Soil "Glue" Activity

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NGSS:
HS-LS2.C: Ecosystem Dynamics, Functioning, and Resilience

HS-ESS2.E: Biogeology

MS-ESS3.C: Human Impacts on Earth Systems

Summary/ Background: The health of soils is crucial in reducing soil degradation and supporting the systems of the underground life cycle. In healthy soils, sand, silt and clay particles are held together by "soil glues", or glomalin, a protein produced by fungi. Glomalin sticks to soil particles and holds them together, much like glue, to form stable aggregates (clods). This ability is called aggregate stability. When a soil is heavily disturbed during construction or cultivation (tillage), the uppermost layer (topsoil), is drastically changed. These changes decrease soil microbial activity which decreases the amount of glomalin produced. Soil aggregates that have not been disturbed for many years will have larger amounts of glomalin, resulting in more stable aggregates because the glomalin holds the soil particles together. This activity will demonstrate how these soil glues help aggregates hold together, especially when very wet.

Learning Objectives

- Recognize a disturbed soil from a protected soil.
- Observe the effect of disturbance on stability of soil aggregates
- Demonstrate the importance of protecting soils from disturbance
- Provide examples when soils must be disturbed and actions to protect disturbed soils

Grade level: High School

Materials

- 2 wide mouth glasses/glass jars
- 2 pieces of ¼-in wire mesh (about 10 cm x 15 cm) or 2 2-mm sieves
- 2 soil aggregates (clods) about the size of an egg, of topsoil from areas with different surface conditions (examples of areas to sample are undisturbed lawn/forest/pasture/prairie and disturbed areas such as construction sites, dirt path, garden, farm field)

Procedure

Exploratory questions: How does each aggregate look? How are they the same? How are they different?

Step 1: Shape the wire mesh to sit about 4 cm below the rim of each glass/jar while resting on top.

Step 2: Label each glass with the soil surface condition from which it was collected and fill each glass with water to within about 1 cm of the top

Step 3: At the same time place one soil aggregate into the mesh of the corresponding glass, ensuring the aggregate is almost fully submerged.

Step 4: Observe the results and record observations.

Exploratory questions: Did the clods react the same way (did the soil stay together or fall apart)? How does the water look? Does it look the same after 1 min, 5 min, etc? If the water became cloudy, did it become clear? How long did it take?

	Soil Aggregates							
	Clod 1				**Clod 2**			
Observation - Describe Clod 1. Color 2. Shape 3. Size (diameter or if not round length, width, and height) 4. Where did the clod come from?								
	Did the clod stay together or fall apart?	Is there soil in the bottom of the cup?	Is the water clear or cloudy?	Size of clod in screen (diameter only)	Did the clod stay together or fall apart?	Is there soil in the bottom of the cup?	Is the water clear or cloudy?	Size of clod in screen (diameter only)
1 minute								
5 minutes								
10 minutes								
15 minutes								

Discussion: Which clod held together more? Why? Why would one be different than the other based on location (hint: microbial activity perhaps)?

NGSS CONNECTIONS

- Science and Engineering Practices: Obtaining, Evaluating, and Communicating Information; Asking Questions and Defining Problems
- Disciplinary Core Ideas: Earth's Materials and Systems
- Crosscutting Concepts: Systems and Systems Models; Influence of Science, Engineering, and Technology on Society and the Natural World