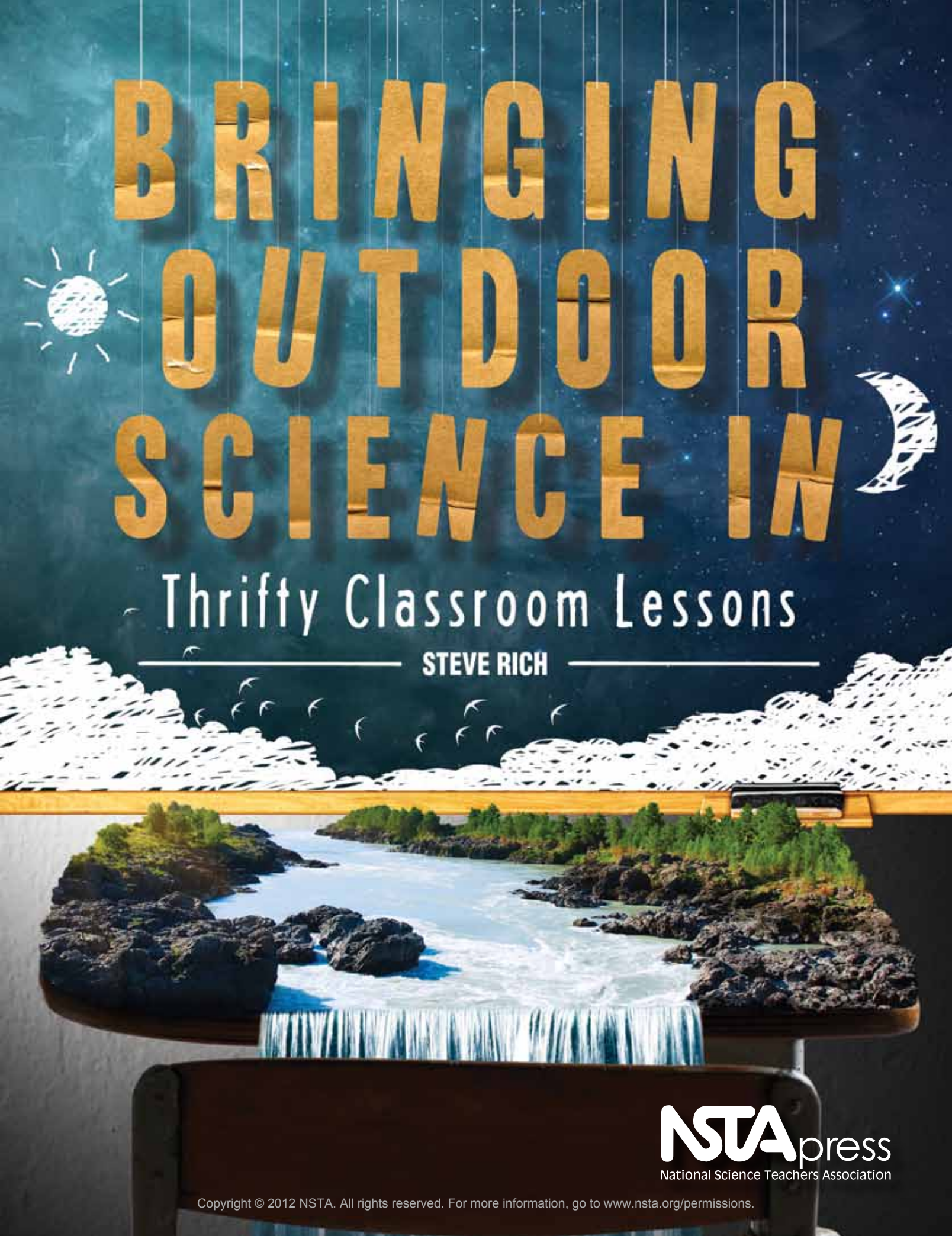
BRINGING OUTDOOR SCIENCE IN

Thrifty Classroom Lessons

STEVE RICH



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Arlington, Virginia

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DEDICATION

This book is dedicated with love, deep respect, and admiration, to my mother, June Coleman Rich, who understood my need as a child to bring outdoor creatures inside, and instinctively knew more than me that one day all the lizards, snakes, frogs, and turtles would propel me toward trying to making a difference for young people and their teachers.

"A mother's heart is a child's school room." ~ Henry Ward Beecher

PREFACE

During more than a dozen years of planning, building, using, and writing about outdoor classrooms, I have met many, many teachers who have discovered the joy of taking students out to the school yard for engaging lessons and learning. At the same time, I have met a number of teachers who have told me they are never going outside with their students. While it's almost foreign to me to consider remaining in my classroom when there is so much science in the school yard, I understand that in some situations this is discouraged by administrators or complicated by a host of factors beyond the control of the teacher. So as a result of my conversations with these teachers, I decided to write *Bringing Outdoor Science In: Thrifty Classroom Lessons.*

In this follow-up to *Outdoor Science: A Practical Guide,* you'll find many units and lessons that can be taught indoors or outdoors. Students participating in these lessons will sometimes use natural materials. One of the best parts of this type of lesson is that the materials from outdoors are free! If you are teaching a lesson using a leaf or a rock, you can simply step outside and gather the materials. There's no need to pull out your science catalog and create a purchase order. Who has time for that anyway?

This book may be used as is for upper elementary and middle grades. Possible adaptations for primary grades are noted in the section "Grade-Level Considerations" within each lesson. In this book the various grade levels are defined as follows: *primary* refers to grades K through 2, *upper elementary* refers to grades 3 through 5, and *middle* refers to grades 6 through 8.

It is my hope that as you use these lessons, you will see the value in taking your class outdoors. The experience of learning outdoors enriches the environmental knowledge base for young people, giving them the insight to become better stewards of natural resources throughout their lives. If you decide not to take students outdoors, certainly you will encourage them to explore just by bringing some of the outdoors into your own classroom.

ACKNOWLEDGMENTS

As *Bringing Outdoor Science In* continues my journey through the world of science education, it is important to acknowledge those who have traveled along this road with me. Sometimes these fellow travelers find feathers for my artifact boxes, provide caterpillar care at the "science lab" (dining room table), or at least pretend to be excited when I make the best-seller list. The primary fellow travelers in the order they hopped on the *Outdoor Science* school bus are June Coleman Rich, Cathy Rich Robinson, Spencer Anthony Rich, and Glenn Russell Bilanin.

The professional fellow travelers are too numerous to name individually, but they include members of the professional organizations that give me such inspiration and joy—National Science Teachers Association (NSTA), Georgia Science Teachers Association (GSTA), Georgia Science Supervisors Association (GSSA), Georgia Youth Science & Technology Center (GYSTC), Council of State Science Supervisors (CSSS), Council for Elementary Science International (CESI), and particularly the Society of Elementary Presidential Awardees (SEPA). My life is so enriched by the people I see at meetings and conferences throughout the country—including the NSTA Press staff members who make being an author such a joy.

My students have been a particular source of inspiration to me, and many of the lessons in this book were born in the classrooms at my schools in Georgia. I cannot thank all of my students individually, so I will choose one to represent them all. Shadra Tomei was a student in my sixth-grade science class years ago and is now a fourth-grade teacher who often allows me the honor of co-teaching science in her classroom, trying out new lesson ideas with her students. I am so proud of Shadra, as I am of every student who ever tried his or her best in class, and goes on in life to be a hardworking citizen and hopefully a steward of the environment as a result of experiences in my outdoor classrooms.

I will also thank the traveler whom I carry only in my heart, my late father, Rochell Rich Jr., who worked so hard to make it possible for my childhood to be enriched with endless outdoor adventures on the water, in the woods, at campgrounds, on farms, and on barrier islands. He still guides me through uncharted waters and on new paths through the woods.

ABOUT THE AUTHOR

As a science teacher in elementary and middle schools, Steve Rich created two outdoor classrooms that were honored with NSTA awards—the Ciba Exemplary Science Teaching Award and the Ohaus Award for Innovations in Science Teaching. His professional experience includes writing books for students and teachers and serving as a science specialist for the Georgia Department of Education and as the coordinator of the Youth Science & Technology Center at the University of West Georgia. He is a frequent NSTA presenter and author of the NSTA Press best seller *Outdoor Science: A Practical Guide*.

Steve is a National Board Certified teacher and a recipient of the Presidential Award for Excellence in Science Teaching. He was a district director of NSTA and president of the Georgia Science Teachers Association. He is a graduate of the University of Georgia and Georgia State University. More information about the author is available at *www.sarinkbooks.com*.

Correlation to National Science Education Standards

	Content Standards	Lessons
Physical Science	K–4 Properties of objects and materials	pp. 80, 84, 92, 110
	5–8 Properties and changes of properties in matter	pp. 80, 84, 92, 110
	K–4 Position and motion of objects	pp. 94, 96, 98, 132
	5–8 Motions and forces	pp. 94, 96, 98, 108, 132
	K–4 Light, heat, and magnetism	p. 126
	5–8 Transfer of energy	pp. 8, 38, 62, 108, 138
Life Science	K–4 Characteristics of organisms	pp. 32, 36, 42, 44, 54, 64, 66, 74, 134
	5–8 Structure and function in living systems	pp. 42, 44, 46, 48, 50, 52, 54, 60, 62, 64, 66, 68, 70, 72, 74, 118, 134
	K–4 Life cycles of organisms	p. 50
	5–8 Reproduction and heredity	pp. 42, 44, 50, 66
	K–4 Organisms and environments	pp. 36, 48, 52, 62, 112, 134
	5–8 Regulation and behavior	pp. 32, 36, 60
	5–8 Populations and ecosystems	pp. 38, 40, 46, 48, 52, 70, 72, 112, 134
	5–8 Diversity and adaptations of organisms	pp. 42, 44, 50, 52, 54, 60, 62, 64, 66, 68, 70, 112, 134
Earth and Space Science	K–4 Properties of Earth materials	pp. 80, 84, 86, 90, 92, 94, 110
	5–8 Structure of the Earth system	pp. 80, 84, 86, 88, 90, 92, 94, 96, 98, 104, 106, 108, 110, 112, 114, 116, 118, 124, 126, 130, 132, 138
	K–4 Objects in the sky	pp. 124, 126, 130, 132, 134, 136, 138
	5–8 Earth's history	pp. 80, 84, 86, 88, 130
	K–4 Changes in Earth and sky	pp. 94, 96, 98, 116, 136
	5–8 Earth in the solar system	pp. 126, 130, 132
Science and Technology	K–4 Abilities to distinguish natural objects/manmade	pp. 64, 66, 80, 84, 86, 90, 92
	K–4/5–8 Abilities of technological design	pp. 12, 74, 88, 106, 138
	K–4/5–8 Understanding about science and technology	pp. 12, 88, 106, 138
Science in Personal and Social Perspectives	K–4/5–8 Personal health	
	K–4 Characteristics and changes in populations	p. 38
	5–8 Populations, resources, and environments	pp. 38, 40, 70, 72
	K–4 Types of resources	pp. 4, 8, 72, 108, 138
	5–8 Natural hazard	p. 116
	K–4 Changes in environments	pp. 94, 96, 98, 116
	5–8 Risks and benefits	pp. 116, 136
	K–4/5–8 Science and technology in local challenges/society	pp. 12, 74, 88, 106, 108, 138
History and Nature of Science	K–4/5–8 Science as a human endeavor	pp. 12, 26, 74, 88, 106, 108, 138
	5–8 Nature of science	
	5–8 History of science	pp. 74, 88

SAFETY NOTES

Every school or school system should have a science safety plan, which may include student safety contracts or a uniform set of lab rules. In addition to what your school system requires, here are some common-sense safety considerations specifically addressing the lessons and ideas in this book:

1. Provide students with a lab safety form or science activity safety form that outlines general science safety procedures. You can use your school system's standard form, if available. If you teach in an elementary school that does not use a standard form, check with a middle school science teacher. The safety form should be sent home to be signed by parents.
2. Students should thoroughly wash their hands after any visits to the school yard and after handling any materials that have been taken in from outdoors.
3. Review students' records for allergies such as those to specific plants or stinging insects.
4. Protective equipment, including but not limited to vinyl gloves, aprons, and eye goggles, is encouraged for the activities in this book.
5. Use care when students are asked to use sharp objects (such as those in dissection kits, toothpicks, pipe cleaners, straight pins, rocks, or arrowheads).
6. When gathering any objects outdoors (rocks, soil, insects, etc.), it is best to look for locations that have not been sprayed with pesticides, herbicides, or other chemicals.
7. When working with water indoors, completely clean up any spills.
8. When working outdoors, students should be reminded not to look directly into the Sun.

ROCKS AND SOILS

4

Humans have built their homes upon the land, often using the rocks and stones from the land as building materials. Rocks and soil are indeed a part of everyday life and an important component of a complete science curriculum.

Where do teachers get rocks to show students? Often a rock collection is one of the more common materials purchased by schools for science teaching. However, not all schools have rock collections and some cannot afford them. A thrifty science teacher can teach a unit on rocks with only those that can be found in the area. Although some locations may not yield all of the samples that would create a substantial rock collection, there are likely to be enough to share the basic concepts that students need in the elementary and middle grades. The same would be true for soils. Even if there is only one soil type in the area, it can be used as a great starting place for teaching about soils. Local soil can be compared with purchased soil samples (e.g., potting soil or play sand). In fact, it is that comparison that lends itself to great science explorations for young people—comparing both soils and rocks through close observation and hands-on experiences.

Use these resources and the lessons in this chapter to introduce students to rocks and soils in their local area and beyond. Consult your district science curriculum and state science standards to

see where these lesson ideas fit best, and consider bringing in a guest speaker from a college geology department, a museum, or a rock and mineral society.

Although these lessons do not constitute an entire unit on rocks and soils, together they do offer an introduction to the important components of the Earth that students see around them every day. Perhaps students will find out why teachers often say, "Science rocks!"

Resources

Websites

- *http://education.usgs.gov*
- *http://www.geosociety.org/educate/LessonPlans/i_rocks.htm*
- *http://school.discoveryeducation.com/schooladventures/soil*

Children's Literature

- *Jump Into Science: Rocks and Minerals* by Steve Tomecek (National Geographic Children's Books, 2010)
- *Rocks, Fossils and Arrowheads (Take Along Guides)* by Laura Evert (Cooper Square Publishing, 2001)
- *Rocks in His Head* by Carol Otis Hurst (Greenwillow Books, 2001)

DON'T FORGET!

- Use care when students are asked to use sharp objects (such as those in dissection kits, toothpicks, pipe cleaners, straight pins, rocks, or arrowheads).
- When gathering any objects outdoors (rocks, soil, insects, etc.), it is best to look for locations that have not been sprayed with pesticides, herbicides, or other chemicals.
- When working with water indoors, completely clean up any spills.

For a full list of safety tips, see page xi.

4 EXPLORING LOCAL ROCKS

Objective

Students will observe rocks that can be found locally and record their observations.

SCILINKS
THE WORLD'S A CLICK AWAY

Topic: Composition of Rocks
Go to: *www.scilinks.org*
Code: BOS026

Why/How to Use This Lesson

To develop an understanding of Earth science, students need to start with the basics and in particular something they can hold in their hands. Most children who have spent any time outdoors have picked up a rock at some time, and in this lesson they will not only hold the rock but will take a closer look. This lesson could be used at the beginning of a unit on rocks or as part of a unit on rocks and soils. Consider following this lesson with "Characteristics of Rocks" and "Making a Rock Collection," which cover all three different types of rocks.

Materials

snack-size resealable plastic bags, rocks, hand lens, ruler, scale (optional), student worksheet

Procedures and Tips

1. Show students a rock that you have found nearby. Ask the students to say some words that describe the rock. Tell them that you are going to ask them to bring in their own rock from home. (If this is not possible, provide rocks for them.)
2. Give students a plastic bag to use to store a rock they will collect. Tell them that it must fit in the bag and they must be able to seal it. This will cut down on the size of the rock and prevent unsafe situations that may result from larger rocks being transported on school buses. Place the following note for parents inside the plastic bag:

> PARENTS: Our class is studying ROCKS. Please help your child find a rock from the local area that will fit in this bag. Seal it up and send it to school with your child. Make sure your child knows to keep the rock in the bag until it is delivered safely to my classroom.

3. When students have brought in their rocks, divide the students into groups to compare and contrast their rocks. Ask them to write three sentences describing the rocks on their worksheets.
4. If a scale is available, students may weigh the rocks and determine which is the heaviest. Students may also use a ruler to measure the size of the rock.
5. Determine if all types of rocks (igneous, metamorphic, sedimentary) are represented by the student samples. You may wish to use this lesson to serve as an introduction to the next step—introducing the three types of rocks and their characteristics.

Grade-Level Considerations

Upper elementary and middle grade students may be assigned to research the geological history of the area, using local rocks as a starting point. For primary grade students, attach a note for parents to the plastic bag for the rock collection activity if it is being sent home. Instead of the student worksheet, you could provide a plain piece of paper on which students would draw a picture of their rock, and perhaps a picture of another rock that is different in appearance.

Assessment/Next Steps

Assess student understanding with the sample discussion questions and the responses to the student worksheet. Rocks brought in by students may be organized into a collection that could be

displayed in the classroom or media center. If there are a wide variety of rocks, you may even wish to use a plastic craft box or similar container to make a permanent collection that you would keep in your classroom.

Sample Discussion Questions

- How are any two of the rocks alike? How are they different?
- Describe your rock in terms of weight, color, and texture.

4

EXPLORING LOCAL ROCKS

Name: _____ Date: _____

Describe your rock in three complete sentences.

_____
_____
_____
_____
_____
_____

Measure your rock and record your data here. Use whatever measuring device is available (for example, ruler or scale). Also compare the rock with a common object (for example, "smaller than a quarter but bigger than a penny" or "weighs about the same as two marbles").

Measurement data: _____

Comparison: _____

Compare your rock with that of another student. Use the chart below to record your observations. Fill in each space with a word that describes one or both of the rocks.

Your Rock	Both	Another Student's Rock

Do you think your rock originally came from the local area or somewhere else? Why?

_____
_____
_____
_____
_____
_____
_____
_____
_____

DON'T FORGET!

- Provide students with a lab safety form or science activity safety form that outlines general science safety procedures. You can use your school system's standard form, if available. If you teach in an elementary school that does not use a standard form, check with a middle school science teacher. The safety form should be sent home to be signed by parents.
- Protective equipment, including but not limited to vinyl gloves, aprons, and eye goggles, is encouraged for the activities in this book.
- When working outdoors, students should be reminded not to look directly into the Sun.

For a full list of safety tips, see page xi.

4 CHARACTERISTICS OF ROCKS

Objective

Students will explore the characteristics of different kinds of rocks.

SCILINKS
THE WORLD'S A CLICK AWAY

Topic: Identifying Rocks and Minerals
Go to: *www.scilinks.org*
Code: BOS027

Why/How to Use This Lesson

This activity goes beyond the local geology and guides students in distinguishing the three different kinds of rocks. This understanding is important to developing an accurate concept of the Earth's ever-changing surface.

Materials

samples of igneous, metamorphic, and sedimentary rocks; hand lens; student worksheet

Procedures and Tips

1. For this lesson, you will need to locate samples of the three types of rocks. Most middle schools with adequate science supplies have rock collections, as do some elementary schools. If your school does not, order from a science supply catalog or contact a local rock and mineral society or the geology department of a local college or university to request a loan or donation of rocks.
2. If the rocks are in a kit, try to take enough of them out so that students cannot see any identifying labels.
3. Give the students a set of characteristics of igneous, metamorphic, and sedimentary rocks and then ask the students to classify the rocks they have been given.
4. If your students have brought in their own rocks, ask them to classify those as well.
5. Use the sample discussion questions to generate class discussion.
6. For the last part of the student worksheet (coming up with a creative way to describe a type of rock), assign one of the three types of rocks to your students either individually or in small groups. For instance, if you have six groups of students, then two groups can be assigned igneous, two metamorphic, and two sedimentary. You may wish to write the names of the rocks on small pieces of paper and have them drawn from a bag or basket.

Grade-Level Considerations

Students in primary grades do not need to know the details of the three types of rocks, although this information is appropriate for upper elementary and middle school students. Students in middle grades can go further in depth with some research on differentiation of the formation of the types of rocks.

Assessment/Next Steps

Check the student worksheets to assess understanding. Students should be able to separate a set of rocks into the three categories based on the characteristics of each. As enrichment and extension, consider inviting a local geologist or representative of a rock and mineral society to visit the class and bring some samples of rocks.

Sample Discussion Questions

- What distinguishes each of the three types of rocks?
- How are the rocks from the collection different from (or similar to) local rocks?

CHARACTERISTICS OF ROCKS

Name: _____ Date: _____

Look at the samples of rocks your teacher has provided. Divide them into three categories, and support your choices by recording your observations regarding the appearance of the rocks. Use the chart below to organize your observations. Use the boxes under each category to write words that describe your observations of the rocks.

Category 1	Category 2	Category 3

Now make a chart of the three categories that scientists have used to classify rocks. Use a reference to find words that describe each category.

1.	2.	3.

How did your original list compare with the second list?

_____

_____

_____

_____

_____

Come up with a creative way to describe one of the three types of rocks—for example, a poem, rap, or song.

4 MAKING A ROCK COLLECTION

Objective

Students will collect and classify a variety of rocks.

SCILINKS THE WORLD'S A CLICK AWAY

Topic: Igneous Rock
Go to: *www.scilinks.org*
Code: BOS028

Why/How to Use This Lesson

If students have collected rocks during other lessons in this chapter, use those rocks as a basis for this lesson; or contact a local rock and mineral society or a geologist at a college. Students can benefit from making a rock collection in which rocks are identified by both category and specific rock type.

Materials

rocks from a local source or from a science supply company, containers such as egg cartons or small plastic toolboxes with dividers, computer access (word processing program) or markers to create labels, digital camera (optional), student worksheet

Procedures and Tips

1. Provide students with samples of the various rock types. Students may bring rocks as well, or search for rocks on the school grounds. Students may also bring in egg cartons to use for their collection containers.
2. Give students guidelines indicating the number of rocks you expect in the collection for each category (igneous, sedimentary, metamorphic) and the requirement for identifying the rock by type and specific name (e.g., obsidian, igneous; or limestone, sedimentary).
3. If students have computer access, they may use a word processing program to create labels for the containers. If not, students may use markers to create labels. Allow students to be creative in labeling and decorating containers for their rock collections.
4. Consider displaying rock collections for a parent night. If the rocks must be returned to school collections or if loaned from other sources, make a record of the student collections with a digital camera.

Grade-Level Considerations

Students in primary grades may be given categories by the teacher such as large, medium, and small. These students may also be asked to classify rocks by color or texture.

Assessment/Next Steps

Student understanding can be assessed by the accuracy with which rocks are labeled. If the rocks and containers used are not assigned as supplies to a certain grade level, you may partner with a teacher in another grade and let the students share the collection and a brief orientation to the rocks with younger students.

Sample Discussion Questions

- How should a rock collection be arranged?
- Why are rock collections helpful to scientists or students?

MAKING A ROCK COLLECTION

Name: _____ Date: _____

Make a plan for creating a rock collection. The following guidelines might be helpful. Write your plans for each of these:

Total number of rocks: _____

Number by category: Igneous _____ Metamorphic _____ Sedimentary _____

Type of container you will use: _____

Make a list of the rocks you will put in your collection. If you do not know the names of each one yet, use a descriptor such as "rough, brown" or "flat, smooth."

Igneous	Metamorphic	Sedimentary

Explain how you will further arrange your rock collection. Consider the appearance of the rocks, the possible age of the rocks, alphabetizing them by name, or any other method that you can explain. Your teacher may want to approve the order before you make a final decision, but strong, logical reasoning for your choices will support the idea you have. Think carefully and write down your thoughts.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

4 HOW HUMANS USE ROCKS

Objective

Students will research and report how humans have used rocks historically and in the present.

SCILINKS. THE WORLD'S A CLICK AWAY

Topic: Rocks and Human History
Go to: *www.scilinks.org*
Code: BOS029

Why/How to Use This Lesson

The dependence of humans on natural resources such as rocks helps students understand why it is important to take care of our planet and all that it provides. Consider using this lesson as enrichment during a unit on rocks, or as a science connection in a social studies unit on Native Americans.

Materials

hand lens; arrowheads made from rocks (originals are sometimes available for loan from universities, or reasonably priced [several for $1] replicas can be purchased from vendors); *Rocks, Fossils, and Arrowheads* (see the "Resources" section at the beginning of this chapter); student worksheet

Procedures and Tips

1. Start a class discussion about the ways that humans use rocks. (Possible answers might include in buildings, walls, or fences.) If they do not mention historical uses for hunting or weapons, then ask specifically if any student has ever heard of such a use. Show students an arrowhead.
2. If you have been able to locate replicas of arrowheads, allow students to examine them with a hand lens. (SAFETY NOTE: Some arrowheads can be sharp—check to be sure they are not too sharp for students to handle.)
3. Ask students to consider how the arrowheads were made. You may wish to give students the opportunity to research this using books or the internet. It may be helpful to read aloud to the class a few pages from *Rocks, Fossils, and Arrowheads*.
4. Ask students to sketch the arrowhead they have, and then to sketch how it might have been used historically.

Grade-Level Considerations

Rather than give each student one arrowhead to examine, it would be safer for primary grade students to just look at a sample that you keep in your hands.

Assessment/Next Steps

Check student sketches and descriptions of the use of arrowheads for reasonable responses such as hunting.

Sample Discussion Questions

- What were the first tools used by humans? How were they used?
- How have humans used rocks throughout history?
- How are rocks used by humans in the present day?

HOW HUMANS USE ROCKS

Name: _____ Date: _____

What are some ways that humans have used rocks in historical times?

_____

_____

_____

In the smaller box sketch the historical rock item (or replica) that your teacher has provided, showing details such as shape, markings, and color. Then in the larger box sketch a scene that illustrates the use of the rock item the way it would have been used in the past.

Write a description of the scene that you have created. Use at least three complete sentences.

_____

_____

_____

_____

4 CHARACTERISTICS OF SOILS

Objective

Students will compare different types of soils.

SCILINKS THE WORLD'S A CLICK AWAY

Topic: Soil Types
Go to: *www.scilinks.org*
Code: BOS030

Why/How to Use This Lesson

Even though there are great lessons within the local rocks and soils, basic differences between types of soil are important for students to recognize in the overall scheme of Earth science. Use this lesson to anchor other activities where students are looking at soils that have been found outdoors.

Materials

play sand, potting soil, claylike soil sample, plastic containers, hand lens, student worksheet

Procedures and Tips

1. Have one type of soil sample available in a plastic container, and have an extra plastic container. Pour the soil from one container to another and ask students to describe what they see.
2. Give samples of each of the three types of soil to small groups of students. Allow them to touch the samples and examine them with the hand lens.
3. Ask students to record their observations in the chart on the student worksheet.
4. Students should use a textbook, reference book, or the internet to verify the characteristics of soil that they have recorded. Students should compare the three types of soil and make any notes needed to supplement the observations they have written.

Grade-Level Considerations

Think about how to simplify the concept for younger students. It may be helpful to focus on one characteristic of soil such as color. For instance, if you have white sand, red clay, and black potting soil, it may be enough for primary grade students to differentiate the colors.

Assessment/Next Steps

Assess student understanding with the discussion questions below and for reasonable responses on the student worksheet.

Sample Discussion Questions

- Are all soils the same? Why or why not?
- Do all soils react the same way to water or wind? Explain.

CHARACTERISTICS OF SOILS

Name: _____ Date: _____

Write words or phrases in each of the spaces to describe the soils you have examined.

Sand	Potting Soil	Claylike Soil

How were the three types of soil alike?

_____

_____

_____

_____

How were they different?

_____

_____

_____

_____

How do humans use the different types of soil?

_____

_____

_____

_____

Choose one of the three types of soil and list a plant that you think would grow well in it.

_____

_____

_____

_____

4 SOILS FROM HERE AND THERE

Objective

Students will compare and contrast soils from various locations.

SCILINKS
THE WORLD'S A CLICK AWAY
Topic: Soil and Climate
Go to: *www.scilinks.org*
Code: BOS031

Why/How to Use This Lesson

Whether students have lived in one place all of their lives or have moved often, it is likely that they do not think about how soil might be different from one place to another. This lesson will require students to think about the differences in soils from various locations.

Materials

small containers, samples of various types of soil, hand lens, paper plates, student worksheet

Procedures and Tips

1. In your own travels or in those of friends and colleagues, ask for soil samples as a "souvenir" from as many places as you can get them. You might ask a pharmacy for small medicine bottles or find similar-size containers for collecting soil. Small resealable plastic bags will work too. Once you have several soil samples, arrange them in groups so that you have two or three per set that look as different as possible. Label them with letters and make a key that says where they came from (e.g., A = Miami Beach, B = Mount Saint Helens, C = Great Smoky Mountains, Tennessee). Always include a sample of local soil, too.
2. Start your lesson by asking students if soil is the same everywhere. Ask them if they have been anywhere that the soil is noticeably different from the soil around their home. If you live in a strictly urban area, it's possible that students have not seen the natural soil in the area. (Of course this is possible anywhere, depending on how much experience students have being outdoors both at home and school.)
3. Give two or three soil samples to small groups of students and ask them to fold the student worksheet and then answer the questions on the top half of the worksheet. Give them time to discuss with other group members where they think the soils originated.
4. Give students a key that tells where the soils came from. Ask students to compare the original locations of the soils (as shown on the key) with their predictions and complete the bottom half of their worksheets.

Grade-Level Considerations

For primary grades, simplify by using just two soil samples. Consider using sand and a dark soil. Primary grade students can usually identify that sand is the type of soil on a beach or in the desert.

Assessment/Next Steps

Students should be assessed based on their reasoning regarding where the soil came from, not on accuracy of a specific location where the soil originated. After this lesson, you may wish to ask students to bring back soils from places they visit, perhaps from a grandparent's home or somewhere they visit during school holidays.

Sample Discussion Questions

- Describe the appearance of the soil in the local area.
- Have you ever been anywhere that the soil looked different? Where? Why do you think some soils are different colors from others?

SOILS FROM HERE AND THERE

Name: _____ Date: _____

Fold your paper at the dotted line. Follow your teacher's instructions.
Record your observations of the soils you have.

_____

_____

_____

Make a prediction about their original location.

_____

What evidence makes you choose that location?

_____

_____

(Once all questions above are answered, your teacher will give instructions before you unfold.)

- FOLD HERE- -

Now you know the actual location where your soils came from. How do the actual locations differ from your prediction?

_____

_____

_____

_____

_____

_____

Describe the soil that is found in the place you originally predicted. Is the soil there like the sample you had in any way? Explain.

_____

_____

_____

_____

_____

_____

_____

Objective

Students will identify factors that can cause changes in the surface of the Earth.

SCILINKS THE WORLD'S A CLICK AWAY

Topic: What Is an Earthquake?
Go to: *www.scilinks.org*
Code: BOS032

Why/How to Use This Lesson

Students may have the misconception that landforms on Earth do not change—or at the very least they may think that landforms do not change often. This lesson will help identify factors that cause or contribute to changes in the Earth's surface features. If you teach a unit on storms or natural disasters, this would be a good lesson to include.

Materials

plastic containers, soil, card stock paper or thin cardboard, scissors, toy cars, toy houses and buildings, twigs, digital camera (optional), student worksheet

Procedures and Tips

1. Discuss the various ways that the Earth's surface can change and how it affects human life (earthquakes, fault lines, volcanoes, erosion).
2. Following the suggestions below, you may wish to make a model that will represent an area that will be hit by an earthquake or a moving fault line.
3. Using a plastic container (shoe box size) for each of several cooperative groups in your classroom, cut card stock or cardboard into pieces that will fit in the container. Bend them once so that they are able to fold and be held down by the soil, yet have a tab or piece that sticks up above the soil. Place them carefully and then fill the container about halfway with soil.
4. Use toy cars or buildings to make a scene of a town or neighborhood. Students can add twigs to represent trees and use other natural items found in the school yard as they see fit.
5. Once students have their models set up, they can record how it looks with a digital camera or a sketch.
6. Students can pull the tab on the "fault line" and pull it completely out of the container, which should dislodge some of the soil and move the objects that are in the scene.
7. Students should create another sketch or take an "after" photo of the scene.
8. On the worksheet, students should record what they have seen.
9. Another way to do this would be to leave out the cardboard and simply slide the container back and forth vigorously on the tabletop. You may wish to have students measure the distance they slide it each way as a means of comparison among groups. Assign each group a different length (e.g., group 1 will slide it 20 cm each way, group 2 will slide it 30 cm each way, etc.).

Grade-Level Considerations

This lesson would be better as a demonstration for primary grade students. You could have one set of materials in a center that students could later visit in small groups to repeat what you have demonstrated.

Assessment/Next Steps

Assess students on their responses on the student worksheet. You may wish to repeat the process with a larger container, giving students the opportunity to be more creative and test additional setups and hypotheses.

Sample Discussion Questions

What are some of the factors that change land? How do these changes affect what the land looks like?

EARTH'S CHANGING SURFACE

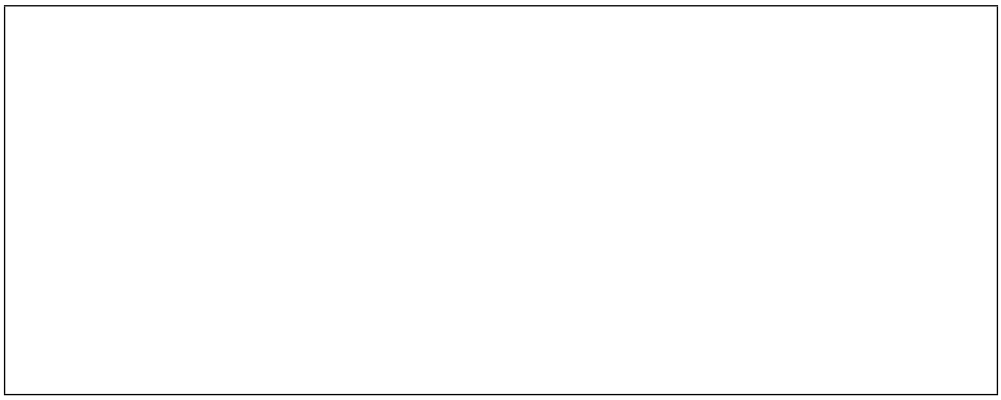
Name: _____ Date: _____

Write a description of a fault line and an earthquake.

_____

_____

Draw a sketch of your model of an area with a fault line.



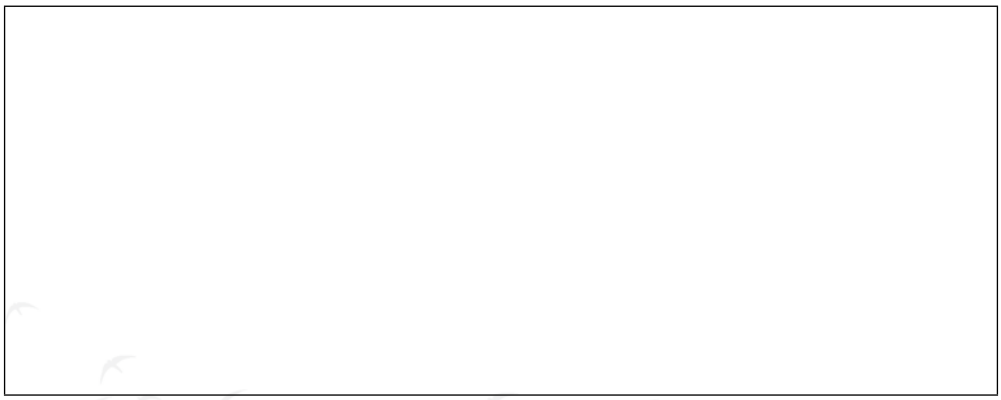
What happened to the scene when you activated the fault line?

_____

_____

_____

Draw an updated sketch that shows what happened after the fault line shift.



What changed? How is this like real life?

_____

_____

_____

_____

EROSION

Objective

Students will study soil erosion caused by water.

SCILINKS THE WORLD'S A CLICK AWAY

Topic: Soil Erosion
Go to: *www.scilinks.org*
Code: BOS033

Why/How to Use This Lesson

Erosion often changes the surface of the Earth in very visible ways. Students should be able to identify the effects of erosion as one of the many forces that affects the Earth's surface. More than likely, there is erosion somewhere in your school yard or nearby.

Materials

photographs of eroded soil, rectangular plastic containers, soil, water, cup or beaker for water, a variety of household and natural items that can be used to try to control erosion in the student demonstrations, digital camera (optional), student worksheet

Procedures and Tips

1. Show students some photographs of eroded soil. These may be from a book, the internet, or ideally from the school yard or other local area. Ask students to describe what they see.
2. Ask students to watch your demonstration carefully. Using a plastic container with a layer of about 10 cm of soil, tilt it upward at one end and pour water down the center of the soil. Ask students to describe what they see.
3. Divide students into groups of about four students each and give each group a plastic container, at least the size of a shoe box. They should fill it with about the same amount of soil as in the demonstration. All of the containers should be the same size, and the amount of soil in the container should be measured so that it is uniform. Keep one dry container of soil for a control.
4. Ask students to make a plan to slow down the erosion that they saw in your demonstration.
5. Give students a variety of materials with which they may attempt to control erosion in their containers. These may be common household items such as plastic wrap, popsicle sticks/craft sticks, toothpicks, or paper clips; natural items such as small rocks, sticks, or mulch; or any other object that you think would work.
6. After students have an opportunity to create barriers to erosion or preventive measures, each group should pour a consistent amount of water onto the soil with the container tilted up at a uniform level.
7. Pour the same amount of water in the container that only had soil and no preventive measures.
8. Ask students to compare what happened. Based on the amount of soil that stayed in place, find out which group had the most effective erosion control.

Grade-Level Considerations

For primary grades make this a whole-class project with only two containers. Allow students to help decide what to put in to prevent or reduce erosion. Students can draw a picture of what happened and write words or a sentence to describe their drawings.

Assessment/Next Steps

Assess students for reasonable responses on the worksheet. As a next step, consider going outdoors to document soil erosion in the school yard with digital cameras. Students can write about erosion in science journals, and they can compare the same spot a month later to see if it has changed.

Sample Discussion Questions

- Describe what happens to bare soil when there is a large amount of rain.
- Have you ever seen erosion? Describe what you saw.

EROSION

Name: _____ Date: _____

What happened to the soil when the water was poured?

_____

_____

Choose materials to make a barrier to erosion. What will you use? How will you make your barrier? Write your plan in at least three steps.

_____

_____

_____

_____

Make a sketch of your barrier on the left, and then pour the water. Make a sketch on the right that shows what happened after the water was poured.

Your barrier:	**Show what happened afterward:**

4 BARRIER ISLANDS

Objective

Students will model the characteristic changing shape of a barrier island and will discover the role of a barrier island in a coastal system.

Why/How to Use This Lesson

Barrier islands are an important ecological and geological part of shorelines. When there is an oil spill or hurricane, it is the barrier island that stands between danger and the mainland. Use this lesson to support standards in Earth science, and consider a further study of barrier island ecology that would address life science standards.

Materials

rectangular plastic containers; play sand; water; plastic representations of trees, buildings, fences, cars, and animals (optional); student worksheet

Procedures and Tips

1. Find an aerial photograph of a barrier island to show students; you can search for barrier island photographs at the U.S. Geological Survey website (*www.usgs.gov*). Ask students what role they think a barrier island plays in the coastal area.
2. Ask students to help you build models of barrier islands and to demonstrate its changing nature. Ask them what materials might be helpful.
3. Add sand and enough water to moisten it to a rectangular plastic container. Have students shape the sand into a model of the mainland shore and a barrier island in front of it. See the figure at the end of this lesson for a top view of the model.
4. Add enough water to model the ocean at the shoreline and to surround the barrier island model. If you are using plastic containers that are about the size of shoe boxes, it works well to have the "shore" at one of the shorter ends so that the water has plenty of length to move back and forth.
5. The plastic container should then be gently rocked back and forth toward the shore so that water moves back and forth around the barrier island. Compare this to what happens when the tides go in and out twice a day.
6. Students should be able to observe significant changes in the barrier island. They should sketch the changes they see and write about them.
7. Check for understanding with a class discussion.

Grade-Level Considerations

Make this a demonstration lesson for primary grade students rather than having them work in groups.

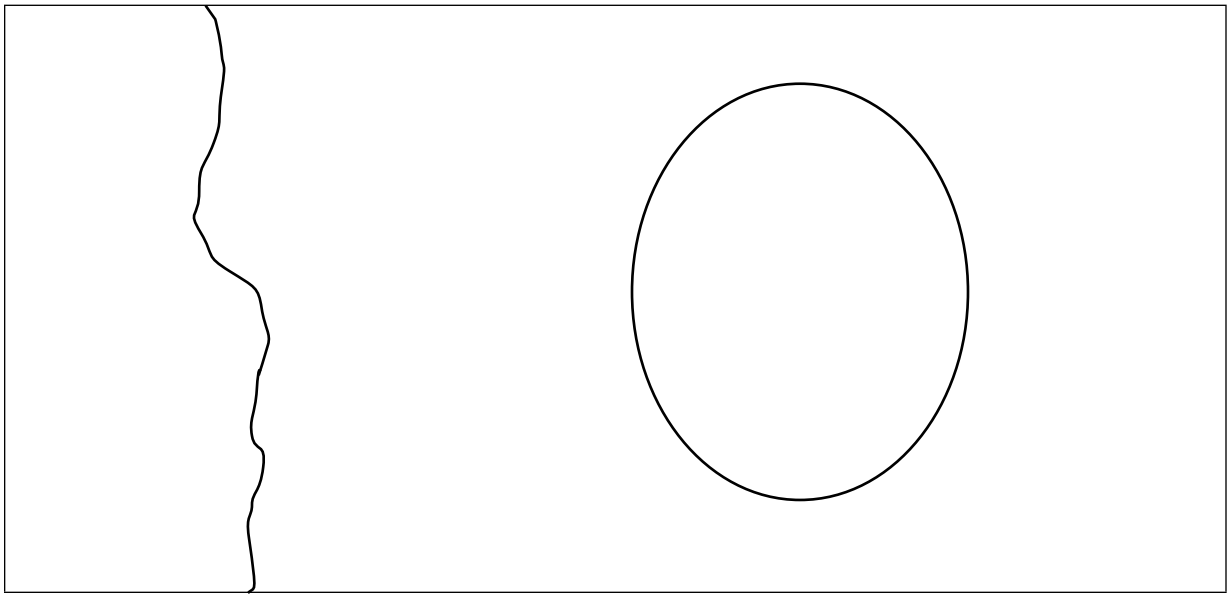
Assessment/Next Steps

Informal assessment will include teacher observations during the activity and reasonable responses on the student worksheet. If you have given students relatively small containers for group work, the next step might be using a much bigger container for a larger model. If you live in a coastal area, consider a field trip to visit barrier islands, or invite a scientist who has researched barrier islands in your area. Coastal geologists would be a good resource, as would information from organizations such as the National Oceanic and Atmospheric Administration (NOAA; *www.seagrant.noaa.gov*) and Centers for Ocean Sciences Education Excellence (COSEE; *www.cosee.net*).

Sample Discussion Questions

- What is the meaning of the word *barrier*?
- What do you think we can demonstrate with this barrier island model?
- How do barrier islands change over time?

This is a representation of what the barrier island models should look like from above:



BARRIER ISLANDS

Name: _____ Date: _____

Write a definition of a barrier island in your own words.

_____

_____

_____

Draw a sketch of your model of a barrier island.

What happened to the island when you moved the water to simulate waves?

_____

_____

After moving the water back and forth at least 10 times, draw an updated sketch.

What changed? How is this like real life?

_____

_____

_____

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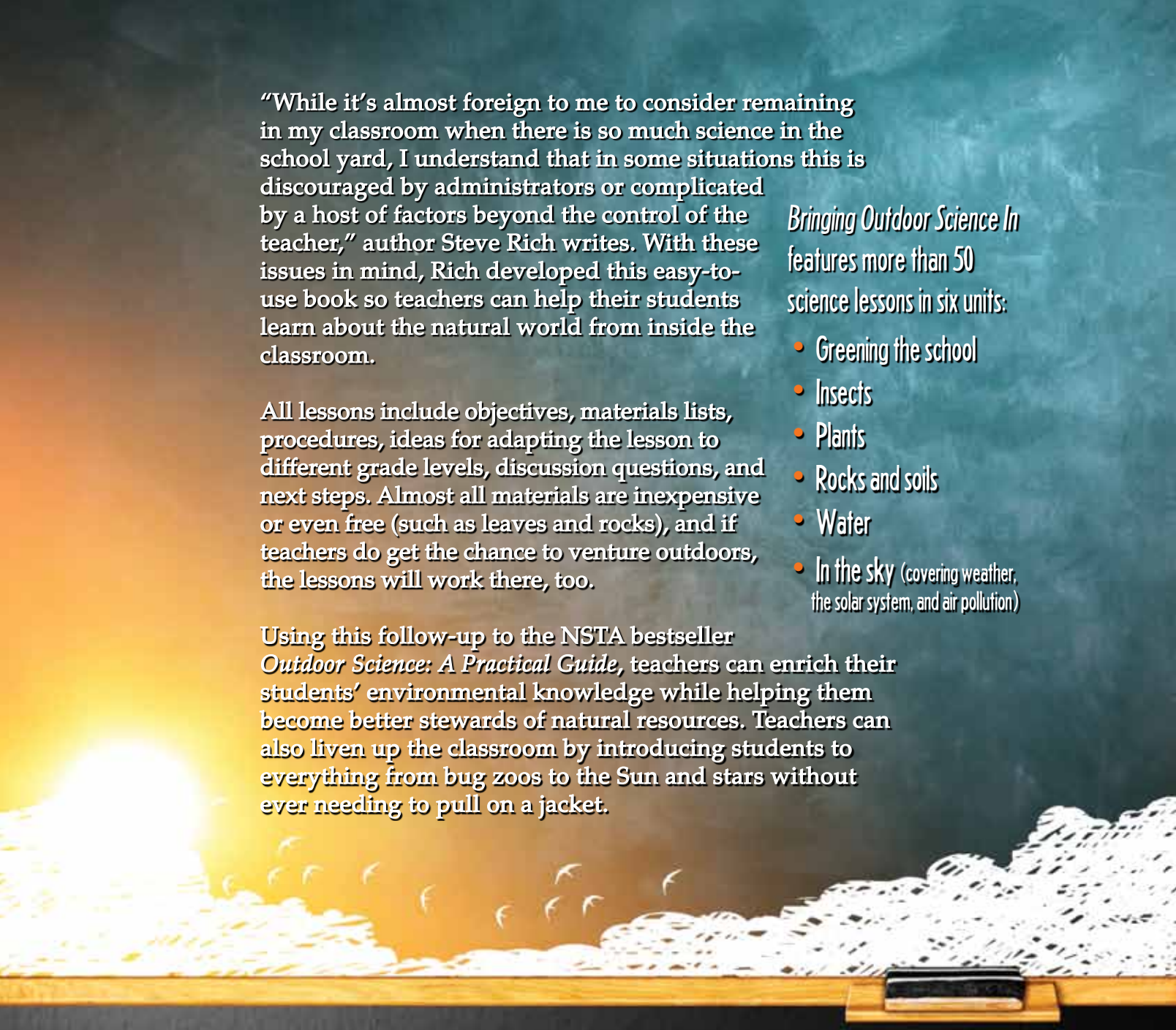
"While it's almost foreign to me to consider remaining in my classroom when there is so much science in the school yard, I understand that in some situations this is discouraged by administrators or complicated by a host of factors beyond the control of the teacher," author Steve Rich writes. With these issues in mind, Rich developed this easy-to-use book so teachers can help their students learn about the natural world from inside the classroom.

All lessons include objectives, materials lists, procedures, ideas for adapting the lesson to different grade levels, discussion questions, and next steps. Almost all materials are inexpensive or even free (such as leaves and rocks), and if teachers do get the chance to venture outdoors, the lessons will work there, too.

Bringing Outdoor Science In features more than 50 science lessons in six units:

- Greening the school
- Insects
- Plants
- Rocks and soils
- Water
- In the sky (covering weather, the solar system, and air pollution)

Using this follow-up to the NSTA bestseller *Outdoor Science: A Practical Guide*, teachers can enrich their students' environmental knowledge while helping them become better stewards of natural resources. Teachers can also liven up the classroom by introducing students to everything from bug zoos to the Sun and stars without ever needing to pull on a jacket.



BRINGING OUTDOOR SCIENCE IN

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