



TEACHER'S GUIDE
Pioneer and Trailblazer
Vol. 19 No. 6

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Educational consultant **Stephanie Harvey** has 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.

Lexile® Framework Levels

Pioneer
 Who Takes Care of Our Forests?560
 Digging Up History..... 510
 Out of the Water, Into the Lab..... 500

Trailblazer
 Who Takes Care of Our Forests?650
 Digging Up History..... 610
 Out of the Water, Into the Lab..... 640

Standards Supported

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

See each lesson for the specific standard covered.

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WINNING
ENVIRONMENTAL
EDUCATION**

National Geographic Learning Framework

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 Make Connections to Better Understand

Second Grade Standard Supported

- **CCSS Reading Informational Text:** Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text. [2-3]
- **CCSS Reading Informational Text:** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. [3-3]

What You'll Need

- "Who Takes Care of Our Forests?" (*Explorer*, pages 2–9)
- Think Sheet (Teacher's Guide, page 6)
- Clipboards
- Pencils

CONNECT & ENGAGE (20 minutes)

Kids sit in a group with you in front of you. Hold up pages 2–3

Say: *I'm excited to learn more about this topic today. Let's turn and talk about what we think we already know about forests. I'll walk around and listen in to your conversations.*

Kids turn and talk.

Say: *I listened in on some good conversations, and I heard that some of you already know a few things about forests. This can really help as we read. Good readers take the time to consider what they already know about a topic before they read and also while they are reading. That's called making connections—connecting what we already know to new information we are learning. This helps us better understand.*

Say: *Today we are going to learn about some people who take care of our forests.*

Read the title of the article and read the jobs people do to take care of our forests.

MODEL (10 minutes)

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

Say: *I'm going to show you how I make connections and think about what I already know to help me understand what I am reading.*

Say: *I have a two-column chart that I'll use to jot down a few things I already know in the "My Connections" column. Then, after considering my connections, I'll write down how they help me better understand what I'm reading.*

Read aloud pages 4–5, stopping after reading each person's information.

Say: *Let's look first at Ken Price's information. He's a Forest Technician. He says a forest is a renewable resource and what grows there can grow again. My connection to that is that I have several trees in my yard. Every spring, lots of seeds fall from my maple trees. In the summer, I see lots of little maple sprouts all over my lawn. I think that's what is meant by renewable resource. I'm going to write these things on my chart.*

My Connections	How They Help Me Understand
maple trees, seeds, and sprouts in my yard	helps me understand what "renewable resource" means

Say: *Now with Coeli Hoover's information, I made the connection that I already know that trees and plants take in carbon dioxide and release oxygen. Knowing that trees and plants store carbon helps me better understand why Coeli can measure the carbon in them.*

Say: *The next person is Magen Dufurrena. Magen is a Wildland Firefighter. My connection here is that I know that there have been wildfires in California, and I've seen them on the news. I know they can cause a lot of damage. Making this connection helps me understand why Magen has to work quickly and travel by helicopter to reach the fires.*

Say: *I'm going to add my connections and understandings about Coeli's and Magen's information to the chart.*

My Connections	How They Help Me Understand
Trees and plants take in carbon dioxide.	helps me understand why carbon can be measured in trees and plants
I've seen wildfires on the news and the damage they can do.	helps me understand why Magen has to work quickly and travel by helicopter to reach the fires

LANGUAGE ARTS Make Connections to Better Understand

Say: *Another way to make connections to better understand is to make connections across or within the text. On pages 2–3, I see that these three people, even though they work different jobs, all care in some way about our forests. I can also connect that to the title of the article, “Who Takes Care of Our Forests?” I understand that these are three people who do.*

GUIDE (10 minutes)

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

Say: *You can try this now. I’ll read, and you can think about what you already know and the connections you have to the text.*

Read pages 6–7 aloud. You might want to read Cady Lancaster’s information and then stop to have kids turn and talk and record their connections. Next, read Darren J.H. Sleep’s information and then Ashley Coble’s, asking kids to turn and talk and record their connections after each segment.

Say: *Did you have some interesting connections? Who can share a connection with us?*

Let a few kids share their connections with the class.

Say: *Remember, the reason we consider what we already know and make connections with the text is to help us better understand what we are reading. Now take some time to record on your Think Sheets how the connections you made help you better understand. Then turn and talk again about your connections and how they help you understand what we are reading about in the article.*

Kids record on their Think Sheets and turn and talk.

Say: *I said before that another way to make connections is across or within the text. How do these three people connect with the others we read about on pages 4–5?*

Kids should mention that these three people also take care of our forests in the work that they do.

COLLABORATE (25 minutes)

Say: *Now you are ready to work with a partner. You can take turns reading the rest of the article. Write your connections in the first column of your chart. You and your partner will have different connections.*

Say: *You can discuss your different connections. Be sure to also take time to write on your Think Sheet chart how these connections help you understand.*

Say: *I’m going to move around the classroom, so let me know if you need help.*

Partners work together. Move around the room, conferring with partners.

SHARE THE LEARNING (10 minutes)

Kids join a sharing circle with you and share out, using respectful language.

Say: *Okay, flip through the article and consult your Think Sheet to choose a connection you would like to share. Also share how that connection helped you understand what you were reading. 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: *You’ve learned that thinking about what you already know and making connections to the text helps you better understand what you are reading. Turn and talk about some of the important connections you made today.*

Kids turn and talk so that all have a chance to share their connections.

Say: *Everyone, you made some wonderful connections today!*

THINK SHEET

Use this chart to write your connections and how they help you understand.

My Connections	How They Help Me Understand

LESSON FRAME Make Connections to Better Understand

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.

minutes)

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

Say: *I'm excited to learn more about this topic today. Let's turn and talk about what we think we already know about _____. I'll walk around and listen in to your conversations.*

Kids turn and talk.

Say: *I listened in on some good conversations, and I heard that some of you already know a few things about _____. This can really help as we read. Good readers take the time to consider what they already know about a topic before they read and also while they are reading. That's called making connections—connecting what we already know to new information we are learning. This helps us better understand.*

MODEL (10 minutes)

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

Say: *I'm going to show you how I make connections and think about what I already know to help me understand what I am reading.*

Say: *I have a two-column chart that I'll use to jot down a few things I already know in the "My Connections" column. Then, after considering my connections, I'll write down how they help me better understand what I'm reading.*

Read aloud page(s) _____.

Say: *Let's look at _____. My connection to that is _____. I'm going to write that on my chart.*

Say: *Now I am going to write how my connection helps me understand what I am reading.*

GUIDE (10 minutes)

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

Say: *You can try this now. I'll read, and you can think about what you already know and the connections you have to the text.*

Read page(s) _____ aloud.

Say: *Did you have some interesting connections? Who can share a connection with us?*

Let a few kids share their connections with the class.

Say: *Remember, the reason we consider what we already know and make connections with the text is to help us better understand what we are reading. Now take some time to record on your Think Sheets how the connections you made help you better understand. Then turn and talk again about your connections and how they help you understand what we are reading about in the article.*

Kids record on their Think Sheets and turn and talk.

COLLABORATE (25 Minutes)

Say: *Now you are ready to work with a partner. You can take turns reading the rest of the article. Write your connections in the first column of your chart. You and your partner will have different connections. You can discuss your different connections. Be sure to also take time to write on your Think Sheet chart how these connections help you understand.*

LESSON FRAME Make Connections to Better Understand

Say: *I'm going to move around the classroom, so let me know if you need help.*

Partners work together. Move around the room, conferring with partners.

SHARE THE LEARNING (10 minutes)

Kids join a sharing circle with you and share out, using respectful language.

Say: *Okay, flip through the article and consult your Think Sheet to choose a connection you would like to share. Also share how that connection helped you understand what you were reading. 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: *You've learned that thinking about what you already know and making connections to the text helps you better understand what you are reading. Turn and talk about some of the important connections you made today.*

Kids turn and talk so that all have a chance to share their connections.

Say: *Everyone, you made some wonderful connections today!*

Who Takes Care of Our Forests?

SCIENCE

Standards Supported

- **NGSS Crosscutting Concepts: Science Addresses Questions About the Natural and Material World:** Scientists study the natural and material world. (2-ESS2-1)
- **NGSS Crosscutting Concepts: Science is a Human Endeavor:** Science affects everyday life. (3-ESS3-1)

Resources

- Projectable PDF or interactive digital magazine
- Find Your Green Job poster (Teacher's edition)
- Content Assessment Master (page 10)
- Article Test (page 15)

Science Background

According to the International Labour Organization, in 2017 there were 9.8 million "green" jobs. By 2030, it is estimated that there will be up to 60 million more.

What are "green" jobs? Simply put, they are jobs that benefit the environment or conserve natural resources. Green jobs can be found in every sector of the economy.

This article, which focuses on green careers in the forestry, was written in conjunction with Project Learning Tree® (PLT), an initiative of the Sustainable Forestry Initiative® Inc. For more details about PLT and its Green Jobs in Forests curriculum, go to: <https://www.plt.org/curriculum/green-jobs-forest-careers/>.

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 forests.

EXPLORE

Display the "**Who Takes Care of Our Forests?**" **article** with the projectable PDF or the interactive digital magazine. Point out the magazine's cover, which identifies this article as "Green Careers." As a class, discuss what green careers are and why "Green Careers" is also a good title for this article.

EXPLAIN

After reading, discuss what a renewable resource is and invite volunteers to identify renewable resources found in a forest. (Examples include: trees, plants, water, animals, etc.) As a class, discuss how natural forces and human activities can disturb forests and the natural resources they contain. Point out that each of the people featured in the article is doing something to keep our forests healthy. Have students turn and talk to review what each scientist does and how his or her efforts help conserve forests.

ELABORATE

Point out to students that the nine jobs featured in the article are just a small sample of the green careers available in forestry. There are, in fact, opportunities for people with a wide range of personalities and interests. Display and review the "**Find Your Green Job**" **poster**. Invite students to pick a forestry job that suits their personality and interests. Then have them conduct research to learn more about that career.

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: Who Takes Care of Our Forests?

Pick four scientists from the article. Identify their jobs. Then describe how each one helps take care of our forests.

Identify	Describe

Explore the "Find Your Green Job" poster. Which green job that best fits your personality? Write and draw to show and tell how you could help take care of forests if you had this job.

Write	Draw

Digging Up History

SOCIAL STUDIES

Standards Supported

- **C3: Historical Sources and Evidence:** Explain how historical sources can be used to study the past. (DS.His.10.K-2)
- **C3: Historical Sources and Evidence:** Summarize how different kinds of historical sources are used to explain events in the past. (DS.His.9.3-5)

Resources

- Projectable PDF or interactive digital magazine
- Content Assessment Master (page 12)
- Article Test (page 16)

Social Studies Background

George Washington is remembered for many things—most notably, being the first president of the United States. One accomplishment people may not be aware of is his role in creating the fantastic gardens at his Mount Vernon estate.

Although hired workers and enslaved people did the manual labor, Washington designed and oversaw the landscape at Mount Vernon himself. This included four gardens that surrounded a large guitar-shaped lawn, known as a bowling green. A gravel path around the bowling green allowed visitors to wind their way from one garden to another.

Each of the four gardens had a specific purpose. In the lower garden, or the kitchen garden, enslaved people grew fruits and vegetables year round. In the botanical garden, Washington experimented with growing new plants. The fruit garden and nursery was home to plants that required more space.

The highlight for the many guests to visit Mount Vernon was the upper garden, which featured an assortment of flowers and exotic plants from around the world. Washington even built a greenhouse as the focal point of this formal garden. During the cold Virginia winters, it was a safe place to keep tropical plants, which would be planted in the upper garden come spring.

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 Mount Vernon.

EXPLORE

Display the "**Digging Up History**" article with the projectable PDF or the interactive digital magazine. As a class, brainstorm a list of ways people could learn about Mount Vernon's past.

EXPLAIN

After reading, remind students that a primary source is a source of information created in the past that tells us about that time. **Ask:** *What kinds of primary sources helped researchers learn about the gardens at Mount Vernon?* (diary/notes, lists, drawings, studies of the soil) Have students turn and talk to discuss what each type of primary source revealed about the gardens. Encourage them to summarize how researchers studied the soil, what they found, and what that discovery told them. (They dug shallow rectangles in the ground. They found places where the soil was darker than the dirt around it. This showed where George Washington planted things because he used rich dark soil to make the ground fertile in his planting beds.) Challenge students to also explain what researchers learned from the pollen and seeds they found in the soil. (which plants Washington planted)

ELABORATE

Remind students that people study primary sources to learn about the past. In this article, they learned how primary sources revealed clues that helped scientists and historians accurately recreate George Washington's gardens. As a class, examine the size, contents, and composition of Washington's gardens as well as his front lawn. Discuss what these clues reveal about Washington himself.

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: Digging Up History

Write a sentence about three sources researchers used to learn about the gardens at Mount Vernon. Draw pictures to show what they revealed.

Write	Draw

Out of the Water, Into the Lab

SCIENCE

Standards Supported

- **NGSS Science and Engineering Practices: Scientific Knowledge is Based on Empirical Evidence:** Scientists look for patterns and order when making observations about the world. (2-LS4-1)
- **NGSS LS2.C: Ecosystem Dynamics, Functioning, and Resilience:** When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary to 3-LS4-4)

Resources

- Projectable PDF or interactive digital magazine
- Sharks! poster (Teacher's edition)
- Content Assessment Master (page 14)
- Article Test (page 17)

Science Background

Oceans, which cover more than 70 percent of Earth's surface, are home to a huge variety of animals. Their waters are also the final resting ground for a wide range of pollutants. Everything from plastics and pesticides to sewage and toxic chemicals is entering our seas. And it's making the animals that live there sick.

National Geographic Explorer and marine biologist Andrej Gajic is studying how all of these pollutants impact sharks and their cousins, skates and rays. In addition to observing live sharks in the water, he examines tissue samples from already-dead sharks that were accidentally caught by fishers.

Gajic has discovered diseases in various shark organs and pieces of plastic in their stomachs and intestines. He hopes his work helps make people more aware of how their actions affect marine life.

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 sharks.

EXPLORE

Display the "**Out of the Water, Into the Lab**" article with the projectable PDF or the interactive digital magazine. As a class, brainstorm a list of problems sharks might face. Discuss reasons why a scientist would need to study sharks both in the water and in a lab to find answers.

EXPLAIN

After reading, remind students that Andrej Gajic is studying sharks to see how pollution in the ocean is affecting them. **Ask:** *How does he know that sharks in the Adriatic Sea are in trouble?* (There are plastics, chemicals, and other waste poisons in the sea.) *What has Gajic learned after examining sharks both in the ocean and in his lab?* (The pollution is causing diseases in the sharks and the sharks are eating the plastic.) Have students turn and talk to discuss reasons why Gajic's work is important. Have them brainstorm a list of things they could do to help.

ELABORATE

Display and review the "**Sharks!**" poster. Encourage students to describe the sharks, where they live, and what they eat. As a class, discuss reasons why it's important to protect sharks from pollution in the ocean.

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: Out of the Water, Into the Lab

Write questions that Andrej Gajic has in his studies of sharks in the top half of each circle. Write the answers in the bottom half. Draw a picture of a shark in the middle circle.

The diagram consists of a central circle with a dotted line extending from its top to a larger circle. This larger circle is connected by dotted lines to four smaller circles, each divided vertically into two halves. The top half of each of these four circles is for writing questions, and the bottom half is for writing answers. The central circle is intended for drawing a picture of a shark.

ARTICLE TEST: Who Takes Care of Our Forests?

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

1. Why is a forest a renewable resource?
Ⓐ It has rocks and soil.
Ⓑ What grows there can grow again.
Ⓒ It can be plotted and mapped.

2. What does a carbon modeler do?
Ⓐ make carbon
Ⓑ store carbon
Ⓒ measure carbon

3. What kind of scientist can find trees that have been stolen?
Ⓐ wood scientist
Ⓑ forester
Ⓒ forest technician

4. What does a GIS resource specialist do?
Ⓐ study water
Ⓑ plant trees
Ⓒ make maps

5. What is the difference between a forester and a forest technician?

ARTICLE TEST: Digging Up History

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

1. How many main gardens did George Washington have?
Ⓐ two
Ⓑ three
Ⓒ four

2. What did researchers learn from the drawings enslaved people made?
Ⓐ what was planted
Ⓑ why certain things were planted
Ⓒ which tools were used to plant things

3. What did studying the soil help them find?
Ⓐ where the soil was deeper
Ⓑ where the soil was muddier
Ⓒ where the soil was more fertile

4. What other clues did they find in the soil?
Ⓐ worms
Ⓑ pollen and seeds
Ⓒ bowling greens

5. Why did Washington have one garden that was a laboratory?

ARTICLE TEST: Out of the Water, Into the Lab

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

1. Why does Andrej Gajic dive at night to see sharks?
Ⓐ Sharks are easier to see in dark waters.
Ⓑ Sharks are nocturnal creatures.
Ⓒ He is too busy to dive during the day.

2. What does he think might be making sharks sick?
Ⓐ polluted waters
Ⓑ shallow waters
Ⓒ muddy waters

3. Who gives him the sharks he studies in his lab?
Ⓐ fishers
Ⓑ poachers
Ⓒ aquariums

4. What has he found after studying sharks in his lab?
Ⓐ All sharks are healthy.
Ⓑ Sharks cause pollution.
Ⓒ Sharks eat plastic.

5. What is one thing you can do to help sharks in the ocean?

Pioneer and Trailblazer

ANSWER KEY

Who Takes Care of Our Forests?

Assess Content, page 10

Part 1: Answers will vary depending on which type of scientists students choose to include. However, descriptions about how they help protect forests should come from the article.

Part 2: Students should select a job from the poster. If you like, have them conduct research to learn more about the job. Then they should write and draw to show and tell how they could help protect forests if they had this job.

Article Test, page 15

1. B; 2. C; 3. A; 4. C; 5. A forester makes sure that forests regrow after trees are harvested. A forest technician builds partnerships between groups of people to take care of forestland.

Digging Up History

Assess Content, page 12

Students may identify Washington's notes, Enslaved peoples lists and drawings, the soil, plans drawn by Samuel Vaughan, seed and pollen samples that were collected, or Washington's bowling green (front lawn). Drawings should accurately reflect what was learned from studying each source.

Article Test, page 16

1. C; 2. A; 3. C; 4. B; 5: He tested plants there to see how well they would grow in Virginia's soil.

Out of the Water, Into the Lab

Assess Content, page 14

Questions and answers will vary but should all come from the article and relate to Andrej Gajic's study of sharks.

Article Test, page 17

1. B; 2. A; 3. A; 4. C; 5. Possible response: Practice citizen science. If you're walking on a beach and find shark egg cases, take a photo, and upload it to iNaturalist to help scientists learn where sharks are living.