

Erosion Boxes Lesson Plan

Science SOLs Addressed: 3.7, 3.10, 4.8, 5.7, 6.5

Time Needed: 30-45 minutes

Summary

Soil is an important resource that is used to grow many different crops and plants to meet the needs of people everyday. Soil is also an important ecosystem. Unfortunately, large amounts of soil are lost due to erosion. In this hands-on activity, students experience first hand how ground cover affects soil erosion using the following scenarios: bare soil, gully (ditch), silt fence, and sod.

Objectives

Students will:

- Define soil erosion.
- Observe how ground cover affects soil erosion.
- Discuss ways to prevent soil erosion.

Materials

- 4 oblong erosion boxes
- 1 small watering cans and water
- 1 dust pan
- 4 plastic measuring cups
- Stopwatch or watch to time activity
- Bucket of soil
- Sod

Silt fence mounted on skewers or chopsticks

Background

Soil erosion is defined as the process by which soil is moved from one place to another. Wind and water are two forces that can cause erosion. Erosion is a natural process, but humans help speed the process of erosion, especially when large areas are cleared of all trees, shrubs, etc. If trees and other plants are growing in a particular area, soil erosion is minimized considerably because the plant roots help hold the soil in place and keep it from washing away. If nothing is growing there, and it rains on bare soil, that soil will wash away into our rivers and streams.

Soil erosion can cause numerous problems in our waterways. For example, if there is pollution (i.e., chemicals, fertilizers, pesticides, and other toxins) in the soil, that pollution can get into the water when the soil is washed away. These

pollutants can make the animals that live in the water sick; they can even make us sick! Another way soil erosion can cause problems is if the soil gets into the water, it can kill the critters that live there because the sediment can clog their gills, decrease the amount of sunlight, and increase the temperature, which creates unfavorable living conditions for the organisms that live there. Lastly, when fertile topsoil is washed away, the farmer cannot grow as much food as before. If too much soil is eroded away, the farmer may not be able to grow anything at all.

The easiest way to prevent soil erosion is plant trees and other plants if there is bare soil—the roots will help prevent soil erosion. On construction sites, developers and contractors use silt fences until construction is complete. Silt fences can help minimize soil washing off construction sites. And once construction is complete, trees, shrubs, and grass can be planted.

Procedure

1. Begin the activity by asking students to define soil erosion. Ask them why soil erosion is undesirable. Give them time to come up with the reasons outlined above. Ask them to name places they have seen soil erosion, such as construction sites, farms, housing developments, rivers/streams, etc.
2. Divide the students into 4 groups. Each group will be assigned an erosion scenario (bare soil, gully/ditch, silt fence, and sod) and the appropriate kit that corresponds with their scenario. Each kit has a set of instructions and needed materials. It is helpful if the soil can be in a central location to the groups so each group has equal access.
3. Explain to the students that each group will follow the instructions for their scenario as written on the card in their kit (please see below for each scenario's instruction card). Tell them that they will perform an experiment to decide which scenario will have the most and which will have the least amount of soil erosion.
4. Allow each group enough time (approximately 10 minutes) to prepare their erosion box according to the instructions. Explain that each group will present their scenario to the rest of the class and perform the runoff experiment. Ask students to predict which scenario will have the most soil erosion and which will have the least soil erosion. They need to rationalize their decision.
5. Start with the bare soil erosion box. Set up the erosion box on an incline (using dust pan) so water will flow downward. Add a pre-determined amount of water (as listed on the instruction sheet) to the watering can—record this

Scenario Instruction Cards

BARE SOIL EROSION BOX INSTRUCTIONS:

1. Add soil to your erosion box up to the line.
2. Pack down the soil to the line on the box.
3. Use 2 cups of water for the rain.
4. Predict what will happen to the bare soil when it rains on your erosion box.

SOD/GRASS EROSION BOX INSTRUCTIONS:

1. Add sod to your erosion box. You may need to pack it down so it is not above the line.
2. Use 2 cups of water for the rain.
3. Predict what will happen when it rains on your erosion box.

SILT FENCE EROSION BOX INSTRUCTIONS:

1. Add soil to your erosion box up to the line.
2. Smooth the top of the soil out.
3. Place your silt fence near the end of the erosion box with the spout.
4. Be sure to push the silt fence into the soil as far as it will go.
5. Use 2 cups of water for the rain.

GULLY/DITCH EROSION BOX INSTRUCTIONS:

1. Add soil to your erosion box up to the line.
2. Pack down the soil to the line on the box.
3. Using your finger, make a ditch up and down the slope.
4. Use 2 cups of water for the rain.
5. Predict what will happen to the ditch when it rains on your erosion box.

amount on the chalkboard or on a piece of paper. Hand the watering can to the “rain” volunteer. Make sure the collection volunteer is ready with their measuring cup at the outfall of the erosion box. When all the students involved are ready, have the student begin making it “rain” with the watering can. The timekeeper should keep track how long it takes for the water to stop flowing out of the erosion box into the measuring cup. Once the water is done flowing, the time it took should be recorded. The amount of water in the measuring cup should be measured and recorded; the properties of the runoff should also be recorded. Ask the students to determine if they think the water collected is clean or if there is a lot of soil that was eroded when it “rained.” Why did this happen?

6. Repeat the same process for the gulley (ditch), silt fence, and sod scenarios.

Discussion

1. After recording the results for the scenarios, ask students to determine which box produced the cleaner water. Why did that happen? The students should also determine which measuring cup had the least amount of water in it; what does this tell us? They need explain their rationale. Were their predictions in the beginning correct?
2. After the discussion, ask students to name ways to stop soil erosion. Their ideas can include: plant trees, grass, shrubs; install silt fences on construction sites; for older students, they may also come up with rip-rap (rocks on river/stream banks where soil erosion occurs frequently); no till farming, etc.

Extensions/Adaptations

1. After the bare soil scenario is recorded, the students can see the effect of adding straw to bare soil. Add straw to the bare soil and repeat the process as indicated on the instruction card. Does the straw help minimize soil erosion? How does the result with straw differ from bare soil?
2. After the activity is over, invite students on a mini-field trip. On this mini-field trip, students will investigate their school grounds for soil erosion problems. If a problem is identified, they can draw the area indicating where soil erosion is occurring. As a class, they can decide on ways to help fix the problems (i.e., plant trees, grass, shrubs, install a silt fence, etc.). If allowed, the students can put their ideas to use by planting trees, grass, and/or shrubs, or writing a letter to the principal outlining the problem and their ideas on ways to fix them.