



SOIL IMPORTANCE | *3rd Grade through 5th Grade*

LESSON OUTCOMES

Students will identify the components of soil and understand how these components work together.

- Soil is a valuable resource that is made up of four main components
- Our Learning Garden has soil that we must care for
- Healthy soil is a balance of different ingredients (components)

STANDARDS ALIGNMENT

Next Generation Science Standards

- 3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some less well, and some cannot survive at all.
- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.
- 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

Common Core – English Language Arts

- SL.3.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
- SL.3.3. Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.
- SL.3.4. Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.
- SL.3.6. Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.
- SL.4.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly
- SL.4.3. Identify the reasons and evidence a speaker provides to support particular points.
- SL.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
- SL.5.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
- SL.5.3 Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.
- SL.5.4 Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.



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MATERIALS & PREPARATION

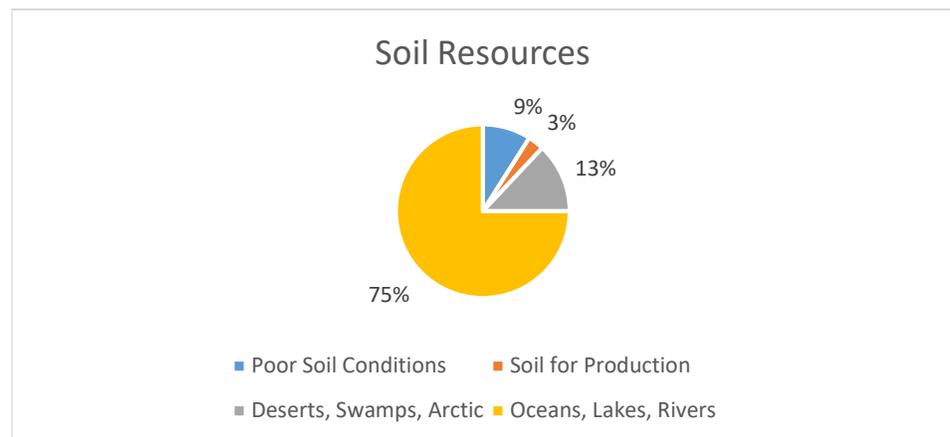
- 1 apple for the soil resources demonstration
- 1 knife for cutting apple
- Soil Components Card, cut out
- Review lesson and familiarize yourself with your Learning Garden
- Optional: supplies for additional Learning Garden activities

Soil Porosity Experiment:

- Soil Porosity - worksheet 1 per student group
- Cups or medium containers - 2 per student group
- Liquid measuring cup or beaker - 1 per student group or enough for easy sharing
- Soil sample from Learning Garden - 1 per student group
- Calculator - 1 per student group
- Pencil
- Clipboard or hard surface for writing, 1 per student group

TEACHER BACKGROUND

Soil is a resource that has incredible value to our daily lives. It provides us with things like food, clothes and building materials. Very few things that we use on a day to day basis don't link directly back to soil, including the meat that we eat and the gum that we chew! When you look at the earth there are a variety of resources; however, soil that is suitable for growing food only makes up 3% of the Earth while water (oceans, lakes, and rivers) make up 75% of the Earth.

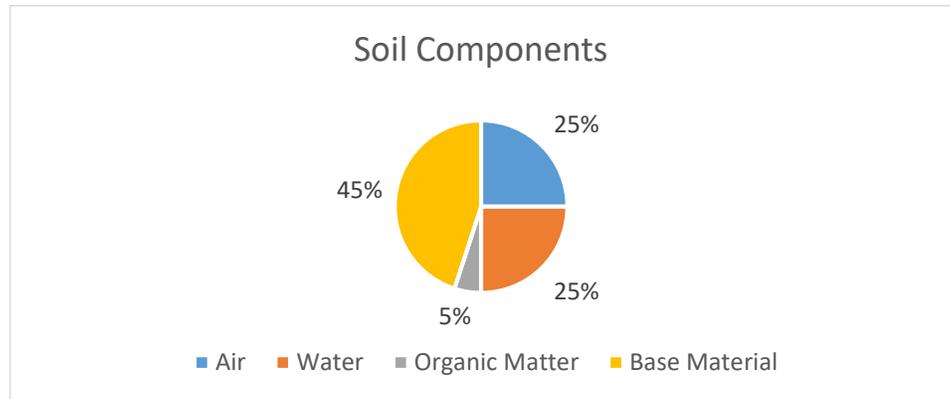


Soil is made up of four main components, which include: base material, organic matter, water, and air. Depending on the soil in your Learning Garden the base material, which makes up 45% of your soil, can be any of the following: mineral matter (small rocks and mineral particles), peat moss, and coconut coir. Organic matter, which makes up 5% of your soil, includes things like leaves, sticks, straw, worms, and other bugs. Water and air make up the remaining 50% of your soil, the ratio of air to water fluctuates based on the soil's moisture level.



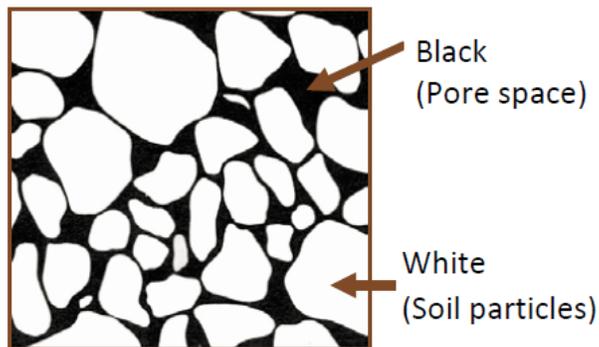
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TEACHER BACKGROUND CONTINUED



The porosity of soil is a measurement of how much of its volume is open space, or pore space, that is available for air and water. Porosity is expressed as a percentage of the material's total volume weight. When conducting a porosity experiment, water will be carefully poured into a container of soil. The water will be measured at the beginning and end of the experiment and the difference between the two represents the available pore space. The available pore space is then calculated as a percentage.

$$\text{Total Volume of Water} - \text{Volume of Water Remaining} = \text{Pore Space}$$
$$(\text{Pore Space} \div \text{Total Volume of Water}) \times 100 = \% \text{ Porosity}$$



INTRODUCTION

Spend time discussing the following introductory questions:

- Name three things that come from the soil that aren't food.
- How much of the earth is made up of soil that can be used for food production?
- What is soil made of?



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ACTIVITY

Classroom Lesson (20 minutes)

During the classroom portion of today's lesson students will be learning about how much soil we have available for food production and the four components of soil.

1. Show your students an apple and let them know that it represents the earth. Cut the apple in the 4 sections and discard 3 of the 4 sections (75%). Let your students know that 75% of the earth is made up of water, which includes oceans, lakes, and rivers. What remains (25%) represents dry land.
2. Cut the remaining piece into 2 sections and discard 1 section (13%). Let your students know that 13% of the earth's dry land is made up of deserts, mountains, wetlands, or ice (artic).
3. Cut the remaining piece into 4 sections and discard 3 of the 4 sections (9%). Let you students know that 9% of the earth's dry land is made up of soil that is too poor to grow in and it is too hot or too wet.
4. The remaining 3% of earth's dry land is made up of soil that is available for food production. This 3% of land must compete with urban development including housing, cities, schools, shopping centers, landfills, factories, and so on.
5. Discuss the implications of only having 3% of land that is suitable for growing crops with your students.
6. Transition your students, let them know that now we understand the importance of soil and we are going to learn about the four soil components.
7. Draw a simple pie cart on the board or on a large piece of paper. Divide up the pie chart based on the Soil Components graph.
8. Have four student volunteers come up and select a Soil Component Card, read the card, then place the card in the correct place on the pie chart based on the percentage information.
9. Review with students the four components of soil: base material, organic matter, water, and air.

Break here if doing two lessons.



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ACTIVITY CONTINUED

Garden Activity (20 minutes)

Welcome your students to the Learning Garden and line students up along one side of the Learning Garden. Stand on the opposite side of the Learning Garden so you can address the entire group.

Ask students if they know what they will be doing in the Learning Garden today. Let them know they will be participating in an experiment to see how much water different types of soil can hold.

1. Let your students know that today they will be working in groups to complete a soil experiment.
2. Introduce the supplies at each work station and ask for a student volunteer to read the introduction found on the Soil Porosity worksheet. Review any additional instructions about the activity.
3. Break students up into groups. Be sure to bring enough supplies for each group.
4. Give your students 15 minutes to complete the soil experiment.
5. Gather your students back together and review the important role that air and water play in plant survival, growth, and health.

NOTE: As the teacher, be aware of poisonous plants and other hazards in and around your Learning Garden and review those concerns with your student. Review any additional rules to the Learning Garden. Ask students about known bee/wasp stinging allergies before going into the Learning Garden.

CONCLUSION

Have students share key parts of the day's activity and review the Lesson Outcomes.

Students should clean-up the Learning Garden as needed.

Additional Learning Garden Activities

Extend your Learning Garden experience and have your students participate in any of the following Learning Garden activities as appropriate. Activities can include:

- planting
- watering
- weeding
- harvesting



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Soil Component Cards

Water – 25%

Water clings to the soil and is taken up by the plant roots. The amount of water in soil fluctuates with the amount of air in the soil.

Air – 25%

Air fills all the gaps in soil that aren't being used by water, parent material, and organic matter. The amount of air in soil fluctuates with the amount of water in the soil.

Base Material – 45%

Base material can be made of mineral matter, peat moss, and/or coconut coir. Base material makes up most of the soil and can vary greatly depending on your soil type.

Organic Matter – 5%

Organic matter is made up of things that are or were once living. This can include things like leaves, sticks, straw, worms, and other bugs.



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Soil Porosity Experiment

Determine how much air and water your Learning Garden soil holds

NAMES:

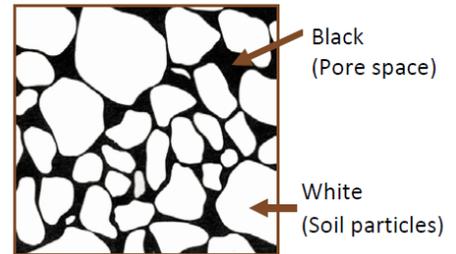
DATE:

INTRODUCTION

Soil is made up of different particles that have different sizes, these particles have space between them that is called pore space. The amount of space between particles, or pore space, determines the amount of water and air that soil can hold. In this activity you will be calculating how much pore space is available for air and water, then converting that number to a percentage, which will be the soil's porosity.

MATERIALS

1. 2 cups or medium containers
2. Liquid measuring cup or beaker
3. Soil sample from Learning Garden
4. Calculator
5. Pencil
6. Clipboard or hard surface for writing



Note: If your soil sample is entirely dry, it may not mix well with the water, and in some cases your soil may even float. Make sure your soil is slightly wet before you begin the experiment!

Our group predicts that the Learning Garden soil will hold (circle one):

HYPOTHESIS

All the water $\frac{3}{4}$ of the water $\frac{1}{2}$ of the water $\frac{1}{4}$ of the water None of the water

PROCEDURE

1. Collect the materials and bring them to your work area in the Learning Garden.
2. Measure 4 ounces or 120 mL of water into one cup or container.
3. Collect 4 ounces or 120 mL of soil from your Learning Garden into the other cup or container. (It is important that you have the same volume of soil and water!)
4. Carefully pour the water into the soil cup. Stop pouring when the water level reaches the top of the soil. Once this happens you know your soil has been fully saturated.
5. Measure how much water is left in the water cup.
6. Complete the following chart to calculate your soil's pore space and porosity.

How to Calculate Pore Space:

Total Volume of Water - Remaining Volume of Water

How to Calculate Porosity:

Pore Space \div Total Volume of Water x 100

7. Repeat the experiment two more times using a different soil sample



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Soil Porosity Experiment

Determine how much air and water your Learning Garden soil holds

NAMES:

DATE:

DATA TABLE

Trial Number	Description of Sample	Total Volume or Water	Remaining Volume of Water	Calculate Pore Space: see equation below	Calculate Porosity: see equation below

CONCLUSION

On average our Learning Garden soil held (circle one):

All the water $\frac{3}{4}$ of the water $\frac{1}{2}$ of the water $\frac{1}{4}$ of the water None of the water

GROUP QUESTION

Why is it important to have water and air in the soil of your Learning Garden?