Quick Glance

In this lesson, campers will:

Note: This will vary depending on the tasks you decide to do with campers.

- Identify the different kinds of plants that can grow in a garden. Especially fruit and vegetables
- Recognize how plants are structured, work and live
- Name what plants need to grow and live
- Explain how important soil is for growing healthy plants
- List the different types of soil and how they affect plants
- Practice their gardening skills

Tasks:

- Introduction to the gardening session
- Exploring the garden
- Discovering what plants need to grow and thrive
- Examining soil
- Hands-on gardening
Days 1 & 2: Go Gardening!

About:
Campers jump into gardening basics as they become familiar with the Frost Valley garden. There are a few tasks that can stand alone or be taught together to introduce campers to the elements of soil and plant parts.

Achievement-Based Objectives:
These describe what the camper will have learned and might apply during and beyond the gardening session. At the end of this lesson, campers will have:

- Identified what is in the Frost Valley garden
- Explored their connections to gardening
- Named the basic parts of plants
- Examined what soil is made up of and how it helps things grow
- Applied their gardening skills in the Frost Valley garden

Lesson Focus:
Introduction to Frost Valley garden; garden exploration and observation; garden guidelines; plant needs, parts, and lifecycle; soil exploration: types of soil, organic matter, nutrients; hands-on gardening

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Time</th>
<th>Main Topic</th>
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</thead>
<tbody>
<tr>
<td>4-6</td>
<td>60 minutes each day</td>
<td>Session introduction, garden visit, and plant and soil tasks</td>
</tr>
</tbody>
</table>

NOTES
- Gardening tasks can be divided between the two days.
- Most tasks can be done indoors should it rain.
### Materials and Prep:

Prepare the following materials before class. Handouts and items to duplicate and/or enlarge are in *Lesson Docs* at the end of the lesson.

<table>
<thead>
<tr>
<th>Task</th>
<th>Items</th>
<th>Preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overview</strong></td>
<td>✓ Doc 1: What campers will learn</td>
<td>Reproduce the camper-friendly objectives on chart paper. Find a place near</td>
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<tr>
<td></td>
<td>✓ Self-adhesive chart paper</td>
<td>the garden to post and also in an indoor classroom (the greenhouse, for</td>
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<td></td>
<td>✓ Markers</td>
<td>example) where rainy-day gardening tasks might take place.</td>
</tr>
<tr>
<td><strong>Garden Guidelines</strong></td>
<td>✓ Doc 2: Sample Garden Guidelines</td>
<td>Create these before the session.</td>
</tr>
<tr>
<td></td>
<td>✓ Self-adhesive chart paper</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Markers</td>
<td></td>
</tr>
<tr>
<td><strong>What’s in the Garden?</strong></td>
<td>✓ Doc 3: What’s in the Garden?</td>
<td>Distribute Doc 3 to the campers. If possible, before the session begins,</td>
</tr>
<tr>
<td></td>
<td>✓ Doc 4: What’s in the Garden? Hints</td>
<td>create and laminate several copies of a list of all of the plants that are</td>
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<td></td>
<td></td>
<td>in the garden. Distribute this to campers during the first day of the</td>
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<td></td>
<td></td>
<td>session so they can see what is growing. If desired, each camper can “adopt”</td>
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<tr>
<td></td>
<td></td>
<td>one or more plants to care for during the week.</td>
</tr>
<tr>
<td><strong>Gardening</strong></td>
<td>All items for general gardening tasks are</td>
<td>Review the overview carefully. Focus on materials required, as well as the</td>
</tr>
<tr>
<td></td>
<td>in the Frost Valley Gardening Session</td>
<td>planting schedules.</td>
</tr>
<tr>
<td></td>
<td>Overview</td>
<td></td>
</tr>
</tbody>
</table>
## Procedures

<table>
<thead>
<tr>
<th>Step</th>
<th>Task 1: Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Organize campers into a circle. Introduce the instructors.</td>
</tr>
<tr>
<td><strong>OPTION 1</strong></td>
<td>If campers don’t know each other, have them quickly share their names and the plant they feel best represents them. Keep this brief.</td>
</tr>
<tr>
<td><strong>OPTION 2</strong></td>
<td>Campers briefly share any type of gardening experience they have had (in this case, gardening is a broad concept, and can include, for example, a window box).</td>
</tr>
<tr>
<td><strong>OPTION 3</strong></td>
<td>Campers share visions of their fantasy or ideal garden. What would be in it? What would it look like? Would it serve a specific purpose (i.e., a vegetable garden that feeds everyone on the block)? And so on.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Give campers a few minutes to get a quick look of the Frost Valley garden.</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Reconvene campers into a circle. Ask campers what their expectations are for the camp session. Ask if anything in particular interested them as they explored the garden. Validate contributions; briefly describe what will happen during the week, and how they might learn more about the aspects of the garden that caught their attention.</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Tell the campers that they will spend as much time as possible in the garden learning, planting, harvesting, maintaining, and lots of fun gardening activities.</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Introduce garden guidelines. (See Doc. 2, Sample Guidelines.) Ask campers how they can remind each other of the guidelines during the week. Or, campers can create a set of guidelines.</td>
</tr>
<tr>
<td>Step</td>
<td>Task 2: What’s in the Garden?</td>
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<td>------</td>
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</tr>
<tr>
<td>6</td>
<td>Distribute <strong>Doc 3: What’s in the Garden?</strong> to small groups or pairs of campers. (If desired, campers can individually.) Tell them they will be exploring the garden and greenhouse to identify plants and other aspects of gardening, like how things get watered, how they grow, etc. <strong>Information:</strong> See <strong>Doc 4: What’s in the Garden?</strong> for various signs and other cues that can be used to help campers find items and answers. (Use the guide with younger campers to get them thinking about what to look for.)</td>
</tr>
<tr>
<td>7</td>
<td>Give campers some time to visit the garden and the greenhouse (instructors should accompany campers to the greenhouse). The group can be divided so a few teams/campers start in the greenhouse and the others in the garden. They switch locations after a set time.</td>
</tr>
<tr>
<td>8</td>
<td>Have campers sit in a circle to share some of their observations. <strong>OPTIONAL:</strong> Campers name the plant they will adopt for the week.</td>
</tr>
</tbody>
</table>
| 9    | Explore with students the vegetable and fruit growing in the garden. Discussion prompts can include:  
  ✓ Have you seen vegetables and fruit growing in a garden?  
  ✓ Have you had a vegetable/fruit garden?  
  ✓ What’s great about growing fruit/vegetables at home, in your yard, at school, etc.?  
Build on what campers say to briefly point to:  
  ✓ How much healthier fresh produce is, especially right from the garden  
  ✓ How much money is saved by growing “your own food”  
  ✓ How great it is to get local produce  
How great it is to be able to come right to the camp garden for fruit and veggies |
| 10   | Tell campers they will “dig into” plants to learn more about how they grow and what they need to thrive. |
### Task 3: Gardening Learning Tasks

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>There are five stand-alone learning tasks. Choose the one that best matches the group. Or that focuses on what is most relevant to the day’s gardening activities. Choose one task to work on over two days. Or choose one different task for each day. Each learning task has key concepts, materials, and a hands-on learning activity.</td>
</tr>
<tr>
<td>12</td>
<td>Share <em>Doc 1: What campers will learn</em>. Make sure this includes only those items that campers will be exploring during the session.</td>
</tr>
</tbody>
</table>

### Task 4: Gardening

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>The hands-on gardening aspect of the session is flexible. Read the garden overview for details to determine the best way to approach gardening for each session group. Campers should have several gardening opportunities. Note that if rain does not allow for outdoor gardening or learning tasks, the overview provides myriad indoor “rainy day” gardening tasks.</td>
</tr>
<tr>
<td>14</td>
<td>Make sure there are at least 10 minutes set aside for clean up after gardening: returning tools to storage, putting the hose away, putting items into the compost, etc.</td>
</tr>
</tbody>
</table>
Gardening Learning Tasks

The first two gardening days mesh a few basic gardening concepts with hands-on gardening. To facilitate the learning of these various concepts, choose a task to do over the two days or choose a different task to lead each day.

<table>
<thead>
<tr>
<th>Learning Task</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>I) Plant Basics</td>
<td>Introduction to plant needs and parts</td>
</tr>
<tr>
<td>II) Soil</td>
<td>Examining what soil is made of</td>
</tr>
<tr>
<td>III) Soil Searching</td>
<td>Determining the types of soil</td>
</tr>
<tr>
<td>IV) Is the Garden Soil Organic?</td>
<td>Exploring soil’s organic matter</td>
</tr>
</tbody>
</table>

Some important considerations:

1) The rationale for the focus on soil is that this builds on basic knowledge campers might have about gardening, but may not fully grasp the powerful role soil plays, especially how soil affects vegetable and fruit gardens. Also, soil is really fun to explore, especially for young people.
2) There is a learning task that addresses plant parts and their functions, as well as what plants need to grow and thrive. It’s basic, but it’s a good starting point for reinforcing what campers might already know.
3) The Key Concept section for each task provides basic information. You can build on the background to give campers more details that strengthen their understanding.
4) All tasks can be modified and adapted. Do build on your gardening knowledge to enhance tasks.
5) When campers are gardening, help them recall and incorporate any newly learned concepts.

Preparation:

- Read the task instructions carefully.
- Be sure to have a basic understanding of the key concepts. This is critical!
- Gather all of the materials before the session.
- Keep gardening gloves and/or latex-free rubber gloves (not great for the environment, but might be a necessity) available for campers who might not want to touch soil and other items.
- Some tasks involve tools (like a hammer) and chemicals (like hydrogen peroxide). Make sure campers safely and properly use these materials, and that age is a consideration (younger campers should probably not use them).
- Keep water and paper towels handy for campers to rinse their hands, wash tools, etc.
LEARNING TASK I: PLANT BASICS

A. What Plants Need

Key Concepts

Plants are living things. Here is what they need to live:

**Sunlight**: They need to be planted where they can get the amount of sunlight they need. Light is used as energy for making food (photosynthesis). Too little light makes plants weak...and they will also have fewer flowers and fruit.

**About photosynthesis**: Photosynthesis is the process by which plants make food. Chlorophyll in the chloroplast of plants is the green pigment that plants need to covert carbon dioxide and water, using sunlight, into oxygen and glucose. During photosynthesis, chlorophyll captures the sun’s rays and creates sugary carbohydrates of energy, which allow the plant to grow.

**Water**: Plants get water through their roots. If they have too much or too little water, they will not grow well. Most plants use water to carry moisture and nutrients back and forth between the roots and leaves. Water and nutrients are usually taken up through the plant roots. Too much or too little water can be bad for plants.

**Air**: Soil needs to be loose and have air pockets in it for the plants. If the soil is too wet or too tightly packed, there is not enough air in the soil.

**Nutrients**: Plants need certain foods called nutrients to grow and be healthy just like you do. These nutrients come mainly from decaying organic (plant and animal) materials in the soil. Too few or too many nutrients can be bad for plants. Healthy soil provides the nutrients a plant needs to grow and thrive.

**Time and Space**: Plants need a certain amount of space to grow. Each plant has a certain planting space to give the roots and leaves room to grow. Without enough room, plants become stunted or too small. Overcrowded plants are also more likely to suffer diseases since airflow may be limited. Plants need time to grow, and they all grow at different times and speeds.
Steps

1. Probe with campers what they believe plants need to grow. **Ask:** Are those elements in the Frost Valley garden? Build on what campers say. For example, if they say plants need sun, ask why and then fill in the gaps.

2. Ask campers what happens to plants that don’t have the basic elements. For details on photosynthesis, see the diagram below.

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**Photosynthesis**

When you get hungry, you might decide to raid the cookie jar or ask your mom to make you a sandwich. You do this because humans and animals get energy from the foods they eat.

1. **SUNLIGHT**
   - Light shining down from the sun is absorbed by the plant’s cells. These tiny cells are what make up the plant and its leaves.

2. **CHLOROPHYLL**
   - Inside some of these cells is a special ingredient called chlorophyll. This is the compound that traps the sun’s light to start the process of photosynthesis.

3. **WATER**
   - Water and carbon dioxide are two of the main ingredients needed for photosynthesis. These two substances are made of many smaller parts called molecules.

   - **Water molecules**
     - Oxygen atom
     - Hydrogen atoms

   - **Carbon dioxide molecules**
     - Carbon atom
     - Oxygen atoms

4. **END RESULT**
   - The oxygen which is left from the transformation is released back into the air.
   - The sugar created by photosynthesis is sent to the rest of the plant for food.

**INGREDIENTS**

- Light energy
- Rays from the sun
- Water
- Gathered by plant’s roots in the soil
- Carbon dioxide
- Present in cells of green plants

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A fun way to explore plant needs with younger children: Share hints about each element and have campers guess what that element is. For example: “I am very hot and you can’t touch me. I give plants the energy they need to make food. What am I?” (Sun)
B. Plants parts

Key Concepts

Roots: These provide plants with three main functions: They anchor the plant, provide support, and absorb nutrients and water. Some roots also store sugar and starch, which provide food for the plant. Did you know that some are edible? Examples of edible roots include beets, carrots, parsnip, rutabagas, sweet potatoes, and turnips.

Stems: These contain tube-like structures that carry nutrients and water from the plant’s roots to its leaves. Stems can be either above ground or below ground. Above ground stems provide support for the plant and allow the leaves to reach the sunlight they need to grow. Above ground stems will actually allow the plant to bend toward the light. Below ground stems typically provide food storage for the plant. Some, but not all, stems are edible. Examples of edible stems include: asparagus, celery, garlic, ginger, and white potatoes.

Leaves: These make food for the plant by absorbing sunlight through the process of photosynthesis. Leaves vary in shape, allowing for easy classification of plants. Did you know that some leaves are edible? Examples of edible leaves include cabbage, collards, kale, lettuce, parsley, and spinach.

Flowers: These contain the reproductive parts of the plant where new seeds are formed. Did you know that some flowers are edible? Examples of edible flowers include broccoli, chive blossoms, garlic blossoms, nasturtiums, squash blossoms, and violets. Then there is the fruit, which actually is the part of the plant that surrounds and protects seeds, and also helps in their transportation. Lots of fruit are edible like cucumbers (you thought that was a veggie!), grapes, peaches, pears, peppers (yep, a fruit!), pumpkins, and tomatoes (note, not a vegetable). There are also types of fruit that you can’t eat, so you need to find out whether they are edible before you pop one into your mouth.

Source: http://www.co.brown.wi.us/i_brown/d/uw_extension/plant_parts_6-22-2010.pdf
Materials

- Straws for stems
- String or similar item to make plant roots
- Green paper for leaves or to make pre-cut leaves
- Paper to make flowers or pre-cut flowers

This is a great hands-on activity for younger campers. For older campers, the instructor can do a Q&A about the parts, as small groups examine different plants to identify the parts, and to taste the parts that are edible.

Steps

1. Have campers spend a few minutes making a plant with the various items. Ask them to share the different parts and explain what they do. Build on what the campers say to add details using the Key Concepts.

2. OPTIONAL: If campers have adopted plants, have them note what part of the plant is edible and where the seed comes from.

3. If possible, have a few different garden plants and/or seedlings for campers to examine parts identification. You can also refer to the photosynthesis diagram to point out plant parts and their function.

4. Point out that there are plant parts that we eat. Probe with campers what those might be. Have them generate a list. Match to what is below (not comprehensive but lists items campers are likely to know) and name others that campers did not note. (Where possible, provide examples, focusing on what is growing in the garden.)

<table>
<thead>
<tr>
<th>Buds</th>
<th>Brussels sprouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulbs</td>
<td>garlic, green onions (Scallions), leeks, shallots, onions</td>
</tr>
<tr>
<td>Immature flower</td>
<td>broccoli, cauliflower</td>
</tr>
<tr>
<td>Leaves &amp; leaf stalks</td>
<td>cabbage, chicory collards, endive, kale, lettuce, parsley, spinach</td>
</tr>
<tr>
<td>Roots and taproots</td>
<td>beets, carrots, parsley, parsnips, radishes, turnips</td>
</tr>
<tr>
<td>Seeds or seed pods</td>
<td>corn, dill, lentils, peanuts, peas, soybeans, and bush, green, lima, string and sugar beans</td>
</tr>
<tr>
<td>Stems, spears or tubers</td>
<td>Asparagus (in the form of a spear), Cardoon, Celeriac, Celery, Chinese cabbage, Jerusalem &amp; Chinese Artichoke, Kohlrabi, Rhubarb, Seakale, Swiss and Ruby chard, and Potatoes (in the form of a tuber)</td>
</tr>
<tr>
<td>Vegetable fruits</td>
<td>Cucumbers, Eggplant, Peppers, all Melons, Pumpkins, Pickles, Zucchini, Summer/Winter Squash, and Tomatoes.</td>
</tr>
</tbody>
</table>
LEARNING TASK II: SOIL

A. Making Soil

Key Concepts

Soil is the material that constitutes the outermost layer covering practically all of the Earth's land surface.

Soil is made up of 25% air, 25% water, 45% rock particles, and 5% organic material.

Soil is formed by:

- The slow process of weathering (the breaking down of rock)
- Erosion (the moving and deposition of weathered rock material)
- The combining of rock particles with air, water and organic material

It can take from 100 to 600 years or more for nature to make one inch of topsoil.

Often one inch of topsoil is removed from land by erosion in one year.

Soil can be "manufactured" by people imitating the forces of nature.

When people use composted organic materials in their gardens, they are helping soil to develop.
Materials

- Magnifying glasses
- Denim (or other strong fabric) soil-making bag
- Campers can gather the following or have these items ready for use at the learning station: dead leaves, flower petals, small twigs, other small plant material pebbles and sand (make sure there are more pebbles and sand than organic matter because soils contain more rock parts than organic materials), and water
- Hammer or mortar and pestle
- Safety goggles (if campers will be grinding the materials)
- Gardening or other types of gloves if campers do not want to get their hands “dirty” (avoid latex gloves because of allergies)

**OPTIONAL:** If campers are going to plant in their home-made soil:

- Fast-growing seeds or seedlings
- Small cups or milk cartons (make sure there is some drainage)
- Markers

Steps

1. Ask: What is soil? Allow campers to generate a variety of responses.
   (**NOTE:** One distinction to make: In the gardening world, the preferred term is soil, not dirt. This is a fun way to explain it: “Dirt is what you find under your fingernails. Soil is what you find under your feet.”
   
   **Source:** [http://school.discoveryeducation.com/schooladventures/soil/down_dirty.html](http://school.discoveryeducation.com/schooladventures/soil/down_dirty.html)

2. Provide half-cup samples of the four types of common soils: silt, clay, sand, and loam.

3. Give campers time to look closely at the different types of soil: What do they see? What are the soils made of? How are they different? How is soil made? Build on what campers say to provide some background on how soil is made.

4. Ask them why is it helpful to know how soil is made when it comes to gardening. Note that certain soils have the right combination of elements that help plants grow. The right mix has:

   - Water, which is necessary for carrying nutrients into the roots and up the stem, and for the plants to grow.
   - Air is necessary to allow the roots to "breathe," and there are air spaces in the soil so that water can enter it
   - Organic matter, plant and animal parts, which help hold the water in the soil and provide nutrients
   - Rocks and minerals that provide nutrients to the plants and structural support to the roots
5. Explain to the students that they are going to make soil by replicating natural processes. (Have campers gather the materials noted above if these are not already at the learning station.)

6. Place all materials in a small bag made of denim or other heavy material (or use mortar and pestle to grind materials). Pound mixture with a hammer until the rocks are pulverized. (Determine whether your group can use hammers and/or mortar and pestle safely. If the campers do the work, teach them how to use the hammer and make sure they wear safety goggles.)

**OPTIONAL:** Campers can plant 10 seeds in their soil and 10 more seeds in a pot containing natural soil. Then observe and compare the growth. This will take a week or more, which means that later on, they will have to “visit” their plants even though they are not in the gardening. If there is another communal space like the greenhouse where campers can put their container to water and monitor over time, have them write their names on their cups/pots and store them for informal observation. Or, they can bring the planter to their cabins or home. Instruct campers to note when the seeds begin coming up; measure the seedlings as they grow; and determine in which soil the plants seem to be growing better.

*Adapted from:* A Recipe for Soil [http://www.uen.org/Lessonplan/preview?LPid=2508](http://www.uen.org/Lessonplan/preview?LPid=2508)
LEARNING TASK III: SOIL SEARCHING

Key Concepts

- Most soils are formed from sediments that have been moved by erosion—blown by winds, or moved by water or glaciers.
- Different types of sediment make different types of soil. Most common soils are a mixture of sand, silt and clay.
- Which do you think is best for gardening, especially for growing vegetables and fruit?

Sand: This type of soil is comprised of large, gritty particles; it feels like sugar. It’s too coarse for planting. Soils with lots of sand have big spaces between the particles. They don't hold water or nutrients. Sand doesn't react with other chemicals. Sandy soils don't stick together very well. Plant roots can't hold onto this soil. But the big spaces do allow air into the soil. There are some plants that are able to grow in sandy topsoil by putting their roots deep, through the sand to the subsoil.

Silt: This type of soil is made up of smaller, smooth particles. It feels like flour. It’s too light, and not great for gardening. This material is finer than sand, but still feels gritty. Silt is commonly found in floodplains and is the soil component that makes mud. Soils with a lot of silt make excellent farmland, but erode easily. This is soil blown away in dust storms and that floods carry downstream.

Clay: This type of soil is made up of tiny particles. It is sticky when wet, and forms hard clumps or clods when it dries. (It feels like modeling clay). Lots of clay makes the soil heavy and dense. The spaces between the soil particles are very tiny. When clay soil is dry, it's almost as hard as concrete. Plant roots can't push through it. No air can get in from the surface. Most bacteria and other soil organisms that need oxygen can't breathe.

Loam: This is the perfect type of soil for gardening. It has a good mix of organisms, sand, silt, and clay for fruit and vegetable gardening. This soil has enough large and small spaces for air and water to flow in. Plant roots can easily grow through these spaces.
Materials

- Soil samples representing four types of soils: sand, silt, clay, and loam (provide these ahead of time, or have campers dig for soil sample on the grounds, pulling soil from the garden first, which should essentially be the final type of soil, loam. You will have to scout out areas where each of these soil types is found.)
- Water
- Magnifying glass
- Four strainers (one per soil type)
- Cups or jars on which to place the strainers
- Paper towel
- Soil Searching Observation Guide (below)

If campers dig soil:

- Small shovels, spades or spoons
- Cups for collecting soil

Preparation

- Place the different soil types in accessible locations at the learning station.
- Create small signs per soil type.

Steps

1. Briefly probe with campers what they think is in soil and why soil is good for plants.

2. Ask whether all soil is the same and what type of soil they think is best for gardening. Validate the differences they note, if any.

3. Ask how they can determine soil types and figure out whether the soil in the Frost Valley garden is good for the plants growing in it.

4. If soil samples have not been selected and prepared, direct campers to find the different soil types (mark areas in and around the garden).

5. Post the Soil Type Observation Guide or post the instructions on a large sheet of chart paper for campers to follow. Or, conduct each exercise with the group, facilitating tasks, discussion, and findings. Note: One task involves pouring water into the soil types using a strainer. Please assist campers in this task.)
6. Review findings with campers. Refer to Key Concepts to further camper understanding of soil types. Ask what soil they think is the best for gardening. Tell them that the soil in the planter represents the type of soil that most garden plants prefer. Point out that different types of plants can grow in different types of soil. Examples:

**Sandy soil**
Nasturtium (great for color and also edible, plant and leaves!)
Certain grasses
Root vegetables, like carrots, parsnips, and beets
Some herbs

**Clay**
Brassicas (cabbages and broccoli)
Legumes (as companion plants that provide nitrogen
Some trees and shrubs

**Silt**
Some trees and shrubs
Can grow vegetables as long as mixed with compost for balanced water retention and drainage

7. **OPTIONAL**: Campers plant seedlings in each type of soil and observe how they fare during the week. Or, they can bring the seedling set home or back to their cabins to observe.


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**Soil Shake**

This is another great way for campers to see the different types of soil. And it’s fun to do, especially for younger campers. *(NOTE: For younger campers, start off with the Soil Water Dance as described below).*

- Tell the group that water moves through each of the different types of soil (sand, silt, clay, loam) differently.
- Ask campers to stand.
- Divide half the group as “soil” and half as “water.”
- First, tell the soil group that it is sand particles (the biggest type of sediment). Have the campers them stand very far apart, just like sand particles.
- Have the water group move around the “sand.” Ask: Was it easy or difficult to move around the sand particles?
- Tell the campers that next, they’ll represent clay particles (much smaller).
• Have the campers stand very close together. The campers representing water then try to move through the “clay” particles. Ask: How is this different? Review that water moves quickly through sand and that it moves very slowly through clay. (At a farm or in the garden water often puddles on top of clay-based soil for many days).
• Repeat a similar process with silt and loam.

Materials:

✓ Glass jars for different types of soil
✓ Digging tools (small shovels, spoons, etc.)

Steps

1. Tell campers they will find out what types of sediment are in the garden.
2. Guide students in collecting several samples of soil from different locations in the garden, keeping the samples separate.
3. Put each sample in a glass jar, filling the jar about half way with soil. Add water until the jar is almost full.
4. Tightly put on the lid and shake the soil until any clumps are broken down. Leave the jar to settle for several hours (up to 24!).
5. When students return to the jars, they will see three distinct layers.
6. Guide students in observing that the different soil particle types – silt, sand, and clay – have settled out into separate layers.
7. Ask: What types of soil is each soil type composed of? Does one have more sand or more clay?

Adapted from: Growing Minds. Garden Lessons: Soil Exploration
SOIL TYPES OBSERVATION GUIDE

INSTRUCTIONS: Reproduce the questions/task on chart paper. Or pose each question aloud so campers can do each exercise at the same time.

1. What color is the soil?

Most soils are shades of black, brown, red, gray, and white. Generally, the darker a soil is, the more nutrient rich it is. The darker color often indicates an increase in decomposed organic matter known as humus. Gray soils often indicate poor drainage, while red soils can indicate very poor soils.

2. Break each soil sample. Rub each sample, one at a time, between your thumb and forefinger. Describe how each soil type feels. Is it gritty, sandy, smooth, etc.? Are there clumps in the soil? Add water to each soil sample until it sticks together and you can make a ball. What happens when you do this? What does this tell you about the type of soil you have?

Different types of sediment make different types of soil. Most common soils are a mixture of these sand, silt and clay. But which is best for gardening, especially vegetables and fruit?

Sand: Large, gritty particles (Feels like sugar). It’s too coarse for planting. Soils with lots of sand have big spaces between the particles. They don't hold water or nutrients. Sand doesn't react with other chemicals. Sandy soils don't stick together very well. Plant roots can't hold onto this soil. But the big spaces do allow air into the soil. There are some plants that are able to grow in sandy topsoil by putting their roots deep, through the sand to the subsoil.

Silt: Smaller, smooth particles. Feels like flour; too light. Not great for gardening. This material is finer than sand, but still feels gritty. Silt is commonly found in floodplains and is the soil component that makes mud. Soils with a lot of silt make excellent farmland, but erode easily. This is the soil blown away in dust storms and carried down stream in floods.

Clay: Tiny particles, sticky when wet, forms hard clumps or clods when it dries. Feels like modeling clay. Lots of clay makes the soil heavy and dense. The spaces between soil particles are very tiny. When clay soil is dry, it’s almost as hard as concrete. Plant roots can't push through it. No air can get in from the surface. Most bacteria and other soil organisms that need oxygen can't breathe.

Loam: The perfect soil for plants and soil organisms has about the same amount of sand and silt, plus a smaller amount of clay. This soil has enough large and small spaces for air and water to flow in. It also has enough clay to let it stick together and hold humus, or the organic component of soil. These clumps make another size of space. Plant roots can easily grow through these spaces.
3. Look at each soil sample under a magnifying glass. Which soil sample has the largest particles? What kinds of things do you see in the soil? Are there rocks, twigs, worms, etc.? What do these things do for the soil? Are they good?

Address organic elements of soil. These provide important nutrients. Soil with greater amounts of organic organisms, dead and living, is better for gardening.

Soil is comprised of different elements. Rock is the parent material of soil. Rock is the source of the inorganic (non-living) materials found in soils. The rock is broken down into sediments (small pieces of rock and minerals) through the process of weathering. These sediments are a component of soil.

Most soils are formed from sediments that have been moved by erosion, blown by winds, or moved by water or glaciers. (Fast moving water leaves behind gravel and sand. Slow moving water and lakes leave behind fine textured clay and silt when sediments in the water settle.)

4. Is there space in the soil for air? How do you know?

About half of the total mass of soil is made up of vast, interconnecting cavities, or holes. These holes are filled with both air and water. The amount of air and the amount of water filling these spaces varies dramatically throughout the year and from location to location, but averages about 50% each. The air found in soil is very different from the air found in the atmosphere. The air in soils is not exposed to moving air currents and is much more moist or humid than atmospheric air. It also tends to be very rich in carbon dioxide and poor in oxygen.

5. Pour water over each type of soil. How does each type of soil absorb water? Which seems to absorb water the best? How would plants do in each type of soil based on how water is absorbed? (NOTE: Conduct this study with the soil types, strainer, and a clear cup or jar. Some water may take a long time to go through the soil. You can set aside those samples for campers to review later. But, their slowness can still be discussed in the context of water absorption levels. In this activity, too, they can determine the amount of air each soil type has. Bubbles will rise to the top indicating air. Campers can count the bubbles and compare the size of the bubbles to determine which soil sample has the most air.)
The type of particle in the soil determines how much room there is for water absorption. The speed with which water passes through soil is related to the size and chemical characteristics of the soil particles and how tightly they are packed. In general, the smaller the soil particles are, the more energy the water will expend getting through the pores, resulting in slower passage.

Soil type is very important in not only how fast water is absorbed into soil, but also in water retention (how much is held in the soil as opposed to how fast it drains out). Some soils take up water very slowly, such as clay soils, and also hold it well (they do not drain well). Some soils absorb water well, such as peat and sandy soils. Peat holds the water well (but doesn't drain very fast because of the high organic content), whereas sandy soils do not hold water well, allowing it to drain out fairly quickly.

6. Does the soil have water and air? Campers use paper towel to see how much water is in the soil. They can squeeze the sample onto the paper towel or place the samples on the paper towel. Which sample has the greatest amount of water?

An ideal soil is composed of 45% mineral content (sand, silt, and clay), 5% organic material (humus or plant debris and soil organisms), 25% water, and 25% air.
LEARNING TASK IV: IS THE GARDEN SOIL ORGANIC?

Key Concepts

Why is organic material so important in soil?

The organic material is what provides the majority of the nutrients that plants need.

Dead and decaying plant and animal material provide fertilizer to the soil.

Without organic matter, the soil would not be fertile and plants would not grow well in it. This would be like you trying to live and grow without food.

Organic materials provide food for plants.

Organic soil is great for planting because it is fertile, holds more water and has a better structure.

Organic soil is also alive with all sorts of organisms working to make the soil more nutrient rich.

In this experiment, learners examine the garden soil to determine whether there is organic matter. A chemical reaction between soil carbon and hydrogen peroxide makes this possible.

Soil is mixed with hydrogen peroxide (H2O2). The carbon from the organic matter in the soil bonds with the oxygen (O2) in the peroxide to form carbon dioxide (CO2) bubbles and water. The carbon dioxide (a gas) occurs as bubbles that the learners can observe.

Vigorous, long lasting bubbling indicates a large amount of organic matter. Since the carbon is bonding with the oxygen, scientists say that the organic material has been "oxidized". You will notice that once the bubbling process is complete, the soil has changed color.

Materials

- Soil from the garden
- Hydrogen peroxide
- Cups for soil
- Tablespoon
- Coffee stirrers
- Timer
- Latex-free rubber gloves (if campers are going to use the Hydrogen peroxide)
- Safety goggles or glasses (if campers are going to use the Hydrogen peroxide or even be close to the instructor who is using the chemical)

Steps

1. Campers add three to four tablespoons of Hydrogen peroxide to the soil in the cups until the soil is completely covered. This should produce bubbles.

2. Using a watch with a second hand, learners will record the length of time the bubbling occurs.

3. If there is not enough time to record how long the soil bubbles, learners can stir their soil and watch their cups for five minutes and then report the amount of bubbling.

4. Record the length (or amount) of bubbling. Ask the groups to report their findings. Is there organic matter in the soil? A lot? What can be added to the soil to give it more organic matter?
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Doc 1: What campers will learn

Reproduce the following on a sheet of self-adhesive chart paper. Only list those items that campers will actually be doing (you may not do all of the tasks). Post so campers can see the list. Modify accordingly.

You, the campers, will learn:

✓ About the different kinds of plants that can grow in a garden, especially fruits and vegetables

✓ How plants are structured, work and live

✓ What plants need to grow and live

✓ About how important soil is for growing healthy plants

✓ About different types of soil and how they affect plants

✓ How to garden or to build your gardening skills
Doc 2: Sample Garden Guidelines

- Follow all gardening instructions
- Ask before you pick anything.
- If you pick something with permission, also ask whether you can eat it.
- Don’t do any work in the garden without permission.
- Walk on the paths and not on the beds. If you have to harvest or plant, make sure not to damage any plants.
- Place sharp edges or points of tools face down.
- Keep tools off the paths.
- Clean gardening tools before putting them away.
- Wash your hands after gardening.
- Wash fruit or vegetables before eating.
Doc 3: What’s in the Garden?

Reproducible version below.
What’s in the Garden?

In the garden

1. What kind of a garden is growing?

2. What do you see in the garden? (Look closely to find all sorts of things.)

3. What’s planted in the garden?

4. What is your favorite plant?

5. Take a few minutes to explore your favorite plant. What does it smell like? How does it feel? What does it look like? What part of the plant do you think you can eat?

6. What is in and around that garden that help it grow?
In the greenhouse

1. What is in the greenhouse?

2. Why are these plants in the greenhouse?

3. Describe the greenhouse. Include what you see, describe whether it’s hot or cold inside, and talk about anything else you see or feel.
Doc 4: What’s in the Garden? Hints

For younger camps, small signs can be placed in and around the garden with “hints” that can guide their garden hunt.

In the garden:

1. **What kind of a garden is growing?** Signs can include the names of vegetables and fruit that are growing; words that point to “how good” they are (e.g., yummy, delicious, etc.).

2. **What do you see in the garden? (Look closely to find all sorts of things.)** Signs or cues can include soil, water source, many types of vegetables, flowers, fruit, beds, etc.

3. **What kind of plants are in the garden? Before you look at their names, see if you can guess.** The names of the plants should be covered up so campers first try to identify them.

4. **What is your favorite plant?**

5. **Take a few minutes to explore your favorite plant. What does it smell like? How does it feel? What does it look like? What part of the plant do you think you can eat?**

6. **What is in and around the garden that helps it grow?**
   Place images of the sun, air, water, and soil around the garden. Or, perhaps short statements like: “I am very hot but plants love my light” for the sun. “When I fall, it’s hard to play outside, but the plants drink me up” for rain/water. And so on.

In the greenhouse:

7. **What is in the greenhouse?**
   This can be most anything the campers see, but focus them in on the plants.

8. **Why are these plants in the greenhouse?**
   For younger campers, maybe some clues like signs with statements, such as: “Because I am so young, I need a safe place to stay until I am bigger,” and so on.

9. **Describe the greenhouse. Include what you see, describe whether it’s hot or cold inside, and talk about anything else you see or feel.”**