Student task sheet: Soil site and texture evaluation laboratory live field trip

Component #1: Field site observations

1. Where is the site located?
2. What color is the soil?
3. What types of vegetation are present?
4. How much vegetation is present?
5. Are there visible signs of wind or water erosion?
6. List other field site observations.

Component #2: Collecting soil samples

With the use of a spade or soil probe:
1. Collect samples of the soil and place it into containers. (Containers may range from glass jars with lids to resealable bags.)
2. Label the container of each soil sample with the soil site location.

Note: Attempt to collect soils of differing textures as indicated on the NRCS maps.

Student task sheet: Soil texture "feel" laboratory

After taking appropriate safety measures, use the labeled soil samples obtained either from field site visitation or from the NRCS to do the following:

1. Pour a small amount of a soil sample into your hand, filling your palm.
2. Add small quantities of water to the soil in your hand until the soil reaches a "play dough" type consistency that can be formed into a pliable ball.
3. Compare and contrast soil samples of differing textures by rubbing your thumb across the soil "pliable ball" to feel the individual particles in each sample. (Characteristics of sandy, clayey, and silty textures are amplified to the touch when moistened.)
4. Thoroughly wash your hands with soap and water.
5. Record your observations.

Student task sheet: Soil particle separation laboratory

Hypothesis
Develop a hypothesis about the textures of the various soil samples that are about to be analyzed.

Day #1

Materials
Soil samples, glass containers with lids, water

Procedures
1. Fill the glass containers approximately 3/4 full of soil. (A separate container will be needed for each soil sample analyzed).
2. Pour water into the container of soil, completely saturating the soil and continue filling to the point that the container is completely full. (A small air space is fine).
3. Securely seal the container with a lid.
4. Shake the container of soil and water vigorously to suspend every individual soil particle in the water.

5. Place the containers on a safe, solid surface where they will remain completely undisturbed for approximately 24 hours.
6. Thoroughly wash your hands with soap and water.

Day #2
Materials
Sealed containers of soil-water mixtures prepared on Day #1, ruler, calculator, soil texture triangle

Procedures
1. Visually inspect the settling pattern of the soil particles in the containers.
2. Identify the three distinct layers of soil particles that have formed.
3. Place a ruler next to the container.
a. Measure the total amount of soil in the container (linear measure from bottom to top).
b. Measure the amount of soil particles in each layer (linear measure).
4. Calculate the percentages of sand (bottom layer), silt (middle layer), and clay (top layer).
5. Use the soil texture triangle to determine the soil texture.
6. Compare your findings with your hypothesis and with the NRCS maps.

Student task sheet: ATV and motorcycle tire traction and maneuverability laboratory

Hypotheses: Apply your knowledge about soil texture differences to develop hypotheses about their effect on ATV and motorcycle tire traction. Use the following questions to guide your hypotheses development.

In dry and wet conditions:
1. How will a sandy soil affect tire traction and maneuverability?
2. How will a clayey soil affect tire traction and maneuverability?

Materials
Table top, rubber mat, and at least two: soil samples of differing soil textures, glass containers to contain soil, and beakers for measuring water.

Procedures
1. Using your thumb, apply an equal amount of downward pressure while moving across a finished table or desktop.
2. Using your thumb, apply an equal amount of downward pressure while moving across a rubber mat.
3. Record the differences you noted between the two. Use words like friction, resistance, smooth, rough, etc. in the description of your findings.

Similar to testing the friction between a finished desktop and a rubber mat by rubbing a thumb across their surfaces, friction can be assessed on the soil surfaces and inferences can be drawn regarding ATV tire traction and maneuverability.

Using at least two soils of differing textures (preferably textures on extreme ends of the soil texture triangle, i.e., sandy and clayey), do the following:

1. Fill two containers with soils of differing textures.
2. Using your thumb, apply an equal amount of downward pressure while moving a thumb across the dry soil surfaces.
3. Record the differences you noted. Use words like friction, resistance, smooth, rough, etc. in the description of your findings.

4. Based on your findings, how will tire traction and maneuverability of motorcycles and ATVs be affected by the surfaces of soils of textures similar to those in with which you have just experimented?
5. Compare your findings against your hypotheses.
6. Pour equal amounts of water into the containers of soil.
7. Replicate the friction test (#2 and #3 above) on wet soils.
8. Based on your findings, how will tire traction and maneuverability of motorcycles and ATVs be affected by the surfaces of soils of textures similar to those in with which you have just experimented?
9. Compare your findings against your hypotheses.

Student task sheet: The effects of soil texture on infiltration, percolation, and garden productivity laboratory

Hypotheses
Apply your knowledge about soil properties and soil texture differences to develop hypotheses about their effect on infiltration and percolation.

For testing infiltration and percolation rates:

Materials
A stop watch and at least two identical glass jars containing equal amounts of soils of different textures with equal amounts of premeasured quantities of water for each jar of soil.

Procedures
Using at least two soils of differing textures:
1. Simultaneously pour the entire amount of premeasured water onto the surface of the soil in a glass container of soil and start the stopwatch. (The amount of premeasured water will depend on the size of the volume of soil in the container).
2. Observe the water as it travels to the bottom of the soil.
3. When the water reaches the bottom of the container, the stopwatch should be stopped and the results recorded.
4. Repeat steps 1 through 3 for each soil sample.
5. Compare results against hypotheses and draw conclusions.

Extension
Apply your findings to gardening. Use these and other questions in your applications:

1. How is the growth and production of garden plants affected by infiltration and percolation rates?
2. How does infiltration and percolation affect runoff?
3. How does runoff affect gardening, i.e., soil water availability, erosion, etc.?
4. Can soil texture be used to predict the productivity of a garden?

Student task sheet: Gardening water-holding capacity laboratory

Hypotheses
Apply your knowledge about soil properties and soil texture differences to develop hypotheses about their effect on water-holding capacity.

Materials
A beaker and at least two identical glass jars containing equal amounts of soils of different textures.

Procedures

Using at least two soils of differing textures:
1. Pour equal amounts of soil into the glass container.
2. Pour measured amounts of water into the glass containers of soil. (Measured amounts of water should differ.)
3. Record observations.
4. Compare findings with hypotheses.

In relating this back to gardening, discuss the importance of soil water availability in the production of garden vegetables and the role that soil texture plays in that process.

Student task sheet: Gardening mineral retention laboratory

Hypotheses
Apply your knowledge about soil properties and soil texture differences to develop hypotheses about their effect on mineral retention.

Materials
9 small flower pots; enough sandy, silty, and clayey soil to fill the flower pots (3 pots per soil type); at least 18 garden seeds of the same plant (2 seeds per pot).

Procedures
Using at least three soils of differing textures:

1. Fill the flower pots with soil, leaving one to two inches of air space at the top, as follows:

a. 3 pots with sandy soil
b. 3 pots with silty soil
c. 3 pots with clayey soil

2. Plant two garden seeds of your choice (all of the same plant) in each of the nine flower pots.
3. Water the plants weekly or more often as needed, insuring that all receive the exact same amount at each watering.
4. Record weekly linear plant growth measurements.

The measurements can continue as long as the students and teacher deem appropriate.

At the conclusion of the experiment, compare findings with hypotheses.

Relate findings and conclusions to gardening by answering questions such as:

1. Which soil texture promoted the greatest plant growth?
2. How much of the difference found in plant growth can be attributed to the mineral retention of the soil?
3. Why do certain textures retain minerals better than others?
4. What is the ideal soil texture for growing a garden?

Student task sheet: Lake bottom soil textures and fishing laboratory

Using the soil texture feel, the soil particle separation, the infiltration and percolation, and the water-holding capacity laboratory procedures, apply your findings in developing a hypothesis

about the type of soil texture present in most lake bottoms and the role they play in supporting aquatic life.

Procedures

1. Collect soil samples from one or more lakes.
2. Conduct the soil particle separation laboratory to determine the soil texture.
3. Record your findings.
4. Compare findings with hypotheses.

Extension

In applying the importance of lake bottom soil textures to the sport of fishing answer the following questions:

1. Why do clayey soils hold water on the surface better than other soil textures?
2. What role does infiltration and percolation play on the soil's ability to keep water on the surface?
3. In what ways are aquatic ecosystems dependent on soil texture?

Student task sheet: Soil formation laboratory

Materials

One paper plate and two rocks per student. (Preferably, the rocks will be of softer origin, e.g., sandstone or calcium carbonate concretions.)

Procedures

1. Place the paper plate on a table.
2. Rub the rocks together over the paper plate.
3. Observe the "soil" formed as a result of the rubbing together of the rocks.

Extension

Using your findings from the soil formation experiment, discuss the following:

1. How much time is required for soil development?
2. What are the effects of the following on soil development?
a. Parent material
b. Climate
c. Biosphere
d. Topography
e. Time
3. What is the role of physical and chemical weathering on soil formation?