Growing Up Organic operates on traditional and unceded territory of the Algonquins: now known to many as Ottawa, and now home to many from across Turtle Island and beyond.

Grades 3-4

Soil Exploration Workshop

Mindfulness minute: If it speaks to you, take two minutes with your students before this workshop to slow down and root down with this mindfulness minute.

LESSON FOCUS AND GOALS

InWhat do we mean when we say healthy soil? How can we tell if soil is healthy or not? Why is healthy soil so important? What can we do to keep our soils healthy?

LEARNING OBJECTIVES

Grade 3

Science and Technology: Understanding Earth and Space Systems- Soils in the Environment
OVERALL EXPECTATIONS:

1-Assess the impact of soils on society and the environment, and of society and the environment on soils
2-Investigate the composition and characteristics of different soils
3-Demonstrate an understanding of the composition of soils, the types of soils, and the relationship between soils and other living things

SPECIFIC EXPECTATIONS:

1.1 - Assess the impact of soils on society and the environment, and suggest ways in which humans can enhance positive effects and/or lessen or prevent harmful effects
1.2 - Assess the impact of human action on soils, and suggest ways in which humans can affect soils positively and/or lessen or prevent harmful effects on soils
2.2 - Investigate the components of soil, the condition of soil, and additives found in soil, using a variety of soil samples from different local environments, and explain how the different amounts of these components in a soil sample determine how the soil can be used
2.4 - Investigate the process of composting, and explain some advantages and disadvantages of composting
3.1 - Identify and describe the different types of soils
3.2 - Identify additives that might be in soil but that cannot always be seen
3.3 - Describe the interdependence between the living and non-living things that make up soil (e.g., earthworms ingest the soil and absorb the nutrients, then their castings return the nutrients to the soil; the roots of plants use the soil as an anchor to keep the plants from blowing away);
3.4 - Describe ways in which the components of various soils enable the soil to provide shelter/homes and/or nutrients for different kinds of living things

Health and Physical Education: Healthy Living
SPECIFIC EXPECTATIONS:

D1.1- Demonstrate an understanding of how the origins of food (e.g., where the food is grown, harvested, trapped, fished, or hunted; whether and how it is processed or prepared) affect its nutritional value and how those factors and others (e.g., the way we consume and dispose of food) can affect the environment

Mathematics: Number Sense
SPECIFIC EXPECTATIONS:

B1.7- Represent and solve fair-share problems that focus on determining and using equivalent fractions, including problems that involve halves, fourths, and eighths; thirds and sixths; and fifths and tenths

Grade 4
Science and Technology: Understanding Life Systems
SPECIFIC EXPECTATIONS:

2.1 - Follow established safety procedures for working with soils and natural materials
3.3 - Identify factors that affect the ability of plants and animals to survive in a specific habitat;
3.4 - Demonstrate an understanding of a community as a group of interacting species sharing a common habitat (e.g., the life in a meadow or in a patch of forest)

Mathematics: Numbers and Numeration
SPECIFIC EXPECTATIONS:

B1.4- Represent fractions from halves to tenths using drawings, tools, and standard fractional notation, and explain the meanings of the denominator and the numerator
B1.5-Use drawings and models to represent, compare, and order fractions representing the individual portions that result from two different fair-share scenarios involving any combination of 2, 3, 4, 5, 6, 8, and 10 sharers

MATERIALS NEEDED

1 apple and a knife
One blank piece of paper for each student
Colouring pencils or crayons
Blackboard or white board
Spades or spoons
Clipboards (1 per team of two or three students)
Garden journals or observation sheets
Magnifying glasses (1 per team of two or three students)

STRUCTURE / ACTIVITY

Part One: What is healthy soil?

Begin by introducing students to the garden and asking them why they think soil is one of the most important things in the school garden.

Soil provides a place for roots to develop and plants to anchor themselves
Soil contains minerals and nutrients which plants need to grow; we get the nutrients by eating fruits and vegetables grown in the soil that absorb the nutrients and minerals.
Soil provides shelter for many insects

The most obvious way we can tell if soil is healthy or not is by observing the plants that are growing in it. Healthy soil means healthy plants. Another word for healthy soil is "fertile" - this means soil where things grow well.

Ask the students to guess how much of our planet is covered in "healthy soil" where we can grow food. Have each student have a piece of paper to fold into fractions. Start with the apple and have students follow you as you cut the apple into fraction by folding their paper accordingly.

Imagine that the Earth is this apple. How much of the Earth do you think is covered by water? Answer: Water covers ¾ of the Earth: this includes lakes, oceans, rivers, and streams.

Cut the apple in quarters and discard three. Have the students fold their paper in four, open it, and write water on three of the folded areas.

How much is left? Answer: ¼ -This remaining quarter is land.

Cut the remaining ¼ in half. And have students refold the paper and fold it again in half.

One of these pieces (1/8 of the total) represents land that is not suitable for humans to live on. Can you think of what those might be? Answer: Deserts, swamps, mountains, and the arctic.

Have the students unfold the paper and indicate "deserts/swamps/mountains/arctic" on one of the eighths that is not water. Refold.

Now cut one of the 1/8 apple pieces into four. And have students fold their folded paper again four times. You will now have 4 pieces representing 1/32 of the apple. The first represents areas that are too rocky to plant things and the second represents areas that are too wet to plant things. The third 1/32 piece represents land that has been developed, covered in houses, roads, parking lots, etc.

What do we have left? Answer: 1/32 or 3% of the Earth is suitable for growing food.

With the apple, peel off the skin of your 1/32 piece to show the surface left from the apple that is appropriate for growing food.

Part 2: Healthy soil in our schoolyard

How we treat the soil determines whether soil is healthy or not. In groups of two or three, have students identify two different areas of the schoolyard: one that they identify to be healthy soil, the other to be unhealthy. Ask the students to collect soil samples from each area and examine the samples with magnifying glasses. Ask the students to write down some preliminary observations:

Where did you find the healthy soil? Where was the unhealthy soil?
How could you tell the soil was unhealthy? How could you tell it was healthy?
How are the soil samples different: What colour is the soil? Is it dry or wet? How does it feel?

Have the students examine their soil samples with the magnifying glasses, and record what they find – the "soil ingredients" – on their observation sheets.

Ask each group to record the ingredients they identified on a white board or large sheet of paper.

What did you find? Did others find the same thing?

Assemble some of the items the students have found, in larger specimens. These may include: rocks, leaves, twigs, roots, etc. Explain that soil is made up of four five things:

1. Non-living things (sand, rocks)
2. Living things that have decomposed (leaves)
3. Water
4. Air

1/2 of soil by volume is typically made up of mineral and organic matter; with 95% being mineral matter and only 1-5% being organic matter. The other half of the soil's volume is made up of water and air, these are the two components which vary the most: the wetter the soil is, the less air it will contain, the drier the soil is, the more air it contains.

Referencing the larger specimens:

How do we get from these ingredients to soil?
What other things might be in the soil that we can't see?

Soil's secret ingredient is...**Microorganisms!**

Bacteria, fungi and other microorganisms are responsible for breaking down the ingredients of soil to turn it into the rich soil we have in our garden. Over 100 billion microorganisms live in one pound of soil! As for the mineral matter which does not decompose, natural forces like wind and water are responsible for breaking down rocks into tinier and tinier pieces. This whole process takes a LONG time! It can take over one hundred years to create one inch of rich topsoil! Healthy soil contains lots and lots of microorganisms.

Why do you think one area had healthy soil and another area had unhealthy soil? Are there things that we have done to make one area unhealthy or healthy?
What can we do to help make soil healthy in our garden, and in other areas of the schoolyard?

Extension: Comparing healthy and unhealthy soil

Explain that the healthier soil is, the more organic matter it contains and the more microorganisms live in it. We can determine how much organic matter is in our soil with a simple test:

Invite students to place their samples of unhealthy soil into one glass jar and their samples of healthy soil into a second jar (each jar should be half full).

Fill the rest of the jar up with water, tighten the lid and invite students to shake the jars for two minutes.

After resting for 4-5 hours, the soil in the jars will separate to reveal the contents of each sample: sand will sink to the bottom, silt will rest on top of the sand and clay will stay on top. Loamy soil has proportions of 40% sand; 40%silt and 20% clay. You can determine the proportions of your soil by measuring the layers in each sample.