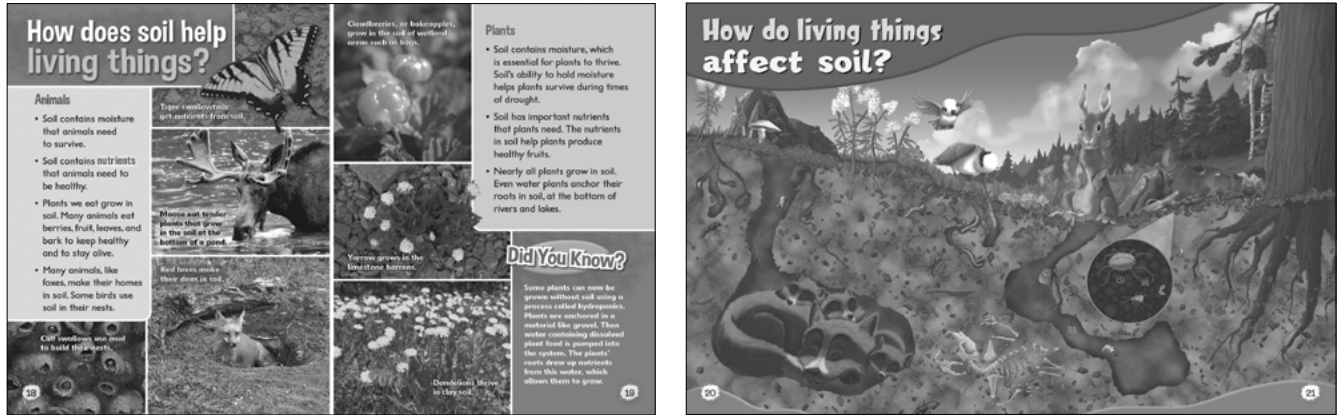


Soil and Living Things



Focus: Students will investigate how living things affect and are affected by soil, and develop their understanding of composting.

Specific Curriculum Outcomes

Students will be expected to:

- 12.0 use a variety of sources of science information and ideas [GCO 2]
- 13.0 investigate and describe how living things affect and are affected by soils [GCO 1/3]
- 14.0 propose an answer to an initial question or problem and draw a simple conclusion [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- question, predict, observe, collect data and research, analyze, and make a conclusion about plants and soil
- make a conclusion about the role or the impact of worms on the process of decay
- make sketches and discuss how living things (i.e., plants and animals) interrelate with soil

NOTES:

Attitude Outcome Statements

Encourage students to:

- consider their own observations and ideas when drawing a conclusion [GCO 4]

Cross-Curricular Connections

English Language Arts

Students will be expected to:

- interpret, select, and combine information using a variety of strategies, resources, and technologies [GCO 5]
- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imaginations [GCO 8]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• <i>Underneath the Sidewalk</i> (Read Aloud) • Student Magazine, pages 18–21 • IWB Activity 3 • IWB Activity 4 • <i>What Is the Inquiry Process?</i> poster • IWB Activity 5 Literacy Place • <i>Explore! Magazine: Nature Up Close</i> (“The Forest Man of India,” pp. 21–23, Shared Reading—Nature Watch Inquiry Unit)	• students' Science Journals • clipboards and paper (optional) • clear container or aquarium • nutrient-rich soil • 100–500 live worms (e.g., red wigglers) • food scraps (e.g., cut-up banana peels, orange peels, apple cores, grape stems, etc.) • black paper • 2 L bottles (1 per group) filled with gravel and soil (added using a funnel) • 20–30 live earthworms, insects, spiders, or grubs • bristol board • non-toxic (edible) coloured sand (optional) • materials for making musical instruments (optional)	• Invite an Elder or Indigenous Knowledge Keeper to share how everything on Earth is connected. • Invite an expert such as a local composter, a worm farmer, or an ecologist to visit the classroom. • Gather Internet and print resources related to animals and plants from Newfoundland and Labrador. • Gather Internet and print resources for poems or songs about animals that are suitable for students.	• compost • composter • decay • decompose • humus • living • moisture • non-living • nutrients • organic matter

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

- Plants and some animals depend on the moisture and nutrients in soil for their survival.

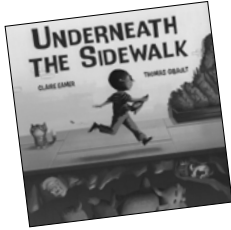
- Many animals make their homes in soil and some birds use soil in their nests.
- Plants absorb minerals from the soil. Examples of minerals include carbon, calcium, iron, nitrogen, sulfur, and phosphorus.
- Soil found in different areas of Newfoundland and Labrador is suitable for growing different types of plants and trees. For example:
 - Aquatic: **Yellow water lily** grows in ponds and lakes that are nutrient-rich. Its leaves and flowers float on top of the water, while the stem stretches down to the bottom of the pond/lake, and its roots are in the soil under the water.
 - Bogs: Wetland areas have soils in which many plants thrive. The **pitcher plant** is Newfoundland and Labrador’s provincial flower. It is a carnivorous plant (or insectivore) that traps insects and digests them. Pitcher plants live in poor-quality soils in wetland areas (bogs). The prey that they consume boosts the plant’s nutrient levels. Another common wetland plant is the **blue flag iris**. It has purple flowers and narrow leaves. **Cranberries** thrive in bogs as well.
 - Boreal forest: This nutrient-rich, moist soil features many berry plants in sunlit clearings, such as **bakeapple**, **crowberry**, **blueberry**, and **bunchberry**. Other plants include **coniferous** and **deciduous trees**, **Labrador tea**, **moss**, **fungi**, and **lichen**.
 - Limestone barrens/Tundra: **Yarrow**, **partridgeberry**, **yellow dwarf orchids**, **sageleaf willow**, **Laurentian primrose**, **yellow lady’s slipper**, **harebell**, **alpine chickweed**, and **dwarf spruce trees** grow (slowly) in this exposed environment.
 - Meadows: **Goldenrod**, **dandelion**, **fireweed**, **alders**, **lupins**, and **pearly everlasting** can all be found thriving in meadows or along roadsides.
 - Pebble beach: **Oyster plant** creeps along the stones on beaches. **Seaside plantain** and **silverweed** grow well on rocky beaches as well.
 - Sand/Forest: **Bunchberry** has four white petals and red berries that grow in a “bunch.” It can be found on sandy beaches and also in forests. **Sea Pea** and **oyster plant** are two flowering plants that thrive in beach sand.
 - Clay-based soil: **Dandelions** thrive.

Possible Misconceptions

- Students may think that soil is dead and doesn’t contain living organisms. In fact, soil is filled with living organisms such as bacteria, fungi, earthworms, spiders, beetles, grubs, and also plant roots.
- Some students in grade 3 may think that nothing can grow in some types of very poor-quality soil. This is incorrect. Even poor soils will still allow for some specialized plants to grow—the plants are just less diverse. For example, these plants thrive in clay-based soil: **alder**, **goldenrod**, **yarrow**, **sea holly**, and **sedum**. The barrens host **partridgeberry**, and **yellow dwarf orchids** grow on high limestone cliffs on the west coast of Newfoundland. Saltwater marshes and tidal areas are a haven for **red glasswort**, which is a type of **pickleweed**. In sand, along the coast, **seaside sandplant** (or **sea sandwort**) thrives.

ACTIVATE

Read Aloud: *Underneath the Sidewalk*



Summary

A girl falls through a crack in the sidewalk and meets the “beasts” who live underground.

Before Reading

Show students the cover of *Underneath the Sidewalk* and ask:

- **What is a sidewalk built on?** (the ground, soil)
- **What do you see in the soil beneath this sidewalk?**
- **What do you think this story is going to be about?**

Tell the students that as you read the text aloud, they should listen to find out what lives in the soil underneath this sidewalk.

During Reading

Read the story aloud fluidly and expressively. Then read the story again, pausing to discuss the text and illustrations. Clarify any new vocabulary as necessary. Prompts for discussion might include:

- **What would we actually find living in the soil underneath the sidewalk? Would there be “beasts”?** (There would be “beasts” such as earthworms, insects, spiders, grubs, etc., but no monsters.)
- **Would there be spaces in the soil? Would they be big enough to play in?** (Yes, there would be small spaces such as those created by plant roots and the digging of earthworms and ants. There might also be burrows of animals.)
- **The spread with “OH NO!” shows other things besides living things in the soil** (rocket ship, bones, jewels, remains of old cities). **What might you find in the soil around you?** (e.g., organic matter, animals bones, rocks)
- **Could you really slide down tree roots and swing from grass shoots?** (No, but they would be there in the soil.)

After Reading

Have students write and illustrate a short story about another adventure the girl has with her friends underneath the sidewalk. Encourage students to make their stories rhyme. Invite students who are interested to read their stories aloud to the rest of the class. Post all of the students’ stories in the classroom or create a class book.

Soil-Centred Walkabout

Take students outside to examine the soil and turn over rocks. (If there has been a recent heavy rainfall, invite students to look for earthworms.)



Encourage students to take note and make their own sketches of any living organisms they see in soil in their Science Journals. (Alternatively, students may wish to take clipboards and then, when they are back in the classroom, cut and paste the sketches into their Science Journals.) Ensure that students put all rocks, sticks, and natural materials back as they found them so as not to harm the ecosystem.

Soil and Living Things

Invite students to discuss with a partner how they think soil helps living things. Create a web on the board, or on chart paper, to show students' thinking. Then share pages 18–19 of the Student Magazine. Allow students time to examine the animal and plant pictures and to read the text. Ask:

- **What do plants and animals need to live?** (food, clean water, shelter, air)
- **How can soil help with these needs?** (provides food/nutrients; shelter; contains water/air; filters water)

Add any new ideas to the web.

Vegetation Visualization

Have students close their eyes and ask them to visualize a sandy beach. Say:

- **You know what the soil is like at beaches. You see a wide expanse of sand. You might see some hills or cliffs.**

Ask:

- **What plants do you see?**

Then take students on an imaginative trip, high in the hills. Describe a rocky, exposed landscape, such as the limestone barrens on the west coast of Newfoundland—which hosts many rare and endangered plants—and/or the tundra (and permafrost) of the Torngat Mountains in northern Labrador. Ask:

- **What plants or flowers grow here?**
- **Are they large or small?**

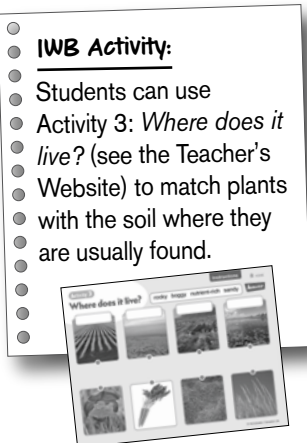
Next, travel to a marshland or bog. Ask:

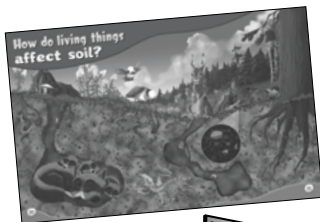
- **What do you see and smell?**
- **Can you hear anything?**
- **What kinds of plants and flowers do you see?**

Finally, journey to a forested region. Ask:

- **What plants do you see on the forest floor?**
- **What kinds of trees grow here?**
- **How tall are the trees?**
- **What animals make their homes here?**

If students are unsure of the vegetation for the various landscapes, you could provide visuals to stimulate discussion.





Living Things Affect Soil

Invite students to look at pages 20–21 of the Student Magazine. Give students 5–10 seconds to quickly preview this spread and look at the illustration. Ask students what their brief preview makes them wonder about, and add their questions to the I Wonder Wall.

Read aloud the title question: *How do living things affect soil?* Spend a few moments brainstorming possible responses together as a class. Jot down students' ideas on the board or on chart paper. If the following responses are not mentioned, add them to the list of ideas:

- Plant roots help to drain water from the soil. This keeps the soil from staying too wet.
- Plant roots dig down into the soil and create spaces for air and water.
- Roots can help to make soil by splitting rocks into smaller pieces that become soil.
- Ants, earthworms, and other animals dig and mix the soil. They also create tunnels and burrows in the soil which help to create spaces for air and water.
- Earthworms eat decaying plant materials that pass through the animals and fertilize the soil.
- Living things help soil by recycling nutrients—when living things die in the soil, they are broken down by tiny bacteria and fungi. The minerals are released into the soil. Living plants need these nutrients to grow.
- Humans can affect soil negatively by leaving garbage and contaminating the soil with toxic products such as gasoline and motor oil.

Classroom Visit

You may wish to invite an Elder or Indigenous Knowledge Keeper to share with students the belief that everything on Earth—humans, plants, animals, water, air, the land—is connected. They can explain how air, water, plants, animals, and people can all affect the health of soil.

CONNECT

It's Alive ... With Creepy Crawlers

Discuss the fact that soil contains small living organisms. Tell students you are going to play an active game. You will need to do this activity in the gym, the hallway, or in a large, open area outside. Assign numbers to students from 1 to 5. Students who are numbered 1, 2, 3, or 4 represent rock, clay, silt, and sand, respectively. Students who are numbered 5 represent a small living organism, such as an ant, a worm, or a vole. Have students who are numbered from 1 to 4 link arms or hold hands. Students' arms can cross, forming a web or grid of students. The number 5 students—the ants, worms, or voles—are then challenged to make their way through the web of soil particles in the same way that these living organisms create tunnels and burrows under the ground.

IWB Activity:

- Invite students to identify components of soil as living, once-living, or non-living using Activity 4:
- *Components of soil* (see the Teacher's Website).





Let's Investigate Plants

Plants thrive in different types of soil. Have students work in small groups and devise a rich inquiry question of their own to investigate plants and soil. Each member of the group may suggest a question and add it to a list. Students are to consider each question and ask each other further probing questions. Have students find a way to narrow down their discussion and choose just one question from the list to explore further. Some groups of students might debate in order to select one question, while others will draw randomly from the list. Some sample questions might include:

- **What does soil need to stay healthy?**
- **How do plants help soil?**
- **What do plants take from the soil?**
- **How does soil help plants?**

Guide students to keep their group's question narrow and ask them to focus on a particular plant and a specific soil type.

Read aloud the steps of the *What Is the Inquiry Process?* poster. This will assist students as they progress through the steps of this student-led investigation.

Next, have students make a prediction. This will be a proposed answer to the question they will focus on during this investigation. Students may wish to begin their prediction with the sentence stem: "I predict that _____."

After gathering and recording their observations, data, and research, students will analyze this material and make a conclusion. The conclusion should be a statement that explains what they learned or discovered about plants and soil. Their conclusion should also relate back to their original prediction by saying whether or not the prediction is supported or justified by their research findings or results.

Calling All Soils!—A Competition

Tell students there is going to be a soil competition. Who will be the winner: Sandra Sand, Milton Silt, Roman Loam, or Clayton Clay? Have students start off by ordering different types of soil, from the best kind for growing things to the worst kind for growing things. Ask them to justify the reasoning behind their ranking system. Be sure to point out that even poor soils can be the perfect environment for specialized species of plants. This is why harsh environments like the limestone barrens still have unique flowering plants growing there.

After working through this first example, students can come up with their own criteria for winning soils with other notable features or qualities. Students can make badges to highlight the winning qualities of different types of soil. Encourage students to connect the winning qualities of soil to plants, if possible, and then to explore other creative winning qualities, such as nutrient-rich, best colour, holds shape, or grittiest. Challenge students to include each type of soil as a winner for some quality. Ask:

- **Which type of soil is the best for gardening and farming?** (sandy loam—soil that contains some sand, silt, and clay, but more sand than silt and clay)

- **How do decaying plants help form soil?** (Plants break down into organic matter, decompose, and are eaten by animals, micro-organisms, and fungi, which breaks them down further. They become mixed into the soil, which increases the volume of soil on the ground.)

CONSOLIDATE

Worm Farm

Start with a clear container or aquarium. Add nutrient-rich soil, live worms, and food scraps such as those from students' lunches (cut-up banana peels, orange peels, apple cores, grape stems, etc.), or add some compost that students bring from home. Make sure students understand that the compost must be made up entirely of vegetable waste. No fats, oils, meats, dairy, paper towel, or cardboard should be included. Water the soil daily to keep it moist.

Help students to wrap the clear container in black paper to keep the worm farm dark. This will promote more activity in the worms. When students want to observe the worms, they can remove the paper and put it back in place when they are finished.

Allow students, working in small groups, to take the lead in developing their own group investigation based on the role or the impact of worms in the worm farm. Encourage them to begin by creating a question or stating a problem. Some student groups may choose to investigate by sketching the worm farm and adding labels to the tunnels, some of the worms, and the layers of compost and newly formed soil—made up of “castings” or the waste that worms produce. Others may wish to collect data by taking the mass of the worm farm on day 1 and then at two-week intervals—even continuing to collect data for two or three months, if possible—to measure how much new soil has been created. Still other groups may want to record the temperature of the top layer of compost each day for two weeks and graph the results. Some student groups may opt to examine samples from different layers in the worm farm and look at them under a magnifying glass. You may wish to offer suggestions for graphing or charting data as necessary to help propel students' learning. Have students make a conclusion based on what they have learned.



The worm farm can become a classroom composter and students can observe the process of decay over several weeks or months. Explain that this is called vermicomposting. Discuss the words “compost,” “composter,” and “decompose” and add these terms to the Word Wall.

Expert Interviews

Invite an expert from the community to visit the class to talk and answer students' questions. The expert could be a local composter, a worm farmer, or an ecologist. Encourage students to develop a list of questions in advance that they would like to ask the expert.

Mini-Biosphere in a Bottle

In small groups, students can construct a terrarium using clear, 2 L bottles filled with gravel and soil (added using a funnel), and earthworms, insects,

spiders, or grubs. Ensure that living organisms have adequate oxygen, water, and food to survive.

Note: Students should take care with living organisms, such as insects and spiders, and treat them with respect.

Have students make sketches and discuss how the living organisms interrelate with the soil. Ask:

- **How do earthworms help the soil?** (burrow through it, mix it, pull dead leaves down into it, add air to it, help break down decaying organic matter, leave behind castings that nourish the soil like fertilizer)
- **How does the soil help the earthworms?** (They find food—organic matter—in the soil and it helps them survive.)
- **How do soil and plants help spiders?** (The plants that grow in soil provide structures for spiders to build webs and lay their eggs. The plants also provide a shelter for the spiders to rest and wait for an insect to get stuck in their web.)
- **How do spiders help plants?** (They capture and eat insects that harm plants. This allows the plants to thrive and be healthy.)
- **How do spiders help the soil?** (By eating the pests it means farmers and gardeners won't have to use pesticides to keep their plants healthy. This keeps dangerous chemicals out of the soil, which keeps the soil healthy.)

Discuss answers as a class.

Animals Dig Earth

Have students choose an animal from Newfoundland and Labrador that lives in soil. Have them research the animal and explore its relationship with and its dependence on soil. Ask:

- **Does this living organism affect soil? How?**
- **Is this living organism affected by soil? How?**

In diary format, have students make a bristol board display to tell the story of the animal from its point of view. Be sure students include information about water, nutrition, and shelter. Have students add pictures from the Internet, their own sketches, and fun facts about the living organism. Ask students to list their sources (books, magazines, Websites, videos, etc.) on the back of their display board. Some animals for students to consider are cliff swallows, butterflies, mosquitoes, worms, voles, mice, rabbits, and beavers.

Ask questions such as the following to prompt a class discussion about animals and soil:

- **What animals live in soil?** (e.g., earthworms, ants, potato bugs, earwigs, millipedes, voles, mice, rabbits, gophers/groundhogs, foxes)
- **How do animals change soil?** (mix it up, add air to it, add their waste to it)
- **What is compost?** (decomposing organic matter that is being broken down and mixed by earthworms and micro-organisms; compost contains humus)
- **How do decaying animals help form soil?** (Animals break down into organic matter, decompose, are eaten by animals, micro-organisms, and fungi,

IWB Activity:

- Challenge students to use Activity 5: *What is its role in soil?* (see the Teacher's Website) to identify how different living things affect soil.



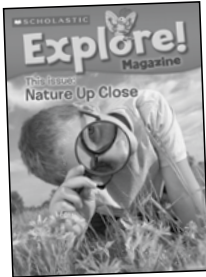
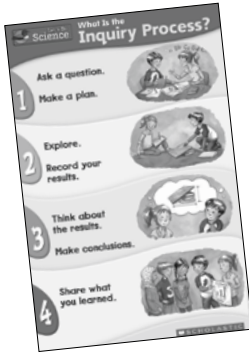
which breaks them down further. They become mixed into the soil, which increases the volume of soil on the ground.)

Do Worms Mix Soil?

Pose this question to the class and have students investigate and explore in whatever way they wish. Most likely, student groups will investigate by creating a worm farm and adding some objects to the surface.

Circulate around the classroom to check in with individuals and small groups of students. Make sure students understand that the word “mix” can mean stir, combine, turn over, churn, or blend. For students who may be veering off topic or would benefit from more structure, you might recommend a graphic organizer and/or review the steps of the Inquiry Process using the *What Is the Inquiry Process?* poster.

If you wish, purchase some non-toxic (edible) coloured sand for worm farms. Place a thin layer of red sand on top of a layer of soil. Add a layer of soil and then add a thin layer of yellow sand. Repeat a few times to create striped layers in the worm farm. When the worms wriggle and burrow in the soil, they will leave a trail of coloured sand.



Literacy Place Connection:

“The Forest Man of India,” on pages 21–23 of *Explore! Magazine: Nature Up Close*, describes how one man has spent over 30 years growing a forest on a large, empty sandbar. Revisit or read the text with students and ask:

- How do you think the termites, ants, earthworms, and insects helped to improve the condition of the soil?

EXPLORE MORE

Above and Below

Have students draw an “above and below” soil picture that includes living things (plants and animals) that are found locally both in and above the soil. Students can add labels and/or captions to explain how these living things help soil.

Animals in Soil

Have students write a poem or song about an animal (e.g., worm, groundhog, mouse) that lives in soil. Alternatively, have students research poems or songs that have been published about underground animals or soil. Host a literacy fest with a kindergarten or grade 1 class to share poems and songs. If they wish, students could make musical instruments, such as shakers containing small pebbles, sand, or loamy soil.