# Soil Color and Moisture

sead : stem

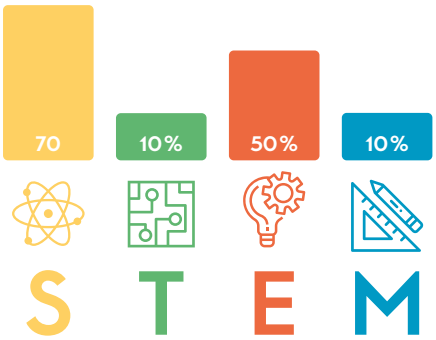
**Subjects**
Earth Science | Geology

**Topics**
Soil Moisture | Soil Color

**Key Words**
Soil | Moisture content | Color scales | Grayscale colors

**Connection to SDG**


**STEM Chart**




**Time for Activity**

2–3 hours

## Introduction

The amount of water present in a sample of soil is called the soil's moisture content. Moisture is very important and the amount of moisture needs to be in a careful balance, not too dry and not too wet, for organisms to thrive in it. Specifically, the moisture content of the soil needs to match the needs of the plants, animals, and other organisms living in the habitat. Some organisms need a lot of moisture, like ferns and salamanders. Others, like cacti and snakes, are adapted to desert habitats and need very little water. Most often, evenly moist soil is a haven for plants and small, soil-dwelling animals.

Moisture conditions affect the soil structure in many ways. Soil that is too wet or does not drain properly can suffer from erosion. Soil that is too dry can become hard and compacted. Also, different types of soil respond to moisture differently. A sandy soil will drain water quickly, but a clay soil will absorb water and become soggy. Since the moisture content of the soil is so important, how can it be measured? In this experiment, students will learn how to use color scales to indicate the moisture content of your soil.

## Key Objectives

1. Do understand that there is there a difference between dry soil samples and wet soil samples.
2. To understand what happens to the color of the soil as more water is added.
3. To understand how to use the results to determine the moisture level of other soil samples.

## Materials

1. Soil (3 cups)
   - a. This can be from your backyard, another outdoor location with exposed soil, or purchased from a plant nursery
   - b. If you collect your soil from an outdoor location, you may want to use a spoon, small shovel, and/or a sealable container to do this.

# Soil Color and Moisture

sead : stem

**Subjects**
Earth Science | Geology

**Topics**
Soil Moisture | Soil Color

**Key Words**
Soil | Moisture content | Color scales | Grayscale colors

- c. Be sure to note in your lab notebook where you collected the soil from.
2. Small baking dish
3. Cookie sheet
4. Oven
5. Small cups for your soil samples (21)
6. Permanent marker
7. Measuring spoons and cups
8. Water
9. Paper (3 sheets)
10. Pen, pencil, or marker
11. Digital camera
12. Computer
13. Printer
14. Lab notebook

## Safety

1. An adult is needed to help with using the oven.

## Guiding Questions

1. How does the color of soil change when moist or dry?
2. How is a color scale developed?
3. Do different soil types have different colors when moist or dry?

## Tasks/Steps

1. Put 3 cups of soil into a small baking dish. Place the dish on a cookie sheet.
2. Have an adult help you place the cookie sheet (with the baking dish on it) in the oven and bake the soil at low heat (200°F) for 2-3 hours. This will evaporate all of the water from your sample.
3. Remove the soil from the oven and allow it to cool completely.
4. Take 7 of the small cups and label then 1–7 using a permanent marker. Repeat this with the remaining unlabeled cups until all of the cups are labeled with a number.
   - a. This means you should end up with three cups labeled "1," three labeled "2," three labeled "3," and so on up to the number 7.
5. Using a measuring spoon, place 2 tablespoons (Tbsp.) of dry soil into each of the 21 small cups.
6. Follow Table 1, below, to add different amounts of water (in teaspoons [tsp.]) to each cup. (Note that no water should be added to the cups labeled "1," as these cups will be dry soil controls.) After adding the water to each cup, stir the soil in each cup thoroughly.

# Soil Color and Moisture

sead : stem

**Subjects**
Earth Science | Geology

**Topics**
Soil Moisture | Soil Color

**Key Words**
Soil | Moisture content | Color scales | Grayscale colors

| Sample | Soil (Tbsp.) | Water (tsp.) |
|---|---|---|
| 1 | 2 Tbsp. | 0 tsp. (no water) |
| 2 | 2 Tbsp. | 1/2 tsp. |
| 3 | 2 Tbsp. | 1 tsp. |
| 4 | 2 Tbsp. | 1 1/2 tsp. |
| 5 | 2 Tbsp. | 2 tsp. |
| 6 | 2 Tbsp. | 2 1/2 tsp. |
| 7 | 2 Tbsp. | 3 tsp. |

7. On a sheet of paper, use a pen, pencil, or marker to write the numbers 1–7. Leave enough room above the number so that you can place a spoonful of each sample above each number.

8. On the numbered sheet of paper, place one spoonful of each soil sample above the matching number. Do this with one of your numbered sets of cups (labeled 1–7).

9. Take a photo of your sheet of paper with a digital camera. Be sure to fit all of your samples in the photo.

10. Repeat steps 7–9 with your other two sets of cups (each labeled 1–7). Use a newly numbered paper for each set of cups.

11. Download the photos to your computer, and print out the photos in grayscale colors, or black and white.

12. Download this grayscale color bar and print out a copy of it: http://www.kumagera.ne.jp/kkudo/grayscale.jpg

13. Compare the colors of your soil samples with the different grayscale colors (on the bottom of the image, with percentages listed above them). Assign each sample a grayscale percentage (from zero, which is white, to 100%, which is black). Do this using the grayscale color bar by matching up the colors of the scale with those of your photo. In your lab notebook, make a data table like Table 2, below, and write your results in your data table.

| | Grayscale Percentage | Average Grayscale Percentage |
|---|---|---|
| 1 | | |
| 1 | | |
| 1 | | |
| 2 | | |
| 2 | | |
| 2 | | |
| 3 | | |
| 3 | | |
| 3 | | |
| etc. | | |

14. Calculate the average grayscale percentage for each of the samples that have the same number. Write this in the data table in your lab notebook.

    a. For example, if one sample #2 had a grayscale percentage of 50%, another sample #2 had a grayscale percentage of 55%, and the third sample #2 had a grayscale percentage of 50%, the average grayscale percentage for sample #2 would be 52% (since 50% + 55% + 50% = 155%, and 155% ÷ 3 = 52%).

# Soil Color and Moisture

sead : stem

**Subjects**
Earth Science | Geology

**Topics**
Soil Moisture | Soil Color

**Key Words**
Soil | Moisture content | Color scales | Grayscale colors

15. Make a graph of your data by hand or you can try using the Create a Graph web site for kids from the National Center for Education Statistics.

    a. On the x-axis (the horizontal axis), list your sample numbers (1–7). On the y-axis (the vertical axis), list your average grayscale percentages (0–100%).

16. Is there a difference between dry samples and wet samples? What happened to the color of the soil as more water was added? Could you use your results to determine the moisture level of other soil samples?

**Authors/Source**
Brynie, F.H., 2005. Parent's Crash Course: Elementary School Science Fair Projects, Hoboken, NJ: Wiley Publishing Inc. pp 162-164. Sara Agee, Ph.D., Science Buddies, Teisha Rowland, Ph.D., Science Buddies, „Soil Color and Moisture." Science Buddies, 12 Jan. 2020
https://www.sciencebuddies.org/science-fair-projects/project-ideas/Geo_p011/geology/soil-color-and-moisture