Youth Activity

HOW MUCH WATER WILL THIS HOLD?

Learning Objectives

To observe how water drains from different types of soils and the impact soil health has on surrounding waters.

Materials

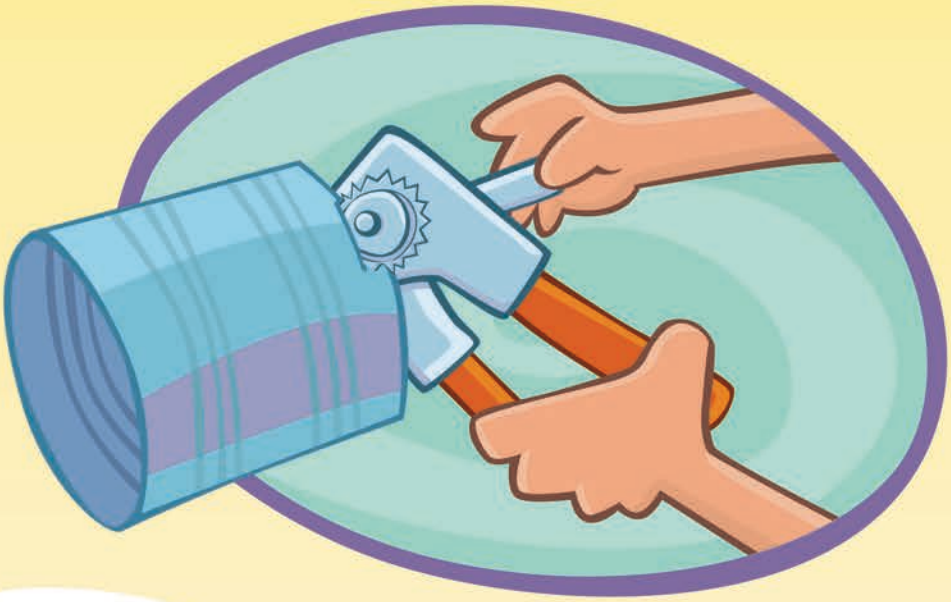
Large metal can(s), emptied and rinsed; can opener; pliers; ruler; permanent marker; large measuring cup; plastic drink containers with lids (such as soda bottles); a stopwatch (or a wristwatch with a second hand); clipboards with paper and pens.

Activity Description

Soil that has been compacted (packed down) by livestock, tractors, construction vehicles, or other human activity does not capture and hold rainwater. When it rains, the water runs off this land instead of percolating (dripping) down into the soil, which can cause serious erosion on land and along stream banks and lead to extreme fluctuations in stream water levels. In addition, pollutants can flow directly into streams and other waters with this runoff, damaging not only water quality but fish and wildlife habitat.

In contrast, healthy soils retain water because they are riddled with small pores and cavities, many of which are created by plant roots and soil-dwelling creatures such as earthworms.

Step 1: Find soil samples. To demonstrate how different types of soils absorb water, find at least a few of these samples in the area where you plan to conduct this activity:



- Bare, compacted soil (such as a walking path or on a playground)
- Grassy area that doesn't get a lot of foot traffic
- An area with leaves and other plant material on top of the soil (preferably a wooded area or one with shrubs, but you could also use a mulched garden plot)
- Muddy, wet soil
- Flat paved area (such as a concrete sidewalk or paved parking lot)
- Sandy soil (you can buy a bag of sand and dump it on the ground, if needed)

Step 2: Prepare field materials. To test how quickly soil drains from each sample area, start with a metal can:

- Check the rim at the top of the can for sharp edges and crimp down any rough pieces with the pliers.
- With a ruler, measure two inches from the bottom of the can and draw a line inside the can with a permanent marker.
- Fill the can with water to the two-inch level. This will show the effect of two inches of rain on your sample site.
- Pour the water from the can into a measuring cup and make a note of how much water that is.
- Fill plastic soft drink bottles with that amount of water. You will need one bottle of water per can for every soil site you test.
- If you are using different size cans, you'll need to measure the amount of water needed for each can size. Write the water amount (such as 8 ounces) on the outside of each can and soft drink bottle to be sure you pour the correct amount into each can.
- Cut the bottoms off the cans with the can opener. Again, check for sharp edges and crimp them down with the pliers.

Illustrations by Peter Grosshauser

Step 3: Experiment. Now you're ready for the field. At each sample site:

- Ask the youth to predict how quickly the water will drain into the soil.
- Assign four youth to take part in each test: One to place the can, one to pour water, one to use the stopwatch, and one to record the location and time.
- Twist the can back and forth into the ground until the bottom rim is about half an inch down. (On paved or heavily compacted areas, someone will need to hold the can in place instead.)
- Pour the water into the can, being careful not to spill. Start the timer as soon as you start to pour.
- Keep timing until all the water has disappeared into the soil. If you reach the 5-minute mark and the water has not drained, call a halt and move on to the next site. (You can use the time that you're waiting to discuss why the water is not draining well into a specific soil location. See "Discussion Questions" below.) On the cement or asphalt, the water will immediately run out because the can will not seal tightly to the ground and these surfaces will not absorb water.

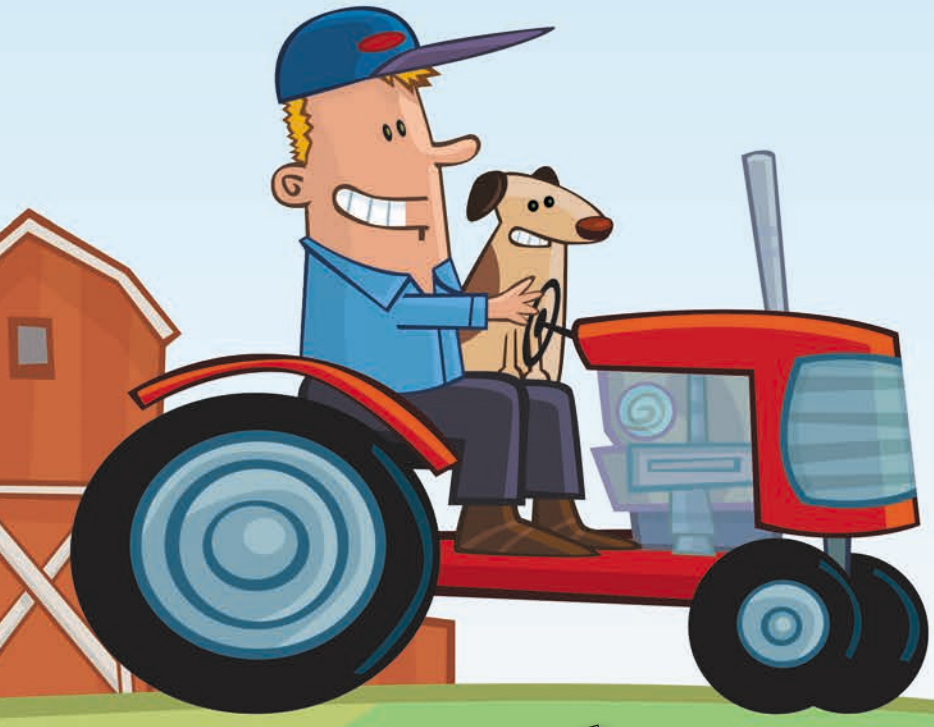
Options: If you have a large group of children, divide them into smaller teams. Provide each team with the necessary equipment (metal can, water, stopwatch or watch, paper and pen) and let each team conduct their own experiments.

With older children, bring in the science. Conduct two to three experiments at each site and have the children calculate the average time per minute and then translate that into the average per hour. Add more water to the same site and see if the rate changes.

Discussion Questions

Which soil(s) absorbed water more quickly?

Answer(s): *Will vary. On bare, compacted soil, the water should remain in the can for a long time. Severely compacted soil can seem as hard as an asphalt road or concrete sidewalk. With healthy soil, such*



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as the grassy and wooded areas, the water should drain away more quickly but not immediately – that means the ground is absorbing the water but it will also hold it for plants to drink. On the sand, the water should drain even faster, but that also means the sand will not effectively hold water for plants to use over time.

Why is it important for soil to be able to absorb water?

Answer(s): *When it rains, the rain water picks up pollutants such as pet waste on lawns, excess fertilizer from farms, dirt from construction sites, even oil that leaked from a car onto the roadway. Tree and plant roots can filter pollutants out of the water – that is, if the ground absorbs the water before it runs into local streams, ponds, or storm sewers.*

In addition to not absorbing water, compact soil such as clay prevents air from moving through and can restrict the growth of plant roots, which will restrict plant growth. So for trees and plants to do their jobs, it's important to protect soil quality.

Note: *Did you know the water that runs into our storm sewers may not go to a wastewater management plant to be cleaned? That water – and any pollution in it – may run directly into local waterways, such as rivers, lakes, and bays.*

What activities damage soil quality and how can we improve soil quality?

Answer(s): *To keep our soils in the best shape, we can just leave them alone – but that would mean no food or homes, since farming and construction activities can damage soil quality. That won't work! Instead, we can work to limit the effects of soil-damaging activities. We can do this by keeping an area of plants in between farms fields and streams (called a "buffer zone"), so those plants can stop and absorb polluted water before it runs into streams. Or we can use soil-catching fences at construction sites to prevent dirt from washing into local waterways. At home, we can improve our soil by adding organic materials (such as decaying leaves and other plant parts) to it – perhaps compost we've made ourselves or purchased at the local nursery.*

Estimated Time

Allow 5 to 10 minutes per soil site for the experiments (although asphalt/concrete will take less than 1 minute because the can will not seal tightly to the ground) plus additional discussion time at the end.

Ages

Recommended for ages 5 to 8, although your discussion of how soil works will need to be somewhat simple.

For ages 9 to 11, no specific changes are needed for this activity. However, you can talk in more detail about soil structure and encourage the youth to think about ways to improve soil structure and how that would improve fish and wildlife habitat.

Credits

Soil and Water Conservation Activities for Youth, Program Aid Number 1391, U.S. Department of Agriculture, Soil Conservation Service (now the Natural Resources Conservation Service), 1986.