Hands-on

STAR★net

Tested & Approved STEM Activities

STREAM LANDSCAPES

Activity Guide

STAR★net

Science-Technology Activities & Resources For Libraries

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Developed by the Lunar and Planetary Institute/Universities Space Research Association
September 2015

This material is based upon work supported by the National Science Foundation under Grant No. DRL-1421427.
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STREAM LANDSCAPES

Overview

Children create channel features with flowing water on "stream tables," which are constructed in plastic trays with layers of sand, diatomaceous earth, and rocks. They use the stream tables to model the ways in which flowing water alters the surrounding landscape — often in beautiful ways.

Activity Time

20-30 minutes

Intended Audience

Families or other mixed-age groups, including children as young as 5 years old *with assistance from an older child, teen, or adult*
School-aged children ages 8-9
Tweens up to about age 13

Type of Program

☑Facilitated hands-on experience
☑Station, presented in combination with related activities (although the children may not have enough time to explore all concepts presented here)
☐Passive program
☐Demonstration by facilitator

What's the Point?

- Water flowing over the surface of the Earth has shaped our landscapes in beautiful ways.
- By observing clues in the world around us, we can learn about the way Earth changes.
- Models — such as the children are using here — can be tools for understanding the natural world.

Facility Needs

- ☐ An indoor or outdoor gathering space
- ☐ 2 tables
- ☐ Access to water
- ☐ Optional: a writing surface where the groups may draw stream features, such as:
  - ☐ 1 white board
    OR
  - ☐ 2–4 (~36" × 48") pieces of butcher

  AND

  - ☐ 4–8 dry-erase or other appropriate low- or no-odor markers

    OR

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paper, posted on the wall or used to cover the tables

OR

- ☐ 5 or more sheets of poster paper

- ☐ 4–8 crayons

Materials

For the Facilitator

- ☐ Materials to construct four "stream tables:"
  - ☐ 1 utility knife
  - ☐ 4 plastic wallpaper trays or window planter boxes (from home improvement or hardware stores) or other long, narrow, plastic containers
  - ☐ 8 standard bricks OR ☐ 8 foam floral/craft bricks
  - ☐ 4 (5-gallon or larger) trash cans or buckets (rectangular-shaped is best)
  - ☐ 4 large trash bags to line the buckets or trash cans
  - ☐ 10 pounds of clean playground sand
  - ☐ Optional (*recommended*): 5 pounds of pesticide-free diatomaceous earth (from a home improvement or pool supply store)

    OR

    ☐ Optional: 1-2 (24 oz.) bottles of craft sand, any color (readily available at hobby or department stores)

    AND

  - ☐ 1 pair of work gloves

    AND

  - ☐ 1 dust mask
  - ☐ 8-12 small rocks (2" diameter or less)
  - ☐ Masking tape
- ☐ *Brief Facilitation Outline* page (below)

For Each Group of 6-8 Children

- ☐ 4 stream tables, constructed beforehand using the materials listed above
- ☐ 6-8 pitchers, filled with water
- ☐ Optional: cell phone cameras

Facilitator's Note: Diatomaceous earth will aid in creating well-defined landscapes. Sand and diatomaceous earth can be dried out and reused!

Caution: Although it is a natural product and is available in "food grade," diatomaceous earth poses an inhalant hazard and can cause eye irritation if handled improperly. If you choose to use it in your stream tables, set up the stream tables beforehand and keep the diatomaceous earth moist or covered to keep it from becoming airborne in the presence of children. Use caution when working with the diatomaceous earth and setting up the tables. You may use a mask to protect yourself. It is also a good idea to wear gloves when handling this material as it may dry hands significantly.

Supporting Media

Consider setting up a digital media player (such as a computer), speakers, and access to the Internet to display websites or multimedia before, during, or after the activity.

Books

One Million Things: Planet Earth

John Woodward, DK Children, 2009, ISBN-13: 978-0756652357
Visually stunning images and clearly written text cover multiple Earth science topics, including rivers and the landforms they create. Appropriate for ages 8 and up.

Earth as Art

Lawrence Friedl and Karen Yuen, National Aeronautics and Space Administration, 2012, ISBN 9780160913655, NP-2012-07-889-HQ
Children may enjoy the shapes, colors, and textures of Earth's land, oceans, ice, and atmosphere captured by satellites. Appropriate for ages 10 and up; younger children may need assistance interpreting these images, which are viewed from the unique vantage point of space.

Websites

National Geographic Education

http://education.nationalgeographic.com
There are multiple National Geographic resources relating to flowing water and the landscapes it creates. For instance, there are encyclopedia entries, with links to multimedia, text, and activities for "river," "mouth," "alluvial fan," and "oxbow lake."

NASA Earth Observatory

http://earthobservatory.nasa.gov
Find images of the Earth and its features, which have been captured by satellites and astronauts in space. Search for key words such as "river" or "alluvial fan," or browse a topic such as "Surface Water." Appropriate for ages 10 and up; younger children may need assistance interpreting these images, which are viewed from the unique vantage point of space.

Visual Aids

Earth as Art

For iPad devices, free from iTunes: https://itunes.apple.com/us/app/nasa-earth-as-art/id577527077?mt=8#

As a slide show or image files to download from the U.S. Geological Survey Earth Resources Observation and Science (EROS) Center: http://eros.usgs.gov/imagegallery

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Preparation

Beginning six months before the activity

- Prepare and distribute publicity materials for programs based on this activity. If possible, build on the children's knowledge by offering multiple science, technology, engineering, art, and mathematics (STEAM) programs. See the STAR_Net resources listed at http://community.starnetlibraries.org/resources for ideas.
- Prepare each plastic tray:
  - Use a utility knife to poke three pea-sized holes on the bottom of each tray, about one inch from the end.
  - Using tape, cover the holes on the underside of the tray to contain the sand.
  - In half of the trays, pour a one-inch-deep layer of sand. *As much as possible, leave the holes at the ends of both trays uncovered so the water can drain.* On top of the sand pour a two-inch-deep layer of diatomaceous earth. Add a thin layer of sand across the surface of the diatomaceous earth. For the top layer, sprinkle just enough sand to cover the diatomaceous earth.
  - In the other half of the trays, pour a two- to three-inch layer of sand. Have the sand along the edges be a little higher than in the center so that water will flow down the center.
  - Bury two or three rocks in each tray just beneath the surface in different locations.

The day before the activity

- Each team will use *two* stream tables, placed side by side and tilted at different angles, to create and compare different types of stream features. Set up the stream tables, lined trash cans, and pitchers of water on the tables:
  - Place the trays so that the children can easily group around them.
  - Position each plastic tray so that the end with the holes hangs over the table edge about six inches.
  - Place a lined trash can or bucket under the part of the tray that extends over the edge to catch excess water as it drains from the tray.
  - Place three bricks under the other end of the plastic tray with the diatomaceous earth, so it is tilted about 20 degrees. You may want to recruit help with positioning the trays on the bricks.
  - Place one brick under the tray with the sand only, so that it is tilted about 5 degrees.
  - Place three or pitchers of water beside each tray, so that each child may have one.
  - Dampen the sand.
  - Remove the tape to uncover the holes in the trays.

Pouring water at the top of the sloped tray will create features ("**channels**") much like those formed by water flowing across Earth's surface. In the tray with a low slope, the water will travel more slowly. The water will be damned up by, and flow around, the buried rocks. The speed at which the water is poured also creates different results.

At a slow rate and a low gradient or angle of tilt, a gently meandering stream may form. This stream will have an "s-shape" and is called a "**meandering stream**."

At the steep tilt and high flow rate, the flowing water will create **braided streams** — multiple channels — with teardrop shaped islands between the channels. The water will **undercut** the channel edges making slumps. At even higher rates of flow, the whole surface may flood.

As it erodes the channel bed and banks, **sediment** (silt, clay, sand, and gravel) is moved downhill. At its end, a river slows down and no longer has the energy to move the sediments. A slow, steadily moving river may form a flat, low plain or wetland — a **delta** — as the slowing river drops its sediments.

Based on the way channels are shaped, it is possible to infer the elevation of a terrain. If the channels are gentle meanders, the tilt of the landscape is relatively gentle. If there are braided streams and significant erosion, the gradient of the landscape is much steeper.

Following the activity

- Leave the stream tables out to dry and store them, covered, for future use.

Activity

1. Share ideas and knowledge.

- Introduce yourself and the library. Help the children learn each other's names (if they don't already).
- Frame the activity with the main message: Water flowing over the surface of the Earth has shaped our landscapes in beautiful ways.
- Invite the children to talk about what they already know about streams (or rivers), if they have any direct experiences with streams or the canyons, alluvial fans, deltas, and other features carved by water — especially those that are nearby. Use open-ended questions and invite the children to talk with you and each other.
- Point out the stream tables and invite the children to make predictions about what will happen in each tray when water is poured at the top ends. Encourage comparisons between the high- and low-tilt plastic trays.

Making predictions, and later reflecting on them, is a great skill for analytical thinking! Encourage the children to talk with you and each other using questions like:

- What do you predict will happen when you pour water onto the surface at the top of the trays?
- Do you think the features will be different in the tray with the lower tilt compare to the one with the higher tilt? If so, in what way(s)?
- What do you think will happen when the water meets an obstacle, like a buried rock?

2. **Guide the children in creating model landscapes on the stream tables.** Invite the children to divide into teams and take turns slowly pouring water, *gently* and *steadily*, into the high end of each tray. Encourage the children to describe, draw, and/or photograph:
    - The different types of features;
    - What happens along the stream edges (i.e. sand building out some parts of the meanders and eroding others with the shallow tilt/slow water flow);
    - What happens when the water meets an obstacle;
    - What features form when the water is poured quickly vs. slowly; and
    - How the features in the tray with the lower tilt compare to the one with the higher tilt.

3. **Conclude.** Discuss how everyone's predictions compared with what each group observed. Summarize that water flowing across the water tables cut into the surface and carried some of the material away to create meanders, braided streams, and undercuts. Water flowing over Earth's surface forms different, often beautiful, features depending on the angle of the landscape. If the landscape tilts at a gentle angle and the flow rate is low, the flowing water will create more organized — and fewer — channels that may form gently curving meanders. Erosion of the channel edges will be less catastrophic. At a steeper tilt — or a high flow rate — the flowing water will flood across the surface and create braided streams with teardrop shaped islands between the channels. The water will undercut the channel edges, making slumps.

Correlation to Standards

National Science Education Standards

Grades K–4

Earth and Space Science – Content Standard D

Changes in the Earth and Sky

- The surface of the Earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.

Grades 5–8

Science as Inquiry – Content Standard A

Abilities Necessary to Do Scientific Inquiry

- Different kinds of questions suggest different kinds of scientific investigations. Some investigations making models.

Earth and Space Science – Content Standard D
Structure of the Earth System

- Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.
- Water covers the majority of the earth's surface.

References

Explore! Carving Channels, Lunar and Planetary Institute, 2007
www.lpi.usra.edu/explore/mars/surface/carving_channels.shtml

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1. **Share ideas and knowledge.**
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   - Frame the activity with the main message: Water flowing over the surface of the Earth has shaped our landscapes in beautiful ways.
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   - Point out the stream tables and invite the children to make predictions about what will happen in each tray when water is poured at the top ends. Encourage comparisons between the high- and low-tilt plastic trays.

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