Forty Minute Fieldwork: Infiltration

Key topic areas	Equipment and resources required
• Soils • The rock cycle • The water cycle • Rivers and flooding • Weathering • Farming	Infiltrometer * Stop watch Water container (500ml) Data recording sheet **

Context

Students can investigate infiltration rates through different soil types or through different ground surfaces that might be found around the school grounds. These surfaces might include:

- The school playground
- A managed piece of grassland (such as a football pitch)
- An unmanaged piece of grassland (such as a wild area)
- A sand pit
- An area of gravel
- An area of bare soil (that is subjected to continuous footfall)
- An area of Astro-turf or all-weather tartan

Students measure the length of time it takes for a set amount of water to infiltrate into the ground. Analysis of the results should result in a discussion around pore and soil particle size, and the impact this might have after a prolonged rain event. More compacted soil will have smaller pores between particles and therefore have a slower rate of infiltration. Soil with the presence of vegetation roots will keep pores relatively open, increasing the rate of infiltration. Sand and gravel have much larger particle sizes than clay or silt, and so individual particles do not fit together as easily, leaving larger pore spaces. Therefore, sandy and gravely soils tend to have higher rates of infiltration than silt or clay based soils.

Classroom set up

Introduce the key term 'infiltration' and ensure students understand its meaning. Avoid confusion with the idea that the soil 'absorbs' water and remind students that infiltration is just a part of the water cycle where water is in continuous movement.

A homemade infiltrometer

Discuss the idea that all soils and ground surfaces are different, possibly by showing diagrams of soil profiles which highlight how porous some soils might be and how soil particles are naturally different sizes.

Discuss the different soils or ground surfaces that you plan to use in your infiltration survey and ask students to place them in rank order - from the soil or surface which will record the fastest rate of infiltration to the one that will record the slowest. Ask for justification with the expectation that students will discuss pore and particle sizes as well as the effect of root systems on infiltration rates. Students might like to record these as a hypothesis.

Allocate different sites around the school grounds to pairs of students, ensuring that the full range of soils or surfaces are being surveyed. In the time they have it is unlikely that students will be able to survey all the sites available to them so it may be a good idea to make sure that at least two of the sites that each pair surveys are very different in type.

* See The Island Geographer guide 'Make your own infiltrometer'

** See The Island Geographer guide 'Infiltration Survey' data collection sheet

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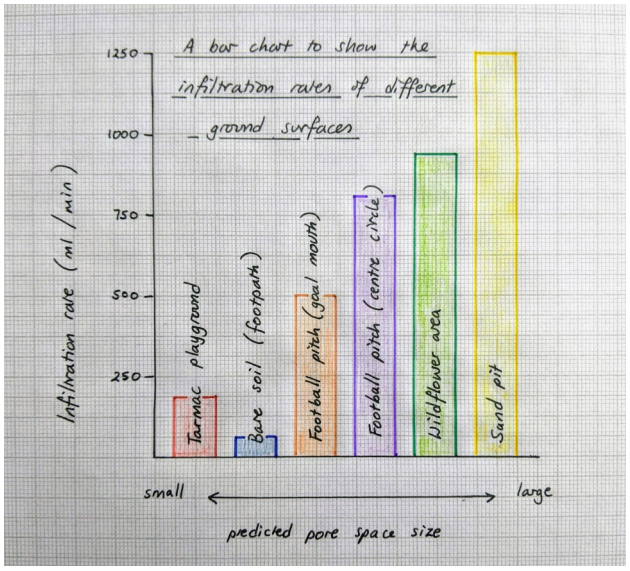
In the field

Pairs of students (or small groups) are equipped with a water container (filled with 500ml of water) and an infiltrometer. The infiltrometer is placed firmly onto the ground surface being surveyed. It may be necessary to hammer the infiltrometer slightly into the surface (or create a seal using tack) to prevent leakage from the sides of the tube as the water is poured in. As one student starts to pore the 500ml of water into the infiltrometer, another student starts the stop watch. As soon as all the water has disappeared from the surface, the stopwatch is stopped and the length of time recorded. In some cases, the water will infiltrate extremely quicky (such as in a sand pit) while in others it may be the case that the water simply does not infiltrate at all (such as on a tarmac playground). In the case of the latter students should stop recording when there is no further movement of the water line.

Suggested data presentation

As the infiltration rate data is discrete, and is representative of an amount of time, the results should be shown as a column chart rather than a histogram, indicating that each soil or surface type is independent of each other.

The order of the columns along the x axis may not matter but it might be a good idea to place the columns in the hypothesised order of pore space size. This allows students to more easily see if there is any ground surface or soil type which shows an infiltration rate different to that which they were expecting.



Key questions for reflection and analysis

- How can we calculate the **rate** of infiltration given the time records we have?
- What impact did different types of vegetation have on infiltration rates?
- Based on our results, which ground surface or soil type had the largest particle size and the largest pore spaces?
- Which of the ground surfaces or soil types we encountered would be best for arable farming?
- Which of the ground surfaces or soil types we encountered would be worst in a flood prone area?
- What impact might water pressure (by the act of pouring) have had on the results?
- What impact might air pressure have had on the results?
- What other factors might have had an impact on the results?
- Were there any opportunities for human error, or bias, to affect the results?
- Why didn't we repeat the survey multiple times in the same place?

Taking it further

This simple infiltration study can be expanded by repeating the measurements after a prolonged rain event. Students can compare the length of time it takes for the same amount of water to infiltrate once the soil or ground surface they are measuring is already relatively saturated with water. This can lead into an evidenced discussion about fluvial lag times and how some river basins may be more prone to flooding than others after extended rain periods.

