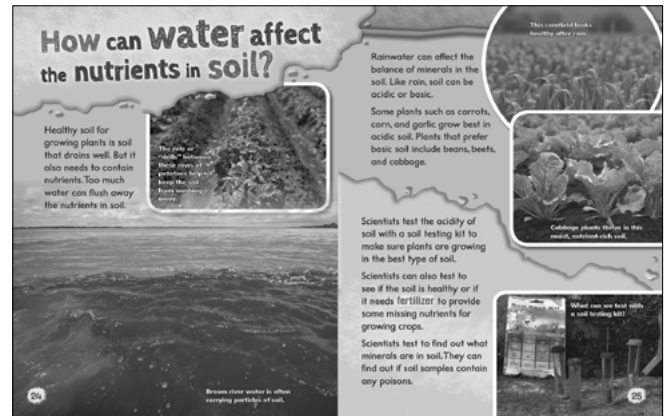
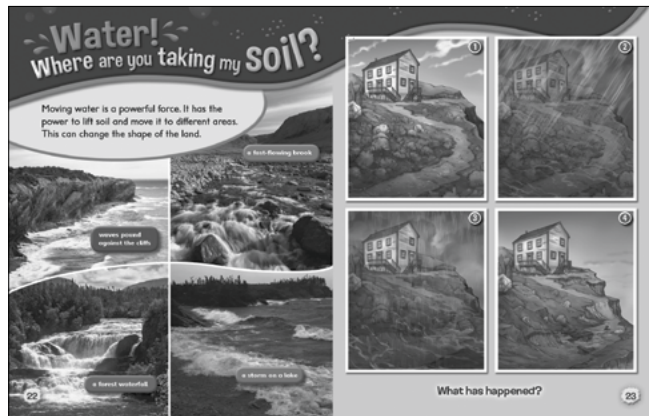


How Does Moving Water Affect Soil?



Focus: Students will observe and explore how different samples of soil react to moving, or poured, water.

Specific Curriculum Outcomes

Students will be expected to:

- 15.0 investigate the effects of moving water on different soils [GCO 1/3]
- 16.0 predict based on an observed pattern [GCO 2]
- 17.0 communicate procedures and results [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- use their prior knowledge about soil to create predictions when initiating science inquiry investigations
- choose an effective method to communicate their procedures and results about the effects of moving water on soil

NOTES:

Attitude Outcome Statements

Encourage students to:

- willingly observe, question, and explore [GCO 4]
- show interest in and curiosity about objects and events within their immediate environment [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- explore, extend, clarify, and reflect on their thoughts, ideas, feelings, and experiences [GCO 1]
- create texts collaboratively and independently, using a variety of forms for a range of audiences and purposes [GCO 9]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 22–25 • <i>What Is the Inquiry Process?</i> poster	• paint tray or shallow basin • large yogurt or plastic ice cream container • small yogurt container • sand • watering can, water • modelling clay • variety of materials such as spray bottles, squeezable water bottles, straws, watering cans or perforated yogurt containers, liquid measuring cups, graduated pitchers, buckets • variety of soil samples (sand, clay, pebbles) • piece of wood (i.e., plank) • cardboard carton • students' Science Journals • materials such as yogurt containers, masking tape or duct tape, craft sticks, plastic berry baskets, Styrofoam trays, alfalfa sprouts • poster board (optional) • video camera, digital camera, or tablet (optional)	• Prepare slips of paper with questions about soil being washed by water. • Contact a local farmer or gardener and invite this expert to speak to the class about nutrients in soil, testing soil, and crop rotation.	• soil erosion • nutrients

Safety

- Have students wash their hands thoroughly with soap and water after handling soil.
- Ensure that students wipe up any spills, especially with water, to prevent slip hazards.

Science Background

- When water moves or flows across the ground, it has an impact on the soil. Fast-moving water—from heavy rainfall or from forceful waves—can

shift soil to a different area. It can wash away soil from the sides of cliffs, hills, or mountains. It can dislodge the soil that keeps trees' roots secure, making trees topple over. It can carve deep crevices in soil and, over many years, create deep valleys.

- Sloped areas can keep their soil in place much better when they are covered in plants and trees. The plants and trees, with their extensive root system, act as a sort of “net” that blankets the soil and holds it in place.
- Soil that is washed away from farmers' fields, mining areas, or industrial sites can dump toxins into bodies of water, such as rivers, lakes, and oceans.
- Coastal erosion is an issue of concern in Newfoundland and Labrador. Forceful waves can cause damage to low-lying coastal roads and disturb delicate dune landforms, carrying sand out to sea. Over time, this can lead to a shrinking beach, island, or land mass, with more and more of the “land” being carried out under the seawater.
- Green roofs take unused space (i.e., flat rooftops) and transform it into a green space using local plants that are adapted to the weather and exposed conditions. The plants and grasses used in the green roofs help reduce greenhouse gases. Like all plants, they absorb carbon dioxide and produce oxygen. This leads to better air quality in urban centres. Green roofs are good insulators, so they help reduce the costs of heating and cooling structures. They have a waterproof membrane below the soil or sod to prevent leaks.
- Green roofs are an increasingly popular feature seen in some modern sustainable buildings. A 12-storey office tower called Fortis Place is a commercial structure in St. John's that has a green roof. Corner Brook City Hall also has a green roof. Historically, there are roofs made from sod that can be seen at L'Anse aux Meadows National Historic Site. These thick sod coverings, with an underlayer of wood framing, insulate the building from cold-weather conditions. Root cellars—basement or underground cold storage areas that are excavated into hillsides—are very common in traditional homes in Newfoundland and Labrador. Vegetables kept in root cellars stay cool throughout the winter months, but don't freeze because they are insulated by the soil under the ground.

ACTIVATE



Force of Water

Share pages 22–23 of the Student Magazine with the class. Read aloud the title question: *Water! Where are you taking my soil?* Give students some time to examine the photos on page 22, then ask:

- **How do you think the water is affecting the soil in these pictures?**
- **Can you think of other situations where water affects soil?** (e.g., floods, hurricanes)



Then, examine each panel of the cartoon on page 23 with the class and discuss what has happened. Introduce the term “soil erosion” and add it to the Word Wall.

Invite students to share some stories about heavy rainfalls. Prompts for discussion could include:

- **Where was the water running?**
- **Was there anything being carried away by the water?**
- **Was the water a different colour?**

High on a Hill

Tell students you're going to do a demonstration about moving water. Ask them how moving water can affect soil. Record students' ideas on the board.

Set-up: In a paint tray or shallow basin, place a large, upside-down yogurt or plastic ice cream container. Explain that this represents the hill. Fill a small yogurt container with moistened sand. Turn the container over so that the small form of sand makes a shape on the hill. Ask:

- **What do you think will happen when rain falls on the sand at the top of the hill?** (The sand will collapse or change shape.)

After students have had an opportunity to make predictions, begin the demonstration. Use a watering can to gently sprinkle water on the sand. Students will observe that lots of the packed sand washes away and flows with the water down the sides of the hill to the valley below. Sprinkle more rainwater until little rivers begin to form below the sand.

Have each student come up close to observe the rivers and rivulets of water. They may wish to use magnifying glasses to see tiny particles of sand in some of the water. If necessary, point out that very little sand remains on top of the hill. Explain that this demonstration models what can happen to landforms during heavy rainfalls.

Collapsing Models

Have students make a small figure or structure from modelling clay. Have them test some of the figures by putting them on top of an upside-down yogurt container and sprinkling them with water. Have students compare this to the previous teacher demonstration with sand (High on a Hill). Ask:

- **What happened to the clay figure?** (its shape changed; it slowly collapsed into a lumpy shape)
- **How does this compare to the sand we tested earlier?** (it kept its shape better than the sand)
- **Can you make a conclusion about how moving water affects clay?** (less clay washes away, collapses, or dissolves compared to sand)

In both this activity and the High on a Hill activity (above), students can see how moving water takes away some of the particles in the soil. Discuss as a class what effect the moving water is having on the soil. Help students to understand that the moving water is washing away the soil. Invite students to add any new questions they may have to the I Wonder Wall.



CONNECT



Mudslide

Provide a variety of materials such as spray bottles, squeezable water bottles (e.g., those used by cyclists), straws, watering cans or perforated yogurt containers, liquid measuring cups, graduated pitchers, buckets, and a variety of soil samples. Have students fill a “mess area” in which to investigate soil and water.

Ask students to build a ramp from a piece of wood (i.e., a plank) and a cardboard carton. Have them coat the wood in a layer of soil about 2 cm deep, 5 cm wide, and 20 cm long. Have three different samples of soil available (e.g., sand, clay, and pebbles).

Students can select the materials they would like to investigate, making and recording their predictions about what will happen to the soil samples. Then have students add water, using the different types of containers to represent rainfalls ranging from light to heavy. Students will observe what happens to the soil. Encourage them to record their observations in their Science Journals. Repeat with each sample of soil. Discuss their results as a class. Were their predictions supported?

Rooftop Garden

Provide or have students find pictures of rooftop gardens. Ask:

- **Can you see the soil?**
- **How does the soil stay on the roof and not wash away onto the ground below?** (Plants and small stones hold it in place. There is a low “wall” around the outside that keeps the soil inside a sort of tray-like structure, similar to a sandbox.)

Have students create model rooftop gardens in the classroom. Materials may include upside-down yogurt containers, masking tape or duct tape, craft sticks, plastic berry baskets, Styrofoam trays, soil mixtures, sand, small stones, and alfalfa sprouts.

CONSOLIDATE

You Asked It

Have a collection of questions about soil washing away written on slips of paper. Have students work in pairs or groups of three to answer the question. The questions can include the following:

- **What happens to soil when it rains?** (it gets wet; it absorbs some water; it changes shape; it gets mucky; it washes away)
- **How does water move soil?** (bits of soil are carried along by flowing water)
- **How can erosion be prevented?** (by planting trees or putting rocks on slopes to hold the soil in place)
- **Why do farmers plant trees around their fields?** (to stop the soil from blowing away)

Have students explore the question, conduct research, and then communicate their results in a method of their choice. Three options are provided below, but students may wish to choose other presentation methods.

1. Infographic Poster

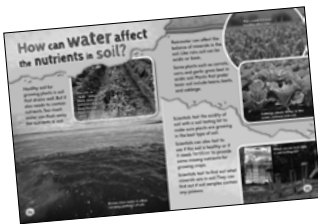
Have students present information about moving water and soil erosion using the format of an eye-catching poster with pictures, graphics, words, captions, and photos. Their poster should be focused on the effects of moving water on soil, and which types of soil are most resistant to the effects of moving water. It should contain science vocabulary, such as “rock,” “pebbles,” “silt,” “sand,” “loam,” “particles,” “soil erosion,” and “moving water.”

2. Infomercial

Have students present information about moving water and soil erosion through a government-sponsored infomercial. Their infomercial should be focused on the effects of moving water on soil, and which types of soil are most resistant to the effects of moving water. It should contain science vocabulary, as listed in 1) above.

3. Documentary Video

Have students present information about moving water and soil erosion through a short video. Their video should be focused on the effects of moving water on soil, and which types of soil are most resistant to the effects of moving water. Students may wish to include outdoor footage of flowing water that contains soil particles, and/or clips from interviews with members of the community. The video should contain science vocabulary, as listed in 1) above.



Water Flows, Soil Goes

Introduce pages 24–25 of the Student Magazine to the class by reading the title question aloud: *How can water affect the nutrients in soil?* Ask students to keep their ideas to themselves while they examine the visuals and read the text. Then, in small groups, have students discuss the question. Prompts for discussion may include:

- **How do nutrients help plants?**
- **What happens if these nutrients are taken away?**
- **How can moving water, or too much water, affect the nutrients?** (wash away soil and carry nutrients away; water contaminated by industrial waste can add acid to the soil)

Protecting Our Soil

Invite a local farmer or gardener to speak to the class about nutrients in soil, testing soil, contour plowing, and crop rotation. After the talk, have students suggest ways to keep soil healthy and full of nutrients. Together, come up with a class action plan to protect soil. For example, students might decide to start a compost program at school and use the compost to enrich the soil in the school’s garden.

EXPLORE MORE



The Effects of Heavy Rainfall on Soil

Challenge students to conduct an independent inquiry investigating the effect of heavy rainfall on soil in their region. Have them interview local farmers (or property owners), or find information in the newspaper about how people are protecting soil from erosion. Review the *What Is the Inquiry Process?* poster and have students focus on one question for their inquiry, such as:

- How do farmers prevent soil from washing away in a specific area?
- What do farmers do to protect soil from erosion?
- How do property owners stop soil from washing into lakes, rivers, and/or the ocean?

Have students communicate their findings in a short write-up or newspaper-article format with illustrations and quotations to support their conclusions.

Local Disasters

Have students research local natural disasters involving moving water such as Hurricane Igor and the resultant flooding in 2010.

Claymation

Have students use a video camera, digital camera, or tablet to make a short animated video featuring clay figures, which they have modelled themselves. Students may want to demonstrate in the video what happens when a clay figure encounters too much water.