Grade 8
Science
Unit 8: Pollution and Its Effects

Time Frame: Approximately three weeks

Unit Description

This unit focuses on human activities that affect Earth’s systems and resources, such as point source and non-point source pollution. The importance of clean water and factors that would be considered methods of protecting water resources are also addressed in this unit.

Student Understandings

Students will be able to describe the effects of soil composition on plant growth. The students will understand that natural and human-induced pollution serves as a major threat to our water and air. Local issues provide motivation for an investigation of pollutants, and students will learn to focus on issues related to the quality of life, and the degradation of habitats.

Guiding Questions

1. Can students describe the importance of soil compatibility and plant type as it relates to Louisiana crops and vegetation?
2. Can students identify point and non-point sources of pollution?
3. Can students distinguish among several effects of water erosion and preventative measures?
4. Can students articulate the importance of conserving water?
5. Can students analyze the effects of human activities on the environment?

Unit 8 Grade-Level Expectations (GLEs)

<table>
<thead>
<tr>
<th>GLE #</th>
<th>GLE Text and Benchmarks</th>
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<tbody>
<tr>
<td>SI-M-A1</td>
<td><em>The following Science as Inquiry SI GLEs are embedded in the suggested activities for this unit. Additional activities incorporated by teachers may result in additional SI GLEs being addressed during instruction on the Pollution and Its Effects unit.</em> Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)</td>
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<td>GLE #</td>
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<tr>
<td>2.</td>
<td>Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)</td>
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<td>3.</td>
<td>Use a variety of sources to answer questions (SI-M-A1)</td>
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<td>4.</td>
<td>Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)</td>
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<td>5.</td>
<td>Identify independent variables, dependent variables, and variables that should be controlled in designing an experiment (SI-M-A2)</td>
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<td>6.</td>
<td>Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)</td>
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<td>7.</td>
<td>Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)</td>
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<td>8.</td>
<td>Use consistency and precision in data collection, analysis, and reporting (SI-M-A3)</td>
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<td>11.</td>
<td>Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)</td>
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<td>12.</td>
<td>Use data and information gathered to develop an explanation of experimental results (SI-M-A4)</td>
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<td>13.</td>
<td>Identify patterns in data to explain natural events (SI-M-A4)</td>
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<td>14.</td>
<td>Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)</td>
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<td>15.</td>
<td>Identify and explain the limitations of models used to represent the natural world (SI-M-A5)</td>
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<td>19.</td>
<td>Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)</td>
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<td>20.</td>
<td>Write clear, step-by-step instructions that others can follow to carry out procedures or conduct investigations (SI-M-A7)</td>
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<td>22.</td>
<td>Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)</td>
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<td>25.</td>
<td>Compare and critique scientific investigations (SI-M-B1)</td>
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<td>26.</td>
<td>Use and describe alternate methods for investigating different types of testable questions (SI-M-B1)</td>
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<td>27.</td>
<td>Recognize that science uses processes that involve a logical and empirical, but flexible, approach to problem solving (SI-M-B1)</td>
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<td>33.</td>
<td>Evaluate models, identify problems in design, and make recommendations for improvement (SI-M-B4)</td>
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<td>34.</td>
<td>Recognize the importance of communication among scientists about investigations in progress and the work of others (SI-M-B5)</td>
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<td>35.</td>
<td>Explain how skepticism about accepted scientific explanations (i.e., hypotheses and theories) leads to new understanding (SI-M-B5)</td>
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<td>37.</td>
<td>Critique and analyze their own inquiries and the inquiries of others (SI-M-B5)</td>
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<td>38.</td>
<td>Explain that, through the use of scientific processes and knowledge, people can solve problems, make decisions, and form new ideas (SI-M-B6)</td>
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<td>39.</td>
<td>Identify areas in which technology has changed human lives (e.g., transportation, communication, geographic information systems, DNA fingerprinting) (SI-M-B7)</td>
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<tr>
<td>40.</td>
<td>Evaluate the impact of research on scientific thought, society, and the environment (SI-M-B7)</td>
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### Science and the Environment

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<tr>
<th>GLE</th>
<th>Description</th>
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<tr>
<td>50.</td>
<td>Illustrate possible point and non-point source contributions to pollution and natural or human-induced pathways of a pollutant in an ecosystem (SE-M-A3)</td>
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<tr>
<td>51.</td>
<td>Analyze the consequences of human activities on global Earth systems (SE-M-A4)</td>
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<td>52.</td>
<td>Describe the relationship between plant type and soil compatibility (SE-M-A9)</td>
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<td>53.</td>
<td>Distinguish among several examples of erosion (e.g., stream bank, topsoil, coastal) and describe common preventive measures (SE-M-A10)</td>
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For this unit, have students maintain a science learning log (view literacy strategy descriptions). Explain that explorers, scientists, and mathematicians have always kept logs of their observations, thoughts, new understandings, hypotheses, and reflections. In this way, they could record progress, test new ideas, and document what they learned. Similarly, with their science learning logs for this unit, students will record new understandings, explain scientific processes, pose and solve problems, make and check predictions, and reflect on what has been learned.

**Sample Activities**

**Activity 1: Soil Sleuths (SI GLEs: 1, 4, 5, 6, 8, 37, 38, 39, 40; SE GLE: 52)**

Materials List: science learning logs, Internet access for students, chart paper or poster board, pH indicators (hydronium paper or probes), school campus map for students and enlarged map for whole-class viewing, optional – state and national wall maps

For this activity it may be advantageous to have a variety of plants on display in the room, e.g., a succulent or cactus, an African violet, some ivy, and/or a planter of herbs.

Part A:
Some areas are known for particular types of vegetables and crops. Ask students if they have heard Kentucky referred to as the bluegrass state or if they have heard people talk about vadalia onions. See if they know why the red peppers from Avery Island are so unique that today people from all over buy souvenir items that show Tabasco® when they come to Louisiana. (Many students may not know that while the seeds are started in Louisiana the plants are actually shipped to Latin America where they are grown and picked.) A special condition/variable for each of these and other locations is the soil.
Continue the class discussion asking students to name the vegetable crops and agricultural products grown in Louisiana. Offer hints to secure responses that include sugar cane, cotton, rice, soybean, peppers, pine forests, pecans, etc. Using the student responses, create a list for the class to view. Once the list is generated, turn their attention to focus on where these plants are generally grown in the state. As the geographic locations are given, write them besides the appropriate plant(s). Continue the questioning, asking why the different types of plants and trees are found in different locations. Ask why, since the climate generally is the same in Louisiana, we do not find cypress tupelo trees right alongside longleaf pines or next to pecan trees. If a map of the US is available, have students identify the types of plants found in locations along the same line of latitude in states to the east and west. Ask them to propose why the flora is so different in the various locations. Use the plants on display to bring the differences in soils to focus. The soil that is best for the African violet is nothing like the soil that is preferred by cacti.

Many types of soil exist in Louisiana. They are transported (alluvial and aeolian) rather than residual soils. Understanding the characteristics of these soil types is not only vital to the agricultural and forestry industries, but also to the home gardener and to efforts to save the wetlands. Most shrubs, garden vegetables, crops, and trees prefer slightly acidic to very acidic soils; there are common varieties that grow best in alkaline soils.

Distribute copies of the Nature Conservancy page Places We Protect in Louisiana [http://www.nature.org/wherewework/northamerica/states/louisiana/preserves/] and the Louisiana Soils page from the LSU Ag Center publication Understanding Louisiana Soils [http://www.lsuagcenter.com/NR/rdonlyres/DB1BE3F5-C7F6-444B-83E7-079302758610/43127/pub3034UnderstandingLouisianaSoilsHIGHRES.pdf]. Students may also use the Louisiana Online Soil Manuscripts and click on General Soil Map for their parish ([http://soils.usda.gov/survey/online_surveys/louisiana/]) to identify the soil in their area. However, the soil surveys for several major parishes like Calcasieu, East Baton Rouge, Lafayette, Jefferson, and Orleans are not online. Hard copies may be found at local libraries or by contacting the US Department of Agriculture. Additional soil area maps can be located in Louisiana atlases and on websites.

Divide the students into cooperative groups to complete this investigation. To provide an awareness and understanding of soil as a critical resource with unique properties, the students will investigate both the historical vegetation and the economic crops being grown in various locations at this time. Assign each student group one of the physiographic regions of the state or other section as identified in the resources. In their science learning logs (view literacy strategy descriptions), have students suggest a list of plants and trees they believe will easily be grown in the area. Using all available resources, students should study the region they were assigned to find information on native plants and changes that occurred when the region was settled. Students should record their research in their learning log. Particularly important will be identifying how land use changed with population growth and economic development in our state.
The information collected should include the properties of the soil that make it compatible for the vegetation found in the area as the state was settled and for the crops that are cultivated in the area now. Students should also review the data on the effects of the local crop choices as they relate to the soil’s natural nutrients and determine the importance of this information. They should compare the predictions they made to the list of plants actually found in the area. Students will often predict the plants in their area will be found everywhere in the state and are surprised when they realize that sugar cane is not a crop grown in Ruston.

Student class presentations should be made providing a journey around the state. The wrap-up should include a discussion that addresses the different variable factors that influence the composition of local soils.

Part B
Separate the school campus into sections for teacher selected student observation and testing. Provide students with a map of the school campus divided into these sections. Take a walk around the campus with students and provide each group with a test site. The students will determine the soil’s pH in their section, using available pH indicators, record the slope of the land and direction water might run off, and record the amount of sunlight and weather exposure at various times of the day in their science learning logs. Review Unit 4 for how to test for soil pH. Back in the classroom, all student groups will record their observations on the enlarged school campus map. Post this information in the classroom for whole-class viewing.

Using the information on local soils presented in Part A and the pH information collected above, students will design and present a proposal for a school garden on chart paper. The proposal should be done to scale and include the type of garden, types of plants and preferred soil pH, current soil pH, physical design and layout of the garden, as well as the school campus location. The proposal should include the number of each type of plant and other equipment required. The physical design, layout of the garden, and school campus location must all be accompanied by an explanation with data for support.

In determining what types of plants to include in their garden plan, students will need to determine if the plants are compatible with the local soil type and other surface conditions noted during their onsite inspection. Information on the pH Preference of Plants can be found at [http://www.colostate.edu/Depts/CoopExt/TRA/PLANTS/acidlove.html](http://www.colostate.edu/Depts/CoopExt/TRA/PLANTS/acidlove.html). They can use The Savvy Gardener website (http://www.savvygardener.com/Features/soil_pH.html) to suggest how to alter the soil pH if needed. After determining if their plants and soil are compatible, they will research the plant to find out the amount of sunlight their plants need. Some students will need to rethink their design, location, and/or plants after their initial investigation. Remind them that scientists use the same scientific processes and knowledge to solve problems, make decisions, and form new ideas.

As an option, host a competition (grade, class, etc.) to plant a school garden; the winning team’s proposal will be the “contractors” for the project. See Resources for information...
Activity 2: Where Does Water Run? (SI GLEs: 2, 8, 11, 27; SE GLE: 50, 51)

Materials List: maps of school grounds or local area with street names (city planning map), markers, trundle wheel (or other distance-measuring device such as a tape measure), calculators, Internet access, science learning logs, teacher selected resources (see part A), optional guest speaker

Part A: To introduce the concept of water pollution, ask students to imagine what life would be like without clean air. What would life be like without clean water? Students should work in groups of two or three to generate a list of things or actions that might contaminate, or make unsafe, the air we breathe and the water we use to drink, cook, and bathe. They should note the ideas in their science learning logs. A group spokesperson should present each set of ideas to the class. Have a student create a master list of suggestions as the group reports are shared that will be visible to the entire class.

Continue the discussion asking students How many remember seeing brown rings of water (terrestrial runoff) or lines of leaves and sticks around the school along the sidewalk or across their lawns after storms and hurricanes? Have they noticed grease spots on the driveways in their neighborhood or in parking lots at shopping centers? Where are storm drains on their street? Have any seen the drains or drainage ditches clogged with tree branches and other debris? Why should we be concerned about storm-water runoff? Where does the runoff that enters the storm drains go?

Stress to students that the runoff will contain what is termed non-point source pollution as opposed to point source pollution. Non-point source pollution originates at one site and is carried by water to another site, making the source difficult to determine in many cases. Point-source pollution occurs at one site, and the source is usually easily identified. Discuss agricultural sources of pollutants, such as fertilizers, manure, pesticides, etc. These contaminants can reach the river either via groundwater or through drainage ditches. Remind students that the drink cups and popcorn bags dropped on the ground during an outdoor sporting event have chemicals; so during rainstorms, not only are the packaging materials moved by the running water the butter, sugar and other ingredients that dissolve in water enter the runoff stream. As a class, prepare a list of examples of both point and non-point pollutants.

Pass out the maps of the school grounds or other study site to each group. Identify what area is pictured and discuss the map’s features with the students. Have the students identify whether the area is predominantly residential, industrial, commercial, or mixed use. Using the definition of non-point source pollutants, allow the students time to explore all the possible pollution sources in the area and indicate each on the map with a colored dot. Students will create a “key” for their map by choosing a different color to represent the type of non-point source pollutants that is contributing to the storm water runoff in that area. The students will then consider the physical layout (topography) of the area.
the area and discuss what runoff will enter the different storm drains. Discuss where the runoff from the drains goes. If different sections of a city map are provided to small groups of students, a large complete map could be prepared for display on the class wall. Have the students prepare an informational handout that can be used to describe the problem of local non-point source pollutants.

Part B: To reinforce what the students have learned in the classroom, select a study site near the school building to determine the effects of non-point source pollutants. (If an area is not available on urban school grounds, the teacher could seek nearby community or business support, such as a site at an urban park or on church grounds. This is an excellent opportunity to have public involvement.) Explain to the students that scientists conduct investigations much like they will do in this activity: the use of scientific processes and knowledge can help solve problems, assist in decision-making, and inspire new ideas. Students will take a walk through the study site chosen. In their science learning logs (view literacy strategy descriptions), they will list the storm debris they find around the storm drains and identify pollutants that might degrade the habitats and constitute a health risk for people, plants, or animals.

Back in the classroom, the students should indicate on a street map of the area the storm drains and outlets and possible sources of non-point source pollutants that might reach that drain; they should also provide an explanation of non-point source pollutants and storm-water runoff.

As a whole class, analyze the consequences of human activities, not only on the local community, but also on global Earth systems. Review the questions previously discussed in Part A. Students should compare their previous understandings in Part A with what they investigated in Part B. Display the maps around the school campus and at local areas in the community. Students can also write an article to the local newspaper along with any pictures taken from the study site.

Following the investigation, students should write their answers to the following questions in their science learning logs.

- What is storm water runoff?
- What types of potential pollutants does the water come in contact with?
- Where does the water go when it leaves the study site?
- What can we do to slow down and reduce storm-water runoff?
- What are storm drains and where are they found?
- What do storm drains do?

Students should generate new questions or identify problems that they would like to investigate based on their observations. Provide resources and materials for these investigations to be developed, when possible. See Resources for borrowing an Enviroscape for the classroom.

As an option, invite a guest speaker to learn how storm-water runoff is treated locally, or discover this through another field investigation.
Activity 3: Campus Pollution Patrol (SI GLEs: 3, 7, 11, 13, 19; SE GLE: 50)

Materials List: science learning logs, Pollutant Walk Word Grid BLM, graph paper, various old magazines (with pictures of pollution), scissors, poster paper

In preparation for a class walk over the school campus, the teacher should look for signs of and sources of pollution ahead of time for the success of the activity.

Part A: Students will learn important concepts about pollution and expand their reading vocabularies using a word grid (view literacy strategy descriptions). On the board or a piece of chart paper, draw a word grid like the Pollutant Walk Word Grid BLM. Model how to complete the word grid; students will complete the word grid on the walk. As they identify a source or type of pollution they should enter it in the Pollution Found column. Students will fill in the word grid by placing a “✓” in the space linking the pollution observed to the type of pollution, “point” or “non-point,” and provide evidence to defend their classification.

Review what was learned about non-point source pollutants from Activity 2. Take the students on the walk (outdoors or indoors) to look for pollution or pollutants with the Pollutant Walk Word Grid BLM. Students should classify their findings as point or non-point source pollution in their science learning logs (view literacy strategy descriptions) (some point pollutants may become non-point sources at some future time). During the walk, have the students identify pollution they can see (litter, smoke), hear (honking horns, airplanes), or smell (diesel fumes, fresh paint). Alternatively, have students find examples of pollution on land (litter), in the air (car exhausts), and in the water (pollutants that could wash into storm drains). As students spot different examples, they should explain on the Pollutant Walk Word Grid BLM why each one could be considered a pollutant.

During the walk, ask students the following questions: What kind of plants or animals (including people) could be affected by each type of pollution or pollutant seen? What might have caused each form of pollution? Could the pollution or pollutant be avoided or lessened?

Back in the classroom, student groups will compare what was found on the walk. Student groups could identify the same pollution but categorize it differently. Or after graphing, will they discuss to see why the graphs may not be the same?

Part B: Once students return to the classroom, instruct them to create a bar graph on poster paper, depicting the number of pollutants in each category (point/non-point) they identified on the outdoor or indoor walk. Students will also draw pictures of pollution they spotted on the walk and list things that might cause pollution, even odors. As an alternative, students can look through magazines for examples of the pollution found. They should try to find at least one example (sight, smell, and sound or air, land, and water). Have the students take turns placing the pictures they drew into the pollution categories. Each group will then take turns discussing the finished chart, identifying
patterns in the data that might explain natural events (for example, how a piece of litter got on the ground; how oil got on the pavement).

Part C: Students will use “quick writes” to reflect upon their learning of pollution, which forces the students to write their knowledge of content under a time constraint. The students will have two minutes to write a short essay in their science learning logs, describing the pollution they spotted on the walk and listing the things that might cause pollution, even odors. They can use their charts created in Part B as a visual reference.

Activity 4: Erosion Prevention (SI GLEs: 7, 12, 14, 15, 20, 25, 26, 33, 34, 35; SE GLEs: 53)

Materials List: stream tables or large pans; sand; silt; loam; gravel; or clay to model stream and river erosion; wood or bricks; water; pouring container; grass blades; bean plants; science learning logs; teacher-selected research materials on preventative measures for stream, river, and coastal erosion; one for each student group: poster paper, makers, colored paper, scissors, glue

Part A: River or Stream Erosion
In order to distinguish among the effects of water erosion and preventative measures against them, groups of three to four students will set up stream tables or large pans with sand, silt, loam, gravel, or clay to model stream and river erosion. For each stream and river erosion trial, all stream tables should be placed at the same inclination (using wood or bricks to raise one end of the table or pan). First, students should pour water at a constant flow to observe the rate of erosion for each material. They should record their observations in their science learning logs. After the initial test, students should use teacher selected materials to research preventative measures for erosion based on their observations. Next, independently, student groups should develop a hypothesis based on this research. Student groups should test a different type of preventative material for each trial, with the stream table placed at the same inclination for each trial. The tests might include placing a variety of plants along streams and rivers or building containment walls. Students should write step-by-step instructions of their investigation so that other students could replicate it. During the testing process, discuss the significance of erosion reduction with each preventative measure with the students. Following the experimentation, provide the groups testing the same hypothesis the opportunity to discuss their findings together; students should also develop ideas to improve their preventative measure. These combined groups should select a spokes-person and present their findings to the whole class. Conclude with, through the use of scientific processes and knowledge, people can propose solutions to problems, make decisions, and form new ideas. During the wrap-up discussion, make sure the students understand that historically the greatest area of wetland loss has been along the Mississippi River as it changed course and people removed the bottom land hardwood forests to extend the agricultural reach of farms along the river’s banks.
Part B: Coastal Erosion
Students will research processes limiting coastal erosion, using all available resources. Some suggested plans include placing a variety of plants along coastlines, shorelines, and off-shore natural and man-made barriers; building jetties; burying barges; dredging material into marshes; and restoring barrier islands. Allow student groups to select one of the coastal protection methods they found interesting during their research. Students should develop a poster displaying the preventative measure for coastal erosion which indicates the pros and cons of the action. Provide student groups with poster paper, markers, colored paper, scissors, and glue. During group presentations of the posters to the class, students observing should critique each design and make recommendations for improvement. They should record their observations and ideas in their science learning logs. Following this discussion, solicit the results and write on the board or overhead the preventative measures and the pros and cons for each. See the Resources list for information on coastal erosion and preventative measures. Student presentations should address the proposed costs for each of the erosion reduction techniques. It will be important for students to understand that it is not easy to place a value on some conditions, such as the loss of a bird rookery.

Part C: Students should understand that finding and implementing solutions to reducing coastal erosion is an enormous task. Many different federal and state agencies are involved along with citizen networks and community organizations in projects around the state. Students should discuss the concept that many ideas and models have been presented and looked upon with skepticism, especially here in Louisiana. In their research, students will find numerous models and plans for saving Louisiana’s coastline.

In the world of science, skepticism is often the reason that better alternate solutions and new understandings are reached. Furthermore, students should cite evidence that communication among scientists completing similar investigations, as well as reviewing the work of others, is of great importance to the scientific community.

Activity 5: Every Drop Counts (SI GLEs: 7, 13, 22; SE GLE: 51)

Materials List: one liter container, eye dropper or pipette, science learning logs, computer and projecting system, student computers with Internet access, aluminum pie plate

Water is necessary for all living things, but rarely do we stop and think about how much water a person uses in one day. In this activity, students will research their personal everyday water usage. After showing students a liter container as a reference point of volume, direct them to predict the amount of water they think that they use in one day. Tally the student predictions in liters. Tell students that they will be monitoring their water usage throughout the day, and that the next class day, they will calculate their total water usage. Students will then compare their predictions with the actual usage. The class will discuss possible water uses. Direct students’ thoughts toward some of the less obvious or hidden uses of water, if not named, such as industrial use for manufacturing the products they used, irrigation of the fields for the food they ate, fast food preparation,
hydroelectric use, and fire control. While they may not have actually turned the tap on to use water for these purposes, the fact is the water was part of their day.

In order to identify patterns in data to explain natural events, students should calculate their actual water usage, followed by a student discussion about the percentage of fresh, drinkable water that is present on planet Earth. With one liter representing all of Earth’s water, show students that only one drop represents all the potable water available. (For dramatic effect, one liter can be shown to the class and guesses of the amount of available fresh water can follow. An eyedropper or pipette can then show the one drop of potable water. If the class is kept quiet, dripping the one drop of water into an aluminum pie plate makes a striking sound.)

Refer students to what was learned from Activities 2 and 3. Discuss the variety of pollution sources. Students should include examples from recreational, commercial, construction, agricultural, municipal, and residential areas. Next, students will research water conservation practices using the following websites: Water Education Foundation (http://www.water-ed.org/kids.asp), Clean Water Program (http://www.oceansidecleanwaterprogram.org/kids.asp), and Water Conservation Tips (http://www.penlight.org/pages/water/water_cnsrvtntips.html). The variety of pollution sources need to be brought into focus with the students.

After viewing the information, students need to be able to discuss the following questions:

- How do people use water?
- How do people pollute water?
- What would happen if we didn’t have enough clean water to drink and for other uses?
- What can we do to protect the Earth’s supply of usable water?

Students should respond in writing in their science learning logs (view literacy strategy descriptions) to the following questions:

- What would happen if greater and greater volumes of our drinkable water became polluted?
- What are some things that I can do to personally conserve the amount of water I use?

As an option, the video “Source of Life: Water in Our Environment” is available from the LPB Cyberchannel (www.lpb.org/cyberchannel) if the school participates in this service. Find out as a class how conserving water can positively impact the environment by watching this video.
Activity 6: Can We Fix It? (SI GLEs: 2, 3, 19, 38, 39, 40; SE GLE: 51)

Materials List: Likert Scale Example BLM, Human Impacts/Activities Rubric BLM, Human Impacts/Activities Links BLM, Internet access, all available research materials including teacher-selected resources, access to a printer for publication of a newsletter

With the students, prepare a list of potential environmental problems found in Louisiana. Some suggested topics are the following:

- Agricultural runoff into streams and rivers
- Fertilizer runoff into streams and rivers from golf courses, and subdivisions
- Clear-cutting timber in forested areas
- Saltwater intrusion into a nearby cypress swamp
- Increasing dependency upon petroleum products
- Habitat destruction
- Rapid removal of water from state aquifers

Pass out and review the Human Impacts/Activities Rubric BLM so that students understand the scoring criteria for this activity. Allow student groups to select a potential problem or assign a problem to each group. Students will research their potential water resource problem to identify solutions and find statistics to support the reduction of the stress caused on Earth systems. They should use the Human Impacts/Activities Links BLM and the Internet and/or teacher selected research resources. Using the information collected, students will produce a two-page public service newsletter that outlines the problem, poses questions, relates research, and gives possible solutions. Students should also discuss what new “problems” their possible solutions could cause to the environment.

In groups of four, students will use the following steps to guide them through the completion of this activity.

1. As a group, designate what roles each team member will fill: researcher, graphic designer, writer, editor/proof reader. The teacher should receive a list of the position information for each group.
2. Once those roles are filled,
   - the researcher will investigate the topic
   - the graphic designer will search for pictures, create illustrations, and find images for the public service newsletter
   - the writer and editor will prepare a masthead for the newsletter
3. After the research, group members will reconvene to share and update the information about their topic and layout plans for their newsletter.
4. Student writers will use the information to develop the text while the graphics person will share possible images to illustrate the information to be shared.
5. Student editors will proof and finalize the newsletter.
6. All members of the group will need to review the Human Impacts/Activities Rubric BLM to verify that all required details have been addressed.
Copy the newsletters from each group for distribution to the class. Students will read each of the newsletters and decide whether the problems can be easily corrected and quick solutions found. The students will rate decisions on a Likert Scale from 1 to 4 (1-strongly agree, 4-strongly disagree). The Likert Scale Example BLM is an idea of how to set up a Likert Scale. The students must be prepared to defend their decisions on the issue.

**Sample Assessments**

**General Guidelines**

Assessment will be based on teacher observation/checklist notes of student participation in unit activities, the extent of successful accomplishment of tasks, and the degree of accuracy of oral and written descriptions/responses. Science *learning log* entries provide reflective assessment of class discussions and laboratory experiences. Performance-based assessment should be used to evaluate inquiry and laboratory technique skills. All student-generated work, such as drawings, data-collection charts, models, etc., may be incorporated into a portfolio assessment system.

- Students should be monitored throughout the work on all activities via teacher observation of their work and lab notebook entries
- All student-developed products should be evaluated as the unit continues.
- Student investigations should be evaluated with a rubric.
- For some multiple-choice items on written tests, ask students to write a justification for their chosen response.

**General Assessments**

- The student will contrast point and non-point source pollution when given examples of each type.
- The student will explain how pollutants can contaminate multiple resources such as air and land or land and water?
- The student will identify pollutants that might constitute a health risk for people, plants, or animals.
- The student will identify several ways humans have changed the environment in a local area and describe changes that were good and changes that were not so good.
- The student will visit areas of erosion on the school campus such as sidewalks, gutter downspouts, drainage ditches, or areas of runoff and suggest ways to prevent or combat it.
- The student will write a description of how to model coastal erosion after modeling stream and river erosion.
- Collect and check students’ science *learning logs* for data accuracy and reasoning.
• The student will record in laboratory notebooks and determine their own water usage and reduction plans.

Activity-Specific Assessments

• **Activity 3:** Collect pictures of potential pollution sources (e.g., fertilizing a lawn, plastic six-pack holders, motor oil being pour into a drain or on the ground, cars on the highway, person walking a dog, person listening to a portable stereo). Make transparencies of the pictures. The student will explain how the object in the picture might generate pollution and suggest ways to prevent or reduce it.

• **Activity 4:** A common “solution” to coastal erosion is to build a wall known as a jetty between the private dry land and the public beach. Direct students to write an essay explaining why they support or reject this approach and what arguments might be offered by someone with a view that opposes their own.

• **Activity 5:** The students will design a newsletter that could be distributed to the citizens of a local community, suggesting methods of addressing water problems and conservation.

**Resources**


• *Rising Seas, Coastal Erosion, and Takings Clause:* [http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterPublicationsSLRTakings.html]

• *Every Drop Counts. Project Learning Tree.* American Forest Foundation.

• *Agriculture and Pollution* [http://www.ehso.com/ehshome/agriculture.htm]

• *Pollution from Agriculture* [http://www.naturegrid.org.uk/rivers/gt%20stour%20case%20study-pages/plln-frm.html]

• *GEMS Environmental Detectives.*


• *You are the Solution:* [http://protectingwater.com].

• *Polluted Runoff – non point solution:* [http://www.epa.gov/owow/nps]


• *Project WET, K-12 Curriculum & Activity Guide& Activity Guide.*
• Where Does Water Run Off After School? Project Wild Aquatic. Western Regional Environmental Education Council.
• “Water: From Earth for You,” “Erosion: On the Move, Erosion: On The Move...Defending The Coast Against Wave Attack,” “Water; Water Everywhere, and Not a Drop to Drink or Can You Survive a Flood” (all available online at http://www.lpb.org/education/classroom/itv/envirotacklebox/
• Human Impact on the Natural Environment.
  http://www.hobart.k12.in.us/jkousen/Biology/impact.html
• What’s up Hot Topics in the Environment
  http://www.thirteen.org/edonline/wue/hot_topics.html
• What’s up in the Environment Class projects
  http://www.thirteen.org/edonline/wue/class_projects.html#projects
• Nature.org
  http://www.nature.org/wherewework/northamerica/states/louisiana/preserves/
• Agclassroom http://www.agclassroom.org/kids/stats/louisiana.pdf;
• Understanding Louisiana Soils
  http://www.lsuagcenter.com/NR/rdonlyres/DB1BE3F5-C7F6-444B-83E7-079302758610/43127/pub3034UnderstandingLouisianaSoilsHIGHRES.pdf
• USDA online soil surveys
  http://soils.usda.gov/survey/online_surveys/louisiana/index.html
• School Garden Wizard http://www.schoolgardenwizard.org/
• Improve Your Garden Soil http://www.improve-your-garden-soil.com/soil-classification.html
• Information on agriculture and industry in Louisiana
  http://www.theus50.com/louisiana/information.shtml