5-8 Pollution Activity

South Carolina Aquarium

Overview

Focus Question
Where does the pollution in watersheds come from?

Activity Synopsis
Students will learn about point source and non-point source water pollution by making and testing a model of a growing community.

Time Frame
Two to three hours

Objectives
The learner will be able to:

- Identify different types and sources of water pollution
- Define the terms point source and non-point source water pollution
- Categorize types of water pollution as point source or non-point source pollution
- Identify technologies designed to reduce the amounts of point source and non-point source water pollution

Student Key Terms

- Best Management Practices (BMP's)
- non-point source pollution
- point source pollution
- runoff

Teacher Key Terms

- buffer zone
- shock loadings

Standards

South Carolina College- and Career-Ready Science Standards 2021

5th Grade: 5-LS2-1, **5-ESS2-1**, **5-ESS3-1**
6th Grade: 6-ESS2-4
7th Grade: 7-PS1-3, 7-LS2-1, 7-LS2-2, **7-LS2-4, 7-ESS3-3**

***Bold standards are the main standards addressed in this activity**

2014 Academic Standards and Performance Indicators for Science

5th Grade: 5.S.1A.1, **5.S.1A.2**, 5.S.1A.3, 5.S.1A.4, 5.S.1A.6, 5.S.1A.7, 5.S.1A.8, **5.5.1B.1, 5.E.3A.1**, 5.E.3B.1, **5.E.3B.4**
6th Grade: 6.S.1A.1, 6.S.1A.2, 6.S.1A.3, 6.S.1A.4, 6.E.4A.6, 6.E.4A.7, 6.E.4B.8, **6.S.1B.1**
7th Grade: 7.S.1A.1, 7.S.1A.2, 7.S.1A.3, 7.S.1A.4, 7.E.4A.6, 7.E.4A.7, 7.E.4B.8, **7.S.1B.1**
8th Grade: 8.S.1A.1, 8.S.1A.2, 8.S.1A.3, 8.S.1A.4, 8.E.4A.6, 8.E.4A.7, 8.E.4B.8, **8.S.1B.1, 8.E.5A.1**

*** Bold standards are the main standards addressed in this activity**

South Carolina College- and Career-Ready Science Standards 2021

5th Grade Performance Expectations

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
5-ESS3-1. Evaluate potential solutions to problems that individual communities face in protecting the Earth's resources and environment.

6th Grade Performance Expectations
6-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

7th Grade Performance Expectations
7-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
7-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
7-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
7-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
7-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

2014 Academic Standards and Performance Indicators for Science

Fifth Grade Performance Indicators
5.S.1A.1 Ask questions used to (1) generate hypotheses for scientific investigations or (2) refine models, explanations, or designs.
5.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
5.S.1A.3 Plan and conduct controlled scientific investigations to answer questions, test hypotheses and predictions, and develop explanations: (1) formulate scientific questions and testable hypotheses, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
5.S.1A.4 Analyze and interpret data from informational texts, observations, measurements, or investigations using a range of methods (such as tabulation or graphing) to (1) reveal patterns and construct meaning or (2) support hypotheses, explanations, claims, or designs.
5.S.1A.6 Construct explanations of phenomena using (1) scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.
5.S.1A.7 Construct scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
5.S.1A.8 Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support hypotheses, explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.
5.5.1B.1 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.
5.E.3A.1 Construct explanations of how different landforms and surface features result from the location and movement of water on Earth's surface through watersheds (drainage basins) and rivers.
5.E.3B.1 Analyze and interpret data to describe and predict how natural processes (such as weathering, erosion, deposition, earthquakes, tsunamis, hurricanes, or storms) affect Earth's surface.
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.

Sixth Grade Performance Indicators
6.S.1A.1 Ask questions to (1) generate hypotheses for scientific investigations, (2) refine models, explanations, or designs, or (3) extend the results of investigations or challenge claims.

6.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
6.S.1A.3 Plan and conduct controlled scientific investigations to answer questions, test hypotheses, and develop explanations: (1) formulate scientific questions and testable hypotheses, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
6.S.1A.4 Analyze and interpret data from informational texts, observations, measurements, or investigations using a range of methods (such as tabulation, graphing, or statistical analysis) to (1) reveal patterns and construct meaning or (2) support hypotheses, explanations, claims, or designs.
6.S.1A.6 Construct explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.
6.S.1A.7 Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
6.S.1A.8 Obtain and evaluate scientific information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of student experimental investigations.
6.S.1B.1 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.

Seventh Grade Performance Indicators
7.S.1A.1 Ask questions to (1) generate hypotheses for scientific investigations, (2) refine models, explanations, or designs, or (3) extend the results of investigations or challenge claims.
7.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
7.S.1A.3 Plan and conduct controlled scientific investigation to answer questions, test hypotheses, and develop explanations: (1) formulate scientific questions and testable hypotheses, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
7.S.1A.4 Analyze and interpret data from informational texts, observations, measurements, or investigations using a range of methods (such as tabulation, graphing, or statistical analysis) to (1)
reveal patterns and construct meaning or (2) support hypotheses, explanations, claims, or designs.
7.S.1A.6 Construct explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.
7.S.1A.7 Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
7.S.1A.8 Obtain and evaluate scientific information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of student experimental investigations.
7.S.1B.1 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.

Eighth Grade Performance Indicators
8.S.1A.1 Ask questions to (1) generate hypotheses for scientific investigations, (2) refine models, explanations, or designs, or (3) extend the results of investigations or challenge claims.

8.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
8.S.1A.3 Plan and conduct controlled scientific investigation to answer questions, test hypotheses, and develop explanations: (1) formulate scientific questions and testable hypotheses, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
8.S.1A.4 Analyze and interpret data from informational texts, observations, measurements, or investigations using a range of methods (such as tabulation, graphing, or statistical analysis) to (1) reveal patterns and construct meaning or (2) support hypotheses, explanations, claims, or designs.
8.E.4A.6 Construct explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.
8.E.4A.7 Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.
8.E.4B.8 Obtain and evaluate scientific information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of student experimental investigations.
8.S.1B.1 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.
8.E.5A.1 Develop and use models to explain how the processes of weathering, erosion, and deposition change surface features in the environment.

Cross Curricular Standards

South Carolina Social Studies Standards
6.5.CX, 7.5.1.PR, 7.5.2.ER

South Carolina College and Career Standards for ELA
Inquiry (I) – 6-1.1, 6-2.1, 6-3.1, 7-1.1, 7-2.1, 7-3.1, 8-1.1, 8-2.1, 8-3.1
Writing (W) - 6-1.1, 6-2.1, 6-3.1, 6-4.1, 6-5.2, 6-6.1, 7-1.1, 7-2.1, 7-3.1, 7-4.1, 7-5.2, 7-6.1, 8-1.1, 8-2.1, 8-3.1, 8-4.1, 8-5.2, 8-6.1
Communication (C) – 6-1.1, 6-1.2, 7-1.1, 7-1.2, 8-1.1, 8-1.2

Common Core Math Standards
6.G.1, 7.G.6

Common Core ELA Standards
Writing – 6.2a, 6.3e, 6.10, 7.2a, 7.3e, 7.10, 8.2a, 8.3e, 8.10
Speaking/Listening – 6.1, 7.1, 8.1
Language – 6.1, 6.3, 7.1, 7.3, 8.1, 8.3
Writing for Literacy – 6-8.1, 6-8.2, 6-8.4, 6-8.7

Background

Key Points
Key Points will give you the main information you should know to teach the activity.

- When rainwater falls on the ground, it will often pick up any pollutants in the environment and carry them to local bodies of water where they will contaminate the watersheds.

5-8 Pollution Activity

- **Point source pollution** is pollution whose source is easily identified. This is usually pollution associated with factories or large farms. For example, if an unusual chemical is found in a watershed, it could be traced to a factory on that watershed that makes use of that chemical.
- Non-point pollution is pollution whose source cannot be identified. Fifty percent of all pollution is **non-point source pollution**. Non-point pollution often comes from the everyday actions of regular people and includes things such as pesticides on lawns or spilled oil from a car.
- **Best Management Practices** are plans on ways to reduce the amount of pollution entering the environment.

Detailed Information

Detailed Information gives more in-depth background to increase your own knowledge, in case you want to expand upon the activity or you are asked detailed questions by students.

Water pollution in our watersheds is an issue that affects us all. It affects us directly through our drinking water and indirectly through slow changes in the environment. We have been aware of the problems and solutions for decades, but are learning new solutions every day. Industry and individuals have made important changes in their practices and daily lives but there is still a lot that can be done.

There are different types of pollution that affect the water in our watersheds. One type is categorized as point source pollution. **Point source pollution** enters the environment from an identifiable source, such as from a discharge pipe of a factory. Industries that have identifiable discharges include sewage livestock farms, landfills, and water treatment plants. These industries discharge many different kinds of pollution, ranging from livestock manure to industrial chemicals.

The discharge of materials from point sources is regulated by state and federal government agencies. These industries are issued a National Pollutant Discharge Elimination System permit. This means that the pollutants are controlled and monitored as they are emitted into streams, rivers and other bodies of water. The emissions must meet the guidelines of the permits or the facility may be heavily fined. There are some facilities that do not meet the guidelines of laws passed by the state and federal governments. These facilities are not breaking the laws. They have been "grandfathered" through the laws. Many of these facilities were operating before the laws were created and are not able to comply without spending lots of money on refurbishing major parts of the facility. The companies that run the facilities would possibly go bankrupt if they were made to comply with the laws. New laws come into effect each year that could change this. Companies may be able to get government assistance to make the necessary changes to improve their emissions.

Point sources of pollution, such as the industries mentioned above, contribute a great amount of pollution to streams, rivers, and other bodies of water, but they do not contribute a majority of the pollution. The Environmental Protection Agency estimated that 50% of the pollution in our nation's waters comes from non-point sources. Non-point sources of pollution are the products of everyday activities by people like you and me.

Non-point source pollution is pollution that comes from sources that cannot be directly located. An example of non-point pollution is the fertilizer that people put on their lawns. When excess fertilizer washes off of the lawn during a rainstorm it can enter the watershed as runoff. **Runoff** is water that flows on the surface across lawns, roads and other landscape features. Pollution can be carried or dissolved in runoff and enter the watershed. Once in a body of water, the pollution can be sensed with the proper equipment, but it cannot be directly linked to any particular lawn in the community. It is pollution that originated from an indistinguishable (non-point) source. Runoff originates from urban areas, agriculture land, construction sites, lawns, and some industries, such as mining. The main elements of polluted runoff are heavy metals, salts, sediment, nutrients, and bacteria.

Many of our daily activities can contribute to non-point source pollution, including lawn and landscape maintenance; car maintenance; use of vehicles; and construction of structures, like homes, highways and shopping malls. In these activities, we apply fertilizers and pesticides; spill small amounts of oil and gasoline; and dig up the ground causing soil erosion. The chemicals and loose soil stay in the area until there is precipitation. The water from a rainstorm falls in these areas, picks up the pollution, and then flows towards storm drains and streams and rivers.

When the rainwater goes directly into a stream it carries all of the pollution with it. Storm drains, though, are not always a better destination for the rainwater. Many towns' storm drains and water treatment systems are unable to cope with the high volume of

water that runs through them during a storm. When this happens the runoff is diverted directly into the watershed. The runoff contains heavy metal, salts, oils and soil, sometimes in high concentrations. These types of events have been called "**shock loadings**." Shock loadings can temporarily make the water unfit for life. In many communities, beaches are closed to recreational activities immediately after a rainstorm. The runoff from the storm carries too much pollution into the water for it to be safe to swim.

What can we do? Point source water pollution is under strict regulations, so we are already helping the environment by restricting how industries pollute water environments. We cannot entirely eliminate pollution from industries because we need them to support our way of life. But we can still develop new and better methods of reducing industry's waste.

There are many things that we can do to help reduce non-point source water pollution. As people participate in a variety of activities, they contribute little bits of non-point source pollution. Each person or activity is not contributing dangerous levels, but all of the little bits added together can be damaging to the environment, wildlife and people. The key to lessening non-point source pollution is education. If everyone understands how their activities contribute to pollution, maybe they can make small changes in their activities that will help reduce their own pollution contribution. Examples include using environmentally friendly fertilizer on their lawn and reducing the amount of oil they spill when working on their cars by laying down a cloth to catch oil drippings and then recycling the old oil by taking it to a nearby oil change business.

Towns and cities can reduce the amount of non-point source pollution by increasing the frequency of street cleaning, encouraging people to take mass transit, enforcing stricter regulations concerning construction site runoff and use of fertilizers and pesticides. Towns and cities review potential pollution sources in their area and generate Best Management Practices (BMP's) to deal with them. Examples of BMP's include planting **buffer zones** of vegetation in certain areas. The buffer zones absorb runoff and allow it to be slowly emitted after the rainstorm, preventing some of the shock loading of watersheds.

Point source and non-point source water pollution can be reduced if people and community leaders have the information they need. Taking care of the water in our watersheds is a responsibility we all must share. We are all a part of the problem and we can all be a part of the solution.

Point Source and Non-point Source Water Pollution
This table includes common types and sources of point source (ps) and non-point source (nps) water pollution. Also included is information about how the pollution enters the watershed (runoff, ground water, or direct) and what some **Best Management Practices (BMP's)** are that may help reduce the amount or effect of the pollution from these sources.

Type of pollution	Point (ps) or non-point (nps)	Source	Best Management Plans (BMP)
salts	nps	salting icy roads	careful use
pesticides, fertilizers	nps	lawn care	careful use
pesticides and fertilizers	nps	golf courses	careful use
pesticides	nps	agriculture pesticides	buffer zone or collection pool
oils, gasoline	nps	recreational activities	careful use
oils, gasoline	nps	long commutes/ excess driving	carpooling, mass transit
oils, gasoline	nps	car maintenance	careful use
oils, gasoline	nps	paved roads	porous roads
nutrients and bacteria	nps	agriculture fertilizers/manure	buffer zone or collection pool
nutrients and bacteria	nps	septic systems	better containment

hazardous chemicals	nps	households	careful use
eroded soil, heavy metals	nps	mining	better containment
eroded soil	nps	construction runoff	better containment
chlorine, heavy metals	ps	Industrial facilities	careful use
chlorine	ps	sewage treatment plants	careful use

Procedures

Materials

- Watering can or squirt bottle
- Water
- Food coloring
- Measuring spoons
- Clay (non-hardening)
- Clear plastic/aluminum foil trays (tops to seedling trays work well)
- Wax paper
- Vegetable oil
- A variety of spices
- Carpet or sponges cut up into small piece

Procedure

1. How is the land around rivers developed by people? Ask the students to list some different ways that people use rivers and the land around rivers. Use a local example if your town or city is located on or near a large river.

2. Divide the students up into groups of four to six students each and introduce the activity to the students. Each group represents a new community along a river. They will plan and build a model of their community, which will be reviewed and tested in a certain way (revealing the rainwater test too early might reduce the impact of the lesson).

3. Have each group create a drawing for their new community. Guidelines for the plan:
   a) Streams should be included in the landscape. There should be several streams flowing from the land portions of the model into the river.
   b) The community can have homes, shopping areas, factories, mines, lumber companies, hotels, recreational facilities, natural areas, public parks, whatever the students think the community would need to be a place where people would want to live.

4. Each group should create a model of their community with clay on a clear plastic tray with raised sides.
   a) A piece of wax paper should be placed on the bottom of the tray to make clean up easier.
   b) Clay represents the land and should be placed in the model accordingly. A thin layer of clay can be placed in sections in the model to represent the land between the streams and river. Clay should not be placed where the river and streams will flow.
   c) The river and land should end two inches from the end of the tray. This is the ocean or lake that the river flows into.
   d) Students can create small models of the buildings or plant life of their community with clay or other waterproof materials.

5. Once all of the groups have finished their models, discuss the terms point source water pollution, non-point source water pollution, and runoff with the students (refer to the lesson's background section if needed). Explain to the students that they will be testing to see how much pollution the community they designed might be producing.

6. One group at a time, prepare and test the student's models.

a) The teacher will place small amounts of "pollution" on developed areas of the models according to a key you create. An example key would use spices (pepper, paprika, etc.) to represent point source pollution, and vegetable oil to represent non-point source pollution. The amount of "pollution" should be correlated to the size of the source of pollution. Example: a small factory would get 1/8 teaspoon of pepper and a large factory would get 1/2 teaspoon of pepper sprinkled over it; a lawn would get a half drop of vegetable oil and a golf course or farm field would get two drops.
b) The teacher can place pieces of carpet or sponge in areas that represent natural places (parks, fields, forests, marshes, etc.) or in a water treatment plant if the students included one (if possible do not introduce the idea of a water treatment plant until a second run through of the activity)
c) Create a slight slope to the model by placing a book or other object under one end. The flow of the river in the model should be towards the "lake" or "ocean" portion of the model where there is a two inch open space.
d) Make it rain on the model with water from a small watering can or spray bottle (put blue food coloring in the water for affect): use the same amount of water for each group's model, such as 250 ml. The runoff from the rain should flow into the streams and river and collect in the "lake" or "ocean"
e) The students should determine what pollution entered the runoff?; how much runoff and pollution the carpet (natural areas) held onto; how they could improve their model to help with the pollution
f) Follow the same procedure with each group

7. If time permits, conduct a second trial of the experiment. This time with improvements to the models
   a) Have the groups modify their models in ways that will lower the amount and impact of their pollution
   b) They can include water treatment plants, buffer zones of vegetation, collection pools, etc.
   c) A chart can be created that shows the differences between the results of trial 1 and trial 2.

Follow-up Questions

- What can we do to help? Have the students list things that they can do to lower the amount of pollution they create in their daily activities.

Assessment

Assessment #1:
Have each student write a Best Management Practices (BMP's) plan for the community they created in the activity. If they made revisions to their models for a second test, then have them report on those changes and the results as well. The BMP's should include the types of management practices they have chosen (minimum of 3), what type of pollution these practices target, whether the pollution is point source or non-point source, and how the management practices will lessen the amount or impact of the pollution.

Scoring rubric out of 100 Points

Complete a Best Management Practice:	20 points
Describe at least three management practices they have chosen:	20 points
Describe the target pollution for each management practices:	20 points
Identify each pollution type as point source or non-point source:	20 points
Explain how the management practices will lessen the impact of the pollution:	20 points

Assessment #2:
Provide each student a Point and Non-point Source Pollution Worksheet. They will look at a picture and choose 5 different sources of pollution. Students will then identify each circled source as either a point or non-point source pollution as well as provide possible solutions to eliminate or reduce the source of pollution.

Scoring rubric out of 100 points

Student circles five different pollution sources found in the picture:	5 points each (total 25 points)
Students correctly identifies each pollution circled as either point or nonpoint pollution source:	5 points each (total 25 points)

Student suggests possible solution for each pollution problem: 10 points each (50 points total)

Assessment #3:
Have each student or small teams of students 1) collect at least 5 pieces litter from the school grounds or from home (using gloves and avoiding dangerous objects); 2) glue each collected item to a piece of poster board, leaving space for a slogan; 3) develop an "Environmental Slogan" about preventing non-point source pollutants by preventing litter and add this message to their poster; and 4) share their posters with the class and then display them around the school, in church, or in the community.

Scoring rubric out of 100 points

Collection of at least 5 pieces of litter:	20 points
Litter securely attached on poster board:	20 points
Environmental Slogan:	30 points
Presentation of poster:	30 points

Assessment #4
Have each student complete the attached Pollution Solution Worksheet. For each pollution example, students will determine whether it is point or non-point pollution and then figure out a solution. Next they will determine if a pollution statement is true or false. When false, they will rewrite the statement to read true. Lastly, they have the option of extra credit for as many pollution sources they can come up with, one for each letter of the alphabet.

Scoring rubric out of 100 points

Identification of each pollution source as point or nonpoint: 2 points each (30 total)
Suggest possible solution for each pollution problem: 3 points each (45 total)
Determine which statements are true or false and correct false statements: 5 points each (25 total)

Extra Credit: 1 point for each letter (25 total)

Cross-Curricular Extensions

STEM Extension
Have students do a schoolyard clean up and then add the data to the Aquarium's Litter Legacy Journal (South Carolina Citizen Science App). Have them figure out what can be done to decrease the litter.

Social Studies Extension
Have students research a pollution event that occurred in South Carolina. For example, occasionally aquatic birds have washed up on the Atlantic coast covered in oil. Students can research where and when spills have occurred and what measures were taken to clean up the spill and prevent future spills.

Social Studies Extension
During a visit to the South Carolina Aquarium, have students find exhibits that depict different human uses of aquatic habitats. The students can record their findings in a journal as they walk around the Aquarium. Examples of Aquarium exhibits that depict human uses of aquatic habitats include the Piedmont Reservoir (hydroelectric plants), Freshwater Marsh (rice fields) and Blackfish Banks (artificial reefs).

Social Studies Extension
Students can participate in a town council meeting simulation about a proposal to build a stock car racetrack a few miles upstream from a National Park. National Parks are often home to threatened or endangered species and a source of pollution a few miles away could threaten the health of the ecosystem in the National Park. Students can fill the roles of the developers, town council members, racecar team owners and drivers, racecar event fans, environmentalists, and local citizens. The students should write a few sentences

that they will read during the meeting. The students that are the council members must come up with a decision that best reflects the needs and desires of the community.

Physical Education Extension by South Carolina Aquarium master teacher, Missy Vogt.

Resources

Teacher Reference Books

Audubon magazine, published by the National Audubon Society.
This bi-monthly magazine has articles on wildlife all over the world and the conservation issues affecting them.

Carson, Rachel. *Silent Spring*, Houghton Mifflin Co., 1993.
This book, first published in 1962, was a powerful look at how pesticides have affected the natural world. It led to the banning of DDT and helped start the environmental movement.

Duany, Andres, Elizabeth Plater-Zyberk and Jeff Speck. *Suburban Nation: The Rise of Sprawl and the Decline of the American Dream,* North Point Press, New York, 2000.
A look at the issues around and consequences of America's current system of urban development.

Leopold, Aldo. *A Sand County Almanac,* Oxford University Press, New York, 1949.
This classic of nature writing was one of the first texts to examine the ethical reasons of why humans need to preserve wild places.

Ricklefs, Robert E. and Gary L. Miller. *Ecology*, W.H. Freeman Company, 1999.
This college textbook is a great resource for finding out how wildlife communities interact with each other as well as the abiotic factors of their environment, and what human influences can be on these communities.

Teacher Reference Websites

Chesapeake Bay Foundation Environmental Education
www.cbf.org/
The Chesapeake Bay Foundation has put together an exemplary watershed protection program that encompasses many states. This site includes information on what they have done in this program as well as curricula and other education related items.

South Carolina Department of Health and Environmental Control (DHEC): Bureau of Water
www.scdhec.net/water
This site offers information on drinking water, water pollution control, watersheds plus much more.

Southern Appalachian Watershed Conservation Clearinghouse
http://sunsite.utk.edu/samab/proj/watershed.html
This site offers links to a number of websites related to watershed conservation in the Southeastern United States.

Surf Your Watershed: A Service to Help You Locate, Use, and Share Environmental Information about your Place
www.epa.gov/surf
This site allows you to learn specific information related to the watershed your town is located in.

Student Reference Books

Bruning, Nancy. *Cities Against Nature,* Childrens Press, Chicago, 1992.
A student's look at how urban development affects wildlife communities.

Cone, Molly. *Come Back, Salmon,* Sierra Club Books for Children, San Francisco, 1992.
Learn how the students of Jackson Elementary School in Everett, Washington, cleaned a nearby stream, stocked it with salmon and protected it from pollution.

Herda, D.J. *Environmental America: The Southeastern States,* The Millbrook Press, Brookfield, CT, 1991.
A student's look at the environmental issues affecting the Southeastern United States.

Liptak, Karen. *Saving Our Wetlands and Their Wildlife,* Franklin Watts, New York, 1991.
This book describes the different types of wetlands and the wildlife found there. It also includes ideas for protecting the wetland habitats.

Mattson, Mark. *Scholastic Environmental Atlas of the United States*, Scholastic Inc., 1993.
This excellent reference book is filled with maps and charts that help kids to understand different aspects of environmental issues such as overpopulation and waste disposal.

McVey, Vicki. *The Sierra Club Kid's Guide to Planet Care & Repair,* Sierra Club Books for Children, San Francisco, 1993.
Learn how activities we do every day affect the environment. Includes tips for improving our environment as well as classroom activities for students.

Student Fiction Books
These books may be too elementary for middle school students, but they are beautiful books that can be appreciated by everybody, accept, maybe, pre-teens

Cherry, Lynne. *The Great Kapok Tree,* Harcourt Brace Jovanovich, Publishers, New York, 1990.
A man getting ready to chop down a tree in the Amazon rainforest falls asleep and is visited by many different members of the rainforest wildlife community who tell him why they do not want the tree to be cut down.

Cherry, Lynne. *A River Ran Wild,* Harcourt Brace Jovanovich, Publishers, New York, 1992.
A beautifully illustrated story of how a river in New England has changed during the last 400 years as more people moved to live on its banks.

Jeffers, Susan. *Brother Eagle, Sister Sky: A Message From Chief Seattle*, Dial Books, New York, 1991.
A beautifully illustrated book of the ecological message of Chief Seattle, an Indian chief who lived in the Pacific Northwest from 1790 to 1866.

Curricula

Aquatic Project WILD
Aquatic Project WILD is an interdisciplinary curriculum for K-12 teachers on aquatic wildlife and ecosystems. The activities cover a broad range of environmental and conservation topics.
For more information click on http://www.projectwild.org/ProjectWILDK-12AquaticcurriculumandActivityGuide.htm

The GLOBE Program
Global Learning and Observations to Benefit the Environment (GLOBE) is a hands-on international environmental science and education program. GLOBE links students, teachers, and the scientific research community in an effort to learn more about the environment through student data collection and observation. To learn more about the GLOBE program visit their website at www.globe.gov.

Project WILD
Project WILD is an interdisciplinary curriculum for K-12 teachers on a broad range of environmental and conservation topics.
For more information click on: http://www.projectwild.org/

5-8 Pollution Activity

Project WET
Project WET is an interdisciplinary curriculum for K-12 teachers on water. The activities cover a wide range of water-related topics. For more information visit the website at http://www.projectwet.org/

SC MAPS
SC MAPS is a standards-based interdisciplinary curriculum for middle school teachers that focus on the geology of the regions of South Carolina using aerial photographs, images and topographic maps. Great source for good maps!
For more information visit the website at http://www.cas.sc.edu/cege/resources/scmaps/scmaps.html