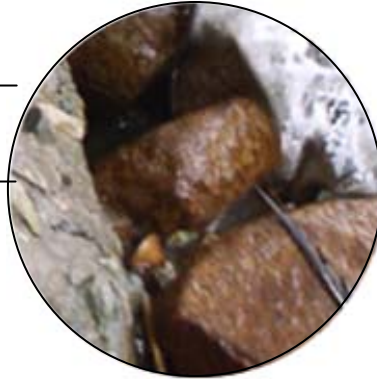


LAND EROSION

Does Vegetation Matter?

TEACHER



Activity Overview

Erosion is the process by which the earth's surface is worn away by natural elements such as wind and water. Water that moves over the earth's surface and erodes or carries away soil and other particles is called runoff. As runoff flows into lakes, ponds, and other water supplies, it deposits these particles as sediment. Too much sediment can severely harm aquatic habitats. Lake Alajuela at the Panama Canal, for example, has lost some of its capacity to store water because it is partly filled with sediment.

In this activity, students will collect runoff from two simulated sites: 1) a tray with soil, 2) a tray with grass covered sod, to see how vegetation affects erosion. They will use a Turbidity Sensor connected to a TI CBL 2™ or Vernier LabPro and a TI-73 Explorer™ to compare and examine the runoff from the sites.

Conclusion: Students will observe that less soil runs off from the pan with grass covered sod. They will also observe that the turbidity of the runoff from the tray with soil is higher than the turbidity from the tray with grass covered sod. Vegetation plays a major role in reducing erosion by anchoring soil particles in place.

Activity at a Glance

Grade: 4-9
Subject: Science
Category: Earth Science
Topic: Erosion, Deposition,
Weather, Climate

Time Required

- Two 45-minute periods

Level of Complexity

- High

Materials*

- TI-73 Explorer™
- TI CBL 2™ or Vernier LabPro
- TI-73 DataMate
- Turbidity Sensor
- 2 sampling bottles with lids
- Empty Turbidity Cuvette (comes with sensor)
- Turbidity standard (StableCal® Formazin Standard 100 NTU) (comes with sensor)
- Soft, lint-free cloth or tissue
- 1 bag of potting soil (medium size)
- Grass covered sod (enough to fill one large pan)
- 2 clear spray bottles with measurements marked
- 2 large aluminum pans
- Blocks or books to prop up pans
- 2 large cafeteria trays
- Rubber gloves



Adapted from "Experiment 3 — Turbidity," Water Quality with Calculators, written by Johnson, Robyn L., Holman, Scott, and Holmquist, Dan D., published by **Vernier Software & Technology**, 2002.

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Concept Background

- Between 1950 and 1990, the population of people in the Panama Canal area increased from 22,000 to 113,000. Forests were cleared to make room for homes, farms, and cattle pastures. In those 40 years, a third of the watershed's forests were cleared.
- As trees were cut down, soil washed away more easily. Deforestation of the Panama Canal watershed has resulted in serious soil erosion, filling Lake Alajuela with sediment and making hilly areas more susceptible to dangerous landslides.
- The Panama Canal Commission first used the non-native grass *Saccharum spontaneum* in the 1960s to combat soil erosion in the watershed. The non-native invasive species quickly spread, threatening native vegetation.
- Decisions people make today will affect the watershed 20 to 30 years from now. Indigenous people, farmers, and ranchers must consider their precious natural resources as they look for ways to meet their economic needs.

Preparation and Classroom Management Tips

- You may consider arranging the soil in Pan 1 and the grass covered sod in Pan 2 in advance.
- Go over Part A of the activity during the first period. Go over part B during the second period.
- If you cannot test for turbidity right away, store the sample in an ice chest or a refrigerator.
- In Part A, you may consider asking students to measure the water added to each tray, the amount of runoff collected from each tray, and compare the amounts. This way they can see how much water each site absorbed.
- Consider explaining to students that it is important to perform a calibration for the Turbidity Sensor in order to make sure that the collected data for Turbidity is accurate (Procedure, Part B, Step 3). If the same cuvettes are always used, these calibration values should be good for several months.
- This activity works well with students working in groups, or as a demonstration.
- Encourage students to answer the questions in Data Analysis in their journal.
- Create your own student questions for use on your students' TI graphing devices using the Texas Instruments StudyCard applications. For more information, go to <http://education.ti.com/us/product/apps/studycards/scresources.html>.

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TI-73 Explorer™

* This activity has been written for the TI-73 Explorer™ but you can easily substitute the TI-83 or TI-83 Plus.



Turbidity Sensor



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Data Analysis

Part A — Vegetation

- 1** Q. How much water did you spray on the soil of Pan 1?
 - A. *Answers will vary. Students will measure the volume of water they sprayed on the soil using the measurements marked on the spray bottle.*

- 2** Q. How much water did you spray on the grass covered sod of Pan 2?
 - A. *Answers will vary. Students will measure the volume of water they sprayed on the grass covered sod using the measurements marked on the spray bottle. They should spray the same amount of water with either bottle.*

- 3** Q. Which cafeteria tray had more runoff?
 - A. *Cafeteria Tray 1 should have more runoff than Pan 2.*

- 4** Q. What does the amount of runoff in each pan suggest about vegetation?
 - A. *More soil runs off from the pan with soil than from the pan with grass covered sod because grass covered sod holds back water. Pan 1 collects more runoff than Pan 2, even though about the same amount of water was sprayed on the pans. Therefore, vegetation reduces runoff.*

- 5** Q. How does the runoff in each pan look? (Hint: Is one darker than the other? Do you see soil particles in it?)
 - A. *Runoff from Pan 1 (soil) should appear darker and should have more particles than runoff from Pan 2 (grass covered sod).*

- 6** Q. What does the color of the runoff in each pan suggest about how much soil erodes?
 - A. *The darker the color, the more soil has been removed. The runoff was lighter and the soil removal less in Pan 2.*

- 7** Q. What does the color of the runoff in each pan suggest about vegetation?
 - A. *The color of the runoff indicates how much soil has been removed from the pan. The darker the color, the more soil has been removed. The runoff was lighter and the soil removal less in Pan 2 because of the grass covered sod. Therefore, vegetation slows erosion.*

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National Education Standards

Science Standard E: Science and Technology

Students should develop abilities of technological design and understandings about science and technology.

Science Standard F: Science in Personal and Social Perspectives

Students should develop an understanding of personal health, populations, resources and environments, natural hazards, risks and benefits, and science and technology in society.

Math Standard: Connections

Students should develop an understanding of how mathematical ideas interconnect, and should be able to apply mathematics in contexts outside of mathematics.

Geography Standards 14–16:

Environment and Society

Students should learn how human actions modify the physical environment, how physical systems affect human systems, and the changes that occur in the meaning, use, distribution, and importance of resources.

English Language Arts Standard 8

Students use informational resources to gather, synthesize, and communicate information.



JASON

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Part B — Clarity of Runoff

- 1** Q. Which runoff sample had the highest turbidity? Why?
 - A. *The runoff from Pan 1 had the highest turbidity because runoff from the pan with soil carries more particles than the pan with grass covered sod.*

- 2** Q. Turbidity is an indication of the clarity — or lack of clarity — of your runoff samples. Is the runoff sample with the highest turbidity the one that has the darkest color?
 - A. *Answers will vary. Students should observe that the runoff from Pan 1 (soil), which has the highest turbidity, appears to be darker than runoff from Pan 2 (grass covered sod).*

- 3** Q. What does turbidity tell you about the amount of soil removed from each pan?
 - A. *Turbidity indicates how much soil runs off. The higher the turbidity the more soil ran off.*

- 4** Q. Based on your data and the research article, how does vegetation affect erosion?
 - A. *Vegetation helps absorb the water and holds the soil in place. When vegetation is cut down, more soil washes away. Making sure land areas have vegetation will ensure that less soil runs off. Tropical forests prevent erosion.*



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