

Rising Waters and You

Lab Activities Student Instructions

Stream Table Activity 1

Background:

When a river overflows, velocity decreases suddenly, causing the river to drop some of the larger grains of sediment that were suspended in the water. This causes a natural shoulder on the river called a levee. Humans have long been living and working on the flood plains of rivers. To protect themselves from flood waters, they have built bigger and sturdier levees along the river banks. In Holland, people have built similar structures called dikes to keep rising ocean water out of their coastal plains. In Japan, dikes are built to keep Tsunami waves from inundating coastal towns. People have also built many dams along the same principles to create reservoirs of drinking water or to provide hydroelectric power. All of these structures have to be carefully built as they can fail in a variety of ways. In this lab, you will experiment to see how levees and related structures can fail, and you will try to determine ways to make these types of structures stronger.

Classroom Activity:

1. Using the stream table set up described above, create a levee out of sand. This levee should be approximately as high as the walls of the stream table (not higher or you might risk overflow) and several inches wide at the base.
2. Start the water flow and start a stopwatch. You do not want the water flow to be so high that it blasts the back of your levee. Again, keep an eye on the lake to be sure it does not overflow.
3. Watch the levee. Do you see water coming out the other side? As soon as you see water coming out of the downstream side of the levee, note the time. Also, note where the water came from (e.g., the bottom, the sides, or over the top in a crevasse).
4. Continue to watch the levee. How long does it take to start to collapse? Describe what happens to your levee over time.
5. Now consider what you might do to strengthen your levee. Your teacher should have some materials available for you. Try to design a new levee that will not fail in the same way that your previous levee did. You should also try to make it hold out longer than the previous levee did. Build your newly designed levee and then repeat steps 2-4.
6. Clean up your station and answer the following questions.
 - o After you started running the water, how long did it take the water to start seeping through the levee/dam?
 - o Did it take longer to collapse your levee/dam once you reinforced it? Why or why not?
 - o Talk to other people in your class to see what they did. Which methods of reinforcement do you think worked best and why?
 - o Describe the different ways that your levees/dams failed in the different trials.
 - o What types of materials would you suggest that engineers build their levees/dams from?
 - o If you were to design a levee or dam, how would you ensure that it would not fall in a flood?

Stream Table Activity 2

Background

Every year, insurance agencies and governments spend millions of dollars helping people whose homes and property have been damaged by floods. People continue to live on flood plains because they provide wonderful farmland, good commerce, and beautiful places to live. Some places along the flood plain might be safer than others. In this experiment, you will determine which part of a meander is safer to live on in normal conditions and which side is safer in a flood.

Classroom Activity

1. Set up your stream table so that the sand slopes upwards toward the water source and ends in a lake towards the bottom. Create a meandering river by drawing an S in the sand two fingers wide and about a centimeter deep. Use materials dredged out of the river to create levees along the sides of the river.
2. Locate the top meander (the curve on the S closest to the water source). Place a house on the inside portion of the meander, right on the back of the levee, and place another house on the outside of the meander, the same distance from the river channel as the first house. Draw a map showing the layout of your stream.
3. Start the water flowing at a low rate (there should be water constantly flowing in the river channel, but it should not be gushing). Start your stopwatch at the same time.
4. Note on your map areas where you see erosion (sediment being carried away from the riverbanks) and areas of deposition (where sediment is put down again).
5. Time how long it takes for one of the houses to fall into the river. Note which house it was and how long it took. If no house falls in after 10 minutes, stop the experiment and note that nothing happened to the houses.
6. Repeat steps 1-5, but this time increase the water velocity to represent a river at high water levels.
7. Repeat steps 1-5 again, but now create a flood either by storing water in a reservoir at the top of the stream table or by pouring water in rapidly. Again, note areas of erosion on your map, time the amount of time it takes for a house to fall in, and note which house falls in first.
8. Clean up your station and answer the following questions.

Questions:

- Under normal river conditions, did erosion occur on the inside or on the outside of the levee. Under these conditions, where would you want to build your house?
- When you increased the volume of water, did it change the pattern of erosion and deposition?
- When the river floods, what happened to the meander? If it got completely abandoned, label it an oxbow lake on your map.
- In a flood, what might happen to people living on the outside of a meander? On the inside?
- What safety precautions might you suggest for people living close to rivers?
- After the big flood, did the river remain the same shape or was a new river formed. Can you identify some features that were formed after the big flood from your research on the e-sheet at the beginning of this lesson? Label them on your map.