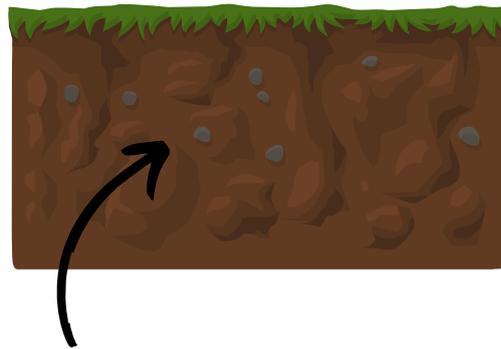


Biosphere Explorers

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Soil and Water Erosion



Introduction

Soil is a material composed of minerals (clay, silt, and sand), organic matter, living organisms, gas, and water. Soil minerals form the basis of soil. They are produced from rocks through the processes of weathering (from water and wind, for example) and natural erosion. The amounts of these five materials decide the soil's properties - for example, a more sandy soil will drain better than a clay soil.



Research tip: Find out the difference between soil and compost.

As an extra activity, you can show how organic material gets broken down by placing a mix of raw food scraps and soil in a transparent container. Keep it in a cool, dark place, and make sure there's oxygen available for any worms. Look at it once a day for a few weeks to see the material break down.



Experiment Introduction

Before starting the experiment, we need to know what we are setting out to investigate. Discuss why soil is so important to us and nature. You can look at nutrient cycles, food systems, soil biodiversity, and much more to answer this question - a simple Google will get you started.

Have a walk about your school grounds. Does your soil look healthy? Are there parts of bare soil (mud)? Is there much biodiversity of plant life on your school soils? You could make a quadrat and estimate the number of plant species in your school grounds and at another location.

Next, talk about where bare soil might also be found. Is it more likely to be found where humans have altered the natural landscape?

Finally, research what effects water erosion has on our soil.

Soil and Climate Change

How is our climate changing, and in what ways does this impact on our soil?

You can use the Met Office for weather data and compare thirty year periods from 1961 (the standard measuring periods) and see specific figures for 2009-2015 in Dumfries and Galloway Council's State of the Environment report. You could compare Dumfries to Scotland, or to other areas of the world. Your pupils could draw graphs and examine trends from this data.



Research tip: Learn about the Great American Dust Bowl.

Before you start the experiment on the next page, make your HYPOTHESIS.

A hypothesis is a prediction that we make based on what we know about the world. We use the experiment to test and, maybe, prove our hypothesis.

Our experiment is going to be about water erosion affecting soil - in other words, how does rainfall damage soil? Your hypothesis will therefore be about what type of soil (bare, with detritus (dead material), or with living material) you think will be affected the most.

The Experiment

SOIL AND WATER EROSION

Equipment

- 3x80g of soil or compost
- 2x10g of dead material (leaves)
- 10g living material (grass)
- 3x150ml of water
- 3 plastic bottles (all the same) cut horizontally by an adult
- Spoons or gloves to use when handling the soil etc.
- 3 containers which will hold drained water, at least 150ml
- Towel or books to prop the bottles on

1. Adults cut the plastic bottle - lie it horizontally and take the top off. Leave the base and spout intact. View our video if unsure. Warn your groups of any sharp plastic or tape it down.
2. In bottle one, place 80g of soil evenly.
3. For bottle two, mix 80g soil with 8g dead material (sticks and leaves), and place evenly. On that surface place the remaining 2g of dead material, ensuring full coverage especially at the base where the water will be poured. This is very important to ensure poured water does not immediately go into the soil layer, or your results will all mirror the first bottle.
4. For bottle three, mix 80g soil, 10g dead material, and 8g of living material. Repeat the above step for the remaining 2g of living material.
5. Set your bottles up next to each other so they are all the same angle, and then place the three containers underneath the spouts.
6. Take 150ml of water and pour methodically - slowly and gently - into the base of the first bottle. Time how long it takes you to pour.
7. Repeat the above step for each bottle, matching the pouring time as closely as possible.
8. Leave to drain for five minutes and then look at your drained water - whichever bottle had the most drained water will be that which suffers the most from water erosion in the real world. This should be bottle 1.

In the real world

Ideally, you will have seen that the bare soil has the most water runoff, which means it suffers the most from water erosion. From your past research, your class will know what impacts water erosion has on our soil.

Now it's time to discuss what can be done to prevent our soil from being bare in the first place. You can research regenerative farming or ask someone in that community to talk to your class (e.g. Propagate Scotland). You can look at how we might improve our forestry practices and visit a local managed timber woodland, such as Galloway Forest Park. You could even reach out to organisations that protect our rivers to see how, from their perspective, damaged soil impacts on water quality (e.g. Galloway Fisheries Trust).

Your class can also look at their own gardens or areas around their house. How much is covered with impenetrable surfaces? If they have gardens, what happens to the mowed grass or autumn leaves - do their adults rake them up and compost them, or chuck them away? Can your pupils talk to their adults about leaving piles for nature, or reverting some of their yard back to natural grassy areas?

You could potentially go around the school grounds with this in mind, and perhaps take on a project to restore bare ground or section off areas for dead material to be collected and left.

This experiment is from our Biosphere Explorers project, which aims to connect young people with nature and the biosphere.

Visit carboncentre.org/biosphere-explorers for more learning material.

