**ACTIVITY: Investigating soil moisture content**

**Activity idea**

In this activity, students find the moisture content of a soil sample and compare it to soil samples from different locations around the school.

By the end of this activity, students should be able to:

* observe similarities and differences among soil samples
* measure and record changes in soil moisture content
* use a simple formula to determine soil moisture content
* upload the data to a soil moisture database (optional).

[Introduction/background notes](#Introduction)

[What you need](#need)

[What to do](#Do)

[Extension ideas](#extension)

Student handout: [Measuring soil moisture](#handout)

**Introduction/background**

Air and water usually make up about half the volume of soil. Air and water are in small spaces called pores between soil particles. Plants and other soil creatures rely on soil moisture and air to survive.

Soil moisture content often changes with seasons. During the summer, plants grow quickly and require more water from the soil. Soil moisture is also lost by evaporation in hot weather. Rainfall or irrigation is needed to replenish soil moisture. In the winter, plants grow slowly, and when there is higher rainfall, the soil pores can fill with water and the soil becomes waterlogged. The excess water will eventually get used by plants, be evaporated or filter down into the groundwater.

There is an optimum soil moisture for good plant growth – this can change depending on the species of plant.

Soil moisture also changes with location. A soil sample from a playing field shaded by trees may have more or less moisture than a sample collected out in the open.

The soil’s texture also influences whether it holds on to water or is free draining. The soil texture in a school vegetable garden is probably different to the soil texture under the sports field.

This activity gives students the opportunity to measure soil moisture content and make comparisons by location and/or time. Knowing about soil moisture content is important for people who grow crops, manage livestock and look after sports fields.

**What you need**

* Soil samples from the playing field, school garden, under an eave, in a shaded area, native area and so on – take care to dig away from buried electrical, gas or water lines
* Ice cream containers (two per soil sample)
* Sieve or colander
* ½ cup measure
* Kitchen scale
* Microwave oven
* Calculator
* Copies of the student handout [Measuring soil moisture](#handout)

**What to do**

1. Hand out copies of the student handout [Measuring soil moisture](#handout) and ask students to follow the instructions.
2. Discuss the results. Students may be surprised to find the moisture content for some soils is greater than 100%. Compare the soil sample to a sponge – a sponge can double or triple its weight when wet. Soils can do the same.
3. Compare the data from the soil samples. What might explain differences in soil moisture content? (Soil may be wetter/drier in shady areas depending on the time of the year. The vegetable garden may receive irrigation during dry months. Soils also vary from location to location i.e. from the top of a hill to the bottom.)
4. Students can record their soil moisture data on a soil moisture database. Use the form located at the bottom of the article [Investigating soil moisture content](https://www.sciencelearn.org.nz/resources/736-investigating-soil-moisture-content).

**Extension ideas**

1. Choose one or two locations and repeat the experiment each month to see how soil moisture changes during the seasons. Graph the results.
2. Look at [NIWA climate maps](https://www.niwa.co.nz/climate/daily-climate-maps) that show last 15 days’ rainfall and temperature. How might these affect soil moisture?
3. If students have recorded data on the soil moisture database, compare their results with schools in the same region. Ask questions about the results, checking the dates the data was loaded and rainfall maps.
4. Research why some crops are grown on different soils. For example, peat soils are used for growing blueberries, gravelly soils in Hawke’s Bay are ideal for wine grapes and the loamy soils in the Waikato are used for pasture crops. What is the role of soil moisture and rainfall in determining why these crops are successfully grown in these areas?

**Student handout: Measuring soil moisture**

Do you think all soils contain the same amount of water? This activity will help answer that question.

***What to do***

1. For each soil sample, put some soil into a sieve or colander and shake it over an ice cream container to remove stones and large pieces of organic material.
2. Weigh the clean ice cream container and record its weight.
3. Measure out ½ cup of soil and put it in a clean ice cream container. (Keep some of the left-over soil for comparison.)
4. Weigh the container of soil. Subtract the container weight to determine the initial soil weight. Record the soil location and the initial soil weight on the data collection table.
5. Microwave the soil for 1 minute. Be careful! The soil can get very hot.
6. Remove the container and gently shake it until steam from the soil is no longer obvious.
7. Weigh the container of soil and record the weight (minus container weight). Observe what the soil looks like.
8. Continue to heat the soil in 1-minute intervals and record the weight.
9. Stop heating the soil when the weight does not change. This is the final weight.
10. Observe changes to the soil. Return the sample to the ½ cup measure to look at any change in the volume of soil. Use the senses of sight and touch to observe before and after samples.
11. To determine the percentage soil moisture content, subtract the final weight from the initial weight and divide by the final weight, for example, (68 – 49) ÷ 49 = 0.387 or about 39%.
12. Repeat these steps with the remaining samples.
13. Record your data on a [soil moisture database](https://www.sciencelearn.org.nz/embeds/1-measuring-soil-moisture-data-collection-form) (optional).

***Example sample and results***

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|  | **Vegetable garden soil**  Before and after 5 minutes in the microwave  Initial weight: 68 g  Final weight: 49 g  Soil moisture content:39% |

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| **Soil moisture data collection table** | | | | | | | | | **Date:** | | |
| **Soil location** | **Initial soil weight** | **Weight after 1 minute** | **Weight after 2 minutes** | **Weight after 3 minutes** | **Weight after 4 minutes** | **Weight after 5 minutes** | **Weight after 6 minutes** | **Weight after 7 minutes** | **Weight after 8 minutes** | **Final soil weight** | **% soil moisture content** |
| Example: *Vegetable garden* | *68 g* | *58 g* | *54 g* | *51 g* | *49 g* | *49 g* | *-* | *-* | *-* | *49 g* | *39%* |
| Example:  *gully floor* | *45 g* | *38 g* | *34 g* | *29 g* | *21 g* | *19 g* | *19 g* | *-* | *-* | *19 g* | *137%* |
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