

Soil stability test

Focus questions	How do soils differ in stability? What helps soil to be stable?
Learning target	Students compare different soils to see which has better structure.
Vocabulary	Glomalin, fungi

MS-LS2-3 Ecosystems: Interactions, Energy, and Dynamics

Performance expectation MS-LS2-3	Classroom connection: This activity helps students to see how critical microorganisms are to a soil system.
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Science and engineering practices

Developing and Using Models	Classroom connection: Students compare soils to see the effect of immersive wetting.
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Disciplinary core ideas

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems	Classroom connection: The difference between soils of the same type that hold together vs fall apart when immersed in water is due to a microorganism and a protein that it secretes.
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Cross-cutting concepts

Energy and Matter Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems	Classroom connection: The transfer of energy from fungi to the roots of plants may be lacking when the soil is tilled or cultivated. This affects soil aeration, water infiltration, run off, and the health of plants growing in the soil.
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Background

Throughout this unit, different aspects of soil have been highlighted. Soil stability is often left out of the discussion. Soil stability or structure is a result of healthy microbes, plant cover, and adequate nutrient flow. The test used in this activity is referred to as a slake test. As soil is immersed in water, portions of the soil will slake off into the water, if the soil has little glomulin or microbe activity. Humans can improve the stability of a soil by rotating crops, having plants in soil all year round, and reducing the amount of cultivation or tillage.

Teacher preparation

- Using the same soils for all of these lessons allows students to create a baseline of data, then compare for soil organisms, texture, and nutrients to determine if there is a pattern to location and numbers of organisms and nutrients found.
- Watch Soil Health Lessons in a Minute: Soil Stability Test (youtu.be/9_ItEhCrLoQ) for a demonstration for how to set up this activity.
- This pdf helps to explain the role of glomalin, a protein secreted by fungi, in soil formation and health: nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1144429.pdf

Student handout

Data

Sample location	Time (min.)	Soil stability	Water clarity	Notes (loose sediment, action of water on soil, etc.)
	1			
	2			
	3			
	1			
	2			
	3			
	1			
	2			
	3			

Reflection

1. What causes the difference between soil samples?

Answers will vary: human land use, vegetation differences, precipitation and climate, agricultural management practices, etc.

2. What is the difference between good and poor soil stability? How is this demonstrated in the soil slake test?

Good stability is demonstrated by the soil holding together when immersed in the water. Bubbles may be visible to show that water is infiltrating the soil and displacing air in the soil. Sediments do not drop off to dissolve or become suspended in the water. Poor stability will be shown by a soil that seems to fall apart or disintegrate when exposed to the water.

3. What happens to soil with poor stability when intense rain comes in contact with it? Why does this happen?

Soils with poor stability will be washed away with hard rain. The nutrients attached to the soil sediments will be washed away with the sediments.

Student handout

4. How does soil stability impact a soil's ability to produce crops?

A stable soil will be able to hold roots, more water and protect plants from drought conditions longer. The microbial community will be intact and help to deliver nutrients from the soil to the plants.

5. How might a farmer improve soil stability?

Reducing tillage will help improve soil stability, as well as rotating crops and incorporating fertilizers when added.

Rubric for self-assessment

Skill	Yes	No	Unsure
I can determine which soils have higher stability.			
I can determine the advantages of soils with higher stability when compared to soils with less stability.			
I can explain how soil stability is related to soil microbes, soil texture and soil nutrients.			

Differentiation

Other ways to connect with students with various needs:

- **Local community:** Students may investigate the soil types for their local community by visiting websoilsurvey.nrcs.usda.gov/app/ and comparing the nutrient levels in various locations. Determine if there is a pattern when comparing soil stability and the other aspects tested in this unit: texture, nutrients, and microbial activity.
- **Students with special needs (language/reading/auditory/visual):** Students can be paired for the activity to allow team collaboration in determining if there is a pattern.
- **Extra support:** Watch Soil Health Lessons in a Minute: Soil Stability Test (youtu.be/9_ItEhCrLoQ).
- **Extensions:** Students may present a full soil write-up about their samples and use the evidence from each of the tests to support their reasoning that soil health includes all of these aspects.

Assessments

Rubric for assessment

Skill	Developing	Satisfactory	Exemplary
The model determines soil stability.	Students can explain the demo as a model, but do not connect to soil stability or structure.	Students can explain the demo as a model and connect the model to soil stability by using one example of how structure keeps soil intact during rain or other similar example.	Students can explain the demo as a model, use an example of how soil stability is helpful, and can generalize to different soil samples and different aspects of soil working together as a system.
Develop a model.			Student can model soil stability in a different way.

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