what lies beneath
part 1: examination of soil profile

FRAMEWORKS

SCIENCE
- **NS 1.6.5** Communicate results and conclusions from scientific inquiry.
- **NS 1.7.5** Communicate results and conclusions from scientific inquiry.
- **ESS 8.8.13** Illustrate soil profiles.
- **ESS 8.8.14** Apply knowledge of soil profiles to local soil samples.
- **ESS 8.8.15** Investigate the formation of soil types.
- **ESS 8.8.17** Identify the basic nutrients needed by plants that are present in soil: nitrogen, phosphorus and potassium.
- **ESS 8.8.19** Investigate and analyze the composition of a variety of soils.

LANGUAGE ARTS
- **W 5.6.10** Write across the curriculum.
- **W 5.7.10** Write across the curriculum.
- **W 5.8.10** Write across the curriculum.

OBJECTIVES

The students will learn:

- **OBJECTIVE #1** To describe soil and how it is formed.
- **OBJECTIVE #2** To identify major soil horizons.
- **OBJECTIVE #3** To identify the properties of each major horizon.
- **OBJECTIVE #4** To analyze soil samples in terms of horizons.
- **OBJECTIVE #5** To appropriately use verbal speaking skills in class discussion with the teacher and Garden Program Specialist.
The composition of the soil is important for nurturing the growth of garden and agricultural crops.

**OVERVIEW**

The weathering of rock produces soil layers known as horizons, labeled O, A, B, C and E. They range from weathered bedrock to rich humus containing organic materials. The major horizons are A, the surface horizon; B, subsoil; and C, the parent material.

**GARDEN ACTIVITIES**

- Plant, harvest and work in the garden according to the Garden Guide
- Examine different horizons of soil, including major and sub-horizons
- Recipes and Taste tests as time permits (refer to Delta Garden Study Recipe Book)
**TIPS FOR THE CLASSROOM**

*Pre-lesson preparation:*
- ▲ Determine how the “A Soil Profile” visual will be used and prepare appropriately.

**LESSON OUTLINE**

<table>
<thead>
<tr>
<th>activities</th>
<th>estimated duration</th>
<th>actual duration</th>
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<tbody>
<tr>
<td><strong>in the classroom</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▲ Offer the icebreaker</td>
<td>5 minutes</td>
<td></td>
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<tr>
<td>▲ Explain and diagram the horizons of the soil, using the visual aid</td>
<td>10 minutes</td>
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<tr>
<td><strong>in the garden</strong></td>
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<tr>
<td>▲ Examine the dirt and garden area for examples of horizons</td>
<td>5 minutes</td>
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<tr>
<td>▲ Plant, harvest and work in the garden according to the Garden Guide</td>
<td>15 minutes</td>
<td></td>
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<tr>
<td>▲ Pick and taste produce as available</td>
<td>5 minutes</td>
<td></td>
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<tr>
<td><strong>back in the classroom</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▲ Hand out Student Learning Workbooks, review and assign “Take it Home Activity” as homework</td>
<td>5 minutes</td>
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**TIPS FOR THE GARDEN**

*Pre-lesson preparation:*
1. Prepare to examine and discuss soil components and horizons, as well as their relationship to the garden.
2. Prepare a brief garden work activity for students in the garden.

**classroom materials needed**
- ▲ Student Workbooks
- ▲ Keep the “A Soil Profile” visual handy during class

**garden materials needed**
- ▲ Garden tools
# LESSON PLAN

## I. Start in the classroom

### A. Icebreaker

Ask the students: “A soil horizon describes each of the distinctive layers that are in soil. Can you guess how many soil horizons there are?”

**Answer:** 40, and today we will learn about a few of them.

### B. Present Main Topic

- Using the visual, explain the major and sub-horizons of the soil.
- Explain and define the characteristics of each horizon.

## II. Take class to the garden

- Discuss the layers of the garden and school grounds for differences in the soil. Discuss in which horizon agricultural and garden crops typically grow and why.
- Plant, harvest and work in the garden according to the Garden Guide.
- Instruct students to pick and taste available vegetables. Explain that soil rich in nutrients yields better crops than a nutrient-poor environment.

## III. Take class back to classroom

- Hand out the Student Workbook as reference material and class assignment. Review take it home activities and encourage students to do them.
The weathering of soil results in layers known as **horizons**.

Garden and agricultural crops are typically grown in the A horizon, which contains organic matter called humus, sometimes identified as O horizon.

Soil scientists, also called pedologists, have identified the following soil horizons:

Three **major horizons**, A, B and C, which are present in most soils, and two **sub-horizons**, O and E.

At the top of the profile (or sometimes buried) is the **O horizon**. This is a thin layer that consists not of true mineral soil, but primarily **humus**, which is organic matter that has decomposed to the point that it is no longer recognizable. Typically dark-brown or black layer in color, humus helps provide carbon, hydrogen and oxygen to the soil and hold nutrients and moisture.

Underneath the O horizon is the **A horizon**, the top layer of true mineral soil. Not surprisingly, it is called **topsoil** or **surface soil**. It reaches a depth of a few feet at most, but can be as little as a couple of inches thick or be missing altogether. It consists of a mixture of organic matter, roots, worms, insects, fungi and bacteria as well as inorganic material such as small rocks and mineral fragments. The living organisms help decompose manure, plant residue and crop pests and “fix” certain nutrients from the air and make them available for plants to grow.

The color ranges from brown to gray. (Some textbooks don’t distinguish the O horizon per se, but consider it part of the A horizon.)

Water trickling down from the A horizon carries or leaches organic and inorganic substances to the lower horizons. This process is called **eluviation**.

The **subsoil**, or **B horizon**, follows next. It contains some roots and few other living organisms, materials leached from the A horizon, clay, bigger rock and minerals. It is reddish brown or tan in color. While lacking in organic material, it often serves as a **reservoir for moisture**. It takes hundreds or thousands of years to build subsoil.

Underneath the B horizon lies the **C horizon**, or **weathered parent rock**. It is made of materials leached from the B horizon and partly weathered rock fragments. It is orange/yellowish in color.

**Sources**

- United States Department of Agriculture, Natural Resources Conservation Service http://soils.usda.gov/education/resources/lessons/profile/
- Great Plant Escape – Four Major Components of Soil http://urbanext.illinois.edu/gpe/case2/c2facts1.html
- Soil Composition and Formation http://nerrs.noaa.gov/Doc/SiteProfile/ACEBasin/html/envicond/soil/sform/htm
a soil profile

horizons

humus O

2"

topsoil A

10"

sand and silt

subsoil B

30"

bedrock C

48"
Our last lesson explained the difference between top and subsoil. Now let’s take a closer look at the soil profile. The soil profile includes components of the soil and soil layers, called soil horizons. Soil contains four major components: water, minerals, organic matter and air. Water, minerals and organic matter provide nutrients for plants and animals living in the soil. The air in between soil particles allows water to flow down to plant roots, soil organisms, and all the way through the soil horizons into the aquifer.

Soil scientists, also called pedologists, have identified three major horizons, A, B and C, which are present in most soils, and at least two sub-horizons, O and E.

At the top of the ground (or sometimes buried) is the O horizon. It can be remembered because O stands for organic. This is a thin layer that consists not of true mineral soil, but primarily humus, which is organic matter that has decomposed to the point that it is no longer recognizable as a plant or animal.

Underneath the O horizon is the A horizon, the top layer of true mineral soil, also called topsoil. It is called topsoil or surface soil. It reaches a depth of a few feet at most, but can be as little as a couple of inches thick or be missing altogether. It has a mixture of organic matter, roots, worms, insects, fungi and bacteria as well as inorganic material such as small rocks and mineral fragments.

The bottom layer of the A horizon is referred to as the E horizon. This is made up mostly of sand and silt. It is lighter in color than the A horizon.

The subsoil, or B horizon, is next. It contains some roots and few other living organisms, materials leached from the A horizon, clay, bigger rock and minerals. It is reddish brown or tan in color.

Underneath the B horizon lies the C horizon, or bedrock. It is made of materials leached from the B horizon and partly broken-down rock fragments.
1. **List each soil horizon and its main components.**

2. **What are the 4 major components of soil?**
   1. __________________________
   2. __________________________
   3. __________________________
   4. __________________________

**Take it Home**

Soil is the result of millions of years of weathering, the breaking up and breaking down of bedrock.

Go for a walk today after school and think of how many other people may have walked the same path, compacting the soil and rocks.
1. List each soil horizon and its main components.
   - O – humus
   - E – sand and silt
   - B – some roots, minerals
   - C – bedrock

2. What are the 4 major components of soil?
   1. Minerals
   2. Organic matter
   3. Air
   4. Water
EARTH SYSTEMS
what lies beneath, part 1

ESS 8.8.13 Illustrate soil profiles.

1. Prepare a diagram of a typical soil profile and label the major horizons.

2. What are the 4 major components of soil?

Take it Home
Soil is the result of millions of years of weathering, the breaking up and breaking down of bedrock. Go for a walk today after school and think of how many other people may have walked the same path, compacting the soil and rocks.
1. Prepare a diagram of a typical soil profile and label the major horizons.
   Students will draw a diagram.

2. What are the 4 major components of soil?
   1. Minerals
   2. Organic matter
   3. Air
   4. Water
what lies beneath, part 1

**ESS 8.8.13** Illustrate soil profiles.

1. **Prepare a diagram of a typical soil profile and label the three major horizons.**

2. **What are the 4 major components of soil?**

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**Take it Home**

*Soil is the result of millions of years of weathering, the breaking up and breaking down of bedrock. Go for a walk today after school and think of how many other people may have walked the same path, compacting the soil and rocks.*
1. **Prepare a diagram of a typical soil profile and label the major horizons.**
   
   *Students will draw a diagram.*

2. **What are the 4 major components of soil?**
   
   1. Minerals
   2. Organic matter
   3. Air
   4. Water