

Erosion Loco Motion

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Adapted from: Project Learning Tree: Project WILD Aquatic K-12 Curriculum and Activity Guide

Time: approx. 50 minutes

Overview

This activity introduces participants to the importance of sediment in riparian areas. Also discusses the processes, different types, and importance of erosion, particularly in the Willamette River Valley.

Benchmarks Addressed

SC.05.ES.01 Identify properties and uses of Earth materials

SC.05.ES.03 Identify causes of Earth surface changes

SC.05.ES.03.01 Identify effects of wind and water on Earth materials using appropriate models

SC.08.ES.03.04 Give examples of landform changes that occur at different rates

Learning Objectives

By the end of this activity, participants will be able to:

Name and describe the five different forces that influence erosion.

Describe the different modes for transporting sediment in river systems.

Understand the history of Lake Missoula and the importance of the floods in Willamette Valley.

Materials Needed

Stream Simulator

Large board to act as ice dam

Blank Paper (if additional activity is needed)

Coloring Materials (if additional activity is needed)

Background Material

Sediment is made up of excess particulate matter from the surrounding watershed.

Sediment can enter the water in two main forms: (1) **Surface erosion**, which sends small amounts of particles into the water and (2) **Mass erosion**, where sediment moves very quickly such as a landslide.

Erosion is a process in which external factors break down the composition of rocks and

Earth materials. The different factors that influence erosion are: gravity, water, ice, and wind. Erosion can also be caused by human activity. In the Willamette Valley humans cause erosion by clear-cut logging, building roads and houses, and allowing animals to overgraze the land.

Sedimentation, in excessive amounts, may harm aquatic wildlife by reducing nutrients, diminishing sunlight to plants, and altering stream energy and velocity. For example, excess sedimentation can deposit on top of organisms living on the streambed making it harder for fresh water to flow over them, and therefore deprives them of oxygen needed for respiration. Sedimentation affects aquatic wildlife by reducing nutrients, diminishing sunlight to plants, and altering stream energy and velocity.

There are different types of sediment transport within a river system:

- (1) **Suspended Load**, finer sediment-usually clay or silt suspended in the water flow, and
- (2) **Bed Load**, coarse sediment, sand and gravel that moves along the floor of the stream.

There are 5 types of erosion:

Gravity-erosion caused by down-slope movement of rock, caused by the pulling of gravity, (i.e. landslides)

Water/Shoreline-erosion caused by the constant movement of water

Ice- usually caused by the movement of a glacier

Wind- particles being moved from one place to another through wind gusts

Human Caused- overproduction of land

Case Study

Historically, sediments were brought down to the Willamette Valley through a series of floods brought about during glacial periods. During glacial periods large sheets of ice formed over the western part of Montana, and the northern part of Idaho, damming the Clark Fort River. Eventually, warming led to the formation of a huge lake named Lake Missoula. When the ice dam broke, due to warming, water flushed out of the lake at incredible speeds causing mass erosion in what is now Washington and Oregon. The floodwaters filled with ice and sediment rushed down, covering what is now Willamette Valley. As the sediments settled, it formed the nutrient-rich soils we have today in the Willamette Valley.

Activity Description

Assemble the Stream Simulator and be sure it is ready for use. Be sure to have a large board to use as an "ice dam" and rocks of different sizes in the bed of the simulator.

Step 1. Introductions (1-5 minutes)

Introduce yourself. Tell the students that you will be discussing the history of the Willamette River Valley and discussing the process of erosion. State the learning objectives. Then proceed with a series of questions:

Has anybody been down to the Willamette River?

What did they notice about the rocks in this area?

What different sizes did they see?

What do you think causes the different sizes of rocks?

Step 2. Providing the knowledge (15 min)

Ask students if they know what erosion means. An expected answer should be something like: "when rocks break apart". Discuss the different types of erosion, as stated above. Pay special attention to water erosion, and note that it can take place in river systems. Explain that erosion produces sediment: small particles of rock material.

Discuss how different sizes of sediment are moved throughout the stream (Sediment Transport). Noting that small pieces move easily (Suspended Transport) and large pieces of rock need very powerful water (Bed Load). You could also do this by asking questions. This will provide an easy transition into the next part of the activity.

Step 3. Hands on in the Simulator/ Applying the knowledge (20 min)

Ask students to come up to examine and touch the different types of rocks in the simulator. Discuss that although the small particle (sand and gravel) do not look like the bigger rocks, at one time they could have been part of larger rocks.

Then ask students to gather around the Stream Simulator. Discuss the story of Lake Missoula; be sure to note that when the ice dam broke, the fast moving water caused erosion across the area that was flooded. Ask students what kinds of things may have gotten transported through the floodwaters. Also, ask what the students think happened when the water slowed down as it entered the Willamette Valley.

Then demonstrate what this might have looked like on the Simulator. Have the students create a narrow stream with plenty of vegetation. Near where the water comes in, dam up the river with the large board. Have the students pick a special rock or area to watch closely when the area is flooded.

When a large amount of water has gathered in the simulated "lake", pull the board up quickly. You could ask for a volunteer to do this, and watch the water travel through the channel. Explain that this is what happened when the ice dam broke and the water was released from Lake Missoula, but on a much larger scale.

In order for children to fully understand the destruction that took place, tell them that the water knocked down trees and carried boulders as big as cars. If needed, this step of the activity can be repeated to ensure student understanding.

Step 4. Gauging Understanding (5 min)

While standing around the Simulator ask students if they can point out different kinds of sediment transport taking place within the simulated river. A student may observe small pieces of sand and gravel. Or, if the water is moving faster they may see large rocks moving.

Tell the students that erosion is an important part of river ecosystems. Bring other examples into view such as the Grand Canyon and the Columbia River Gorge. Then ask if the students can remember an example of where humans cause erosion in the Willamette Valley. Tell the students that they can control the amount of erosion they cause by doing things like staying on the path when they go for hikes, and being careful around river banks.

Step 5. Wrap Up (5-10 minutes)

Ask the students to return to their desks. Hand out a sheet of paper divided in half. Ask the students to illustrate a healthy stream on one side, and a stream that has been changed by human caused erosion on the other. While students are drawing restate that erosion is a natural function of river systems, but there are cases in which it destroys precious habitat.

Supplemental Activities

This activity is designed for a small number of students, less than 14 or so. If you have a larger group you may consider the following options, but will need additional assistance from another adult:

Divide the students into two separate groups. Follow the lesson plan until Step 3. At this point ask one group to come up to the Simulator, where you will follow through with the rest of the activity. The other group will need to move to a different area, away from the Simulator and do an activity of your choice.

The group not at the Simulator will need a piece of blank paper as well as coloring materials. At this time they should discuss the different forces that influence erosion (water, ice, wind, gravity, and human). Have the students divide their paper in half, on one side of the paper they should draw a stream in which erosion is taking place at a sustainable pace. On the other half, the students should draw a stream in which erosion has happened too quickly and caused destruction. Destruction can happen from a landslide or heavy wind or rain, or can also be human caused.

This activity will allow students to gain a better understanding of the forces that influence erosion, and how they affect river systems. Ask the students if anyone would like to share what they have drawn with the rest of the students.

Additional Reading/Resources

Alt, David D. *Glacial Lake Missoula, and its Humongous Floods*. Missoula, Mont: Mountain Press Pub, 2001.

Baker, Victor R. *Paleohydrology and Sedimentology of Lake Missoula Flooding in Eastern Washington*. Boulder, Colorado. Geological Society of America, 1973.

U.S. Geological Survey. *Introduction to Suspended-Sediment Sampling*, Scientific Investigations Report 2005.

Closs, Gerry. Downes, Barbara. Boulton, Andrew. *Freshwater Ecology: A Scientific Introduction*. Malden, MA. : Blackwell Pub. Co., 2004

Manci, Karen M. 1989. *Riparian Ecosystem Creation and Restoration: A Literature Summary*. U.S. Fish and Wildlife Service Biological Report. Jamestown, ND: Northern Prairie Wildlife Research Center Online

Chambers, Jeanne C. and Miller, Jerry R. *Great Basin Riparian Areas: Ecology, Management, and Restoration*. Washington, D.C.: Island Press, c2004

HYPERLINK

"http://vulcan.wr.usgs.gov/Glossary/Glaciers/IceSheets/description_lake_missoula.html"

http://vulcan.wr.usgs.gov/Glossary/Glaciers/IceSheets/description_lake_missoula.html

HYPERLINK "<http://www.glaciallakemissoula.org/virtualtour/index.html>"

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