? (*The fossils came from the same time in Earth's history.*)

As students work on their answers to Activity Page 16.2, circulate around the room, and provide support as needed. (See **Know the Standards**.)

SUPPORT—Allow students to do internet searches on brachiopods so they understand what kinds of organisms they are.

SUPPORT—If necessary, discuss with students different types of data that they could be looking for in the scenario, including type, size, and distribution of the fossils.

Know the Standards

In this lesson, students should understand that fossils provide clues about what environments and organisms were like many years ago and how they are different from the environments and organisms we see today. Students do not need to identify specific fossils or present plants and animals, although they should be able to generally identify organisms that look similar to the fossils today. Therefore, this activity will be limited to students using the information they can gather from the scenario to solve a mystery about how the environment has changed over time.

SUPPORT—It may be helpful to go over the chart with students independently—or as a whole class—so they understand what kind of information to record in the table. For instance, in the first column, students should put the name of the fossil, which is *brachiopod*. In the second column, students only need to write whether they think it was an animal or a plant. In the third column, remind students that the same type of fossil was found in two locations, so they should list all of the locations in this column.

Give students time to complete the questions to solve the mystery on their Activity Pages (AP 16.2).

5. Summarize and discuss. 5 MIN

Once students have had time to complete their Activity Pages, hold a whole-class discussion to summarize what students discovered. Students should be able to explain that fossils in the scenario provided the clues necessary to serve as evidence that the present environment is very different today than it was many years ago.

Ask students the following questions:

» Do the fossils that were found on the farm come from different times in Earth's history? (*no*)

» Do you think all of the fossils are the same age? (*yes*)

» What do you think the farmland was like when the brachiopod lived there? (*aquatic, underwater*)

Elicit from students that the fossils came from layers of rock that were deposited long ago, so the environment in that spot must have once been very different from what it is like now.

Ask if students have any questions about the activity, and address any misunderstandings.

6. Check for understanding. 5 MIN

Activity Page

AP 16.2 and Answer Key

Summative Assessment Opportunity

See the Activity Page Answer Key for correct answers and sample student responses.

- Collect the completed Solving a Fossil Mystery (AP 16.2). Look at students' answers to the questions for understanding of the fact that the fossils came from layers of rock that were deposited long ago, so the environment in that spot must have once been very different from what it is like now. Students should be able to tell that the environment was once aquatic, based on the fact that the brachiopod fossil looks like a seashell. This means the land was underwater. Students should also be able to tell that this is an old fossil, based on the rock layer in which it was found.
- You do not have to collect A Fossil Mystery (AP 16.1) from students.

UNIT REVIEW

Habitat Changes and Extinction

Big Question: How do changes in habitats lead to the extinction of species?

At a Glance

Learning Objectives

- ✓ Describe how different species have become extinct.
- ✓ Describe the importance of habitat change in the process of extinction.

Lesson Activities

- reading
- discussion and writing

NGSS References

Performance Expectation 3-LS4-1: Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.

Disciplinary Core Idea PS4.A: Evidence of Common Ancestry and Diversity

Crosscutting Concepts: Scale, Proportion, and Quantity; Scientific Knowledge Assumes an Order and Consistency in Natural Systems

Science and Engineering Practices: Analyzing and Interpreting Data

Analyzing and Interpreting Data is important to this lesson because students will learn how scientists interpret fossil and other data to analyze the reasons living things have become extinct in the past. Students will also learn that scientists collect data to track animal populations and species that are not surviving well due to changes in their environment.

For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

The Big Idea

Environments on Earth are vastly varied, resulting in dramatically different habitats that support a huge diversity of organisms. Though organisms vary dramatically, they all have in common that they get what they need for survival from their habitats. Species have adaptations, including behavioral traits, that are specifically matched to survival within their habitats. Habitats change, however, sometimes slowly and sometimes quickly. Habitat changes, such as disruptions caused by invasive species, can affect entire interrelated ecosystems. Changes in a habitat affect the organisms that live there. Organisms may adapt to habitat changes, may relocate because of them, or may not survive.

The fossil record provides evidence of endless habitat change throughout Earth's history, which led to the extinction of countless species. Extinctions are not limited to the past, though. Present habitat changes continue to put species at risk.

Core Vocabulary

Core Vocabulary is shown in green below. It is atypical to introduce new Core Vocabulary in a Unit Review. However, the arc of the content story line for *Habitats and Change* makes it optimal to address this term at the very end of the unit.

endangered species

Language of Instruction: During instruction, also remind students of their prior exposure to the following terms.

adaptation	**conservationist**	**fossil**	**migrate**
behavioral trait	**ecosystem**	**habitat**	**organism**
climate	**extinct**	**invasive species**	**survive**

Core Vocabulary Deck: Students should refer to their full set of Core Vocabulary cards during the review discussion.

Instructional Resources

Student Reader

Ch. 10

Activity Page

AP UR.1

Student Reader, Chapter 10
"Habitat Changes and Extinction"

Activity Page
When Living Things Cannot Survive Habitat Change (AP UR.1)

Make sufficient copies for your students prior to conducting the lesson.

Materials and Equipment

Collect or prepare the following items:

- index cards (1 per student)
- timer (optional)

The Core Lesson 45 min

1. Focus student attention on the Big Question. 5 min

How do changes in habitats lead to the extinction of species? Begin by reviewing the meaning of the word *extinction*. Ask the following questions to prompt discussion:

- Can you recall a species that is extinct? (*a dinosaur species*)
- What happens to living things when their habitat changes? (*Some of them survive, and some do not.*)

Ask students to turn and talk to a partner to explain if they think that there is any way to prevent living things from becoming extinct.

> **SUPPORT**—To facilitate the turn-and-talk conversation, assign one student as partner A and one student as partner B. Set a timer to allow each partner to discuss their ideas.

Have students keep this question in mind as they continue with the lesson.

2. Read and discuss: "Habitat Changes and Extinction." 15 min

Student Reader

Ch. 10

Read together or have students read independently "Habitat Changes and Extinction," Chapter 10 in the Student Reader. The selection reinforces the idea that some living things cannot survive changes in the environment well or at all.

Preview Core Vocabulary

Before students read, write **endangered species** on the board or chart paper. Encourage students to pay special attention to the term as they read. Students do not need to prepare a Core Vocabulary card for this term.

Have students take out the Core Vocabulary card decks they have completed throughout the unit. Instruct students to quickly scan the cards as a reminder of terms to look for during today's reading and Unit Review discussion. Have students place the deck at the top left corner of their desks. When they encounter any term in the deck during reading or discussion, they should move the card for that term to the top right corner of the desk. Emphasis in this lesson is for students to use Core Vocabulary in context in the discussion and to be aware of their use of the terms.

Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 53

After students have read the page, ask the following:

- How do species become extinct? (*when there are no more individuals left to reproduce because changes to the environment could not be overcome*)
- What kinds of things can cause many individuals of a species to die? (*The habitat changes, for example, with the introduction of a new predator, disease that kills a food source, or change in climate. Organisms that cannot move or adapt die.*)

Page 54

After reading this page, ask students to underline or circle the two ideas that explain why dinosaurs became extinct. Ask the following:

- What do the two ideas have in common? (*that the sun was blocked and it became cold*)
- If it became cold and dark, why would plants not be able to survive the change? (*They need sunlight to make food.*)

Page 55

Discuss the meaning of the term *mass extinction*. Distribute one index card to each student, and have students write *mass extinction* on the front of the card. Have them write the meaning of the term on the back of their index card. Then ask the following:

- What ideas do scientists have to explain the mass extinction that happened 250 million years ago? (*An asteroid from space struck Earth.*)
- What evidence did scientists see that supports that a mass extinction happened? (*They found fossils of many different organisms in lower layers of rock, and then the layers on top of it were empty of those types of fossils.*)
- Do all organisms on Earth die in a mass extinction? (*no, only the ones that cannot respond to the changes by finding new shelter and food sources*)

  SUPPORT—Remind students that the older rock layers are deeper beneath newer layers. Scientists can look for fossils in the rock layers, and when those fossils can no longer be found, that is how they know when the last of those animals or plants lived on Earth.

Page 56

After reading this page, ask the following:

- What do the western black rhino and Steller's sea cow have in common? (*They were not able to adapt when their habitat changed, and they became extinct.*)

Pages 57–58

After reading these pages, have students brainstorm a list of ways that people have tried or could try to help prevent more living things from becoming extinct.

3. Teach Core Vocabulary. 5 MIN

- **endangered species:** (n. a species that is at risk of becoming extinct within a few years) Discuss animals that are on the endangered species list, which protects the habitats of endangered species and restricts the killing of these organisms. Many plants as well as animals, such as Bengal tigers, western lowland gorillas, blue whales, orangutans, giant pandas, sea turtles, and bluefin tuna, are endangered species.

4. Prompt student writing. 15 MIN

Activity Page

AP UR.1

Distribute and review When Living Things Cannot Survive Habitat Change (AP UR.1). Tell students they will select one of the organisms they read about that has gone extinct or that is an endangered species and will answer questions about that organism. Read the directions and questions with students.

SUPPORT—If needed, help students by making a list of organisms to choose from on the board or chart paper and providing the page numbers that tell about each of them. Also, remind students that living things are affected when their habitat is changed and that scientists learn about how habitats changed by looking at clues in fossils.

Circulate around the room as students complete their Activity Pages. Make sure students are clear on what is being asked of them for each question. (See **Know the Standards**.)

Ask volunteers to share their answers on When Living Things Cannot Survive Habitat Change (AP UR.1). Point out that student answers are similar because all organisms that have become extinct did so because they could not survive changes that happened in their habitat.

Know the Standards

How can students provide evidence that some organisms survive less well or not at all when habitats change? ***By looking at fossils!*** Fossils show that some organisms that existed in the past no longer exist. Scientists can observe and compare the numbers of organisms in groups of endangered species to know if people are helping or harming populations. Some organisms are living today that have survived well, despite changes that have occurred to their habitat. These organisms have become adapted, or changed, over time.

5. Check for understanding. 5 MIN

Activity Page

AP UR.1 and Answer Key

Formative Assessment Opportunity

See the Activity Page Answer Key (AP UR.1) for correct answers and sample student responses.

Collect the completed When Living Things Cannot Survive Habitat Change (AP UR.1). Scan the answers to see that students demonstrated that they understand that change causes living things to not be able to survive in a habitat. Also, check that students were able to describe that scientists can see how habitats have changed by looking for clues in fossils.

UNIT 3

Teacher Resources

Activity Pages

Name _____ Date _____

Activity Page 1.1 Use with Lesson 1.

The Needs of Bluebirds

There are three types of bluebirds in the United States. Eastern bluebirds live in the eastern states. Western bluebirds live in the western states. Where do mountain bluebirds live? If you said they live on tall mountains in the west, you would be right!

Wherever they live, bluebirds have similar needs. Bluebirds like open space to fly around in. A grassy field with a few trees along the edge is just right for them. They like to perch, or sit, a few feet above the ground. When a bluebird spies berries or an insect, such as a grasshopper, ant, or caterpillar, it swoops down to the ground to eat.

Bluebirds need to drink water. They like to drink from water that is dripping or less than two inches deep. They also like to take baths in the shallow water.

Bluebirds make cup-shaped nests to hold their eggs. They build their nests inside an opening in a tree or wooden structure. They may also use the opening for shelter from cold or rainy weather.

How can you design a habitat near your school where bluebirds can survive? If bluebirds are to live in the habitat you designed, the habitat must meet their needs. Read about these birds again. **Then write your ideas in the table**.

Bluebird Needs	**How Will You Meet These Needs?**
Food	
Water	
Shelter	
Space	

Name _____ Date _____

Activity Page 2.1 Use with Lesson 2.

What Lives in a Grassland Habitat?

A grassland habitat is drier than a forest. It is wetter than a desert. Trees do not grow there, but lots of types of grasses do.

Think about each kind of organism in the table. **Write a claim about whether it can survive and reproduce in a grassland. Next, write evidence to support your claim. Finally, add one more organism to the list. Write your claim and evidence to explain if the organism will survive in a grassland.**

Kind of Organism (a living thing)	**Claim** (your idea)	**Evidence** (facts that make your claim true)
clownfish		
cactus		
grass		
duck		
arctic hare		

Name _____ Date _____

What Is the Advantage of the Adaptation Called Blubber?

Some types of animals need to keep their bodies warm. What if these animals live in icy cold ocean water? How can you model one way they stay warm for survival in their habitat?

STEP 1: Get two cups of icy cold water from your teacher. Bring them to your work area. Then go back, and get a cup of shortening and a small spoon.

STEP 2: One partner will have the role of experimenter. The other will be the timer. Decide who will take on each role. Later, you will switch roles.

STEP 3: Cover one index (pointer) finger with plastic wrap, or put on a plastic glove. If you are the experimenter, use the spoon to spread a thick layer of shortening over your covered index finger. Keep the other index finger clean.

STEP 4: If you are the timer, find out from your teacher what timer tool you will use. Make sure you are ready to use and read the timer.

STEP 5: If you are the experimenter, place one index finger in each cup of icy water. If you are the timer, time the number of seconds the experimenter can hold each finger in the water before it feels too cold. Write the experimenter's name and the number of seconds in the table.

Student's Name	Number of Seconds the Finger with Shortening Stayed in the Water	Number of Seconds the Clean Finger Stayed in the Water

STEP 6: Now switch roles. Repeat Steps 3–5. Make sure to fill in the table.

STEP 7: Use paper towels to clean your hands. Follow your teacher's directions for returning the materials.

STEP 8: Animals such as whales, seals, and walruses have a layer of fat under their skin. This layer is called *blubber*. **Write an argument**. Explain the function of how blubber is used for survival for these animals. Use evidence from your experiment to support your argument.

Name _____ Date _____

Activity Page 4.1 (Page 1 of 2) Use with Lesson 4.

What's My Adaptation?

As you read Chapter 2, think about each living thing described. **Write in the table** the examples of organisms and their adaptations. Then write your answer to the question in complete sentences.

Organism	Habitat	Adaptation(s)	Advantage
giraffe			
topi			
owl			
cactus			
horned viper			

poison dart frog			
capybara			
widowbird	grasslands		
giraffe			

Choose one organism from your table. Suppose it didn't have its adaptation. What might happen to that living thing?

Name _____ Date _____

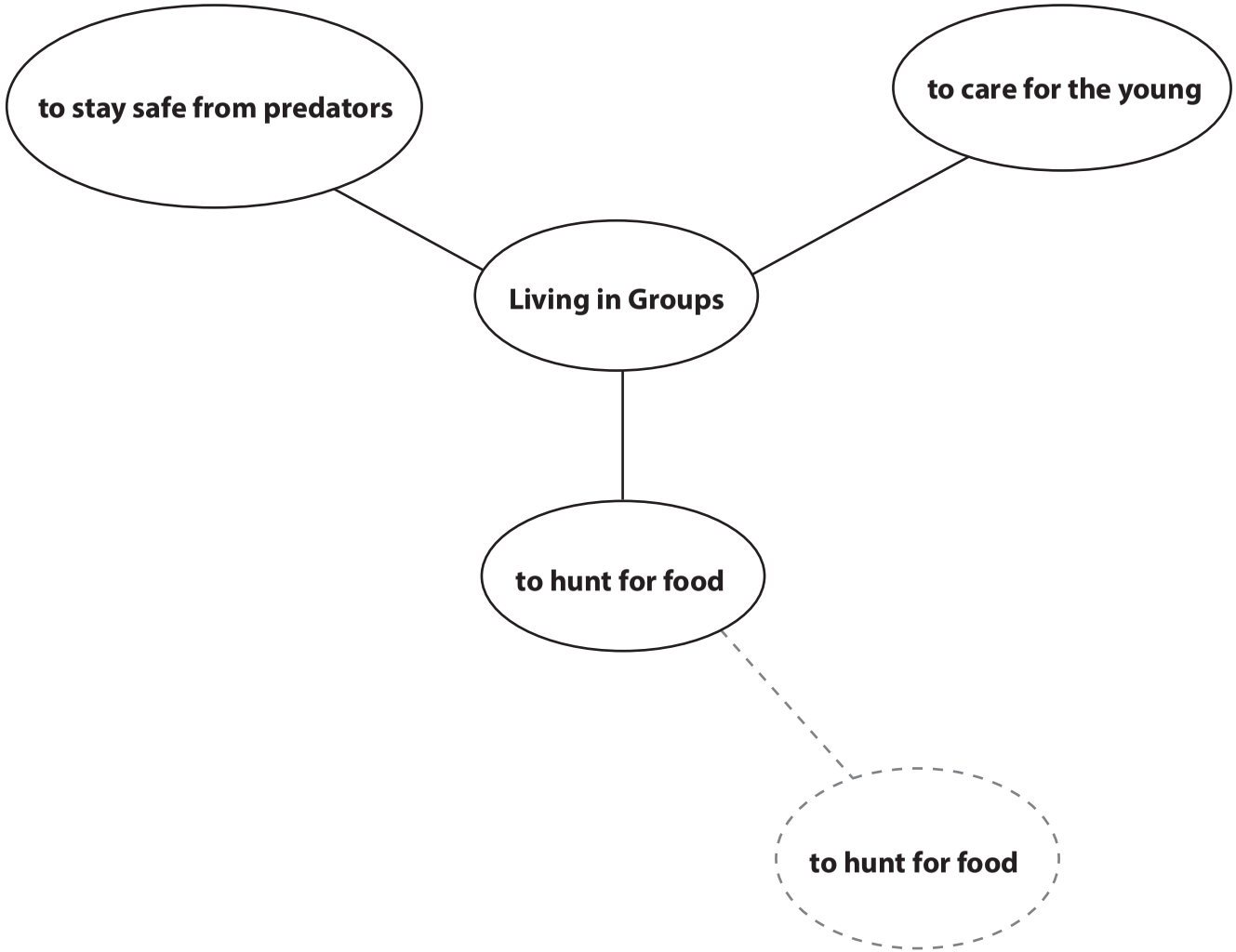
Activity Page 5.1 (Page 1 of 2) Use with Lesson 5.

Advantages of Living in Groups

As you read Chapter 3, complete the concept map on the next page. **Write the name of the animal next to a reason it lives in groups. Draw a line to connect to that bubble on the map**. You can write each kind of animal more than once.

After you complete your concept map, **write your answer to the question below**. Write your answer in complete sentences.

Is there usually one advantage for a species to live in groups? Make a claim to explain why or why not. Use evidence from your completed map to support your claim.


to stay safe from predators
to care for the young
Living in Groups
to hunt for food
to hunt for food

Name _____ Date _____

Activity Page 5.2 Use with Lesson 5.

How Big Are Animal Groups?

Use the information in the table to **answer the questions** below it.

Species	Number of Individuals in the Group
African lion	15–40
Gray wolf	7–8
Bottlenose dolphin	2–15
Blue wildebeest	1,000,000
Meerkat	Up to 40
African elephant	3–52
Domestic honeybee	40,000–80,000
Killer whale	5–30
Leaf-cutter ant	6,000,000–16,000,000
Emperor penguin	10–500

1. Read the two claims. Circle the one that the table supports.

Most animals have groups of about the same size.

Animal groups vary greatly in size.

2. How does evidence from the table support your claim?

_____

_____

_____

Name _____ Date _____

Activity Page 6.1 Use with Lesson 6.

Snowy Owl Fact Sheet

Habitat:	Arctic tundra
Climate:	The coldest on Earth. Winters are very long. Plants can grow only two months of the year. There is not much rain or snow, so it is very dry.
Ground and soil:	The ground is rocky and flat. The soil is frozen all year. But in summer, some ice melts, and there are puddles of water.
Other species in this habitat:	Plants/plantlike organisms: Bushes, grasses, lichens, and mosses grow low to the ground. There are no trees. Animals: caribou, arctic hares, lemmings, polar bears, arctic foxes, mosquitoes
What eats it?	Wolves and foxes
Physical traits:	• Like other owls, this bird has two very big eyes that face forward. • Short, hooked beak. Very sharp curved talons on their feet. • Feathers are thick and heavy. Feathers of male are white. Feathers of female and young are white with black spots. Even their feet are covered with feathers.
Behavioral traits:	• Moves by walking, hopping, and flying. Can fly low to the ground. • Rests next to small bumps in the ground to get out of the wind. • Hunts for food in daytime or nighttime. • Swallows prey whole. • Stores food on the ground that it cannot eat for later. Makes a nest on the ground. The male owl guards the nest. The female sits on the eggs and chicks to keep them warm. The male brings food to the female.
Food and water sources:	• Eats three to five lemmings (small mouselike animals) each day. • Gets water from eating lemmings.
Group size:	Lives mostly alone, except to mate and reproduce.

Name _____ Date _____

Activity Page 6.2 Use with Lesson 6.

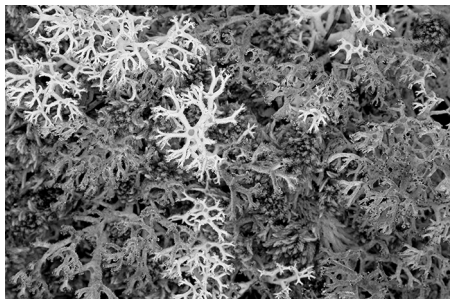
Caribou Fact Sheet

Habitat:	Arctic tundra
Climate:	The coldest on Earth. Winters are very long. Plants can grow only two months of the year. There is not much rain or snow, so it is very dry.
Ground and soil:	The ground is rocky and flat. The soil is frozen all year. But in summer, some ice melts, and there are puddles of water.
Other species in this habitat:	Plants/plantlike organisms: Bushes, grasses, lichens, and mosses grow low to the ground. There are no trees. Animals: snowy owls, wolves, arctic hares, lemmings, polar bears, arctic foxes, mosquitoes
What eats it?	Wolves and bears
Physical traits:	• Grow and shed antlers every year. • Big hooves on their feet that can spread out wide. Edges of hooves are sharp for walking on ice and digging in snow. • Have two kinds of hair: long stiff hairs to shed water and soft fur to keep warm. The long hairs help them float in water.
Behavioral traits:	• When winter is coming, they travel to a forest for shelter. • Can run 40 miles per hour when chased by a predator, such as a wolf or bear. • Can swim across fast-flowing rivers. • Males use their antlers to fight other males for mates. • They move to windy or drier ground to keep away from mosquitoes.
Food and water sources:	• In summer, they eat grasses and other tundra plants. In winter, they eat forest plants called lichens that are under the snow. • They drink water from rivers and from puddles of melted ice.
Group size:	Travel in a large herd each season. The herd keeps moving so it does not eat all the food in an area.

Name _____ Date _____

Activity Page 6.3 Use with Lesson 6.

Reindeer Lichen Fact Sheet



Habitat:	Arctic tundra
Climate:	The coldest on Earth. Winters are very long. Plants can grow only two months of the year. There is not much rain or snow, so it is very dry.
Ground and soil:	The ground is rocky and flat. The soil is frozen all year. But in summer, some ice melts, and there are puddles of water.
Other species in this habitat:	Lichen are not plants or animals. In fact, they are two kinds of organisms living together. One partner is a fungus, and the other is an alga. Plants/plantlike organisms: Bushes, grasses, other lichens, and mosses grow low to the ground. There are no trees. Animals: snowy owls, wolves, arctic hares, lemmings, polar bears, arctic foxes, mosquitoes
What eats it?	Reindeer lichen are also called *caribou lichen*. It is the main winter food of caribou. Not many other animals eat it.
Physical traits:	• Can survive in very cold temperatures. • Does not get very tall. • Has no roots. • Makes chemicals that stop insects from eating it.
Behavioral traits:	• When no water is available, lichens dry out and become hard. When there is water, it will become soft again. • Can grow in the cracks of rocks. • Can grow under snow.
Food and water sources:	• Lichens make their own food using energy from sunlight. • It stores water in parts of the plant.
Group size:	Lives in large groups but is not a social animal.

Name _____ Date _____

Activity Page 6.4 Use with Lesson 6.

Purple Sea Star Fact Sheet

Habitat:	Pacific Ocean coastal tide pool
Climate:	The ocean water along the Pacific coast is cold. When the water covers the rocks, the tide pool will be cold. When there is no water, the sun beats down, and the tide pool will be hot.
Ground and water:	Tide pools are located on the rocky coastline between high and low tides. Waves crash on the rocks. At different times of the day, the rocks are covered in water or not. The ocean water that covers the tide pools is salty.
Other species in this habitat:	Other kinds of sea stars, mussels, limpets, chitons, snails
What eats it?	Sea otters and seagulls
Physical traits:	• Has a star-shaped body with four to seven arms. • Its color can be purple, orange, red, or brown. • The underside of each arm is covered in tiny suckers. These hold tight to rocks and shells. • If a ray (arm) is lost, a new one can grow in its place.
Behavioral traits:	• Can stay out of the water in the open air for up to eight hours at a time. • Uses suckers to pull apart the two shells of mussels. • Puts its stomach into the mussel shell to eat it.
Food and water sources:	• Eats mussels, barnacles, snails, and other animals with hard shells. One sea star can eat up to eighty mussels a day. • Takes in seawater through an opening in its body.
Group size:	Not a social animal, but they do live close to one another, sometimes on top of one another.

Name _____ Date _____

Activity Page 6.5 Use with Lesson 6.

Turban Snail Fact Sheet

Habitat:	Pacific Ocean coastal tide pool
Climate:	The ocean water along the Pacific coast is cold. When the water covers the rocks, the tide pool will be cold. When there is no water, the sun beats down, and the tide pool will be hot.
Ground and water:	Tide pools are located on the rocky coastline between high and low tides. Waves crash on the rocks. At different times of the day, the rocks are covered in water or not. The ocean water that covers the tide pools is salty.
Other species in this habitat:	Other kinds of snails, mussels, limpets, chitons, sea stars
What eats it?	Purple sea stars, sea otters, crabs, other snails, octopuses, seagulls, humans
Physical traits:	• Hard shell shaped into a coil. Shell is about one inch wide. • Soft body that can fit inside the shell. • A large black flat foot comes out of the shell. The foot is used to move and to hold tightly to rocks. • Small tentacles that have eyes on their ends. • A mouth with toothlike parts can scrape food off rocks. • Gets air from water with a part called a gill. When they are out of water, they get air from the water inside their shells. • A round hard part covers the opening to the shell when the body is completely inside.
Behavioral traits:	• When not covered in water, individuals group in shady spots on the rocks. • Moves away from purple sea stars. • May roll downhill to move away from a predator faster. • Can crawl onto a predator snail's shell to escape harm.
Food and water sources:	• Eats algae and seaweeds off rocks. • Uses seawater for water and for breathing.
Group size:	Individuals can be found in large groups in tide pools but are not social animals. If a snail senses that other snails are being eaten, it moves away to safety.

Name _____ Date _____

Activity Page 6.6 Use with Lesson 6.

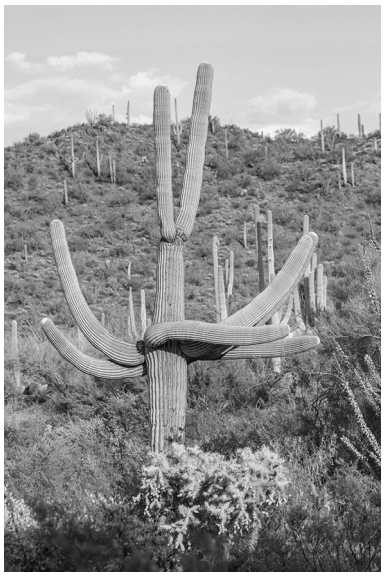
Surfgrass Fact Sheet

Habitat:	Pacific Ocean coastal tide pool
Climate:	The ocean water along the Pacific coast is cold. When the water covers the rocks, the tide pool will be cold. When there is no water, the sun beats down, and the tide pool will be hot.
Ground and water:	Tide pools are located on the rocky coastline between high and low tides. Waves crash on the rocks. At different times of the day, the rocks are covered in water or not. The ocean water that covers the tide pools is salty.
Other species in this habitat:	Animals: Sea stars, mussels, crabs, limpets, chitons, snails. Limpets are animals similar to snails. Plants: Pickleweed Plantlike organisms: Algae, seaweed
What eats it?	One kind of limpet lives only on surfgrass.
Physical traits:	• Leaves are long green ribbons that float on the water in the tide pool. This makes shade and keeps the habitat cooler. • Roots are very strong. They attach themselves to rock. • Also provides hiding places for animals.
Behavioral traits:	• Can reproduce underwater. • Will not grow near polluted water.
Food and water sources:	• Makes its own food using energy from the sun. • While most kinds of plants need fresh water, surfgrass can use salt water.
Group size:	Surfgrass plants grow near one another. They can look like a meadow habitat on land.

Name _____ Date _____

Activity Page 6.7 Use with Lesson 6.

Saguaro Cactus Fact Sheet



Habitat:	Sonoran Desert in Arizona, California, and Mexico
Climate:	The Sonoran is a hot desert. It rains very little and only in winter and summer.
Ground and water:	Rocky soil that water passes through easily. It will grow on the side of a hill or where the ground is flat.
Other species in this habitat:	Gila woodpeckers cut holes in the cactus. They build nests in the holes.
What eats it?	Collared peccaries, jackrabbits, long-nosed bats, doves, woodpeckers, insects
Physical traits:	• Has two kinds of roots. One kind goes deep in the ground to reach water. The other kind is right near the surface to take up rainfall. • Has spines for protection.
Behavioral traits:	• Grows very slowly. • The flowers open at night. Bats help the flowers make seeds for reproduction. • The young plants need to grow under the shelter of bushes. • Can die if there are freezing temperatures.
Food and water sources:	• Makes its own food using energy from the sun. • Roots take up water from the ground.
Group size:	Saguaros do not behave in groups the way many animals do.

Name _____ Date _____

Activity Page 6.8 Use with Lesson 6.

Gila Monster Fact Sheet

Habitat:	Sonoran Desert in Arizona, California, and Mexico
Climate:	The Sonoran is a hot desert. It rains very little and only in winter and summer.
Ground and water:	Rocky soil that water passes through easily.
Other species in this habitat:	Animals: Coyotes, desert tortoises, diamondback rattlesnakes, Gila woodpeckers, great horned owls, kangaroo rats, bark scorpions Plants: Saguaro cacti, trees such as desert ironwoods, bushes such as creosote bushes, smaller plants such as desert marigolds and summer poppies
What eats it?	Coyotes, large birds such as owls
Physical traits:	• Can be as long as two feet. • Has a very strong bite. • Poison from its mouth can kill small animals. • Uses a forked tongue to smell prey. • Stores fat in its tail so it can go a long time without food. • Has brightly colored warning spots on its skin.
Behavioral traits:	• Can find eggs six inches underground. • Only has to eat three or four times a year. • Spends nearly all of its time underground. Comes out at night to find food.
Food and water sources:	• Eats other lizards, baby rabbits, small birds, eggs, and insects. • Does not have to drink for months.
Group size:	Lives alone, except to mate.

Name _____ Date _____

Activity Page 6.9 Use with Lesson 6.

Kangaroo Rat Fact Sheet

Habitat:	Sonoran Desert in Arizona, California, and Mexico
Climate:	The Sonoran is a hot desert. It rains very little and only in winter and summer.
Ground and water:	Rocky soil that water passes through easily.
Other species in this habitat:	Animals: Coyotes, desert tortoises, diamondback rattlesnakes, roadrunner birds, Gila woodpeckers, great horned owls, Gila monsters Plants: Saguaro cacti, trees such as desert ironwoods, bushes such as creosote bushes, smaller plants such as desert marigolds and summer poppies
What eats it?	Owls, snakes, foxes, coyotes
Physical traits:	• Has pouches in its cheeks for carrying seeds. • Has large, strong hind feet and short front feet.
Behavioral traits:	• Hops on two hind feet. Can move six feet in one hop. • Digs underground burrows and spends most of its time there. • Comes out to feed at night, to avoid being seen by predators. • Carries seeds to the burrow and stores them there.
Food and water sources:	• Eats seeds from grass plants and bushes, other plant parts, and insects. • Never drinks water. Gets enough water from the seeds it eats.
Group size:	Lives alone.

Name _____ Date _____

Activity Page 6.10 Use with Lesson 6.

Bluegill Fact Sheet

Habitat:	Freshwater ponds of eastern North America
Climate:	Cold winters, hot summers, a medium amount of rainfall
Ground and water:	Ponds are small bodies of water. The surface is calm. The water is not too deep. The bottom of the pond is often muddy. The water in a pond may come from a stream.
Other species in this habitat:	Animals: Dragonflies, frogs, catfish, painted turtles, snails Plants: Water lilies, duckweed
What eats it?	Large birds, raccoons, larger fish
Physical traits:	• Flat-bodied fish that has one eye on each side of the body. • Mouth is very small. • Breathes underwater with gills.
Behavioral traits:	• The male makes a nest at the bottom of the pond. • He makes grunting sounds to attract a female. • The female may lay her eggs in more than one nest. • The male guards the nest. • Bluegills hide during the day among the plants growing at the bottom of the pond. They find food at night.
Food and water sources:	• Small fish, insects, worms. • Takes in fresh water from the pond.
Group size:	Bluegills are social animals. The males make nests near one another. The fish travel in groups of twenty to thirty individuals. The members of the group help each other find food.

Name _____ Date _____

Activity Page 6.11 Use with Lesson 6.

White Water Lily Fact Sheet

Habitat:	• Lives in freshwater ponds of the eastern United States. • This plant is an invasive species in parts of the western United States.
Climate:	Cold winters, hot summers, a medium amount of rainfall
Ground and water:	Ponds are small bodies of water. The surface is calm. The water is only a few feet deep. The bottom of the pond is often muddy. The water in a pond may come from a stream.
Other species in this habitat:	Animals: Bluegill fish, dragonflies, frogs, catfish, painted turtles, snails
What eats it?	Muskrats, ducks, turtles, beavers, insects
Physical traits:	• Large, flat, round leaves float on water. The leaf has a waxy coating that protects it. • White flower floats on water. The flower's sweet smell attracts insects. Once inside, they help the flower produce seeds. • The stalk that connects the leaves to the bottom of the pond can be up to eight feet long.
Behavioral traits:	Needs still water.
Food and water sources:	• Makes its own food using energy from the sun. • Gets water through its roots and gets air from the top of the leaves.
Group size:	Grows in groups that sometimes cover the whole pond surface.

Name _____ Date _____

Activity Page 6.12 Use with Lesson 6.

Painted Turtle Fact Sheet

Habitat:	Freshwater ponds with muddy bottoms all over the United States
Climate:	Cold winters, hot summers, a medium amount of rainfall
Ground and water:	Ponds are small bodies of water. The surface is calm. The water is only a few feet deep. The bottom of the pond is often muddy. The water in a pond may come from a stream.
Other species in this habitat:	Animals: Bluegill fish, dragonflies, frogs, catfish, snails
What eats it?	Raccoons, otters, minks, foxes
Physical traits:	Hard shell, which it can pull its head and legs into for protection.
Behavioral traits:	• Sits in the sun on rocks or logs sticking out of the water to get warm. The sun also helps get rid of leeches on its skin. • Can dive into water quickly. • Eats when underwater. • Rests at bottom of the pond at night. • Hibernates when the winter is cold. Often buries itself in the mud on the bottom of the pond. Does not need to breathe for months at a time.
Food and water sources:	• Eats plants, algae, small fish, insects. • Takes water from the pond.
Group size:	Often sit in the sun as a group. They also travel over land as a group.

Name _____ Date _____

Activity Page 6.13 Use with Lesson 6.

Yellow-Banded Poison Dart Frog Fact Sheet

Habitat:	Tropical rain forest of South America
Climate:	Warm and wet all year round. Daytime and nighttime temperatures are about the same.
Ground and water:	Lives mostly on the forest floor. Can be found on the soil, on wet rocks or fallen logs, or on tree roots.
Other species in this habitat:	Animals: Scarlet macaws, capybaras, jaguars, manatees, woolly monkeys, giant anteaters Plants: Rubber trees, Brazil nut trees, balsa wood trees, lianas (vines)
What eats it?	Some snakes
Physical traits:	• Has poison in its skin. • When a predator is nearby, its bright colors are easy to see. They are a warning not to try to eat it. Sticky pads on its toes help it climb. • Uses a short sticky tongue to catch food.
Behavioral traits:	• Males show off their colors to attract female mates. • Only males care for the eggs and the tadpoles after they hatch. The tadpoles need to live in water. So, the male carries the babies on his back and places them in a tiny pool of water.
Food and water sources:	• Eats small insects such as ants, beetles, and crickets. Also eats spiders. • Its poison comes from something it eats. Scientists are not sure which animal gives the frogs the poison.
Group size:	When they are not reproducing, these frogs live alone.

Name _____ Date _____

Activity Page 6.14 Use with Lesson 6.

Scarlet Macaw Fact Sheet

Habitat:	• Tropical rain forest of South America • Lives high up in the tallest rain forest trees.
Climate:	Warm and wet all year round. Daytime and nighttime temperatures are about the same.
Ground and water:	The forest floor is moist and dark. Rivers and wetlands are nearby.
Other species in this habitat:	Animals: Capybaras, jaguars, manatees, woolly monkeys, giant anteaters Plants: Rubber trees, Brazil nut trees, balsa wood trees, lianas (vines)
What eats it?	Monkeys, toucans, large snakes
Physical traits:	• Has brightly colored feathers like other parrots. • Has a large, curved bill.
Behavioral traits:	• Can be found eating clay along a riverbank. Scientists think the clay protects their bodies from poisonous plants. • Uses the left foot and claws for handling objects. The right foot is used for standing. • Makes screaming sounds.
Food and water sources:	• Fruits (including nuts), seeds, leaves, flowers, and insects. • Prefers to build nests in trees near rivers.
Group size:	Usually seen in pairs or family groups. At night, the birds flock together to sleep.

Name _____ Date _____

Activity Page 6.15 Use with Lesson 6.

Brazil Nut Tree Fact Sheet

Habitat:	Tropical rain forest of South America
Climate:	Warm all year round. Daytime and nighttime temperatures are about the same.
Ground and water:	The forest floor below these trees is moist and dark. Rivers and wetlands are nearby.
Other species in this habitat:	Animals: Capybaras, agouti, jaguars, manatees, woolly monkeys, giant anteaters Plants: Rubber trees, balsa wood trees, lianas (vines)
What eats it?	• Humans collect and eat the nuts. • Scientists know of only one wild animal that can bite open the hard fruit. This is the agouti. It eats some of the seeds and buries the others. The seeds that the agouti does not dig up later will sprout and grow into new trees.
Physical traits:	• Is one of the tallest trees in the rain forest. • Its fruit looks like a coconut. Inside are up to twenty-four seeds, each with a hard shell.
Behavioral traits:	Can live for about 400 years.
Food and water sources:	• Makes its own food using energy from the sun. • Grows in parts of the rain forest that get only a small amount of rain for up to half of the year.
Group size:	Usually grows in groups of fifty to one hundred trees.

Name _____ Date _____

Activity Page 6.16 (Page 1 of 2) Use with Lesson 6.

Getting to Know You

Read the fact sheet about the species assigned to you. Then write answers to the questions below.

1. What species are you becoming an expert on?

_____

2. In what habitat does this species live?

_____

_____

3. What are the characteristics of this habitat?

_____

_____

4. What adaptations does the organism have to meet its needs?

_____

_____

_____

_____

5. Make a claim about how it would survive if the organism were moved to another habitat.

_____

_____

_____

6. What evidence from the fact sheet supports your claim?

7. If this organism is an animal, is it part of a group?

8. If it is part of a group, how does being in a group help the organism meet its needs?

Name _____ Date _____

Survival Conference

Welcome to the Survival Conference! You were invited because you are an expert in one species.

Habitat Panel

You will speak as part of a Habitat Panel. Each member of your panel will give a short talk. You should also show a photo of your organism. At the habitat panel, tell each of the following:

1. Say one interesting trait that helps your plant or animal survive in its environment.
2. Tell how your plant's or animal's needs compare with those of other plants or animals discussed at the conference.
3. Make a claim about what might happen to your plant or animal if it were moved to another habitat.
4. Use evidence from the conference to support your claim.

Social Animals Panel

If your fact sheet describes a social animal, you will sit on the Social Animals Panel. Experts on the panel will each give a short talk. In your talk, discuss all four questions below. At the end of the talk, everyone should write answers to the questions.

1. What is one kind of animal that lives in groups?

_____

2. How does being in a group help this animal survive?

_____

_____

_____

3. What evidence was used to support this claim?

_____

_____

_____

4. Was there enough evidence to convince you? Explain why or why not.

_____

_____

_____

Complete this checklist at the end of the Survival Conference. Think about how you did. Check "Always," "Sometimes," or "Never."

Self-Evaluation Checklist			
	Always (2 points)	Sometimes (1 point)	Never (0 points)
I spoke loudly enough and looked at my audience.			
I used a photo in my presentation.			
I answered questions from other students.			
I used science vocabulary.			
I can name and compare different kinds of habitats.			
I can explain how an organism is adapted to its environment.			
I made a claim about what would happen if an animal or plant were moved to another habitat.			
I supported my claim with evidence.			
I listened to claims and evidence about how being in a group helps some animals survive.			
I thought about how well the evidence supported the claim.			

Name _____ Date _____

Activity Page 7.1 Use with Lesson 7.

The Effects of Beaver Dams on Living Things

Complete the information about your assigned topic.

Name of Living Thing:		
	Before Beaver Dam	**After Beaver Dam**
What does it eat?		
Type of living space		
How does it find a mate or lay eggs?		

Name _____ Date _____

Activity Page 7.2 Use with Lesson 7.

How Do Beavers Change the Environment?

Beaver dams change the environment. Do you think they make it easier or more difficult for plants and animals to live? **Write your answer in the space below. Give evidence from what you learned to support your answer.**

Name _____ Date _____

Activity Page 8.1 Use with Lesson 8.

Coral Reefs

Coral reefs are a type of ecosystem in the ocean where many organisms are found.

Watch the video on coral reefs.

Answer the questions that follow.

1. Why are coral reefs important ecosystems?

_____

_____

2. Why do some organisms depend on coral reefs?

_____

_____

3. If coral reefs change or die, would this have a positive or negative impact on other organisms in the sea? Explain why.

_____

_____

Name _____ Date _____

Activity Page 9.1 Use with Lesson 9.

Surviving Change in the Environment

Environmental Change	An Organism That Could Survive Well	An Organism That Could Survive Less Well	An Organism That Could Barely Survive
Trees are cut in a forest.			
A new road is built.			
A pond dries up.			
Sea ice melts.			

Name _____ Date _____

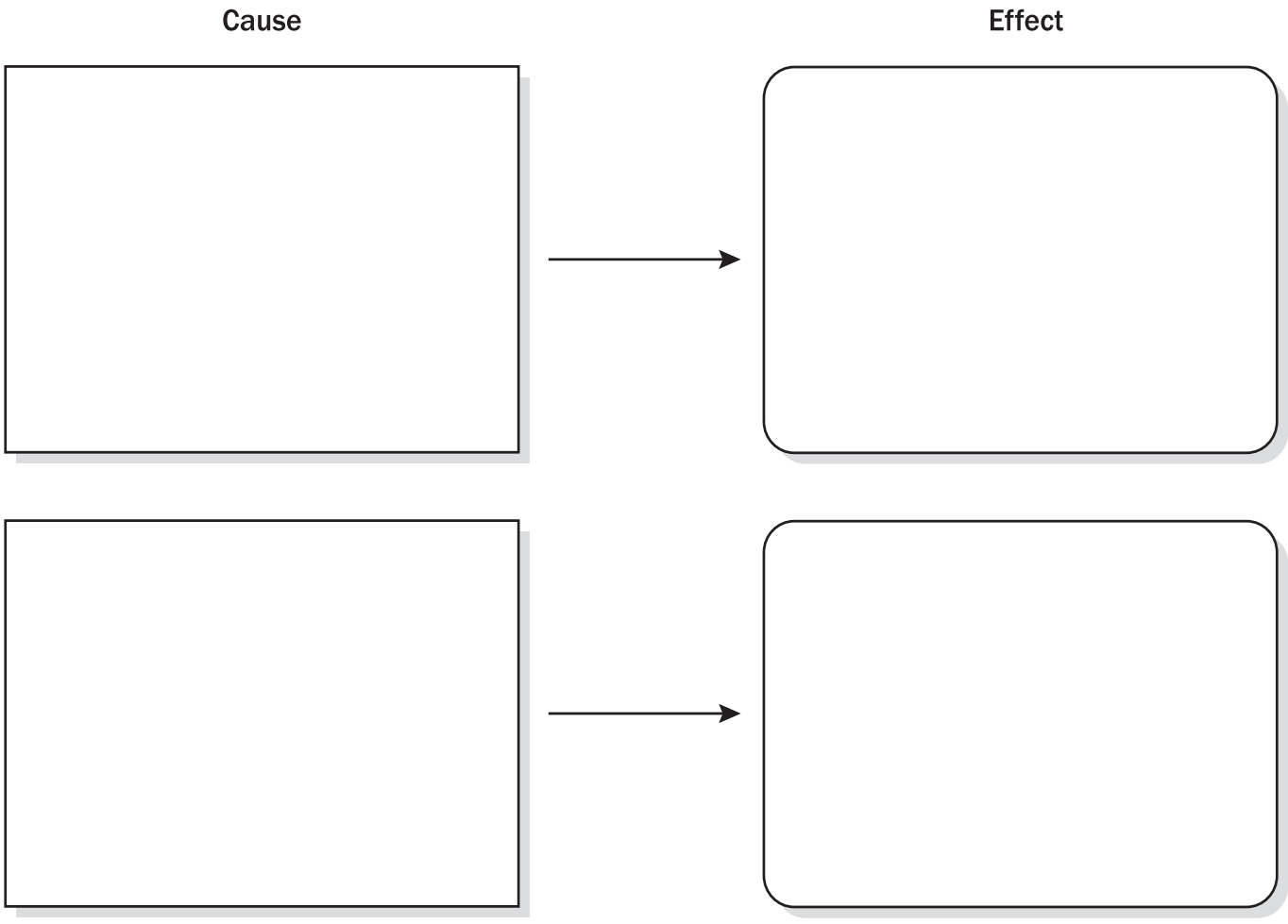
Activity Page 10.1 Use with Lesson 10.

Cause-and-Effect Diagram

Read pages 32, 33, and 34 in the Student Reader.

After you read each example, fill in the diagram below.

- **Identify the cause in the first column.**
- **Identify the effect in the second column.**



Name _____ Date _____

Activity Page 11.1 Use with Lesson 11.

Problems-and-Solutions Table

Complete the table with a partner. Read each ecosystem problem described in Chapter 7, "Ecosystem Problems and Solutions," in the first column. Complete the sentences about criteria and constraints. Then, write one possible solution that conservationists have used to try to help solve each of the problems.

Problem	Criteria A solution to this problem must . . .	Constraints The solution to the problem cannot . . .	Solution
Salmon cannot migrate to lay eggs.			
Wetlands are drying up.			
Animals cannot safely cross roads.			
Sea turtle nests are being disturbed.			

Name _____ Date _____

Activity Page 11.2 Use with Lesson 11.

Thinking About What Makes Solutions Good

Figuring out whether something is good or not is a process called *evaluation*. When you evaluate a solution to a problem, you think about whether or not it is a good solution.

Write answers to the questions below to help you evaluate a solution to a problem.

1. Which environmental problem do you think is most important to find a solution for?

_____

2. What are the criteria for the solution? (Criteria are things the solution must do.)

_____

_____

3. What are the constraints for the solution? (Constraints are things the solution cannot do.)

_____

_____

4. What is a solution that conservationists have used to try to solve the problem?

_____

_____

5. How will this solution solve the problem? Use evidence to support your answer.

_____

_____

6. How does the solution meet the criteria and constraints?

_____

_____

Name _____ Date _____

Activity Page 12.1 Use with Lesson 12.

Local Conservation Project

Write answers to the questions below.

1. What conservation project did you choose?

_____

_____

2. Describe the project.

_____

_____

3. Why is this project important?

_____

_____

4. What kind of human activity caused the habitat issue in the first place?

_____

_____

5. Do you think this project is a good solution to help make the habitat better? Why or why not?

_____

_____

Name _____

Activity Page 12.2

Take home for Lesson 12.

Dear Family Members,

In the past few classroom sessions, your child has learned about the types of changes that occur in ecosystems and the reasons habitats change. There are many human activities that alter habitats and change ecosystems. Conservationists are leading efforts to help reverse or solve some of the destruction done to natural habitats over the years.

For this take-home assignment, your child—and our whole class—will examine conservation efforts or projects that are going on in the local community to address changes to the natural habitat that are caused by human activities. In doing so, your child will answer the question: How is my community helping solve problems of habitat change?

You and your child will have several days to work together to complete this research by taking the following steps:

1. Identify local conservation projects in your community, and have your child select the one that interests him or her the most.

Below are some suggestions of resources that you can contact to find out about the types of conservation efforts going on in your community:

- nature centers
- natural history museums
- parks and recreation departments
- zoos or wildlife centers
- university extension or 4-H programs
- botanical gardens

Below are some examples of types of conservation projects that may be going on in your area:

- planting gardens to attract more pollinators
- organizing waterfront cleanups to reduce litter
- promoting recycling programs to decrease waste
- planting shrubs to stop soil erosion
- adopting parks or highways to clean up litter
- collecting and removing invasive plant species to allow more native species to survive
- planting seeds in damaged areas to encourage more biodiversity

2. Have your child complete Activity Page 12.1 Local Conservation Project. Your child can fill out this Activity Page as research is done on the chosen project. Help your child use the questions on the Activity Page to guide his or her research. Your child will bring this Activity Page back to class.

3. Students will present their conservation projects to the whole class. Then the class will evaluate each project. Students will make a claim about the merits of each project. The whole class will then vote on the one they want to contribute to.

Name _____ Date _____

Activity Page 13.1 Use with Lesson 13.

Let's Dig!

Some scientists spend their days digging up old fossils, such as bones, rocks, and shells. Today, you will get to dig through some layers of earth to see what you can find!

In your group, carefully use the pointy end of your paintbrush to look through the layers of earth to find fossils. When you find a fossil, brush it off with the brush end. Set the fossil on the paper towel.

How many layers of earth are in your pan?

_____

Describe the layers of earth in your pan. What do they look and feel like?

_____

What kinds of fossils did you find in your pan?

_____

Which fossils did you find in the bottom layer of earth?

_____

Which fossils did you find in the middle layer of earth?

_____

Which fossils did you find in the top layer of earth?

_____

Do you think all of the fossils are the same age? Why or why not?

_____

_____

_____

Do you think that the habitats of these fossilized organisms have changed over time? Why or why not?

_____

_____

_____

Name _____ Date _____

Activity Page 14.1 Use with Lesson 14.

Analyzing Fossils

Carefully observe the fossils on each page of Chapter 8, "Fossils and How They Form." Record your notes about the fossil and its habitat in the space on the table.

Fossil	What can you tell about the animal or plant?	What can you tell about the habitat?
Page 41		
Page 42		
Page 43		
Page 44		
Page 45		
Page 46		

Name _____ Date _____

Activity Page 14.2 Use with Lesson 14.

How a Fossil Is Made

Cut out the steps. Glue them in the correct order to show how a fossil is formed.

Step 1	
Step 2	
Step 3	
Step 4	
Step 5	

A fossil is formed.

A plant or animal dies.

It is covered in mud.

Soft parts decompose.

Minerals replace the hard parts.

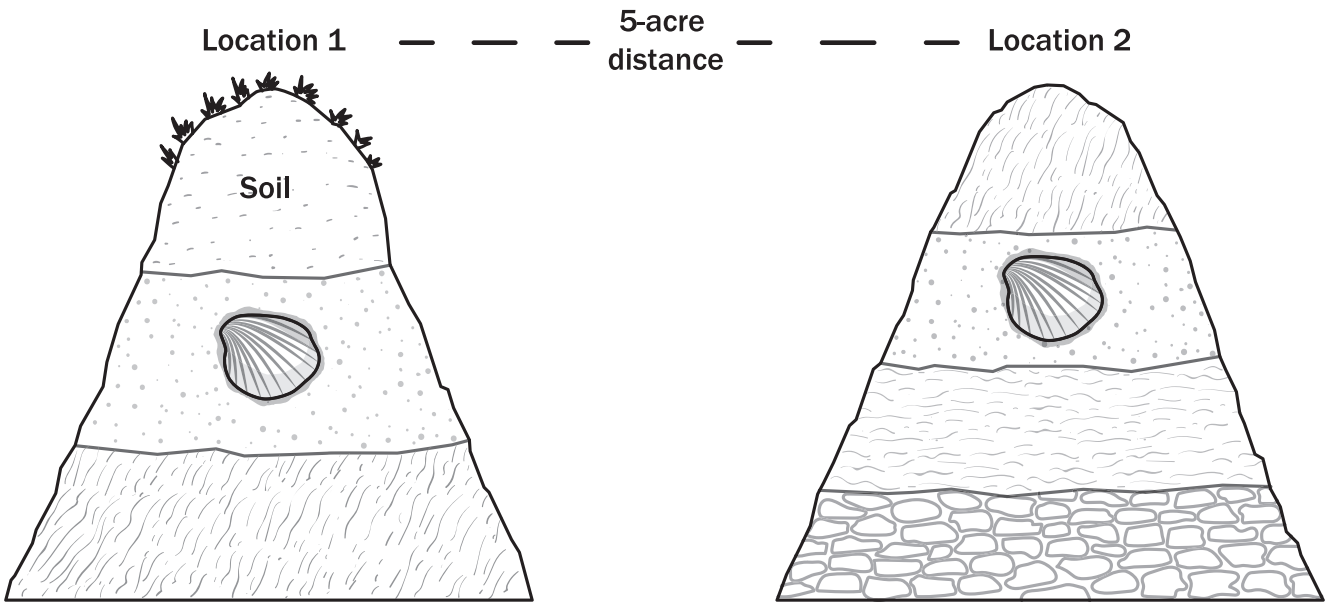
Name _____ Date _____

Activity Page 15.1 Use with Lesson 15.

Rock Layers

Scientists can know about past habitats by looking at layers of rocks.

<u>Study</u> the diagram below.



<u>Answer</u> the questions below.

True or False: Site 2 is older than Site 1. _____

Explain why you think so.

_____

Which layer of rock is the newest? How do you know?

_____

What can you tell about the organisms that existed first?

_____

What can you tell about the habitats that existed in the past and how they have changed?

_____

Name _____ Date _____

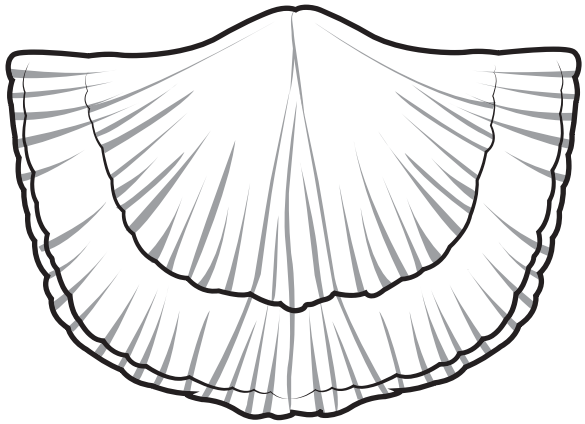
Activity Page 16.1 Use with Lesson 16.

A Fossil Mystery

Alex is a farmer who grows corn. He lives in an old farmhouse that his grandfather built many years ago. The property has a big red barn where Alex keeps the machinery that he uses to work the cornfields. Alex's farm covers acres and acres of land, and at the very edge of the property is a rocky hillside with various layers that has been there ever since Alex's grandfather bought the farmland.

Alex was always fascinated with the hillside on the farm's property. He used to study the different layers closely. Some layers were grainy and dull. Others had sparkly crystals in them. He wondered how long the layers had been there.

One day while Alex was plowing his fields to plant new seeds for corn, something unusual caught his eye. He hopped down from his tractor and picked up something that looked like a seashell. After he dusted it off, this is what it looked like.

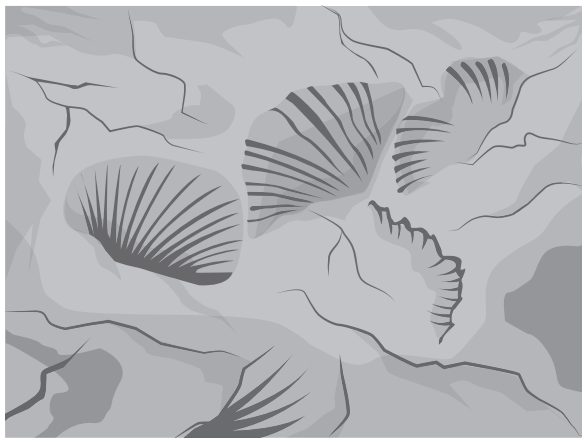


Alex ran back to the house with the fossil in his hand and called his friend Sue, who is a scientist, to come over right away. When Sue arrived, she and Alex studied the treasure. "Do you know what this is?" Sue asked. "This is a brachiopod fossil!"

Alex jumped with excitement at the thought of having found his very own fossil on his farmland.

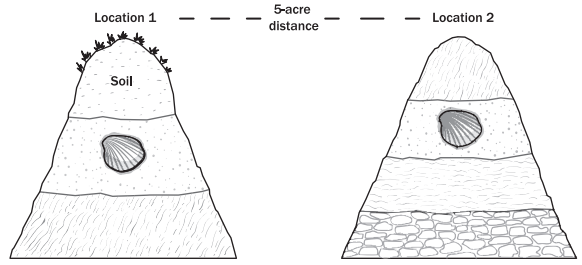
"I bet there are others like this around here," Sue said.

Together, Alex and Sue walked around the farm looking for more fossils. When they got to the rocky hillside at the edge of the property, Alex and Sue studied the rocks very carefully. Alex was certain they would not find any more fossils there. After all, it was acres and acres away from where he found the first fossil.



But to their delight, they found more brachiopod fossils stuck in one of the layers that made up the hillside!

Sue drew a diagram of the rock layers for the field and the hillside for her and Alex to look at. They studied her picture and wondered about how the fossils got there.



Name _____ Date _____

Activity Page 16.2 Use with Lesson 16.

Solving a Fossil Mystery

Now it's your turn to help Alex and Sue figure out why the fossils appeared on the farm! Help them solve this mystery by following the instructions below.

Fill in the chart about the fossil that was found in the scenario:

Name of Fossil	Type of Organism (Animal or Plant)	Where the Fossil Was Found

Answer the questions.

1. Describe the environment in which the organism that is now fossilized most likely lived.

_____

2. Does this fossil seem similar to any organisms that you know of today?

_____

3. What can you conclude about what Alex's farmland looked like many years ago compared to how it looks today? Use data from the scenario as evidence to support your answer.

_____

_____

_____

_____

Name _____ Date _____

Activity Page UR.1 Use with Unit Review.

When Living Things Cannot Survive Habitat Change

When habitats change, some organisms survive well, some survive less well, and some cannot survive the changes.

Select one of the organisms that you have read about that has gone extinct or that is an endangered species.

My extinct or endangered species is _____.

Answer the following questions about it.

1. Why is it endangered or extinct?

_____

_____

_____

2. What evidence explains how it became endangered or extinct?

_____

_____

3. Was (or is) there any way to help it to survive better?

_____

_____

4. What kinds of habitat change threaten these living things?

_____

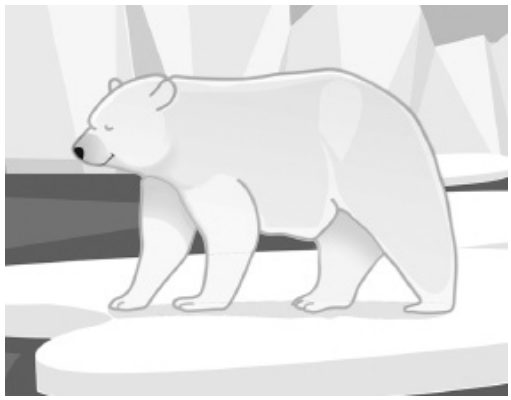
_____

Name _____ Date _____

Unit Assessment: What Have I Learned About Habitats and Change?

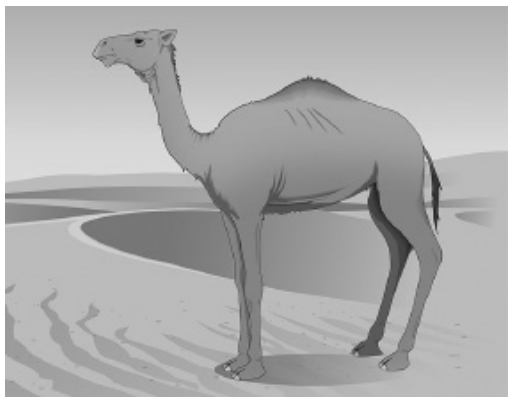
Answer the items below to show what you have learned.

a)



Polar bear

c)

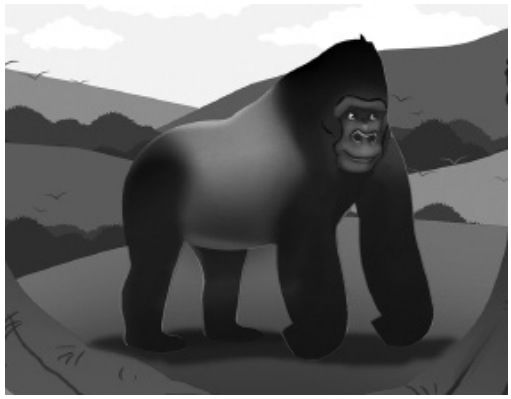


Camel

b)

Dolphin

d)



Gorilla

1. Study each picture. Then write the word from the bank on each line to show where each animal lives.

forest	tundra	desert	ocean

polar bear _____

dolphin _____

camel _____

gorilla _____

Some animals have lots of hair to help them live in cold places, while others have no hair to help them live in warm places. Some have fins to help them swim in water, while others have arms and legs to help them move on land. Some plants and animals hold water in their bodies to help them survive in dry places.

2. Read the paragraph. Think about the adaptations that plants and animals have that help them survive. Then answer the question.

Which of the following plants and animals have adaptations that allow them to survive in a desert? Circle all the correct answers.

a) polar bear

b) cactus

c) gorilla

d) camel

e) dolphin

f) snake

3. Name an animal that lives in groups. Then explain how the adaptation of living in groups allows those animals to survive in their environment.

Animal: _____

Why it lives in groups: _____

_____

_____

_____

4. Organisms have adaptations, or traits, that help them survive in specific habitats. Think about how each trait below is used. Then match each trait to the habitat it is adapted for.

thick fur	tundra
long, hard claws	seashore
shells	desert
places to store water	underground

5. Choose two habitats from the bank. Then tell how they are similar and different.

tundra	seashore	desert	underground

6. Think about what might cause each change below. Then write *natural* or *human-made* on each line to describe the change.

a) A beaver dam causes a pond to form. _____

b) A concrete dam is built to stop water flow. _____

c) Lightning starts a fire that destroys a forest. _____

d) A volcano covers a large area in lava and ash. _____

e) Pollution causes waterways to get warmer. _____

f) All the trees in an area are cut down for houses. _____

g) A coastal area becomes flooded by rising seas. _____

7. Name a habitat. _____

Name an animal that lives in that habitat. _____

Name a change to that habitat. _____

Describe how the animal might respond to the change in its habitat. _____

Tell how an ecosystem might change over time. _____

Describe a trait of a plant or animal that would be helpful or harmful after the ecosystem changes.

8. Read the paragraph below. Then answer each question that follows.

A coast is flooded by rising waters. The only way to make the coast like it was before is to build a levee. A levee is a wall made to keep water out.

Name one problem the levee will solve.

Name one problem the levee might cause.

9. There are five rock layers. Each one is a different age. Put them in order from oldest to youngest. The oldest is 1, and the youngest is 5.

_____ This layer contains fossils of the first life on Earth.

_____ This layer contains fossils of the most recent life on Earth.

_____ This layer is from before there was life on Earth.

_____ This layer contains fossils from the life on Earth right before humans.

_____ This layer contains fossils of life right after the first life on Earth.

Unit Assessment (Page 5 of 5)

A fossil is the remains of a living thing from long ago, usually formed in layers of rock.

10. Based on the description above, which of the following are fossils? Circle all the correct answers.

a) a seashell on the shore

b) rat bones on the side of the road

c) a plant impression in rock

d) a snake skin in the dirt

e) a dinosaur tooth on the ground

f) a footprint in a rock slab

Scientists find five different layers of rock in an area. The first layer has the fossils of sea creatures in it. The second layer has no fossils. The third layer has the fossils of dinosaurs in it. The fourth layer has no fossils. The fifth layer has the fossils of sea creatures.

11. What is a possible explanation for how the habitats in the rock layers change over time? Use evidence from the paragraph to explain your answer.

Activity Pages Answer Key: *Habitats and Change*

AP 1.1 The Needs of Bluebirds (Page 129)

Food: berries on plants; grasshoppers, ants, and caterpillars on the ground

Water: puddles of water or a stream

Shelter: openings in trees or wooden structures, such as fences

Space: a place to perch and see food and water

AP 2.1 What Lives in a Grassland Habitat? (Page 130)

clownfish: cannot meet its needs in a grassland; A clownfish needs to live in saltwater coral reefs with anemones.

cactus: cannot meet its needs in a grassland; The grassland habitat is wetter than a desert.

grass: can meet its needs in a grassland; Lots of types of grass live there.

duck: cannot meet its needs in a grassland; A duck needs water, such as a pond.

arctic hare: cannot meet its needs in a grassland; The grassland habitat is warmer than the Arctic.

Answers will vary. Make sure the answer is a living organism. Claims will vary. Students should provide facts for their claims as evidence.

AP 3.1 What Is the Advantage of the Adaptation Called Blubber? (Pages 131–132)

STEP 5: Answers will vary depending on student.

STEP 8: Student answers should contain evidence from their experiment and should reflect the fact that blubber helps keep these animals warm in cool or cold environments.

AP 4.1 What's My Adaptation? (Pages 133–134)

Examples:

giraffe: mostly grassland with a few trees; long neck; obtaining food

topi: mostly grassland with a few trees; long skinny snout for finding young grasses; obtaining food

AP 4.1, continued

owl: forest; large eyes to see in dark, talons and hooked beak for grabbing and tearing animals; obtaining food

cactus: hot desert; thick stem, waxy skin, sharp spines; protection

horned viper: desert; colors that help it blend in; protection

poison dart frog: rain forest; poison, bright warning colors; protection

capybara: rain forest; jumps into water, webbed feet for swimming, can hold breath underwater; protection

widowbird: grasslands; long tail feathers on males; attracting mates

giraffe: mostly grassland with a few trees; males use long necks to fight for mates; reproducing

Answers will vary depending on the example chosen. If the adaptation met the need for food or water, the organism might starve or die from lack of water. If it met the need for protection, the organism might be eaten. If it met the need for reproduction, the organism would survive but might not have offspring.

AP 5.1 Advantages of Living in Groups (Pages 135–136)

Samples for **to stay safe from predators**: Meerkat sentry keeps watch; some meerkats dig burrows; wildebeests move close together.

Samples for **to care for young**: The whole pack cares for wolf pups; meerkat helpers babysit; all elephant females care for the calves.

Samples for **to hunt for food**: Lions hunt as a pack; dolphins herd fish into a tight ball.

Most students will claim that there is more than one advantage to animals living in groups. They should support their claim with evidence from the concept map.

AP 5.2 How Big Are Animal Groups? (Page 137)

1. Animal groups vary greatly in size.
2. Students should cite specific numbers from the table to show that animal groups vary greatly in size.

AP 6.16 Getting to Know You (Pages 153–154)

Answers will vary based on the species assigned to each student. Answers should accurately reflect the fact sheets provided to students, and student claims should be reasonable based on the evidence provided in those fact sheets.

AP 6.17 Survival Conference (Pages 155–156)

Habitat Panel: Answers will vary but should reflect an understanding of the environment in which the assigned animal lives.

Social Animals Panel: Answers will vary but should reflect the kind of social groups in which the assigned animal lives.

Checklists will vary depending on students' views of how they did during the conference.

AP 7.1 The Effects of Beaver Dams on Living Things (Page 157)

Answers in the table will vary but should accurately reflect the research that each student conducted.

AP 7.2 How Do Beavers Change the Environment? (Page 158)

Beavers mostly change the environment to make it better when they build dams. The beaver dam provides a home for other animals such as muskrats. The beaver dam causes the river to slow and form a pond. The pond is a place where water lilies can grow and amphibians and fish can live. Although beaver eat aspen trees, the trees grow back quickly and thicker than before.

AP 8.1 Coral Reefs (Page 159)

1. Students should explain that coral reefs are important ecosystems because they are home to many different species and organisms.
2. Students should explain that some organisms depend on coral reefs for shelter or a safe habitat.

3. Students should be able to explain that if coral reefs change or die, this would have a negative impact on other sea organisms because the organisms that live there and depend on the coral reefs would have to move, find new sources of food, find new shelter, etc.

AP 9.1 Surviving Change in the Environment (Page 160)

Sample answers for each environmental change:

Trees are cut in a forest: insects that live in soil; ferns and other shade plants; bees with hives in the tree

A new road is built: vultures; deer; turtles

A pond dries up: raccoon; frogs and turtles; water lilies, fish

Sea ice melts: seals; polar bears; fish that live in cold water

AP 10.1 Cause-and-Effect Diagram (Page 161)

Students should correctly identify the causes for pages 32, 33, and 34, as well as correctly identify at least one of the effects, or ways in which the animal responded to the changes in the environment.

Pages 32 and 33: Cause: Sea ice is melting. Effects: Polar bears are eating less. They are using more energy to hunt for food. Some are dying.

Page 34: Cause: River temperatures are rising. Effect: Salmon are migrating earlier in the year, when the rivers are cooler.

AP 11.1 Problems-and-Solutions Table (Page 162)

Answers in the table will vary but should reflect the evidence provided throughout the Student Reader.

AP 11.2 (Page 163)

Sample answers:

1. Animals cannot safely cross roads.
2. Animals can migrate safely. Traffic can move smoothly.
3. animal behavior, resources
4. build wildlife crossings above roads

AP 11.2, continued

5. Wildlife can cross above roads, below roads, or over dams so that they are safe from cars and can have increased chances to survive in the environment and to reproduce or find mates.
6. It allows animals to migrate safely and keep traffic running smoothly. Animals did use it, so they changed their behavior.

AP 12.1 Local Conservation Project (Page 164)

Answers to the questions will vary based on which local conservation project each student chose. Answers should reflect student research.

AP 13.1 Let's Dig! (Page 166)

There are three layers in the pan. The remaining answers will vary based on which objects are buried in which layers in the pan and what these objects represent. Student answers should show an understanding of the relative age of fossils based on which layers they were found in (the oldest fossils will be in the layer on the bottom of the pan, the youngest fossils will be in the top layer, for example).

AP 14.1 Analyzing Fossils (Page 167)

Page 41: It was an animal that walked and could have lived on land and in water; it could have been wet or dry.

Page 42: It was a meat eater; cannot tell.

Page 43: A snail may have lived in it; it was underwater.

Page 44: It was from a pine tree; it was a forest.

Page 45: It had protection from other animals; it was cold.

Page 46: They were insects; it was a forest.

AP 14.2 How a Fossil Is Made (Page 168)

Step 1: A plant or animal dies.

Step 2: It is covered in mud.

Step 3: Soft parts decompose.

Step 4: Minerals replace the hard parts.

Step 5: A fossil is formed.

AP 15.1 Rock Layers (Page 169)

- False. Site 1 contains a layer older than Site 2 because the lowest layer does not contain fish but does contain trilobites, which existed before fish.
- Layers G and Z contain the same fossils and are the same layer in different locations. These are the newest layers in both locations because they are on top of all the other layers.
- Answers will vary but may include that they had hard outer shells that protected their bodies.
- The earliest habitats in both locations were watery because the fossils found in them are of animals that lived in water. The later habitats were on land because they had plants and land animals living on them, as shown by the fossil footprints and leaf impressions. These show that over time, the habitats changed.

AP 16.2 Solving a Fossil Mystery (Page 171)

chart: column 1: brachiopod; column 2: shelled animal; column 3: in a layer of rock in a hill on a farm; and in a farm field

1. water
2. Yes; it is similar to some shelled organisms that live in water today.
3. Because the fossil is from an organism that lived in water and there is more than one on the farm, the area once must have been covered in water. Today it is dirt and rock. This means that it changed over time.

AP UR.1 When Living Things Cannot Survive Habitat Change (Page 172)

Answers will vary based on the species each student chooses but should be based on evidence from the Student Reader and sound research.

Unit Assessment: Teacher Evaluation Guide

Teacher Directions: The Unit Assessment is not intended to assess student understanding of Next Generation Science Standards (NGSS). Assessment of these standards is done in each unit and lesson through a variety of hands-on and other activities.

The Unit Assessment for students is set as a fifty-point test. Assessment items with simpler answers that test knowledge but not the deeper understandings of the content, such as multiple choice, are worth fewer points. Assessment items that require more complex thinking and a deeper understanding of the content, such as providing short answers that explain phenomena, are worth more points. Assessment items that require more extensive understanding of content—as well as synthesis of that content and other student knowledge—are weighted with more points.

Expected Answers and Model Responses

1. polar bear: tundra (4 points)
dolphin: ocean
camel: desert
gorilla: forest

2. **b)** cactus (3 points)
d) camel
f) snake

3. Sample answer: Zebras. They live in groups to better protect themselves from predators. (5 points)

4. thick fur—tundra (4 points)
claws—underground
shells—seashore
places to store water—desert

5. Sample answer: Tundras are very cold places. They have few trees or vegetation. They are often covered in snow. Deserts are very warm places during the day and cold at night. They have few trees and little vegetation. They are often covered in sand. (5 points)

6. **a)** natural (7 points)
b) human-made
c) natural
d) natural
e) human-made
f) human-made
g) natural

7. habitat: (sample) ice sheets (4 points)

animal: (sample) polar bear

change: (sample) Ice sheets are melting.

response: (sample) Polar bears may change their diet or try to find new ice sheets.

8. Sample answer: A sea dries up and becomes a desert. Gills on fish would be harmful because the fish need water to breathe and cannot live in a desert. (3 points)

9. Problem to solve: Sample answer: By keeping water out, the levee will save the lives of many animals that live on the coast.

Problem to cause: Sample answer: Some land animals eat fish. The levee may stop them from getting food. (2 points)

10. 2, 5, 1, 4, 3 (5 points)

11. **c)** a plant impression in rock (3 points)

e) a dinosaur tooth on the ground

f) a footprint in a rock slab

12. Sample answer: The oldest and youngest habitats in the layers had sea creatures in them. This means that they were both watery areas. The middle habitat contained dinosaurs. This meant that it was a land area. The rock layers show that the habitats went from water, to land, and back to water over time. (5 points)

Appendix A

Glossary

Green words and phrases are Core Vocabulary terms for the unit, and Student Reader page numbers are listed in parentheses. **Bold-faced words and phrases** are additional vocabulary terms related to the unit that you should model for students during instruction and that are often used within the Student Reader, and these latter terms do not have specific page numbers listed. Vocabulary words are not intended for use in isolated drill or memorization.

A

adaptation, n. a body part or behavior that helps a living thing survive (7)

advantage, n. a natural or learned condition that helps an organism adapt to a particular habitat

amber, n. hardened resin from trees

B

behavioral trait, n. a way an organism behaves, or acts (13)

C

camouflage, n. a pattern of coloration that makes an organism difficult to see against the background in its habitat

climate, n. the pattern of weather over a long period of time (30)

conservation, n. the act of protection of a species, habitat, or resource

conservationist, n. a person who works to protect plants, animals, habitats, and ecosystems (35)

conserve, v. to save or protect

construction, n. the building of a structure

D

dam, n. a structure that blocks flowing water

decompose, v. for an organism to break down and become part of the environment

desert, n. a dry habitat that is often hot and sandy

disadvantage, n. a condition or trait that is harmful or presents a challenge

disrupt, v. to cause a disturbance or problem

dominance, n. strength or power over other weaker individuals

E

ecosystem, n. all the living and nonliving things in a place and their interactions (19)

ecosystem change, n. a natural or human-caused influence in a habitat

endangered species, n. a species that is at risk of becoming extinct within a few years (58)

environment, n. the conditions or surroundings in which plants and animals live

evidence, n. proof of the past or of a fact, such as fossils that show imprints of animals that lived long ago

extinct, adj. having no surviving members (47)

F

forest, n. a habitat that is thick with trees

fossil, n. the remains of a living thing from long ago, usually formed in layers of rock (41)

fresh water, n. water with little to no natural salt content

G

glacier, n. a huge moving block of ice and rock on land

H

habitat, n. the natural place where an organism lives (1)

I

interact, v. to act upon one another, such as trees, worms, birds, and soil in an ecosystem

invasive species, n. an organism that causes harm in a place where it does not normally live (22)

M

migrate, v. to move from one place to another in different seasons **(27)**

N

native, adj. a plant or animal that is found naturally in a habitat

natural hazard, n. a natural event that causes negative changes to a habitat or ecosystem

O

organism, n. a single living thing

overpopulation, n. too many of one kind of species in an ecosystem

P

preserve, v. to take care of something in order to keep it in its original form

R

relative, adj. a comparison to identify similarities, such as comparisons of fossils and current species of plants or animals

respond, v. to react to a change by doing something

restore, v. to bring back something or to repair damage

role, n. a specific job or prescribed behavior in an interaction

S

salt water, n. water with a naturally high salt content

survive, v. to stay alive **(1)**

system, n. a group of related parts that can make up a whole

T

trait, n. a characteristic or quality that may be physical or behavioral

tundra, n. a very cold habitat that is often rocky and flat

Appendix B

Classroom Safety for Activities and Demonstrations

In the Core Knowledge Science program (CKSci), activities and demonstrations are a vital part of the curriculum and provide students with active engagement related to the lesson content. The activities and demonstrations in this unit have been selected and designed to engage students in a safe manner. The activities and demonstrations make use of materials and equipment that are typically deemed classroom safe and readily available.

Safety should be a priority when engaged in science activities. With that in mind, observe the following safety procedures when the class is engaged in activities and demonstrations:

- Report and treat any injuries immediately.
- Check equipment prior to usage, and make sure everything is clean and ready for use.
- Clean up spills or broken equipment immediately using the appropriate tools.
- Monitor student behavior to ensure they are following proper classroom and activity procedures.
- Do not touch your eyes, ears, face, or mouth while engaging in an activity or demonstration.
- Review each step of the lesson to determine if there are any safety measures or materials necessary in advance.
- Wear personal protective equipment (e.g., safety goggles, aprons, etc.) as appropriate.
- Check for allergies to latex and other materials that students may have, and take appropriate measures.
- Secure loose clothing, hair, or jewelry.
- Establish storage and disposal procedures for chemicals as per their Safety Data Sheet (SDS), including household substances, such as vinegar and baking soda.

Copy and distribute the Student Safety Contract, found on the next page, for students to read and agree to prior to the start of the first unit so students are aware of the expectations when engaged in science activities.

Online Resources

For additional support for safety in the science classroom, follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Student Safety Contract

When doing science activities, I will do the following:

- Report spills, breakages, or injuries to the teacher right away.
- Listen to the teacher for special instructions and safety directions. If I have questions, I will ask the teacher.
- Avoid eating or drinking anything during the activity unless told to by my teacher.
- Review the steps of the activity before I begin. If I have questions I will ask the teacher.
- Wear safety goggles when working with liquids or things that can fly into my eyes.
- Be careful around electric appliances, and unplug them, just by pulling on the plug, when a teacher is supervising.
- Keep my hands dry when using tools and devices that use electricity.
- Be careful to use safety equipment like gloves or tongs when handling materials that may be hot.
- Know when a hot plate is on or off and let it cool before touching it.
- Roll or push up long sleeves, keep my hair tied back, and secure any jewelry I am wearing.
- Return unused materials to the teacher.
- Clean up my area after the activity and wash my hands.
- Treat all living things and the environment with respect.

I have read and agree to the safety rules in this contract.

_____ _____/_____/_____/

Student signature and date

_____

Print name

Dear Parent or Guardian,

During science class, we want to create and maintain a safe classroom. With this in mind, we are making sure students are aware of the expectations for their behavior while engaged in science activities. We are asking you to review the safety rules with your daughter or son and sign this contract. If you have any questions, please feel free to contact me.

_____ _____/_____/_____/

Parent or guardian signature and date

Appendix C

Strategies for Acquiring Materials

The materials used in the Core Knowledge Science program (CKSci) are readily available and can be acquired through both retail and online stores. Some of the materials will be reusable and are meant to be used repeatedly. This includes equipment such as scales, beakers, and safety goggles, but also items such as plastic cups that can be safely used again. Often these materials are durable, can be cleaned, and will last for more than one activity or even one school year. Other materials are classified as consumable and are not able to be used more than once, such as glue, baking soda, and aluminum foil.

Online Resources

The Material Supply List for this unit's activities can be found online. Follow the links in the Online Resources Guide for this unit:

www.coreknowledge.org/cksci-online-resources

Ways to Engage with Your Community

The total cost of materials can add up for an entire unit, even when the materials required for activities and demonstrations have been selected to be individually affordable. And the time needed to acquire the materials adds up too. Reaching out to your community to help support STEM education is a great way to engage parents, guardians, and others with the teaching of science, as well as to reduce the cost and time of collecting the materials. With that in mind, the materials list can be distributed or used as a reference for the materials teachers will need to acquire to teach the unit.

Consider some of the following as methods for acquiring the science materials:

- School Supply Drive—If your school has a supply drive at any point in the year, consider distributing materials lists as wish lists for the science department.
- Open Houses—Have materials lists available during open houses. Consider having teams of volunteers perform an activity to show attendees how the materials will be used throughout the year.
- Parent Teacher Organizations—Reach out to the local PTO for assistance with acquiring materials.
- Science Fair Drive—Consider adding a table to your science fair as part of a science materials drive for future units.
- College or University Service Project—Ask service organizations affiliated with your local higher education institutions to sponsor your program by providing materials.
- Local Businesses—Some businesses have discounts for teachers to purchase school supplies. Others may want to advertise as sponsors for your school/programs. Usually you will be asked for verifiable proof that you are a teacher and/or for examples of how their sponsorship will benefit students.

Remember: If your school is public it will be tax exempt, so make sure to have a Tax Identification Number (TIN) when purchasing materials. If your school is private, you may need proof of 501(c)(3) status to gain tax exemption. Check with your school for any required documentation.

Appendix D

Advance Preparation for Activities and Demonstrations

Being properly prepared for classroom activities and demonstrations is the first step to having a successful and enriching science program. Advance preparation is critical to effectively support student learning and understanding of the content in a lesson.

Before doing demonstrations and activities with the class:

- Familiarize yourself with the activity by performing the activity yourself or with a team, and identify any issues or talking points that could be brought up.
- Gather the necessary materials for class usage. Consider if students will gather their materials at stations or if you will preassemble the materials to be distributed to the students and/or groups.
- Identify safety issues that could occur during an activity or demonstration, and plan and prepare how to address them.
- Review the Teacher's Guide before teaching, and identify opportunities for instructional support during activities and demonstrations. Consider other Support and/or Challenge opportunities that may arise as you work to keep students engaged with the content.
- Prepare a plan for postactivity collection and disposal of materials/equipment.

While engaged in the activity or demonstration:

- Address any emergencies immediately.
- Check that students are observing proper science safety practices as well as wearing any necessary safety gear, such as goggles, aprons, or gloves.
- When possible, circulate around the room, and provide support for the activity. Return to the Teacher Guide as students work, to utilize any Support and Challenge opportunities that will make the learning experience most meaningful for your students.

After the activity or demonstration:

- Use your plan for students to set aside or dispose of their materials as necessary.
- Have students wash their hands after any activity in which they could come in contact with any potentially harmful substances.

When engaging students in activities and demonstrations, model good science practices such as wearing proper safety equipment, never eating during an investigation, etc. Good science practices at a young age will lead to students observing good science practices themselves and being better prepared as they move into upper-level science classes.

Appendix E

What to Do When Activities Don't Give Expected Results

Science activities and experiments do not always go according to plan. Microwave ovens, super glue, and x-rays are just some of the discoveries made when people were practicing science and something did NOT go according to plan. In your classroom, however, you should be prepared for what to do when activities don't give the expected results or when an activity doesn't work.

When going over an activity with an unexpected result, consider these points in discussion with your students:

- Was there an error in following the steps in order? You or the student may have skipped a step. To help control for this, have students review the steps to an investigation in advance and make a check mark next to each step as they complete it.
- Did students design their own investigation? Perhaps their steps are out of sequence or they missed a step when performing the activity. Review and provide feedback on students' investigation plan to ensure the work is done in proper sequence and that it supports the lesson's Big Question.
- When measurements were taken, were they done correctly? It is possible a number was written down incorrectly, a measurement was made in error, such as wrong unit of measure or quantity, or the starting or ending point of a measurement was not accurate.
- Did the equipment or materials contribute to the situation? For example, chemicals that have lost their potency or a scale that is not measuring accurately can contribute to the success or failure of an activity.

One of the greatest gifts a student can learn when engaged in science is to develop a curiosity for *why something happened*. Students may find it challenging or frustrating to work through a problem during an activity, but guiding them through the problem and figuring out *why* something happened will help them to develop a better sense of how to do science.

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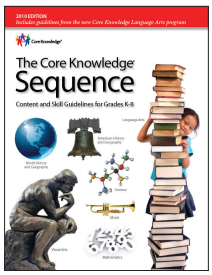

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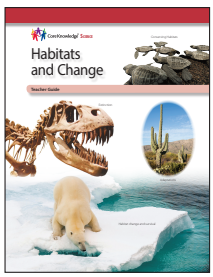
The *Core Knowledge Sequence* is a detailed guide to specific content and skills to be taught in Grades K–8 in language arts, history, geography, mathematics, science, and the fine arts. In the domains of science, including earth and space, physical, and the life sciences, the *Core Knowledge Sequence* outlines topics that build systematically grade by grade to support student learning progressions coherently and comprehensively over time.



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In general, the content and presentation are appropriate for readers in the middle elementary grades. For teachers and schools following the *Core Knowledge Sequence*, this book is intended for Grade 3 and is part of a series of **Core Knowledge SCIENCE** units of study.

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