

Slip, sliding away - soil erosion

Soil is a vital resource, essential to our everyday lives, but its importance is often overlooked. Soils provide nutrients for plants and animals and can also act as a carbon dioxide reservoir. Millions of tonnes of topsoil from farms and forests are eroded by wind and rain each year, causing potential problems for the environment.

The loss of nutrient-rich topsoil threatens the productivity of agricultural land. Rivers, lakes and streams can become silted up, as soil is washed into water courses, causing issues with flooding and pollution. Soil erosion can reduce the amount of food grown in a particular area and over time land-owners may have to increase the use of fertilizers to off-set the effect of loss of nutrients. This can lead to further environmental problems.

Learners may already be aware of soil erosion in the context of deforestation, especially relating to rainforests. Once trees and plants are removed their network of roots is lost - soil can be more easily washed or blown away leading to the degradation of the habitat. Land in rain-forested areas is often cleared to grow cash crops - like soy beans or oil palms, for cattle ranching, mining, oil and gas extraction and for building. The study of soils provides an opportunity to find out more about this fascinating area - there are a number of practical activities that can be undertaken in the primary classroom to investigate soils [1] and the world beneath our feet [2]. SSERC Bulletin 82 [3] focused on the not so humble earthworm and the importance of their activities on soil health.

At SSERC we have taken one classroom activity designed to demonstrate soil erosion [4] tested it and made some modifications to improve the effectiveness of the model.



Figure 1 - Bottle with compost added and selection of seeds.

To create a model to investigate soil erosion you will need:

- 6 x 2 litre plastic bottles with bottle-tops attached.
- 3 plastic lids/pieces of cardboard large enough to support the plastic bottle.
- Compost.
- Seeds - we used fast growing, quick to germinate varieties e.g. cress.
- Bark chips, dead leaves and sticks - these can be collected from an outdoor area.
- Strong string/thread.

Mark and cut out a 10 cm x 25 cm rectangular hole along the side of three of the plastic bottles. Sharp scissors can be used to cut the plastic. Teachers should decide if this part of the preparation can be carried out in class - this will depend upon the age, maturity and experience of the learners.

Fill each bottle with 450 g compost, press down firmly to make sure the soil is compacted and beneath the level of the neck of the bottle. Ensure that the bottles have lids in place (Figure 1).

See Health & Safety advice relating to compost and refer to SSERC Bulletin 61 for advice on sowing seeds safely [5].

Stick each bottle onto the flat piece of cardboard or plastic, with the cut-out hole on top, this will prevent the bottle rolling around.

Leave one bottle as it is - this will represent an environment that has been cleared of vegetation. To the second bottle add a top layer of leaves, bark and sticks - this will represent an unplanted area of land with cover or “mulch” provided by decomposing plant materials. >>



Figure 2



Figure 3

In the third bottle sow seeds of quick growing plants (e.g. cress) across the entire surface of the soil. **Make sure you sow the seeds right up to the neck of the bottle** - otherwise the unplanted soil at the neck will wash straight out. We found this was really important, soil was not held in place if the plant roots are established further back within the bottle. If you are planting larger plants, or sowing slower growing seeds, ensure that roots have plenty of time to develop and form a well-established network - especially in the area at the neck of the bottle.

The panel of plastic that was cut out can then be placed loosely back in place on all the bottles, it will encourage quicker germination of the seeds. Keep all bottles damp

but not over-watered. Continue to care for the plants, remembering to allow plenty of time for the network of roots to develop before carrying out the investigation. Remove the cut-out plastic panel from the bottles once the seeds start to germinate. When you are ready to test the different “environments” take the remaining three plastic bottles, cut them in half horizontally and save the bottom half.

Cut two holes in the side of the bottles, near the top and thread string through to create a handle (Figure 2).

This can then be hung off the end of each of the three bottles (Figure 3). To create a gradient and ensure the water flows through the bottles, the

back of the bottles should be gently raised - we rested the plastic lids/ bottles on a metre stick (Figure 4).

Remove the bottle caps and slowly pour 500 ml water into the very back of each of the bottles, as far back as the cut section will allow. We have a video of this investigation carried out at SSERC [6].

We observed a difference in both the colour (or turbidity) and the volume of water collected from the three bottles.

200 ml, 300 ml and 350 ml from bottle with plants, mulch and bare soil respectively, demonstrating that soil is most easily washed away from unplanted, uncovered areas. Applying a layer of mulch to bare areas of land appears to reduce the amount of soil washed away. This activity can then be linked to the importance plants play in the prevention of soil erosion.

Deforestation and soil erosion could form part of a wider climate change project - SSERC is supporting the Children’s Conference at the Primary Science Education Conference (PSEC) in June 2019. Find out more in the article from PSTT in this bulletin. >>

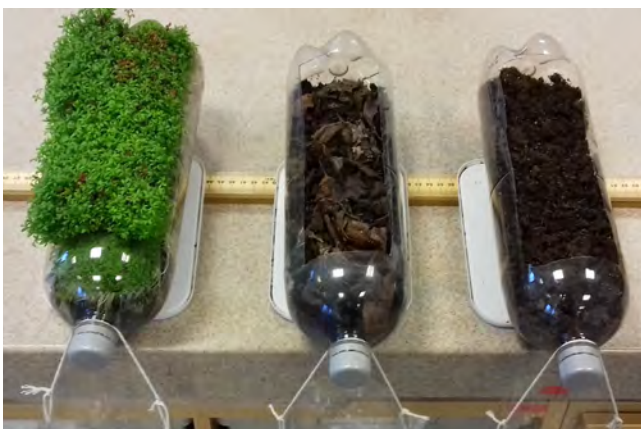


Figure 4 - showing bottles raised by the metre stick.



Figure 5 - We observed a difference in both the colour (or turbidity) and the volume of water collected from the three bottles.

Safe use of compost

- Compost has been implicated as a source of legionella bacterium.
- Practitioners & Learners could be at risk while opening bags of compost and potting up plants.
- Use freshly produced compost that has been stored in a cool place away from the sun – do not store compost in a greenhouse.
- Open bags carefully in a well-ventilated area using sharp scissors or knife.
- Pot up plants in a well-ventilated area.
- Avoid making dust - Reduce risk of air borne particles by wetting dry materials before applying.
- Cuts should be covered and hand washing to be carried out after activities. Consider wearing gloves.

Experiences and Outcomes

I can help to design experiments to find out what plants need in order to grow and develop. I can observe and record my findings and from what I have learned I can grow healthy plants in school - *SCN 1-03a*.

Through carrying out practical activities and investigations, I can show how plants have benefited society - *SCN 2-02b*.

I can describe and recreate the characteristics of my local environment by exploring the features of the landscape. *SOC 1-07a*.

I can describe the physical processes of a natural disaster and discuss its impact on people and the landscape - *SOC 2-07b*.

Having explored the landscape of my local area, I can describe the various ways in which land has been used - *SOC 1-13a*.

By exploring a natural environment different from my own, I can discover how the physical features influence the variety of living things - *SOC 1-13b*.

I can consider ways of looking after my school or community and can encourage others to care for their environment - *SOC 1-08a*.

I can discuss the environmental impact of human activity and suggest ways in which we can live in a more environmentally-responsible way - *SOC 2-08a*.

I can consider the advantages and disadvantages of a proposed land use development and discuss the impact this may have on the community - *SOC 2-08b*.

References

- [1] <http://www.soil-net.com/primary/> (accessed 5th November 2018).
- [2] https://www.owlscotland.org/images/uploads/resources/files/World_beneath.3May16web.pdf (accessed 5th November 2018).
- [3] https://www.sserc.org.uk/wp-content/uploads/Publications/Primary-Bulletins/82/SSERC-bulletin-82_web.pdf (accessed 5th November 2018).
- [4] <https://www.soils4teachers.org/files/s4t/erosion-model.pdf> (accessed 5th November 2018).
- [5] http://info.sserc.org.uk/images/Primary_Bulletins/61/PB_61.pdf (accessed 5th November 2018).
- [6] <https://youtu.be/A0Q3FKfswNU>.

Further links

- <https://www.stem.org.uk/resources/> (search soil - accessed 5th November 2018).
- <https://www.tes.com/teaching-resource/rocks-and-soils-double-sided-fact-sheet-6182638> (accessed 5th November 2018).
- <https://www.soils4kids.org/> (American website - accessed 5th November 2018).