2-ESS2 Earth's Systems

2-ESS2 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-a. Use observations to construct explanations about how landforms and bodies of water provide homes for living things. [Clarification Statement: Examples of landforms that provide homes are caves used as shelters. An example of cause and effect is a home being created or destroyed as a result of a landform change. Science is how we know about the ways animals live.]

2-ESS2-b. Develop models to investigate how wind and water can move Earth materials from one place to another and change the shape of the land quickly or slowly. [Clarification Statement: Examples of changes that occur slowly to shapes of landforms could be sediments built up at the mouth of the river, building and rebuilding of sand dunes, or changes that occur quickly to landforms such as coastal erosion after a hurricane.]

2-ESS2-c. Communicate information about possible design solutions to the loss of homes on land for living things resulting from wind or water resulting in change in the shape of the land.* [Clarification Statement: Students should consider how homes would be replaced and how the homes would change.] [Assessment Boundary: Design that would prevent future losses are not assessed.]

2-ESS2-d. Use drawings and physical models to test, compare strengths and weaknesses, and communicate design solutions that slow or prevent wind and/or water from changing the shape of the land.* [Clarification Statement: Strengths and weaknesses include impacts of design solutions on the natural world.] [Assessment Boundary: Students should be provided a problem in which wind or water could possibly change the shape of the land.]

2-ESS2-e. Develop and use models to describe patterns of kinds and shapes of landforms and of bodies of water. [Clarification Statement: An example of a pattern might include students using models to compare the shapes of oceans, lakes, and rivers.]

2-ESS2-f. Use observations to construct explanations that water exists in different forms in natural landscapes, determining the variety of life forms that live in a particular location. [Clarification Statement: Students should gather information on the ocean, rivers, lakes, ponds, and moisture in the soil to explain the variety of life in various places, including local areas. An example of the cause and effect relationship is the form of water determining the variety of life forms that can live there.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models
Modeling in K–2 builds on prior experiences and progresses to include identifying, using, and developing models that represent concrete events or design solutions.
- Develop and/or use models (i.e., diagrams, drawings, or physical replicas, dioramas, dramatizations, or storyboards) that represent amounts, relationships, relative scales (bigger, smaller) and/or patterns in the natural and designed worlds. (2-ESS2-e),(2-ESS2-b)

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Make direct or indirect observations and/or measurements to collect data which can be used to make comparisons. (2-ESS2-d)
- Make direct or indirect observations and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal. (2-ESS2-d)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence or ideas in constructing explanations and designing solutions.
- Use information from direct or indirect observations to construct explanations. (2-ESS2-a),(2-ESS2-f)

Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.
- Critique and/or communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers. (2-ESS2-c),(2-ESS2-d)
- Record observations, thoughts, and ideas. (2-ESS2-c)

Disciplinary Core Ideas

ESS1.C: The History of Planet Earth
- Some events, like an earthquake, happen very quickly; others, such as the formation of the Grand Canyon, occur very slowly, over a time period much longer than one can observe. (2-ESS2-b)

ESS2.A: Earth Materials and Systems
- Wind and water can change the shape of the land. The resulting landforms, together with the materials on the land, provide homes for living things. (2-ESS2-a),(2-ESS2-b),(2-ESS2-c),(2-ESS2-d)

ESS2.B: Plate Tectonics and Large-Scale System Interactions
- Rocks, soils, and sand are present in most areas where plants and animals live. There may also be rivers, streams, lakes, and ponds. Maps show where things are located. One can map the shapes and kinds of land and water in any area. (2-ESS2-e),(2-ESS2-a)

ESS2.C: The Roles of Water in Earth's Surface Processes
- Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. It carries soil and rocks from one place to another and determines the variety of life forms that can live in a particular location. (2-ESS2-f)

ETS1.B: Developing Possible Solutions
- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. *(secondary to 2-ESS2-d)*

ETS1.C: Optimizing the Design Solution
- Because there is always more than one possible solution to a problem, it is useful to compare designs, test them, and discuss their strengths and weaknesses. *(secondary to 2-ESS2-c),(secondary to 2-ESS2-d)*

Crosscutting Concepts

Patterns
- Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. (2-ESS2-e)

Cause and Effect
- Events have causes that generate observable patterns. (2-ESS2-a),(2-ESS2-f)
- Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-ESS2-d)

Stability and Change
- Some things stay the same while other things change. (2-ESS2-b),(2-ESS2-c)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology
- Observations and measurements are also used in engineering to help test and refine design ideas. (2-ESS2-d)

Influence of Engineering, Technology, and Science on Society and the Natural World
- Developing and using technology has impacts on the natural world. (2-ESS2-d)

Connections to Nature of Science

Science is a Way of Knowing
- Science knowledge helps us know about the world. (2-ESS2-a),(2-ESS2-f)

Connections to other DCIs in this grade-level: will be added in future version.

Articulation of DCIs across grade-levels: will be added in future version.

Common Core State Standards Connections:

ELA/Literacy –

RI.2.10 By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 2–3 text complexity band proficiently, with scaffolding as needed at the high end of the range. (2-ESS2-e),(2-ESS2-a),(2-ESS2-f)

W.2.2 Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section. (2-ESS2-a),(2-ESS2-f),(2-ESS2-c),(2-ESS2-d)

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-ESS2-e),(2-ESS2-a),(2-ESS2-f)

SL.2.1 Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups. (2-ESS2-a),(2-ESS2-f),(2-ESS2-c),(2-ESS2-d)

SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings.(2-ESS2-a),(2-ESS2-f),(2-ESS2-c),(2-ESS2-d)

Mathematics –

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice, Disciplinary Core Idea, or Crosscutting Concept.

2-ESS2 Earth's Systems

MP.1	Make sense of problems and persevere in solving them. (2-ESS2-d)
MP.3	Construct viable arguments and critique the reasoning of others. (2-ESS2-a),(2-ESS2-f)
2.NBT.3	Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. *(2-ESS2-a),(2-ESS2-b),(2-ESS2-c)*
2.MD.3	Estimate lengths using units of inches, feet, centimeters, and meters. *(2-ESS2-e),(2-ESS2-b),(2-ESS2-d)*
2.MD.4	Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit. *(2-ESS2-e),(2-ESS2-b)*
2.MD.5	Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. *(2-ESS2-e),(2-ESS2-b)*

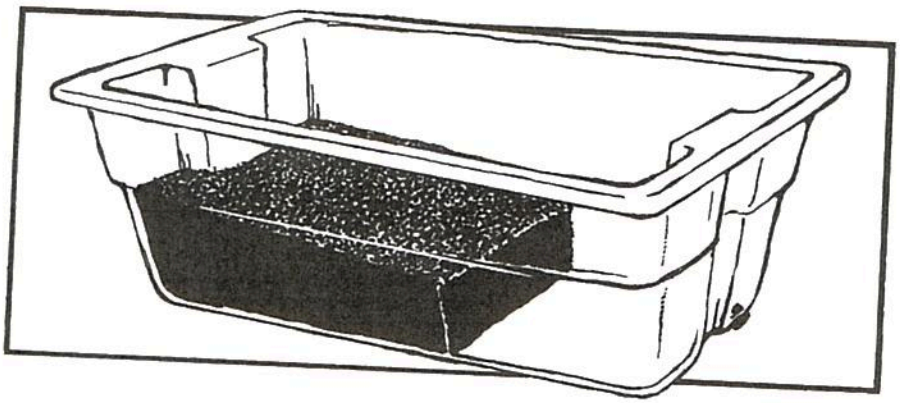
*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice, Disciplinary Core Idea, or Crosscutting Concept.

Student Instructions for Setting Up a Stream Table Investigation

1. Use the black china marker to write a "4" (the lesson number) on your cylinder. Then label the cylinder with your group letter or color.

2. Place the large pad on top of your work space. Place the small pad on the floor under the edge of the work space. Make sure the absorbent sides of the pads are up.

3. Mix the soil in the stream table.

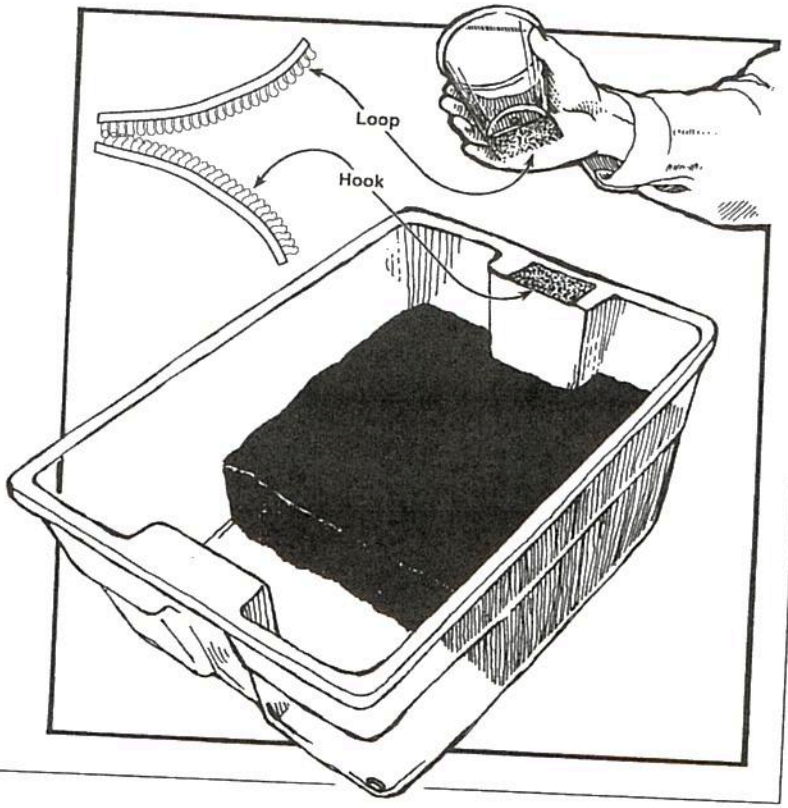


4. Using your plastic spreader, push the soil away from the hole. Bulldoze your soil into a single block that angles slightly up toward the end of the box.

5. Position your stream table on your work space so the end of the box with the drain hole hangs over the edge.

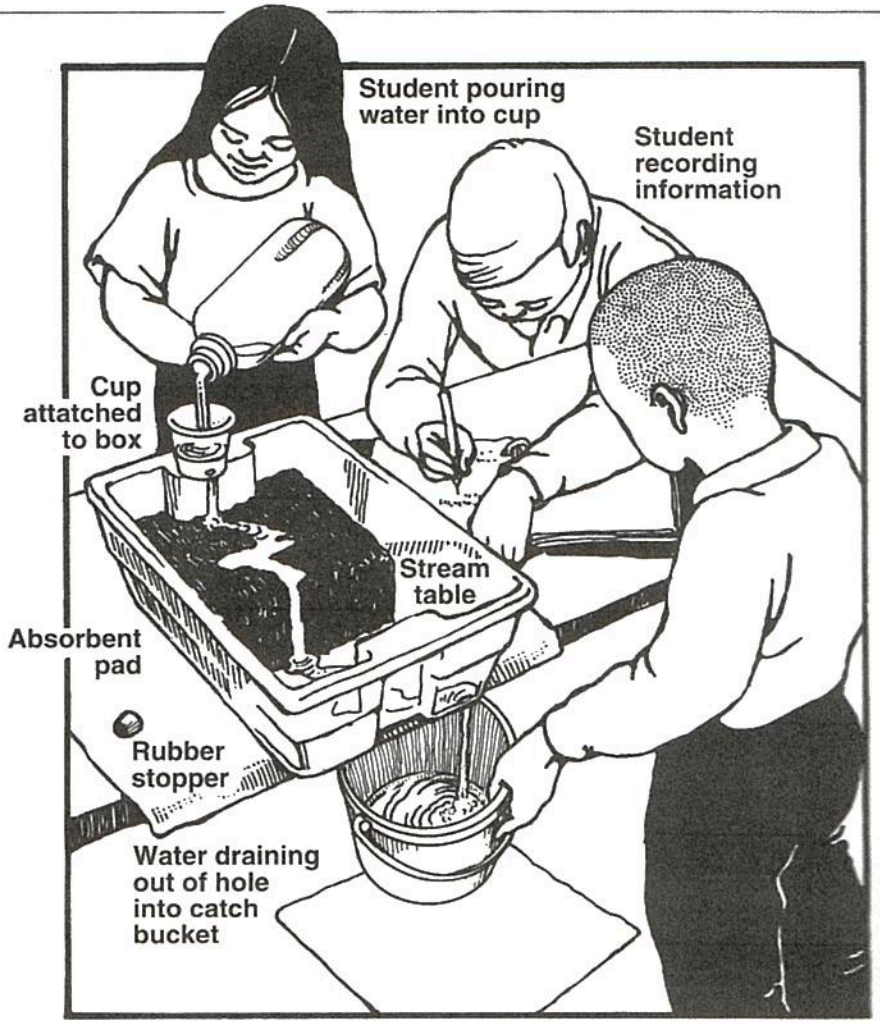
6. Remove the cap from the soda bottle.

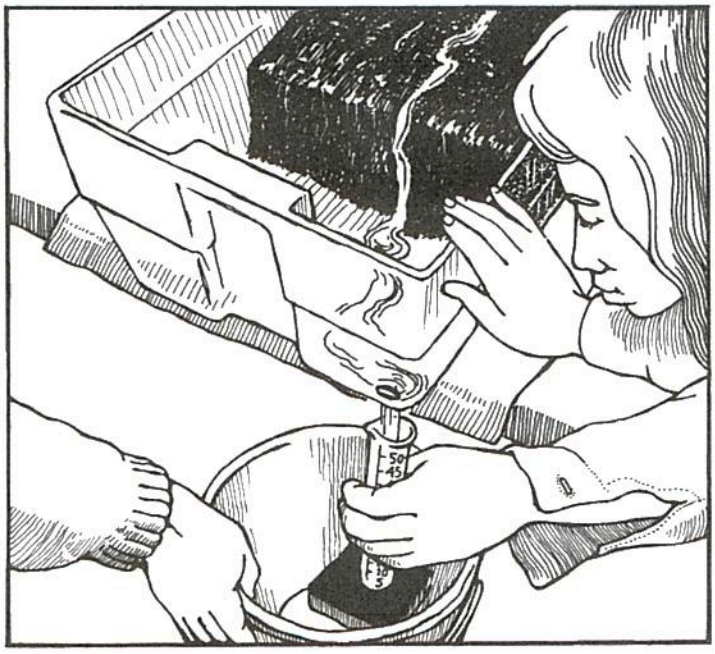
7. Attach the Ultra Velcro® on the cup to the Ultra Velcro® on the stream table. Rock the cup back and forth to join the two pieces of Ultra Velcro®. It may feel a little loose and the cup may tilt when filled with water, but this is normal.



8. When your group is ready, remove the rubber stopper. Hold the bucket directly under the drain hole.

9. Pour the water slowly into the *cup*. Try to keep the water up to the line on the cup at all times. Do not touch the soil once you have started to pour.





10. When you have poured out nearly all the water, collect a sample of runoff. To do this, place the empty cylinder under the drain hole. Fill the cylinder with runoff to the 50-ml mark. Keep the cylinder in a safe place. You will observe it throughout the rest of the unit.

11. Observe and discuss with your group the soil and water in your stream table and cylinder. Record all observations on **Record Sheet 4–A: Comparing Streams.** Do the following steps:

- On your record sheet, describe or draw a picture of your stream. Use crayons and label your picture.

- Measure the length of your stream. Lay the string along the stream, matching its shape. With a permanent marker, mark the end of the stream on your string. Now remove the string and use a ruler to measure the distance from the end of the string to the mark.

- Measure the width of your stream.

- Measure the width of the soil deposited at the end of the stream with a string or ruler.

- On Record Sheet 4–A, draw a picture of your cylinder of runoff.

Record Sheet 4-A

Name(s): _____

Group: _____

Comparing Streams

Directions: Complete only the first column during Lesson 4. You will complete the other columns during Lessons 10 and 13.

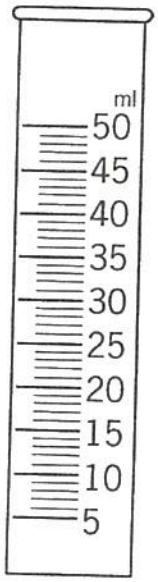
	Lesson 4	Lesson 10	Lesson 13
Date			
Description or drawing of stream			
Measurements (in cm)			
Length of stream			
Width of stream			
Width of soil dropped at the end of the stream			
Other observations			

Record Sheet 4-A Name(s):_____

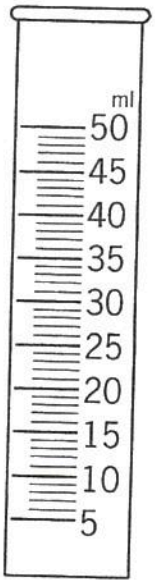
Comparing Streams, *continued*

1. What does the cylinder of runoff look like today? Color the soil and water in the cylinder.

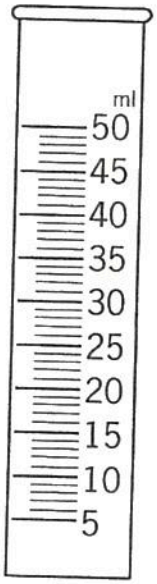
Lesson 4



Lesson 10

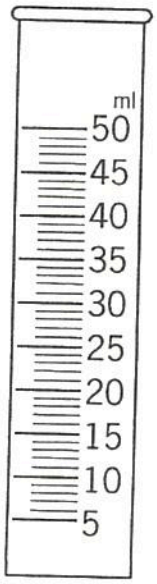


Lesson 13

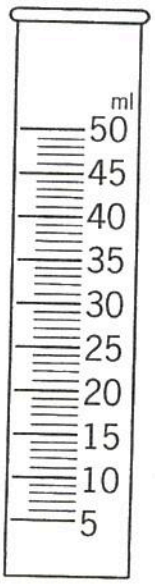


2. Talk with your group. Predict what the cylinder will look like tomorrow.
3. What does the cylinder of runoff look like after it sits for a day? Color the soil and water in the cylinder.

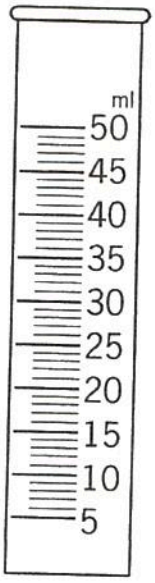
Lesson 4



Lesson 10

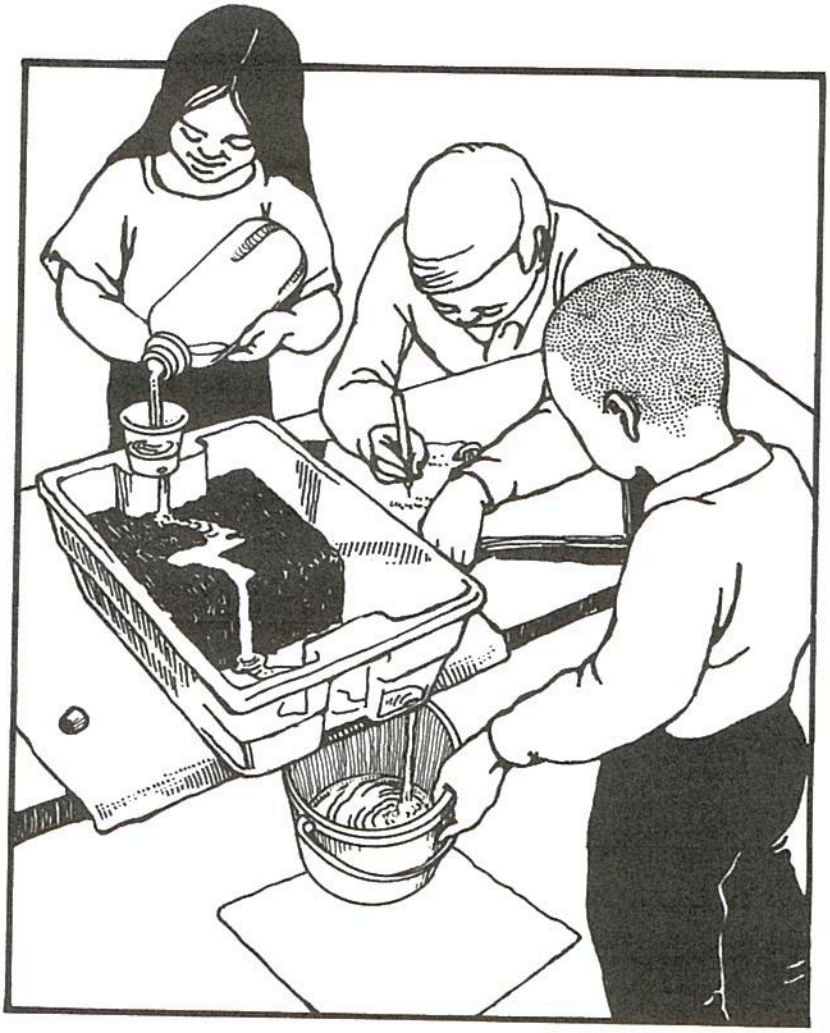


Lesson 13

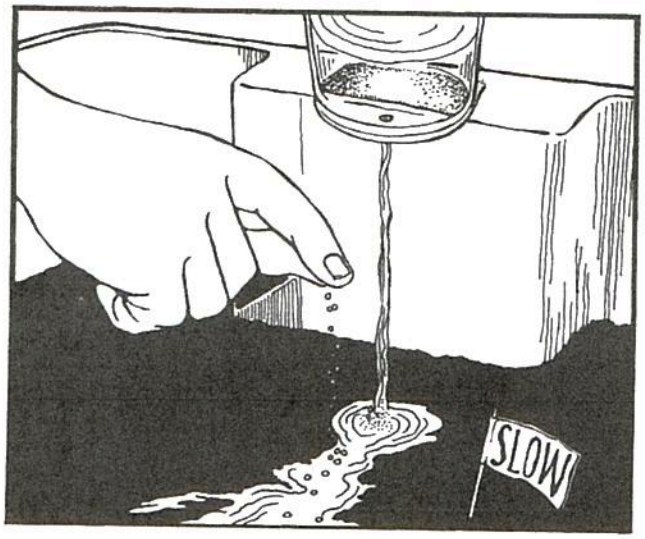


Student Instructions for Tracking the Movement of Soil

1. Bulldoze the land. Attach the cup to the Velcro® on the stream table. Set up your stream table as shown in the illustration.



2. Slowly pour the water into your cup. Try to keep the water at the line. When a stream forms, place a "pinch" of marine sand in the stream near the cup. If the marine sand clumps, break it up gently with the tip of a toothpick.



3. Watch the marine sand move.
   - Place the flags marked *Slow* in areas where the stream is moving slowly.
   - Place the flags marked *Fast* in areas where the water is moving quickly. Stick the flags directly into the soil.

4. Continue to observe the speed of the stream and how soil is worn away (eroded) and dropped off (deposited) by the water. Talk with your group about what you observe.

5. When your bottle of water is empty and your stream is no longer running, look closely at your land.

   - Place the flags marked *Wears away soil* in places where soil was eroded by water.

   - Place the flag marked *Drops off soil* in one place where soil was deposited by water.

6. In your notebook, draw your stream table results. Label your drawing with the words *Fast, Slow, Wears away soil,* and *Drops off soil.*

7. Record observations in your notebook. Then try to answer the following questions:

   - How is the speed of the stream related to the way water erodes or deposits soil? Use evidence from your stream table to support your answer.

   - During a heavy rainstorm, what do you think would happen to the soil on a steep hill? Why do you think this would happen?

8. Clean up.

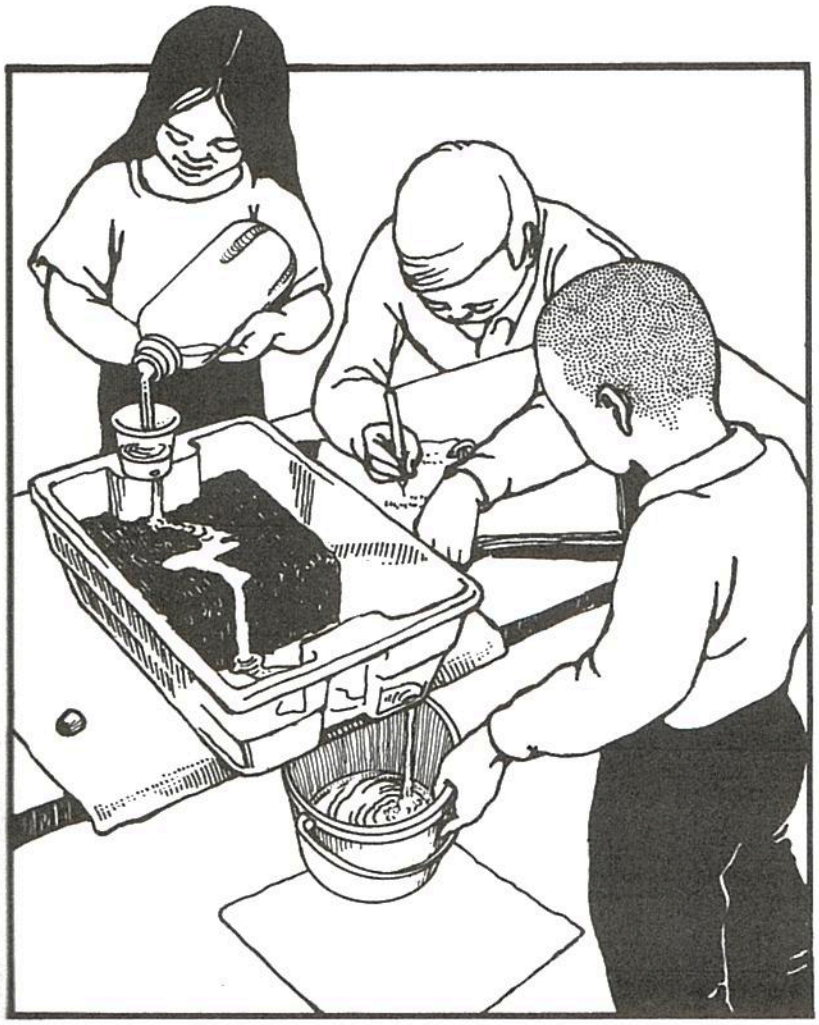
   - *Do not* tilt your stream table to drain extra water out of it.

   - Put the rubber stopper back in the drain hole.

   - *Do not* change the way your land looks. You will draw your stream in Lesson 8.

Student Instructions for Modeling a Rushing River

1. Use the black china marker to write a "10" (the lesson number) on your cylinder. Also write your group letter or color on it.



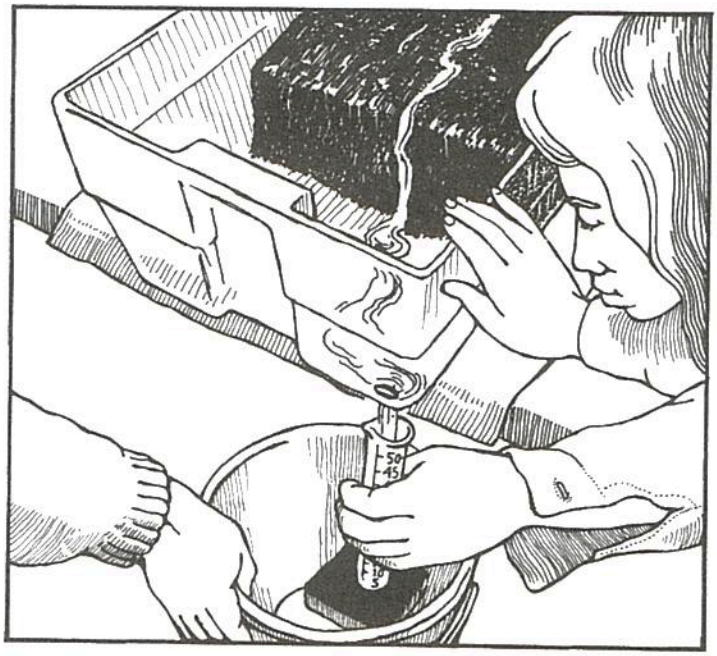
2. Set up your stream table as you have in other lessons.

3. Attach the plastic cup with the large hole (red dot) to the Ultra Velcro® on your stream table.

4. When your group is ready, remove the rubber stopper. Hold the bucket directly under the drain hole.

5. Pour the water slowly into the cup. Try to keep the water at the line on the cup at all times. Do not touch your soil once the water begins to flow.

6. When you have poured out nearly all the water, collect a sample of runoff. To do this, place the empty cylinder under the drain hole. Fill the cylinder with runoff to the 50-ml mark. Keep the cylinder in a safe place to observe throughout the rest of the unit.



7. Observe and discuss with your group the soil and water in your stream table. Record all observations on **Record Sheet 4–A: Comparing Streams.** Write today's observations in the *Lesson 10* column. Use the string to measure your stream.

8. Write a description of your stream or draw a picture of it on your record sheet. Use crayons and label your picture.

Student Instructions for Exploring Slope

1. Mark your empty cylinder with your group letter or color and the lesson number.

2. Stack your books about 18 cm (7 in) high on your work space. Cover the books with the large absorbent pad. Place the smaller pad on the floor.

3. Raise the end of the stream table and set it on the covered books so the stream table is at an angle. Use the illustration to help you. The drain hole should be near the edge of your work space.

4. Attach the plastic cup with the large hole (red dot) to the stream table.

5. Remove the rubber stopper from the drain hole.

6. Hold the catch bucket under the drain hole.

7. When you are ready, pour water into the cup. You may need to hold the cup steady with your hand. Try to keep the water level with the line on the cup at all times. Do not touch your soil once you have begun to pour.

8. When you have poured almost all the water, collect a sample of runoff. To do this, hold the empty cylinder under the drain hole. Fill the cylinder with runoff to the 50-ml mark. Put the cylinder in a safe place.

9. Observe and discuss with your group the soil and water in your stream table. Record all observations on **Record Sheet 4–A: Comparing Streams.** Put your observations from today in the *Lesson 13* column. Measure the length of your stream with the string. Use the string or a ruler to measure the width of the soil deposited at the end of the stream.

ACTIVITY 92: What Factors Affect Water Erosion?

MATERIALS NEEDED

- Two identical erosion trays
- Sprinkler
- Two basins, such as plastic dishpans
- Water
- Several books
- Soil
- Leaves, sticks, and small rocks
- Paper towels

PROCEDURE

1. Put an equal amount of soil on the two erosion trays.
2. Spread several leaves, sticks, and small rocks over the top of the soil in one tray.
3. Tilt both trays at the same angle and place the basins below the trays as illustrated. Sprinkle one quart of water over each one. First predict which tray will lose the most soil.

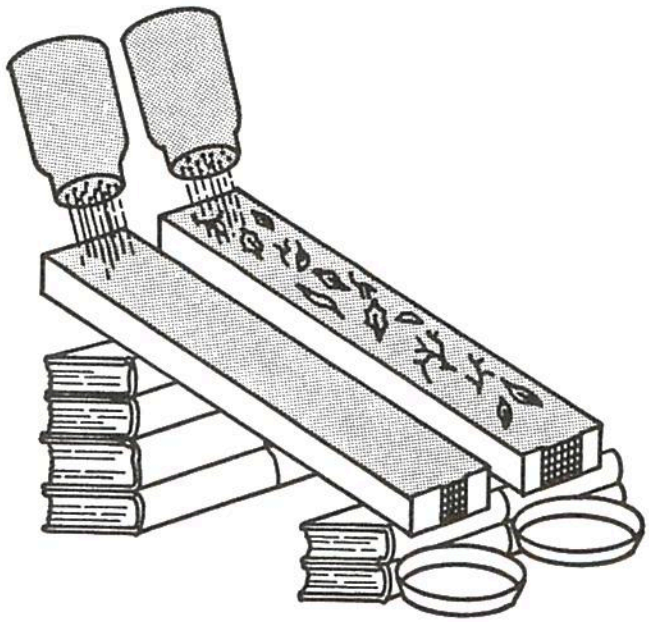


FIGURE 92-1. Erosion trays.

4. Use paper towels to filter out all the soil that was washed away in the quart of water. Was your prediction in step 3 correct?
5. Again place equal amounts of soil on the two trays. This time, leave the soil bare on each tray.

6. Lower one tray slightly and raise the other slightly. Which do you think will lose the most soil during a "rainstorm?"
7. Sprinkle one quart of water over each of the two trays and filter out the soil that is washed away. Was your prediction in step 6 correct?
8. Compare the amount of soil washed away in step 7 with the amount washed away in step 3.
9. What can you say about soil erosion in the mountains and factors that affect it?
10. Try to think of other ideas you could try to find out what might make soil erosion occur faster or more slowly.

TEACHER INFORMATION

In this activity students will learn that erosion occurs faster on steeper slopes and that erosion is retarded by plant growth and debris.

The "erosion trays" could be as simple as two or three layers of cardboard. They could also be made from a sheet of aluminum or sheet metal. Old plastic dishpans could be used by cutting the sides down part way and cutting one end out. Cookie sheets can also be used.

For the sprinkler, a watering can designed for flowers will work well, or simply use a quart jar and punch several holes in the lid with a sharp instrument.

Let students devise additional erosion activities using the same equipment. For instance, they could get a small slab of sod from the edge of the lawn and test it for erosion. Try some of the loose soil with leaves, sticks, and rocks mixed in as well as lying on top of the soil. Compare sandy soil with clay soil.