



# Explorer



## Special Issue: Wetlands

- Boglands 6**
- All About Carbon 12**
- Rwanda's Dragonflies 14**
- Protecting the Marsh 18**
- Managing Mangroves 22**

## TEACHER'S GUIDE Pathfinder and Adventurer Vol. 19 No. 7

### IN THIS GUIDE:

About the Learning Framework .....3

Language Arts  
Lesson and Think Sheet.....4-9

Introduction/What You Need to Know  
Science Lesson and BLM ..... 10-11

Balance for the Bogs  
Science Lesson and BLM ..... 12-13

Flying Flowers of Rwanda/Protecting  
the Marsh/Managing Mangroves  
Science Lesson and BLM ..... 14-15

Article Tests ..... 16-18

Answer Key ..... 19

Educational consultant **Stephanie Harvey** helped shape the instructional vision for this Teacher's Guide. Her goal is to ensure you have the tools you need to enhance student understanding and engagement with nonfiction text.

### Standards Supported

- Common Core State Standards (CCSS)
- Next Generation Science Standards (NGSS)
- C3 Framework for Social Studies State Standards (C3)

**See each lesson for standards covered.**



Looking for a fun way to test your student's recall? Each story in this issue of Explorer has an accompanying Kahoot! quiz.

### Lexile® Framework Levels

#### Pathfinder

|   |             |
|---|-------------|
| Introduction/What You Need to Know .....                                  | 610/710     |
| Balance for the Bogs .....  | 700         |
| Flying Flowers of Rwanda/Protecting the Marsh/<br>Managing Mangroves..... | 710/720/700 |

#### Adventurer

|   |             |
|---|-------------|
| Introduction/What You Need to Know .....                                  | 840/880     |
| Balance for the Bogs .....  | 920         |
| Flying Flowers of Rwanda/Protecting the Marsh/<br>Managing Mangroves..... | 840/860/840 |

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## INTRODUCTION

### BACKGROUND

Since 1888, the National Geographic Society has funded scientists and explorers and shared their findings with the world. To support educators who use our resources, we have created a Learning Framework, which lays out what we believe students should learn from their experiences with the Society.

### PURPOSE

The Learning Framework was designed to convey the Society's core beliefs and values. It is built around a set of attitudes, skills, and knowledge that embody the explorer mindset.

To determine the learning outcomes within the Learning Framework, we dug deep into national standards in key subject areas. We also sought advice from subject matter and child development experts, along with the combined expertise of NG instructional designers, researchers, and content developers. To learn more, go to: <https://www.nationalgeographic.org/education/learningframework/>.

### IMPLEMENTATION

Each article in this magazine has a knowledge-based link to the Learning Framework.

## MINDSET OF AN EXPLORER: KEY FOCUS AREAS

### Attitudes



**CURIOSITY** An explorer remains curious about how the world works throughout his or her life. An explorer is adventurous, seeking out new and challenging experiences.

**RESPONSIBILITY** An explorer has concern for the welfare of other people, cultural resources, and the natural world. An explorer is respectful, considers multiple perspectives, and honors others regardless of differences.

**EMPOWERMENT** An explorer acts on curiosity, respect, responsibility, and adventurousness and persists in the face of challenges.

### Skills



**OBSERVATION** An explorer notices and documents the world around her or him and is able to make sense of those observations.

**COMMUNICATION** An explorer is a storyteller, communicating experiences and ideas effectively through language and media. An explorer has literacy skills, interpreting and creating new understanding from spoken language, writing, and a wide variety of visual and audio media.

**COLLABORATION** An explorer works effectively with others to achieve goals.

**PROBLEM SOLVING** An explorer is able to generate, evaluate, and implement solutions to problems. An explorer is a capable decision maker—able to identify alternatives and weigh trade-offs to make a well-reasoned decision.

### Knowledge



**THE HUMAN JOURNEY** An explorer understands where we came from, how we live today, and where we may find ourselves tomorrow.

**OUR CHANGING PLANET** An explorer understands the amazing, intricate, and interconnected systems of the changing planet we live on.

**WILDLIFE AND WILD PLACES** An explorer reveals, celebrates, and helps to protect the amazing and diverse creatures we share our world with.

## LANGUAGE ARTS Synthesizing Information for the Big Ideas

### Fourth Grade Standard Supported

- **CCSS Reading Informational Text:** Determine the main idea of a text and explain how it is supported by key details; summarize the text. (4–2)

### Fifth Grade Standard Supported

- **CCSS Reading Informational Text:** Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text. (5–2)

### What You'll Need

- Explorer Special Issue: Wetlands
- Think Sheet (Teacher's Guide, page 6)
- Clipboards
- Pencils

### CONNECT & ENGAGE (5–10 minutes)

Kids are in a group in front of you. Hold up the cover of the magazine.

**Say:** *This is a special issue of Explorer magazine. Every article in this issue is about wetlands. I'm going to read aloud page 3. It was written by the magazine's managing editor, Brenna Maloney. Reading this may give us a sense of what big ideas will be covered in this issue.*

Read page 3 to students.

**Say:** *This message from the managing editor starts to give us some ideas about the importance of wetlands, but we will find out more as we continue reading. However, we've already started to learn a few details about wetlands, which will help us determine the big ideas in this issue.*

**Say:** *It's our job as readers to think about and synthesize the variety of facts and details to arrive at the big ideas. Turn and talk about some of the details you learned about wetlands from the managing editor's message on page 3.*

Kids turn and talk.

At this point, you may also want to spend some time reading through and discussing with students "What You Need to Know" on pages 4–5 to build more background about wetlands before reading the other articles in the magazine.

### MODEL (10 minutes)

Kids sit in a group with you in front of them. You will be modeling using pages 14–15 of the article "Flying Flowers of Rwanda."

**Say:** *Nonfiction articles like the ones we are reading are packed with information. When we encounter lots of information in our reading, we need to slow down, read closely, and pay attention to the details. These are the bits and pieces that can help us synthesize and discover the big idea.*

**Say:** *Titles can often tell us what an article is about. If a title doesn't tell us exactly, it can at least give us clues. We can use other information like photos and illustrations to help, too. Let's look at this title—"Flying Flowers of Rwanda." Let's also look at the photo and the text on page 14. Under the title on page 14, the text says "Can dragonflies help save Rugezi Marsh? I'm already getting lots of clues from the title and also the photo. I'm intrigued by the title. From the question under the title, I am going to guess that the dragonflies are what the author is calling "flying flowers." That's pretty cool, and that small illustration of the dragonfly does look a little like a flower. I have a question though. I wonder how dragonflies can save the marsh.*

**Say:** *I'm going to keep reading now to look for details that might help me understand how dragonflies can help save the marsh. I'll read aloud page 15, and then I'll go back to the text and write down the details that I learned.*

Read the text on page 15 and write the details on sticky notes or on the board. Be sure to "think aloud" so students can understand how you are sorting through and processing the information. The details are a little different in Pathfinder and Adventurer. You can write down the details exactly as they are written in the article or paraphrase them a bit, as shown below.

- *Rwanda is in Africa. The author, Erasme Uyizeye, grew up there.*

## LANGUAGE ARTS Synthesizing Information for the Big Ideas

- *Erasme's village was close to a wetland that was rich in rivers and streams.*
- *Erasme and his friends swam and played in those rivers.*
- *Erasme remembers trying to catch dragonflies as they flew by. They called them "flying flowers of the river."*
- *Over time, there were fewer and fewer dragonflies. Erasme wondered why.*
- *Erasme now does a lot of his work in Rugezi Marsh, a wetland that covers a large area.*
- *More than 40 species of birds rely on the marsh, and people do, too. The marsh is a source of water and hydroelectric power.*

**Say:** *Next, I'll look again at the details and think about how they fit together. I'm also not forgetting that we said the title can often tell or be a clue to the big idea, so I'm going to keep that in mind, too.*

**Say:** *Well, I've got quite a few details listed, and they all tie together with Erasme and his work in the marsh in Rwanda. I know the dragonflies are part of the big idea, but I don't exactly know in what way yet. I'm guessing they are important for the marsh and that I'll find out more as I read on. I'm going to be on the lookout for more details that will help me understand what the big idea is.*

**Say:** *Now, turn and talk about what you noticed me doing as I was reading and thinking about the details and the big idea.*

Let students turn and talk and then share out.

### GUIDE (10 minutes)

Hand out Think Sheets and have kids attach them to their clipboards. Kids remain in a group in front of you.

**Say:** *Let's keep reading. I'll read some more text aloud, and you can read along, too. Don't forget to look at the photos and the map, too. Write down the details you hear on the Think Sheet squares.*

Read aloud page 16. Kids should note on their Think Sheet squares a few more details.

### Pathfinder Details

- Years ago, Rwanda suffered an energy crisis.
- Power produced by the power station dropped.
- Water levels in Lake Burera dropped, too, because people had not taken care of the marshland.
- There was too much human activity and too little rainfall to replenish the ecosystem.
- Much of Rwanda's population depends on agriculture, which puts a lot of pressure on its wetlands.
- Over the last 20 years, people are working to restore the marshland and some of those efforts are working.
- Dragonflies might be part of the solution because they are good indicators of the health of a wetland.
- Dragonflies spend most of their life cycle in the water, but the water must be clean for them to thrive. They also need healthy plants nearby to help hide them from predators.
- Erasme created a monitoring system using dragonflies to help identify areas that need protecting.

### Adventurer Details

- Years ago, Rwanda suffered an energy crisis.
- Power produced by the power station dropped.
- Water levels in Lake Burera dropped, too, because people had not taken care of the marshland.
- There was too much human activity and too little rainfall to replenish the ecosystem.
- Much of Rwanda's population depends on agriculture, which puts a lot of pressure on its wetlands.
- Over the last 20 years, people are working to restore the marshland and some of those efforts are working.
- Dragonflies might be part of the solution.
- Erasme created a method of using dragonflies to monitor the water quality of the marsh.
- Dragonflies are good indicators of the health of a wetland because they are very sensitive to their environment.
- Dragonflies spend most of their life cycle in the water, but the water must be clean for them to thrive. They also need healthy plants nearby to help hide them from predators.
- Erasme's dragonfly-based monitoring system can help identify areas that need protecting.

**Adventurer Details, cont.**

- This is also something local communities can do with training.

*Okay, what details did we have on this page? Do you have a better idea now about what the big idea might be? How could we state the big idea, based on the details we've seen so far? Turn and talk about that, and then you can share out.*

Encourage kids to think about how to synthesize the details and come up with a few different ways of stating the big idea. Some suggestions kids might have include the following:

- Dragonflies are a sign of a clean and healthy wetland and can be used to monitor and track wetland areas that need protecting.
- Erasme and his team are helping to restore the Rugezi Marsh by monitoring and tracking dragonflies to identify the areas that need protecting.

Let kids know that there are many ways to state the big idea. Have kids share and discuss their different ways of thinking about and stating the big idea.

**COLLABORATE (25 minutes)**

**Say:** *Now it's your turn. Find a partner and choose one of the other articles in the magazine to read together. We know that all of the articles in this issue are about wetlands, but each article has a different focus, with different details and different big ideas.*

**Say:** *Write down the details on your Think Sheet squares. Keep talking about how they fit with the other details in the article. As you read and learn more details, you might have some different thoughts about what the big idea is. Continue to synthesize these details and refine your thinking about the big idea.*

**Say:** *While you are working together, I'm going to walk around the room to see if you need any help or have any questions.*

Kids read, write down details, and talk about them and the big idea. Move around the room, conferring with partners.

**SHARE THE LEARNING (10 minutes)**

You might want to have kids do one or both of the following to share their learning.

- Have partner groups who read the same article share and compare the information about the details they wrote down and their thoughts about the big idea. Remind students that there are different ways to state a big idea.
- Have partner groups who read a different article share the big idea of the articles they read and discuss the details that helped them synthesize the big idea.

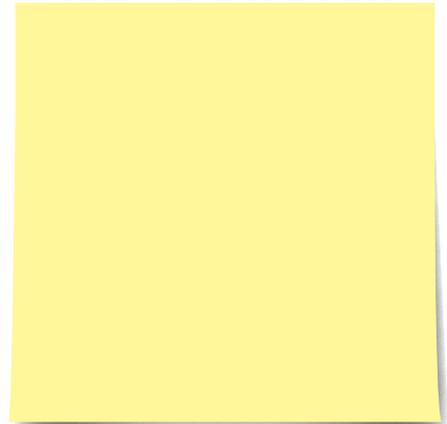
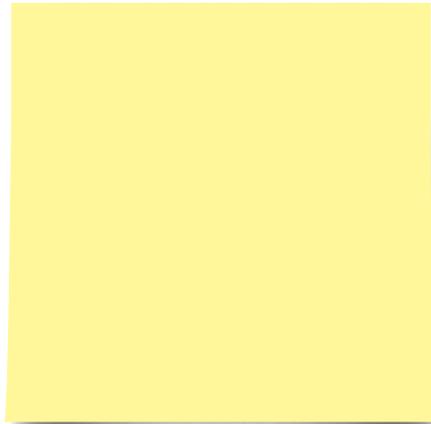
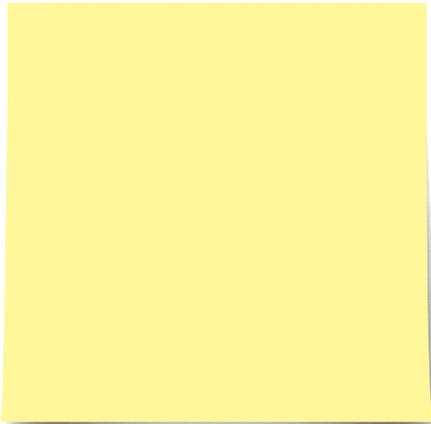
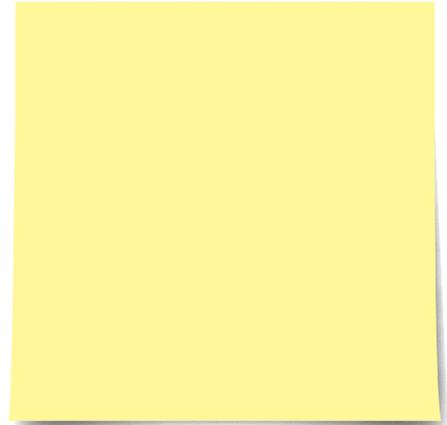
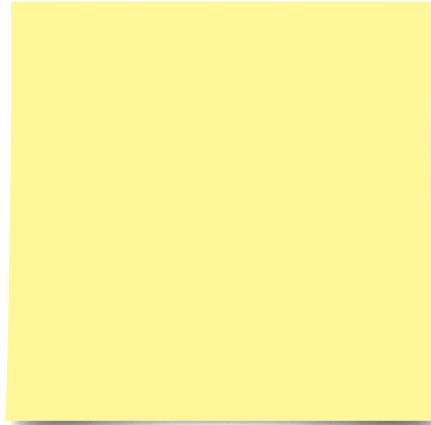
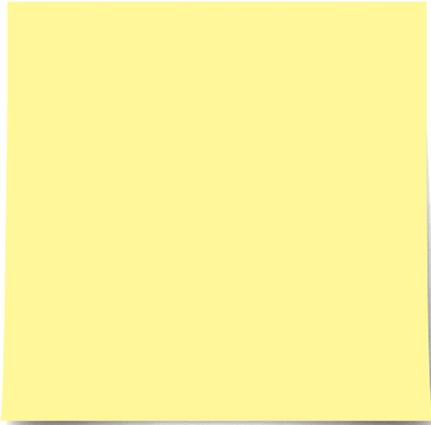
**Say:** *Synthesizing the details to see how they all relate to one another to come up with the big idea takes some clever thinking. Great work today, everyone!*

Name \_\_\_\_\_

Date \_\_\_\_\_

**THINK SHEET**

Write the details you learned in the note squares. Write the big idea on the lines at the bottom.



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# LESSON FRAME Synthesizing Information for the Big Ideas

## What You'll Need

- Nonfiction text
- Think Sheet template
- Clipboards and pencils

This frame is a kind of template of the lesson we just worked on. It has the instructional moves and language of the lesson, but the specific content has been removed. This way you can use the Lesson Frame for the other articles in the issue or for any nonfiction text you might be teaching.

## CONNECT & ENGAGE (5–10 minutes)

Kids are in a group in front of you. Hold up page(s) \_\_\_\_\_.

**Say:** *Titles can often tell us what an article is about. If a title doesn't tell us exactly, it can at least give us clues. We can use other information like photos and illustrations to help, too. Let's look at this title \_\_\_\_\_. Let's also look at the pictures and the text on these pages. Turn and talk about what you think this article might be about.*

Read the title of the article and the text on page(s) \_\_\_\_\_. Give kids time to turn and talk and then share out with the class.

**Say:** *A title can help us begin to figure out what the big idea of an article is. You can think about it this way: Many writers try to synthesize, or combine, a lot of information to create a title that gives readers a clue to what they will be reading. And they have to do this in just a few words. That's not an easy task, is it?*

**Say:** *It's our job as readers to use the title as a clue, and then as we read, synthesize the variety of facts and details to arrive at the big idea.*

## MODEL (10 minutes)

Kids sit in a group with you in front of them.

**Say:** *Nonfiction articles like the one we are reading are packed with information. When we encounter lots of information in our reading, we need to slow down, read closely, and pay attention to the details. These are the bits and pieces that can help us synthesize and discover the big idea.*

**Say:** *Watch and listen as I show you how I do this. I'm going to write down the details. Next, I'll look again at all of the details and think about how they fit together. I'm also not forgetting that we said the title can often tell or be a clue to the big idea, so I'm going to keep that in mind, too.*

Read aloud page(s) \_\_\_\_\_. Then write down on sticky notes or on the board what the details are. Be sure to "think aloud" so students can understand how you are sorting through and processing the information. You can write down the details exactly as they are written in the article or paraphrase them a bit.

**Say:** *Wow! There are a lot more details than I realized. I want to think about these details and the title again. The title is \_\_\_\_\_. Now I know for sure that \_\_\_\_\_. The details on these pages helped me figure that out. From these details I also \_\_\_\_\_. I'm going to keep this in mind as we continue to read and synthesize the details to come up with the big idea of this article.*

**Say:** *Turn and talk about what you noticed me doing as I was reading and thinking about the details and the big idea.*

Let students turn and talk and then share out.

## LESSON FRAME Synthesizing Information for the Big Ideas

### GUIDE (10 minutes)

Hand out Think Sheets and have kids attach them to their clipboards. Kids remain in a group in front of you.

**Say:** *Let's keep reading. I'll read some more text aloud, and you can read along, too. Don't forget to look at the photos. Write down the details you hear on the Think Sheet squares.*

Read aloud page(s) \_\_\_\_\_. Kids should note on their Think Sheet squares a few more details.

**Say:** *Okay, what details did we have here? Do you have a better idea now about what the big idea might be? How could we state the big idea, based on the details we've seen so far? Turn and talk about that, and then you can share out.*

Encourage kids to think about how to synthesize the details and come up with a few different ways of stating the big idea.

**Say:** *Let kids know that there are many ways to state the big idea. Have kids share and discuss their different ways of thinking about and stating the big idea.*

### COLLABORATE (25 Minutes)

**Say:** *Now it's your turn. Find a partner and continue reading together.*

**Say:** *Write down the details on your Think Sheet squares. Keep talking about how they fit with the other details in the article. As you read and learn more details, you might have some different thoughts about what the big idea is. Continue to synthesize these details and refine your thinking about the big idea.*

**Say:** *While you are working together, I'm going to walk around the room to see if you need any help or have any questions.*

Kids read, write down details, and talk about them and the big idea. Move around the room, conferring with partners.

### SHARE THE LEARNING (10 minutes)

Kids join a sharing circle with you.

**Say:** *Let's take some time to have a few of you share the big idea of the article you read and the details that helped you determine the big idea. Remember to share using respectful language. After you share, ask if anyone has any comments or questions. Then you can invite someone else to share.*

Kids share out and invite others to share, always using respectful sharing language. There should be time for about 3 or 4 kids to share out with the whole group.

**Say:** *Synthesizing the details to see how they all relate to one another to come up with the big idea takes some clever thinking. Great work today, everyone!*

# Introduction/What You Need to Know

## SCIENCE

### Standards Supported

- **NGSS ESS2.A: Earth Materials and Systems:** Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1)
- **NGSS ESS2.C: The Roles of Water in Earth's Surface Processes:** Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5-ESS2-2)

### Resources

- Projectable PDF or interactive digital magazine
- Wetlands of the World posters: Bog, Mangrove, Swamp, Marsh (Teacher's edition)
- Content Assessment Master (page 11)
- Article Test (page 16)

### Science Background

A wetland is an area where water covers the soil for at least part of the year. From swamps and marshes to bogs and mangroves, there are many kinds of wetlands. The type of wetland that forms in an area depends on factors such as the type of soil, topography, climate, and vegetation.

Wetlands are important ecosystems. They help prevent flooding, clean and filter water, and provide homes for many different plant and animal species.

The soil in a wetland is soft and spongy, making it difficult to build on the land. So for most of history, people saw wetlands as wastelands. They drained wetlands and put the land to other uses. In the early 1970, governments started to see the value in wetlands and began preserving these ecosystems. In many parts of the world, it is now illegal to alter or destroy wetlands.



Click here for the Kahoot! quiz:  
<https://play.kahoot.it/#/k/182f497f-e096-480e-9566-9663aad937b6>

### ENGAGE

Encourage students to review the **Introduction** and the article and turn and talk with a partner to discuss what they see. Invite students to ask questions or share what they already know about wetlands.

### EXPLORE

Display the **Introduction** with the projectable PDF or the interactive digital magazine. Instruct students to read the text and examine the photos. As a class, make a list of basic facts that help define what a wetland is. Then have students read the **"What You Need to Know"** feature on the following spread.

### EXPLAIN

After reading, remind students that a wetland is land that is covered by water for at least part of the year.

**Ask:** *Why are wetlands valuable natural resources?*

(They act like giant sponges and water treatment facilities, are diverse ecosystems that are home to many species, and they are important to people.)

*What threats do wetlands face?* (development, agriculture, invasive species, and climate change) Have students discuss these issues in small groups.

Guide students to recognize that people caused many of the problems wetlands face. But people can work together to find solutions. Challenge students to identify things people can do to help keep wetlands healthy.

### ELABORATE

Display and review the four **"Wetlands of the World" posters**. Instruct students to compare and contrast the four types of wetlands they see. Invite volunteers who have visited any of these types of wetlands to describe the plants, animals, and landscape they found there. Challenge students to identify key features that differentiate one type of wetland from another.

### EVALUATE

Have students complete the **Content Assessment** for this lesson. Then have them take the **Article Test**. Encourage them to share and compare their results in small groups.

Name \_\_\_\_\_

Date \_\_\_\_\_

## CONTENT ASSESSMENT: Introduction/What You Need to Know

Conduct research to find an interesting bog, mangrove, swamp, and marsh somewhere in the world. Identify each wetland and its location. Describe what it is like and list plants and animals that live there. Summarize threats it faces.

| Bog       |            |
|-----------|------------|
| Identify: | Describe:  |
| List:     | Summarize: |

| Mangrove  |            |
|-----------|------------|
| Identify: | Describe:  |
| List:     | Summarize: |

| Swamp     |            |
|-----------|------------|
| Identify: | Describe:  |
| List:     | Summarize: |

| Marsh     |            |
|-----------|------------|
| Identify: | Describe:  |
| List:     | Summarize: |

# Balance for the Bogs

## SCIENCE

### Standards Supported

- **NGSS ESS3.A: Natural Resources:** Energy and fuels that humans use are derived from natural resources and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)
- **NGSS ESS3.C: Human Impacts on Earth Systems:** Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

### Resources

- Projectable PDF or interactive digital magazine
- Content Assessment Master (page 13)
- Article Test (page 17)

### Science Background

A bog is a type of freshwater wetland most often found in cold or even Arctic areas. Bogs often form in shallow lakes when plant debris slowly builds up and fills the lake. It can take hundreds or even thousands of years for a bog to form.

While grasses and sedges eventually cover a bog's surface, at its bottom is a thick, spongy mat of material called peat. Peat is a valuable fossil fuel, and some people cut it into squares, dry it out, and burn it for heating and cooking.

Few plants can grow in a bog's soggy soil. In addition to being highly acidic, the soil has low levels of oxygen and nutrients. Plants that do live here have adapted to survive. Some are carnivorous and get their nutrients from the insects they catch and digest.

Bogs are known as carbon sinks. They store huge amounts of carbon in peat. This helps keep global temperatures from rising.

### ENGAGE

Encourage students to flip through the article and turn and talk with a partner to discuss what they see. Invite students to ask questions or share what they already know about bogs.

### EXPLORE

Display the "**Balance for the Bogs**" article with the projectable PDF or the interactive digital magazine. As a class, discuss what a bog is. Then brainstorm ideas about what it means for a bog to be in balance.

### EXPLAIN

After reading, remind students that a bog is a type of wetland that accumulates peat, which is a deposit of dead plant material. Have students turn and talk to discuss how a bog forms. (These details can be found in the "**How Raised Bogs Form**" sidebar.) Rejoin as a class. **Ask:** *How are bogs connected to Earth's atmosphere?* (Bogs are carbon sinks. They absorb and store a large amount of carbon dioxide from the air. This reduces the greenhouse effect on Earth.) Point out that some people use peat as a fossil fuel. **Ask:** *What happens when people burn peat?* (It releases thousands of years of stored carbon into the air.) *Why does that matter?* (It can warm our planet.) In small groups, have students discuss why people should work to protect bogs and how these efforts can help recover these important wetlands.

### ELABORATE

Display the "**Carbon Sources vs. Carbon Sinks**" feature with the projectable PDF or the interactive digital magazine. Have students turn and talk as they discuss what carbon sources and carbon sinks are and how they are connected. Challenge students to explain why it is important for people to maintain a balance between these opposing processes.

### EVALUATE

Have students complete the **Content Assessment** for this lesson. Then have them take the **Article Test**. Encourage them to share and compare their results in small groups.



Click here for the Kahoot! quiz:  
<https://play.kahoot.it/#/k/3e124e82-d672-45a5-b909-4b5a4408c6a4>

**CONTENT ASSESSMENT: Balance for the Bogs**

Explain the link between bogs, carbon dioxide, and the greenhouse effect.

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Summarize reasons why turf-cutters in Ireland want to use peat from bogs and conservationists want to preserve it.

| Turf-cutters | Conservationists |
|--------------|------------------|
|              |                  |

Where do you stand on this issue? Use facts from the article to support your opinion.

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# Flying Flowers of Rwanda

## SCIENCE

### Standards Supported

- **NGSS Crosscutting Concepts: Cause and Effect:** Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1)
- **NGSS ESS3.C: Human Impacts on Earth Systems:** Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

### Resources

- Projectable PDF or interactive digital magazine
- Content Assessment Master (page 15)
- Article Test (page 18)

### Science Background

The Rugezi Marsh is a large wetland located in northern Rwanda. It is a diverse ecosystem for plants and animals. It is also an important resource for people, who rely on its waters to feed the two area hydroelectric plants that bring power to their homes.

Years ago, lack of rainfall and the growing demands of human activities caused water levels in the marsh to plummet, putting this valuable resource at risk. Ever since, people have been working hard to restore the wetland.

National Geographic Explorer Erasme Uyizeye is one of those people. And in his quest to restore the wetlands, he discovered a surprising helper: dragonflies. Dragonflies spend most of their lives in the water. They thrive where water is clean and healthy plants abound. By monitoring dragonfly numbers, Uyizeye is helping to identify areas of the marsh that need protecting.



Click here for the Kahoot! quiz:  
<https://play.kahoot.it/#/k/0feed09d-c7a3-4c60-97de-de9eed4c0859>

### ENGAGE

Encourage students to flip through the article and turn and talk with a partner to discuss what they see. Invite students to ask questions or share what they already know about marshes.

### EXPLORE

Display the "**Flying Flowers of Rwanda**" article with the projectable PDF or the interactive digital magazine. As a class, discuss reasons why the author and his friends might have called dragonflies "flying flowers." Then have them brainstorm ideas about how dragonflies could help save a marsh.

### EXPLAIN

After reading, remind students that Explorer Erasme Uyizeye loved watching dragonflies as a child. **Ask:** *How is his childhood passion connected to the work he does today?* (Over time, he started seeing fewer dragonflies. He became an ecologist to figure out why.) Point out that a lot of Uyizeye's work is done at the Rugezi Marsh. Have students turn and talk to discuss what this marsh is like.

**Ask:** *What problems has the marsh faced?* (Too much human activity and too little rainfall caused water levels to drop.) *How have people tried to restore the marshland?* (They stopped certain drainage and farming activities and blocked most fishing.) *How did Uyizeye's observations of dragonflies become part of the solution?* (He realized that dragonflies are good indicators of the health of a wetland.) Have students discuss how Uyizeye used this knowledge to save the Rugezi Marsh.

### ELABORATE

Have students read the "**Protecting the Marsh**" and "**Managing Mangrove**" articles. Discuss each article. Then challenge students to explain how careful observation, like Uyizeye's monitoring of dragonflies, has or could help people better protect each type of wetland.

### EVALUATE

Have students complete the **Content Assessment** for this lesson. Then have them take the **Article Test**. Encourage them to share and compare their results in small groups.

## CONTENT ASSESSMENT: Flying Flowers of Rwanda

Answer each question about the article.

|   |  |
|---|--|
| <p>Why is the Rugezi Marsh important to the people of Rwanda?</p>                           |  |
| <p>What changed and how did this cause problems for the people?</p>                         |  |
| <p>What did Explorer Erasme Uyizeye observe that helped him find a solution?</p>            |  |
| <p>What did he do after making this observation that is helping to protect the wetland?</p> |  |
| <p>What do you think other researchers can learn from Uyizeye's experience?</p>             |  |

**ARTICLE TEST: Introduction/What You Need to Know**

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

1. What do all wetlands have in common?  
Ⓐ They are completely filled with saltwater.  
Ⓑ They are covered by water for at least part of the year.  
Ⓒ They have thick, spongy mosses.
  
2. Which continent has no wetlands?  
Ⓐ Asia  
Ⓑ Australia  
Ⓒ Antarctica
  
3. What do wetlands do when they act like giant sponges?  
Ⓐ prevent flooding  
Ⓑ remove vegetation  
Ⓒ wash away beaches
  
4. Which sentence about wetlands is true?  
Ⓐ Introducing non-native plants and animals creates healthier wetland ecosystems.  
Ⓑ Wetland plants, fungi, and algae absorb harmful chemicals.  
Ⓒ It is impossible to permanently flood a wetland.

5. What are four things people have done to threaten wetlands?

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**ARTICLE TEST: Balance for the Bogs**

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

1. What is a bog?  
Ⓐ a wetland filled with salt-loving trees  
Ⓑ a wetland dominated by woody plants and trees  
Ⓒ a wetland that accumulates peat
  
2. How long does it take to add one meter of soil in a bog?  
Ⓐ 10 years  
Ⓑ 100 years  
Ⓒ 1,000 years
  
3. What part of a bog is sometimes used as a fossil fuel?  
Ⓐ fen  
Ⓑ peat  
Ⓒ mosses
  
4. Why are bogs good for the environment?  
Ⓐ They store carbon.  
Ⓑ They release carbon dioxide.  
Ⓒ They are a carbon source.

5. How do people turn a bog from a carbon sink into a carbon source?

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**ARTICLE TEST: Flying Flowers of Rwanda**

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

1. What grows in a marsh?  
Ⓐ woody plants and trees  
Ⓑ mosses  
Ⓒ reeds and grasses
  
2. Why is the Rugezi Marsh important to the people of Rwanda?  
Ⓐ Dragonflies live there.  
Ⓑ It is a source of water and power.  
Ⓒ It protects Rwanda from tides.
  
3. Where would you find more dragonflies in the Rugezi Marsh?  
Ⓐ in healthier parts  
Ⓑ in more polluted parts  
Ⓒ in parts with more saltwater
  
4. What does the lack of dragonflies help identify?  
Ⓐ areas that have recovered  
Ⓑ areas that need protecting  
Ⓒ areas that don't need to be monitored

5. Why are dragonflies good indicators of the health of a wetland?

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# Pathfinder and Adventurer

## ANSWER KEY

### Introduction/What You Need to Know

#### Assess Content, page 11

Answers will vary depending on which examples students pick. However, students should select one bog, mangrove, swamp, and marsh. They should identify the name and location of each, describe what it is like, list important plants and animals found there, and summarize threats each location faces.

#### Article Test, page 16

1. B; 2. C; 3. A; 4. B; 5. People have filled or drained wetlands to build houses and roads, turned wetlands into farms, introduced non-native plants and animals, and caused climate change, which can permanently flood wetlands.

### Balance for the Bogs

#### Assess Content, page 13

**Explain:** Bogs are carbon sinks. They absorb carbon dioxide from the air, trap the carbon, and keep it in place. This reduces the greenhouse effect on Earth and helps keep Earth's temperatures from rising.

#### Summarize:

**Turf-cutters:** Peat is a fossil fuel. Turf-cutters want to cut and dry the peat so they can burn it. Although burning peat is not efficient, it is cheaper than alternatives and it is part of their culture and traditions.

**Conservationists:** Conservationists want to preserve peat to reduce the amount of greenhouse gases released into the atmosphere. They also want to preserve the bogs so future generations can enjoy them.

**Opinion:** Answers will vary, but students should use facts from the article to support their answers.

#### Article Test, page 17

1.C; 2. C; 3. B; 4. A; 5: They burn peat, releasing stored carbon into the air and creating carbon emissions. This turns a bog from a carbon sink into a carbon source.

### Flying Flowers of Rwanda

#### Assess Content, page 15

1. It controls, holds, and filters water that flows into two lakes. It is home to many species of animals, and it is a source of both water and hydroelectric power for the people.

2. Too much human activity and too little rainfall caused water levels to drop. Power production dropped and the country suffered an energy crisis.

3. He observed that dragonflies are good indicators of the health of a wetland.

4. He created a monitoring system, using dragonflies, to help identify areas that need protecting.

5. Answers will vary.

#### Article Test, page 18

1. C; 2. B; 3. A; 4: B; 5. Dragonflies spend most of their life cycle in the water. For them to thrive, the water must be clean. They also need healthy plants nearby. This helps them hide from predators.