Litter Lessons

Environmental Lessons Correlated to the S.C. Department of Education’s Science Standards
About PalmettoPride

PalmettoPride is South Carolina’s anti-litter organization, working to create a litter-free South Carolina. PalmettoPride was created by the Legislature to fight litter and keep our state clean, green and beautiful.

Through numerous programs and events, our organization aims to educate the public on the impacts of litter to help prevent it, enforce the current litter laws, bring awareness to the issue, and encourage and empower groups to take ownership of their communities to pick up.

PalmettoPride is a non-profit, 501(c) 3 organization that is a true public/private partnership with the goal of encouraging “behavioral change” in our citizens about litter. Surveys suggest that over 80 percent of people who litter do so intentionally. Changing this intentional behavior isn’t going to happen overnight. We fight to eradicate litter and change the behavior of those that litter through four different avenues.

1. **Education** – Our education efforts have reached hundreds of thousands of South Carolina school children through our anti-litter curriculum, marionette show and various other programs and contests.

2. **Enforcement** – We work closely with law enforcement to identify and prosecute littering offenses as well as illegal dumping.

3. **Awareness** – We raise awareness of litter in South Carolina to inform citizens that reducing litter isn’t just about pickups or beautification, it’s about economic development.

4. **Pickup** – We support hundreds of local organizations and thousands of volunteers to take pride in their communities and on pickup efforts that have dramatically reduced litter.

Litter Prevention Education Programs

Education is where litter prevention begins. PalmettoPride has programs and contest available for every school in South Carolina to participate in to develop a solid litter education program.

To sign your class or school up for one of PalmettoPride’s many educational programs or contests, call (803) 758-6034.
Lesson Summary

In this lesson, students examine the different materials that could contaminate water – an issue that becomes the springboard for a discussion about how our water supply can become contaminated and why we need to dispose of waste materials properly.

Background Knowledge

(Taken in part from the SC 2014 Science Standards Support Document.)

It is essential for students to know that there are many places on Earth where water (salt or fresh) is found. Most of the water on Earth is saltwater. Water is mostly in liquid form in these features, but sometimes it can be solid (ice).

Earth’s water features include rivers, streams, lakes and ponds. Rivers are large, flowing bodies of fresh water that usually empty into a sea or ocean. Streams are small, flowing bodies of fresh water that flow into rivers. Lakes and ponds are areas where water, usually fresh water, are surrounded by land. Lakes and ponds differ in size with ponds usually being smaller than lakes.

Earth’s surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes. Changes to an environment can also be caused by human carelessness, urbanization and pollutants. Humans cut down trees to build homes and animals struggle to find trees and plants for food and shelter. There are less trees to clean the air.

Humans pollute the water with toxic chemicals and trash resulting in poor quality drinking water for humans and animals. Sometimes people may allow materials to be dumped into rivers not thinking that rivers flow into the estuaries and ocean where they are harmful to life there.

Focus Questions for Students

• What materials mix with water?
• What materials will not mix with water and will either sink or float?
• How do we know if there is something hazardous in our water?
• What kind of human impact is there on our drinking water?

Materials List

• 4 plastic cups filled with plain water and labeled “water”
• 4 plastic cups labeled “A,” “B,” “C” and “D”
• Four trays
• 4 medicine droppers
• Water, vinegar (which is used to model pesticides), alcohol (which is used to model acid rain), cooking oil (which is used to model motor oil)
• Paper towels
Engage
Show video “What is a Watershed?” at www.youtube.com/watch?v=BYwa_0w1jGY (officemmdivide).
Discuss that everyone lives in a watershed. Ask why would it be important to care for the water that eventually drains into the ocean?

Explore
Introduce the lesson by asking the students what materials mix with water. Give students the opportunity to discuss what the term “mix” means and to name things that will and will not mix with water. Lead the class in a discussion of the remaining focus questions.

Distribute copies of the “Are You a Mixer or Not?” chart (provided at the end of this lesson) to all students in the class. Explain to students that they are going to investigate materials that mix and do not mix with water by conducting an experiment.

Science & Engineering Practices
1. Ask questions and define problems.
2. Develop and use models.
3. Plan and conduct investigations.
4. Analyze and interpret data.
5. Use mathematical thinking.
6. Construct explanations and design solutions.
7. Engage in scientific argument from evidence.
8. Obtain, evaluate, and communicate information.

Content Vocabulary
- Conservation – the wise use of natural resources.
- Earth Materials – is a general term that includes minerals, rocks, soil and water.
- Environment – the surroundings or conditions in which a person, animal or plant lives.
- Human Impact – effect resulting from human activity.
- Liquid – a substance that flows freely.
- Natural Resources – materials people can take or use from Earth.
- Pollution – anything that harms the natural environment.
- Qualitative Properties – properties that are observed and can generally not be measured with a numerical result.
- Recycle – using trash to remake new goods that can be sold again.
- Reduce – cutting back on the amount of trash we make.
- Reuse – finding a new way to use trash so that we don’t have to throw it out.
- Solids – a sample of matter that retains its shape and density when not confined.
- Water Cycle – the cycle of processes by which water circulates between the earth’s oceans.
- Watershed/Drainage Basin – an area or ridge of land that separates waters flowing to different rivers, basins or seas.

This video was published on September 26, 2011. It includes an explanation of a watershed and its benefits by M&M Divide RC&D at www.mmdividercd.org.
The Experiment

Set out the four cups labeled “A,” “B,” “C,” and “D” and filled with the appropriate liquid. Do not reveal to the students the substances that are in the cups.

Begin by holding up cup of a plain water and asking the students if they would drink this water.

- “Does it look safe?”

Ask the students to imagine that the cup of water will model fresh water found a lake, stream, river or another familiar water source.

Then explain that a rainstorm has come. Ask the students if the water is still safe to drink. After a brief class discussion, add some drops of the material from Cup A to the water and ask the students to describe what they notice. For example:

- “Did the material mix with the water?”
- “What could the material be?”
- “Is there a noticeable smell?”

Students discuss whether or not they would drink the water in Cup A. They respond to the questions posed by the teacher.

Tell the students that material from Cup B represents fertilizer or pesticides that human use. Begin by asking what the importance of using fertilizer or pesticides would be. Discuss the benefits. Add the material from Cup B (vinegar) to a clean cup of water and ask students to describe what happened to the water. For example:

- “Did this material mix with the water?”
- “Is this safe to drink?”
- “Would this material harm a lake?”

Allow students to smell the contents of the cup of water. (They should notice a pungent smell, so add enough for this smell to occur.) Explain the concept that even though this substance (i.e., the vinegar) mixed with water, the water might not be safe anymore. Discuss about how this would affect the ecosystem in or around the water.

Next discuss with the class the concept of acid rain. Pollutants mix with the rain and cause this phenomenon. Then add to the water the contents from Cup C (alcohol) and ask students to observe and answer the following:

- “What happened to the water?”
- “Did this material mix with water?”
- “Do you think it is safe to drink?”

Allow the students to smell the contents of the cup of water. They may not notice the smell as strongly as they did the vinegar. Tell them that this is alcohol and ask them if they would drink the water now and if they think this material would affect a lake.

Students describe what they notice when material from Cups B and C are added to the water. They determine if the substance mixes with the water and what material it might be. Students also state whether they notice any odor.

Then add the contents from Cup D (cooking oil) to the water and ask students to describe what happened. For example:

- “Did the substance mix with the water?”
- “Is the water safe to drink?”
- “What is this material?”
After observing the results from Cup D, talk with the class about parking lots and highways that have oil on them because of cars. Use pictures of what oil looks like in garages so students can see the ugliness that it causes. Ask students to consider the following questions.

- “What happens when it rains and the residue is washed into ditches and drainage?”
- “Could this affect people by contaminating the water supply?”
- “How might this be considered litter?”

Explain that when people do not properly maintain their cars or properly dispose of their used motor oil, the resulting litter is harmful to people and to the environment. As the motor oil is added, students describe the results. Students should notice that this material does not mix with water but instead floats on top of it. Students decide if this water is safe and brainstorm what the material might be.

**Explain**

Give students the opportunity to discuss the lesson. Lead the class in completing the “Are You a Mixer or Not?” chart.

Ask the students to a model of each cup and describe what occurred during the experiment. Have students explain, discuss and write about what they have learned about how certain materials adversely affect our environment.

### Elaborate & Culminating Activity

Depending on grade level, create a poster, brochure, Google slide presentation or an illustration depicting how pollutants found in the water can affect the natural environment and design a solution that would reduce the negative human impact on the earth’s water.
### S.C. Science Standards

#### Kindergarten Standard Alignment

**Standard: K.L.2** – The student will demonstrate an understanding of organisms found in the environment and how these organisms depend on the environment to meet those needs.

**Conceptual Understanding: K.L.2A.** – The environment consists of many types of organisms including plants, animals, and fungi. Organisms depend on the land, water, and air to live and grow. Plants need water and light to make their own food. Fungi and animals cannot make their own food and get energy from other sources. Animals (including humans) use different body parts to obtain food and other resources needed to grow and survive. Organisms live in areas where their needs for air, water, nutrients, and shelter are met.

**Performance Indicator: K.L.2A.4** – Analyze and interpret data to describe how humans use their senses to learn about the world around them.

**Performance Indicator: K.L.2A.5** – Construct explanations from observations of what animals need to survive and grow (including air, water, nutrients and shelter).

**Performance Indicator: K.L.2A.6** – Obtain and communicate information about the needs of organisms to explain why they live in particular areas.

#### Grade 1 Standard Alignment

**Standard: 1.E.4** – The student will demonstrate an understanding of the properties and uses of Earth’s natural resources.

**Conceptual Understanding: 1.E.4B.** – Natural resources are things that people use that come from Earth (such as land, water, air, and trees). Natural resources can be conserved.

**Performance Indicator: 1.E.4B.1** – Obtain and communicate information to summarize how natural resources are used in different ways (such as soil and water to grow plants; rocks to make roads, walls, or buildings; or sand to make glass).

**Performance Indicator: 1.E.4B.2** – Obtain and communicate information to explain ways natural resources can be conserved (such as reducing trash through reuse, recycling, or replanting trees).

#### Grade 2 Standard Alignment

**Standard: 2.L.5** – The student will demonstrate an understanding of how the structures of animals help them survive and grow in their environments.

**Conceptual Understanding: 2.L.5B.** – Animals (including humans) require air, water, food, and shelter to survive in environments where these needs can be met. There are distinct environments in the world that support different types of animals. Environments can change slowly or quickly. Animals respond to these changes in different ways.

**Performance Indicator: 2.L.5B.2** – Develop and use models to exemplify characteristics of animals that help them survive in distinct environments (such as salt and freshwater, deserts, forests, wetlands, or polar lands).

**Performance Indicator: 2.L.5B.3** – Analyze and interpret data from observations to describe how animals respond to changes in their environment (such as changes in food availability, water, or air).

#### Grade 3 Standard Alignment

**Standard: 3.E.4** – The student will demonstrate an understanding of how the composition of Earth and the processes that shape features of Earth’s surface.

**Conceptual Understanding: 3.E.4B.** – Earth’s surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.

**Performance Indicator: 3.E.4B.3** – Obtain and communicate information to explain how natural events (such as fires, landslides, earthquakes, volcanic eruptions, or floods) and human activities (such as farming, mining, or building) impact the environment.

**Performance Indicator: 3.E.4B.4** – Define problems caused by a natural event or human activity and design devices or solutions to reduce the impact on the environment.

**Standard: 3.L.5** – The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.

**Conceptual Understanding: 3.L.5A.** – The characteristics of an environment (including physical characteristics, temperature, availability of resources, or the kinds and numbers of organisms present) influence the diversity of organisms that live there. Organisms can survive only in environments where their basic needs are met. All organisms need energy to live and grow. This energy is obtained from food. The role an organism serves in an ecosystem can be described by the way in which it gets its energy.

**Performance Indicator: 3.L.5A.1** – Analyze and interpret data about the characteristics of environments (including salt and fresh water, deserts, grasslands, forests, rain forests, and polar lands) to describe how the environment supports a variety of organisms.

**Conceptual Understanding: 3.L.5B.** – When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.

**Performance Indicator: 3.L.5B.1** – Obtain and communicate information to explain how changes in habitats (such as those that occur naturally or those caused by organisms) can be beneficial or harmful to the organisms that live there.

**Performance Indicator: 3.L.5B.2** – Develop and use models to explain how changes in a habitat cause plants and animals to respond in different ways (such as hibernating, migrating, responding to

#### Grade 5 Standard Alignment

**Standard: 5.E.3** – The student will demonstrate an understanding of how natural processes and human activities affect the features of Earth’s landforms and oceans.

**Conceptual Understanding: 5.E.3B.** – Earth’s oceans and landforms can be affected by natural processes in various ways. Humans cannot eliminate natural hazards caused by these processes but can take steps to reduce their impacts. Human activities can affect the land and oceans in positive and negative ways.

**Performance Indicator: 5.E.3B.3** – Construct scientific arguments to support claims that human activities (such as conservation efforts or pollution) affect the land and oceans of Earth.
**Are You a Mixer or Not?**

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<th>MATERIALS THAT MIX WITH WATER</th>
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One man’s trash is NOT another man’s treasure.

Lesson Summary

In this activity, students explore the concepts of recycling and reuse by investigating the forms of trash that are generated by a typical household and then considering the issue of the proper disposal of those kinds of trash items and the impacts proper and improper disposal (human Impact) has on the environment.

Background Knowledge

Note: This background is taken in part from the “2014 S.C. Science Standards Support Document.”

The objective of this indicator is to obtain and communicate information to explain the use of natural resources that come from Earth. Therefore, the primary focus of learning should be for students to communicate how natural resources can be conserved through reducing trash or replanting trees. This could include, but is not limited to understanding how to conserve natural resources, generate and answer questions related to conservation using above methods (or others), develop models to support hypotheses, explanations, claims or designs. For example, students could communicate observations and explanations of conservation in a science journal. Students should have a firm understanding of what the terms “natural resources” and “conservation” mean. Students should be able to sort and classify objects as trash and recyclables (e.g., plastic, paper, glass). It is also important to know that replanting trees after they have been cut down is important in soil restoration and preservation. Replanting trees is also important to replenish a natural resource.

Focus Questions for Students

- What is trash?
- Where does trash go?
- What can we do with materials instead of throwing them in the trash pile?
- How much trash does your family produce in one day?
- Who is responsible for disposing of the trash at your house?
- How can you determine if an item of trash can be recycled or reused?
- How can I stop trash from ending up in landfills?
- What are the most effective ways to handle the various types of waste that we generate?
- Why is it important to think about myself as part of a living system that includes nature and people?

How much garbage do you and your family make each day?
Engage

Introduce the lesson by discussing the concepts of recycling and reuse and explaining the recycling standards currently in place in your city and county.

Lead the class in a discussion of the focus questions. Help the class to see the relevance of this lesson by relating it to their everyday circumstances.

Read the story “Turning Trash to Treasure” by Ada Pearson. You also can sign up for a free trial to SCRIBD and watch it read aloud online at www.scribd.com/book/260839484/Turning-Trash-to-Treasure.

Science & Engineering Practices

1. Ask questions and define problems.
2. Develop and use models.
3. Plan and conduct investigations.
4. Analyze and interpret data.
5. Use mathematical thinking.
6. Construct explanations and design solutions.
7. Engage in scientific argument from evidence.
8. Obtain, evaluate and communicate information.

Materials List

- Examples of Images or cleaned items of trash found in a family home
- Three sorting bags or small boxes labeled “Recyclable,” “Reusable” and “Throw Away - Landfill”
- Information on local recycling standards (For a list of county recycling programs, visit www.scdhec.gov/recycleheresc.)
- Paper, pens and markers or computers with graphics software for making a brochure
- The children’s book “Turning Trash To Treasure” by Ada Pearson
- Pictures of landfills for resources (Visit the websites below.)
  - www.zerowasteamerica.org/BasicsOfLandfills.htm
  - www.zerowasteamerica.org/landfills.htm
  - www.zerowasteamerica.org/Pictures.htm

Content Vocabulary

- Conservation – the wise use of natural resources.
- Natural Resources – the materials that people can take or use from Earth.
- Recycle – using trash to remake new goods that can be sold again.
- Reduce – cutting back on the amount of trash we make.
- Reuse – finding a new way to use trash so that we don’t have to throw it out.
- Upcycle – reuse (discarded objects or material) in such a way as to create a product of a higher quality or value than the original.
Explore

After reading the story, ask these guiding questions.

• “What did Maria put in the bag when she cleaned up her room?”
• “Why does she think those things are trash?”
• “What do we throw in the trash?”
• “What’s a landfill?”
• “How does Maria feel when she sees the pictures of the landfills?”
• “Why do you think Maria’s mom asked her to take things out of her room before bringing more things into her room?”
• “What would her room look like if she brought more things in faster than she took them out?”

Show the picture of Maria’s room with arrows flowing in and out.

• “How does Maria think about trash at the beginning of the story?”
• “How does Maria think about trash at the end of the story?”
• “What has Maria learned?”
• “What could we upcycle?”

Explain

1. Have empty and clean props or images ready like water bottles, coffee cans, juice boxes, toilet paper or paper towel rolls, snack food bags (e.g., potato chip bags), sandwich bags, bottle caps, corks, old sneakers, milk containers and egg cartons.

2. Use these images or props to engage students in a discussion on what they would do with that piece of trash? Would they recycle, reuse or throw it away (landfill)?

3. Have students put item in the sorting bag labeled either “Recycle,” “Reuse” or “Throw Away - Landfill.” Have students explain their reasoning for choosing where the item should go. If students choose to reuse, discuss options for reusing that item. Continue until all items or images have been sorted. Lead the discussion to how human impact affects the environment through recycling and reusing efforts.

4. Discuss human and environmental impacts of increasing the size of landfills and the issues that surround the landfill area. Use the Landfill resources to show students what the landfill is. Discuss “Where Does the Trash Go” information on the following page with students.

Elaborate

Distribute copies of the “Household Trash Survey” form (provided) and explain how students are to complete it.

Students record data on the “Household Trash Survey” form about the types of trash they have observed at home. Students will bring the survey to class the next day. To expedite the lesson, teachers can send the survey home the day before and elaborate on the survey during the lesson.

In upper grades, to integrate a math activity, the class could create a bar or line graph to show the types of trash found on the survey. In fifth grade, students could find the average number of recycled, reusable and throw away items found in the class. This information could then be communicated in graph form.

Evaluate & Culminating Assessment

Grades K-1

Have student create a “Trash to Treasure” upcycle art project. Students can pick an item that they could turn into a “treasure.” Depending on time and resources, students could draw the upcycled item and write a description of how the new item could be used or students could actually create the upcycle creation from recycled materials.

Grades 3 & 5

Have students write a short paper on recycling and reusing from their point of view. They also can produce pamphlets informing families about how to dispose of trash effectively and efficiently. Have students give the pamphlets to their parents and their neighbors.
Where does trash go?

An average family of four throws away about 120 pounds of garbage each week. In many neighborhoods, every household has a “hurbie curbie” container or bags where trash is held for collection by garbage trucks that come by on a regular basis.

Garbage is picked up by large garbage trucks.

In some areas, recycled items are picked up by recycling trucks.

In other areas, families are responsible for taking their trash to drop-off locations.

Recyclables are taken to recycling centers.

In some areas, garbage trucks pick up waste and take it to a transfer station where garbage is compacted to make it smaller. It is then loaded onto trucks and taken to a landfill.

At a landfill, garbage is placed in special lined areas that prevent it from polluting the surrounding land and water. Each day’s garbage is buried and covered with an additional layer of soil.
<table>
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<tr>
<th>SPECIFIC TYPE OF TRASH</th>
<th>This item can be <strong>RECYCLED</strong>. (If yes, put a check in the box.)</th>
<th>This item can be <strong>REUSED</strong>. (If yes, put a check in the box.)</th>
<th>This item is <strong>NOT REUSABLE</strong> and <strong>NOT RECYCLABLE</strong>. (If yes, put a check in the box.)</th>
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## Kindergarten Standard Alignment

**Standard: K.P.4** – The student will demonstrate an understanding of the observable properties of matter.

**Conceptual Understanding: K.P.4A** – Objects can be described and classified by their observable properties, by their uses and by whether they occur naturally or are manufactured (human-made). Different properties of objects are suited for different purposes.

**Performance Indicator: K.P.4A.1** – Analyze and interpret data to compare the qualitative properties of objects (such as size, shape, color, texture, weight, flexibility, attraction to magnets, or ability to sink or float) and classify objects based on similar properties.

**Performance Indicator: K.P.4A.2** – Develop and use models to describe and compare the properties of different materials (including wood, plastic, metal, cloth, and paper) and classify materials by their observable properties, by their uses, and by whether they are natural or human-made.

**Performance Indicator: K.P.4A.3** – Conduct structured investigations to answer questions about which materials have the properties that are best suited to solve a problem or need.

## Grade 1 Standard Alignment

**Standard: 1.E.4** – The student will demonstrate an understanding of the properties and uses of Earth’s natural resources.

**Conceptual Understanding: 1.E.4B** – Natural resources are things that people use that come from Earth (such as land, water, air, and trees). Natural resources can be conserved.

**Performance Indicator: 1.E.4B.2** – Obtain and communicate information to explain ways natural resources can be conserved (such as reducing trash through reuse, recycling, or replanting trees).

## Grade 3 Standard Alignment

**Standard: 3.E.4** – The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth’s surface.

**Conceptual Understanding: 3.E.4B** – Earth’s surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.

**Performance Indicator: 3.E.4B.4** – Define problems caused by a natural event or human activity and design devices or solutions to reduce the impact on the environment.

## Grade 5 Standard Alignment

**Standard 5.E.3** – The student will demonstrate an understanding of how natural processes and human activities affect the features of Earth’s landforms and oceans.

**Conceptual Understanding: 5.E.3B** – Earth’s oceans and landforms can be affected by natural processes in various ways. Humans cannot eliminate natural hazards caused by these processes but can take steps to reduce their impacts. Human activities can affect the land and oceans in positive and negative ways.

**Performance Indicator: 5.E.3B.3** – Construct scientific arguments to support claims that human activities (such as conservation efforts or pollution) affect the land and oceans of Earth.
Who dirtied the water?

Lesson Summary

This interactive lab combined with storytelling introduces students to the effects of litter and pollution on the freshwater ecosystem. Each student is allowed hands-on involvement in a demonstration of how land development can lead to the destruction of a natural habitat.

Background Knowledge

It is essential for students to know that there are many places on Earth where water (salt or fresh) is found. Most of the water on Earth is saltwater. Water is mostly in liquid form in these features, but sometimes it can be solid (ice). Earth’s water features include rivers, streams, lakes and ponds. Rivers are large, flowing bodies of fresh water that usually empty into a sea or ocean. Streams are small, flowing bodies of fresh water that flow into rivers. Lakes and ponds are areas where water, usually fresh water, are surrounded by land. Lakes and ponds differ in size with ponds usually being smaller than lakes.

Earth’s surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes. Organisms survive best in certain environments in which the appropriate amounts of physical factors (light, temperature, water, soil and space for shelter and reproduction) are present.

Each environment has a unique combination of these factors that allows certain organisms to survive there. Ponds are usually shallower than lakes and the temperature of the water usually stays the same from top to bottom. Plants and algae usually grow along the edges where the water is shallow. Examples of animals that live in freshwater include fish, amphibians, ducks, turtles or beavers.

Focus Questions for Students

• What sources of litter pollution can enter a contained freshwater ecosystem?
• What effect does human development have on this ecosystem?
• What methods of litter reduction can prevent these pollution problems and maintain the health of the ecosystem?

Science & Engineering Practices

1. Ask questions and define problems.
2. Develop and use models.
3. Plan and conduct investigations.
4. Analyze and interpret data.
5. Use mathematical thinking.
6. Construct explanations and design solutions.
7. Engage in scientific argument from evidence.
8. Obtain, evaluate and communicate information.
Habitats change due to natural causes or actions of organisms (humans). These changes may be helpful or harmful to the organisms that live there. All organisms change the environment in helpful or harmful ways. Changes to an environment can also be caused by human carelessness, urbanization, pollutants or the introduction of nonnative species. Humans cut down trees to build homes and animals struggle to find trees and plants for food and shelter; there are less trees to clean the air. Humans pollute the water with toxic chemicals and trash with the result being drinking water for humans and animals is poor quality; plants and animals that live in the water are harmed.

Due to lack of resources, animals migrate to new areas and there is more competition for space and food which can affect the ecosystem. Both plants and animals may be unable to respond to changes in their habitat and may individually die or become extinct. Extinction is the death of an entire group of organisms. Extinction occurs if over many generations, animals or plants cannot adapt to changes in the environment.

Human activities can also harm the land causing resources to be polluted or destroyed. Sometimes people may allow materials to be dumped into rivers not thinking that rivers flow into the estuaries and ocean where they are harmful to life there. Careless dumping of trash on land or in oceans pollutes those areas. Careless human activities in agriculture, industry, construction or mining can cause pollution on the land, in the water and in the air.

**Materials List**

- Introduction to the story – “Today I will be telling you a story about a beautiful pond, which we will use this bowl to represent and how it changed when the first human discovered it.”

- Story’s beginning – “Once upon a time, deep out in an unexplored area of (your county), South Carolina, there was a beautiful pond (or lake). The water was crystal clear, and an abundance of fish and other wildlife lived in and around this pond (or lake). In the background was a beautiful river and the woodlands were as they had been for centuries. The overall picture was like something that you would see on a postcard. About 10 years ago, a lost hiker discovered this wonderful place. He told himself that if he ever made it back to civilization, he would sell his house and bring his family of four to build a house on the edge of the pond (or lake). Just a month later, the man did sell his house and he came back to purchase a section of the land along the edge of the pond. The Division of Forestry allowed him to have a narrow road cut through the once-untouched forest. He also was given permission from the appropriate authorities to construct his house and have a septic system and drainage field put in.”

- 1 large glass bowl

- 11 small canisters filled with the following substances: 1) leaves and twigs; 2) sand and gravel; 3) water dyed blue; 4) soapy water; 5) crumbled crackers; 6) sugar and salt solution; 7) plastic and paper litter; 8) vegetable oil; 9) goldfish crackers; 10) peanut butter and coffee grounds; and 11) vegetable oil with dark food coloring
**Engage**
Read the beginning of the story to the class. Lead a discussion on creating this picture of what this ecosystem looked like as an uninhabited ecosystem. Discuss how the ecosystem interacts.

**Explore**
Discuss the Focus Questions for students. Have each small group elaborate on each question and how they would answer the question prior to culminating activity.

**Explain**
Read the story beginning (above) and then ask the students the following questions.
- “If you were the family moving into this forest to live near the pond (or lake), would you fish and swim in the pond (or lake)?”
- “Would you canoe in the pond (or lake)?”
- “What are some other activities you might enjoy doing there?”

Ask what organisms would they expect to find in the ecosystem? Allow students to brainstorm in partners or small groups. For fifth grade, students could discuss abiotic and biotic features and discuss how the organisms in the ecosystem interact. Students will continue to listen to story and answer the questions asked by the teacher.

**Elaborate**
Continue with the story.

“As crews began to cut their way through the forest, branches, twigs, and leaves from nearby trees were left littered along the pathway. Soon, a large amount of plant material fell into the lake from this litter.”

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**Content Vocabulary**

- **Conservation** – the wise use of natural resources.
- **Drainfield** – are underground wastewater disposal facilities use to remove contaminants and impurities from a septic tank.
- **Ecosystem** – a biological community of interacting organisms and their physical environment.
- **Extinction** – is the death of an entire group of organisms.
- **Littering** – make (a place) untidy with rubbish or a large number of objects left lying about.
- **Natural Process** – (plural natural processes) a process existing in or produced by nature (rather than by the intent of human beings). For example, volcanic activity and tidal activities.
- **Natural Resources** – the materials that people can take or use from the Earth.
- **Physical Factors** – factors that affect the survival of an organism, such as light, temperature, water, soil, space for shelter and reproduction.
- **Pollution** – anything that harms the natural environment.
- **Recycle** – using trash to remake new goods that can be sold again.
- **Reduce** – cutting back on the amount of trash we make.
- **Reuse** – finding a new way to use trash so that we don’t have to throw it out.
Ask this question.

- “How would this action affect plants and animals in the lake?”

Have students predict the outcome. Then have the student with Canister No. 1 (leaves and twigs) empty its contents into the “pond” (i.e., the bowl). Then ask the class these questions.

- “Would you fish and swim in the pond now? Would you still canoe in the pond?”
- “How has the lake ecosystem changed?”

Students respond to the questions asked by the teacher. Students record observations in science notebook. Continue with the story.

“The first thing that was constructed was a narrow dirt and gravel road. The crew left the dirt and gravel piled along the roadside and made no attempt to put things as they had been. As a result, dirt and gravel littered the roadway. During the first big rainstorm after the road had been built, a large quantity of this dirt and gravel washed into the pond.”

Have the student with Canister No. 2 (sand and gravel) empty its contents into the “pond.” Then ask the class these questions.

- “Would you fish and swim in the pond? Would you canoe in the pond now?”
- “How has the lake ecosystem changed?”

Students respond to the questions asked by the teacher. Students record observations in science notebook. Continue with the story.

“Just six months after the family had been living in their new home, the son turned sixteen and bought his first car. He wanted to keep it looking nice and washed the car once a week. He was not very responsible in cleaning up and he left the soap bottle out. As a result, the soap bottle rolled close to the pond and some of the soap found its way into the pond.”

Have the student with Canister No. 3 (water dyed blue) empty its contents into the “pond.” Then ask the class these questions

- “How many of you would fish and swim in the pond now? Would you canoe in the pond now?”
- “How would this event affect the ecosystem?”

Students respond to the questions asked by teacher. Students record observations in science notebook. Continue with the story.

“The daughter really enjoyed watching the waterfowl that populated the pond. Every morning, she would go down to the edge of the pond and toss in some old bread or crackers to the ducks. Some of this food was not eaten and the resulting litter settled to the bottom of the pond.”

Have the student with Canister No. 4 (soapy water) empty its contents into the “pond.” Then ask the class these questions.

- “Does anybody still want to fish and swim in the pond? Would you still canoe in the pond?”
- “How would this event affect the ecosystem?”

Students respond to the questions asked by teacher. Students record observations in science notebook. Continue with the story.

“The family settled into their newly constructed home, the mother and father began a garden and lawn. In order to get the garden and lawn growing, the family began a regular fertilizing schedule. Some of the fertilizer made its way into the pond.”

Have the student with Canister No. 5 (crumbled crackers) empty its contents into the “pond.” Then ask the class the following questions.
“Would you fish and swim in the pond now? Would you canoe in the pond now?”

“How would this event affect the ecosystem?”

Students respond to the questions asked by teacher. Students record observations in science notebook. Continue with the story.

“The family decided to put a pool in their backyard. There weren’t very careful about disposing of the containers of the chemicals they used in the pool. As a result, some of the chemicals leaked and found their way into the pond.”

Have the student with Canister No. 6 (sugar and salt solution) empty its contents into the “pond.” Then ask the class these questions.

• “Would this stop anyone from swimming in the pond? From fishing or canoeing in the pond?”

• “How would this event affect the ecosystem?”

Students respond to the questions asked by teacher. Students record observations in science notebook. Continue with the story.

“After about a year, the family had some neighbors build a house next door. These neighbors were not careful about keeping the pond clean. They left trash lying around in their yard and some of this trash blew or washed into the lake.”

Have the student with Canister No. 7 (plastic and paper litter) empty its contents into the “pond.” Then ask the class these questions.

• “Would this stop anyone from swimming in the pond? From fishing or canoeing in the pond?”

• “How would this event affect the ecosystem?”

Students respond to the questions asked by teacher. Students record observations in science notebook. Continue with the story.

“These neighbors also brought with them an old motorboat. Every time they drove the boat around the pond a little bit of oil would leak into the lake.”

Have the student with Canister No. 8 (vegetable oil) empty its contents into the “pond.” Then ask the class these questions.

• “Would you still fish and swim in the pond? Would you still canoe in the pond?”

• “How would this event affect the ecosystem?”

Students respond to the questions asked by teacher. Students record observations in science notebook. Continue with the story.

“Another year passed, and a third family built a house on the other side of the pond. They were an older couple who loved growing roses. The biggest problem with the roses is they are often infested with insects. In order to keep the roses looking their best, the couple sprayed them once a week with pesticides. Some of this chemical spray drifted over the pond and got into the water. These chemicals were very dangerous to the fish and caused them to die.”

Have the student with Canister No. 9 (goldfish crackers) empty its contents into the “pond.” Then ask the class these questions.

• “Would you still fish and swim in the pond? Would anyone canoe in the pond?”

• “How would this event affect the ecosystem?”

Students respond to the questions asked by teacher. Students record observations in science notebook. Continue with the story.

“Within a year, the same couple had a problem with their septic system. The drainage field had the tendency to overflow and sewage began to leak and litter the pond.”
Have the student with Canister No. 10 (peanut butter and coffee grounds) empty its contents into the “pond.” Then ask the class these questions.

- “Would you still fish and swim in the pond? Would you still canoe in the pond?”
- “How would this event affect the ecosystem?”

Students respond to the questions asked by teacher. Students record observations in science notebook. Continue with the story.

“Seven years passed and many other families developed land around the once untouched pond. On the eighth year, a toy company cut down a big section of the surrounding forest and built a large factory. As it produced thousands of toys to be shipped to stores all around the world, some toxic by-products were not recycled properly and the containers found their way into the pond.”

Have the student with Canister No. 11 (vegetable oil with dark food coloring) empty its contents into the “pond.” Then ask the class these questions.

- “Would you still fish and swim in the pond? Would you think about canoeing in the pond?”
- “How would this event affect the ecosystem?”

Students respond to the questions asked by teacher. Students record observations in science notebook.

**Evaluate: Culminating Activity**

Students (or student partners) recreate the effects of pollution on a freshwater ecosystem with a model drawn in their notebook. Students will choose an event from the story and design a solution to reduce the negative human impact had on the freshwater ecosystem. Students can create a visual way to share their solution.

**Differentiation of Instruction**

Students with special needs can benefit from hearing students go through the story and explain the effects of pollution on freshwater ecosystems. These students can then partner with other students to talk about the effects of pollution and to have input on the drawings and the summary paragraphs. Advanced students can construct a model of a pond depicting the effects of pollution.
Service-Learning Connection Preparation

The teacher can arrange for students to participate in Beach Sweep/River Sweep. Beach Sweep/River Sweep is South Carolina’s largest cleanup of aquatic litter and debris.

By participating in this cleanup effort, students can see firsthand the hazards of aquatic debris and the effects it has on beaches and waterways as well as the threat it poses to wildlife.

For specific information on Beach Sweep/River Sweep, you may contact PalmettoPride at info@palmettopride.org.

Plan your event for a Saturday so that parents can transport students and participate in the project as well. Students should prepare informational posters promoting the event and asking parents to provide trash bags and gloves. Challenge families to provide a picnic lunch with no throwaway items!

1. **Service** – Students and parents participate in the planned Beach Sweep/River Sweep cleanup.

2. **Reflection** – Students discuss with their parents what their cleanup work has accomplished.

3. **Celebration** – After the discussion, the students have a picnic with their families. They give special attention to leaving the area clean after the picnic.
## Grade 1 Standard Alignment

**Standard: 1.E.4** – The student will demonstrate an understanding of the properties and uses of Earth’s natural resources.

**Conceptual Understanding: 1.E.4B** – Natural resources are things that people use that come from Earth (such as land, water, air, and trees). Natural resources can be conserved.

**Performance Indicator: 1.E.4B.1** – Obtain and communicate information to summarize how natural resources are used in different ways (such as soil and water to grow plants; rocks to make roads, walls, or buildings; or sand to make glass).

**Performance Indicator: 1.E.4B.2** – Obtain and communicate information to explain ways natural resources can be conserved (such as reducing trash through reuse, recycling or replanting trees).

## Grade 3 Standard Alignment (continued)

**Conceptual Understanding: 3.L.5A.** – The characteristics of an environment (including physical characteristics, temperature, availability of resources, or the kinds and numbers of organisms present) influence the diversity of organisms that live there. Organisms can survive only in environments where their basic needs are met. All organisms need energy to live and grow. This energy is obtained from food. The role an organism serves in an ecosystem can be described by the way in which it gets its energy.

**Performance Indicator: 3.L.5A.1** – Analyze and interpret data about the characteristics of environments (including salt and fresh water, deserts, grasslands, forests, rain forests, and polar lands) to describe how the environment supports a variety of organisms.

## Grade 3 Standard Alignment

**Standard: 3.L.5** – The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.

**Conceptual Understanding: 3.L.5B** – When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.

**Performance Indicator: 3.L.5B.1** – Obtain and communicate information to explain how changes in habitats (such as those that occur naturally or those caused by organisms) can be beneficial or harmful to the organisms that live there.

**Performance Indicator: 3.L.5B.2** – Develop and use models to explain how changes in a habitat cause plants and animals to respond in different ways (such as hibernating, migrating, responding to light, death, or extinction).

## Grade 5 Standard Alignment

**Standard 5.E.3** – The student will demonstrate an understanding of how natural processes and human activities affect the features of Earth’s landforms and oceans.

**Conceptual Understanding: 5.E.3B** – Earth’s oceans and landforms can be affected by natural processes in various ways. Humans cannot eliminate natural hazards caused by these processes but can take steps to reduce their impacts. Human activities can affect the land and oceans in positive and negative ways.

**Performance Indicator: 5.E.3B.3** – Construct scientific arguments to support claims that human activities (such as conservation efforts or pollution) affect the land and oceans of Earth.
Classifying Litter:
Be a part of the solution, not the pollution.

This lesson was adapted in part from Longwood University’s “How can we Help Protect our Water Resources” lesson. For more information, please visit www.longwood.edu/cleanva/images/Sec3.classifydebrislesson.pdf.

Lesson Summary

In this lesson, students will discuss the harmful effects of aquatic debris. Students will sort household garbage or trash into different categories to understand some different types of aquatic debris, and they will also discuss different sources of aquatic debris.

Lastly, the students will discuss some solutions to the problem of aquatic debris, and they will make a display presentation to publicize harmful effects of aquatic debris, different kinds of trash, and possible solutions.

Focus Questions for Students

• How can we classify different kinds of debris found in water?
• What are the different ways that debris can find its way into the water?
• Predict the effects on animals of different kinds of aquatic debris (litter) in water.
• What are the hazardous effects of debris on the water and wildlife?
• Describe possible solutions to reduce harmful debris from entering the water.

Background Knowledge

What different kinds of litter can be found in local water and how can it cause harm to people and animals? This lesson is designed to increase students’ awareness of different kinds of debris in water environments.

Many times, we think first of debris on our beaches and in our oceans. However, debris is also found in other aquatic environments, such as streams, rivers, ponds and lakes. Litter on beaches and in waterways is more than an ugly eyesore. Now we realize that debris has serious detrimental effects.

Litter can hurt humans and animals, and can harm or destroy aquatic habitats.

Materials List

Gather a large garbage bag of assorted items representing a typical household’s trash (e.g., soda can, plastic bottle, plastic grocery bags, bottle caps) provided and cleaned by the teacher.

SAFETY & REGULATIONS: All trash objects should be cleaned and checked by the teacher before being handled by students. Avoid any sharp objects or materials containing harmful chemicals.
Animals and humans can be harmed, aquatic habitats can be destroyed or damaged, littered beaches may need to be closed due to health concerns and it can be very costly to carry out cleanups or repair damage caused by debris. Impact on animals is the first harmful effect of aquatic debris that most people think of. Fish, birds, mammals and sea turtles can either ingest aquatic debris or become entangled. When animals ingest debris, they have a false sense of being full and they can then die of starvation. Birds, fish, turtles and other animals that become entangled in fishing line, six-pack rings or other packaging become restricted in their movement. Entanglement makes it harder for the animal to eat and breathe an often leads to death.

Plastic trash is a danger to animals. Plastics have many desirable qualities and so are widely used, but plastics also take hundreds of years to break down. Plastic materials can also look very like some animal foods and so are often mistakenly ingested by animals. Other harmful effects of aquatic debris include risks to human health and safety, for example from pieces of glass or metal, or such things as discarded needles and syringes. Boaters can be endangered by entanglement of boat propellers.

Aquatic habitat is diminished or destroyed when debris covers submerged aquatic vegetation or smothers bottom dwelling species. Chemicals from debris can have detrimental effects on water quality. There are also economic impacts from aquatic debris. It is very costly to carry out cleanups of trash and debris, and there are other indirect consequences such as lost tourist income to littered parks and beaches.

**Science & Engineering Practices**
1. Ask questions and define problems.
2. Develop and use models.
3. Plan and conduct investigations.
4. Analyze and interpret data.
5. Use mathematical thinking.
6. Construct explanations and design solutions.
7. Engage in scientific argument from evidence.
8. Obtain, evaluate and communicate information.

**Content Vocabulary**
- **Aquatic Debris** – litter found in the water (all sources – rivers, streams, lakes, ponds and ocean).
- **Littering** – make (a place) untidy with trash or many objects left lying about.
- **Pollution** – anything that harms the natural environment.
- **Recycle** – using trash to remake new goods that can be sold again.
- **Reduce** – cutting back on the amount of trash we make.
- **Reuse** – finding a new way to use trash so that we don’t have to throw it out.
**Engage**

Begin the lesson by talking with children about how different kinds of trash can enter the water (stream, rivers, lakes and oceans). Discuss how this type of litter can affect the animals living in that habitat. Emphasize to the students that trash or garbage refers to waste being generated and when it is improperly disposed it then becomes debris or litter.


**Explain**

Ask children to work in groups to predict some effects that debris might have on different animals. After the groups have shared their predictions, describe to the children some specific examples of hazardous effects of debris on wildlife.

Debris in water can have harmful effects on wildlife, but the debris can also have other harmful consequences. Ask the students what other harmful effects they can think of, and then discuss some examples with them. Other harmful effects include hazards for humans as well as animals, impacts on aquatic habitats, and economic impacts from costly cleanups and lost tourist revenues.

As harmful effects of debris are discussed, organize these on the board in different categories. Have students summarize the different harmful effects of aquatic debris in their science journals.

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**Plastic bags are a big problem.**

Of all trash, plastic trash has the greatest potential to harm the environment, wildlife and humans. It can be found floating at the surface, suspended in the water column, or on the bottom of almost all water bodies. It is transported by rivers to the ocean, where it moves with the currents, and is often eaten by birds and fish, concentrating toxic chemicals in their tissues, and filling their stomachs, causing them to starve.

*SOURCE: U.S. EPA*
Elaborate

Discuss with students about different kinds of trash and how trash might be produced at home.

- Ask the children what different kinds of trash their families produce.
- Ask the students how the trash that their family produces might find its way into a stream, lake or other water body.
- Ask the students if they have recently visited a river, a lake or the ocean, and what trash they have seen near the water.

Make sure students recognize that any trash that is improperly disposed is considered debris (litter) and can potentially enter a waterway and have negative impacts there.

Provide the class with a collection of trash (that has been collected previously and cleaned for use in the classroom). For safety reasons, the teacher should provide this trash. Students should not bring trash from home. This allows the teacher to be sure that students will not come into contact with any harmful objects. The trash should also be washed clean before bringing into the classroom. A large plastic garbage bag can be filled with cleaned trash in advance, and then the bag can be emptied out in the classroom, either on the floor or on a large table.

Have the students work in small groups to observe, describe, and then eventually classify the trash. First, allow each group to collect different pieces of trash for the group to study more closely. Let the groups talk about their collection of trash and the characteristics of each piece. After each group has had time for a discussion, direct each individual student to choose a favorite piece of trash.

The students should then make a drawing of their object and also write a sentence describing the object in words. When the students have finished doing this, gather the groups together and show the whole group drawings and descriptions made by some of the students. For the classifying activity, begin by having each of the small groups work together to sort their own collection of trash objects into separate families. The students should sort their collection of objects into several smaller families of objects.

Students could classify the objects of trash in a number of different ways. The most obvious way to classify trash and aquatic debris is by its appearance. For example, different objects are made of different materials, such as plastic, metal, glass, cloth or paper. Objects can also be classified according to their source or what they were used for. Examples of different activities producing trash include fast food consumption, smoking, fishing, other sports and games, advertising with balloons and illegal dumping. Objects could also be classified as biodegradable or non-degradable, recyclable or non-recyclable, or by the type of impact they can have on the environment. Some objects, including fishing line, are dangerous to wildlife because animals can become entangled.

Make sure to walk from group to group as the students do this and ask each group what it is that the objects grouped together share in common with each other. When
each group has sorted their objects, ask each small group to explain for the class how the sorting was carried out. Discuss with the class different ways that groups have decided to classify the trash and tell students about some of the other possible ways that they may not have considered.

The last thing for students to do, having learned about the harmful effects of aquatic debris, classified different types of trash and discussed different ways that trash gets into the water, is to generate some possible solutions to the aquatic debris problem. Ask students to think about the reasons that people litter, and then suggest solutions that will change this behavior.

Evaluate

• **Pick one type of litter that was classified earlier.** Students will research the type of hazards associated with this type of litter on ecosystem and ocean habitat and design a solution on how to eliminate this type of litter from the waters.

• **Students will create a visual way to present this information** (e.g., poster, slide presentation, drawing).

• **Students will answer the “Questions for the Class to Consider”** in their science journal or questions can be used as a formative assessment from the lesson.

## Questions for the Class to Consider

- What kinds of litter or aquatic debris have you seen around a river, a lake or the ocean?
- How might different kinds of litter or debris be harmful to animals?
- What might you do to help stop animals being hurt by aquatic debris?
- What might you do to help reduce the amount of trash?
- Do you support or oppose requiring that grocery stores charge for bags to encourage consumers to use reusable shopping bags?
### Grade 3 Standard Alignment

#### Standard 3.E.4
The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth’s surface.

**Conceptual Understanding: 3.E.4B**
The Earth’s surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.

**Performance Indicator: 3.E.4B.4**
Define problems caused by a natural event or human activity and design devices or solutions to reduce the impact on the environment.

#### Standard 3.L.5
The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.

**Conceptual Understanding: 3.L.5A**
The characteristics of an environment (including physical characteristics, temperature, availability of resources, or the kinds and numbers of organisms’ present) influence the diversity of organisms that live there. Organisms can survive only in environments where their basic needs are met. All organisms need energy to live and grow. This energy is obtained from food. The role an organism serves in an ecosystem can be described by the way in which it gets its energy.

**Performance Indicator: 3.L.5A.1**
Analyze and interpret data about the characteristics of environments (including salt and fresh water, deserts, grasslands, forests, rain forests, and polar lands) to describe how the environment supports a variety of organisms.

### Grade 3 Standard Alignment (continued)

**Conceptual Understanding: 3.L.5B**
When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.

**Performance Indicator: 3.L.5B.1**
Obtain and communicate information to explain how changes in habitats (such as those that occur naturally or those caused by organisms) can be beneficial or harmful to the organisms that live there.

**Performance Indicator: 3.L.5B.2**
Develop and use models to explain how changes in a habitat cause plants and animals to respond in different ways (such as hibernating, migrating, responding to light, death, or extinction).

### Grade 5 Standard Alignment

#### Standard 5.E.3
The student will demonstrate an understanding of how natural processes and human activities affect the features of Earth’s landforms and oceans.

**Conceptual Understanding: 5.E.3B**
Earth’s oceans and land forms can be affected by natural processes in various ways. Humans cannot eliminate natural hazards caused by these processes but can take steps to reduce their impacts. Human activities can affect the land and oceans in positive and negative ways.

**Performance Indicator: 5.E.3B.3**
Construct scientific arguments to support claims that human activities (such as conservation efforts or pollution) affect the land and oceans of Earth.
Eliminating Litter Hazards in Our Community

Lesson Summary

This lesson will help teach students to be good stewards of the environment.

Background Knowledge

Habitats change due to natural causes or actions of organisms. These changes may be helpful or harmful to the organisms that live there.

All organisms change the environment in helpful or harmful ways. Natural changes in the environment include floods, fires, droughts, landslides, volcanic eruptions and earthquakes. Changes to an environment can also be caused by human carelessness, urbanization, pollutants or the introduction of nonnative species.

Human activities can benefit the land and oceans by preserving the resources that these areas provide. Natural resources are the materials that people can take or use from Earth. Natural resources include air, water, trees, rocks and minerals, soil, coal and oil.

The wise use of natural resources is called conservation. Human activities that help to keep the natural resources of Earth available and clear of pollution are conservation efforts. Some efforts involve everyone trying to REDUCE (use less of something), REUSE (use something over again) and RECYCLE (make something new from an old product).

Other efforts involve trying to save the land and oceans through clean-up projects, installing fence lines to prevent dune erosion, jetties along the entrance to harbors or groins along beaches in an effort to keep sand from washing away. Beach restoration projects help to restore sand on beaches.

Focus Questions for Students

• How can litter impact personal safety?
• In what ways can a littered area be a health hazard?
• What steps could we take to solve a problem such as littering in South Carolina?
• What are some consequences that could be used to keep people from littering?

Materials List

• Poster board for students to write the consequences for littering
• Markers, colored pencils or crayons
• Computers with Internet access for researching litter laws currently in place in South Carolina
• One of the following scenarios for each group

Changes to an environment can be caused by human carelessness.
Planting trees, bushes or grass is a way to improve air quality as well as keep erosion from carrying away soil. To conserve fossil fuels, humans may use cars that run on electricity, carpool, use public transportation, walk, ride a bike, etc. Buildings may use solar energy for electricity.

Pollution is anything that harms the natural environment. When the taking or using of natural resources causes harm to Earth’s air, water including oceans, or land, then the human activity has caused pollution. Oceans are rich in food, minerals and other resources and can be easily polluted. Human activities can also harm the land and oceans causing resources to be polluted or destroyed.

Sometimes people may allow materials to be dumped into rivers not thinking that rivers flow into the estuaries and ocean where they are harmful to life there. Careless dumping of trash on land or in oceans pollutes those areas; smoke and fumes from burning fuels pollutes the air; oil spills harm the ocean and can cause life there to be killed. Careless human activities in agriculture, industry, construction, or mining can cause pollution on the land, in the water and in the air.

**Science & Engineering Practices**
1. Ask questions and define problems.
2. Develop and use models.
3. Plan and conduct investigations.
4. Analyze and interpret data.
5. Use mathematical thinking.
6. Construct explanations and design solutions.
7. Engage in scientific argument from evidence.
8. Obtain, evaluate, and communicate information.

**Content Vocabulary**

- **Littering** – make (a place) untidy with rubbish or a large number of objects left lying about.
- **Reduce** – cutting back on the amount of trash we make.
- **Reuse** – finding a new way to use trash so that we don’t have to throw it out.
- **Recycle** – using trash to remake new goods that can be sold again.
- **Natural Resources** – the materials that people can take or use from Earth.
- **Conservation** – the wise use of natural resources.
- **Pollution** – anything that harms the natural environment.
**Engage**
Show the short YouTube video “Stop Littering” to activate prior learning about impacts of littering, how to reduce, reuse and recycle.

**Explore**
Discuss the Focus Questions for students. Have each small group elaborate on each question and how they would answer the question prior to culminating activity. Focus on how “reduce, reuse and recycle” may impact those focus questions.

**Explain**
Have students define and illustrate important vocabulary – littering, reduce, reuse and recycle. **Optional**: Play the “Going Green Song – Reduce, Reuse, Recycle” video from YouTube to reinforce the vocabulary.

**Procedure**
1. Read and make copies of the following scenarios.
2. Assemble materials.
3. Divide the class into five or six groups. Each group can represent a small town comprised of a mayor, engineer, business owner, school principal, and so on. Tell students they will read about a particular litter problem, come up with a solution to that problem, and present it to their classmates. Emphasize that each person will be required to speak during their group’s presentation to the class.
4. Give each group one of the scenarios (see above) and ask them to consider the problem in relation to the focus questions. Allow students plenty of time to brainstorm, discuss their scenarios and the focus questions, formulate a solution to the problem, and identify consequences for future prevention of the problem. Remind students to record the consequences on poster board.

**Adopt A Beach**
The Adopt-A-Beach program is a great way for businesses, civic clubs, school groups and neighborhood associations to make a significant contribution to the preservation of our coastal environment. Everyone who participates in a beach cleanup becomes a powerful advocate for the beach against litter.

The S.C. Department of Health and Environmental Control has released an application for the Adopt-A-Beach Program at MyCoast South Carolina. The system provides a streamlined process for program registration, beach adoption and data reporting.

To start, visit [mycoast.org/sc](http://mycoast.org/sc) to register with MyCoast, establish a beach cleanup group and select a beach to adopt. In the new system, you will choose an entire beach to adopt rather than targeting a specific stretch of beach.

Download the MyCoast application on any smartphone that will be taken to the beach and use it to record the trash remove from the beach. After your beach cleanup, view a summary of your event under the Beach Cleanup Reports section of MyCoast South Carolina.

Visit [www.scdhec.gov/ocrm](http://www.scdhec.gov/ocrm) for more information.
5. Students work with others in their group, brainstorming and discussing their scenarios to formulate a solution to the problem. They record their solutions on poster board.

6. Have each group give its presentation to the class. Each group gives its presentation to the class, explaining the possible solutions to the hypothetical litter problem that will keep it from reoccurring.

**Elaborate**

**Community Littering Scenario Activity**

Each group reads its scenario, develops a solution to the problem and determines consequences that will help to keep people from continuing the particular behavior. Each group presents its findings to the class. After the presentations, students reflect on the effect that littering has on them personally and on their community as a whole.

### Scenario No. 1

It is a beautiful summer day, and you have been out playing baseball with your friends at the park. On your way from home, you and your friends pass by an abandoned store where somebody has dumped old boxes and mattresses, oil and paint cans and used tires.

You see a couple of teenagers walk by, and as they pass, one of them flicks a lit cigarette into a stack of boxes.

**Group Work**

Discuss the hazards that are created when these sorts of litter are allowed to accumulate. Demonstrate one or more of these three hazards for the class. Evaluate the impact this activity had on the environment and what are some steps that could be taken to reduce the negative impact human.

Write on the poster board several possible solutions that might keep people from littering.

### Scenario No. 2

You and your mom are going to the mall so that you can spend the money you got for your birthday. Your mom is driving down the Interstate when suddenly, sheets of paper and empty trash bags begin to fly out of the back of the truck that is ahead of your car on the road. One large trash bag lands on your windshield, completely blocking your mom's view of the road and the vehicles around her.

**Group Work**

What are some of the dangers that are created when articles are not properly secured in the back of a truck that is going down the highway? What could the truck driver have done to keep such an incident from happening? How could this litter impact the environment?

Write on the poster board several possible solutions to make people aware that this is a type of littering.
### Scenario No. 3

Your neighbors are having the roof of their house re-shingled. The workers have been there for several days pulling off the old shingles and nailing down the new ones. They have been careless in cleaning up the debris that has been thrown onto the ground. Some nails are lying in the yard and in the driveway. Your dad comes home and parks his car in the driveway.

**Group Work**

Discuss the potential dangers that exist when roofing debris is not completely cleaned up. What can be done to prevent these dangers? Write on the poster board several possible solutions that might keep roofing companies from failing to clean up their debris properly.

### Scenario No. 4

People have been dumping cans, bottles, and food wrappers from McDonald’s and Burger King into the ditch behind your playground. You and your friends are playing baseball when your only ball is hit over the fence and lands in that ditch. When you go to retrieve the ball, you see that the ditch is filled with things that are smelly, wet and rotten. You also see several large rats.

**Group Work**

How did this littered area directly impact you and your group of friends? How might this type of litter impact the environment? Discuss some possible solutions to this kind of litter problem. Write on the poster board several possible solutions that might keep people from dumping their garbage in ditches and in other areas they think are hidden.

### Scenario No. 5

While walking down the street you finish drinking your soda and hold on to your plastic bottle until you come across a trash can. As you walk up to the trash can you can see that it is overflowing and the trash is falling onto the sidewalk.

**Group Work**

What should you do with your trash? Add it to the overflowing trash can or hold onto it until you find another? Discuss what you would do.

### Scenario No. 6

While riding your bike one afternoon, you run over a broken bottle that has been thrown on the road. You begin to skid and lose control of your bike.

You cannot keep from falling and you land very heavily on your left side. Your arm, shoulder, and knee hurt badly, and you are bleeding.

**Group Work**

Discuss the role that littering played in this accident. What can be done to make sure that accidents such as this never happen again? Write on the poster board several possible solutions that might keep people from littering our streets and roads.
Evaluate

Write a well-developed paragraph using this prompt. You are a city planner for a city in South Carolina that is either in the coastal zone, Piedmont region or the Sandhills region. Choose a region. In this region, you have been asked to develop a litter campaign for that community.

How would you inform the public on the reasons why the litter program is needed in the area and what kind of negative impact can littering have on the region. Include three ways the community can clean up their environment.

Additional Resources

*Differentiation of Instruction:* This lesson can be adapted easily to provide accommodations for students who have specific learning needs. Teachers may allow students to participate orally without writing or provide other avenues to express knowledge. Students can be challenged additionally by focusing on the effects of negligent behaviors as described in the scenarios.

- “Human Interaction With the Environment: Natural Resources” – This is a Slideshare/PowerPoint presentation on the topics of pollution and conservation. It is available at [www.slideshare.net/awhitelily/human-interaction-with-the-environment](http://www.slideshare.net/awhitelily/human-interaction-with-the-environment).
- Pollution Video 1 – For Kids -Pollution: Meaning & Definition – This is a video, from a child’s point of view, of pollution, sources, and effects. This resource is at [www.youtube.com/watch?v=aXmfQLC8ju4](http://www.youtube.com/watch?v=aXmfQLC8ju4).

S.C. Science Standards

**Grade 3 Standard Alignment**

**Standard 3.E.4** – The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth’s surface.

**Conceptual Understanding: 3.E.4B** – Earth’s surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.

**Performance Indicator: 3.E.4B.4** – Define problems caused by a natural event or human activity and design devices or solutions to reduce the impact on the environment.

**Grade 5 Standard Alignment**

**Standard 5.E.3** – The student will demonstrate an understanding of how natural processes and human activities affect the features of Earth’s landforms and oceans.

**Conceptual Understanding: 5.E.3B** – Earth’s oceans and landforms can be affected by natural processes in various ways. Humans cannot eliminate natural hazards caused by these processes but can take steps to reduce their impacts. Human activities can affect the land and oceans in positive and negative ways.

**Performance Indicator: 5.E.3B.3** – Construct scientific arguments to support claims that human activities (such as conservation efforts or pollution) affect the land and oceans of Earth.

**Performance Indicator: 5.E.3B.4** – Define problems caused by natural processes or human activities and test possible solutions to reduce the impact on landforms and the ocean shore zone.
The Impact of Litter on a Natural Habitat

This lesson was adapted from the “Plastic Pollution Curriculum and Activity Guide” at https://seagrant.psu.edu/topics/educational-materials-and-curriculum.

Lesson Summary

In this activity, the students identify different kinds of habitats and describe the characteristics of each. They then integrate that information with the use of technology (the Internet), draw a food chain or food web and determine how things would change if litter were added to the particular habitat. As the Keep America Beautiful organization explains, cigarette litter is everything from a partially smoked cigarette, cigarette butts, matches and lighters to the packaging itself. Students will learn, in particular, that litter, including cigarette butts, plastics and other littered products introduce a product to our environment that breaks down very slowly and is not completely biodegradable – cellulose acetate, a form of plastic, which cigarette filters are made of. One of the smallest pieces of litter, cigarette butts remain the most heavily littered item in South Carolina.

Background Knowledge

It is essential for students to know organisms have energy roles in their environments. Each role is determined by how the organism obtains its energy and how they interact with other organisms in the environment.

Focus Questions for Students

• What is a habitat?
• What is a food chain? What is a food web?
• What effect could litter have on a food chain?
• What effect could litter have on a natural habitat as a whole?
• How can cigarette smoking be an environmental issue?
• How much litter is produced from cigarettes each year?
• Do most people consider cigarette butts litter? Why or why not?

Materials List

• Chart paper, markers, crayons
• Computers with Internet access
• Example of a food chain or web (NOTE: Helpful Internet pages include www.vtaide.com/png/foodchains.htm and www.arcytech.org/java/population/facts_foodchain.html.)

Changes in the environment can occur due to changes in populations.
The flow of energy in an environment can be represented using the following diagrams

- **Food webs** – A food web describes the organisms in a particular ecosystem found in interconnecting food chains using pictures or words and arrows. Food webs also describe the complex patterns of energy flow in an ecosystem by modeling who consumes whom or what.

- **Energy pyramids** – An energy pyramid is a graphical representation of the energy flow in an ecosystem. The amount of energy that moves from one trophic level to another in an energy pyramid is not the same. Energy availability decreases as it moves up the energy pyramid. The most energy is available at the producer level of the pyramid.

It is essential for the student to know that changes in the environment can occur due to changes in populations. Changes in populations can occur when new members enter a population or when members leave a population. This will have an effect on the population density (the number of organisms in the given amount of space) for a particular area.

The natural slowing of population growth as it nears Earth’s carrying capacity is due to an increase in the death rate and a decrease in the birth rate as a result of:

- **Food and water shortages**;
- **Pollution of the environment**; and
- **Spread of diseases**.

An increasing population can have an effect on the amount of available clean water. If clean water is being depleted at a greater rate than it can be purified, it is not considered renewable in our lifetime.

**Content Vocabulary**

- **Food web** – describes the organisms in a particular ecosystem found in interconnecting food chains using pictures or words and arrows.
- **Energy pyramid** – a graphical representation of the energy flow in an ecosystem.
Engage: ‘Getting Out of A Bind’

This activity is adapted from “Marine Debris: It Can Be Deadly” developed by The Center for Marine Conservation and the California Coastal Commission in the “Save Our Seas Curriculum Guide.”

This simple activity teaches students empathy for wildlife by simulating an animal's entanglement in plastic litter. Follow the procedure below.

1. Use a volunteer to demonstrate. Put a rubber band around the back of his or her hand, catching the thumb and the little finger. (See diagram.) Have the child try to remove the rubber band without using the other hand or teeth or rubbing it against something.

2. Hand out rubber bands for everybody to try. Tell each child to pretend his or her hand and arm is a bird entangled in plastic. For example, the hand is its head, the fingers its beak and the forearm its neck. Cup elbow with free hand. Place rubber band around the “beak” or “neck.” Allow children only 30 seconds to free themselves. No helpers!

3. Is everyone successful in untangling themselves? Many animals don’t get free, of course, and starve, strangle or suffocate.

4. Discuss the following with the students. What plastic or other material could the rubber band represent in a natural setting (fishing line, plastic six-pack rings, fishing nets, packing straps)? How could an animal get into a situation in which fishing line, strapping bands, six-pack rings or a net would entangle it? (By swimming into plastic accidentally. Also, a bird might eat the bait on a fishing line, then become entangled or take the line back to a nest of vulnerable babies. Some students might have rubbed their hands against the table to remove the band. In the natural environment, what would animals rub their heads against? Probably a rock. What would happen to an animal that rubbed its head against a rock until the band came off?

Explore

Have students review these websites.

- **Model Ecosystems**

- **Ecosystems, Organisms and Trophic Levels**
  http://glencoe.mheducation.com/sites/dl/free/0078802849/383916/BL_03.html

Students will explore different ecosystems and how the biotic and abiotic factors interact within the ecosystem.

Explain

1. Lead the class in a discussion of the focus questions. Ask students to describe their own habitat. Have the students brainstorm to identify major types of habitats (e.g., ocean, jungle, desert, polar region) and locate them on a globe or world map.

2. Have the students list on chart paper the major habitats they have identified.

3. Have the students conduct research on the Internet or in the library media center to identify additional habitats and to learn the characteristics of each.

4. Have the students list on chart paper the habitats they have identified through their research.
5. Have the students develop a graphic organizer on the chart paper to communicate the characteristics of one ecosystem, including the types of animals and other organisms that live there. Specifying the abiotic and biotic features of that ecosystem. Share with the class.

6. Divide the class into groups and have each group select one ecosystem to research further. Each student in the group is to write a brief report on what he or she has learned from the activity.

**Elaborate**

Furnish student groups with an example of a food chain and a food web. Then have the students work in their group to draw the food chain for their chosen habitat. (This task may require some additional research.)

Student groups are to conduct research to determine how litter and/or pollution would affect this food chain/web and ultimately affect the particular ecosystem they have researched.

**Evaluate**

Each group is to write up its findings and share them in a presentation they have created to the entire class. Have students include the answers they developed to the focus questions in their journals as an individual assessment.

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**S.C. Science Standards**

**Grade 7 Standard Alignment**

**Standard: 7.EC.5** – The student will demonstrate an understanding of how organisms interact with and respond to the biotic and abiotic components of their environments.

**Conceptual Understanding: 7.EC.5A.** – In all ecosystems, organisms and populations of organisms depend on their environmental interactions with other living things (biotic factors) and with physical (abiotic) factors (such as light, temperature, water or soil quality). Disruptions to any component of an ecosystem can lead to shifts in its diversity and abundance of populations.

**Performance Indicator: 7.EC.5A.1** – Performance Indicators: Students who demonstrate this understanding can: Develop and use models to describe the characteristics of the levels of organization within ecosystems (including species, populations, communities, ecosystems and biomes).

**Performance Indicator: 7.EC.5A.3** – Analyze and interpret data to predict changes in the number of organisms within a population when certain changes occur to the physical environment (such as changes due to natural hazards or limiting factors).

**Conceptual Understanding: 7.EC.5B.** – Organisms in all ecosystems interact with and depend upon each other. Organisms with similar needs compete for limited resources. Food webs and energy pyramids are models that demonstrate how energy is transferred within an ecosystem.

**Performance Indicator: 7.EC.5B.1** – Students who demonstrate this understanding can: Develop and use models to explain how organisms interact in a competitive or mutually beneficial relationship for food, shelter or space (including competition, mutualism, commensalism, parasitism and predator-prey relationships).

**Performance Indicator: 7.EC.5B.2** – Develop and use models (food webs and energy pyramids) to exemplify how the transfer of energy in an ecosystem supports the concept that energy is conserved.
The Lasting Effects of Litter

Lesson Summary

In this lesson, students investigate the characteristics of soil texture and composition by conducting two tests in which comparisons are made between uncontaminated soil and soil that has been contaminated by litter.

Students will investigate the impact that litter has on soil. They examine the characteristics of soil – acid balance (the pH factor), temperature and permeability through a series of investigations that compare uncontaminated soil with soil that has been contaminated by litter.

Background Knowledge

This section was taken in part from the “Support Guide for Grade Seven – South Carolina Academic Standards and Performance Indicators for Science” at https://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Science_7thSupport.pdf.

It is essential for students to know that soil is one of the most valuable abiotic factors in an ecosystem. Soil has an effect on the types of plants that can grow in an ecosystem, which directly impacts the types of other organisms that can survive there. If a change in the properties of soil occurs, the ecosystem (including biotic and abiotic factors) will also change.

Soil quality is based on properties that can be observed such as soil profile, composition, texture, or particle size. Soils form in layers, or horizons, and all the layers make up the soil profile. A mature soil profile consists of three layers – topsoil, subsoil and parent material above bedrock. Topsoil that is nutrient rich, containing a mixture of humus, clay, and minerals, is most suitable for plant growth. Most animals live in the topsoil horizon.

Focus Questions for Students

- What is soil and what is it composed of?
- What are the biotic and abiotic features of the soil?
- What impact does litter have on the quality of soil?
- How does litter affect the pH, temperature and permeability of soil?
- What effect can litter have on the texture and composition of soil?
- What effect can contaminated soil have on human health?
- What happens if the litter is not removed and stays in the soil?
- What are some problems that may occur if litter is not removed?
Soil is a mixture of rock particles, minerals, decayed organic material, air, and water. The decayed organic matter in soil is humus. The sand, silt and clay portion of soil comes from weathered bedrock material. The combination of these materials in soil determines the soil type and affects the types of plants that can grow in it or animals that can live in it. Factors that may affect soil type are the types of plants, climate, time, and slope of the land.

Soil depends on the size of individual soil particles and is determined by the relative proportions of particle sizes that make up the soil. Texture names include loam, sandy clay loam, silt loam or clay depending upon the percent of sand, silt and clay in the soil sample. The texture affects the amount of water that can be absorbed for use by plants and animals.

Soil particles are classified by size ranging from coarse sand to very fine sand to silt, and finally to the smallest particle, clay. Soil particles that are larger than 2 mm are called gravel. Particle size also affects the amount of water that can be absorbed and used by plants and animals. Soil quality is also based on properties that can be measured, such as permeability and pH.

Soil particles have open spaces (pores) between them that let water flow through. How freely that water flows is the permeability of the soil. The closer the particles pack together because of particle size, the less permeable the soil is. Measuring permeability involves calculating the rate of drainage.

Soils can be basic or acidic and usually measure 4-10 on the pH scale. Indicators can be used to measure the pH of soils. Most plants grow best in soils with a pH of between 5 and 7. Regardless of the nutrients present in the soil, if the pH is not suitable those nutrients will be inaccessible to the organisms. Lime is a kind of fertilizer that alters pH and making the soil nutrients more accessible.

As part of “Extended Knowledge,” Students should construct explanations of how changing the soil quality (including composition, texture, particle size, permeability and pH) in specific ecosystems will affect the characteristics of that ecosystem. The students should be able to analyze and interpret data from soil profiles as evidence to support their scientific argument.

### Content Vocabulary

- **Soil** – a mixture of rock particles, minerals, decayed organic material, air, and water.
- **Humus** – the decayed organic matter in soil.
- **Permeability** – how freely that water flows through the soil.
- **Soil pH** – soils can be basic or acidic and usually measure 4-10 on the pH scale.
- **Soil Profile** – consists of three layers: 1) topsoil; 2) subsoil; and 3) parent material above bedrock.
- **Soil Texture** – affects the amount of water that can be absorbed for use by plants and animals.

### Science & Engineering Practices

1. Ask questions and define problems.
2. Develop and use models.
3. Plan and conduct investigations.
4. Analyze and interpret data.
5. Use mathematical thinking.
6. Construct explanations and design solutions.
7. Engage in scientific argument from evidence.
8. Obtain, evaluate and communicate information.
### Materials, Equipment and/or Resources Needed

- **Materials for Soil Composition Test**
  - 2 4-cup (1 liter) mason jars with lids per student group
  - 125 ml of uncontaminated soil for one jar per group
  - 125 ml of contaminated soil for one jar per group
  - For each jar per group, you will need:
    - 750 ml of water
    - A squirt of dishwasher gel or powder or TSP (trisodium phosphate)

- **Materials for Soil Texture Analysis**
  - 100 ml of uncontaminated soil per group
  - 100 ml of contaminated soil per group (see above)
  - Paper, pencils, clipboards, chart paper and markers
  - Shovels, buckets, and gloves for collecting soil and litter from the school grounds
  - 8 samples taken from the top 8 inches (20 cm) of the soil on the school grounds for each student group (see specific quantities below):
    - 4 uncontaminated samples
    - 4 samples contaminated with litter that has been collected from the school grounds or a roadside area, cut into small pieces, and mixed into the soil
  - pH soil test kit for each student group (available at garden supply stores)
  - pH water test kit for each group (available at pet stores, Wal-Mart or stores that sell tropical fish and aquariums)

- **Materials for Soil Temperature Test**
  - A dial or digital probe thermometer for each group
  - 12 cm finishing nail and hammer for each group
  - A wooden block with 6 mm diameter hole through it for each group
  - A calibration thermometer for each group

- **Materials for Soil Permeability Test**
  - 100 ml of water per student group
  - 100 ml of uncontaminated soil per group
  - 100 ml of contaminated soil per group (see above)
  - Filter paper or coffee filters for each group
  - A beaker (250 ml) to collect the drained water for each group
  - A stop watch or watch/clock with a second hand for each group

### Website Resources

Teacher Preparation

One week prior to running the soil composition test, have students collect the soil samples and the litter from the school grounds and mix the bits of litter into the soil that is to be used as the contaminated sample.

1. **Gather the necessary items and information.**

2. **You may want to take a soil sample to your local Clemson Extension office or a local nursery** for an authentic analysis before your students begin their own testing. Do not release this information to your students but rather use it to monitor and guide your students’ work.

3. **Become familiar with the directions for testing the soil.** You may want to make a copy of the directions for each group of students.

For the soil composition test, add 125 ml of contaminated soil to one jar and 125 ml of uncontaminated soil to the other jar and then follow the directions at [www.raw-connections.com/garden/maint/soiltest.htm](http://www.raw-connections.com/garden/maint/soiltest.htm).


For the pH soil test, follow the directions on the kit. For the soil permeability test, follow these directions.

1. **Put 100 ml of uncontaminated soil in a piece of filter paper.**

2. **Suspend the soil in the filter inside a 250 ml beaker** by securing the filter with a rubber band around the beaker’s mouth.

3. **Pour 100 ml of water over the soil.**

4. **Start the stop watch when you start pouring.** Record the amount of time the water takes to drain through the soil.

5. **Save the sample of water.**

6. **Repeat steps 1 through 4 with the sample of contaminated soil.**

For the pH water test, follow the directions on the kit to test each of the two water samples that were drained from the jars in the soil permeability test. For the soil temperature test, follow GLOBE Teacher’s Guide directions at [http://archive.globe.gov/sda-bin/ wt/ghp/tg+L(en)+P(soil/Temperature)](http://archive.globe.gov/sda-bin/wt/ghp/tg+L(en)+P(soil/Temperature)).
DAY 1: SOIL COMPOSITION TEST

Engage
Guide students into a discussion of the focus questions and an exploration of what soil is and what lives in the soil. This discussion will lead students into the subject of investigating soil composition and soil textures to determine soil quality. Have students discuss their responses to the focus questions.

Explore
Provide the students with materials and directions for conducting a soil composition test. Have them work in their groups to conduct the test.

Explain
Explain to the students that they are to conduct a series of soil composition and characteristic tests and then to write individual lab reports in their journals.

The lab report must include:

- The materials used to conduct the test;
- The procedure that was followed;
- The results of the tests; and
- The conclusions they reached on the basis of the test results.

Elaborate
Students work in groups to conduct soil composition tests. They then write their individual lab reports in their journals.

Evaluate
Written lab reports detailing the soil composition testing and the conclusions the students have reached. Lead a discussion about any patterns or trends the class might be observing about the data collected.

DAY 2: SOIL TEXTURE TEST

Engage
Review the conclusions from Day 1 investigations.

Tell the students they will now be conducting a soil texture investigation by using the dichotomous key on the “Texture by Feel Guide” Web page (the address is in section F, above). Tell the students that they must note any observations about texture differences and the biotic and abiotic materials found in both the uncontaminated and the litter-contaminated samples.

Explore
Provide the students with materials and directions for conducting a soil texture analysis. Have them work in their groups to conduct the test.

Explain
Tell the students that after completing this test, they must write a second lab report in their journals. The report must cover the same points that their first lab report covered, detailing the testing process and the conclusions to which it led them.

Elaborate
Students work in groups to conduct the soil texture analysis. They then write their individual lab reports in their journals.

Evaluate
Written lab reports detailing the soil texture analysis composition testing and the conclusions the students have reached. All student groups are to prepare an oral report of their findings so far. Each group prepares an oral report of its findings and also puts its findings and conclusions on a Wall charts with findings and conclusions. Lead a discussion about any patterns or trends the class might be observing about the data collected.
DAY 3: SOIL PERMEABILITY & pH TEST

Engage
Give students the instructions and materials for conducting the soil permeability test. Remind them to save the water that is drained through the soil.

Explore & Explain
Students conduct the permeability test on both samples of soil according to directions. They record the test results in their journals or on data sheets.

Elaborate
Students conduct the pH test on the water collected from the soil permeability test and record the test results in their journals or on data sheets. Students then write their individual lab reports in their journals.

Evaluate
Written lab reports detailing the analysis of the testing and the conclusions the students have reached. Students can report their findings to the class and add the data to the Wall Chart.

DAY 4: SOIL TEMPERATURE TEST & CONCLUSION

Engage
Take students outside to the campus area where they collected their soil samples prior to beginning the lesson.

Explore & Explain
Give the students instructions and materials for conducting the soil temperature tests.

Elaborate
Students conduct the soil temperature test according to the directions and record the test results in their journals or on data sheets. Students then write their individual lab reports in their journals.

Evaluate
Review written lab reports detailing the soil texture analysis composition testing and the conclusions the students have reached.

Culminating Analysis
1. Lead the class in a discussion of the groups’ overall findings and guide them into drawing a conclusion with regard to the effect that contaminated soil can have on human health. Revisit the “Focus Questions.” Allow students to discuss each question as a group or a whole class discussion. (Students discuss and arrive at a class conclusion with regard to the effect that contaminated soil can have on human health.)

2. In their journals, students write reflections about what they learned about the relationship between the quality of soil and the effect of litter. Each student then writes his or her own answer to the key question regarding litter and the campus soil: “What can we as students and a school population do to solve this problem?”

3. Direct students to reflect on what they have discovered about soil composition, texture, permeability and temperature by writing a conclusion to the questions in their science journals.

4. Tell the class that in their journal entries, they must define the terms “soil texture” and “soil composition,” identify any abiotic and biotic factors they have observed and describe what effect litter has on the soil composition and texture. They must also propose solutions to the litter problem.
Extension to Other Content Areas

- **Mathematics** – The class can graph the results of the data collected in the activities.

- **Social Studies** – Students can research such questions as these: “Why is there so much focus on the litter problem in South Carolina?” “What are the history and purpose of organizations like PalmettoPride and Keep America Beautiful?”

- **Language Arts** – Students can write letters to the local conservation board and the Clemson Extension Service asking for information about how students can help with the litter problem.

Service-Learning Connection

Upon completing the analysis and returning the information to the participants, students write to the local newspaper and the school newspaper about their project, emphasizing the importance of not littering and the success of teaching others about the litter problem.

The seventh-grade students could emphasize the importance of litter control and demonstrate to the younger students what litter does to the soil. The seventh-graders could design info-graphics or pamphlets for students to share with their parents.

Differentiation of Instruction

Students with special needs can be paired with other students to complete the activity. In addition, students with special needs can be given blank lab reports to complete and discuss as part of a whole-group discussion. As a means of accommodating the varying ability levels that may exist within a class, students can be given the questions at the beginning of the lesson, and if necessary, the teacher can lead the whole class in conducting each of the tests and reporting results on a class data sheet. Advanced students can design and conduct additional tests on the soil. They can add this data to the overall test data, graph the findings and determine if there is any kind of statistical relationship between the amount of litter in the soil and the quality of the soil.

S.C. Science Standards

Grade 7 Standard Alignment

**Standard: 7.EC.5** – The student will demonstrate an understanding of how organisms interact with and respond to the biotic and abiotic components of their environments.

**Conceptual Understanding: 7.EC.5A.** – In all ecosystems, organisms and populations of organisms depend on their environmental interactions with other living things (biotic factors) and with physical (abiotic) factors (such as light, temperature, water or soil quality). Disruptions to any component of an ecosystem can lead to shifts in its diversity and abundance of populations.

**Performance Indicator: 7.EC.5A.2** – Construct explanations of how soil quality (including composition, texture, particle size, permeability, and pH) affects the characteristics of an ecosystem using evidence from soil profiles.
It’s all wrapped up!

This lesson was adapted from “Garbology,” from the Center of Science and Industry (COSI) and developed by the Southwest Environmental Health Sciences Center, University of Arizona.

Lesson Summary
This lesson examines the packaging, specifically the over-packaging of commonly used food products and encourages students to ask the tough questions and propose solutions for this environmental problem. Students will examine the role of product packaging and resource waste.

Background Knowledge
According to the EPA, in 2006, Americans produced 251 million tons of trash. About 80 million tons – or 32% of the trash – came from packing and containers. Of the total trash, only 32 percent of the volume was recycled.

All of this trash adds up and presents many problems. One of those issues is where to put the trash. Landfill space is running out and landfills present ecological problems to the community surrounding them. The Model T Ford provides an example of rethinking trash and packaging. The box that the car was shipped in was to later be used as the floorboards.

This activity will look at the amount of packaging used relative to the product it is used for and will encourage students to consider packaging as part of product purchases.

Teacher Preparation
1. Assemble the supplies for making the visuals for the group presentations.
2. Make a copy of the “Food Packaging Survey” chart and the “Follow-Up to the Packaging Survey” question sheet for every student. (Both sheets are provided.)
3. Become familiar with the concept of over-packaging.

Focus Questions for Students
- What are some items that your family purchases from the grocery store on a weekly basis? How are these items packaged?
- What is the purpose of packaging?
- Does the way a food item is packaged add to its consumer appeal?
- Does the packaging of a food item add to the cost of the product?
- Are manufacturers and producers packaging items in materials that can be reused or recycled? Should they be required to so?
- How can buyers support the use of environmentally friendly packaging?
- What role does the government play in regulating the packaging of consumer products?
- What are some ways that over-packaging can be reduced or eliminated without violating the rights of the producers?
- Why or how can excess packaging lead to environmental problems and contribute to the litter problem?
**Procedures**

Introduce the focus questions. Have students respond to them orally. Record their ideas on chart paper.

**Engage**

1. Record the different brands of gum and their prices in the appropriate columns of the handout.
2. Find the total mass of your group’s package (gum + packaging). This may be printed on the package. If not, use a balance or scale.
3. Record the printed gum mass. This may not be present. Use balance if necessary.
4. Calculate the mass of the packaging: total mass – gum mass = packaging mass.
5. Unwrap all of the gum in your package. Measure the mass of gum. Record actual gum mass.
6. Measure the packaging mass. Record actual packaging mass.
7. Calculate and record the packaging percentage of the total mass: actual gum mass X 100 = total packaging mass.
8. Calculate and record the cost per gram of gum: price X 100 = actual gum mass.
9. Graph the percentage of packaging on the bar graph on the handout.
10. Get the information from the other groups and complete your bar graph.

**Content Vocabulary**

- **Economics** – the study of choice.
- **Technology** – any modification to the natural world created to fulfill the wants and needs of humans.

**Materials List**

- 6-7 different brands of gum, each with unique packaging
- Scale or balance
- Calculators
- Colored markers, chart paper, poster board, rulers, and so forth for visuals for student presentations
- Computers with Internet access
- YouTube – “Food Packaging: Making the Best of a Bad Situation” by TEDx Talks at [https://www.youtube.com/watch?v=v08F0YE-k2E](https://www.youtube.com/watch?v=v08F0YE-k2E)
Explore

POSSIBLE REFLECTIVE QUESTIONS

- What types of materials are used in the packaging of the gum?
- Are any of the materials recyclable? If not, are the materials waste or can they be reused?
- Did higher cost relate to more packaging?
- Why do we need packaging?
- Does the packaging affect which gum you buy?

Explain

Pass out the “Food Packaging Survey” charts to the class. Have students take the charts home and complete them on the basis of the specific food products that they and their family members buy and use for a one-week period. They will record the specific materials and the number of different materials that were used as packaging for items such as meats, eggs, and snacks that they or their family purchased during that one week.

After completing the survey, students should examine their findings by completing the “Follow-Up to the Packaging Survey” sheet and conduct additional research as needed.

Elaborate

Divide the class into groups and have each group design a presentation that uses visuals (charts, posters, graphs and so forth) that feature the results of their food packaging surveys and the follow-up question sheets. Then have the groups redesign the packaging of one of the products they presented so that the over-packaging is eliminated but all needs for the packaging of the food product are met.

Evaluate

Allow groups to present their newly designed items to the entire class.

S.C. Science Standards

Grade 8 Standard Alignment

Conceptual Understanding: 8.S.1B. – Technology is any modification to the natural world created to fulfill the wants and needs of humans. The engineering design process involves a series of iterative steps used to solve a problem and often leads to the development of a new or improved technology.

Performance Indicator: 8.S.1B.1 – Performance Indicators: Students who demonstrate this understanding can: construct devices or design solutions using scientific knowledge to solve specific problems or needs: 1) ask questions to identify problems or needs; 2) ask questions about the criteria and constraints of the device or solutions; 3) generate and communicate ideas for possible devices or solutions; 4) build and test devices or solutions; 5) determine if the devices or solutions solved the problem and refine the design if needed; and 6) communicate the results.

Grade 11 Standard Alignment

Standard: ECON-1 – The student will demonstrate an understanding of how scarcity and choice impact the decisions of families, businesses, communities and nations.

Enduring Understanding: Economics is the science of choice. The study of economics equips a student with the knowledge to evaluate the benefits versus the costs of goods and services. To make informed decisions about benefits versus costs, the student will understand that individuals and societies will behave in their own best interests in order to exploit the opportunities available to them.

Indicator: ECON 1.3 – Apply the concept that people respond to positive and negative incentives to past and current economic decisions.
Food Packaging Survey Sheet

<table>
<thead>
<tr>
<th>FOOD</th>
<th>TYPE OF PACKAGING</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plastic</td>
<td>Glass</td>
</tr>
<tr>
<td></td>
<td>Cardboard</td>
<td>Cardboard</td>
</tr>
<tr>
<td></td>
<td>Foil-Lined</td>
<td>Tin</td>
</tr>
<tr>
<td></td>
<td>Aluminum</td>
<td>Foil-Lined</td>
</tr>
<tr>
<td></td>
<td>Polystyrene</td>
<td>Tin</td>
</tr>
<tr>
<td></td>
<td>Plastic Wrap</td>
<td>Plastic Wrap</td>
</tr>
<tr>
<td></td>
<td>Paper</td>
<td>Paper</td>
</tr>
</tbody>
</table>

- Meats
- Eggs
- Juice
- Soft Drinks
- Cereal
- Fruits & Veggies
- Fast Food
- Snacks

Follow-Up to the Food Packaging Survey

After completing the “Food Packaging Survey Sheet,” answer the following questions in complete sentences unless otherwise specified.

1. List the items you surveyed that were packaged in materials that could be reused or recycled.

2. List some examples of products that you feel are over-packaged.

3. Does the way an item is packaged add to its consumer appeal? How? Provide examples.

4. Can you think of alternative ways to package some of the products? Describe those alternatives.

5. Of the items you examined, which ones are available in more environmentally friendly packages? For example, recycled paper containers versus Styrofoam cartons.

6. How will the completion of this survey influence the buying habits of you and your family?

7. Of the items you surveyed, which ones are more likely to end up as litter? Explain why.

8. What are some ways to reduce excess packaging? (You may need to do additional research.)