Lessons 20–21
Long-Term Changes in an Environment

Prepare

In Lessons 20 and 21, students explore how long-term changes in an environment can create long-lasting problems for the organisms that live there. Students also brainstorm possible solutions to address some of these problems. In Lesson 20, students model a long-term change in a forest environment and communicate the effects of that change on the organisms that live there to learn that some organisms stay and survive, some move in or out, and some die. In Lesson 21, students evaluate proposed solutions to problems caused by a long-term change in an environment. Students also apply their knowledge of how organisms respond to changes in their environment during a Conceptual Checkpoint.

Student Learning

Knowledge Statement

When an environment experiences a long-term change, some organisms will stay and survive, some will move away, some will die, and other organisms will move to the changed environment.

Concept 3: Effects of Environmental Change

Focus Question

What happens to organisms when the environment changes?

Phenomenon Question

How do long-term changes in an environment affect the organisms that live there?

Objectives

- Lesson 20: Analyze the effects of a long-term change in an environment on the organisms that live there.
- Lesson 21: Evaluate potential solutions to help organisms survive after a long-term change in an environment.

Texas Essential Knowledge and Skills Addressed

3.2C **Construct** maps, graphic organizers, simple tables, **charts,** and bar graphs using tools and current technology to organize, examine, and evaluate measured data. (Addressed)

3.3A **Analyze, evaluate, and critique scientific explanations by using** evidence, **logical reasoning,** and experimental and observational testing. (Addressed)

3.3B **Represent the natural world using models** such as volcanoes or the Sun, Earth, and Moon system and identify their limitations, including size, properties, and materials. (Addressed)

3.4 Collect, **record, and analyze information using tools, including** cameras, computers, hand lenses, metric rulers, Celsius thermometers, wind vanes, rain gauges, pan balances, graduated cylinders, beakers, spring scales, hot plates, meter sticks, magnets, collecting nets, **notebooks,** and Sun, Earth, and Moon system models; timing devices; and materials to support observation of habitats of organisms such as terrariums and aquariums. (Addressed)

3.9A **Observe and describe the physical characteristics of environments and how they support populations and communities of plants and animals within an ecosystem.** (Addressed)

3.9C **Describe environmental changes** such as floods and droughts **where some organisms thrive and others perish or move to new locations.** (Addressed)

English Language Proficiency Standards Addressed

1A Use prior knowledge and experiences to understand meanings in English.

5F Write using a variety of grade-appropriate sentence lengths, patterns, and connecting words to combine phrases, clauses, and sentences in increasingly accurate ways as more English is acquired.

Materials

		Lesson 20	Lesson 21
Student	Science Logbook (Lesson 20 Activity Guide)	●	
	Describe an Environment: glue stick, environment illustration (Lesson 20 Activity Guide), set of forest animal photographs, pencil or other writing utensil	●	
	Model a Change in an Environment: environment illustration with pasted forest animal photographs from previous activity, 4″ × 5″ piece of black construction paper, clear tape	●	
	Parking Lot Animal Information (1 per student pair)	●	
	Science Logbook (Lesson 21 Activity Guides A and B)		●
Teacher	Forest Environment Photograph (Lesson 18 Resource A)	●	
	Parking Lot Photograph (Lesson 20 Resource B)	●	
	Anchor chart	●	●
	Proposed Solution Photographs (Lesson 21 Resource A)		●
	Proposed Solution Comparison Chart (Lesson 21 Resource B)		●
	Conceptual Checkpoint Volcano Photographs (Lesson 21 Resource C)		●
	Conceptual Checkpoint Animal Photographs and Information (Lesson 21 Resource D)		●
Preparation	Prepare Forest Animal Photographs (see Lesson 20 Resource A).	●	
	Cut out a 4″ × 5″ piece of black construction paper for each student.	●	
	Print Parking Lot Animal Information (Lesson 20 Resource C) for each student pair.	●	

Lesson 21

Objective: Evaluate potential solutions to help organisms survive after a long-term change in an environment.

Agenda

Launch (5 minutes)

Learn (35 minutes)

- Discuss Possible Solutions (20 minutes)
- Conceptual Checkpoint (15 minutes)

Land (5 minutes)

Launch 5 minutes

Remind students of the photograph of the bird they glued on their environment illustration (Lesson 20 Activity Guide) in the previous lesson. Explain that this bird is a cardinal. Tell students that the photograph represents just one cardinal but that many cardinals live in the forest environment where the company wants to build the parking lot. Recall with students the effects that building a parking lot might have on a cardinal. Tell students that the company building the parking lot is developing a plan to reduce the effects of this construction on the cardinals that live there.

▶ **How does the forest environment provide cardinals with what they need to survive?**

- *The trees are part of the cardinals' habitat.*
- *The plants probably provide the cardinals with food.*
- *Living things like cardinals need water. I think the cardinals probably get water from the river.*

▶ **How will building a parking lot affect the cardinals' habitat?**

- *The company will need to cut down some trees, so there might not be enough room for all the cardinals to live.*
- *If the plants are gone, then the cardinals might not have any food.*

As a class, recall how long-term changes differ from seasonal changes. Emphasize that long-term changes, such as building a parking lot, prevent an environment from returning to its original state.

Tell students that they will brainstorm some solutions the company could apply to help cardinals survive this long-term change as they continue to explore the Phenomenon Question **How do long-term changes in an environment affect the organisms that live there?**

Learn 35 minutes

Discuss Possible Solutions 20 minutes

Have students work either individually or with a partner to generate a list in their Science Logbooks (Lesson 21 Activity Guide A) of ways the company could make the environment more suitable for cardinals after building the parking lot.

Sample student responses:

- *The company could build birdhouses on the light poles in the parking lot for the cardinals to live in.*
- *Maybe the company could make a park somewhere inside the parking lot with trees and other plants.*
- *The company could add some birdfeeders around the parking lot.*

Display the proposed solution photographs (Lesson 21 Resource A). Inform students that the company is considering these options to encourage cardinals to return to the environment after the parking lot is built.

Have students work with a partner to compare the company's ideas with their own and discuss whether the company's ideas could be successful. Tell students to record notes in their Science Logbooks (Lesson 21 Activity Guide A). After a few minutes, invite students to share their ideas with the class by asking the following question.

- **Why do you think these ideas would be successful or unsuccessful in helping cardinals survive in the changed environment?**
  - *The birdhouse would be successful because it gives the cardinals somewhere to live.*
  - *The birdfeeder would be successful because it provides food for the cardinals to eat.*
  - *The tree would help the cardinals because they can live there, but other animals might benefit from it too.*

Tell students that the company wants to choose one option. Explain that students will use a conversation routine, such as Inside–Outside Circles, to analyze each solution. If using Inside–Outside Circles, have students complete three rounds of the conversation routine and analyze one solution each round. Post or project the following questions for students to consider as they discuss each solution with a peer.

- **1. What does this solution provide for the cardinals?**
- **2. How many cardinals can use this solution?**
- **3. What are potential drawbacks of this solution?**

Sample discussion ideas:

Birdhouse	Birdfeeder	Planted Trees
1. *It gives the cardinals a place to live.* 2. *One cardinal or one family of cardinals can use each birdhouse.* 3. *This solution doesn't help that many cardinals unless there are a lot of birdhouses. It also doesn't give the cardinals any food.*	1. *It gives the cardinals food.* 2. *A lot of cardinals can get food from a birdfeeder.* 3. *Other animals may be attracted to the birdseed. Someone would also need to fill up the birdfeeder when it gets empty.*	1. *Trees give the cardinals places to live. Trees may also give the birds food.* 2. *Several cardinals can live in one tree. If lots of trees are planted, a lot of cardinals can live in them.* 3. *The trees may take a long time to grow.*

Differentiation

Some students may benefit from individual thinking time to prepare for this discussion. Consider allowing students to write down their responses to the questions before discussing them with other students during the routine (5F).

English Language Development

This discussion involves using the word *solution*. English learners may benefit from scaffolding in the form of sentence frames. Consider using sentence frames such as the ones below.

- This solution provides _____ to the cardinals.
- I think that _____ (number) cardinals can use this solution because _____.
- The potential drawbacks of this solution are _____.

Differentiation

Students may benefit from recording their discussion ideas or discussing the ideas as a class. Consider allowing students time to record their ideas about each solution between each discussion round. Alternatively, discuss students' ideas as a class and summarize student responses on the board (5F).

Inform students that people who work for the company also collected information about each solution and created a comparison chart to help them make their decision. Project and review the proposed solution comparison chart (Lesson 21 Resource B).

Instruct students to choose the best solution and to perform a Quick Write in their Science Logbooks (Lesson 21 Activity Guide A) to explain why they think it is the best option. Tell students to use the information in the proposed solution comparison chart to support their decision.

Sample student responses:

- *I think that the birdhouse is the best solution because it gives cardinals a place to live. If the company puts in more than one birdhouse, many cardinals can have a home. It is low cost, and it doesn't take much time, which means it will help the cardinals faster.*
- *I think that the birdfeeder is the best option because it can feed a lot of cardinals in the area. It is medium cost and takes less time than planting trees, so it could be ready sooner. I also think it is the best solution because the food will attract the cardinals back to the environment.*
- *I like planting trees the best because they can be a home for many cardinals. Trees are a natural habitat and not an artificial one, which means the cardinals may feel more comfortable. Trees also provide food for cardinals, so even though they cost a lot and take a lot of time to grow, trees are the best solution.*

Teacher Note

Students may wonder how a tree can provide food for birds. If students show interest, explain that most birds eat a variety of berries, seeds, nuts, or insects. The way a tree can provide food depends on the kind of tree planted. Many trees, such as spruce, oak, and dogwood, provide seeds, nuts, and fruits. However, trees also attract insects. For example, as leaves fall to the ground, some insects, such as crickets and beetles, thrive in the damp environment under the fallen leaves.

Poll students on their responses, and allow them to discuss the benefits and drawbacks of each solution as a class. After the class discussion, poll students again to see whether they changed their minds about the merit of any solution. Then explain that real companies engage in similar processes to agree on and select the best solution for reducing the effects of human-caused changes in environments.

Teacher Note

Some students may benefit from having a printed copy of the information. Provide copies to students as needed.

Teacher Note

Selecting the best solution is often a complex process. Exposing students to complex solutions helps them understand that some solutions could have multiple benefits but bigger drawbacks, whereas other solutions could offer a safer choice but make less of an impact on solving the problem. Support students as they consider these three solutions and weigh the benefits and drawbacks by explaining that they can choose any solution as long as they provide sufficient evidence to support their decision (5F).

Content Area Connection: English

Consider providing a paragraph framework for students so they can focus on the content rather than the structure of their responses.

Display the anchor chart, and remind students that the long-term change they discussed (building a parking lot in a forest environment) is one that humans chose to introduce in the environment. Explain that humans do not cause all long-term changes and that natural events can also cause long-term changes in an environment.

▶ **What natural Earth events could cause long-term changes in an environment?**

- *In the beginning of the module, we talked about how Colorado used to have a lot of water but now it's mostly land. I wonder how that happens.*
- *I think earthquakes cause long-term changes.*
- *A volcano could erupt and cause changes that last a long time.*

Conceptual Checkpoint 15 minutes

Tell students that they will now use what they know about how organisms respond to changing environments to complete a Conceptual Checkpoint. Project the first two photographs of the Tungurahua Volcano in Ecuador (Lesson 21 Resource C). Explain that the first photograph shows the volcano at a time when it was dormant, and the second photograph shows the volcano erupting in 2011. Inform students that this volcano has erupted many times over hundreds of years.

Display the third photograph. Tell students that this photograph shows an environment around the volcano after an eruption. Explain that lava entered the environment when the volcano erupted and then cooled and hardened to form solid rock, which changed the environment. The changed environment is much rockier and has far fewer plants than the environment did before the eruption. Keep this photograph projected while students complete the Conceptual Checkpoint.

Display the photograph and information about the mouse (Lesson 21 Resource D). Explain to students that this mouse lived in the environment around the volcano before the eruption changed the environment.

Read the information about the mouse to students. Ask students to respond to the following question in their Science Logbooks (Lesson 21 Activity Guide B).

- **Will the mouse stay in the changed environment, move to a new environment, or die? Use evidence to support your answer.**

After students respond to the first question, display the photograph and information about the snake (Lesson 21 Resource D). Explain that this snake lived near the environment around the volcano before the eruption changed the environment.

Read the information about the snake to students. Ask students to respond to the following question in their Science Logbooks (Lesson 21 Activity Guide B).

- **Could the snake move to the changed environment and survive there? Use evidence to support your answer.**

Sample student responses:

- *The mouse will stay in the changed environment because there are still plants around the rock that formed after the eruption. The mouse can eat seeds from the plants.*
- *The snake could move to the changed environment and the survive there because there are mice there that it could eat. Snakes can also live in open areas like the environment around the volcano after the eruption.*

Conceptual Checkpoint

This Conceptual Checkpoint assesses student understanding of the Concept 3 Focus Question: **What happens to organisms when the environment changes?** Students should demonstrate an understanding of how organisms respond to changes in their environment.

Evidence

Look for evidence that all students

- provide a reasonable explanation about the mouse's response to the change in the environment and
- provide a reasonable explanation for why the snake would or would not move to the new environment.

Next Steps

If students struggle to determine the possible responses of the organisms, meet with them individually or in small groups to provide additional support. Review the possible responses of organisms to a changing environment (i.e., stay, move away, move to, die). Discuss the information provided about the mouse and snake to determine which response is most likely for the mouse and which response is most likely for the snake. If needed, remind students of their prior experiences with organism needs and the suitability of environments for different organisms.

Land 5 minutes

Ask students to reflect on the changes in environments they analyzed over the last several lessons.

▶ **Describe the different kinds of changes in environments that we learned about.**

- *First we looked at seasonal changes like fall turning to winter and winter turning to spring. These changes are predictable because they happen every year.*
- *We also looked at human changes like building a parking lot. That kind of change can last a long time.*
- *We learned about how a volcano can erupt and change the environment too.*

▶ How do these changes affect the organisms that live in the environments?

- *Monarch butterflies can't survive in their environment in winter, so they migrate to a warmer place.*
- *Building a parking lot can cause some organisms to die because their habitat is gone. But a parking lot can also cause new organisms to move in if the changed environment is suitable for them.*
- *A volcanic eruption could cause plants to die, but some kinds of organisms may stay even after the eruption.*

Agree that both seasonal and long-term changes in an environment could affect the organisms that live there. Remind students that they have only examined possible solutions to help organisms survive in an environment changed by humans. Ask students to think about the other two kinds of environmental changes: seasonal changes and changes caused by natural Earth events. Encourage students to share ideas about how solutions to help organisms survive these kinds of changes may differ from solutions for changes caused by humans.

Sample student responses:

- *Seasonal changes happen every year. So maybe solutions could be put in place earlier because we can predict the change.*
- *It would be hard to make a solution for a volcano erupting because you don't know when it is going to happen. I think you would have to come up with a solution after the eruption to help organisms move back to the environment.*

Summarize students' ideas and agree that there is a great deal of variety in the kinds of changes that can occur in environments, the effects of these changes on organisms, and the solutions that would best help the organisms survive. Reiterate that both humans and natural events can cause changes in environments and that changes can last a short time or a long time. Inform students that in the next lessons, they will further study monarch butterflies and develop a solution for some problems these butterflies encounter.

Optional Homework

Ask students to describe another example of a seasonal or a long-term change in an environment. Tell students to describe how the change affected the organisms living in the environment and how those organisms responded to the change. Ask students to suggest a solution to help an organism negatively affected by the change in its environment.