

**Overview:**

This lesson is an environmental science lesson as well as a geography lesson. Students will create a soil mountain and evaluate the difference between the erosive impact of water on terraced and non-terraced hillsides. From this, students will understand the benefits of terracing as related to limiting soil erosion and water waste. Terracing is one of the many techniques that Heifer International advocates in increasing food production and helping communities to become self-reliant.

Geography Standards:

- Apply geography to interpret the present and plan for the future. Solve social and environmental problems by making geographically informed decisions.
- Changes in use of resources. Understand how technology affects access to and use of resources.
- How physical systems affect human systems. Understand human responses to variations in physical systems.
- How human actions modify the physical environment. Understand the consequences of human modification to the physical environment.

Materials:

- Soil or sand
- Organic and inorganic materials (leaves, sticks, moss, rocks, etc.)
- Water in several buckets or watering cans
- “Teacher Instructions — Erosion Mountain”
- “Erosion Mountain — Lab Write-Up”

Lesson Procedure:

1. Discuss soil erosion

Refer to the following excerpt from “The Day Papa Came Home” and discuss soil erosion.

Students should understand that topsoil is the most nutrient-rich part of soil and is extremely important in growing healthy crops.

Pedro was leading a session about growing tree seedlings in a nursery. When the seedlings were big enough, villagers would plant them on the edges of their farming plots. The roots of the growing trees would act as barriers to prevent wind and water from eroding the soil...

“The farming plots around here are sloped — some 30 degrees, some 45 degrees, some worse. When it rains, the water washes the topsoil down the hill.” He made a big downward slice through the air with his arm. “Luis, what’s the problem with that?”

“You need topsoil to grow healthy crops,” answered Luis. “It has the most nutrients.”

2. Discuss terracing

Discuss the use of terracing as a method of decreasing or preventing soil erosion. Be sure students understand how the people of San Martin Alto use plants such as milin grass, or seedlings, as barriers at the edge of terraces.

TERRACING THE SOIL

Soil erosion is a major problem when you are trying to farm on steep slopes like those in San Martin Alto. Rain, wind, and gravity make the topsoil fall down the hill, away from our farming plots. To prevent soil erosion people create terraces on the land.

Terraces are small flat areas cut out of sloped land. A series of terraces looks like a giant staircase on the hillside. Terracing is a technique used worldwide to make usable space out of steep hillsides. In San Martin Alto, people create terraces by planting bushes, seedlings, or milin grass close together in a line. The roots of these plants hold the soil back, and then when the rainwater washes the soil downhill, the barrier created by these plants stops the soil from washing down past this line. Eventually, the steep slopes start flattening out. In other parts of the world, people will dig out the flat surfaces and use wood or stones to build the outer edge of each terrace.

Terraces are useful for two reasons. First, because they help prevent loss of topsoil, and second, because it is much easier to grow crops on flat land than steep slopes!

3. Complete the Erosion Mountain Activity

Most students (especially those in urban areas) do not have real-life experience with soil erosion. Erosion Mountain gives students a hands-on experience with the concept of soil erosion and lets them see the erosive force of water with their own eyes. Instructions for Erosion Mountain are on the separate Teacher Instructions handout.

4. Discuss how human actions have increased soil erosion.

Explain that before humans started farming in the Andes and other steep areas, the land was covered with natural plant growth that worked to hold back the topsoil and prevent erosion. But by clearing the natural plant growth for farming, humans introduced the process of rapid erosion to these areas.

Humans invented terracing as an effective way to prevent erosion, and it is a technique that has been applied worldwide. In South America, the Incan civilization used terracing extensively. However, the Spanish conquistadors did not employ the technique very much. Thus, the tradition of using terraces significantly decreased in parts of South America, including in Ecuador. Heifer International is helping to reintroduce this and other effective agricultural techniques to the area.

Teacher Instructions: Erosion Mountain

1. In groups of four or five, or as a teacher demonstration for the entire class, create a 15' high or larger mountain out of soil or sand (sand is preferable). An outside location is preferable, or you can bring the materials into the classroom.

This mountain is going to represent the type of sloped terrain that Luis' village farms on in San Martin Alto, which is similar to many other family farms around the world.

2. One side of the mountain will represent farming without terraces. This side of the mountain will be bare at a slope of 30-45 degrees. Have the students place twigs, grass, or other organic materials in the bare soil to represent farming without terraces.
3. The other side of the mountain will be terraced. Have the students cut terraces out of the hillside. Remind the students that in San Martin Alto they use milin grass and seedlings to prevent soil erosion. Have the students strategically place organic materials on the edges of the terraces. The organic material on this side will act as a barrier to erosion.
4. Use the "Lab Write-Up" sheet to have students write down a hypothesis of erosion patterns for both sides of the mountain. Do this before you pour water on top of the mountain.
5. Slowly pour water on both sides and observe soil erosion happening.
6. Have students complete the observation and analysis sections of the lab write-up. Discuss the accuracy of their predictions.

Alternative Activities:

You could also incorporate other aspects of watershed and soil erosion in the Erosion Mountain Activity by doing the following:

- Place a piece of plastic on the mountain to represent concrete in an urban area. Water and pollution would run straight to the watershed. This lesson could be used to compare urban and rural environments.
- You could also do the same lesson to represent a forested area and a clear cut.
- The *páramo* acts as a sponge, soaking up rainwater and thereby slowing down the speed of water flowing downhill. To see the difference in erosive force between slow flowing water and rapidly flowing water, pour water on different sides of the soil mountain with different speeds.