

What 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?

Grade Levels

Grade 3-4

Curriculum Connections

Grade 3

Science and Technology: Understanding Earth and Space Systems

Overall Expectations

- Assess the impact of soils on society and the environment, and of society and the environment on soils
- Investigate the composition and characteristics of different soils
- 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
- **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
- **3.4** – 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

Mathematics: Number Sense and Numeration

Specific Expectations

- Divide whole objects and sets of objects into equal parts, and identify the parts using fractional names

Grade 4

Science and Technology: Understanding Life Systems

Specific Expectations

- **2.1** – Follow established safety procedures for working with soils and natural materials

Mathematics: Numbers and Numeration

Specific Expectations

- Compare and order fractions (i.e., halves, thirds, fourths, fifths, tenths) by considering the size and the number of fractional parts

- Demonstrate and explain the relationship between equivalent fractions, using concrete materials (e.g., fraction circles, fraction strips, pattern blocks) and drawings
- Represent fractions using concrete materials, words, and standard fractional notation

Materials:

- 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)

Activity

Part One: What is healthy soil?

Begin by introducing students to the garden and asking them why they think healthy soil is one the most important things in the school garden. What does it mean to say soil is healthy? 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 them to guess how much of our planet is covered in soil where we can plant food – “fertile soil”. 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 was this apple. How much of the Earth do you think is covered by water?

Answer: *Water covers $\frac{3}{4}$ of the Earth, this includes lakes, oceans, rivers, 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: $\frac{1}{4}$ -*This remaining quarter is land.*

Cut the remaining $\frac{1}{4}$ in half. And have students refold the paper and fold it again in half.

- One of these pieces ($\frac{1}{8}$ 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 $\frac{1}{8}$ apple piece into four. And have students fold their folded paper again four times. You will now have 4 pieces representing $\frac{1}{32}$ of the apple. The first represents areas that are too rocky to plant things, the second represents areas that are too wet to plant things. The third $\frac{1}{32}$ piece represents land that has been developed, that is, covered in houses, roads, parking lots, etc.

- What do we have left?

Answer: *$\frac{1}{32}$ 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 on their observation sheets. Students will record both living and non-living components that are found in the soil and that they observed on a t-chart.

Gather everyone together in a circle to discuss:

- 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....**Micro-organisms!**

Bacteria, fungi and other micro-organisms are responsible for breaking down the ingredients of soil to turn it into the rich soil we have in our garden. Over 100 billion micro-organisms 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?

Part 3: Putting the garden to bed

After this activity students can help put the garden to bed for the winter season:

- Remove any old vines and dead plants. In the fall, insect pests often lay their eggs on these old plants, so if the vines are left on the soil surface, insect eggs survive the winter and hatch in the garden in spring.
- Add a layer about an inch of compost on the surface of the garden and a thin layer of dry leaves or other mulch.