Earth Science

HUMAN IMPACT

As you read, think about what is causing the dangers amphibians are facing.

SAVE THE FROGS

Meet Toughie.

Take a good, long look. Something about this brown frog makes him unlike any other animal in the world.

Can you guess what it is?

By Glen Phelan

Population: 1

Toughie is a Rabbs' fringe-limbed tree frog from Panama. In the wild, Toughie used to spread his large webbed feet to glide from branch to branch in the treetops. It was like he was flying. That's cool, but it's not what makes Toughie so special.

Toughie is a special frog because he is the last one of his **species,** or kind. Think about it. He's the very last Rabb's fringe-limbed tree frog on Earth. When he dies, the species will be **extinct.** It will be gone forever.

Toughie's species isn't the only one in trouble. **Amphibians,** such as frogs and salamanders, are becoming extinct all across the globe. In fact, scientists expect that one-third to one-half of the nearly 7,600 known amphibian species will become extinct in the next ten years. This means that thousands of kinds of frogs, toads, salamanders, and newts will soon die out. Plus, many more unknown amphibian species may disappear before scientists even get a chance to discover them.

A Deadly Fungus

What is causing so many species to disappear? One of the big killers is disease.

A type of fungus has been spreading around the world. This fungus is a kind of germ. It doesn't harm people or most other living things, but it's deadly to a majority of amphibians. It infects their skin. Amphibians take in water and certain nutrients through their skin. The germs change the skin and prevent the animal from getting what it needs to live. This disease can kill large numbers of amphibians in just a few weeks. Here's what happened to Toughie and other frogs.

Fighting Extinction

Back in 2005, the fungus was discovered in the mountain streams of Panama in Central America. Scientists sprang into action. They rushed to Panama to collect as many healthy frogs as they could find. The scientists especially wanted to protect **endangered** species, because these animals are rare and at risk of becoming extinct.

The Rabb's fringe-limbed tree frogs were endangered. They only lived on a few mountainsides in Panama and no place else in the world. Scientists scooped up several dozen and brought them to labs in the United States.

Eventually all of these tree frogs died of natural causes, except one. This lone survivor lives in the Atlanta Botanical Gardens in a disease-free shelter called a frogPOD. The frog keeper's 6-year-old son named him Toughie.

The fungus has caused about 100 species to become extinct. However, the news isn't all-bad. Scientists are learning more about the dangers of losing amphibians to disease.

The disease that affected Toughie's species was well on its way to doing the same to the Panamanian golden frog. But the golden frog's story is a much happier one.

Before the deadly fungus hit Panama, rare golden frogs were already being raised in captivity. Scientists increased these breeding programs as the disease swept through the country.

Today more than 1,000 golden frogs are alive and well and reproducing in more than 50 zoos in the United States, Canada, and Panama. Good thing, too, because golden frogs haven't been seen in the wild since 2009.

Researchers in the field swab a frog's limb, looking for signs of the deadly fungus.

It's been a race against time to protect the Panamanian golden frog.

Tiny mantella frogs are vulnerable to habitat loss.

Disappearing Habitat

As bad as the fungus disease is, amphibians have much more to worry about. Their largest problem is the loss of their **habitat,** or the place where they live.

Habitat loss is a huge problem in places like Madagascar. This large island lies off the southeast coast of Africa in the Indian Ocean. It is home to about 220 species of frogs that are found nowhere else on Earth. Among them are a group of frogs called mantellas.

Mantella frogs are small and brilliantly colored. Some are lime green and black with orange legs. Others are a shimmering orange, like a goldfish, or bright red, like a cardinal. Mantellas are like sparkling jewels hopping around the forests, swamps, and streams of Madagascar. They are getting more difficult to find in the wild, though. Some haven't been spotted for years. Many of these frog species are endangered because their homes are being destroyed.

Log, Burn, or Plow

How do you destroy a habitat? It's not difficult. Cut down the trees where frogs live. That'll do it. Burn the vegetation to clear land for crops. That works, too. You might build roads through the forest and dump tons of rock into the streams. Or you could dig holes all over the place, looking for minerals like gold and nickel.

These and other human activities are chewing up land in Madagascar. When a habitat is completely or even partly destroyed, the animals that live there can't get all the resources they need.

Frogs can't find enough food, mates, or places to hide from predators. Some may hop away to live elsewhere, but it's not easy to find a place nearby with enough resources. As people develop more land, unspoiled habitat is getting harder to find.

When large swaths of forest are burned to clear land for planting crops, frogs and other animals lose their habitat.

Some Solutions

You may have noticed that people caused most of this habitat loss. You might wonder, "If people cause the problem, can't they also solve the problem?" Yes, they can!

In Madagascar, many people have organized into groups to help save endangered frogs. Some groups keep track of places where mantellas breed to make sure the habitat hasn't been damaged. If it is damaged, the groups get to work. They might fill in the holes left by gold miners. They might plant trees in a field that was abandoned by farmers. They try to restore the habitat to bring back the frogs.

As always, a big part of the solution is letting people know there's a problem. Festivals help spread the word about the fascinating frogs that are part of Madagascar's rich biodiversity.

A Global Threat

Did you ever have one of those days when one thing leads to another and not in a good way? Climate change is like that.

You may know that climate change includes the overall change in temperatures and rainfall around the world. Some places are getting cooler and wetter, but many places are getting warmer and drier, and that's a dangerous combination for many frogs.

Take ponds, for example. Ponds are favorite places for many kinds of frogs to breed and lay their eggs. With higher temperatures and lower rainfall, a pond will have less water. So there is less space for frogs and their eggs.

Tadpoles live in water after they hatch from eggs. But the drying pond may not have enough water for all of the tadpoles to grow and become adult frogs. Warmer, drier conditions may lead to fewer worms and insects, so that means less frog food for adults.

These chains of events form a dangerous pattern. The warmer Earth gets, the greater the risk of more frog species becoming extinct. In fact, several species in Australia are expected to become extinct if the yearly temperature there increases by only 0.5° Celsius.

It's Not Too Late

Scientists estimate that the average global temperature will increase by about 2.0° Celsius in the next 20 years. Under those conditions, many kinds of frogs will disappear from Australia and elsewhere forever.

One of the best ways to help all living things cope with climate change is to protect habitats. One way to do that is to set aside more land for nature preserves or parks. Then there will be more places for frogs and other animals to move to as the climate changes.

Toughie's species will soon be gone. It's sad but true. But it's not too late for others.

Scientists are racing against the clock to stop extinctions from disease, habitat loss, and climate change. Individuals, groups, and governments are responding. If we care enough, we can still save other endangered frogs from Toughie's fate.

Toughie, the world's last Rabbs' fringe-limbed tree frog, died in September 2016.

Wordwise

amphibian: a cold-blooded vertebrate animal, such as a frog, toad, or salamander

biodiversity: variety of living things in an environment

endangered: at risk of becoming extinct, or dying out

extinct: no longer existing in living form

habitat: an environment where animals and plants live

species: a group of living things that share common characteristics

The strawberry poison dart frog is found in Central America.

It's not too late for frogs and other amphibians, but they need our help.

Joel Sartore and the Photo Ark

Look them in the eye. That's what Joel Sartore wants you to do when you gaze at the animals in his photos.

Sartore is a photographer for National Geographic. When he's not taking pictures for the magazine, he is fast at work on a special project. He calls it the Photo Ark. It's a collection of photos he has taken of animals in zoos and aquariums all around the world. His goal is to photograph every animal species that is in captivity. That's about 25,000 species! After many years of work, he's about halfway toward reaching his goal.

Why spend so much time and effort to create a Photo Ark? "I want to show people the incredible **biodiversity,** or variety of living things, on our planet," Sartore says. "I want to inspire people to care about all creatures, great and small, so that we can work together to save as many as possible from extinction." Sartore is especially concerned about amphibians. Most of the photos in this article were taken by him. It's not too late. We can save species if we try. That's the message of the Photo Ark.

NATIONAL GEOGRAPHIC

PHOTO ARK

JOEL SARTORE

Save the Frogs

LANGUAGE ARTS LEXILE 850L

Objectives

- Students will identify and explain connections between vocabulary words.
- Students will explain how the writer uses reasons and evidence to support key points in the text.

Resources

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

Summary

- The article "Save the Frogs" examines threats that frogs face today through the eyes of National Geographic photographer Joel Sartore.

BUILD VOCABULARY AND CONCEPTS

- **amphibian**
- **biodiversity**
- **endangered**
- **extinct**
- **habitat**
- **species**

Display the Wordwise section on page 9 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. Then have them think about how the vocabulary words are related. Tell them to record five connections they see. For example: The Rabbs' fringe-limbed tree frog is a species of amphibian that is nearly extinct.

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

Write the words reasons and evidence on the board. **Then ask:** *What's the difference between these two words?* Invite students to share their ideas. Guide the class to understand that a reason tells why something happened. Evidence shows how.

Tell students that valid reasons and solid evidence are crucial elements of any text. Writers use them to support key points on the topic.

Display pages 2-3 of the projectable magazine. Instruct students to examine the images of frogs. Then invite a volunteer to read aloud the headline and text. **Say:** *Sometimes when you read an article, you have to get a paragraph or two into the text before you can identify the key point the writer is trying to make. Not here. In this article, the writer has stated his main point loud and clear in the headline: Save the frogs.* Point out that there are plenty of frogs in these photos. They seem to be doing OK. Then guide students to ponder the text pointing toward the brown frog. **Say:** *According to the text in this arrow, this frog is different. I wonder why?* Display page 4 of the projectable magazine. Zoom in on the brown frog at the top. **Say:** *Population: 1. That explains it. There's only one frog of this type left! I guess that explains why the frog's name is Toughie. And this is also a strong reason and reliable evidence that supports the writer's point. People must work to save frogs from extinction.*

Give each student a copy of the **Language Arts Assessment Master**. Have students read the article on their own. As students read, encourage them to search for additional reasons and evidence that support the writer's claim that people need to save frogs. Have students summarize what they learned in their own words.

Save the Frogs

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about threats facing frogs. **Ask:** *How is a fungus killing frogs?* (It prevents frogs from taking in water and certain nutrients through their skin.) *Does the fungus only kill frogs?* (No. It's killing other amphibians, too.) *What is causing so much of the frogs' habitat to disappear?* (People are burning the land to clear it for planting crops.) Invite students to share what else they learned about the threats frogs face and how people can save them.

• **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 important 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 a partner. Encourage them to discuss similarities and differences in their sentences to get an even deeper understanding of the vocabulary words.

• **Identifying Reasons and Evidence** After reading the article, remind students that reasons tell why something happened. Evidence explains how. 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, all evidence is solid, and both support the writer's point that people must help save frogs from extinction.

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.

- *Why did scientists bring hundreds of Rabb's fringe-limbed tree frog to labs in the U.S.? Did it work?*
- *How is a fungus causing species of amphibians to become extinct?*
- *What surprised you about what you read?*

Save the Frogs

SCIENCE

Objectives

- Students will recognize that amphibians, including frogs, are endangered as a result of disease, habitat loss, and climate change.
- Students will identify actions people can take to protect disappearing species.

Resources

- Content Assessment Master (page 8)
- "Joel Sartore's Photo Ark" poster (Teacher's Edition)
- "All in a Day's Work" poster (Teacher's Edition)
- Comprehension Check (page 9)

Science Background

Amphibians are cold-blooded animals that live part of their lives in water and part on land. They are vertebrates, meaning they have a backbone. And they go through metamorphosis. When they hatch from eggs, they look quite different from the animals they develop into as adults.

Frogs are one type of amphibian. Like many other amphibians, their skin is covered by a layer of mucus. This slippery layer keeps the moisture in so the frog's skin doesn't dry out.

Amphibians have lived on Earth for about 300 million years. But due to a combination of threats, one in three species of amphibians is now at risk of extinction.

The biggest problems stem from habitat loss, climate change, and disease. As people clear land to plant crops, they destroy habitats. Warmer, drier climates result in fewer ponds and other water sources that amphibians need to live. And a deadly fungus, first described in 1999, has the potential to infect and kill most of the world's 6,000 amphibian species.

While the situation may be perilous, it is not without hope. There is still time for people to protect and restore habitats where amphibian populations can recover.

ENGAGE

Tap Prior Knowledge

Instruct students to think of a time they saw a frog. What did it look like? What did it sound like? Encourage students who felt the frog to describe what it felt like. Then tell students to imagine that there were no more frogs. Brainstorm ideas about how the world would be different.

EXPLORE

Preview the Lesson

Display pages 2-3 of the projectable magazine. Have students compare and contrast the different frogs shown in the photos. Then invite a volunteer to read aloud the headline and deck. **Say:** *To me, this looks like an ordinary frog. It isn't as colorful as the other frogs. And it doesn't have any strange features like the frog at the bottom of the screen. That frog has horns. But this frog has a name: Toughie. That name must be a clue.* As a class, brainstorm ideas about why this frog is unlike any other animal in the world.

Set a Purpose and Read

Have students read the article in order to recognize that amphibians, including frogs, are endangered as a result of disease, habitat loss, and climate change. Instruct them to also identify actions people can take to protect disappearing species.

EXPLAIN

Recognizing Causes and Effects

Display pages 2-3 of the projectable magazine. Zoom in on the comprehension strategy in the upper left corner of the page. Read the strategy aloud. **Say:** *As the headline states, this article is about saving frogs. Here, we learn that humans are somehow responsible for the dangers amphibians are facing. As you read the article, you'll learn what humans have done and why those actions are dangerous for amphibians.* Give each student a copy of the **Content Assessment Master**. With a partner, have students read the article to find and record details about the dangers amphibians face.

NATIONAL GEOGRAPHIC Explorer

SCIENCE

EXPLAIN

(continued)

How People Can Save Frogs
Display page 5 of the projectable magazine. Zoom in on the top photo. As a class, discuss what the researchers are doing (swabbing the frog's limb) and why. (They're looking for signs of the deadly virus.) Remind the class that frogs and amphibians are disappearing for three reasons: disease, loss of habitat, and climate change. Divide the class into small groups. Instruct students to discuss the impact humans have had on amphibian populations as they review the information they collected on their **Content Assessment Masters**. Then rejoin as a class to brainstorm other ways people can help save frogs. (For example, people could find a cure for the deadly virus. They could also raise more frogs in captivity so more species don't become extinct.)

Saving Other Endangered Species
Display page 9 of the projectable magazine. Zoom in on the sidebar about Joel Sartore. Invite volunteers to read the text aloud. Discuss what Sartore does and how he hopes his work will help save endangered species. (He is attempting to photograph every animal species that is in captivity. He hopes the photos will inspire people to care about animals and save them from extinction.) Display the **"All in a Day's Work" poster**. Discuss what Sartore goes through to capture his photos. Then display the **"Joel Sartore's Photo Ark" poster**. Invite volunteers to read aloud the information about each animal. Instruct students to visit Sartore's Photo Ark at: *http://www.joelsartore.com/galleries/the-photo-ark/*. Assign each student a partner. Have each pair pick four different animals from the Photo Ark. Challenge them to recreate the **"Joel Sartore's Photo Ark" poster** with images, captions, and a map related to the four animals they selected.

ELABORATE

Find Out More
Remind students that a deadly fungus is killing many of the world's amphibians. Assign each student a partner. Instruct pairs to conduct research to learn more about this fungus. What is it called? Where did it come from? How does it spread? How can it be treated? And, why does it only affect amphibians? Have partners write a brief summary of their findings. Then have them share what they learned with the class.

Extend Your Thinking About Habitats
Remind students that people have destroyed many frog habitats as they clear land to plant crops. As a class, debate the merits of planting more crops versus saving animal habitats. Challenge the class to identify ways both people and animals can get what they need to survive.

EVALUATE

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

- *What is a habitat?* (an environment where an animal lives)
- *What does an animal get from its habitat?* (everything it needs to survive)
- *Why does Joel Sartore take photos of animals in captivity?* (He wants to inspire people to care about animals so they will want to save species from extinction.)

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

Name _____ Date _____

VOCABULARY ASSESSMENT: Save the Frogs

Record each vocabulary word and its definition.

Word	Definition

Write five sentences to tell how different words are connected.

1. _____

2. _____

3. _____

4. _____

5. _____

Name _____ Date _____

LANGUAGE ARTS ASSESSMENT: Save the Frogs

Record reasons and evidence that prove that people need to save frogs.
Summarize what you learned.

Reasons
Evidence
Summary

Name _____ Date _____

CONTENT ASSESSMENT: Save the Frogs

Use this organizer to record information about three dangers amphibians face.

	disease	habitat loss	climate change
What is happening?			
What, if anything, did people do to cause this problem?			
What, if anything, are people doing to find a solution?			

Name _____ Date _____

COMPREHENSION CHECK: Save the Frogs

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

1. Which amphibian body part has been affected by a deadly fungus?

   Ⓐ brain

   Ⓑ skin

   Ⓒ bones

2. What have people done to destroy many frog habitats?

   Ⓐ cleared land

   Ⓑ swabbed limbs

   Ⓒ planted trees

3. Which type of climate is dangerous for amphibians?

   Ⓐ hot and wet

   Ⓑ cold and wet

   Ⓒ warm and dry

4. What is the population of a species that has become extinct?

   Ⓐ zero

   Ⓑ one

   Ⓒ 100

5. Explain how a deadly fungus is causing many frog species to disappear.

_____

_____

_____

_____