1UW ESS Rockin' Out
Stream Table lesson for science night or classroom visit
Instructions for teachers and volunteers

Age range: K-12, instructions and detail can be adjusted for different grades

Background for teachers and volunteers:

Rivers can be simplified to two key elements: the running water and the ground that it runs across. As rivers move downhill, they slowly move and rock, sand, and soil from its channel, shaping the landscape as they go. The speed of flow, volume of water, steepness of the slope, type and size of ground material, and shape of the channel all interact with one another. The more energy the river has, the more material it can move.

Rivers flow from their 'head' to 'base level'. Usually, base level is the ocean or a lake, but is essentially any area where the water surface slope becomes flat. There, the river loses all its energy and drops all the material it is carrying.

Why it matters:

Rivers are as helpful as they can be dangerous. They deliver us freshwater from the mountains and irrigate fields for agriculture. They are habitats for salmon, beavers, and migratory birds. However, they can also flood and destroy property. They move contaminants from industrial areas - such is the case for the Duwamish Waterway, and for many mining areas in the US. They can turn a landscape into a hazard - as the North Fork Stillaguamish steepened the slope that failed in the Oso landslide. We humans also alter rivers by changing the flora and fauna around them and building dams. We need to understand how rivers change so we do not endanger ourselves or the rivers.

Objectives:

- show that rivers are dynamic and change over time
- learn about different factors that affect rivers
- experimental skills: forming and testing hypotheses

Materials:

- tray with soil/sand with the drainage tube attached
- bucket(s) of water
- pump and feeder tube
- large clip (to hold the feeder tube in place)
- toothpicks/cut straws
- wooden blocks
- shovel
- scoop/cup
- towel/rag (for clean up)

Photos to aid teaching are included at the end of this document.

Set up:

1. Fill a bucket (or two) with water.
2. Make sure drainage tube is securely attached to the pipe in the corner of the tray and the other end goes into the bucket. This is the ‘downstream’ side of the tray.
3. Push the soil towards the upstream side of the tray, forming a gentle slope.
4. Leave ~ 6 inches of space between the soil and the downstream end of the tray – the space is base level (can be presented to students as an ‘ocean’ or a ‘lake’).
5. Secure the pump to the water bucket and drape the feeder tube over the upstream side of the tray. Secure with a clip.
6. Test the pump.

***Make sure to keep the soil out of the drain!

Part 1: River basics

Starter questions:
- have you seen a river before?
- Where can you find rivers?
- What does it look like/what do you think a river looks like?
- What do you see around a river?
- Do you think rivers can move rocks? What about soil/dirt?

Carve a basic starter channel with a slight ‘S’ curve (initial form can be based on responses to the starter questions). Turn on the pump.
- What do you see happening?
  - the shape of the channel may change slightly
  - rock bits move along the channel
  - sand being carried into the pooled water at the bottom of the tray (the ‘lake’)
- Point out the sand spilling into the ‘lake’ – where is this sand coming from?
- What kinds of “rocks” are moving? – Show that larger rock bits are exposed upstream

□ Takeaway: Rivers move material from upstream to downstream. Larger rocks are harder to move. As rivers move these rocks, their shapes can change.

Part 2: Experiments
Not all these experiments need to be done.

Each experiment has 3 parts - Adjustable variables, Effects, and Explanation.

1. Adjustable variables

The students can be prompted to choose what adjustments they want to make (e.g. “What can we do to change our stream?”)

Alternatively, invite students to brainstorm different places or scenarios where components of the river may change (e.g. “If there was a storm, what would be different?)

Encourage students to form hypotheses ("What do you think will happen?) before running the experiments.

2. Effects

Students can be assigned to pay attention to different aspects of the river:

- How fast is the water moving?
- Is the shape of the river changing?
- Is the sand and small rocks in the river moving?
- Are the big rocks in the river moving?
- How fast are the rocks moving?

Ask them to share their findings after the experiment has run.

3. Explanation

Ask students why they think the changes they saw happened.

The table below provides analogies for explaining concepts like energy and momentum that may be abstract for younger grades.

Adjustable variables	Effects	Explanation (Why does this happen?)
Slope - tilt the tray and support the upstream end with blocks Where in the world are there steep slopes? - mountains	Water flows faster Soil moves faster into the ‘lake’ Some bigger rock bits might move	Can compare the water to a ball rolling down a slope – steeper slope means the ball rolls faster. Energy – introduce the idea of pushing something. Running into something has more energy than just standing and pushing move more items or bigger items
Discharge (amount of water) - adjust the pump to let in more water - or reduce the water Where does extra water come from? - heavy rain - melting snow What if we cut off water? - drought - deserts	The channel widens More soil moves into the ‘lake’ Some bigger rock bits might move (Opposite effects if we reduce the water supply)	Energy/momentum – a larger person running into you will cause you to move further/you have to jump sideways further to get out of the way
shape - use the shovel to carve channels with different sinuosities - or carve different paths and ask which one the river will take	Meanders become more pronounced - can add toothpick “trees” on either side to show that the river is eroding on the outside of the bend. The toothpicks on the outside will fall into the stream. Meanders getting cut off if it bends too much	Is it easier to follow an ‘S’ shape or move in a straight line? Rivers are lazy and want the easiest path

dams - use blocks, toothpicks, or piles of sand to block the river What blocks a river? - falling trees - beavers - human dams - glaciers/ice - landslides	Water and soil are trapped behind the dam Water may start flowing around the dam or break through it	Compare the reservoir behind the dam to the ‘lake’ at the bottom of the tray. dams create a local base level

<u>Part 3: Scenarios for application</u>

Ask the question before turning on the water or changing the variable

“I want to build a house next to the river. Where should I build it?”

- let students place toothpicks to mark their “house”.
- Turn water on and see which “houses” stand

“If [insert situation] happens, which makes [insert variable] change, should I leave the house?” (e.g. If there is heavy rain bringing more water into the river…”)

In a classroom, students can write down predictions for different scenarios before testing them.

SUPPLEMENTARY PHOTOS

Egypt’s famous Nile River provides water to many towns in the arid country.
Image: Alexandru Magurean/Getty Images

The Amazon River and its many meanders (bends). Image: National Geographic.

The Elwha River in Olympic NP, WA, has stepped terraces (in the background) that formed as a result of dam building and subsequent removal on the river. The river is important habitat for salmon.
Image: Matt M. McKnight/Crosscut

The town of Oso used engineering to prevent a bend in the North Fork Stillaguamish River from migrating to the left in the photo, fearing it would flood and/or erode the town. However, the river ended up steepening the base of the slopes to the right, thus contributing to the 2014 Oso landslide.
Image: AP press