

TEACHER'S GUIDE



Pioneer

Vol. 16 No. 6

In This Guide

This guide contains language arts and science lessons for articles in this issue of EXPLORER PIONEER.

Explorer Magazine

EXPLORER classroom magazines are specifically written for each grade, 2-5. Through great storytelling and stunning photographs, the EXPLORER magazines develop literacy skills and teach standards-based science content.

The EXPLORER magazines strive to offer a variety of reading experiences for students with different ability levels in the same class. Thus, all articles have been measured using the Lexile® Framework for Reading. Some articles will be easier to read than others, but all articles in EXPLORER PIONEER will be within the 250-550L range.

EXPLORER is part of NATIONAL GEOGRAPHIC EXPLORER'S Education program. For more resources, visit the "For Teachers" tab on EXPLORER'S website, natgeo.org/explorermag-resources.

Your Subscription Includes:

- Magazines
- Classroom Posters
- Projectable Magazine
- Interactive Whiteboard Lesson
- Teacher's Guide
- App (additional subscription required)

Quest for the Quetzal

LANGUAGE ARTS 500L

Objectives

- Students will predict definitions and then write sentences to better understand unfamiliar words.
- Students will identify recognize sentences that describe cause/effect relationships in the text.

Resources

- Vocabulary Assessment Master (page 6)
- Language Arts Assessment Master (page 7)

Summary

- The article “Quest for the Quetzal” introduces readers to the resplendent quetzal, a beautiful bird once revered by ancient civilizations. Now, the bird struggles to survive in a changing world.

BUILD VOCABULARY AND CONCEPTS

- **Aztec**
- **culture**
- **Mayan**

Give each student a copy of the **Vocabulary Assessment Master**. Point out to students that they may have heard some or all of these words before.

Using that background knowledge as a base, instruct students to predict and write a definition for each word. Then have them write a sentence using each word, based on the definitions they wrote.

Display the Wordwise feature on page 8 of the projectable magazine. Review the definitions as a class. Have students add these definitions to their worksheets. Instruct them to write new sentences, using each word as it is defined in the article.

Invite volunteers to read aloud the before and after sentences they wrote for each word. As a class, examine how new knowledge contributed to students' understanding of each word.

READ

Inform students that the purpose of this article is to introduce readers to quetzal, a beautiful bird that lives in Central America.

Display pages 2-3 of the projectable magazine. Read aloud the headline and invite volunteers to describe the bird they see in the photo.

Then highlight the deck. **Say:** *This is a photo of a bird called a quetzal. According to the information here, the quetzal needs our help. There must be a reason for this.* **Ask:** *Do you know what it is?* Invite volunteers to share their opinions.

Explain to the class that when a text contains a statement like this, the writer must always support the information with a reason. **Say:** *Reasons tell why things happen. People can write anything they want to. But if writers don't include logical reasons, the text won't make sense. Good writers always include reasons that support the important points they make in the text.*

Give each student a copy of the **Language Arts Assessment Master**. Have students read the article on their own. As they do, instruct them to identify three points the writer makes. Encourage them to search for reasons that support each point. Challenge them to use the information they collected to explain why the writer says that the quetzal needs our help.

Quest for the Quetzal

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about quetzals. **Ask:** *What do quetzals look like?* (They have shining green feathers on their head, neck, and wings and red feathers on their chest. Males have two long tail feathers.) *Where do quetzals live?* (in misty cloud forests in Central America) *Which ancient cultures valued the quetzal?* (Mayan and Aztec) *How do people in Central America today celebrate the bird?* (The quetzal is the national bird of Guatemala. It's shown on flags and stamps.) Invite students to share what else they learned about quetzals.

- **Predicting Definitions** Have students turn and talk to discuss what they learned about the three vocabulary words. Encourage them to compare their results in small groups. Instruct students to discuss how examining the information they collected impacted their understanding of each term.

- **Identifying Reasons** After reading the article, remind students that reasons tell why something happened. Invite students to share their **Language Arts Assessment Masters** in small groups. Challenge them to examine one another's results to determine that all reasons are valid and support the identified key points in the text.

WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the topic.

- *What does a quetzal look like?*
- *What is it like where quetzals live?*
- *What surprised you about what you read?*

Quest for the Quetzal

SCIENCE

Objectives

- Students will recognize threats quetzals face.
- Students will understand how people can help quetzals survive.

Resources

- Content Assessment Master (page 8)
- Comprehension Check (page 9)

Science Background

The resplendent quetzal—one of the five quetzal species—is a colorful bird found in the mountainous tropical forests of Central America. Many people consider it to be one of the most beautiful birds in the world.

The quetzal has metallic green feathers on its neck, back, and wings. And its chest feathers are bright red. But the tail feathers on the male are what really make this bird stand out. During mating season, mature males can grow tail feathers that are up to a meter long.

The quetzal's beauty has not been lost on people. For thousands of years, the quetzal has held an honored place in Central American culture. Long ago, it was an important part of both Aztec and Mayan cultures. Today, it is the national bird of Guatemala.

But the bird's beauty has also made it a target. Both hunters and collectors have preyed on the bird for its beautiful feathers.

Today, the resplendent quetzal may be one of the most threatened birds of its kind. This is chiefly because as people cut trees and clear land for livestock and crops, the bird's natural habitat is disappearing. Restoring habitats or connecting those that still exist can help ensure the survival of this beautiful species.

ENGAGE

Tap Prior Knowledge

Instruct students to each think of a bird. Invite volunteers to describe the birds they are thinking of. Compare and contrast the results. As a class, discuss how all of the birds are alike. Challenge students to identify interesting ways that the birds are different.

EXPLORE

Preview the Lesson

Display pages 2-3 of the projectable magazine. Invite volunteers to describe the bird they see. **Ask:** *How is this bird different from other birds you've seen?* (Students will most likely note the bird's bright blue coloring and its very long tail feathers.) Read aloud the headline. Point out the word *quest*. **Say:** *A quest is a search. You'd think that a bird that looks like this would be easy to find.* **Ask:** *Why do you think people have to search to find it?* Invite students to share their ideas. Tell students that they will learn more about the bird and the threats it faces as they read the article.

Set a Purpose and Read

Have students read the article in order to recognize the threats quetzals face and to understand how people can help quetzals survive.

Quest for the Quetzal

SCIENCE

EXPLAIN

Recognize Threats Quetzals Face

Display pages 6-7 of the projectable magazine. Review the information as a class. Discuss how quetzals were once honored—and protected—by the Mayan and Aztec cultures. Then display pages 8-9 of the projectable magazine. Invite volunteers to read aloud the text. As they do, point out that quetzals face three main threats: loss of habitat, predators, and people. **Ask:** *Why are quetzals losing their habitats?* (People are cutting down the trees where they live.) *How does this affect quetzals?* (It causes the areas where they live to be separated. This makes it hard for them to find food or mate.) As a class, discuss how and why predators and people are also threats. (Predators eat eggs and chicks. Some people hunt quetzals or try to keep them as pets.) Give each student a copy of the **Content Assessment Master**. Instruct students to draw a picture of a quetzal in its habitat. Then have them identify the three main threats quetzals face.

Understand How People Can Help

Display page 9 of the projectable magazine. Zoom in on the text. Invite a volunteer to read aloud the second paragraph. **Say:** *The text says that people can protect habitats. They can connect habitats and punish people who harm the birds.* **Ask:** *How could people do these things?* (Possible response: Build nature preserves and national parks so the habitats are connected. Pass laws that punish to protect the birds.) Encourage students to think of another way people could protect quetzals. Instruct them to add this information to their **Content Assessment Masters**.

ELABORATE

Find Out More

Display pages 6-7 of the projectable magazine. As a class, review how quetzals have been celebrated in Central American cultures throughout time. As a class, conduct research to find additional ways that quetzals have been honored in Central America.

Extend Your Thinking About Quetzals

Remind students that many of the problems quetzals face were caused by people. As a class, discuss the importance of protecting species like the quetzal. Guide students to understand that people's actions can have long-term consequence on nature.

EVALUATE

Have students record their answers to the assessment questions in their science notebooks or on a separate sheet of paper.

- *What is special about a male quetzal's tail feathers?* (They are very long.)
- *What is the most serious threat quetzals face?* (loss of habitat)
- *In what other ways are people a threat the quetzals?* (Some people hunt quetzals or try to keep them as pets.)

If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article.

Name _____

Date _____

VOCABULARY ASSESSMENT: Quest for the Quetzal

Use this organizer to study each vocabulary word in the article.

Word			
Predicted Definition			
Sentence			
Definition from the Article			
Sentence			

LANGUAGE ARTS ASSESSMENT: Quest for the Quetzal

Identify three points the writer makes in the text. Record reasons that support each point.

Point	Reasons

Complete the sentence.

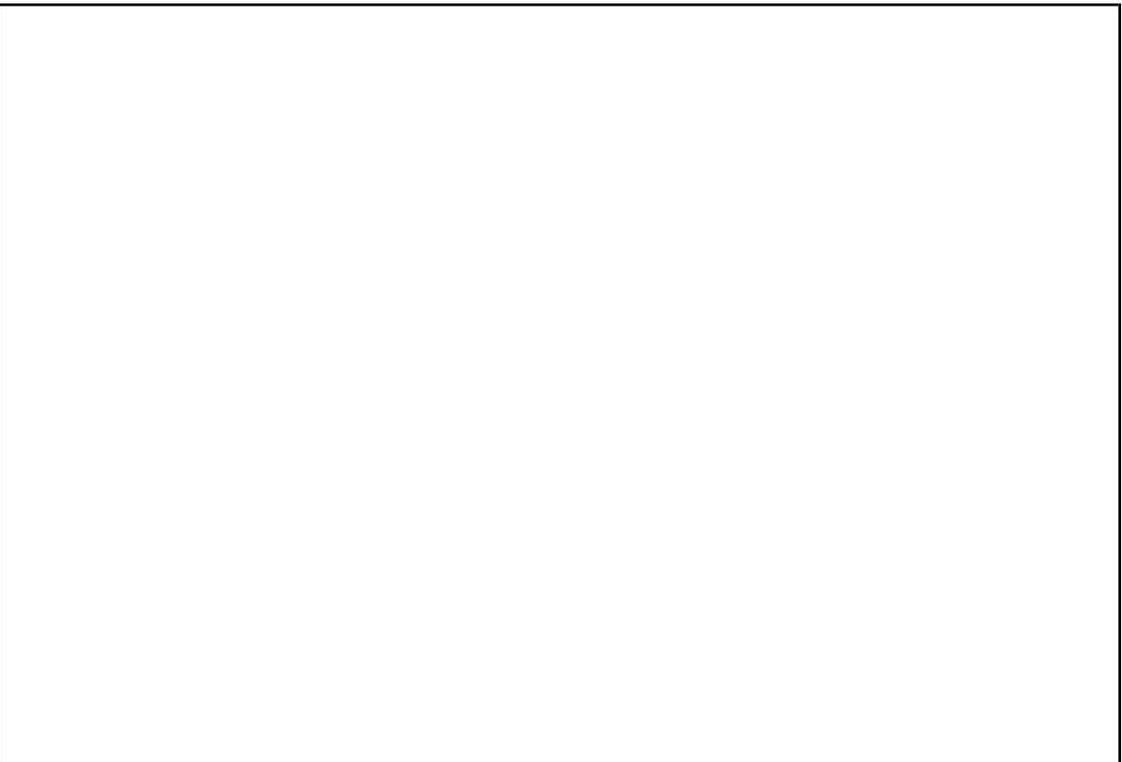
Quetzals need our help because _____

Name _____

Date _____

CONTENT ASSESSMENT: Quest for the Quetzal

Draw a picture of a quetzal. Then answer the questions.



What threats do quetzals face?

How can people help?

COMPREHENSION CHECK: Quest for the Quetzal

Read each question. Fill in the circle next to the correct answer or write your response on the lines.

- 1. What is a quetzal?
 - Ⓐ a mammal
 - Ⓑ a reptile
 - Ⓒ a bird

- 2. Where do quetzals live?
 - Ⓐ in cloud forests
 - Ⓑ on sandy beaches
 - Ⓒ in dry deserts

- 3. What is the most serious threat quetzals face?
 - Ⓐ connection of habitats
 - Ⓑ loss of habitat
 - Ⓒ growth of habitats

- 4. What is causing the quetzal's habitat to change?
 - Ⓐ predators
 - Ⓑ people
 - Ⓒ climate change

- 5. Name two things people can do to help quetzals survive.

Objectives

- Students will identify and explain connections between vocabulary words.
- Students will use information gained from the text and photos to demonstrate an understanding of the topic.

Resources

- Vocabulary Assessment Master (page 14)
- Language Arts Assessment Master (page 15)

Summary

- The article “Out on a Limb” examines trees, exploring both the life cycle of trees and how trees use photosynthesis to survive.

BUILD VOCABULARY AND CONCEPTS

- carbon dioxide
- root
- seed

Display the Wordwise section on page 17 of the projectable magazine. Invite volunteers to read aloud the words and their definitions. Encourage students to share what they know about each word.

Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to record each word and its definition. Have them think about how the vocabulary words are related. Tell them to record three connections they see. For example: Roots and seeds are both parts of a plant.

After reading the article, divide the class into small groups. Have students share the connections they predicted before reading the article. Instruct them to reevaluate each connection based upon what they have learned. If necessary, have students rewrite their ideas to more accurately reflect connections between different vocabulary words.

READ

Display pages 2-3 of the projectable magazine. Tell students to look at the photo. **Say:** *When people read, they usually focus on the words. But photos can tell you a lot, too. For example, when I look at this photo, I see a plant with a lot of limbs. If the photographer was lying on the ground when this photo was taken, this could be a close-up image of a bush. But if you look closely at the center of the photo, you'll find a clue that tells you that isn't the case. There are people in this photo—and they look really small. This plant isn't a bush. It's a giant tree!* **Ask:** *What else can you learn by looking at the photo?* Encourage students to share their ideas

Inform students that the purpose of this article is to teach them about trees. **Say:** *As you read, you'll learn much about trees from the text. But you'll get information from photos, captions, and other items in the article, too. That information can quickly answer some of the questions you have.*

Give each student a copy of the **Language Arts Assessment Master**. Review the questions on the worksheet with the class. Then have students read the article on their own. As they do, instruct them to record each answer. Tell students to word that tells where they found each answer in the article.

Out on a Limb

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about trees. **Ask:** *How are evergreens different from other trees?* (Their leaves are green needles. Their seeds grow in cones.) What happens to the seeds after they fall to the ground? (They sprout new trees.) *What is special about redwoods?* (They are among the tallest trees in the world.) Invite students to share what else they learned about trees as they read the article.

- **Finding Connections** Explain to students that reading definitions tells people what words mean. But readers can get a more thorough understanding if they recognize how words are connected. Point out that this is exactly what they did when they wrote sentences about the vocabulary words in the article. Instruct students to turn and share the sentences they wrote on their **Vocabulary Assessment Masters** with the class. Tell them to discuss similarities and differences in their sentences to get an even deeper understanding of the vocabulary words.

- **Interpreting Information** After reading the article, have students share their **Language Arts Assessment Masters** in small groups. Instruct students to compare the answers and sources they recorded for each question. Have students discuss how using text, photos, and the captions helped them answer their questions more quickly. As a class, identify other types of resources that could help them learn even more about trees.

WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the topic.

- *How are all trees alike?*
- *What is the strangest thing you learned about trees when you read the article?*
- *What surprised you about what you read?*

Out on a Limb

SCIENCE

Objectives

- Students will identify the parts of a tree.
- Students will understand that trees need sunlight, water, and carbon dioxide to live.
- Students will recognize that trees are a very diverse group of organisms.

Resources

- Content Assessment Master (page 16)
- "Solar Powered!" poster (Teacher's Edition)
- "Tree Tales" poster (Teacher's Edition)
- Comprehension Check (page 17)
- Out on a Limb" Interactive Whiteboard (optional)

Science Background

A tree is a type of plant with a woody stem. As the stem grows, it turns into a trunk. The trunk is covered with a protective layer of bark. This allows the tree to live for a long time.

Most trees grow from seeds, and there are two main types of trees that produce seeds: gymnosperms and angiosperms. Gymnosperms grow seeds inside cones. Angiosperms produce flowers. The flowers grow into fruits, which are full of seeds.

All trees have the same basic parts: roots, trunk, branches, bark, and leaves. Roots bring up water and nutrients from the soil. They also anchor the tree into the ground. Branches and the trunk provide additional support. They also create a network for the tree to transport water and nutrients up from the roots. Bark provides protection. And the leaves are where the tree makes its own food.

The process in which a tree or other plant makes food is called photosynthesis. During photosynthesis, the leaves use the energy from sunlight to combine water and carbon dioxide. This reaction creates sugar and oxygen. The sugar provides energy so the tree can live.

ENGAGE

Tap Prior Knowledge

Write the word "tree" on the board. Select volunteers, one student at a time, to say the first word they think of when they see that word. Invite another volunteer to record each response. After you've accumulated at least 10 responses, lead a class discussion. Using the recorded words as a base, encourage students to expand upon their prior knowledge of trees.

EXPLORE

Preview the Lesson

Display pages 12 of the projectable magazine. Zoom in on the four images of the tree parts. **Ask:** *What tree part or parts do you see in each photo?* (leaf and seed, branches and trunk, bark, roots) *Do all trees have these parts?* (yes) *Do the parts look the same on every single tree?* (no) *Why?* (There are many different kinds of trees. The parts on each kind of tree look different.) Tell students that they'll learn more about trees as they read the article.

Set a Purpose and Read

Have students read the article to: identify the parts of a tree; understand that trees need sunlight, water, and carbon dioxide to live; and recognize that trees are a very diverse group of organisms.

Out on a Limb

SCIENCE

EXPLAIN

Identify the Parts of a Tree

Display page 12 of the projectable magazine. Zoom in on the introduction. Read aloud the second paragraph. **Ask:** *What tree parts are named in this paragraph?* (roots, leaves, bark, branches, trunks) As a class, match each part to the correct photo beside the text. Discuss what each part does to help the tree survive. Invite students to share what else they know about each of these tree parts.

Understand What Trees Need to Live

Display the "**Solar Powered!**" poster. Inform students that this poster shows how plants make their own food. Review the information as a class. As you do, help students make connections between the diagram and the information in the text. **Ask:** *Which plant part captures sunlight?* (the leaves) *Why do plants need sunlight to make their own food?* (The energy from sunlight causes a reaction to take place.) *Which plant part captures water?* (the roots) *How do the roots get the water?* (They take it in from the soil.) Point out that plants also need carbon dioxide to make sugar, which is their food. Challenge students to find information in the article that tells where carbon dioxide comes from. (We breathe it out of our lungs. It's in the air.) Give each student a copy of the **Content Assessment Master**. Instruct students to write the correct word on each blank. Then have them draw a picture of a leaf. Tell them to add labels and arrows to show what goes in and out of a leaf as it makes its own food.

Recognize Diversity in Trees

Display the "**Tree Tales**" poster. Invite students to read aloud the blocks of text. Discuss how the parts of each tree are unusual. Review the article as a class. Invite volunteers to identify and describe other trees with unusual parts. Discuss reasons why the parts are unusual.

ELABORATE

Find Out More

Display pages 16-17 of the projectable magazine. Point out to students that the trees shown here are just three examples of trees with unusual parts. As a class, conduct research to identify more trees with unusual parts. Challenge students to find photos and write captions describing the unusual parts of each tree they find.

Extend Your Thinking About Trees

Display page 15 of the projectable magazine. As a class, discuss reasons why location and availability of sunlight, water, and nutritious soil would be important for trees to grow this big. Discuss the impact a changing climate could have on the trees.

EVALUATE

Have students record their answers to the assessment questions in their science notebooks or on a separate sheet of paper.

- *What do roots do for a tree?* (They attach the tree to the ground and draw water and nutrients from the soil.)
- *How do trees change as they grow?* (They get taller and wider.)
- *What does sunlight give leaves so they can make their own food?* (energy)

If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article. You may also wish to examine the optional **Interactive Whiteboard** lesson that accompanies this article.

VOCABULARY ASSESSMENT: Out on a Limb

Record each vocabulary word and its definition.

Word	Definition

Write three sentences to tell how different words are connected.

1. _____

2. _____

3. _____

Name _____

Date _____

LANGUAGE ARTS ASSESSMENT: Out on a Limb

Answer each question. Circle where you found each answer in the article.

Question	Answer	Source
What does an evergreen cone look like?		Text Photo Caption
What is carbon dioxide?		Text Photo Caption
What are the parts of a tree?		Text Photo Caption
What do a tree's rings show?		Text Photo Caption

CONTENT ASSESSMENT: Out on a Limb

Write the correct word on each blank.

sunlight	carbon dioxide	oxygen
	water	sugar

Plants need _____, _____, and _____.

Plants make _____ and _____.

Draw a leaf. Add arrows and labels. Show what goes in and out of a leaf as it makes its own food.



COMPREHENSION CHECK: Out on a Limb

Read each question. Fill in the circle next to the correct answer or write your response on the lines.

1. Which plant part can grow new plants?
Ⓐ leaf
Ⓑ branch
Ⓒ seed

2. What gives trees energy so they can make their own food?
Ⓐ carbon dioxide
Ⓑ sunlight
Ⓒ oxygen

3. Which part gets water for a plant?
Ⓐ the roots
Ⓑ the leaves
Ⓒ the trunk

4. Where does the water a tree needs to grow come from?
Ⓐ air
Ⓑ soil
Ⓒ oxygen

5. How do water and sunlight help a tree grow?

Signs of Life?

LANGUAGE ARTS 430L

Objectives

- Students will assess their familiarity with and knowledge of vocabulary words.
- Students will use context clues to determine the meaning of unfamiliar words.

Resources

- Vocabulary Assessment Master (page 22)
- Language Arts Assessment Master (page 23)

Summary

- The article "Signs of Life?" introduces students to National Geographic Young Explorer Joe Cutler, who braves the wilds of west Africa in search of new species of fish.

BUILD VOCABULARY AND CONCEPTS

- **crater lake**
- **species**

As a class, discuss the difference between familiarity and knowledge. Guide students to recognize that the more familiar you are with something, the more knowledge you have. Challenge students to explain how this concept applies to words when they read.

Display the vocabulary words on a word wall or on the whiteboard. Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to write each word on their papers. Review the categories under the header "Familiarity with the Word." Tell students to make a checkmark to indicate how well they know each word.

Instruct students to write what they think each word means on their worksheets. Then display the Wordwise feature on page 22 of the projectable magazine. Have students write those definitions on their worksheets and compare them with the definitions they wrote.

READ

Inform students that in this article, they will trek through the wilds of west Africa with National Geographic Young Explorer Joe Cutler. Cutler is exploring crater lakes in Cameroon. He is searching for new species of fish. Point out to students that as they learn about Cutler's work, they may see words they don't completely understand. **Say:** *A great way to figure out what these words mean is to study the words around them.*

Display pages 18-19 of the projectable magazine. Read aloud the headline and deck. Highlight the word *dense* in the deck. Then model how to examine the word in context. **Say:** *Whether you've heard the word dense before or not, you can figure out what it means if you search for clues. For example, the text says the writer had to "battle dense jungle." Dense is describing the jungle. If I look at the photo, I can see that the jungle has lots of trees. They're very close together. So dense could mean "thick" or "crowded." That makes sense. After all, he did say that he had to "battle" the jungle. You wouldn't have to fight your way through if the trees were far apart.*

Give each student a copy of the **Language Arts Assessment Master**. Instruct students to read the article with a partner. As partners read, tell them to record two words they don't fully understand. Encourage partners to search for clues that help them understand the meaning of each unfamiliar word. After reading the article, instruct partners to write a definition for each one.

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about Joe Cutler and his search for new fish species. **Ask:** *Why did Cutler want to search for fish in the west African lakes? (Nobody had ever studied most of the lakes before.) Why did he expect to find new species of fish? (Most of the lakes aren't connected to anything else. They could have developed their own species.) What would happen if he found fish that only lived in this part of the world? (The lakes would need to be protected from human development.)* Encourage students to share other facts they learned about Cutler's expedition as they read the article.

- **Strengthen Understanding** *Say: Once you understand what a word means, it's easier to use it correctly in a sentence. A little bit of background knowledge is all you need.* Challenge students to make accurate statements using each of the vocabulary words. Encourage them to use their two vocabulary worksheets as resources. But remind them to be original. Students shouldn't restate sentences from the article. They should create new sentences of their own.

- **Explain Concepts** *Say: One way to see if you understand information is to try to tell someone else about the topic. If you can't explain the concept, you might need to read the article again.* Have students turn and talk to explain to a partner how different features form inside caves. Prompt discussion with questions such as: *What is speciation? Why would a scientist be interested in speciation? Why is a crater lake a good place to find new species of fish?*

WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the topic.

- *What was it like traveling to Lake Edib? What did Cutler do once he got there?*
- *Cutler found fish in some of the lakes he studied but not in others. Why do you think that happened?*
- *What surprised you about what you read?*

SCIENCE

Objectives

- Students will understand how crater lakes form.
- Students will understand why crater lakes can contain new species.

Resources

- Content Assessment Master (page 24)
- Comprehension Check (page 25)

Science Background

National Geographic Young Explorer Joe Cutler is a Ph.D. student at the University of California, Santa Cruz. He is an ichthyologist who studies speciation. Or, in other words, he's a scientist who studies fish and specializes in the development of new species.

In 2015, Cutler traveled to the remote volcanic crater lakes found in the southwest region of Cameroon. His quest was to develop a baseline of the area for further scientific study. He also hoped to identify any endemic species that might have developed in the isolated lakes.

Over a six month period, Cutler collected samples from both crater lakes and rivers. He ended up with more than 3,500 fish specimens, representing more than 80 different species. He also collected about 10,000 aquatic invertebrates. Cutler's work is the most extensive scientific study ever conducted in this part of the world.

ENGAGE

Tap Prior Knowledge

Tell students to imagine that they're going on a field trip to study fish. The fish are in a lake. Poll the class to see how many students would want to go on a field trip like this. Then tell the class that in order to get to the lake, they have to hike through a jungle and wade through water that's filled with blood-sucking leeches. Poll the class again. Did the numbers go down? Discuss reasons why a scientist might undertake a trip like this to get to a specific lake where he could study fish.

EXPLORE

Preview the Lesson

Display pages 18-19 of the projectable magazine. Point out the photo of the man. **Say:** *This photo shows Joe Cutler. He is the National Geographic Young Explorer who wrote this article.* Invite a volunteer to read aloud the headline and text. **Ask:** *Why did Cutler go through all of this to find fish?* (He was looking for new species of fish.) Brainstorm ideas about why he might have thought he could find new species of fish in western Africa.

Set a Purpose and Read

Have students read the article in order to understand how crater lakes form and why crater lakes can contain new species.

EXPLAIN

How Crater Lakes Form

Display pages 20-21 of the projectable magazine. Instruct students to examine the two lakes in the photo. Explain to students that crater lakes are formed by volcanic explosions. **Ask:** *What shape is a volcano's crater?* (round) *What shape are these lakes?* (round) Discuss how the lakes could form over time as the craters fill with water. Challenge students to also explain why most of the lakes are separated from each other. (The tops of the volcanoes don't touch, so neither do the crater lakes that form in them.)

SCIENCE

EXPLAIN

(continued)

Why Crater Lakes Can Contain New Species

Continue displaying the photo of the two crater lakes on pages 20-21 of the projectable magazine. Point out that because of how the lakes formed, they never have touched and they never will. **Say:** *Some animals, such as frogs or insects, could travel between the lakes. But fish live in water. There is no way for a fish in one of these lakes to swim over to the other.*

Ask: *Knowing that, why do you think Joe Cutler came to these lakes hoping to find new species of fish?* (The lakes are self-contained. It's quite possible that new species developed in the lakes. Unable to spread, it's also possible that a species found in one of these lakes is not found anywhere else in the world.) Give each student a copy of the **Content Assessment Master**. Instruct students to draw pictures to show how a crater lake forms, how it fills with water, and how it becomes home to new species of fish. Tell them to write a caption for each picture.

ELABORATE

Find Out More

Remind students that Joe Cutler is a scientist who studies fish. Point out that in the article he identifies several pieces of equipment that he uses to do his work, such as cameras, nets, traps, and a jug of chemicals. As a class, conduct research to learn more about these supplies and how Cutler may have used them. Challenge them to identify additional supplies a scientist who studies fish might have taken on a trip like this.

Extend Your Thinking About Communication

Explain to students that scientists don't just collect and analyze data. They also communicate their results. That's how people learn more about nature. Point out that this article is one way Joe Cutler communicated the results of his expedition. Brainstorm ideas about other ways he could teach others what he learned.

EVALUATE

Have students record their answers to the assessment questions in their science notebooks or on a separate sheet of paper.

- *What is a crater lake?* (a body of water filling a circular, steep-sided volcanic crater)
- *What is a species?* (a group of animals or plants that are similar and can produce young animals or plants)
- *What did Cutler find in the crater lakes besides fish?* (frogs, dragonflies, diving birds, freshwater shrimp, and crabs)

If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article.

Name _____

Date _____

VOCABULARY ASSESSMENT: Signs of Life?

Record information from the article about each vocabulary word.

Word	Familiarity with the Word			Knowledge of the Word	
	I know the word very well.	I've seen or heard the word before.	I don't know the word.	What I think the word means:	How the article defines the word:

LANGUAGE ARTS ASSESSMENT: Signs of Life?

Record two unfamiliar words from the article. Write clues that help you understand what they mean. Then write a definition for each word. .

Word	
Clues	
Definition	

Word	
Clues	
Definition	

Name _____

Date _____

CONTENT ASSESSMENT: Signs of Life?

Draw pictures. Show how a crater lake forms, fills with water, and becomes home to a new species.
Write a caption for each picture.

Captions			Pictures		

COMPREHENSION CHECK: Signs of Life?

Read each question. Fill in the circle next to the correct answer or write your response on the lines.

1. What causes a crater lake to form?
Ⓐ earthquakes
Ⓑ glaciers
Ⓒ volcanoes

2. Where did Joe Cutler go to study crater lakes?
Ⓐ Europe
Ⓑ Africa
Ⓒ Asia

3. What he study in the crater lakes?
Ⓐ the water
Ⓑ the plants
Ⓒ the animals

4. What did he hope to find?
Ⓐ new species of fish
Ⓑ salty water
Ⓒ elephant grass

5. Tell how crater lakes form.

ANSWER KEY

Quest for the Quetzal

Assess Vocabulary, page 6

Students' predictions and the sentences they write will vary. They should record the words and definitions from the Wordwise feature on page 8.

Aztec: American Indian people living in Mexico before the Spanish conquest of the 16th century
culture: the customs, beliefs, laws, and ways of living that belong to a people

Mayan: American Indian people whose civilization reached its height around AD 300-900

Assess Language Arts, page 7

Responses may vary. All points and reasons should be stated directly in the article. Students may note that quetzals need our help because their habitat is disappearing.

Assess Content, page 8

Students should draw a picture of a quetzal. Threats include loss of habitat, predators, and people who hunt quetzals or try to keep them as pets. People can help by connecting habitats and passing laws to protect quetzals from harm.

Comprehension Check, page 9

1. C; 2. A; 3. B; 4: B; 5: Possible responses: People can connect habitats and punish people who harm the birds.

Out on a Limb

Assess Vocabulary, page 14

Students should record the words and definitions from the Wordwise feature on page 17.

carbon dioxide: a gas, made up of carbon and oxygen, that is present in the air

root: the part of a plant that attaches it to the ground; it draws water and nutrients from the soil

seed: a part of a plant from which a new plant can grow

Sentences will vary.

Assess Language Arts, page 15

1. Students may describe a cone as brown, pointed, or even spiky; photo
2. Carbon dioxide is a gas, made up of carbon and oxygen, that is in the air; text (Wordwise)

3. The parts of a tree include bark, roots, leaves, branches, and a trunk; text

4. Rings show a tree's age; caption

Assess Content page, 16

Plants need sunlight, water, and carbon dioxide. Plants make oxygen and sugar. NOTE: Word order may vary. Students should draw a picture of a leaf. Arrows/labels should show sunlight, water, and carbon dioxide entering the leaf and oxygen and sugar exiting the leaf.

Comprehension Check, page 17

1. C; 2. B; 3. A; 4: B; 5: Sunlight and water help a tree make food. The tree needs food to live and grow.

Signs of Life?

Assess Vocabulary, page 22

Students should record the vocabulary words from the Wordwise feature on pages 22-23, make checkmarks to show how familiar they are with each word, and write definitions in their own words. Then they should record the definitions from the article.

crater lake: a body of water filling a circular, steep-sided volcanic crater

species: a group of animals or plants that are similar and can produce young animals or plants

Assess Language Arts, page 23

Answers will vary.

Assess Content, page 24

Students show draw pictures showing a volcano erupting, a large hole filling with water, and a new species living in the crater lake. Captions should explain what is happening in each picture.

Comprehension Check, page 25

1. C; 2. B; 3. C; 4: A; 5: A volcano erupts. It makes a large hole that fills with water.