DIY

LAKE SCIENCE

RUNAWAY RUNOFF

HOW DOES THE GROUND AFFECT WHERE POLLUTION GOES?

ACTIVITY DESCRIPTION

When it rains, water can collect on top of and seep into the ground. Water can also run downhill, carrying soil and pollution with it. In this activity, you'll see how the ground influences where soil and pollution go after it rains.

Age: 10 and up

Preparation: 30 minutes
Activity: 40 minutes
Cleanup: 10 minutes

ACTIVITY MATERIALS

- One tray of green, leafy ground cover plants, at least 30 cm × 30 cm
- Empty plastic plant nursery tray, similar in size to plant-filled tray
- Dirt, potting soil, or garden soil
- Water pitcher
- Water
- Red or other food coloring
- Sieve or strainer
- Large plastic tub
- Tape
- Marker
- Protractor
- Parchment paper, wax paper, or aluminum foil
- Liquid measuring cup, 500 mL (16 oz) or larger

MATERIALS NOTE

You can buy a tray of green, leafy ground cover plants at garden nurseries or even hardware stores. You will need enough dirt, potting soil, or garden soil to fill your empty plastic tray. The large plastic tub should be longer and wider than the empty, plastic nursery tray. The plastic tray of plants will be placed over the tub to catch any water that runs off the surface.

STEP 1

Pollution can come from many different sources, like fertilizers and pesticides applied to gardens and food crops, or oil that leaks from cars onto roadways. When rainwater hits the ground, it can mix with this pollution and carry it wherever the water goes. In this activity, you'll see how pollution travels after rain falls on different surfaces such as loose soil, soil with plants growing in it, and hard surfaces that mimic paved surfaces.

STEP 2

Here is a photo of the experiment. You will hold the tray of different soil types over the tub, with the tray at an angle to model the ground, as shown in the photo. Water poured all over the tray's surface mimics rain. Any water that runs off will be caught in the large plastic tub below. Predict which surface type will allow the most and least amount of water to run downhill and collect in the tub.

STEP 3

Rainwater can also cause erosion, picking up little bits of soil and moving them downhill. Some ground and soil types are more easily washed away than others. Predict which of the surface types (loose soil, soil with plants growing in it, or hard surface that mimics paved surfaces) will have the most and least amount of soil washed away by the "rainstorm" you model.

STEP 4

Start by testing the tray of plants. This represents plant-covered soil, such as a grassy hillside. Arrange the tray as shown in the photo. Use the protractor to make sure the tray makes a 30-degree angle with the ground. You can have someone help you by holding the tray over the plastic tub. Instead, you could use various objects to prop up the tray at this angle. The plastic tub below the tray will catch any water that runs off the lower edge of the soil surface.

STEP 5

Add 10 drops of red food coloring to the soil around the plants. Place each drop at a different location, all around the tray. Make sure you place the drops on the soil, and not on the green leafy plants.

STEP 6

Fill the pitcher with 2 liters of water. For about 15 seconds, slowly pour all the water over the entire surface, being careful not to splash any. Once all the water has been poured, wait 10 seconds for any remaining water to flow off the tray and into the plastic tub.

Some soils are more absorbent than others. If no water flows off the tray, pour another 2 liters of water over the surface, just as before.

STEP 7

Remove the tray and set it on the ground. Pour the water, and any dirt that collected in the tub, through the strainer and into the liquid measuring cup. Write down the volume of water that collected in the tub. Note how red the water is—the redder the water, the more food coloring (pollution) mixed with the water.

STEP 8

Dump all the dirt out of the strainer and onto a piece of paper or foil labelled “soil with plants.” Keep the soil so you can compare the amount that collected in the tub to loose soil in the next step. Pour the red water down the sink drain, and rinse out the large plastic tub.

STEP 9

Next, test loose soil. (If your empty tray has larger holes in the bottom, you might want to line it with sheets of paper or foil to keep dirt from falling through the holes). Fill the empty plastic tray with soil of your choosing. The soil should be loose, with no large clumps. You may need to break up some clumps with your hands. Fill the tray to the brim with soil.

STEP 10

Just like you did with the tray of plants, fill the pitcher with the same volume of water you used previously. Arrange the tray in the same place and angle as you did with the tray of plants. Add 10 drops of red food coloring to various places on the soil. For 15 seconds, slowly pour the water over the entire surface of the soil. Once all the water has been poured, wait 10 seconds for any remaining water to flow off the the tray and into the plastic tub.

STEP 11

Remove the tray and set it on the ground. Pour the water and any dirt in the tub through the strainer, into the liquid measuring cup. Write down the volume of water that ran off the soil. Dump out all the dirt in the strainer onto a piece of paper/foil labelled “loose soil.” Pour the red water down the sink, and rinse out the large plastic tub.

STEP 12

Next, you will test a hard surface. Some surfaces like asphalt and concrete do not let water get absorbed into the soil below. Cover the tray of loose soil with paper or foil. Use tape to cover the seams of overlapping layers of paper. Tape the parchment paper to the tray to hold it in place.

STEP 13

Arrange the tray and plastic tub just as before. Place 10 drops of red food coloring at various places on the paper/foil. Fill the pitcher with the same volume of water used previously. For 15 seconds, slowly pour all the water over the parchment paper.

STEP 14

Remove the tray and set it on the ground. Pour the water that collected in the large tub into the liquid measuring cup. Write down the volume of water that ran off the hard surface.

STEP 15

Compare the volumes of water that ran off all three surfaces. Which surface/s had the most and least water run off into the plastic tub? Were your predictions correct? Were all the water samples red?

Compare the amount of dirt on each piece of paper or foil you saved. This is the dirt that your “rainwater” washed away. Which surface had the most dirt eroded by water?

STEP 16

OPTIONAL

Try repeating the experiment for other soil types, such as sand, clay, or mixtures of these soils. How much water and pollution run off these surfaces?

WHAT'S GOING ON?

You should have found out that the hard surface had the largest amount of water run off. The soil with plants had the least. Soil with plants has spaces for water and pollution to be absorbed into the soil. This limits how much water (and pollution) runs downhill. All of the water samples should have been red with pollution. Hard surfaces like asphalt and concrete do not absorb water. Rainwater tends to mix with any pollution on these hard surfaces. The rainwater carries the pollution downhill. The loose soil with no plants had the most soil wash away downhill. The soil with plants had less erosion because the roots of plants tend to grab onto soil particles, keeping them in place.

Hard surfaces increase runoff. Plants trap soil, keeping it from washing away downhill.

SOIL TRAPS POLLUTION

Plants growing in soil tend to allow less water, less pollution, and less soil to run downhill when it rains. That means where plants grow, less pollution gets washed into lakes and streams than where hard surfaces are found. Over time, small organisms in the soil can transform pollutants left in the soil into substances which aren't as harmful. When much of the ground is covered in asphalt and concrete, as in many cities, water that runs off will be more contaminated with pollutants, and can have harmful effects on nearby bodies of water.

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CREDITS

This project was supported by the National Science Foundation (NSF) under grant number DRL1114663. Any opinions, findings, conclusions, or recommendations expressed in this program are those of the author and do not reflect the views of NSF.

This activity from the DIY Lake Science app allows families to investigate and learn about lakes and bodies of water at home or on the go! The app features twelve hands-on investigations, as well as videos and a lake simulation.

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