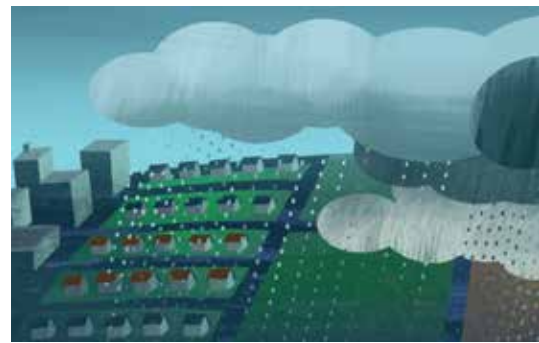
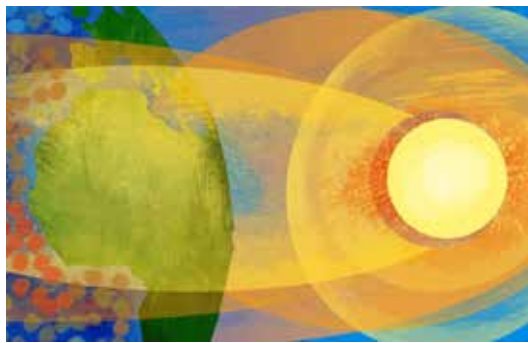




Louisiana Companion

Student Booklet: Grade 7



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These materials are based upon work partially supported by the National Science Foundation under grant numbers DRL-1119584, DRL-1417939, ESI-0242733, ESI-0628272, and ESI-0822119. The Federal Government has certain rights in this material. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

These materials are based upon work partially supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305A130610 to The Regents of the University of California. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.



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Developed by the Learning Design Group at the University of California, Berkeley's Lawrence Hall of Science.

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Louisiana Companion Student Booklet: Grade 7
ISBN: 978-1-64333-328-1

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Safety Guidelines for Science Investigations

- 1. Follow instructions.** Listen carefully to your teacher's instructions. Ask questions if you don't know what to do.
- 2. Don't taste things.** No tasting anything or putting it near your mouth unless your teacher says it is safe to do so.
- 3. Smell substances like a chemist.** When you smell a substance, don't put your nose near it. Instead, gently move the air from above the substance to your nose. This is how chemists smell substances.
- 4. Protect your eyes.** Wear safety goggles if something wet could splash into your eyes, if powder or dust might get in your eyes, or if something sharp could fly into your eyes.
- 5. Protect your hands.** Wear gloves if you are working with materials or chemicals that could irritate your skin.
- 6. Keep your hands away from your face.** Do not touch your face, mouth, ears, eyes, or nose while working with chemicals, plants, or animals.
- 7. Tell your teacher if you have allergies.** This will keep you safe and comfortable during science class.
- 8. Be calm and careful.** Move carefully and slowly around the classroom. Save your outdoor behavior for recess.
- 9. Report all spills, accidents, and injuries to your teacher.** Tell your teacher if something spills, if there is an accident, or if someone gets injured.
- 10. Avoid anything that could cause a burn.** Allow your teacher to work with hot water or hot equipment.
- 11. Wash your hands after class.** Make sure to wash your hands thoroughly with soap and water after handling plants, animals, or science materials.



This road is covered with ice. Ice-covered roads are slippery and dangerous.

Icy Heat

Ice-covered roads are a major problem in cold areas, causing accidents and costly delays. Engineers are working on new ways to melt ice and clear it off roads. To make ice change phase from solid to liquid, you have to transfer energy to it. The engineers are testing out a system that runs electric currents through the surface of a road, raising its temperature and transferring energy to the ice above it. In science and engineering, energy transferred this way is called “heat.”

It might sound dangerous to use heat to keep roads clear of ice. Maybe a hot road would melt the tires of passing cars, or even burn the shoes

of crossing pedestrians! However, this new type of road surface would not feel hot to the touch. In fact, it would probably feel very cool if you put your hand on it. Even when it’s melting the ice, the temperature of the new road surface barely rises above 10°C.

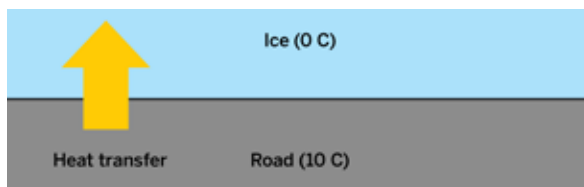
How can something that cool give off heat? In everyday language, the word *heat* can mean all kinds of things, but in science, it has a very specific meaning that has to do with something called thermal energy. Thermal energy is the energy that an object has because its molecules are moving. When you touch something with a higher temperature than your hand, that

object feels warm to you because thermal energy is transferred from the object to your hand. Scientists call the thermal energy that is transferred “heat.” Whenever two objects with different temperatures touch, heat transfers from the object with a higher temperature to the object with a lower temperature.

That’s why the ice-melting road surface feels cold to the touch: it has a lower temperature than your hand, so heat is transferred from your hand to the road surface if you touch it. However, even objects that feel cold to us still have thermal energy, because the molecules are still moving. The road surface is colder than your hand, but it’s warmer than ice, so heat will transfer from the road surface to any ice that is touching it. The road surface doesn’t have to feel hot to us to transfer heat and melt ice.

What about the ice? Could it ever give off heat? We think of ice as cold. Water freezes at 0°C , much colder than our hands ever are, so an ice cube will always feel cold to the touch. When you touch ice, heat will transfer from the warmer object (your hand) to the cooler object (the ice cube). However, the water molecules that make up the ice cube are still moving, even though they are moving more slowly than the molecules in liquid water. The ice cube still has thermal energy.

Now imagine something even colder than the ice cube: a piece of dry ice. Dry ice is solid carbon dioxide and has a temperature of -78.5°C . If the ice cube came into contact with a piece of dry ice, what would happen? Heat always transfers from the warmer object (in this case, the ice cube) to the colder object (the dry ice). The ice cube would give off heat!



The road is warmer than the ice, so heat transfers from the road to the ice.



An ice cube will always feel cold to the touch. That’s because heat transfers from our hands to the ice.



This is carbon dioxide that has frozen solid, forming dry ice. Frozen carbon dioxide is much colder than frozen water.

Name: _____

Date: _____

Reading “Icy Heat”

1. Read and annotate the “Icy Heat” article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

Rate how successful you were at using Active Reading skills by responding to the following statement:

As I read, I paid attention to my own understanding and recorded my thoughts and questions.

- ☐ Never
- ☐ Almost never
- ☐ Sometimes
- ☐ Frequently/often
- ☐ All the time

Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.
2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Rereading “Icy Heat”

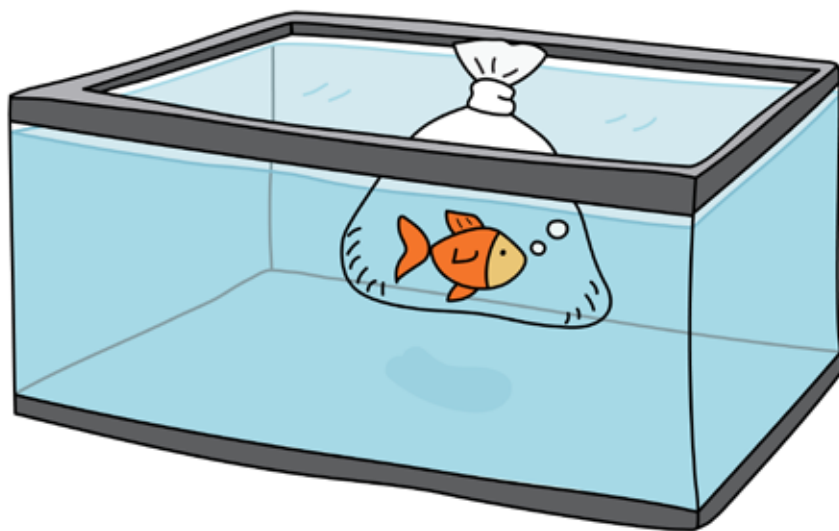
Part 1

Reread the fifth paragraph of the “Icy Heat” article. As you read, highlight and annotate information that helps you understand the scientific meaning of the word *heat*. You will use that information to help you answer the question in Part 2.

Part 2

Read the following information. Use what you learned from the “Icy Heat” article to answer the question on the next page.

Miguel bought a new fish for his fish tank. He brought the fish home in a plastic bag that was filled with water from the fish tank at the store. Before releasing the fish, he put the entire bag into his tank so the fish could get used to the temperature of the water in his tank at home.



Temperature of the water in Miguel's home tank: 21°C

Temperature of the water in the bag: 18°C

Miguel explains to his sister that heat is transferring from the water in the tank to the water in the bag. Miguel's sister doesn't believe him because the water in the tank doesn't feel hot.

Name: _____

Date: _____

Rereading “Icy Heat” (continued)

Part 2 (continued)

How is it possible that heat is transferring from the water in the tank to the water in the bag, even though the water in the tank doesn't feel hot?



Many cabbage farmers have problems with caterpillars eating their cabbages before the cabbages are ready to be picked and sold.

How to Make a Venomous Cabbage

What do you get if you cross a cabbage with a scorpion? That may sound like the beginning of a joke, but it isn't. Scientists have been exploring ways to use scorpion DNA to keep cabbages from being eaten before they're ready for harvest.

Cabbages have the traits they do because humans have selected for those traits. For thousands of years, farmers have been engaging in a practice known as artificial selection. Unlike natural selection, artificial selection happens when humans, not nature, choose for or against traits in organisms. Through artificial selection, farmers choose plants that have desirable traits and breed them so the resulting populations have those

traits. For example, 2,500 years ago farmers found a wild plant with tasty leaves and began growing it as a crop. Scientists call this plant *Brassica oleracea* (pronounced BRASS-ick-ah oh-luh-RAY-see-ah). Over time, farmers chose to replant the seeds of certain individual *Brassica oleracea* plants with a trait that was desirable, such as large leaves. By breeding the offspring of wild plants over and over and selecting for certain traits, farmers caused the traits of the plants to shift. Over many generations, the *Brassica oleracea* plants developed into new types of plants with new traits, including cabbages and other vegetables such as kale and broccoli. Farmers can use artificial selection to choose traits that make their crops easier to grow in certain conditions, such as rocky soil or a particularly dry climate. They can also choose traits that make their crops more appealing to customers.

Today, cabbage is an important food for humans—but cabbages also make tasty meals for caterpillars and other organisms. To keep their cabbages from being eaten in the fields



Scientists use the genes that produce venom in *Androctonus Australis* scorpions to make cabbages less appealing to caterpillars.

before they're ready to be picked, farmers use chemicals called pesticides that kill the caterpillars. However, pesticides can have negative effects on the environment when they get into soil and water nearby. One way to keep the cabbages safe from caterpillars without spraying pesticides on the fields is to change the plants themselves.

To change an organism, scientists can use genetic engineering—they can change the organism's genes so the organism has different traits than it normally would. One type of genetic engineering uses genes from one organism that have been inserted into the cells of another organism. The genes are instructions for the organism to produce certain proteins, and the proteins give the organism its traits. Through genetic engineering, scientists can give an organism traits that it wouldn't normally be able to have.

To engineer insect-proof cabbages, scientists in China inserted genes from scorpions into the cells of the cabbage plants. Scorpions have

genes that instruct their cells to make venom, which they use to paralyze and kill their prey. The scientists added the genes for making venom to the cabbage plants. The cabbages began to produce scorpion venom and store it inside their leaves, so any bugs that ate the cabbages would be paralyzed and die.

In the wild, scorpion venom doesn't just work on insects; scorpion stings can also be very painful and cause paralysis in humans. However, the scientists changed the scorpion venom so it kills insects but has no effect on people. Otherwise, nobody would be able to eat the cabbages. So far, cabbages modified with genes for scorpion venom have been just an experiment and haven't been grown or sold to the public. Although scientists have found no negative effects of eating the modified cabbages, many people are concerned that they may be dangerous. For now, the cabbages you eat will be just plain cabbages.

Scientists can alter the genes in plants and animals to change their traits, but should

scientists do this? This question has led to many ethical debates. When people talk about ethics, they are thinking about the moral issues related to a behavior or activity.

Some people think genetic engineering is a good way to grow more food to feed our rapidly growing population. This is commonly referred to as genetically modified food. Food crops can be given genes that make them resistant to diseases, pests, or the chemicals that farmers use to kill weeds. Crops can also be engineered to grow in places where they wouldn't have been able to grow, such as places that are too cold or have salty soil. Crops can even be engineered to contain more vitamins or vaccines! All these changes make it easier to grow more food. Supporters of genetically modified food argue that changing the DNA of an organism that humans eat is not harmful for humans and that the benefits outweigh the potential drawbacks.

A few countries have decided to ban genetically modified foods. People who are against these foods argue that genetic engineering is a new technique that hasn't been sufficiently studied.

There are also environmental consequences to using these foods. For example, a genetically modified type of corn that was designed to be resistant to pests ended up also harming monarch butterflies. People worry that if plants are engineered to be resistant to weed killer, that will encourage farmers to use more and more chemicals on their crops. Those chemicals end up in the air and water. In addition, the new genes could spread to other organisms, leading to effects that are hard to predict and that may be negative. Opponents of genetically modified foods worry that we don't know whether this food could have negative effects on our health and environment far into the future.

For the moment, the Federal Drug Administration has decided that genetically modified foods are safe to consume. However, genetically modified foods are required to have a label so consumers can decide for themselves. You can take a look at the labels next time you are in the grocery store. Will you choose to purchase genetically modified foods? Why or why not?

Name: _____

Date: _____

Reading “How to Make a Venomous Cabbage”

1. Read and annotate the “How to Make a Venomous Cabbage” article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

Rate how successful you were at using Active Reading skills by responding to the following statement:

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Active Reading Guidelines

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3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Name: _____

Date: _____

Rereading “How to Make a Venomous Cabbage”

Preview the questions in Part 1, below, and then reread the article “How to Make a Venomous Cabbage” to answer the questions. As you read, you may want to highlight or annotate parts of the text that will help you answer the questions.

Part 1

What is artificial selection and how does it work?

How is genetic engineering different from artificial selection?

Name: _____

Date: _____

Rereading “How to Make a Venomous Cabbage” (continued)

Part 2

Problem: A strawberry company wants to breed a strawberry that has a thicker skin and stays fresh longer.

How could this problem be solved through artificial selection?

How could this problem be solved through genetic engineering?

Would you recommend that the strawberry company use artificial selection or genetic engineering to get strawberries with these traits? Explain your thinking.

Name: _____

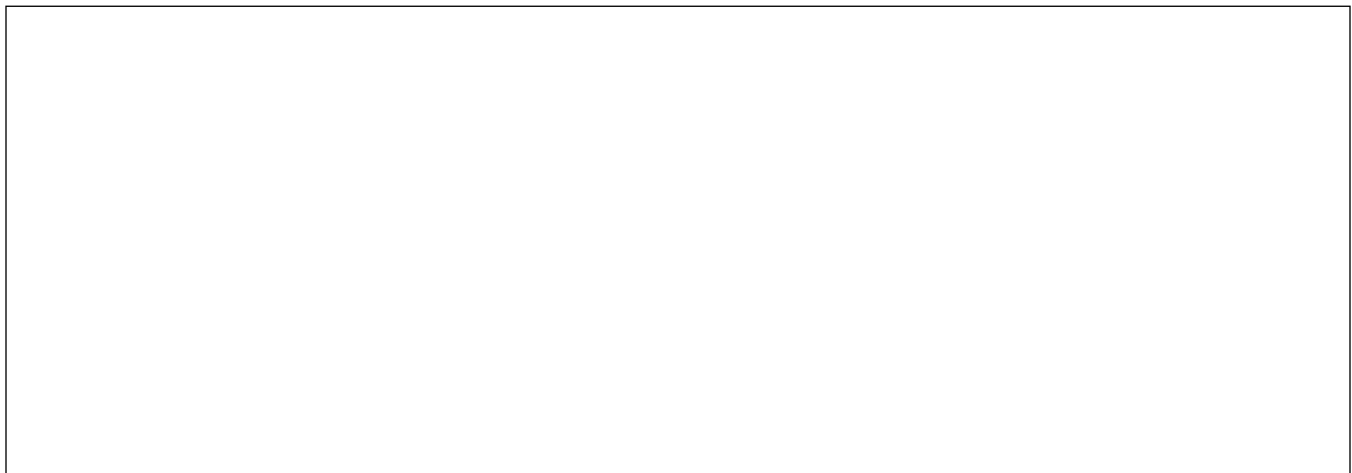
Date: _____

Optional: Considering Genetic Engineering

Using what you read in the article “How to Make a Venomous Cabbage,” fill out the table below.

Why do some people think genetic engineering is a good idea?	What are some concerns that people have about genetic engineering?

Choose one item that you listed in the table above and draw a diagram or picture (in the box below) to explain it. Use what you know about proteins, genes, and sexual reproduction.



Name: _____

Date: _____

Optional: Considering Genetic Engineering (continued)

What do you think about genetic engineering? Do you think scientists should use this new technology? If so, when?

[illegible]

Name: _____

Date: _____

Investigating Changes to Traits in a Population

Part 1: Simulating Changes to Traits in a Population

Discuss predictions with your partner.

Do you think the distribution of neck length traits in the ostrilope population will change over time in this environment that has only tall thornpalms? How do you think it will change?

1. Launch the *Natural Selection* Simulation and open the Ostrilope Neck Length mode.
2. Press RUN and then pause the Sim. Zoom in and press on ostrilopes to find one with a medium neck length: 4 or 5. Press PLAY and observe what happens to that ostrilope.
3. Continue to let the Sim run for 25 generations. While it runs, press on other ostrilopes to see what their neck length trait is and what happens to them. You can increase the speed of the Sim to x4 so the generations pass faster.
4. Press ANALYZE. Compare the neck length traits of the ostrilope population at Generation 1 to the traits in the population at Generation 25. Use the slider to see how the population changed over time.
5. With your partner, discuss what you observe.
6. Answer the questions below.

How did the distribution of traits for neck length change in this ostrilope population after 25 generations in an environment with only tall thornpalms?

Why do you think this change happened?

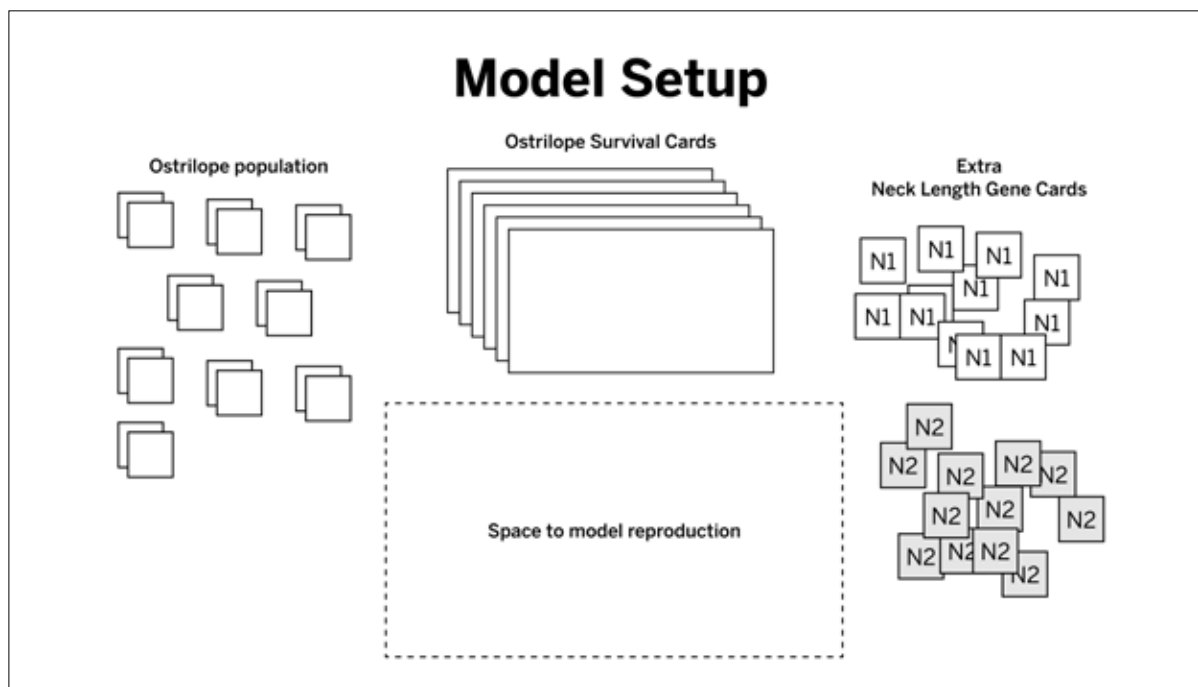
Investigating Changes to Traits in a Population (continued)

Part 2: Modeling Survival, Death, and Reproduction

This is a model of a population of ostrilopes in their environment. In the past, the environment had a mix of short, medium, and tall thornpalms (the ostrilopes' food). Now, the environment has changed, and most (but not all) thornpalms are tall.

Set up your model

1. Shuffle the Ostrilope Survival Cards and place them in a stack, face down, at the top of your desk.
2. Create your starting population of 9 ostrilopes. Pair 2 Neck Length Gene Cards to make each ostrilope. Make:
 - 3 short-necked ostrilopes (N1N1)
 - 3 medium-necked ostrilopes (N1N2)
 - 3 long-necked ostrilopes (N2N2)
3. Place each of the 9 pairs of gene cards (the starting population of ostrilopes) face down on the left side of your desk.
4. Place your extra Neck Length Gene Cards face up on the right side of your desk.
5. Leave space in the middle of your desk to model reproduction.



Investigating Changes to Traits in a Population (continued)

Part 2: Modeling Survival, Death, and Reproduction (continued)

Run your model

1. Pick 1 ostrilope from the population at random and move it to the middle of your desk. Turn over its Neck Length Gene Cards to see if its neck is short, medium, or long.
2. Choose an Ostrilope Survival Card to see if that ostrilope survives and reproduces or dies without reproducing.
 - If it dies, move its genes to the pile of extra Neck Length Gene Cards.
 - If it survives, keep it in the middle of your desk until it has a mate to reproduce with.Put the Ostrilope Survival Card back in the bottom of the pile.
3. Choose another individual ostrilope at random and repeat Steps 1 and 2. Do this until you have 2 ostrilopes that survive.
4. Once you have 2 ostrilopes that survive, you will model reproduction.
 - First, use your extra Neck Length Gene Cards to make copies of each ostrilope's genes.
 - Next, make 2 offspring by randomly pairing 1 gene from each parent.
5. Turn over the parent and offspring pairs of cards and put them in the ostrilope population on the left side of your desk.
6. Repeat Steps 1–5 to continue running your model until your teacher asks you to stop.
7. Turn over the pairs of cards in the ostrilope population and record the results in the table below.

	Starting	Ending
Short-necked ostrilopes (N1N1)	3	
Medium-necked ostrilopes (N1N2)	3	
Long-necked ostrilopes (N2N2)	3	

Discuss the following questions with your partner:

- Compare the data in the “Starting” and “Ending” columns in the table above. What do you notice?
- How did some traits become more common in the population over time?

Name: _____

Date: _____

Investigating Changes to Traits in a Population (continued)

Part 3: Explaining a Change in A Spider Population

Twenty years ago, about half the population of Darwin's bark spiders in the zoo exhibit had sticky silk, and about half had not sticky silk. Now, almost all the spiders in the population have sticky silk. Explain to the zoo director why and how the distribution of traits in the spider population could have changed. In your explanation, be sure to include the following:

- What caused this spider population to have more spiders with the sticky silk trait?
- How did the trait for sticky silk become more common in the population over time?

Write your explanation for the zoo director.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



Milwaukee, Wisconsin, is on the coast of a very large lake called Lake Michigan.

A Tale of the Temperature of Two Cities

Ocean currents carry heat energy around the globe. This affects the temperature of the air and the land nearby. Large lakes around the world also affect the temperature of the nearby air and land. Milwaukee and Madison are two cities in Wisconsin at the same latitude that are only about 70 miles apart. They each receive about the same amount of energy from the sun, but on average, Madison is colder in the winter and hotter in the summer than Milwaukee. How can that be? As shown on the map on the next page, Milwaukee is next to a large body of water—Lake Michigan. Lake Michigan doesn't have the same kinds of currents as the ocean does, but it does have an impact on the temperature of the air and land nearby.

Imagine that you leave a tub of water sitting out in the summer sun all day. The water will get warm, but you will still be able to put your hand in it without getting burned. Now imagine walking barefoot on the black asphalt of a playground in the middle of a sunny summer day. The asphalt would be so hot, you wouldn't want to walk on it! This difference is due to the way energy is transferred to different materials. Due to how water molecules connect to one another, it takes a lot more energy to change the temperature of water than to change the temperature of air or land by the same amount. A lot of energy has to be transferred to water before it gets really hot. In fact, it takes more than four times the energy to heat water than

it does heat asphalt by the same amount. Since water doesn't change temperature very quickly, a large lake can help keep the nearby air from getting too hot or too cold.

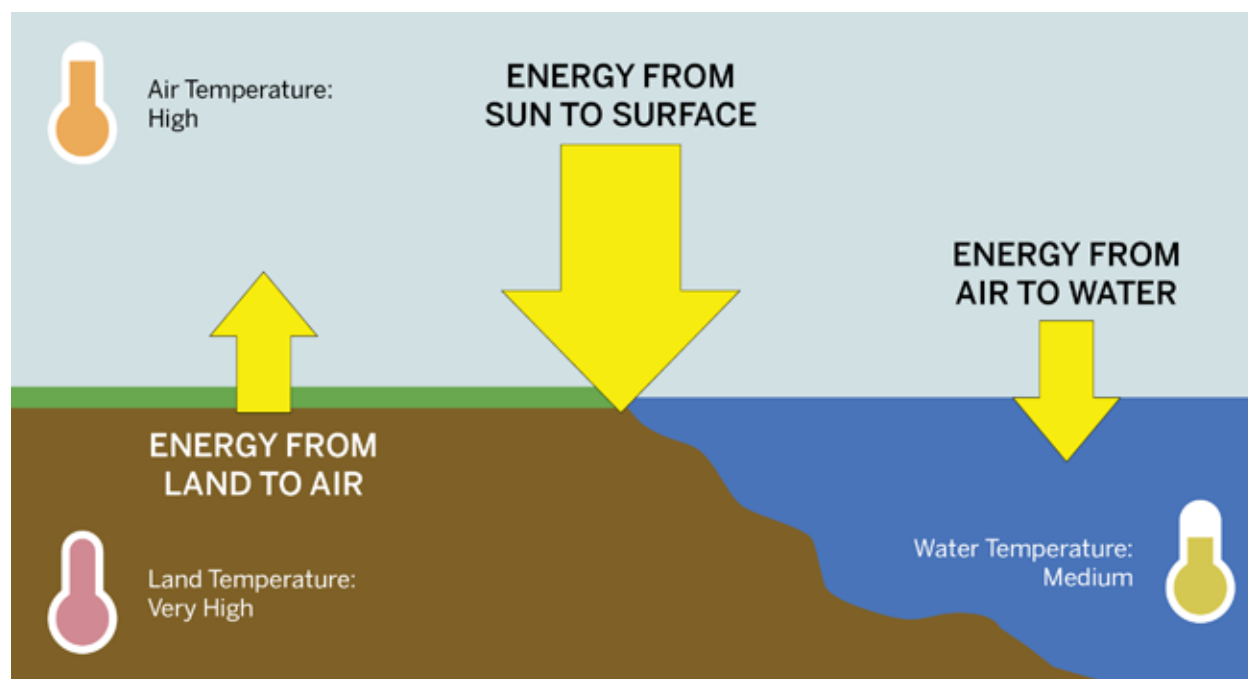
In the summertime, a lot of energy from the sun is transferred to the land, which then transfers energy to the air. The temperature of the air above the land increases. The same amount of energy from the sun is transferred to the water in a lake, but the temperature of the water does not increase as much. As a result, the air becomes warmer than the water, and energy transfers from the air to the water. That means the air near Lake Michigan cools down, resulting in cooler summer temperatures in Milwaukee than in Madison.

Madison does have small lakes nearby, but they do not stay as cool as Lake Michigan. This is because given the same amount of energy from the sun, a small lake will get warmer than a larger lake. Imagine a puddle by the side of a pool. The water in the puddle will get much warmer than the water in the pool.

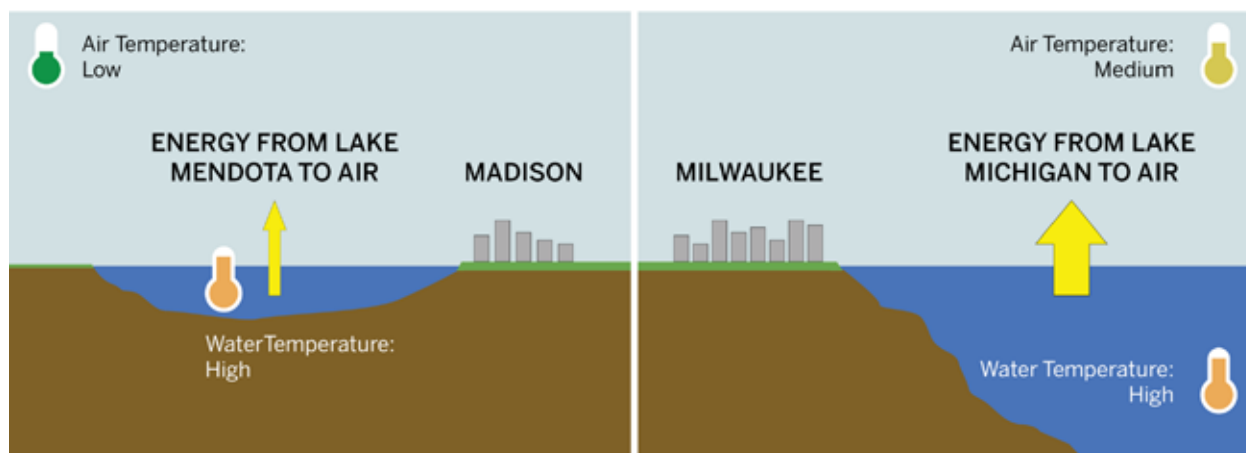


Madison and Milwaukee are two cities in Wisconsin that are located at the same latitude but have different climates.

The same amount of energy from the sun is reaching both bodies of water, but it takes a lot less energy to heat the small amount of water in the puddle. The same is true for the small lakes around Madison—they're like puddles compared to giant Lake Michigan!



As energy is absorbed by Earth's surface, water does not heat as quickly. Energy from the land transfers to the air, and energy from the air transfers to the cooler water.



Since Lake Michigan is larger, it can transfer more energy to the air than a smaller lake such as Lake Mendota.

In the fall, when there is less energy from the sun hitting both Madison and Milwaukee, the air and the land cool down rapidly. However, the water temperature of Lake Michigan takes longer to decrease. The warm lake water transfers energy to the cool air, which keeps the air warmer longer in Milwaukee. The small lakes around Madison do not stay as warm as Lake Michigan, so the air in Madison stays cool.

However, even if the temperature of a small lake and a large lake were the same, the small lake would not be able to warm the nearby air as much as the large lake. Temperature is a measure of the average kinetic energy of the atoms that make up something. Kinetic energy is the energy that an object has because it is

moving. If a small lake and a large lake have the same temperature, it means the atoms that make up the lakes are moving at the same speed, on average. However, since a large lake is made of more atoms, the total thermal energy of that lake would be higher. Thermal energy is the total kinetic energy of all the atoms that make up a sample. Thermal energy of a sample depends on the temperature, the mass of the substance (or how many atoms), and the state of matter (liquid, solid, gas). Lake Michigan is made of a lot more atoms than the small lakes around Madison, so it has more thermal energy than a small lake. With more thermal energy, it can transfer more energy to the air above it, keeping Milwaukee warmer in the fall and winter.

Name: _____

Date: _____

Reading “A Tale of the Temperature of Two Cities”

1. Read and annotate the “A Tale of the Temperature of Two Cities” article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

Rate how successful you were at using Active Reading skills by responding to the following statement:

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- ☐ Never
- ☐ Almost never
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- ☐ Frequently/often
- ☐ All the time

Active Reading Guidelines

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Gathering Evidence About Air Temperature

Part 1

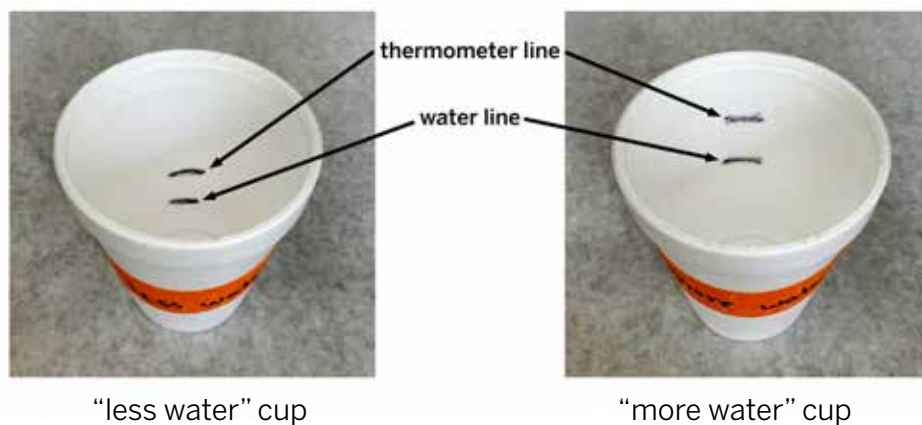
Safety Note: Hot Water and Steam

Handle hot water with care. If spilled, it could burn your skin.

Do not place your hands or face directly above the cup so you do not come into contact with steam. Steam can burn your skin

Conduct an investigation to gather evidence about how different amounts of water can affect air temperature.

1. Hold one thermometer in each cup and measure the initial air temperature. Record your data in the table on the next page.
2. Pour hot water into the cups until it reaches the water line (the bottom line) marked inside the cups. Notice that the cup labeled “less water” gets less water than the cup labeled “more water.”



3. Hold a thermometer in each cup at an angle so it is touching the top line marked inside the cup. The bottom of the thermometer should be about 1 inch above the water, and your hand and face should not be directly above the cup. DO NOT allow the thermometer to touch the water in either cup.



Gathering Evidence About Air Temperature (continued)

Part 1 (continued)

4. Wait 2 minutes and measure the final temperature of the air in each cup. Record this data in the table below.
5. Answer the questions below the table.

	Initial air temperature (°C)	Final air temperature (°C)
“more water” cup		
“less water” cup		

Why did the air above the water change temperature?

Which cup had a larger change in air temperature?

Name: _____

Date: _____

Gathering Evidence About Air Temperature (continued)

Part 2

Preview the questions below and then reread the article “A Tale of the Temperature of Two Cities” to answer the questions. As you read, you may want to highlight or annotate parts of the text that will help you answer the questions.

When energy from the sun transfers to Earth’s surface, why doesn’t water get as warm as the land beside it?

In the summer, how does Lake Michigan keep the air temperature cooler in Milwaukee than the smaller lakes do in Madison?

In the fall and winter, how does Lake Michigan keep the air temperature cooler in Milwaukee than the smaller lakes do in Madison?

Name: _____

Date: _____

Gathering Evidence About Air Temperature (continued)

Part 3

If the temperature of the water in each cup was the same, why was there a difference in the change in air temperature above?

How the Water Cycle Cleans Louisiana's Water



Storm clouds and rain over Louisiana.

Louisiana is wet. It gets the second most rain of any state—only Hawaii gets more. Water flows through Louisiana in the Mississippi River and in countless smaller rivers and creeks. It is found in lakes, wetlands (swamps), the Gulf of Mexico, and even in the air and underground. Water is constantly cycling among these places.

All this water is a valuable resource. People need water for drinking, washing, and for growing crops. People enjoy swimming, boating, and fishing. Lakes, rivers, and the Gulf provide habitat for fish, shellfish, water plants, and more. Water pollution is a serious threat to this resource. Pollution from factories, farms, and households contaminates lakes, rivers, and the Gulf. This pollution can make it harder for people to safely use the water and harder for plants and animals to survive in these habitats.

Pollution gets into water as water moves through Louisiana. However, the cycling of water can also purify the water, cleaning it of pollution. Understanding the water cycle and how it can purify water can help people keep Louisiana's water clean.

Evaporation, Condensation, and Precipitation

In addition to being wet, Louisiana is warm. This means that there is enough energy from the sun to cause a lot of water to evaporate from the surfaces of Louisiana's rivers, lakes, wetlands, and the ocean. When water evaporates, it changes from liquid to invisible gas—water vapor—in the air. As water evaporates, it is cleaned; most of the dirt or pollution in liquid water stays behind. When salty ocean water

evaporates, the salt stays in the ocean. This means that the water vapor in the air above Louisiana is quite pure.

When water vapor rises high in the air, it cools and condenses—it changes back from gas to liquid. Small drops of liquid are what make up clouds. When enough water condenses, these drops get heavy enough to fall as rain. This rainwater is more pure than the water it came from before it evaporated; it has less dirt, pollution, and salt. So while Louisiana's many storms can have negative consequences such as flooding, those same storms are also helpful because they renew supplies of clean freshwater.

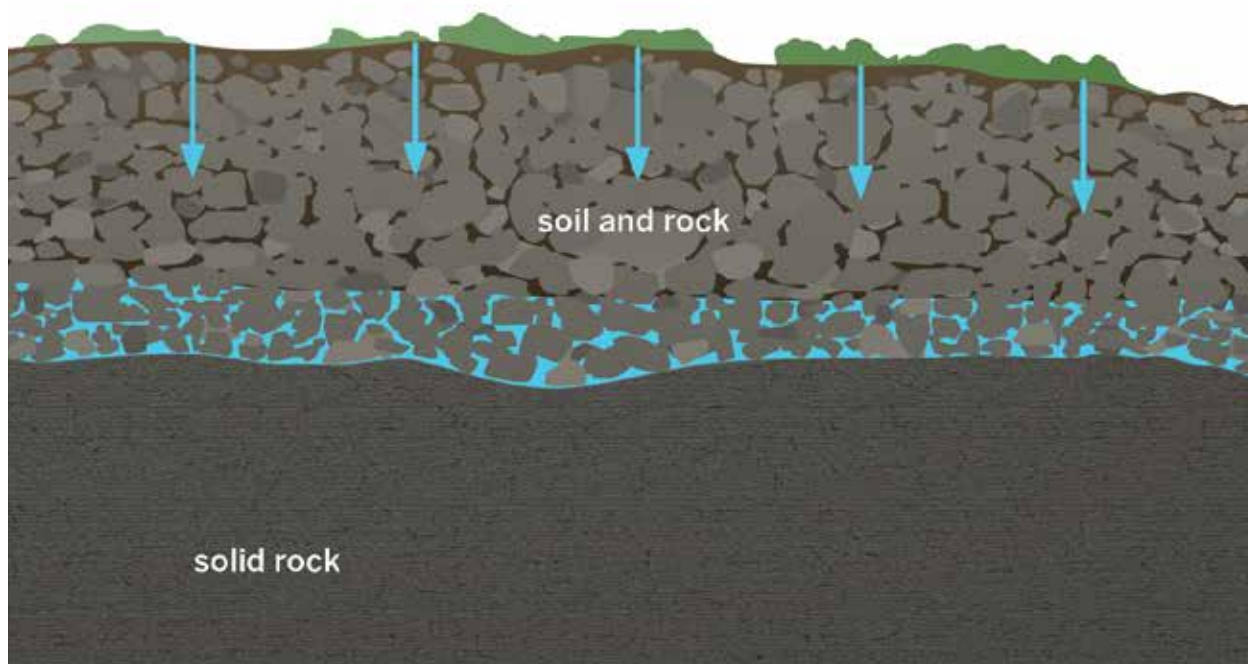
Runoff and Groundwater

When rain reaches the ground, gravity causes it to flow downhill toward rivers and eventually into the ocean. This movement of water over

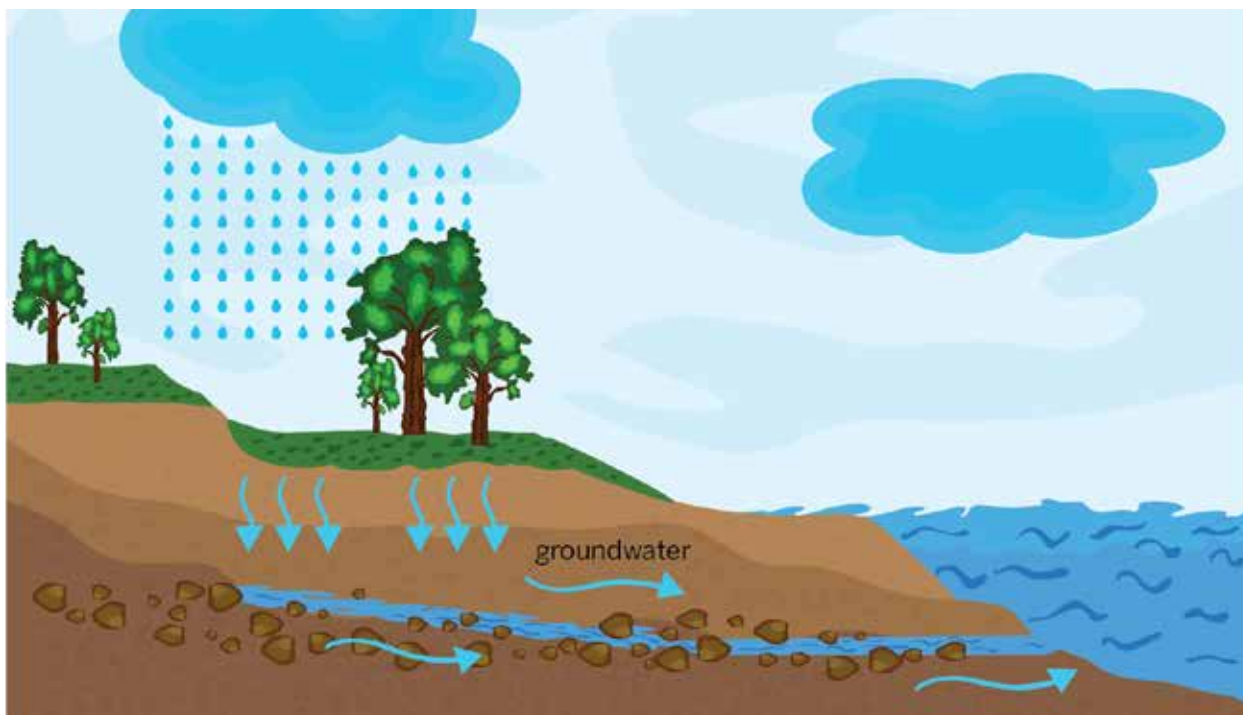
the surface of Earth is called runoff. This part of the water cycle is when a lot of pollution can enter Louisiana's water. As water runs past farms, fertilizer and pesticides (chemicals used by farms) get carried along with the water. As water runs through cities and towns, garbage, oil spilled from cars, and other pollution get carried along with the water. Some factories dump waste into rivers or where runoff flows.

Not all rainwater becomes runoff. Some of it soaks through the soil and into spaces in the rock deeper underground. This underground water is called groundwater. As polluted water moves down through the ground, soil and rock filter the water. Some pollution and dirt stay in the ground above, and cleaner water moves down into the groundwater. Nearly two-thirds of people in Louisiana get their household water from this clean groundwater. Many farmers also use groundwater for their crops.

Water seeps into the ground from the surface.



As water seeps into the ground from the surface, it is filtered by rock and soil. This water is called groundwater.



When polluted water soaks into the ground, it can be filtered. Plants allow more water to soak into the ground, so more of it can be filtered.

In places where there are more trees and other plants, more rainwater becomes groundwater rather than runoff. The roots of the plants slow the flow of water over the surface. Slower moving water has more time to sink into the ground, get purified, and become groundwater. In places where the ground is covered in cement by roads and parking lots, little rainwater soaks in to become groundwater.

Water Cycling Through Plants and Animals

As part of the water cycle, water moves through plants and animals as well. Plants take in water from the ground through their roots. They then release most of that water from their leaves as water vapor. This is called transpiration, and it purifies water similarly as in evaporation.



The trees and plants growing in Louisiana's wetlands can filter water.

Plants in Louisiana's wetlands are especially important for this cleaning of water. Plants in wetlands slow water down as it moves from rivers to the Gulf, and their roots take in a lot of pollution. Water also passes through animals. One important animal in Louisiana's water cycle is the oyster, an ocean animal with a hard shell that lives near the coast. Oysters suck water in and filter out tiny organisms in the water for food. They then spit clean water back out. One oyster can filter about 180 liters (47 gallons) of ocean water every day!

Protecting Louisiana's Water

People in Louisiana are working to keep water clean. People clean up trash from streets and parks so it doesn't get into rivers or the Gulf. Farmers find ways to use less fertilizer and pesticide. The government has made laws so factories dispose of waste properly. People are also using the water cycle's natural filtering to help clean water. They plant trees so more rainwater soaks in to become clean groundwater. They restore damaged wetlands to help filter water. They help more oysters grow along the coast of the Gulf of Mexico. Understanding how water can be purified as it cycles helps people protect Louisiana's water.



Oysters filter ocean water.

Name: _____

Date: _____

Reading “How the Water Cycle Cleans Louisiana’s Water”

1. Read and annotate the “How the Water Cycle Cleans Louisiana’s Water” article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

Rate how successful you were at using Active Reading skills by responding to the following statement:

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- ☐ Never
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- ☐ Sometimes
- ☐ Frequently/often
- ☐ All the time

Active Reading Guidelines

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3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Rereading “How the Water Cycle Cleans Louisiana’s Water”

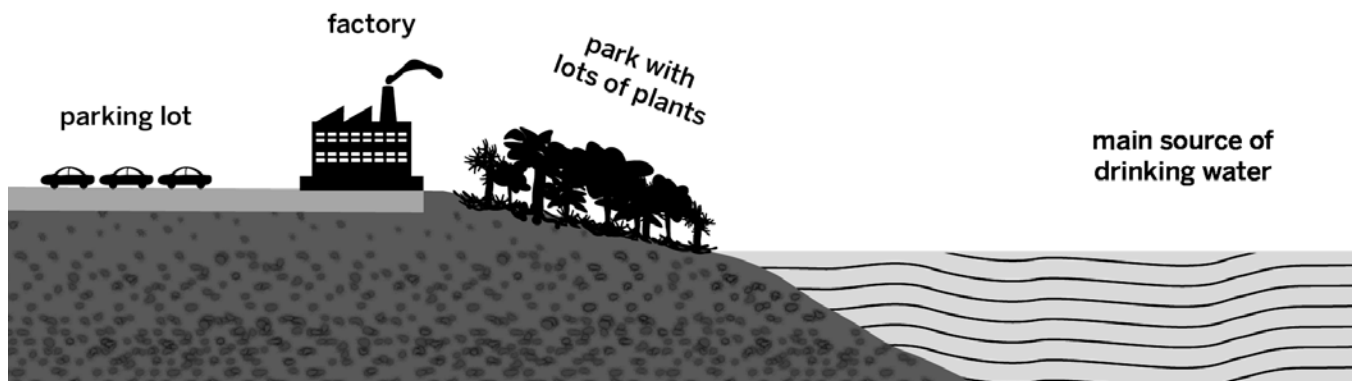
Part 1

Reread “How the Water Cycle Cleans Louisiana’s Water.” As you read, highlight and annotate information that helps you understand how different parts of the water cycle clean water. You will use that information to help you answer the question in Part 2.

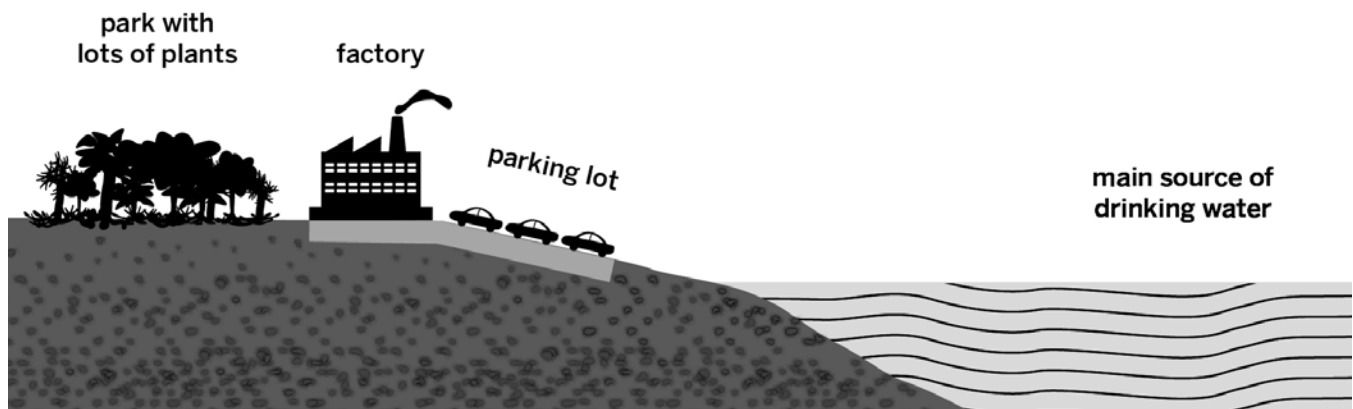
Part 2

The town of Aguabuena is building a factory, a parking lot, and a park near the town’s main source of drinking water. The townspeople are concerned because water near another factory in town is polluted. They are deciding between two different options for where the factory, parking lot, and park will be located. Look at the two options below and answer the question on the next page.

Option 1



Option 2



Rereading “How the Water Cycle Cleans
Louisiana’s Water” (continued)

Part 2 (continued)

Which option would be the best for having drinking water with less pollution? Explain your reasoning.

Name: _____

Date: _____

Investigating Carbon Cycling with a Sim

Part 1

1. Open the *Matter and Energy in Ecosystems* Sim and press PLAY.
2. Find carbon dioxide moving from the atmosphere (abiotic matter) into living things (biotic matter).

Where does carbon dioxide go as it moves out of the atmosphere?

Press VIEW CELL of a living thing that takes in carbon dioxide. What do you observe happening to carbon dioxide in the cell?

3. Find carbon dioxide moving from living things (biotic matter) into the atmosphere (abiotic matter).

From where does carbon dioxide move into the atmosphere?

Press VIEW CELL of a living thing that releases carbon dioxide. What do you observe happening in the cell that leads to the release of carbon dioxide?

Name: _____

Date: _____

Investigating Carbon Cycling with a Sim (continued)

Part 2

1. With your partner, read and discuss the question below.
2. Think about what will happen to carbon dioxide in the atmosphere if there are fewer producers. Discuss your prediction with your partner.
3. Press PLAY in the Sim and then decrease the producers by pressing the KILL button until the images of plants around the box are mostly removed.
4. Press GRAPH VIEW and turn on carbon dioxide (CO₂). You may want to turn off the other lines on the graph so it is easier to focus on carbon dioxide.
5. Let the Sim run for at least another 25 time units. Observe what happens to carbon dioxide in the atmosphere (abiotic matter). You may want to move the graph back in time so you can see the amount of carbon dioxide before and after the producers died.
6. Answer the question below.

How does carbon dioxide in the atmosphere change if there are fewer producers? Why?

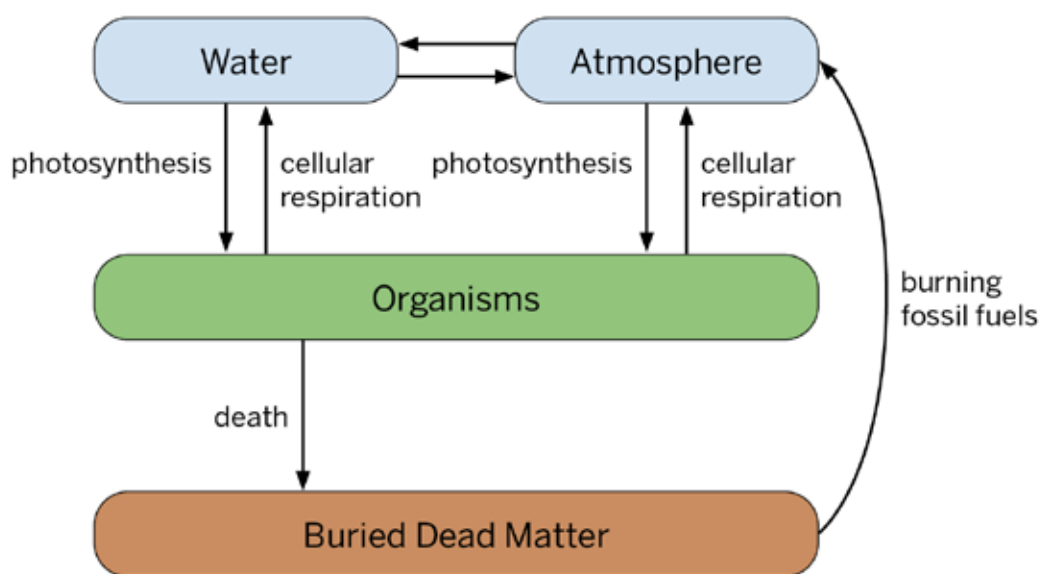
Engineering with Photosynthesis to Reduce Climate Change

The Carbon Cycle, Climate Change, and Photosynthesis

Climate change is one of the biggest challenges that we face as humans. Earth's climate is changing because of an increase in carbon dioxide and methane in the atmosphere. These gases are made partly of carbon atoms. Carbon is found in all the parts of Earth's system, and it cycles among the different parts, including into and out of the atmosphere. For example, carbon dioxide from the atmosphere gets absorbed into ocean water and also moves from the ocean to the air. All organisms (living things) give off carbon dioxide during cellular respiration, and producers (plants and algae) take it in during photosynthesis. When organisms die, they may decompose, and their carbon is returned to the atmosphere; or they may get buried, and, over millions of years, their carbon can become part of rock or fossil fuels. Normally, the total amount of carbon in any one part of Earth's system stays about

the same. However, in the last 100 years or so, human activities, including deforestation and combustion of fossil fuels, have changed this cycle and dramatically increased the amount of carbon dioxide in the atmosphere.

Now, scientists are working to use the power of producers to change the carbon cycle in ways that help solve climate change. Producers take in carbon dioxide molecules from the air. Using energy from sunlight, producers combine the carbon dioxide molecules with water molecules, changing them into glucose molecules and oxygen molecules. This process is called photosynthesis. Producers get the energy they need to grow and survive from the glucose molecules they produce, and they release the oxygen into the atmosphere. Since photosynthesis pulls carbon dioxide out of the atmosphere, perhaps it holds the key to solving climate change. One way humans can make this happen is by planting more trees, but scientists and engineers are working on other ways as well.



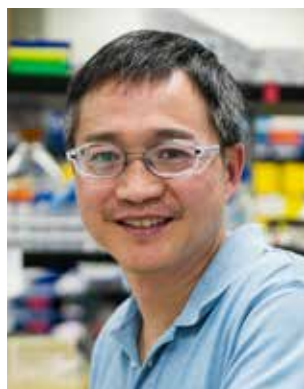
The arrows in this diagram show how carbon moves in Earth's system.



Making Fuel from Algae

Dr. Jianping Yu researches ways of making fuel by using algae. If you've ever seen green pond water, that green color was caused by algae. Algae are producers, and most kinds of algae are tiny organisms that live in water. Some kinds of algae make oils that can be used as fuel. This fuel can be burned instead of fossil fuels to power cars, airplanes, and more. Dr. Yu helps lead a team of scientists and engineers working to grow algae that make more of these oils. Other scientists and engineers are designing ways to separate out the oils quickly and cheaply.

The oils made by algae are made partly of carbon, which comes from carbon dioxide that the algae pull in during photosynthesis. Once the oils are turned into fuel and burned, carbon dioxide is released back into the atmosphere. So how does fuel from algae help solve climate change? When fuel comes from producers such as algae, the fuel is renewable. The carbon in the fuel goes into the atmosphere when the fuel is burned, but it gets cycled back out of the atmosphere at about the same rate when new algae grows. Fossil fuels are nonrenewable. They take millions of years to form, so the carbon put into the atmosphere by combustion of fossil fuels is not cycled back out of the atmosphere at anywhere near the same rate.



Dr. Yu researches fuel made from algae.



Engineers design systems to grow algae for fuel.



Dr. Chory is developing plants that reduce carbon dioxide in the atmosphere.

Designing Plants with Super Roots

Dr. Joanne Chory and her team are working to grow plants that are better at storing the carbon taken in through photosynthesis. Plants remove carbon dioxide from the air, but when they die, their dead matter rots or is burned, and carbon dioxide is released back into the air.

Dr. Chory and her team are changing farm crops, such as corn, so they make super roots. These roots are designed to be longer and to have more of a plant material called suberin. Suberin is a waxy material that's found in melon rinds and cork, in addition to plant roots. Suberin holds a lot of carbon, so the more suberin a plant makes, the more carbon dioxide the plant removes from the atmosphere. Suberin does not decompose easily. When a corn plant is cut down, the suberin in its roots stays underground and does not release much carbon dioxide.

Dr. Chory's team is changing the plants by breeding—they choose the plants that make the most suberin and have them produce offspring.

Then, they choose the offspring with the most suberin and have those produce more offspring, and so on for many generations of plants. They also use genetic engineering to directly change the genes of plants so they make more suberin. One of the challenges the team faces is designing plants that make super roots but that still work well as crops and produce a lot of food. If the team succeeds, they hope that farmers will plant millions of these plants with super roots, all pulling carbon dioxide out of the atmosphere.

The carbon cycle is an essential part of how everything in Earth's system works. Humans have been changing the carbon cycle—and Earth's climate—for many decades through farming, burning fossil fuels, and other activities that add carbon dioxide to the atmosphere. As we understand more about how the carbon cycle affects everything on Earth, we may find more ways to use that understanding to design solutions to climate change.

Name: _____

Date: _____

Reading “Engineering with Photosynthesis to Reduce Climate Change”

1. Read and annotate the “Engineering with Photosynthesis to Reduce Climate Change” article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

Rate how successful you were at using Active Reading skills by responding to the following statement:

As I read, I paid attention to my own understanding and recorded my thoughts and questions.

- ☐ Never
- ☐ Almost never
- ☐ Sometimes
- ☐ Frequently/often
- ☐ All the time

Active Reading Guidelines

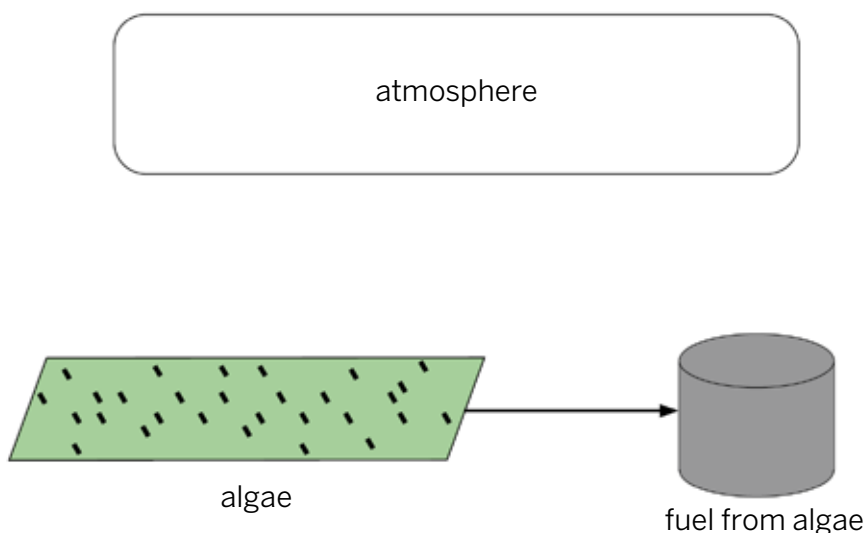
1. Think carefully about what you read. Pay attention to your own understanding.
2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Rereading “Engineering with Photosynthesis to Reduce Climate Change”

Reread the article “Engineering with Photosynthesis to Reduce Climate Change” to help you complete the diagrams and captions on this page and the next page. Focus on the “Making Fuel from Algae” section and the “Designing Plants with Super Roots” section. As you read, you may want to highlight or annotate parts of the text that will help you.

Diagram 1: Fuel from Algae

1. Complete the diagram to show the movement of carbon involved in this solution.
 - Add arrows to show how carbon dioxide moves out of and into the atmosphere.
 - Label the arrows and annotate the diagram as needed.
 - You may want to use the following terms: *carbon dioxide*, *photosynthesis*, *burned*, *combustion*.
2. Complete the caption under the diagram. Explain why this solution could reduce carbon dioxide in the atmosphere.

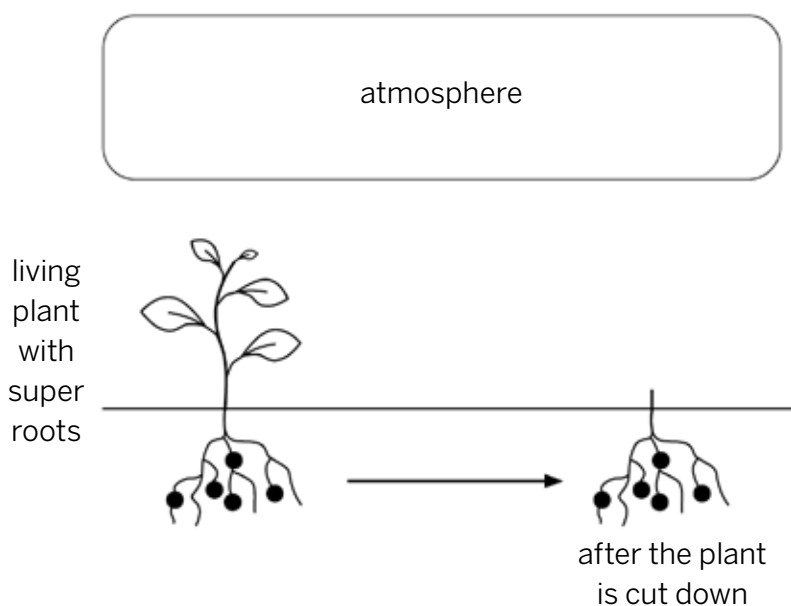


Caption: Using fuel from algae rather than from fossil fuels could reduce carbon dioxide in the atmosphere because . . .

Rereading “Engineering with Photosynthesis to Reduce Climate Change” (continued)

Diagram 2: Plants with Super Roots

1. Complete the diagram to show the movement of carbon involved in this solution.
 - Add arrows to show how carbon dioxide moves out of the atmosphere.
 - Show where carbon is stored in the plant before and after it is cut down.
 - Label the arrows and annotate the diagram as needed.
 - You may want to use the following terms: *carbon dioxide*, *photosynthesis*, *carbon*, *suberin*, *roots*, *underground*.
2. Complete the caption under the diagram. Explain why this solution could reduce carbon dioxide in the atmosphere.



Caption: Planting plants with super roots that make extra suberin could reduce carbon dioxide in the atmosphere because . . .



This coral reef ecosystem is home to a huge number of different species.

The Amazing Variety of Life in a Coral Reef

The coral reef is a carnival of colors and shapes. There are corals shaped like antlers, brains, fans, chimneys, and many others in shapes too strange to describe. Fish dart in all directions, flashing their brilliant colors, as reef sharks loom overhead. Hiding among the corals are crabs, eels, and other animals. Coral reef ecosystems like the one pictured on this page are home to millions of different species. (A species is a group of organisms of the same kind.) Counting the number of different species in an ecosystem is a way to measure its biodiversity—the variety of life there. Coral reefs have greater biodiversity than almost any other ecosystem on Earth.

Greater biodiversity makes an ecosystem more stable. An ecosystem is a complex system of interacting populations with organisms from consumer populations eating organisms from resource populations. In a stable ecosystem, each population stays about the same size—populations are not exploding in size or completely dying out. An ecosystem with more biodiversity is more stable because a change to one population will only cause small changes to the other populations in the ecosystem; eventually, the populations will become stable again.

In an ecosystem with a lot of species, such as a coral reef, there are many consumer

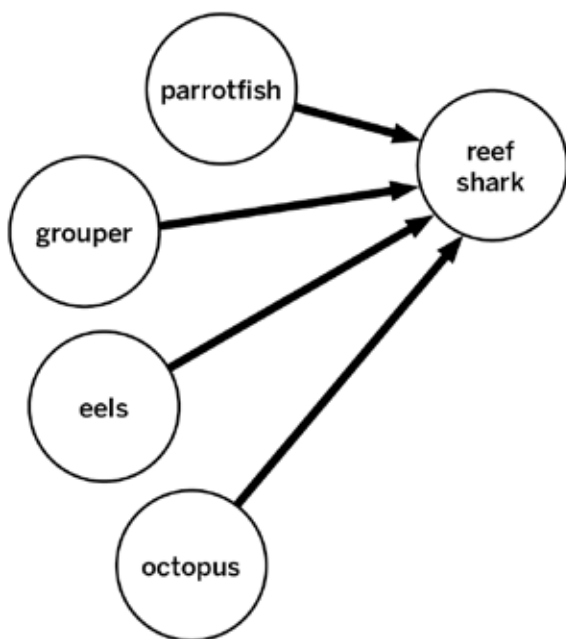
populations and many resource populations. One consumer population may have many different resource populations. For example, a population of reef sharks may eat parrotfish, grouper, eels, octopuses, and several other animals. If the parrotfish population decreases, that will affect the shark population, too. However, the sharks might be able to make up the difference by eating more grouper, eels, and octopuses. Due to this, the effect on the shark population will be smaller than it would have been if the sharks *only* ate parrotfish. In any ecosystem, populations are likely to have small changes over time. Still, in an ecosystem with plenty of biodiversity, the ecosystem tends to remain stable overall.

Stable ecosystems benefit humans as well. In the case of coral reefs, there are many direct and indirect benefits to humans. When a coral reef forms, it creates a physical barrier in the

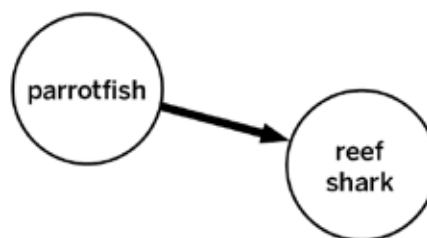
ocean. These barriers help to absorb some of the energy of ocean waves and storms approaching the shore. They can be vital in limiting erosion and storm damage of human habitats along shorelines. Coral reefs also provide food for millions of people. More than a quarter of the fish in the ocean depend on coral reefs, and many humans depend on those fish for food. In addition, scientists are studying coral reef organisms and finding ways to improve our lives in unique ways. For example, a group of engineers learned to make cement more effectively by studying coral. Scientists have even discovered medicines made from coral reef plants and animals that can treat cancer, arthritis, and heart disease!

While biodiversity helps ecosystems remain stable, it's not always enough. Even though coral reefs are some of the most diverse ecosystems on Earth, they can be pushed out

Ecosystem with more biodiversity



Ecosystem with less biodiversity



These food webs show just some of the organisms that live in a coral reef ecosystem. In the ecosystem with more biodiversity, the reef shark has many different populations to eat. In the ecosystem with less biodiversity, the reef shark has only one population to eat. A change to the parrotfish population would have a greater effect on the reef shark population in the ecosystem with less biodiversity because the reef shark population does not have another population to eat.



This scientist is studying bits of coral in a coral nursery. At a coral nursery, people care for broken-off bits of living coral before getting ready to attach them to new places on a reef.

of balance if they are put under too much stress. Unfortunately, many different human activities are putting stress on coral reefs. Pollution from cities, factories, and farms can harm organisms and prevent needed sunlight from reaching coral reefs. Overfishing can decrease populations of fish that play important roles in reef ecosystems. Careless tourists may step on delicate corals and break them. The greatest threat to reefs is the rising temperature and acidity of ocean water due to climate change. Faced by these threats from human activities, coral reefs all over the world are beginning to lose some of their amazing biodiversity.

Many people are trying to help maintain the biodiversity of coral reef ecosystems. In addition to working on problems such as climate change, pollution, and overfishing, scientists

have created coral nurseries. Scientists collect bits of living coral that boats or storms have broken off from a healthy reef, and they let the coral grow in protected areas. Then, scientists take those coral bits and attach them to a damaged reef, hoping the coral will reproduce and spread. In this way, scientists can try to bring back coral species that have been lost in a particular reef ecosystem. Humans rely on the amazing biodiversity of coral reefs and other ecosystems around the world. These ecosystems provide many benefits that can help us survive and thrive. In order to preserve the stability of these ecosystems, we must limit our negative impacts and maximize our positive influences on biodiversity. In this way, we can ensure that the ecosystems stay healthy for future generations.

Name: _____

Date: _____

Reading “The Amazing Variety of Life in a Coral Reef”

1. Read and annotate the “The Amazing Variety of Life in a Coral Reef” article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

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- ☐ All the time

Active Reading Guidelines

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4. After you read, discuss what you have read with others to help you better understand the text.

Name: _____

Date: _____

Rereading “The Amazing Variety of Life in a Coral Reef”

Part 1

Preview the questions below and then reread paragraphs 2, 3, and 4 of the article “The Amazing Variety of Life in a Coral Reef.” As you read, highlight information that helps you answer the questions below.

Why is an ecosystem with greater biodiversity more stable than an ecosystem with less biodiversity?

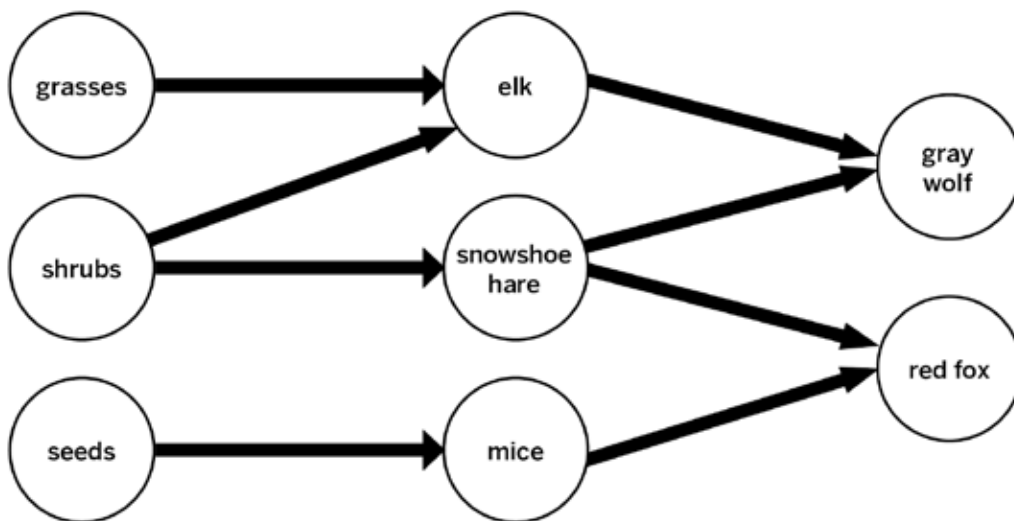
How can stable coral reef ecosystems benefit humans?

Rereading “The Amazing Variety of Life in a Coral Reef” (continued)

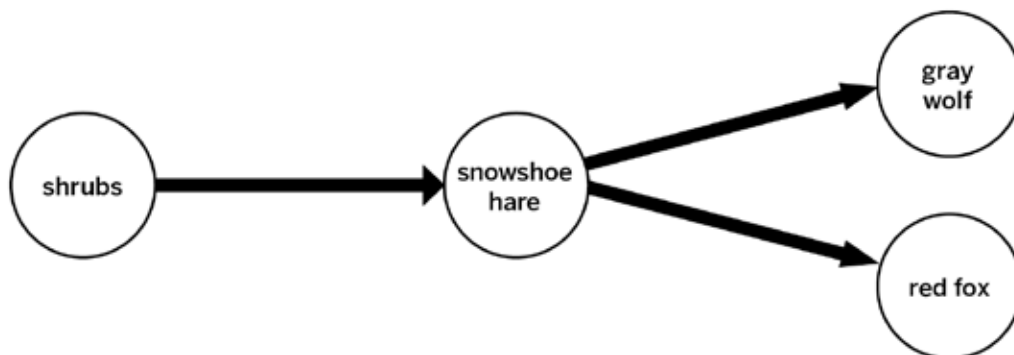
Part 2

The food webs below show two different ecosystems. Use these food webs to answer the question on the next page.

Ecosystem 1



Ecosystem 2



Name: _____

Date: _____

Rereading “The Amazing Variety of Life in a Coral Reef” (continued)

Part 2 (continued)

Imagine that a disease caused the snowshoe hare population to decrease very quickly. Which ecosystem will remain more stable and why? Use the food webs to explain your thinking.

Changes in the Great Barrier Reef Ecosystem

An Underwater Rainbow

Just off the coast of Australia lies one of the most diverse ecosystems in the world: the Great Barrier Reef. This amazing natural wonder is 2,300 km (1,430 miles) long and includes thousands of individual reefs and hundreds of islands, making it the largest coral reef system in the world. In fact, it's the only living thing that's visible from space. The hard rock-like structures that form the reef are made by many tiny organisms called coral. Free-swimming coral larvae attach to rocks and build a hard outer shell, creating the structure of the reef. As they reproduce, more coral attach to the structure and continue adding to it, making it larger and larger over time. It can take

thousands or even millions of years for large reefs to form, and they are constantly changing. In addition to the coral itself, the Great Barrier Reef is home to countless other marine organisms. It is a bustling, active ecosystem filled with colorful schools of fish, massive snails, tiny seahorses, and intricate seaweeds.

Over the last few decades, however, scientists have observed that the Great Barrier Reef has been changing in alarming ways. During the cooler months of the year, the reef appears healthy and filled with living organisms, but during the warm summer months, many of the organisms that usually live in this ecosystem are gone, and the reef becomes unhealthy. To understand why this is happening, first you have



The Great Barrier Reef supports a huge variety of ocean life.



When water gets too warm, coral push out zooxanthellae that live inside them. Coral turns white, so it is called coral bleaching.

to understand the relationship between coral and tiny algae called zooxanthellae (pronounced zo-wa-zan-THEL-ai). Coral provides the algae with a protected environment and the molecules they need for photosynthesis. In return, the algae produce oxygen and the energy storage molecules that coral needs to survive. The zooxanthellae are what make the bright colors we see in healthy coral reefs.

When the water gets warmer than normal, coral gets stressed and pushes the zooxanthellae out. Coral structures turn white, a process that scientists refer to as coral bleaching. Many of the organisms that depend on the coral reef leave or die. Even when the ocean cools again in the winter months and the reef becomes healthier again, many of the coral—and the organisms that depend on them—never recover. Scientists are concerned that the entire Great Barrier Reef could die over time, along with reefs all over the world that are experiencing similar stresses.

The ocean naturally gets warmer and cooler with the change of the seasons, so why have coral been getting unusually stressed in the last several decades? Why has the ocean water been warmer than normal? The answer is connected to climate change.

How Climate Change Affects Coral Reefs

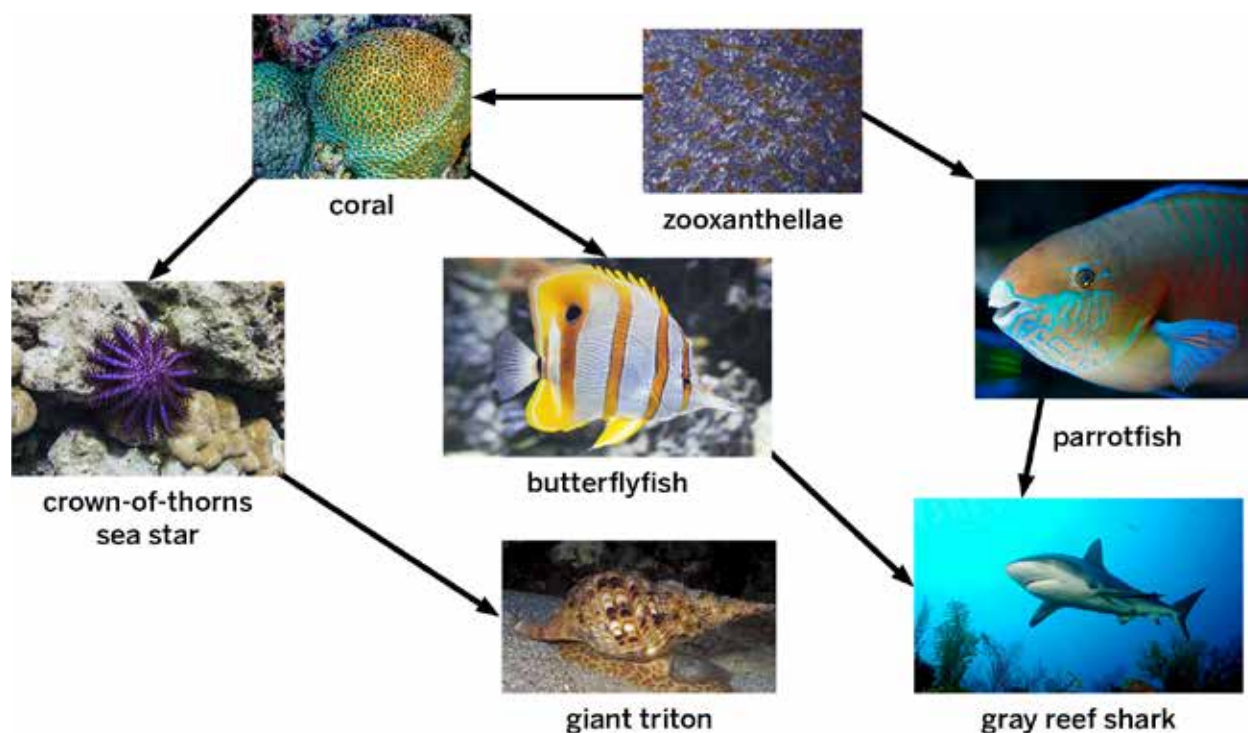
In the last century, the human population has exploded, growing from less than 2 billion in the early 1900s to our current number of nearly 8 billion. Those billions of humans eat a lot of food, including meat from animals such as cows and pigs, which release a lot of methane into the air. In addition, humans depend on machines such as cars and airplanes, which produce methane and carbon dioxide. The combination of these and other factors mean that a lot of carbon dioxide and methane are released into the atmosphere where they have a profound effect on the entire Earth system.

More carbon dioxide and methane cause our atmosphere to trap more energy from the sun, which causes the land and water—including the ocean—to warm significantly. An ocean temperature increase of just 1°C for four weeks can cause coral bleaching, and coral begin to die after another four weeks.

The Great Barrier Reef Food Web

When coral and zooxanthellae of the Great Barrier Reef weaken or die, it affects countless populations of organisms that live in and around the reef. That's because organisms in an ecosystem depend on one another—a change to one population can affect the whole ecosystem.

Parrotfish eat the zooxanthellae that live with the coral. Crown-of-thorns sea stars and fish, such as butterflyfish, eat coral, as do some species of marine snails and worms. During coral bleaching periods, these animals either leave to find more prey or die because they don't have enough to eat. The fish, sea stars, snails, and worms have their own predators that depend on them to survive. In the Great Barrier Reef, parrotfish are eaten by gray reef sharks, and crown-of-thorns starfish are eaten by large sea snails called giant tritons. When enough parrotfish and crown-of-thorns starfish leave or die, the gray reef sharks and giant tritons die out or look for new places to hunt. A change to coral leads to huge changes in the entire ecosystem.



This food web shows a few of the many relationships in a healthy part of the Great Barrier Reef. Coral and zooxanthellae provide food for parrotfish, butterflyfish, and crown-of-thorns sea stars. These organisms provide food for giant triton snails and gray reef sharks. When populations are connected in a food web, a change to one population can affect all the populations.

Making Coral Reefs Healthy Again

When coral reefs become bleached, it doesn't mean that all coral have died. Often, some coral live, especially if the warmer ocean temperatures last less than eight weeks. These reefs have the potential to recover. In order to ensure the long-term health of coral reefs, we must work to lower carbon dioxide and methane gas emissions and slow climate change. If we can reduce the stresses on corals, the whole ecosystem will benefit, from the tiny zooxanthellae to the large predators such as reef sharks and giant triton snails.



A healthy coral reef off the coast of Sulawesi, Indonesia.

Name: _____

Date: _____

Reading “Changes in the Great Barrier Reef Ecosystem”

1. Read and annotate the “Changes in the Great Barrier Reef Ecosystem” article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

Rate how successful you were at using Active Reading skills by responding to the following statement:

As I read, I paid attention to my own understanding and recorded my thoughts and questions.

- ☐ Never
- ☐ Almost never
- ☐ Sometimes
- ☐ Frequently/often
- ☐ All the time

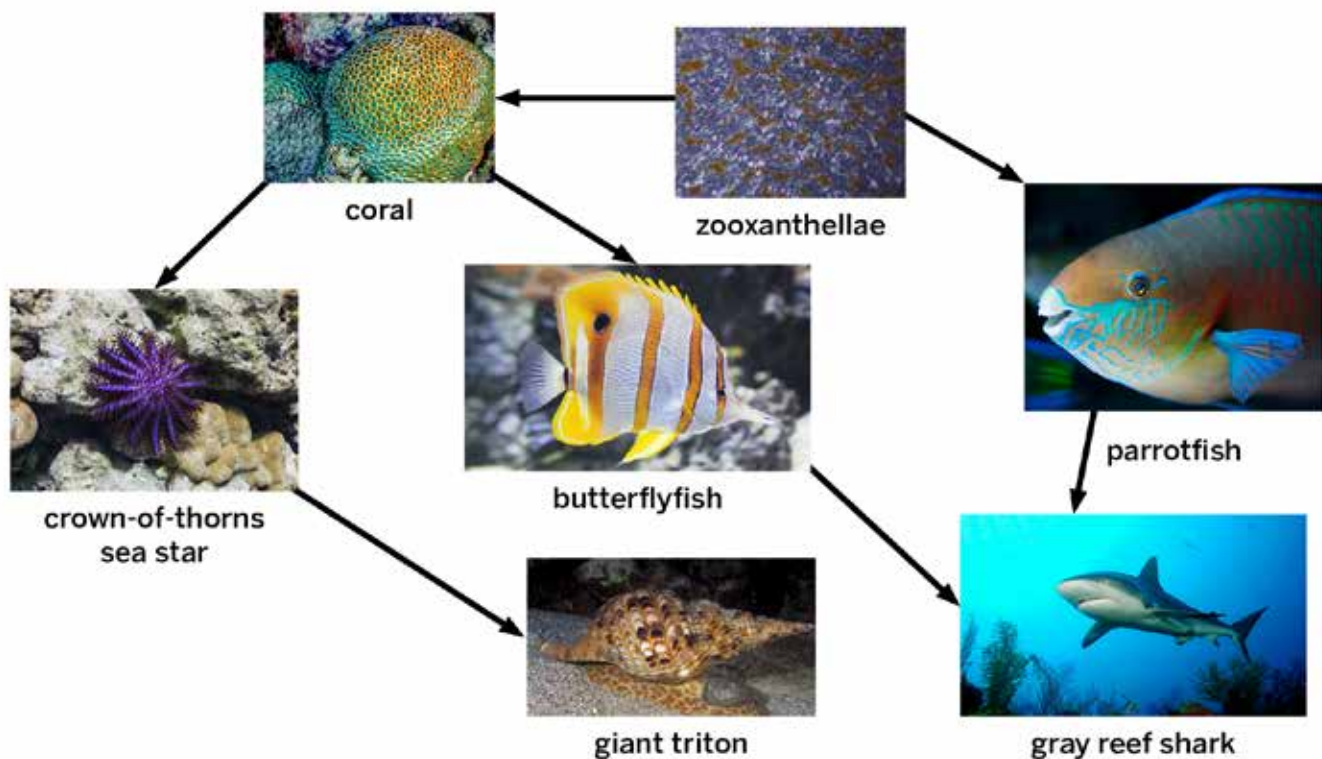
Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.
2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Rereading “Changes in the Great Barrier Reef Ecosystem”

Part 1

Preview the question on the next page and then reread the article “Changes in the Great Barrier Reef Ecosystem” to answer the question. As you read, you may want to highlight or annotate parts of the text that will help you answer the question. Focus on “The Great Barrier Reef Food Web” section and the “Making Coral Reefs Healthy Again” section. The food web below is the same one that appears in the article.



Name: _____

Date: _____

Rereading “Changes in the Great Barrier Reef Ecosystem” (continued)

Part 1 (continued)

The article describes how coral of the Great Barrier Reef are affected by warming ocean water. When coral and zooxanthellae populations of the Great Barrier Reef decrease because of warming water, it can affect all the populations in the reef ecosystem. For each population in the food web (on the previous page), how would that population be affected by a decrease in coral and zooxanthellae populations? Explain your thinking.

Name: _____

Date: _____

Rereading “Changes in the Great Barrier Reef Ecosystem” (continued)

Part 2

Read about the baobab tree (below) and the ecosystem that it is a part of. Then, look at the Madagascar food web on the next page and answer the question.

Baobab Tree Ecosystem in Madagascar

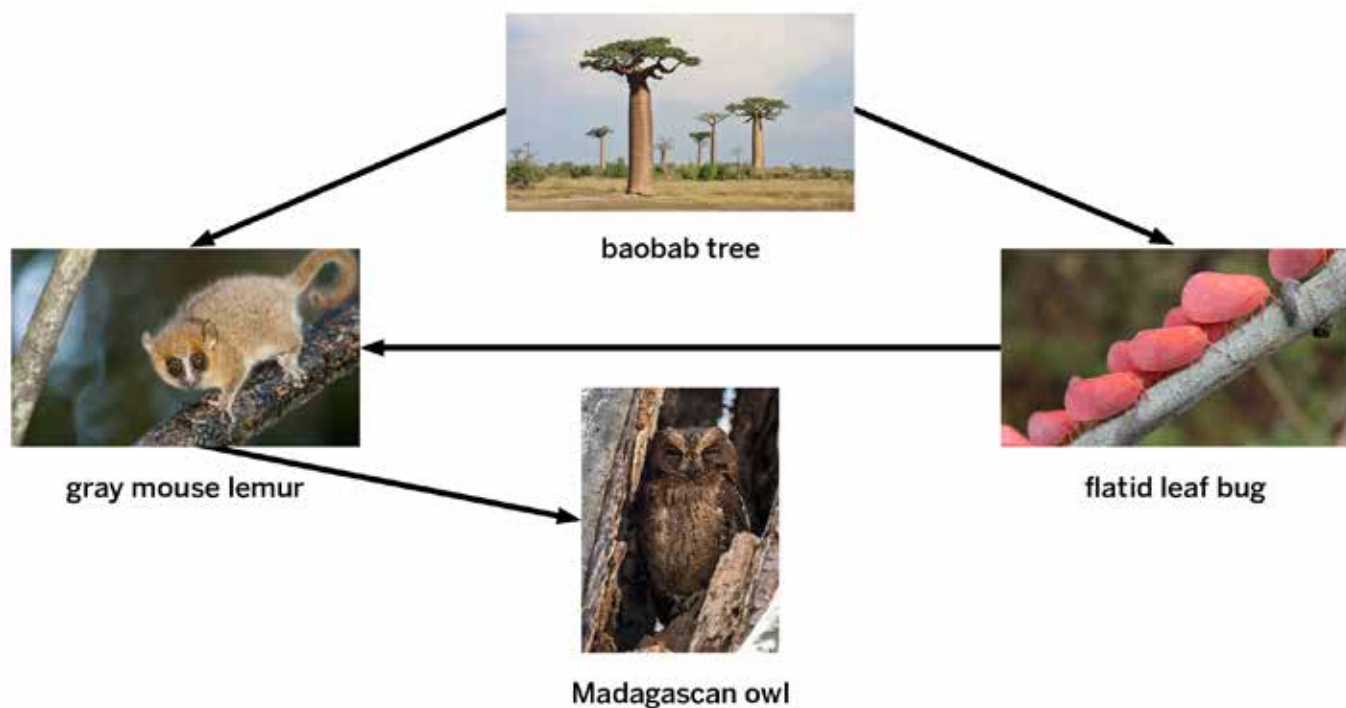
On the island of Madagascar, there is a tree called the baobab. Some of these trees are over 2,000 years old and have been important parts of Madagascar’s ecosystems the entire time.

Baobab trees need a lot of water to survive. Due to climate change, the amount of rain that falls on Madagascar has changed drastically in the last 50 years. Baobabs are no longer getting enough water, and many have died. Scientists now believe that this ancient tree population may not survive.

Many populations, including the tiny gray mouse lemur population, depend on the baobab tree to survive. Gray mouse lemurs eat the nectar and fruit from the baobab tree, as well as insects that live on the tree. Gray mouse lemurs themselves are eaten by many organisms that live in and around baobab trees, such as the Madagascan owl.

Rereading “Changes in the Great Barrier Reef Ecosystem” (continued)

Part 2 (continued)



Food web of a healthy ecosystem in Madagascar.

Use evidence from the text on the previous page and the food web (above) to make a prediction about which populations would be affected if baobab trees continue to die. Why do you think these changes would happen?

Grade 7 Glossary

adaptive trait: a trait that makes it more likely that an individual will survive in a specific environment

rasgo adaptativo: un rasgo que hace más probable que un individuo sobreviva en un ambiente específico

artificial selection: the process by which humans breed organisms to make specific traits more common or less common

selección artificial: el proceso a través del cual los humanos cruzan organismos para hacer que determinados rasgos sean más comunes o menos comunes

biodiversity: the amount of variety among the living things in an ecosystem

biodiversidad: la cantidad de variedad entre las cosas vivientes en un ecosistema

carbon: a type of atom (a tiny piece) that makes up molecules such as carbon dioxide and energy storage molecules

carbono: un tipo de átomo (un pedazo diminuto) que constituye moléculas como el dióxido de carbono y moléculas de almacenamiento de energía

cellular respiration: the chemical reaction between oxygen and glucose that releases energy into cells

respiración celular: la reacción química entre oxígeno y glucosa que libera energía en las células

distribution: the number of individuals with each trait in a population

distribución: el número de individuos que tienen cada rasgo en una población

ecosystem: all the living and nonliving things interacting in a particular area

ecosistema: todos los seres vivientes y no vivientes que interactúan en un área específica

environment: everything (living and nonliving) that surrounds an organism

ambiente: todo (viviente y no viviente) lo que rodea a un organismo

genetic engineering: when humans alter an organism's DNA in order to change its traits

ingeniería genética: cuando los humanos alteran el ADN de un organismo para cambiar sus rasgos

groundwater: water that is underground

agua subterránea: el agua que está bajo la tierra

Grade 7 Glossary (continued)

heat: the thermal energy transferred from something at a higher temperature to something at a lower temperature

calor: la energía térmica transferida de algo con una temperatura más alta a algo con una temperatura más baja

kinetic energy: the energy that an object has because it is moving

energía cinética: la energía que tiene un objeto porque se está moviendo

mass: the amount of matter that makes up an object

masa: la cantidad de materia que forma un objeto

natural selection: the process by which the distribution of traits in a population changes over many generations

selección natural: el proceso por medio del cual cambia la distribución de rasgos en una población con el paso de muchas generaciones

organisms: living things, such as plants, animals, and bacteria

organismos: seres vivos, como plantas, animales y bacterias

photosynthesis: the process by which plants and other producers use energy from sunlight to change carbon dioxide and water into oxygen and glucose (an energy storage molecule)

fotosíntesis: el proceso por el cual las plantas y otros productores usan energía de la luz del sol para cambiar dióxido de carbono y agua en oxígeno y glucosa (una molécula de almacenamiento de energía)

population: a group of the same type of organism living in the same area

población: un grupo del mismo tipo de organismo que vive en la misma área

producer: an organism that can make its own energy storage molecules (such as glucose)

productor: un organismo que puede hacer sus propias moléculas de almacenamiento de energía (por ejemplo, la glucosa)

thermal energy: the total kinetic energy of all the molecules that make up a sample

energía térmica: la energía cinética total de todas las moléculas que forman una muestra

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THE LAWRENCE
HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Amplify.

Published and Distributed by Amplify.
www.amplify.com

ISBN 978-1-64333-328-1



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