- The mathematics of water conservation can help show students the importance of not wasting this critical natural resource. A typical shower uses about seven gallons of water per minute, while about two gallons of water flows from the tap when the water is left running while brushing one's teeth. Have students calculate the amount of water they use while taking a shower and then determine how much water would be conserved by shortening their shower by two minutes. Extend this activity by asking students how much water they would save over a week, a month and a year, and then have them calculate the weekly, monthly and annual water savings for a group of people (e.g., the class, the entire school, their town, etc.). Students can perform a similar analysis to determine the amount of water saved by turning the water off while brushing one's teeth.
- One of the characteristics of a desert ecosystem is that it receives less than 25 centimeters (ten inches) of rain annually. While rain is welcome in the desert, sometimes just ¼ inch of rainfall in a short period of time can cause flooding. Ask students to research "desert flooding" in a city like Las Vegas, Nevada, and then create a pamphlet that explains how such a small amount of rainfall can result in a potentially dangerous situation. Also include steps that residents can take to protect themselves when flooding occurs.
- World Water Day is an annual international observance that was designated by the United Nations General Assembly. It is celebrated on March 22nd and its theme changes each year. Past themes have included "Water and Culture," "Water and Disasters" and "Water for the Future." Celebrate World Water Day by having students plan and host a school-wide event that reflects the current theme of World Water Day. It can be a series of informative posters and presentations, an educational skit or even an interactive exhibit with student tour guides. Visit **www.unwater.org** for more information.

Suggested Internet Resources

Periodically, Internet Resources are updated on our website at www.LibraryVideo.com.

- **www.enviroliteracy.org/article.php/2.html**
  This website from the Environmental Literacy Council explains the pH scale and its connection to acid rain. Click the "Acid Rain" link under "Related Pages" for a detailed description of the formation and environmental and health effects of acid rain.
- **www.chesapeakebay.net/**
  The Chesapeake Bay Program offers a wealth of information, including a history of the Chesapeake, profiles of the animals and plants living in the various bay habitats and descriptions of efforts to restore water quality in the bay.

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- **www.h2ouse.org**
  Developed by the California Urban Water Conservation Council under a cooperative agreement with the U.S. Environmental Protection Agency, this website offers numerous water conservation tips.

Suggested Print Resources

- Parks, Peggy. *Our Environment: Water Pollution*. KidHaven Press, Farmington Hills, MI; 2007.
- Vogt, Gregory. *The Hydrosphere: Agent of Change*. Twenty-First Century Books, Minneapolis, MN; 2007.
- Wyman, Bruce and L. Harold Stevenson. *The Facts On File Dictionary of Environmental Science (Third Edition)*. Facts On File, Inc., New York, NY; 2007.

TEACHER'S GUIDE

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Environmental S·C·I·E·N·C·E for Students™

WATER QUALITY

Grades 5–12

An understanding of the environment and the relationship that humans, plants and animals have with it is instrumental in developing environmental literacy. Such awareness can help to shape future understandings of the Earth and our actions as informed citizens. For this reason, as students engage in a study of the environment, it is important to present them with accurate explanations, global examples and balanced viewpoints. In addition, the environment's link to human health, the economy and society should also be examined to make clear the interconnected nature of these components. *Environmental Science for Students* will help viewers to understand the science behind their changing world as well as consider multiple perspectives. This six-part series explores the causes and effects of issues facing our environment in the 21st century and explores the short- and long-term potential of possible solutions.

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Program Overview

Earth is sometimes referred to as the "blue planet" because over 70 percent of its surface is covered with water. And because water is vital to all life, both its quality and availability are also critical. The substances that enter the water supply and cause water pollution can be classified as either point sources or nonpoint sources. Products that result from pollutants in the atmosphere, like acid deposition, can also affect water quality. Polluted water can adversely affect the environment, the economy and the health of humans and other living organisms. An infamous example of large-scale water pollution resulted from the use of the pesticide DDT.

Many regions of the world are confronted with a lack of available fresh water. Any location where water is being used more quickly than it can be replenished may face water scarcity issues. When groundwater is overused and over-extracted, sinkholes can form. Even changes in climate can affect a region's fresh water supply. Excessive rainfall can cause flooding, which doesn't necessarily help replenish a water supply. Water scarcity can affect the production of energy at hydroelectric plants and can also be the source of conflict between people or countries.

Since different regions of the world have different water needs and concerns, potential solutions to water problems are varied. In some places, techniques like bioremediation and desalination are being used to clean polluted water and increase the freshwater supply. Individuals and organizations can do many things, like recycle grey water, to keep their supply of fresh water from running out. Humans must continue to work on solutions to manage the world's water resources efficiently and effectively.

Vocabulary

water pollution — The presence in water of any substance that can be harmful to humans, plants, animals or the environment.

sewage — The combination of solid and liquid waste produced by humans that comes from drains and toilets in homes and buildings.

fertilizer — A nutrient-containing substance that is usually added to soil to help plants grow.

pesticide — A chemical that is used to repel or kill weeds, rodents or other pests.

sediment — Small particles of rock, sand and organic matter that can be picked up by, and can pollute, a flowing body of water.

thermal pollution — Excess heat, usually in the form of warm water, that enters a body of water and can harm the organisms living there.

point sources — Specific locations that discharge pollutants directly into the soil or a body of water. Examples include factories and sewage treatment plants that use drainpipes and ditches to dispose of waste.

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nonpoint sources — Pollution sources whose pollutants cannot be traced to a specific location. Examples include runoff from farms, construction sites and city streets.

acid deposition — The product that results when polluting gases, like sulfur dioxide and nitrogen oxides, react with water vapor in the atmosphere, thereby forming sulfuric and nitric acids, which are chemicals that can change the normal acidity of precipitation. Liquid precipitation that is more acidic than normal is called 'acid rain.'

estuary — A partially-enclosed coastal area where freshwater rivers and streams flow and mix with salty ocean water.

turbidity — The amount of suspended particles in water. Low turbidity indicates clear water, while water with high turbidity is cloudy and muddy.

dichlorodiphenyltrichloroethane (DDT) — A synthetic chemical first used as an insecticide in 1939. Banned by the Environmental Protection Agency in 1972, DDT is still used in some developing countries where malaria is a major health problem.

Clean Water Act — Legislation passed by the U.S. Congress in 1972 that set standards for allowable levels of contaminants in surface waters and made it a crime to put pollutants directly into rivers and oceans.

Environmental Protection Agency (EPA) — The United States agency, created in 1970, that is responsible for protecting human health and the quality of the natural environment.

grey water — Water drained from domestic sources like washing machines, sinks and showers. Grey water is not drinkable, but can be recycled and used for tasks like watering gardens to reduce reliance on fresh water.

bioremediation — The use of biological agents, like bacteria or plants, to remove or neutralize pollutants in water or soil.

desalination (or desalinization) — The removal of salt from water.

Pre-viewing Discussion

- Create a poster that illustrates the continuous movement of Earth's water in the water cycle. Posters should include illustrations of the main processes involved in the water cycle (evaporation, condensation, precipitation) as well as examples of sources of water on Earth itself, and in Earth's atmosphere.
- What is the source of your water? Have students research the origin of the water used in school and their own homes. Does the water come from a well or from a public water company? For well water, students can investigate whether the water is used straight from the well or is treated before use. For water from a public water company, students can investigate whether the water company uses groundwater or surface water as its supply.
- Why is water essential for life on Earth? Discuss with students how different forms of life rely upon water for survival. Then, have students generate a list of the ways in which they use water on a daily basis.

Focus Questions

1. List some examples of water pollutants.
2. What is the difference between a point source and a nonpoint source?
3. What is acid deposition? How can it affect the environment?
4. What are some of the health effects of drinking or using polluted water?
5. What is DDT? What are some of the helpful and harmful aspects of the use of DDT?
6. What are some of the economic effects of water pollution?
7. What are some of the possible consequences of groundwater being extracted and used faster than it can be replenished?
8. How can flooding be both harmful and helpful to a region?
9. What are some ways in which industries and individuals can reduce water usage and water pollution?
10. What is bioremediation? How can bioremediation improve water quality and quantity?
11. What is desalination? How can desalination improve water quality and quantity?

Follow-up Discussion & Activities

- One way of classifying water pollution is by its source: agricultural, industrial or municipal. Students can work in small groups to investigate their community and make a list of possible sources of water pollution. A three-column table can be used to classify each source as agricultural, industrial or municipal. Each group should present its results to the rest of the class, and all groups can compare their results.
- Point or nonpoint? Separate students into six groups and give each group a piece of paper with one of the following possible sources of water pollution: a leaking underground sewer pipe; excess hot water from a nearby nuclear power plant; nitrogen oxides and sulfur dioxide emitted from the local refinery's smokestack; runoff from the street in front of the school after a storm; a wastewater discharge pipe from the nearby chemical company; runoff from a farm field after heavy rain. Each group should decide whether its example describes a point source or a nonpoint source and list the reasons supporting its decision. Once all groups have finished, each group can discuss its example with the other groups and then decide "point or nonpoint" as a class.
- Is your rainwater too acidic? Liquid precipitation with a pH of about 5.5 or lower is classified as acid rain. Have students collect samples of rainwater and use pH paper or pH meters to determine if their samples qualify as acid rain. Students can collect and analyze samples from different storms at different times of the year and then make a graph of the results.

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