

- Students can observe how particle size affects soil erosion using dirt, gravel, rocks, sand, a rectangular plastic container and a watering can or cup with holes. Mix the dirt, gravel, rocks and sand, and then use the mixture to make a hill on one side of the plastic container. Fill the watering can or cup with holes with water and use it to simulate a steady rain shower on the hill. Students can answer the following questions in their notebooks and then discuss with the class: How did the hill change as the water was added? Did some particles in the soil mixture move more quickly than others? How does particle size affect the rate of erosion? How would changes in either the force or amount of water in the simulated rain shower affect the rate of erosion?
- Along with terracing and conservation tillage, **contour plowing** is another farming method that can help reduce soil erosion. By following the natural contour of the land rather than simply plowing in a straight line, this process creates trenches of land that can break up water flow and make it more difficult for the soil to erode. Divide the class into small groups and have each group create a chart that compares terracing, conservation tillage and contour plowing and gives the definition, benefits, limitations and an illustration of each farming method. After the groups present their charts to the rest of the class, encourage students to discuss the relative merits of the three farming methods and determine if one method is more advantageous than the others.

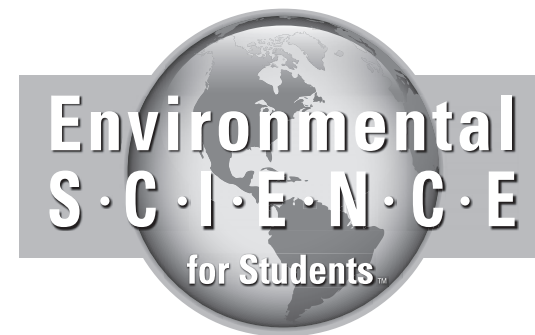
Suggested Internet Resources

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

- www.epa.gov/superfund/sites/
The Environmental Protection Agency's "Superfund Sites Where You Live" website allows users to access information about Superfund sites all over the United States.
- www.accuweather.com/promotion.asp?dir=aw&page=dustbowl
AccuWeather explains meteorological aspects of the 1930s "Dust Bowl" and discusses the potential for this event to happen again in the Midwestern United States.
- soils.usda.gov/sqi/
This website from the United States Department of Agriculture addresses several aspects of soil quality, including how organisms living in the soil affect soil quality and methods of soil quality management.

Suggested Print Resources

- Redlin, Janice. *Understanding Global Issues: Land Abuse and Soil Erosion*. Weigl Publishers Inc., New York, NY; 2006.
- Stille, Darlene. *Soil: Digging Into Earth's Vital Resource*. Coughlan Publishing, Mankato, MN; 2005.
- Wyman, Bruce and L. Harold Stevenson. *The Facts On File Dictionary of Environmental Science (Third Edition)*. Facts On File, Inc., New York, NY; 2007.



SOIL 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.

TEACHER'S GUIDE

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Program Overview

Soil is a complex mixture of nutrients, water, organic matter, air and living organisms that is critical to life on Earth. The ways in which the land is used can affect both the quality and the quantity of soil. While some soil pollutants occur in the soil naturally, other contaminants can be added directly to the soil or reach the soil indirectly. Many soil pollutants, including hazardous waste, are the direct result of human and industrial activity. Remediation of soil contaminated with hazardous waste, like the land around Love Canal in New York, can cost billions of dollars. Even your own garbage can be a source of toxic substances. While some household hazardous waste is incinerated, lots of solid waste ends up in landfills, where it has the potential to contaminate the soil and groundwater. Proper care must be taken with certain household items, like batteries and paint, to ensure they are disposed of properly, while other items, like newspapers and aluminum cans, can be recycled instead of thrown into a landfill.

Natural processes and human activities can also cause soil depletion and erosion, which can be damaging to any living thing that relies on that soil to survive. The 1930s “Dust Bowl” in the midwestern United States is an example of how drought and the use of farming techniques that encouraged erosion led to extremely unfavorable soil quality, which affected the lives of many people. Factors such as overgrazing and overuse of land can result in severe soil depletion and desertification. The most effective method of erosion prevention can vary since farming methods that work well in one part of the world may not work as well in others and different nations often have different agricultural needs and goals. However, there are proven techniques, like terracing and conservation tillage, that can be used to conserve both the quality and quantity of soil.

Vocabulary

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

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.’

hazardous waste — Discarded materials that can be dangerous to living organisms and the environment. There are several categories of hazardous waste: corrosive, explosive, flammable, radioactive and toxic.

Superfund — A fund created by the United States Congress in 1980 that allows the Environmental Protection Agency to assess and oversee the cleaning up of abandoned or uncontrolled hazardous waste sites.

leachate — Contaminated water that collects at the bottom of a landfill. Leachate forms when a source of water, typically rainfall, enters a landfill and absorbs some of the chemicals and other materials found there.

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recycling — The process of extracting raw materials from discarded items and using them to make new products.

erosion — The process by which rocks and soil are broken down and moved.

drought — A long period of time in which there is little or no rainfall.

desertification — The process by which fertile land becomes arid and desert-like, which causes a decrease in the productivity of the land.

terracing — A farming method that involves turning hills and steep slopes into flatter strips of land. Terracing reduces erosion and increases the water retention of soil, which makes the land more suitable for farming.

tillage — A farming method that involves the digging up and loosening of soil in preparation for planting seeds.

conservation tillage (or no-till agriculture) — A farming method that involves the use of specially designed tillers that plant seeds with little or no disruption to the topsoil, which makes the land less susceptible to erosion.

land reclamation — The process by which degraded land is converted into useful land that returns the area to a more natural state.

Pre-viewing Discussion

- The layers of soil, sometimes called soil horizons, detail the history and characteristics of the soil in a given area. Write a brief description of what you would expect to find in each of the basic soil horizons (litter, topsoil, subsoil and bedrock).
- The thousands of different types of soil in the United States are classified into 12 categories called ‘soil orders.’ The U.S. Department of Agriculture has catalogued descriptions, photographs and distribution maps for these soil orders. Review the information at soils.usda.gov/technical/classification/orders/ and then describe the soil orders in your area.
- How much of the food you eat comes from the soil? Make a list of the raw materials from which the foods you eat on a typical day are made (for example, a hamburger on a bun comes from a cow and some kind of grain). Place a check next to each raw material that is grown in the soil and then determine what percentage of raw materials on your list are grown in the soil.

Focus Questions

1. What are some examples of soil pollutants?
2. What is hazardous waste? How can it affect soil quality?
3. Where is Love Canal? What kind of pollution was dumped in the soil there, and how did it affect the area?
4. What toxic substances might be found in household garbage?
5. What is a landfill? What is leachate? How are the two terms connected?
6. What is erosion? How does erosion affect plants living in the soil?

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7. What was the 1930s “Dust Bowl”? How did the Great Depression contribute to the problems of the Dust Bowl?
8. What is desertification? Where can it occur?
9. How can desertification lead to flooding?
10. What are terracing and conservation tillage? How can they reduce soil erosion?
11. What are some examples of how degraded land can be reclaimed?

Follow-up Discussion & Activities

- Many homes contain useful products and substances that could become hazardous waste if disposed of improperly. Students and their families can conduct a “household hazardous waste survey” by carefully going through their homes and making a list of anything that might need to be disposed of with special care. Select one item on your list, find out what makes it hazardous and outline its potential effects on the soil if it was disposed of improperly. Encourage students to research the proper disposal methods in their community for the items on their lists.
- Students can estimate their contribution to the local landfill by keeping track of the trash they throw away. Ask students to keep a journal detailing the different kinds of trash thrown away over a three-day period. Next to each entry, list the type of trash (paper, plastic, metal, etc.) and whether or not that type of trash is recyclable. Have students create a chart summarizing the information in their journals. Students can then compare results with their classmates and discuss the following questions: Are there certain types of trash common to all or most students? How much of the trash thrown away by the class is recyclable? How much of the recyclable trash is actually recycled by students?
- When the same crop is planted in the same field year after year, the nutrients found in the soil may get used up more quickly than they can be naturally replenished. Crop rotation and the use of fertilizers are two possible ways to remedy this nutrient depletion. In small groups, ask students to construct an argument supporting one of the methods. The groups discussing the same method can then get together, compare their arguments and develop a complete list of discussion points to use in a debate on whether crop rotation or the use of fertilizers is the better method to combat soil nutrient depletion.

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