32. *Rio Grande Stream Table*

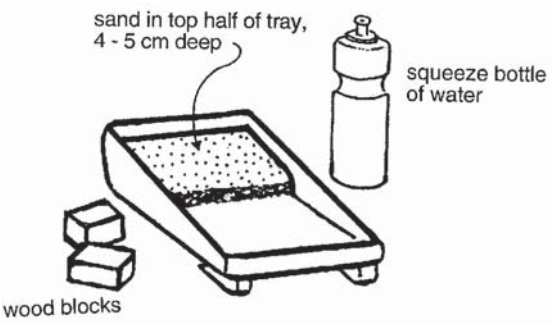
Description: Students will use stream tables to model river processes, especially as they relate to the Rio Grande and the Rio Grande bosque.

Objective: Students will understand that:

- rivers transport sediment;
- rivers shape the land through erosion and deposition;
- the Rio Grande does most of its erosion in the mountains and deposits the sediment along the flatter reaches;
- rivers generally erode on the outside of a meander and deposit sediment along the inside of a meander;
- in the bosque, the inside of a meander is prone to flooding; and
- levees and channelizing of the river have changed the river patterns and processes along the Rio Grande.

Materials: For each student group of three or four students:

paint tray or inexpensive paint tray liners
sand—use playground-grade sand only: sand sold and used for mixing with cement (labeled silica sand), has too many fine particles that can harm the respiratory system.



water bottle or plastic beaker
wood blocks 2″ thick
Legos® or Monopoly® pieces to use as houses
paper towels

32. Rio Grande Stream Table

Grades: 3–12

Time: material preparation: 20–30 minutes
class activity: 60–80 minutes, depending on number of trials

Subject: science

Terms: *erosion, deposition, meander, levee, floodplain, sediment, sand bar*

Background: The landscape of our planet has developed by the interaction of two opposite forces: the force of erosion, wearing away landforms, and the geologic processes that build landforms, generally through volcanism and mountain building. Running water is the most important of the forces of erosion. Year after year, streams and rivers erode and move an enormous amount of rock, sand and gravel from topographically high areas and deposit it in topographically low areas.

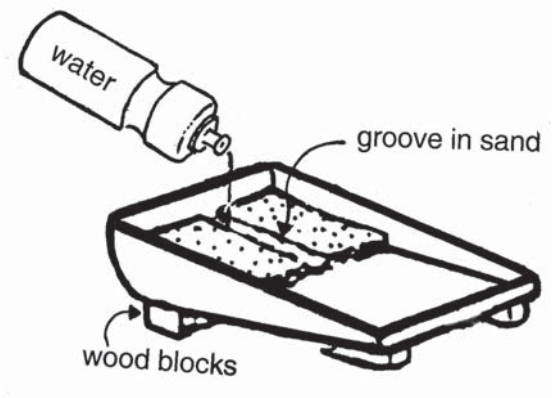
The same stream can: 1) carry and transport material that was eroded elsewhere; 2) erode its own channel and banks; and 3) deposit material along its channel and banks. Whether the stream does one or more of these depends on the energy of the stream. This energy, in turn, depends upon the amount of water in the stream and the gradient of the stream channel (the difference in elevation between the beginning and end of the stream).

Streams adjust themselves as changes occur in their channel and their gradient and in the velocity of their water. Streams attempt to maintain a constant gradient by increasing or decreasing stream velocity, which affects the deposition or erosion of sediment, which in turn affects the depth and width of the stream channel. As the velocity of the water increases, the size of the material that can be carried by the water and the energy of the stream increase.

Monitoring the volume and velocity of streams is very important in order to understand how much water is available downstream for agriculture, cities, flood control and other uses. The very first river gaging station built by the U.S. Geological Survey in 1889 was in New Mexico, at Embudo Station on the Rio Grande south of Taos.

Procedures: Preparation:

1. Poke a hole at the bottom (shallow end) of each paint tray for water to drain.
2. Fill each paint tray one-half to three-quarters full with sand. The deep end should be the top and the shallow end should be the bottom. Most of the sand should be in the deep end at the top.



3. At each student work station, place the paint tray on the table with the drain hole hanging just over the edge of the table.
4. Place a bucket on the floor underneath the drain hole in the paint tray to catch water.
5. Divide the rest of the equipment for student groups.

Doing the activity:

1. Begin by asking the following questions. Accept all answers as hypotheses. You may have students write down the question on their data sheets or in a lab notebook.

   "How do rivers shape the land?"

   "How does the Rio Grande shape the bosque?"

2. Demonstrate to students how to use the stream table. Show how to slowly pour water from the beaker or water bottle onto the sand at the top of the paint tray. Demonstrate how the drain hole must be over the bucket.
3. Allow students some time to play with the sand and water. Have students make streams with a finger in the sand and watch what happens as the water flows down the tray.
4. After students have had about 10 minutes to play, have students build the following models. Students should watch each model and note where the river erodes sediment and where it deposits sediment.
   a. Straight river.
   b. Straight river with the top of the paint tray propped up on the wood block (steeper).
   c. Straight river with most of the sediment pushed up to the top of the tray to form mountains at the top and a flat plain toward the bottom. Do not use blocks.
   d. Curving (meandering) river. Be sure to use a broad meander. Do not use blocks.
   e. Rio Grande–Rio Bravo: Push most of the sand to the top of the tray to form mountains and a flat plain toward the bottom. Make a broadly meandering river on the flatter, lower part of the tray.
   f. Rio Grande–Rio Manso, early: Repeat Trial e above but add houses along the river.
   g. Rio Grande–Rio Manso, later: Push most of the sand to the top of the tray to form mountains and a flat plain toward the bottom. Make a straight river on the flatter, lower part of the tray. Build levees next to the river. Add houses outside the levees.

Note: Make sure the students don't dump the sand in the sink at the end of the activity.

5. You may want to have students draw pictures of their river models, using different colors to mark areas of deposition and erosion (examples: red = erosion, green = deposition). Have students describe how each trial is different from the previous trial. You may either ask students questions after each trial or have them describe on their data sheets or in their lab notebooks what happened.

6. Discuss the results using the following questions. You may choose to write answers on the board or have students answer questions on their data sheets or in their lab notebooks.
   a. How did the river pattern change when you put the stream table up on the block? Was there more erosion or deposition? Why?
      There should be more erosion because there is more potential energy for the water to cut into the sediment.
   b. When a river meanders, where does erosion happen (the outside or the inside of the meander)?
      Students should see erosion happening on the outside of the meander.
   c. When a river meanders, where does deposition happen (the outside or the inside of the meander)?
      Students should see deposition happening on the inside of the meander.
   d. How did the river pattern change when you made the mountains and the plain?
      Students should see more erosion in the mountains and more deposition on the plain. This model reflects the modern Rio Grande.
   e. Based on what you know about cottonwood trees, where would new cottonwoods most likely sprout?
      New cottonwood trees would sprout on the inside of meanders where flooding and deposition happens.
   f. What happened to the houses in Rio Bravo Part II (Trial 4.f)?
   g. Did the levees protect your houses any better?
   h. Based on what you know about cottonwood trees and bosques, what would happen to the bosque after the levees were built?
      The river no longer meanders, floods are confined, and cottonwoods would not begin to grow as easily as before the levees.
   i. In Albuquerque, the Rio Grande is actually higher in elevation than the houses in the North Valley. What would happen if we didn't have levees or if the levees broke?

j. Based on what you know about bosques and river processes, what do you think we should do to help the bosque and protect homes and businesses?

Assessment: Have students draw the Rio Bravo and Rio Manso and show, on the drawing, how the river shapes the land and shapes the bosque. Alternatively, students could answer the question in written, paragraph form.

Extensions: During the activity, students may ask questions about "What would happen if . . .?" Allow students to write down their questions and a hypothesis and then test their hypothesis with the model.

Soil Conservation Districts throughout New Mexico have an outreach program where they bring their "Rolling River" trailer to schools. This is a large stream table where the whole class can see river dynamics in action. Call your local Soil Conservation District office to inquire.

Related Activities: This activity was adapted from similar activities in the following publications:

Gartrell, J. E, Jane Crowder, and Jeffrey Callister. Earth: The Water Planet. 1992. Arlington, VA: National Science Teachers Association.

Project Storyline: Science, the Changing Earth. 1993. The California Science Implementation Network, University of California, Irvine.

Proyecto Futuro. Earth and Space Science Supplemental Curriculum. 1997. New Mexico Museum of Natural History and Science.

Thanks to Kristin Gunckel for this activity.

Drawings from the Earth & Space Science Supplemental Curriculum produced by the New Mexico Museum of Natural History & Science.