

**Accompanying Worksheet:** Soil Characterization (W-S-02)

**Objective:** Students will expose different layers of soil (known as “horizons”) and categorize them based on their textural and color properties.

**Considerations:**

1. Students should pick and expose the site using the Soil Site Selection protocol (S-01) and its accompanying classroom worksheet.
2. This activity works best if students are groups of 2-3.
3. You may wish to create a larger research project based on the results. You could ask students to determine what kinds of vegetation would flourish in the soil sampled, and compare if the vegetation present reflects their predictions. You may also ask about the optimal usage of the land, given its soil properties (this last one works particularly well when combined with the Soil Moisture protocol—you could conceive a project with geotechnical engineering implications involving the building of structures: what could the soil support given its water content and properties?)
4. It is generally necessary for students to dig a fair ways straight down into the soil. If, however, your site is located in an area where digging deep may be problematic (such as a location where soil is dry, hard, or rocky), we suggest finding a nearby natural or artificial cutaway such as a streambed or roadside ditch, where students can simply scrape away the outer layer of soil and reveal the horizons without digging vertically.

**Materials:**

\_\_\_ trowels

\_\_\_ measuring sticks/rulers/tape measures

\_\_\_ bottle of water (spray nozzle suggested)

\_\_\_ Munsell Soil Color Chart

(can be found at <http://www.environmental.southsuburbanairport.com/Environmental/pdf2/Part%204%20-%20References/Reference%2016%20Munsell%20Color%20Charts/MunsellColorChart.pdf>)

\_\_\_ a bottle of vinegar

**Instructions:**

Students will use an exposed soil profile (a spot of ground free of debris and scraped to expose fresh soil). They will look for differences in soil qualities as they dig deeper, and evaluate samples of soil from each distinct layer. Distinguishing layers may be easier said than done, however, so encourage students to look for changes in color, texture, composition (ie rocky, sandy, loamy), moisture, and smell. Students will use the provided worksheet to characterize each soil horizon.

1. Note any organisms in the soil. Are there tree roots or fungal hyphae? Perhaps insects or earthworms?
2. Record if there are none, few, or many rocks in the horizon.

3. Record if there are none, few, or many roots in the horizon.
4. Take a palm-sized sample from the top layer of soil, after the area has been cleared).
5. Describe the moisture level of the soil as wet, moist, or dry. If the soil is dry, moisten it slightly.
6. Examine the soil structure, and record on the worksheet. Soil can be categorized as:
  - a. **Granular**: resembles cookie crumbs; common in soil invaded by plant roots, less than .5 cm diameter.
  - b. **Blocky**: Irregular blocks that are usually 1.5 - 5.0 cm in diameter.
  - c. **Prismatic**: Vertical columns of soil that might be a number of cm long. Usually found in lower horizons.
  - d. **Columnar**: Vertical columns of soil that have a white, rounded salt "cap" at the top. Found in soils of arid climates.
  - e. **Platy**: Thin, flat plates of soil that lie horizontally. Usually found in compacted soil.
  - f. **Single Grained**: Soil is broken into individual particles that do not stick together. Always accompanies a loose consistence. Commonly found in sandy soils.
  - g. **Massive**: Soil has no visible structure, is hard to break apart and appears in very large clods.
7. In the sunlight, examine the soil color, using the Munsell Soil Color Chart, and record the closest match. In some cases, a soil may have many colors. We are only concerned with the most prevalent.
8. To measure consistence, pick out a small bead of soil and gently squeeze it between your thumb and forefinger until it loses its shape and disintegrates. If the soil is dry, moisten it slightly. Mark the worksheet with your category:
  - a. **Loose**: you had trouble gathering enough soil to sample in your fingers before it falls apart.
  - b. **Friable**: the sample breaks with only minimal pressure.
  - c. **Firm**: the sample breaks after a larger amount of pressure.
  - d. **Extremely firm**: normal finger-strength was not able to crush the sample.
9. Using the information on the worksheet, determine the soil texture. The worksheet has a stepwise contrasting-characteristic identification key that will guide you to the proper classification.
10. Using the trowel, set aside a sample of soil to be used for the free carbonates test. **DO NOT TOUCH THIS SOIL WITH YOUR HANDS**. Squirt vinegar on your removed sample, and observe for effervescence (bubbling). Record the level of free carbonates as:
  - a. **None** (no reaction)
  - b. **Slight**
  - or
  - c. **Strong** (many and/or large bubbles)
11. Repeat the process for each horizon. Continue to dig as deep as is feasible, to expose the most horizons for study.

**Adapted from GLOBE Soil Characterization Protocol**

Visit [www.flagstaffscies.org](http://www.flagstaffscies.org) for more information and field worksheets!