

Earth Science Education Activity

How Stable is Your Soil?

Investigating Soil Structure and Aggregate Stability

Background: Soil health is essential to plant growth, water quality, carbon storage, and ecosystem stability. One key indicator of soil health is aggregate stability, which is the ability of soil particles to remain clumped together when exposed to water. When aggregates are stable, soils resist erosion, have improved water infiltration, and there is better support for root development and microbial activity. Aggregate stability is influenced by several factors including organic matter, biological activity, and land management practices. Visual indicators of stable soils include crumbly texture, visible organic matter, and the presence of roots or earthworm channels. Access additional resources for more information on [soil aggregates stability](#) and [testing aggregates stability](#) (p.18–19 and 69–71).

Key Question: How does soil structure vary across campus, and what does it reveal about soil health and land use?

STANDARDS

NGSS: HS-ESS3-3, HS_ESS3-1, HS-LS2-6

SDG 2: Zero Hunger

SDG 15: Life on Land

Learn more about the United Nation's Sustainable Development Goals (SDGs) and [explore resources for educators from UNESCOI](#)

MATERIALS

- ◆ phone with access to the [Slakes application](#)
- ◆ tripod or stable mount
- ◆ 2 Petri dishes per group
- ◆ paper bag or tray
- ◆ shovel



An intact soil clod.

Credit: John Kelley/Retired USDA NRCS, CC BY 2.0



The Slakes mobile app is available for download from the App Store or Google Play.

Credit: Soil Health Institute

PROCEDURE

1. Day 1

- a. Examine a map of your school campus. Identify and mark 3 to 5 distinct sampling locations (e.g., sports field, garden bed, roadside edge, shady area, compacted path).
- b. At your designated location(s), take an image of the soil and the surrounding landscape.
- c. Dig ~2 inches into the topsoil and remove an intact clod. Gently break apart the soil into pea-sized aggregates (1/8 to 3/8 inch diameter). Avoid collecting any aggregates that were smeared when inserting the shovel into the ground.
- d. Back in the classroom, lay the aggregates out in a tray to air dry overnight.

2. Day 2

- a. Mount a smart phone that has the Slakes App installed, approximately 4 to 6 inches above an empty clear plastic dish.
- b. Place three aggregates in the dish that the phone is facing.
- c. Fill a second dish with water.
- d. In the Slakes app, tap 'Start Aggregate Stability Test' to enter sample ID and to capture an initial image of dry soil in the dish.
- e. Move the second dish filled with water into camera view, gently transfer the aggregates to the water filled dish, and take a picture to start testing.

- f.** The app will automatically capture the final image after 10 minutes. It will display the aggregate stability index value for the sample.
- g.** On the My Results Tab, tap 'Export Test Results' as a .csv file.
- h.** Input your data into a shared spreadsheet to compare values with others.

ANALYSIS

- 1.** What was your soil's aggregate stability index? What does this mean?
- 2.** Which locations had the most and least stable soils? What do those areas look like?
- 3.** What patterns do you notice in relation to how land is used (e.g., vegetation, traffic, slope)?
- 4.** What factors do you think influenced the differences in stability?
- 5.** What might be the consequences of low aggregate stability in your environment?
- 6.** What might be done to improve soil stability in some areas of your school campus?

SYNTHESIS

Farmers, land managers, and conservationists depend on stable soils to sustain plant growth, prevent erosion, and keep water clean. Soil structure plays a major role in whether rainwater soaks in or runs off, carrying valuable nutrients with it. Based on your investigation, reflect on what the aggregate stability of soil around your school reveals how well those soils could support crops or resist erosion during a heavy storm. Which areas of campus have soil that might behave like healthy farmland soil, and which might wash away easily?

EXTENSION

Select one location that you want to improve the soil. Look into soil management practices and improvement strategies for the soil. Pitch a project to your administrators and upon approval, implement the intervention at that site. Repeat the Slakes test and observe changes in aggregate stability over time. (Note, aggregate stability is best compared at the same time of the year.)