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 1: What Is Soil?

Overview:

Soil is not the same thing as dirt. Soil is what grows living things; dirt is what's left on your clothes after you work with soil.

Students will learn how important soil is for growing healthy plants. They will come to understand soil composition and its amazing diversity. They will learn about composting to understand how natural decomposition in soil benefits plants.

Learning Goals

- Understand the importance of soil and soil health.
- Understand soil composition

Materials Needed

- Lesson Slides
- Garden trowels–one per business group or one for an individual/teacher to obtain soil samples
- 2 pairs of thin cotton underwear (really!)
- 2-litre bottle
- Soil
- Organic waste (vegetable peels, egg shells, etc)

Time Frame: 40min

Curriculum Expectations

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
- E2.2 Identify different substances that are commonly added to, or absorbed by, the soil, and describe their effects on soil health
- 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
- E2.5 Identify various strategies used to maintain and improve soil health in Ontario
- E2.6 Describe the process of composting, and explain some benefits of composting
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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

- What's the Dirt on...Dirt? https://www.youtube.com/watch?v=if29mjcd5bc
- What is Soil Health? https://www.youtube.com/watch?v=l0oj3YJ28YY&t=171s
- What does an earthworm eat? https://www.youtube.com/shorts/yMiaeU22AVY

In teaching notes

- Physiographic regions of Canada https://www.thecanadianencyclopedia.ca/en/article/physiographic-regions
- Canadian Shield https://www.thecanadianencyclopedia.ca/en/article/shield
- Hudson Bay Lowland https://www.thecanadianencyclopedia.ca/en/article/geography-of-ontario
- St. Lawrence Lowland https://www.thecanadianencyclopedia.ca/en/article/st-lawrence-lowland
- Draw With Rob, Episode 2, Wiggly Worm https://goodineverygrain.ca/draw-with-rob-ep-2/

Teaching Notes

Slide 6: Minds ON!	This slide is a warm-up activity. Have students look at this picture. Either as a group or with a partner, discuss: • What is going on in this picture? • What do you see that makes you say that? • What more can you find? Discuss/refresh students on photosynthesis.
Slide 7: Photosynthesis	Revisit the conditions plants need to grow and be healthy. Review photosynthesis. Ask: What can we remember about this process? What is it called? What did we learn? We learned plants need water and light for photosynthesis. Photosynthesis is the process plants use to make food in their leaves Plants need nutrients from the soil.
Slide 8/9: What is soil?	Watch the video to learn about soil: https://www.youtube.com/watch?v=if29mjcd5bc After watching the video, use the following questions in a whole class or partner discussion. • What surprised you? • What do you wonder?

Slide 10: What is soil?	• Soil is made up of minerals from broken-down rocks, air containing gases such as carbon dioxide and oxygen, water, and organic matter from decaying plants and animals. • The well-being of all plants and land-based animals depends on the complex processes that take place in soil. • Healthy soil is important for feeding plants that store carbon, filtering water, and controlling greenhouse gases.
Slide 11: Healthy Soil	• Healthy soil has high soil biodiversity, which means the number of living things or organisms in it, such as earthworms, insects, microbes, and plant roots. They all contribute toward the ecosystem in the soil. Students will continue to explore this in Stage 4 lessons. • Did you know soil is home to a quarter of our planet's biodiversity? It is one of nature's most complex ecosystems and one of the most diverse habitats on earth; just one teaspoon of healthy soil can contain more living organisms than there are people living on earth!
Slide 12: Discussion	Lead a whole-class discussion: To grow healthy plants, we need healthy soil. Why?
Slide 13: Investigating Soil Health	What is Soil Health? Watch this video to learn what soil health means and discover the "critters" living in it. https://www.youtube.com/watch?v=I0oj3YJ28YY&t=171s

Slide 14/15: **Living Components of Soil**	Brainstorm with students – what are living components of soil? Reminder: Healthy soil has biodiversity. That means lots of things live there, like earthworms, insects, microbes, and plant roots. And did you know? Soil makes up only 10% of Earth's surface. We need it to grow our food, so we need to protect it! As an extension activity, you could introduce this aspect of the lesson with Good in Every Grain's Draw With Rob, Episode 2, Wiggly Worm https://goodineverygrain.ca/draw-with-rob/
Slide 16/17: **Non Living Components of Soil**	Brainstorm: What are non-living components of soil? Use this space to record your ideas. Reminder: Soil also includes minerals from broken-down rocks and gases like carbon dioxide and oxygen. Think about this! We don't eat soil, but we need soil to eat!
Slide 18: **ACTION 1:** **Worm Survey**	**There are THREE action opportunities in this lesson. You will not have time for all of them in one lesson. The PowerPoint for this lesson has editable slides so you can decide what is going to work best for your class.** • **Action 1: Worm Survey** • **Action 2: Composting** • **Action 3: Underwear Test** **Action 1: Worm Survey** A final investigation for students is a worm survey. This brief video shows how worms help soil. https://www.youtube.com/shorts/yMiaeU22AVY The number of worms in a soil sample is an indication of soil health. Students can also mark down other signs of life – centipedes, etc. This activity can be done as a whole-class investigation or in business groups.

Slide 19: **ACTION 2:** **Composting**	This will work well if you are doing this soil lesson when the ground is cold or frozen. There are lots of instructions on YouTube for making a classroom composter, some more complicated than others. This is a simple alternative: Making a mini composter using a 2 L bottle containing soil and organic waste (lid on). Leave it in direct sunlight for 8 weeks. Investigate the benefits of composting and design a poster about why it is important to your city and the food you eat.
Slide 20: **ACTION 3:** **Underwear Test**	The underwear test! How does it work? Just buy two pairs of cheap cotton underwear, bury them in separate locations, and dig them up after at least 60 days (works best in spring – April to June). It's the quick and dirty way to test the microbial activity in the soil. The microbial organisms will eat the cotton part of the underwear, but will leave behind any synthetic materials (i.e. an elastic waistband). The more the underwear is deteriorated, the more microbial activity is present, and the healthier your soil is! Recommendation: Select two sites – one that you suspect will have more and less healthy soil. Test it out. We would love to see what you've learned! Post your results on Facebook, Instagram, Twitter or Tik Tok and tag us! @GoodinEveryGrain

Slide 21: **Wrap Up**	Thought prompts: Students dug up the ground to look for worms. Would a farmer do that too? A farm has parts of plants left over after a harvest. Would that make compost? Soil is not a renewable resource. If we put a building on healthy soil, that soil is lost to us for growing food.
Slide 22: **Check in – What's Next?**	We will be learning about the different types of soil in Ontario, and you will get to be a soil tester! For teachers: To prepare, you can check out a story in Good in Every Grain about soil testing. https://goodineverygrain.ca/2021/04/19/earth-day-2021-soil-testing/

Assessment Resources. Coming soon!
Please check the STEMterprise webpage at https://goodineverygrain.ca/ontario-farming-stemterprise/