Forty Minute Fieldwork: Soil Types

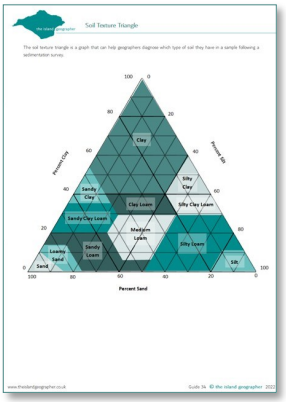
Key topic areas	Equipment and resources required
• Water Cycle and Flooding	Soil Auger
• Carbon Cycle	Large measuring cylinders (one for each soil sample)
• Geology / Lithology	Soil texture triangle *
• Agriculture	Parcel labels (one for each soil sample)
• Ecosystems	

Context

Soil is made up of three broad material groups according to particle size: sand, silt and clay. Different soil types are defined by their relative amounts of sand, silt and clay. Soil types can then dictate the types of arable or horticultural crops that can be grown or how the land might be otherwise used. For example, soils which are predominantly sand will drain quickly and have a low chance of flooding but will equally be more susceptible to erosion. Silt-heavy soils tend to form a hardened surface (known as surface capping) which means it can be harder for young shoots to push through the soil surface in the spring. Soils with a high clay content tend to retain water and flood easily making it difficult to grow many crops. Loam soil (that with less than 20% clay content is thought to be the best overall soil for the growth of the largest number of crops and flowering plants.

Classroom set up

Introduce the idea of soil texture by asking students to think about the key differences between sand and clay; two materials with which they should be familiar. It may be possible to hand out some pure samples of clay and sand so that students can see the key lithological differences. Highlight the idea of how large (and therefore how coarse) the particle size in each material will be and the impact this will have on soil pore size. Importantly, make the link for students between pore size and rate of infiltration, highlighting case studies such as the flooding of the area known as the Somerset Levels (which sits on marine clays).



A soil texture triangle

Show students a soil texture triangle and explain how one might read it. To improve student confidence with the triangular graph, give students some exercises that ask them to name the soil type according to the relative percentages of sand, silt and clay.

Using a map of the school site, students may be able to identify areas of the school grounds where different soil types might be found. For example, it is likely that there will be an area where the soil has been managed (such as a sports pitch or ornamental flowerbeds) and other areas where it has been left in a relatively virgin state (such as a wilderness area).

To develop the enquiry further, a number of scenarios can be put to students to guide their thinking about the impact of different soil types. For example, for their enquiry title, students might like to consider which part of the school grounds is:

- Most likely to flood
- Most suitable for a kitchen garden
- Most likely to erode
- Most or least valuable to a developer

* See The Island Geographer guide 'Soil Texture Triangle'

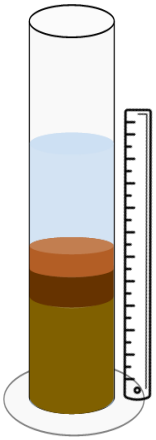
In the field

Taking a soil auger, students collect a soil sample from different areas of the school grounds, including those they have identified in the classroom. As each sample is removed from the ground it is placed in a separate measuring cylinder and a parcel label is attached to the cylinder with a clear description of where the sample came from (using a grid reference if appropriate).

A soil auger partially screwed into the ground

Returning to the classroom, each cylinder should be filled with water to the point until the water level sits around 3cm above the level of the sample. Placing a hand firmly over the open end the cylinder, students should shake the cylinder vigorously so that the soil sample mixes fully with the water. The cylinders are then placed on a flat surface and left to settle over the course of at least 24 hours.

In that time the sand, silt and clay will settle in the measuring cylinder in distinct layers. At the bottom will be a layer of sand, followed by a layer of silt on top of that and a layer of clay on top of that, showing that the material with the largest particle size sinks to the bottom of the cylinder. Then the size of each layer can be measured using either the scale on the measuring cylinder itself or with a ruler held against the outside of the cylinder.



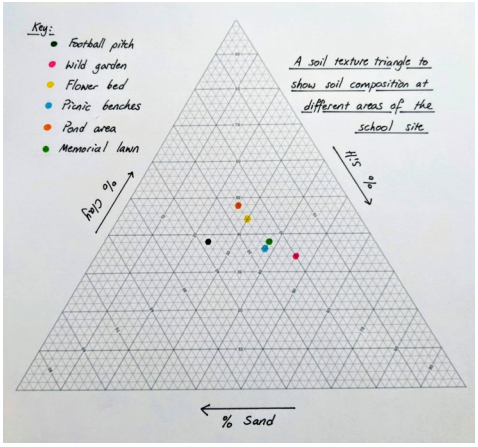
Students can calculate the percentage of clay found at each of the sample sites using a simple equation (which is then repeated for both sand and silt for each sample):

$$\% \text{ clay content} = \frac{\text{size of clay layer (mm)}}{\text{total size of sample (mm)}} \times 100$$

These percentages can be recorded on the parcel labels attached to each measuring cylinder.

Suggested data presentation

To build on students' ability to read triangular graphs it makes sense for them to present their results on one too. Blank triangular graph templates are easy to download and copy for students.



There is likely to be clustering of data points in certain areas of the graph depending on the dominant soil type for the wider lithological area that the school sits in. Students will therefore have to think about what they might use as a marker on the graph for each sample and how they might construct a key.

Students can then allocate specific soil types to each of their samples by reading the category names from the soil texture triangle.

Key questions for reflection and analysis

- How much variety is there in the soil samples we found on the school site?
- If we had collected more samples, how might the results be different?
- Based on our results, where should be plant a new kitchen garden / which area is most likely to flood etc?
- How might the depth the soil auger reached have affected the results?
- Would the results have been different at different times of year?
- Were there any opportunities for human error, or bias, to affect the results?

Taking it further

It may be possible to link up with other schools in the country (such as others in a MAT) , and by sharing results, see how soil types vary around the UK and what impact this might have had on the types of agriculture and land use found in these places.