Exploring a soil pit:
Build a giant soil crumb

· EXPLORE ·
SOILS

Summary:

Soil is often described in terms of its texture, which describes the mixture of sand silt and clay that make up the mineral (rock) components of the soil. However, soil is also made of air, water, and organic matter, including living organisms. Furthermore, the way a soil works is not just influenced by the ingredients of the soil, but in how those ingredients are put together. The way the ingredients of soil are arranged is called the soil's structure, and can take the form of crumbs (a.k.a. aggregates) or larger unstructured blocks.

In this exercise we will use giant versions of soil mineral particles to explore how these fit together, explore the impacts of adding organic matter and organisms, and explore how these affect the strength of the soil when it becomes wet. The exercise also challenges us to think about why the ingredients of soil form into aggregates.

Leanring Objectives:

- Understanding what soil structure is and how it is formed.

- Understanding how the mineral composition of soils affect crumb strength

- Understanding of porosity and water

- Exploring the properties of OM and soil organisms on soil crumb stability

- Exploring the role of soil organisms in making soil crumbs

Equipment:

- 10cm diameter polystyrene balls to represent sand particles

- 2cm diameter polystyrene balls to represent silt particles

- Modelling clay (kiln fired not air-drying)

- Silly string

- Vegetable lard (1 block)

- Instant coffee granules

- Plastic gloves

- Bucket of water

- Fairy liquid for cleaning up

Preparation:

Estimated time 20 minutes.
Prepare clay into small globules (makes estimating percentage easier)

Mix lard/suet with coffee granules to create brown “organic matter” material. This can be done by sealing these together in a food bag, and squashing the bag with your hands.

Time Required:

Introduction 2 minutes, can use pre-made examples.
Making mineral only soil - 4 minutes.
Adding organic matter and organisms - 4 minutes.
Exploration of porosity, structure and aggregation- 4 minutes.
Questions- 0-5 minutes.

Total timing 15-20 minutes.

Background Leanring Needs:

Soil texturing practice and exposure to triangle key [www.landis.org.uk/services/tools.cfm].

Risk Assessment:

Hazard	Liklihood	Severity	Mitigation
Contact of modelling materials with eyes or ingestion	Low/Medium	Low	Use gloves where needed and assist younger children
Site/local specific risks	Unknown	Unknown	Anyone running this activity is advised to conduct a risk assessment for the specific site and conditions

Description of Activities:

1. Explain that large polystyrene balls represent sand particles, small balls represent silt and that the clay represents clay (clay particles are so small that even scaled up they would still be clay-like!).

2. Refer learners to a soil that has already had its texture identified. As a group or individually, use a triangle chart to work out the percentages of each of the three kinds of mineral particles.

3. Divide learners into pairs or small groups and ask them to collect roughly representative **volumes** of “sand”, “silt” and clay from the supplies. Note that this may only include one or two sand particles! Learners may wish to put on disposable gloves for the modelling activities.

4. Ask learners to build a soil aggregate (ie. stick

their particles together into one block). Ask learners to describe the characteristics of their model soil: *"sandy" soils will be very difficult to make into coherent "aggregates"*. Ask learners to note how much of the crumb is air space.

5. Carefully lower the soil aggregate into a bucket of water to represent a wet soil. Ask learners to describe what happens to the aggregate. *Most aggregates will fall apart, as the water gets in between the different particle types.* Retrieve the materials from the bucket.

6. Explain that organic matter and soil organisms are missing, and that these can be represented by the lard/coffee mix and the silly string (fungal hyphae).

7. Ask learners to re-model the aggregate adding 'organic matter' into the aggregate and spraying 'hyphae' onto the surface of the model aggregates. Ask learners to feedback on characteristics of their soil aggregate model: *their aggregates representing all soil textures should hold together better.*

8. Lower the new model into the bucket of water, what difference has the organic matter and hyphae made to the stability of the model? The presence of organic matter and soil organisms should help the aggregate stick together even when wet.

9. Collectively, look at the model aggregates, imagining how they could fit together with each other. Consider how much pores space there would be, and explain that in real soils this is filled with a mixture of water and air..

10. Discussion: If a soil does not contain enough organic matter what is likely to happen to its aggregates in wet weather conditions? *Soil particles will collapse and fill in the pore spaces between the aggregates, resulting in soil* **compaction**. What will happen to a low-organic matter, wet soil if it is put under pressure, eg. by a tractor tyre or hoof? Would soils with more organic matter avoid aggregate collapse and compaction?Discussion: These materials did not assemble themselves into an aggregate - they were put together by an organism - the learners themselves. What organism do the people modelling the aggregates represent in this exercise? *Earthworms, which form soil aggregates out of mineral material, organic matter and micro-organisms in their guts and deposit them as worm casts.*

Potential Extension:

- Combine this with the activity testing soil aggregate stability using mesh baskets and glasses of water.

- Follow this activity with the activity to build a coffee jar wormery.