WATER QUALITY

Watersheds and soil profiles

Focus question	What soils are most vulnerable to erosion?
Vocabulary	Runoff, erosion, groundwater

Background

Water flow is governed by gravity, not directionality, therefore all water runs downhill. Runoff commonly refers to the drainage of water from a land surface, be that a yard, a parking lot, roads, a farm field, feedlot, or other surface. When water runs off of a land surface, many materials may be picked up and moved with the water. This action is called erosion. Erosion might be due to water, or wind or glaciers. Water erosion can be of many types depending on the quantity of water running off and the elevation.

The water cycle incorporates surface water, groundwater, and water in the atmosphere. Surface water is what we see in lakes, rivers, streams, and the ocean. Groundwater is stored in aquifers that provide underground water for drinking and it may feed surface water sources. Precipitation recharges aquifers. The hydrologic cycle is constantly recycling water through the processes of precipitation, evaporation, and condensation.

In this activity you will examine how soil size can impact the ability of water to penetrate or percolate through soil during rainfall.

You will be creating various types of soil profiles during the course of this lab in order to establish why certain soils are better in helping to prevent erosion and excess runoff during certain weather conditions. You will collect data to determine how long it takes for water to move into the profile to establish which soil you believe would be the most suitable for crop growth and conservation.

Materials

- Samples of 30 mL of sand, silt, clay, gravel (You will need additional amounts when testing your own soil mixture.)
- Container to collect wet soils (1 sand, 1 silt, 1 clay, 1 gravel, 1 mix)
- Soil profile tube with lid or parafilm
- Water
- Timer
- Cup to collect water
- Graduated cylinder
- Calculator

Procedure

1. Gather all materials needed for the experiment.
2. Begin by measuring out 30 mL of sand.
3. Measure out 50 mL of water into a graduated cylinder.
4. Carefully pour the sand into the profile tube. *Make sure that your finger is over the hole at the bottom of the profile tube!*
5. While still holding your finger over the hole, begin to pour the 50 mL of water into the profile. Make sure to place the collection cup underneath the profile tubing.
6. When you pull your finger off the hole in the profile tube, begin the timer. Allow the water to run through the soil into the cup below until no more water is coming out of the tube. Stop the timer at that moment and record your data in Table 1, including your overall impression from your observation.
7. Empty the sand from the tube into the designated container and rinse the profile tube.
8. Repeat steps 2–7 using gravel, silt, and clay. Record your data and observations in Table 1.

Table 1

Soil type	**Time for water to clear the tube (sec.)**	**General observations. How did the water move through the profile?**
Sand		
Silt		
Clay		
Gravel		

Graph 1 (comparative bar chart)

Create your own soil profile

Think about how a soil profile appears. Considering the soils/gravel available, create your own soil profile to test for percolation efficiency and potential runoff risk.

1. Working collaboratively with another individual, determine what soil profile you wish to create.
2. Write a hypothesis of expected outcome.
3. Write down your materials and detailed procedures.
4. Create a data table to record your findings for a 3–5 trials.
5. Carry out your experiment with your profile. Make sure to do at least 3 trials and average them.
6. Summarize and analyze your results. Did you prove your hypothesis, why or why not? What would you do differently if you repeated the experiment? Would you alter the soil, water, etc? What errors could have occurred?

Hypothesis

Materials (bulleted list)

Procedures (numbered step by step)

Data table

Graph

Conclusion/analysis

Reflection

1. Farmers use equipment to travel across their fields while planting, spraying for weeds or pests and harvesting. What effects might the continued movement of equipment over the soil surface have on percolation rates?

2. How does percolation rate connect to runoff and erosion?

Rubric for self-assessment

Skill	Yes	No	Unsure
I was able to plan and conduct an investigation that resulted in data that served as reliable measurement.			
I considered limitations and refined the design to address those limitations.			

Lab report template

Lab title

Problem
What is the overall problem you are attempting to answer with your design?

Hypothesis
What is your predicted Statement of Outcome?

Materials
Using bullet points, list all materials that will be needed for your designed experiment.

Procedures
This should be the step-by-step instructions of how to carry out the experiment and where to record the data.

Data collection
This should include your data table with the data you collected during the experiment. This should also include a graph of the data as a visual representation. This would be a good place to include photos or illustrations of the experimental outcome for each test. Analyze the data—what is the data telling the reader?

Conclusion
- Did you prove your hypothesis? Why or why not?
- What did the data specifically tell you about the problem?
  Use examples from your data to support your conclusion.
- Was your outcome what you expected?
- What would you change about your experiment if you retested?
- Were there any possible errors that could have impacted your results?
- How does erosion impact watersheds?
- What solutions might be used to reduce those impacts?