

Using Evidence on the Range- Erosion Experiment

Created by: IRRRC	Time Required: 1 ½ hours – can be broken into input and demonstration, then student experiment portions
Subject: Science	Grade Level: 6 +

Overview	By doing this experiment, students will see the effect of erosion by water under different environmental conditions.
Goal(s) & Objective(s)	Through this experiment students will, relate erosion to the amount of plant cover. Measure the amount of erosion caused by water under different simulated environmental conditions. Identify potential problems caused by erosion in a rangeland ecosystem. Measure the volume of liquids and solids using the metric system and decimals, or standard system and fractions.
Prerequisites & Materials	<p>(optional grades 6+) Student: Have class do J. Black Vocabulary Lesson Teacher: Preview the video clip and text at http://www.lifeontherange.org/range-stories/joseph-black-and-sons.asp</p> <p>Materials:</p> <ol style="list-style-type: none"> 1. Lab area with cleanable surfaces or outdoor area 2. An old-fashioned watering can with lots of holes 3. Cup or liter measuring container to measure soil and water 4. A stopwatch or other timing device with readings in seconds 5. 3 disposable aluminum pans (round or square, but able to be easily bent) 6. 6 blocks of wood to be used to prop up ramps 7. Three lengths of plywood to be used as ramps 8. 3 relatively transparent, identical containers for collecting dirty water 9. Rulers 10. Enough dirt to halfway fill two of the pans. Dirt should be reasonably moist, but not muddy for easy use. Clay textured soils will work best as there will be less infiltration. (For a class, use 5 gallon paint buckets with dirt) 11. A sod sample large enough to cover one pan with the dirt still attached 12. A sod sample large enough to cover one pan with the soil shaken out. 13. Optional – more pans, a sample of native grass/forbes with roots attached & various materials to create nonliving groundcover – straw, bark, mulch, fabric, garden cloth etc.

<p>Teaching Activities: <i>Instructional Approaches/Strategies</i></p>	<p>Procedures</p> <p>Introduction: Choose one or more of the following to lead into the lesson:</p> <ol style="list-style-type: none"> 1. Show pictures of water erosion. Ask students to consider what caused erosion in each situation, and what they think could be done to reduce erosion. 2. Have students complete the pretest “erosion on the range”. 3. If students have been studying erosion, send them home over a weekend or break to observe and list examples of erosion they encounter. <p>Application (<i>optional if completed Vocabulary prerequisite lesson</i>)</p> <ol style="list-style-type: none"> 1. Show the video clip at http://www.lifeontherange.org/range-stories/joseph-black-and-sons.asp 2. Have students complete the video questions while watching (attached) 3. Discuss the questions <p>Experiment (<i>see attached</i>) Complete the following either as a class demonstration with student involvement or in laboratory groups you establish. Be sure to model how to use materials before beginning.</p> <ol style="list-style-type: none"> 1. Hand out the erosion experiment worksheet 2. Demonstrate to students how to set up their experiment. Emphasize proper measuring techniques – measuring water at the meniscus as precisely as possible, and using the ruler to measure the depth of soil collected from each pan.
<p>Assessment:</p>	<p>Complete the experiment worksheet in groups or as a class. Discuss experiments and the effects of erosion.</p>

Attachments:

“Who Cares about Riparian Areas” Experiment guidelines & worksheet
Erosion Experiment Questionnaire
Joseph Black Video Questions

Extensions:

1. Repeat the experiment with different types of artificial riparian cover such as garden fabric, brick retaining walls, native sod or plastic mulch and measure the amount of erosion from each model.
2. Repeat the experiment with different soil textures – clay, loam, or sand.
3. Repeat the experiment with different slopes.
4. Repeat the experiment with the same soil at different levels of beginning moisture.

Who Cares About Riparian Areas?

Desert biomes often receive precipitation in quick bursts – lots of rain in a short period of time. This can cause lots of quick erosion. The amount of erosion is also related to the plants living on the soil. Why are riparian areas along a desert stream important? In this experiment, you will examine several factors that change the amount of erosion to soil by sprinkling water over three models of soil conditions.

Before beginning:

1. Define “riparian area”



2. Based on the video with Chris Black, what does a healthy riparian area look like?

Procedure:

1. Gather the following supplies as your teacher instructs:

- a. Cup or liter container to measure soil and water
- b. Watering can
- c. A stopwatch
- d. Three disposable aluminum pans
- e. six blocks of wood – three larger and three smaller
- f. Three lengths of plywood
- g. Three transparent collection containers of the same size and shape
- h. Rulers
- i. Enough dirt to halfway fill two of the pans Sod with dirt attached
- j. Sod without soil

2. Measure the same amount of soil into two of the pans until the pans are about half filled. **Record the amount of soil you used here:**



3. Set the sod sample without soil in one of the soil filled pans.
4. Set the sod sample with soil in the empty pan.
5. Set up the ramps using the plywood and blocks of wood so that one end of each ramp is higher than the other end. This is to model the slope of a bank going into a stream.
6. Set each pan on its own ramp.
7. Slightly bend the lower end of each pan to form a trough that will allow water to flow into the transparent container.
8. Set one transparent container below the end of each pan to collect any runoff from the pans.



9. You will be pouring water from the watering can to simulate a quick rainstorm on each model. **Form a hypothesis – which pan do you think will lose the most soil because of erosion?**

10. Measure the amount of water it takes to mostly fill your watering can. You will need to measure the same amount of water for each model. **Record how much water to use here:**

11. While your lab partner records how much time it takes, pour water from the watering can over the upper end of each pan. **Write down what you observe (see) on each model in the space below:**

Bare dirt –

Sod with soil removed –

Sod with soil attached –

12. If water drained into at least two of the transparent containers, go to the next step. If water did not drain into two of the containers, Repeat steps 10 and 11 for all three pans until at least two of the collection containers have some water.

13. Allow the water in the collection containers to settle for at least five minutes.

14. Measure the depth of the dirt in each transparent container by lining up the ruler outside the container. Record your measurements in the data table.

15. Measure the volume of runoff from each model by pouring the water and any soil that will pour into a graduated flask or liquid measuring cup. Record your measurement in the data table.

	Appearance after pouring water	Depth of dirt collected from runoff	Amount of water collected from runoff
Bare Dirt			
Sod on top of dirt			
Sod with dirt attached			

16. Clean up your area as directed by your teacher.

Erosion Experiment Questionnaire

Answer the following questions:

1. Which model showed what might happen in an area with...
 - a. No riparian plants?
 - b. Healthy riparian plants?
 - c. Damaged or dead riparian plants?

Extension Questions

2. Explain why riparian plants are important for preventing erosion.
3. Based on the video, what else are riparian plants good for?
4. Predict what could happen to fish habitat in a stream with:
 - a. No riparian plants.
 - b. Healthy riparian plants
 - c. Damaged or dead riparian plants
5. Based on the video, what type of grazing allows riparian plants to be as healthy as possible?

Joseph Black and Sons Video Questions

1. What did Chris Black want to prove?
2. What management technique did he use?
3. Which of the following is a good description of holistic management?
 - a. Managing how deep people dig holes for water
 - b. Managing cattle in Africa
 - c. Management tool that gets the most out of the land when grazing cattle
 - d. Management tool that uses grazing to increase biodiversity and ecosystem health
4. Where has Chris Black used holistic management?
5. Holistic management is used to manage
 - a. Cows
 - b. Wildlife
 - c. The whole ecosystem
 - d. Digging
6. Give an example from the video of an active management technique
7. How does Chris Black measure range health?
8. Based on the video, what do you think “riparian” means?
9. Why do you think it’s important to have different ages and species of plants along a stream?

After watching the video, read the following:

During a tour of the Pole Creek area off of Mud Flat Road, Black showed how his grazing management has allowed Pole Creek to recover into a thriving ecosystem. In the early 1990s, Pole Creek was grazed year-round, **and it had turned into a gravel bed with deeply incised banks and not much vegetation**. He changed the timing to grazing the area in the spring when the cattle are being herded toward Dickshooter Ridge, and then it is rested all summer to allow the plants to grow back, and then he grazes it again in the fall on the way home.

"As long as you're in there for a short time, graze that plant off and get out and provide the recovery period it needs, then the plants will be invigorated and come to their full biological potential," he says.

"This is kind of a perfect riparian scenario," Black says as he shows the diversity of plant life growing next to Pole Creek. "You have a pool of water and overhanging banks with sedges ... it makes for good habitat for fish and other animals. You've got diversity in the age group of willows, and seeing a dynamic system of different species Diversity." Black's management techniques have paid off in solid weight gains for his cattle, which means higher income, and he received a national stewardship award from the BLM in 2008.

10. Look up the definition of “incised” and write it here:

11. What natural process caused the “deeply incised banks”

- a. Sunlight
- b. Volcanic uplift
- c. Erosion
- d. Geothermal pressure

12. What did Chris do to improve the conditions on Pole Creek?

- a. Keep cattle from grazing near it
- b. Changed the grazing to short times in spring and fall only
- c. Installed fences
- d. Planted shrubs every year in spring and fall

13. Why did the changes Chris made have a positive effect on Pole Creek?

- a. They allowed the plants to grow all year without being grazed
- b. They reduced the amount of gravel in the creek
- c. They provided chemical fertilizer for the plants
- d. They provided plants with a recovery period

14. Look up and define the word “riparian” in the space below: