



## STAGE 4: SOIL IN THE ENVIRONMENT

Students will learn about the importance of healthy soil to healthy plants. They will explore soil composition, including the biodiversity of this complex ecosystem, to understand that there are different types of soil. Often soil dictates what can be grown—or not—in a particular area. Students will explore human impact on soil and farmers' role in soil health and the technology they use to mitigate environmental harm. Designing a new farming machine is an optional bonus activity.

Lesson 1: What is Soil?

Lesson 2: Soil Types in Ontario (and Regions)

Lesson 3: Compaction and Erosion

Lesson 4: Soil Nutrients

Lesson 5: STEM and Technology on Farms

Lesson 6: Designing an Innovative Farm Machine

## LESSON 2 – Soil Types in Ontario (and Regions)

### Overview:

Soil is not the same everywhere. That means the same crops cannot be grown everywhere. Farmers need to know about soil, soil health, and what their crops need in order to grow the food we need to eat.

Students will learn about the characteristics of different soil types found in Ontario and practise being an *agronomist*, a scientist who helps farmers understand and care for their soil and crops.

We will also look at regions and their suitability for agriculture. Canada is a large country with seven physiographic regions; some areas are not suitable for agriculture. Ontario includes three of the seven regions: the Hudson Bay Lowlands, Canadian Shield, and the St. Lawrence Lowlands.



## Learning Goals

- Understand the importance of soil and soil health.
- Understand soil composition in Ontario
- Gain an appreciation for plant soil requirements and farming
- Become familiar with the geographic regions of Ontario

## Materials Needed

Note: You will not have time for all three activities; choose the one that will work best for you and your class.

- Lesson Slides

### ACTION 1: Soil Shake

- Jar with lid for each business group (or fewer if you prefer to model the activity for your class)
- Trowels for digging soil samples

### ACTION 2: Soil Sampling

- Trowels for digging soil samples
- Types of Soil in Ontario sheet
- Small containers (Dixie cups) for collecting samples

### ACTION 3: Soil Types Map

- Drawing material: paper, pencils, rulers, notebooks or clipboards to provide a drawing surface
- Types of Soil in Ontario sheet

**Time Frame: 40 min**



## **Curriculum Expectations**

### **Science & Technology Curriculum**

#### **Strand A STEM Skills**

- A1.1 Use a scientific research process and associated skills to conduct investigations
- A1.5 Communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes

### **Science & Technology Curriculum**

#### **Strand E Soils in the Environment**

- E1.1 Assess the importance of soils for society and the environment
- E2.1 Identify the living and non-living components of soil, and describe the characteristics of healthy soil
- E2.3 Examine different types of soils found in Ontario, and describe how different soils are suited to growing different types of food, including crops
- E2.6 Describe the process of composting, and explain some benefits of composting

### **Social Studies Curriculum**

#### **Strand B People and Environments: Living and Working in Ontario**

- B1.1 Describe major connections between features of the natural environment of a region and the type of land use
- B1.3 Identify and describe ... land use ... using mapping and globe skills
- B3. Describe major landform regions and types of land use in Ontario
- B3.3 Identify the major landform regions in Ontario (Canadian Shield, St. Lawrence Lowlands, Hudson Bay Lowlands) and describe the major characteristics that make each distinct

#### **Grade 4: Political and Physical Regions of Canada**

- B3.7 Demonstrate an understanding of cardinal and intermediate directions (e.g., N, S, NW, SW), and use them to locate physical characteristics

### **Agriculture/Agri-Food Themes**

- Soil literally impacts every bite we take. Soil health is a crucial component of agriculture





## Media Links (embedded in the slides)

Properties of soil [https://www.youtube.com/watch?v=\\_yp4WuIVuA4](https://www.youtube.com/watch?v=_yp4WuIVuA4)

Soil Shake (in Teaching Notes, not in slides) <https://www.youtube.com/watch?v=qaL-qAJ8wI4>

Agronomists <https://www.youtube.com/watch?v=9WCqEa39KDY>

Soil Sampling on the farm <https://www.youtube.com/watch?v=S43vi4Prd9Q>

## Teaching Notes

<p><b>Slide 7: Minds ON!</b></p>	<p>This slide is a warm-up activity. Have a little fun, if you don't mind puns!</p> <ol style="list-style-type: none"> <li>1. What is a soil's favourite candy? Answer: Gummy worms</li> <li>2. What is soil's favourite form of transportation? Answer: A dirt bike</li> <li>3. What did the soil say to the plant? Answer: I'm rooting for you</li> <li>4. Why does soil never lie? Answer: Because the truth isn't hard to dig up.</li> </ol>
<p><b>Slide 8: Soil and Farming</b></p>	<p><b>Soil and Farming</b></p> <ul style="list-style-type: none"> <li>• Farmers work hard to ensure their soils stay healthy and full of nutrients for their plants. Farming involves a lot of science!</li> <li>• Farmers need to know a lot about their soil - about the health of the soil and also about what type of soil they have on their farms.</li> <li>• Some plants grow better in certain soil types than others. Understanding what plants need in their soil helps farmers be successful, keep the soil healthy and keep the growing crops healthy.</li> </ul>
<p><b>Slide 9: Properties of Soil</b></p>	<p>Let's watch this video to learn about the properties of soil. <a href="https://www.youtube.com/watch?v=_yp4WuIVuA4">https://www.youtube.com/watch?v=_yp4WuIVuA4</a></p>





<p><b>Slide 10: Size of Soil Particles</b></p>	<p>Imagine how soil particles stack up. Will big ones crush small ones? Will small ones sit on top? We're going to do an activity that will help us answer those questions.</p>
<p><b>Slide 11: ACTION 1: Soil Shake</b></p>	<p>There are THREE action opportunities in this lesson. You will not have time for all of them in one lesson. These slides are editable so you can decide what is going to work best for your class.</p> <p><b>Action 1: Soil Shake</b>  <b>Action 2: Soil Sampling</b>  <b>Action 3: Soil Type Map</b></p> <p><b><u>Action 1: Soil Shake</u></b></p> <p><b>TIP!</b> This lesson will flow most smoothly if the soil shake is prepared the day prior to this lesson - it needs to sit for 24 hours before students can draw their diagram.</p> <p>Before doing the shake test, your class will need to dig some soil samples with a trowel.</p> <p><b>Soil Shake Directions:</b>  Step 1: Find a jar with a lid that will close tight.  Step 2: Fill your jar about half-full of soil. Then fill it up with water. Close the lid <b>tight!</b> Shake well!  Step 3: Wait 24 hours for the soil to settle.  Step 4: Draw a picture of a jar. And then draw a diagram of layers of your soil.</p> <p>Your may wish to illustrate with this video about the soil shake jar test (filmed in Maui):  <a href="https://www.youtube.com/watch?v=qal-qAJ8wI4">https://www.youtube.com/watch?v=qal-qAJ8wI4</a></p>



**Slide 12/13 :**  
**ACTION 1:**  
**Soil Shake**

**Tip!** Consider having students measure and graph the separate layers in centimeters.

If you have multiple soil shakes (from different locations), you can divide the groups and compare graphs.

Ask students what they observed and where the layers landed after shaking.

The layers should be:

Organic matter - floating to the top

Clay - top layer of jar

Silt - middle of jar

Fine Sand - bottom layer of jar

Coarse sand (or gravel) - very bottom of jar

Ask students how this activity might influence where they would plant their granola bar ingredients.

**Slide 14:**  
**Soil Types**  
**in Ontario**

Soils contain air, minerals, water and organic matter. They also contain particles of clay, sand and silt. The combination of all of these things makes up the type of soil it is. Each soil type will have different characteristics for growing things.

There are different types of soil found in Ontario, but the three most common agriculture types are clay, loam and sand soil. Soils can be a mixture of these three types so each field can really vary on what soil type exists.

Something to think about: soil is literally the foundation of most of our food. The plant products we eat grew in soil and the meat we eat comes from animals that eat plants that grow in soil.

Soil is important to people!



<p><b>Slide 15:</b> <b>Clay</b></p>	<p>You can tell soil contains clay by squeezing a handful of moist soil in your hand. If it sticks together or makes a ball, it has clay.</p>
<p><b>Slide 16:</b> <b>Loam</b></p>	<p>If we were farmers, we'd like to have loamy soil on our farms!</p>
<p><b>Slide 17:</b> <b>Sand</b></p>	<p>Sand is made of larger particles, which are heavier, so they drop to the bottom.</p>
<p><b>Slide 18:</b> <b>Chalk</b></p>	<p>Chalk is another type of soil found in Ontario.</p> <p>Chalky soil is not particularly nutritious for plants but can be amended by adding organic matter.</p> <p>(Sources: Encyclopedia Britannica, The Walled Nursery)</p>
<p><b>Slide 19:</b> <b>Peat</b></p>	<p>Peat is another type of soil found in Ontario.</p> <p>Peat is cut and dried as a fertilizer in commercial planting soils and as a fuel, such as for heating instead of wood. It is a slowly renewable energy source; its greenhouse gas emissions when burned are comparable to fossil fuel.</p> <p>(Sources: Encyclopedia Britannica, Ontario Nature)</p>
<p><b>Slide 20:</b> <b>Silt</b></p>	<p>Silt is another type of soil found in Ontario.</p>





<p><b>Slide 21:</b> <b>ACTION 2:</b> <b>Soil Sampling</b></p>	<p>Let's watch this video to learn what agronomists do:</p> <p><a href="https://www.youtube.com/watch?v=9WCqEa39KDY">https://www.youtube.com/watch?v=9WCqEa39KDY</a></p> <p>The video demonstrates examining wheat and other plants, soil sampling, and using technology to monitor a barley field. Also talks about requirements to be an agronomist—interest in plants, math, and the importance of farming.</p> <p>For additional information, visit</p> <p><a href="https://goodineverygrain.ca/2024/01/31/plant-experts/">https://goodineverygrain.ca/2024/01/31/plant-experts/</a></p>
<p><b>Slide 22:</b> <b>ACTION 2:</b> <b>Soil Sampling</b></p>	<p>Justin explains how he samples his soil.</p> <p><a href="https://www.youtube.com/watch?v=S43vi4Prd9Q">https://www.youtube.com/watch?v=S43vi4Prd9Q</a></p> <p>Soil sampling and testing is when farmers or agronomists collect a representative soil sample from each field or section. They will then send these soil samples into a lab where they will be tested and analyzed to determine the levels of available nutrients. Nutrients in the soil are plant food for the growing grains. They will then use these results to determine a) if their fields need more nutrients added via fertilizer and b) how healthy their soil is. These qualities vary from year to year and are constantly changing.</p>
<p><b>Slide 23:</b> <b>ACTION 2:</b> <b>Soil Sampling</b></p>	<ul style="list-style-type: none"> <li>• Take students outside to collect their own soil samples from various locations on the school property (works well in Dixie cups). Or, hand out pre-collected samples.</li> <li>• Let students examine soil samples and discuss similarities and differences. Use the Types of Soil in Ontario sheet to identify their soil samples.</li> <li>• Based on this exploration, ask students to discuss what they think soil is. What types of soil make up your school grounds? Take feedback.</li> </ul> <p>Extension Idea: Have students draw a map of your school grounds.</p>



<p><b>Slide 24:</b> <b>Inquiry Questions</b></p>	<p>Prompts:</p> <p>Remind students about the properties of soil and what soil does on a farm.</p>
<p><b>Slide 25:</b> <b>ACTION 3:</b> <b>Soil Type Map</b></p>	<p>Look at the two maps of a grain farm. Discuss - What do you think farmers can learn from this map?</p> <p>Map found at: <a href="https://www.ontario.ca/page/how-use-agmaps">https://www.ontario.ca/page/how-use-agmaps</a></p> <p>First image is of an aerial view of a 200-acre grain farm (in red box). The second image is the same grain farm with the soil layers added on. Ask students, what can see they see on the map? What is the soil type(s)?</p>
<p><b>Slide 26:</b> <b>ACTION 3:</b> <b>Soil Type Map</b></p>	<p>Show the features on the farm map to give students an idea of what is required.</p>
<p><b>Slide 27:</b> <b>Wrap Up</b></p>	<p>Can you predict what crops would like to grow in the soil at your school?</p> <p>Remind students to consult the Types of Soil in Ontario sheet.</p>
<p><b>Slide 29:</b> <b>Extension -</b> <b>Regions of Ontario</b></p>	<p>There is so much to teach about soils and many cross-curricular connections that can be made.</p> <p>Educators who participated in our pilot recommended extending the soils discussion to the regions of Ontario. We have provided a few slides as a starting point for you.</p> <p>We are excited to hear where you take this learning opportunity!</p>



**Slide 30:  
Regions of Ontario**

This map shows the 7 physiographic regions of Canada—physiographic means physical geography. They are the Canadian Arctic, the Western Cordillera, the Interior Plains, Canadian Shield, the Hudson Bay Lowlands, the St. Lawrence Lowlands, and the Appalachian Region.

As you can see, most of Ontario is within the Canadian Shield, a huge region that covers 5 million square kilometers, or 48% of Canada.

Learn more at: <https://www.thecanadianencyclopedia.ca/en/article/physiographic-regions>

**Slide 31:  
Canadian Shield**

The Canadian Shield is also called the North American Craton (a craton is a large stable block of the Earth's crust that makes up the nucleus of a continent). It covers most of North America, from Mexico to Greenland. It consists of rocks that are at least 1 billion years old and, except for the Canadian Shield, are buried deep and covered by soil. The Shield isn't just rock—it has lots of minerals and is covered by coniferous forests.

Ontario was once covered by ice. As it receded (as recently as 11,000 years ago), it carved out many lakes exposed the rock of the Shield.

Farming can be hard within the shield due to the amount of rock, poorer soil quality and lack of nutrients. But there are farming areas in Ontario, within the Canadian Shield that grow a lot of grains for food (like the Ottawa Valley region and Temiskaming Shores).

Learn more at: <https://www.thecanadianencyclopedia.ca/en/article/shield>





<p><b>Slide 32: Hudson Bay Lowlands</b></p>	<p>Three of Canada's seven regions are in Ontario. In addition to the Canadian Shield, Ontario includes the Hudson Bay Lowlands and the St. Lawrence Lowlands.</p> <p>The Hudson Bay Lowlands is a sedimentary basin; 40% of it is in the middle of the Canadian Shield and the rest is under the water of Hudson Bay and James Bay. Much of the surface is covered by muskeg and peat.</p> <p>Learn more at: <a href="https://www.thecanadianencyclopedia.ca/en/article/geography-of-ontario">https://www.thecanadianencyclopedia.ca/en/article/geography-of-ontario</a></p>
<p><b>Slide 33: St. Lawrence Lowlands</b></p>	<p>The soil of the St. Lawrence Lowlands is underlain by a layer of clay and was shaped by the movement of water as the glaciers retreated.</p> <p>Learn more at: <a href="https://www.thecanadianencyclopedia.ca/en/article/st-lawrence-lowland">https://www.thecanadianencyclopedia.ca/en/article/st-lawrence-lowland</a></p>
<p><b>Slide 34: Region Videos</b></p>	<p>Watch This! These videos that will help you to "tour" the regions. Which region is most likely growing the grains you'll use in your granola bars?</p>
<p><b>Slide 35: Wrap Up</b></p>	<p>In which region(s) are you most likely to find farms growing crops for your granola bars? Why?</p> <p>Canadian Shield has pockets of areas (Temiskaming Shores region) that are provincially renowned for growing the best oats for oat processing into cereals and granola bars.</p> <p>St Lawrence Lowlands grows a lot of high-quality crops that be used to make all sorts of foods, including granola bars.</p>

**Assessment Resources. Coming soon!**

Please check the STEMterprise webpage at <https://goodineverygrain.ca/ontario-farming-stemterprise/>

# Types of Soil in Ontario



Soils are made of air, water, minerals, and organic matter. The amount of each of those elements determines soil types. There are several soil types in Ontario. Some are better for growing plants than others. The most common types of soil in Ontario's agricultural areas are clay, loamy, and sandy. What kind of soil is in your area?

## Clay

Clay is heavy! It stores water well but not air. It is smooth when wet but cracks when dry. It holds together if you squeeze it. Clay agricultural soil is not the same as the clay you make pots with.

Clay holds plant nutrients but drains slowly. It compacts easily so driving big machines on it when wet can damage it. Clay soil is improved by adding microbes.



## Loam

Loamy soil is the best soil for growing! It is a mix of sand, clay, and silt. It holds water, does not dry out in summer, and stays together if you squeeze it.

Loam holds nutrients and drains well so it is good soil for many crops. It may have stones in it, depending how it was formed. That is not ideal. Loamy soil can be made stronger by adding microbes.



## Sand

Sandy soil is mostly sand, which is tiny bits of rock! It is light and feels gritty. Sand is often low in nutrients. It has large particles, so it dries out quickly and nutrients and water can leach away. Plants growing in sandy soil may be dry and need watering and they may need organic fertilizer.

Sandy soil warms up quickly in the spring so it is great for early spring planting.





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## Chalk

Chalk soil has something in common with sidewalk chalk – both contain the mineral calcium carbonate!

Chalk soil does not hold water well, so it is difficult to farm. Chalk is susceptible to water erosion – heavy rain just runs off instead of soaking in. It also does not hold nutrients well.

To make chalky soil better, add organic material – compost, manure, or peat moss.



## Peat

Peat soil is made from plant material decaying in a wet environment over thousands (!) of years. It holds moisture very well.

Peat soil is an excellent material for improving dry types of soil, like sandy soil. It helps make air spaces for roots and it does not contain harmful micro-organisms.

Peat is a non-renewable resource. It should be used carefully.



## Silt

Silt is like sand but with smaller particles that are bigger than clay particles. When silt is dry, it feels like flour; when wet, it forms a ball.

Silty soil is more fertile than sand and easier to farm than clay. It does not filter water well; it compacts and gets hard so farmers avoid driving their heavy equipment on it when it is wet.

Compost and microbes improve silty soil.

