# Activity 15: Using a Stream Table to Investigate Erosion Control

## Maine Geological Survey

### Objectives:

To make the students aware of the different methods of controlling water-induced topsoil erosion.

### Time:

This activity is designed to last 45 minutes.

### Background:

Erosion is the wearing away of the soil by water, wind, and/or ice. This lab activity will consider only erosion caused by the runoff of liquid water. This type of erosion accounts for about 2/3 of all topsoil and subsoil loss. In countries with marginal farmlands and agricultural practices, continued erosion leads directly to food shortages and starvation of some segments (the very old, the sick, and the very young) of the given population.

### Materials:

A stream table box should be constructed that is approximately 16" long by 12" wide by 4" deep (also consider Ward's plastic model economy Stream Table Kit, catalog #364211 for $70). This wooden box should be made watertight by either caulking the seams or lining it with materials such as plastic, tin or tar paper. One end of the box should be

notched with a V 1.5" deep and a spout attached in the V so that runoff water will flow into your waiting pail. You will also need:

- A watering can with 1/2 gallon or larger capacity
- A plastic protractor
- A pail to catch the excess water
- Blocks to elevate the stream table - 4 inch squares cut out of dressed 2x4s work well and let you raise the elevation in approximately 1.5 inch increments, and a mop or towels to deal with any spills
- Different soil types will be needed for the various tests and this may create a need for pails and a trowel or small shovel. Various types of mulch such as hay, pine needles, shredded newsprint or paper will also be needed.
- A supply of small pebbles is needed to construct the check dams. *NOTE: Larger stream tables are more dramatic, but the volume of materials needed to fill them increases greatly with size.*

## Procedure:

The stream table should be filled with an erodible soil, and elevated to a height such that erosion will take place. This height can be determined by trial and error or you may wish to have students perform Activity #41 (Slope Stability) before starting this exercise. Water is added to the upper end of the stream table, flows downhill, creates some erosion, and runs into the pail at the end of the stream table.

By varying the surface of the soil and the height of the table, sheet, rill, and gully erosion can be studied. Once a gully has been created in the surface of the stream table, the students can build a check dam using small pebbles. Have them then add more water at that elevation to check the effectiveness of the dam.

Students can study the effects of contour plowing as opposed to straight rows. To do this, the soil in the stream table needs to be level and the students create 1/4" deep furrows about an inch apart. Furrows which are parallel to the direction of the flow of water represent straight rows, while on a second trial, those which are at right angles to the direction of water flow represent contour plowing.

Students can also experiment with different mulching materials and evaluate their effectiveness in preventing erosion. Materials to use include, but are not limited to, straw, shredded paper, pine needles, kitty litter (aggregate), and so on. Place the mulch material on the surface and compare the erosion to what happens on the same soil, at the same elevation without the mulch. Add similar volumes of water when doing this part of the testing. Sod can also be used to demonstrate the role of living ground cover in preventing erosion.

## Follow-Up:

The USDA has a number of printed pamphlets on erosion and related topics. These pamphlets may be obtained free of charge from your county Soil and Water Conservation Office. See Appendix B.

Also see discussion photos showing shore front erosion (Figure 1 and Figure 2).

## References:

Activity developed by David Hersey, in conjunction with the 1991 CREST intern program.

**Figure 1.** Shore front erosion. Topics of land use, slop and erosion as well as a number of related issues are brought together by what is happening along portions of the Maine coast. While the situation at Camp Ellis probably shows a worst case scenario, many other places along the coast have the potential for scenes such as this.

**Figure 2.** Erosion and property damage at Camp Ellis.

Name_____

# Activity 15: Using a Stream Table to Investigate Erosion Control

## Maine Geological Survey

### Student Sheet

**Purpose:**

This activity allows you to investigate a number of factors that relate to the erosion of topsoil. These include the slope of the land, the nature of the land surface, the placement of dams, and the direction of topsoil disturbance as created by farming activities.

**Materials:**

Students should work in groups of 3 or 4, or as materials allow. Each group will need a stream table, soil materials of one or more types to fill the table, a watering can, a collection pail for water and material that has passed through the stream table, various types of mulch as directed by the instructor, blocks of wood to raise one end of the table, pens, notebooks, and plastic protractor.

**Procedure:**

In each test, roughly the same amount of "rain" should be allowed to fall on the soil so the results obtained will have some degree of consistency.

1. Fill the stream table to within 2 inches of the top with one soil type.
2. **EFFECT OF ANGLE**. Using the blocks, raise the end of the table opposite the V notch about 1.5 inches. Let at least one pint of rain fall of the raised end of the table. Describe the results. Repeat this process for elevations of 3, 4.5, 6, and 7.5 inches. Use the protractor to measure the angle of the slope at each elevation. At 7.5 inches, the slope of the land is about 30 degrees; this is near the upper limit for row crop farming. Note the type and degree of severity of erosion obtained at each elevation.

| Elevation (in.) | Angle (°) | Description of Erosion |
|---|---|---|
| 1.5 | | |
| 3.0 | | |
| 4.5 | | |
| 6.0 | | |
| 7.5 | | |

3. **EFFECT OF CHECK DAMS**. After the last trial in #2 above, a gully or small depression should have been created in the middle of the stream table. If this is not the case, raise the table by one more block and spring one pint of water directly on one spot. After the gully has been established, build a small check dam with pebbles across the gully. Allow an additional unit of rain to fall on the soil and record the results.

4. **EFFECT OF CONTOUR PLOWING**. Keeping the table at an elevation of 6 inches, smooth out all signs of previous erosion and create a series of ¼ inch deep furrows about 1 inch apart, PARALLEL to the direction of water flow. Allow a unit of rain to fall on the soil and observe. Smooth off the soil again and make similar furrows PERPENDICULAR to the direction of water flow. Provide a unit of rainfall and observe. Record the results below.

5. **EFFECT OF MULCH.** Keeping the elevation at the 6 inch level, place the mulch indicated by your instructor evenly across the surface of your soil, being careful to cover the whole test area. Test the effectiveness of the mulch by allowing a unit of rain to fall. Does erosion take place? Describe the results. Repeat this process with different mulches as directed by the instructor.

| Mulch | Description of Erosion |
|---|---|
| Hay | |
| Pine Needles | |
| Shredded paper | |
| Other | |

6. **CLEAN UP** and dispose of materials as directed by the instructor.

**Questions:**

1. At what angle of slope did the erosion start to become severe in your soil? What would have been the result of raising the slope of the land beyond this point?

2. The Activity in Part 4 is a small scale version of contour plowing. How is this effective in slowing down/stopping erosion?

3. What effects did mulch/ground cover have on the erosion process? Were any types of mulch superior to others? Explain why.

4. If you tested more than one type of soil in the stream table, or if other groups of students tested other soils, obtain their data and compare to yours. Do all soils erode in the same fashion? Explain.

5. Some land has been described as unsuitable for farming; or “will not support human populations.” What does this mean and what factors can cause the soil to be described this way? Explain.