Clean

Enjoying the pleasures of healthy and delicious food

For Grades K-5

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2 School environment includes soil, water, weather and animals

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Nothing could be simpler than planting a seed in the ground and watching it grow. And yet to create a thriving, sustainable garden you need much more. Ten thousand years of accumulated human knowledge, skill, breeding, cultivating, harvesting and cooking informs every grain and seed we plant. Agricultural wisdom passed on from one generation to another through song, stories, dance and mentoring has given us the food we eat today.

Tourists invade the Roman Coliseum by the hundreds of thousands but who visits Oaxaca to celebrate the birthplace of corn? Who will travel to the Middle East to build a monument to the first wheat farmers? And yet these agricultural achievements have had an enormous impact on human life, allowing us to settle down and grow our own food.

Every garden we cultivate is an homage and extension to the work of those early farmers. When we teach young people how to garden, we are introducing them to an ancient society that has shaped our bodies and our culture. And, when we teach them to garden sustainably with care towards both plants and animals, we are ensuring the future.

A garden involves plants, but in order for those plants to thrive, they need a sustaining environment. The garden environment includes water, temperature, living soil, animals and (of course) humans. Slow Food's promotion of Good, Clean and Fair food for all includes promoting agriculture that is sustainable over time. Sustainable food production will ensure the ecological well being of our natural systems and the health of our diverse human communities. In order to cultivate thriving gardens that can exist well into the future, learners must understand the complex relationship between the environment, plants and humans.

Changing climate and other environmental conditions call for resiliency in gardening. By understanding the interdependency of the plants, animals, soil and climate, learners can adjust their methods to encourage a healthy garden and planet. The Clean section of the Slow Food USA's School Garden Curriculum provides tangible learning experiences that demonstrate the garden environment and life cycles of plants and animals.

Imagine that you are entering a garden for the first time. You may be overwhelmed by the variety of shapes, colors and smells. Often you cannot tell the difference between different types of plants, or even if...
they are healthy or diseased. Many of the most important signs in the garden are small, such as aphids sucking on the kale or Japanese beetles chomping lacy holes in the bean leaves. Try to answer your questions by researching garden websites or reading garden books. You become overwhelmed with information.

Do the tomatoes have fusarium wilt or blossom end rot? What are the small holes in all of your cabbage plants? Does it matter that you planted the zucchini two weeks late? Often garden experts contradict each other. In order to foster new generations of gardeners, the chaos must be minimized and learners must be introduced slowly into the garden.

In the Slow Food USA’s Good School Garden curriculum, we provide lessons that support education about healthy food choices—incorporating knowledge of how the quality of food is affected by its freshness, cultural factors, preparation, cooking, and consumption. We introduce concepts of taste, ingredients and cooking techniques in order to present complex concepts that are self-directed and enjoyable. In the same way, the complex interaction between humans, plants and animals in the garden must be managed in a way that increases participation and enthusiasm.

The first section of the Clean curriculum, “Basic Garden Skills and Knowledge” includes lessons that guide learners towards noticing plants’ special needs, as well as the interactions of other garden life. The second section, “A Slow Food Garden” presents one model of a school garden with planting guides, recipes and activities that explore specific edibles in the school garden. Both sections assume that learners will have a garden journal to record their observations and findings. In addition, there are specific worksheets at the end of each section that are necessary for the activities.
Tips for Lesson Planning

All activities have a simple guide at the top of the page to help with lesson planning. The information includes:

- Estimated length of the activity, not including preparation time or transition time.
- Grade level(s) most appropriate from K-5
- Location of the activity (indoors or outdoors)
- Activity type
- Suggested optimal season for the activity

Use the following key as a guide to the Info bar.

**KEY**

<table>
<thead>
<tr>
<th>TIME REQUIRED</th>
<th>LOCATION</th>
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<tbody>
<tr>
<td>15 minutes</td>
<td>indoors</td>
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<td>30 minutes</td>
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<tr>
<td>45 minutes</td>
<td>outdoors</td>
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<th>GRADE LEVEL</th>
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<table>
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<tr>
<th>ACTIVITY TYPE</th>
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<tbody>
<tr>
<td>Gardening</td>
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<tr>
<td>Sensory Exploration</td>
</tr>
<tr>
<td>Basic Cooking</td>
</tr>
<tr>
<td>Intermediate Cooking</td>
</tr>
<tr>
<td>Food Preparation</td>
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</tbody>
</table>

- **Gardening** refers to an activity that has a gardening purpose.
- **Sensory Exploration** refers to a food activity whose purpose is to experience the sensory qualities of a food. It does not require assembly or heat, but may require some cutting or preparation.
- **Basic Cooking** refers to a food activity that is simple to prepare, and requires heat.
- **Intermediate Cooking** refers to a food activity that requires more complex preparation, heat, and is appropriate for ages 10 and up.
- **Food Preparation** refers to a food activity that requires assembly, cutting and some simple equipment but no heat.

<table>
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<th>SEASON</th>
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<td>Spring</td>
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<td>Summer</td>
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<td>Fall</td>
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<td>Winter</td>
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CHAPTER 1: Basic Garden Skills & Knowledge
Introduction

The first part of the Slow Food USA’s Clean School Garden Curriculum includes lessons that guide learners towards noticing plants’ special needs, as well as the interactions of other garden life. Instead of reading and memorizing the various insects that dine on plants, learners are encouraged to observe life cycles in the garden and make their own conclusions. Usually planting times are determined by complex charts and calculations produced by experts like County Extension Offices or seed catalogs, which can lead to confusion for novice gardeners. Using phenology (the scientific study of cyclical events), learners will observe the natural world in order to determine the planting times of different crops. Over a few seasons, they will begin to notice which plants prefer the sun to the shade, which plants like more water and which plants do best in specific climates. The organization of a school garden will determine what kinds of lessons learners will discover while planting, cultivating, harvesting, cooking and eating. While a garden that is deliberately planted is not as chaotic as a wild landscape, it can still be overwhelming to a novice gardener. Both adults and parents unfamiliar with the natural world often cannot differentiate between different plants, animals and diseases.

When using the activities in this section, learners will be developing powers of observation and judgment so that they will be able to identify problems and create solutions in the garden. The process of becoming a gardener relies on one’s ability to identify similarities and differences, classify them and then act on the information. Some examples that will be developed throughout this section are:

- Identifying desired plants versus weeds in the garden
- Identifying healthy plants versus diseased plants
- Being able to distinguish friendly insects versus damaging insects
- Knowing plant families and their characteristics
- Identifying plants that like sun versus plants that prefer shade
- Identifying plants that like fertile versus unfertilized soils
- Recognizing edible parts of plants versus inedible parts
- Being able to distinguish harvest times for different parts of edible plants

Building a toolkit of gardening techniques through observation and experience will lead learners to an appreciation of the natural world beginning the journey to becoming a lifelong gardener.
GARDEN JOURNALS AND WORKSHEETS

Learners will record their experiences and conclusions about the garden in their garden journals and the worksheets provided. Teachers and parents can use garden journals in many ways in order to improve learning outcomes and evaluate their school garden programs.

**Garden journals provide:**

- A way to evaluate an individual learner's understanding of a concept or lesson. Each portion of a drawing may be worth points in a rubric so that the learner can receive a grade for a project.
- The means for a learner to remember what they have learned in the garden.
- Information that the learner can share with their parents or family, in order to bring gardening and cooking information home.
- Vocabulary, concepts and questions that lead to further investigation and study.
- An indication to the teacher or parent about what is important to the learner.

When a learner is using their garden journal to draw what they observe and to make notes, there are a few necessary guidelines. First of all, instructors must remember that the purpose of the drawing is to convey information and questions developed by the learner. Do not reward the most “beautiful” drawing by pointing it out or using it as an example. For example, if the learner is drawing a leaf, it is more important that they have the basic shape, descriptions of the leaf and questions about why it looks the way it does. It is not as important for them to have a beautifully colored leaf. If learners do not have the physical skill yet to accurately draw what they are seeing, they can write notes next to their drawing to remind them of what they are trying to say.

For more information about field journaling along with activities that can be easily adapted to a school garden, see John Muir Law's Nature Journaling curriculum at http://www.cnps.org/cnps/education/curriculum/index.php. Law also includes some tips about drawing plants more accurately, which are available on his YouTube channel.

Examples of field guides written and designed by young learners can be found at the Open World Field Guides website: http://fieldguides.cnps.org. Design your own field guide to the insects and/or plants in your school garden and add it to the site.
School Environment
includes soil, water,
weather and animals
Garden Scavenger Hunts

**Objective**
Introduce learners to the plants and animals living in the garden and engage them in becoming more acute observers of their environment.

**Description**
Take your class on a garden discovery any season through a fun scavenger hunt. Divide the class into groups of 3-4 learners. Have each group complete one section of the hunt, minimizing the number of items that you are collecting from the garden. Each section is designed to explore a different part of the garden, and the plants and animals that live there.

**Materials**

<table>
<thead>
<tr>
<th>For each group of learners:</th>
<th>For each learner:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copy of Scavenger Hunt (page TK) on a clipboard</td>
<td>Garden Journal</td>
</tr>
<tr>
<td>Pencil</td>
<td>Pencil</td>
</tr>
</tbody>
</table>

**Preparation**
Before going outside, describe the garden rules to the learners. Explain that the garden is another kind of classroom. Engage them in a discussion about what rules would be best to promote respect of the living plants and animals in the garden as well as each other.

Clearly explain where they can walk and where they cannot.

Ask for help from parents and volunteers so that ideally there is one adult with each group of learners.

**Activity**
1. Each group will be looking for one section of the Scavenger Hunt. They will have 15 minutes to complete the search.
2. After the learners discover an item on the list, have them check it off and then draw it in their journals so that they can share what they have found with the class.
3. After they find all of the items on their list, they will draw or write down the similarities and differences between the items they have found.
4. Gather the class together again and have each group present their findings to the entire class, along with their observations of similarities and differences.

**Discussion**
Use the items found in the scavenger hunt to investigate topics of seed dispersal, plant botany and life cycles. For more information about these topics, use the resources below:
*How Plants Work: The Science Behind the Amazing Things Plants Do* by Linda Chalker-Scott
*How Seeds Get Around* from Michigan State University [http://kbsgk12project.kbs.msu.edu/blog/2012/03/20/how-seeds-get-around-inquiry-learning-about-seed-dispersal/](http://kbsgk12project.kbs.msu.edu/blog/2012/03/20/how-seeds-get-around-inquiry-learning-about-seed-dispersal/)
*Botany for Gardeners* by Brian Capon

Write down any new vocabulary words and have the learners add them to their journals.
Where Are We?

Objective

Learners will be able to describe where the garden is located and how its location impacts the length of the growing season, soils, light and other resources plants need to grow.

Background

Gardens are intimately tied to the landscape in which they are located. Learners often know little about the environment of their schoolyard beyond casual observations. First the class will print out a map of their immediate neighborhood and schoolyard from Google Maps, satellite view. Then, the class will discuss the location of the school, and the local conditions of different areas in the schoolyard. After understanding the big picture, the class will go outside and make maps of various features in the schoolyard. This activity will help them explore and understand some of the relationships between their school, garden and environment.

Materials

For each group of learners:
- Graph paper
- Pencil
- Clipboard

For the class:
- Computer with Internet access, projector or SmartBoard
- A globe or world map
- Map of your state
- Map of your city
- A printed map of the schoolyard

Preparation

If using a computer and projector, or SmartBoard with Internet connection is available, load and test the function of a Google Map or Google Earth application.

If a computer is not available, make and print a satellite map of your schoolyard by going to http://www.maps.google.com, zooming in on your address as much as possible. Print a copy to fill a page or multiple pages that can be taped together. This process may take some trial and error.

Divide the students into groups of 5-8. Assign a volunteer or teacher to each group.

Give each group leader a clipboard, graph paper and pencil.

Activity

1. Begin the lesson in the classroom by pointing out your city’s location on a Google Map, Google Earth Application, globe or world map. Ask students to describe how this location impacts the seasons, frosts and the length of the growing season.

2. Next, zooming into or changing to a state-level map, have the students locate your city, and as a group, describe how the location and elevation impacts what can grow there. For example if you lived in Denver, Colorado it would include the semi-arid climate, elevation’s role on frosts and seasonal temperatures, as well as how the city’s position east of the mountains gives us many sunny days.

3. Finally, zoom into the school, or change to a local map, and use it to explain the position of the garden in the schoolyard and assign groups to specific locations for the outdoor exploration.
4. Have each group explore one quadrant of the school grounds and make a sketch or map of what they find. The sketch should include permanent structures like fences, play structures, garden beds, trees and shrubs, as well as the location of wet, shaded or sunny areas.

5. Meet by the garden and discuss the findings.

6. Repeat the investigation in the garden area, focused on what plants are growing there, areas with different soils or features, as well as sunny and shaded locations. If the garden is divided into plots, wrap up by exploring the characteristics of their garden plot.

**Discussion**

In the garden or classroom, begin a discussion exploring how the position of the garden impacts what will grow well there.

**The discussion should include:**

- How your city’s position on the globe impacts the seasons, planting and harvesting dates (frosts), as well as the characteristic sunny weather caused by the mountains and the rain-shadow effect.

- How the school’s position in the city impacts microclimates, exposure to wind, local temperatures and humidity.

- How the garden’s position in the schoolyard impacts the amount of sun the garden gets, when the sunlight is available (all day, the morning, or afternoon when it is likely to be hot), exposure to wind and rain, and convenience.

**Further Exploration**

There are many opportunities that can be incorporated into this lesson including the introduction of the relationships between position, climate and world biomes; reinforcing basic map skills, using USDA Frost and Plant Hardiness Zone maps to explore local and regional differences, or the map of your state’s agricultural products to explore relationships between the environment and what plants will thrive in an area.

Most states have an agricultural map that is available for young learners. These maps show which crops grow in various climates throughout the state. Here are a few examples.

- **Colorado:** [https://www.colorado.gov/pacific/sites/default/files/Colorado%20Agriculture%20Map%20for%20Kids_1.pdf](https://www.colorado.gov/pacific/sites/default/files/Colorado%20Agriculture%20Map%20for%20Kids_1.pdf)

- **Florida:** [http://www.freshfromflorida.com/content/download/16789/269882/P-01331.pdf](http://www.freshfromflorida.com/content/download/16789/269882/P-01331.pdf)

- **Oregon:** [http://aitc.oregonstate.edu/store/slide/data1/images/map_front.jpg](http://aitc.oregonstate.edu/store/slide/data1/images/map_front.jpg)

Extension activities could also focus on measuring and observing seasonal changes, the availability and local sources for the water used in the garden, as well as a discussion of the garden’s position and ways to improve the environment for plants to thrive.
What’s In My Dirt?

**Objective**
Learners will be able to explain the attributes of different types of soil.

**Background**
Gardeners must know what kind of soil they have in order to know how to make nutrients available for plant growth. Soil consists of minerals (broken down rock), water, organic matter (dead plant matter), gas (air) and microorganisms. The mineral content can be in the form of large pieces such as sand and pebbles, or very small pieces such as clay or silt. The size of the particles effect what kinds of plants will thrive in your soil, how much water is needed and how many nutrients are available. Typically clay soil needs more organic matter in order to add air pockets for plant roots and drainage. Sandy soil also needs additional organic matter in order to retain moisture and nutrients, as they drain more quickly and dissipate. An ideal soil is composed of a mixture of mineral sizes, as well as organic matter, gas and moisture. These conditions encourage a living soil that supports a diversity of microorganisms.

In this activity, learners will become familiar with easily observable mineral and organic soil components.

**Materials**
Collect 4 soil samples (about 5 cups of each soil) from diverse areas such as:
- Soil from a well-established (school, home or community) garden
- Soil from a parking lot or other unimproved area (heavy clay)
- Some compost, if available from your garden or bagged compost
- Soil from your school garden

For each table:
- 4 Mason jars with lids
- 4 plates
- 1 cup of each soil
- Soil Observation Sheet for each learner
- Pencils

**Preparation**
Before the class, take 1 cup from each type of soil and put it in a mason jar. Fill the jar with water and shake it vigorously. Place all of the jars in the classroom at least 2 days before the soil class to let them settle. You will use them at the end of class to demonstrate the different layers of soil.

Divide the soil samples so that there is one sample of each type on the table. Number each sample and make a note of its source for use during the discussion.

Divide the class into 4 groups, with one volunteer per group.
Activity

1. Talk about soil composition using the *What's in My Dirt?* handout on the next page.

2. Each group should have 4 samples on their table, each numbered.

3. Each group should have a Soil Observation Sheet to record their observations. They should note: the color, texture, smell, how sticky, etc.

Discuss the attributes of each sample. Then, tell the learners where each sample came from. Ask the following questions:

- Which sample has the most ideal attributes for growing food?
- What does the school garden soil look like?
- What are some ideas to improve the school garden soil?

Use the Soil Layer diagram on page 23 to observe the jars. Which ones have the most clay? Which have the most humus or organic matter? Which would be best for a vegetable garden?

Discussion

- Read and discuss the book *Soil: Let's Look at a Garden* by Angela Royston or *Soil (Geology Rocks)* by Rebecca Faulkner.

- Have the learners bring in samples from their homes and discuss their qualities.

- Plants need three major nutrients to grow well: nitrogen, phosphorus and potassium. Often native soils will have an abundance of one or two nutrients, but be low in another. You can also use a quick home test to get an overall idea of your garden’s soil fertility. Try the Rapitest Soil Test Kit, available online or in garden stores.

- Take a sample of soil and send it to a soil lab for lead and nutrient testing. There are many different ways to test for the health of your soil. For more information about soil testing, and recommendations for labs, please refer to:
What’s in My Dirt?

**Clay**
*Sticky, heavy or chunky. You can roll it into balls.*
Clay soil does not absorb water easily. But, when it is wet, it stays wet. Sometimes plants cannot get enough air and water in clay soils. Clay soils usually have plenty of nutrients, or minerals, plants need to grow.

**Silt**
*Soft and silky. Very fine particles, but does not stick together.*
Silt does not absorb water well. The particles are very small and plants sometimes cannot get enough air. Water drains away very fast.

**Sand**
*Grainy. Does not stick together.*
Large particles have plenty of air and absorb water easily. Water drains away very fast and sandy soil dries out quickly. Soil nutrients can also be washed away quickly.

**Humus**
*Crunchy, earthy smelling and woody.*
Decomposed living material made up of leaves, plants, roots, etc. Humus also has living small animals and bacteria. Humus is necessary for healthy soil. It helps break up clay soil and holds nutrients for sandy soil. It is brown and crumbly. It is a little slippery and sticky between your fingers.
## Water Test

### Objective
Learners will be able to discern how well their soil retains moisture and develop a strategy for watering that is appropriate to their school garden location.

### Background
Plants need water in order to thrive, but watering needs vary according to the weather, soil type, and the individual plant. Most vegetables prefer soil that is moist and crumbly. If the soil is too dry, then the plant does not have enough water to thrive. However, if the soil is too wet, it becomes compacted and waterlogged. Most plants do not thrive in waterlogged soil because there is not enough oxygen for the roots to respire. In order to design a watering plan that uses the minimum water necessary for the school garden, learners must first understand how long the soil stays moist and what factors affect water retention.

### Materials
- Empty garden plot
- 6 1-liter water bottles
- 6-8 Trowels
- Stop watch
- Garden Journal
- Pencil
- 5 gallon bucket of mulch or straw
- 2-3 cups gravel
- 6 cups garden or bagged compost

### Preparation
Prepare the plot if necessary by removing weeds and loosening soil enough so that learners can dig holes with their trowels.

Before going outside, describe the garden rules to the learners. Explain that the garden is another kind of classroom. Engage them in a discussion about what rules would be best to promote respect of the living plants and animals in the garden as well as each other.

### Activity
1. Divide the class into 6 groups and have them dig 6 holes that are the same size, about 8” in diameter and 4” deep.

2. Prepare the holes in the following way:
   - 1. Nothing is added
   - 2. Nothing is added
   - 3. Add 2” gravel as mulch
   - 4. Add 2” of straw or bark as mulch
   - 5. Add 3 cups of compost
   - 6. Add 3 cups of compost and 2” of straw or bark as mulch

3. Pour 1 liter of water into the first hole. Use a stopwatch to determine how long it takes for the water to drain out of the hole. Record the result on the Water Test Sheet.

4. Add 1/4 liter of water to the second hole. Use a stopwatch to determine how long it takes for the water to drain out of the hole. Record the result on the Water Test Sheet.
5. For the next four holes, pour 1 liter of water into each hole and time how long it takes for each hole to drain. Record the results in the same manner.

6. Visit the holes once a day for the next week to see how long it takes for each hole to become dry. Use a butter knife or small spoon to dig 1” into the soil. Record the data on the Water Test Chart. For each day, record whether each hole is Dry, Moist, Wet, or Muddy.

**Discussion**

While the class is looking at the results of the water test, ask the following questions:

- Are there any holes that stayed muddy for longer than a day? If so, the garden may have drainage issues and it would be better to build high areas (furrows) and plant on the top of them.

- Which holes stayed moist the longest?

- How long did the hole with only 1/4 liter of water stay moist? This hole simulates what happens if you only sprinkle a plot and do not soak it when you water. How can you water more deeply?

- Which combination of mulch and compost will give you the most time between waterings? Which combination of mulch and compost will give you the least time between waterings?
Planning Our Garden

Objective

Learners will be able to gather information from several sources to create a garden planning chart for their school garden.

Background

Gardeners use various techniques to help them plan a vegetable garden. Understanding the timing for sowing, planting and harvesting of many different vegetable varieties can sometimes be overwhelming. Previous gardeners’ expertise is often collected in many different materials from seed packets, to zone charts and garden guides. This lesson will teach you how to see the over all plan of your garden in order to ensure a more successful season.

Materials

- Pencils
- Seed packets or seed catalogs, 4 per table
- Slow Food Plant Cultivation Chart, one per table
- Blank Slow Food Garden Planning Chart, one per table
- Sample Garden Planning Chart, one per table
- Year long calendar
- Graph Paper, 2-3 sheets per table

Preparation

Divide the class into groups of 8 learners

Make sure each table has the materials

Create a large version of the Garden Planning Chart on a whiteboard for the entire class.

Activity

1. Find out which USDA agricultural zone you live in by entering your zip code at this website: http://planthardiness.ars.usda.gov/PHZMWeb/. You can also print out a map of your state’s zones. Write the zone at the top of the Garden Planning Chart.

2. Find out what your average last frost date is by entering your zip code on this website: http://www.almanac.com/content/frost-chart-united-states. Write the date in the appropriate blank at the top of the Garden Planning Chart. You will use this date when you calculate what time to start your seeds indoors or plant them outdoors.

3. Have each group use the seed packets to fill in the following blanks on the form:
   - Plant name (use the full name including variety), Seed Depth,
   - Seed Spacing, Days to Sprout, and Days to Maturity.

4. Use the Plant Cultivation Chart to look up whether or not the plant variety needs a heating mat to start the seeds, and type of plant hardiness.
5. If the seeds can be started inside, calculate the date that learners should plant the seeds in the classroom by subtracting the number of weeks in the Start Inside column from the last frost date. Write the date in the Start Inside column.

6. Using the hardness information for each seed, fill in the Plant Outside Date.
   - For hardy plants, subtract between 2 and 4 weeks before the last frost date.
   - For Tender plants, add one week after frost date.
   - For Very Tender plants, add 2 weeks after the last frost date.

7. Add the Days to Maturity to the Planting Outside date to get the Estimated Harvest date. This will be the earliest that the crop might be ready to harvest.

8. Use the Sample Garden Planning Chart to help learners fill out the form.

9. Enter all of the information provided by each group into the master form at the front of the classroom.

**Discussion**
Once the form has been filled out, you will understand the overall picture of your garden better.

**Answer the following questions using the form:**
- Do we have any plants that will be ready to harvest before the end of school?
- Which plants do we need to plant inside?
- Which plants or seeds can we plant outside early?
- Which ones must be planted after the last frost date?
- Which seeds can be planted directly into the ground?
- When is the best time to have a community planting day?
- Do we have plants that are ready to harvest in the middle of the summer? Who will harvest and eat these plants?
- How can we adjust the schedule to create more plants that are ready to be harvested when school is in session?

**Further Exploration**
Learners can explore the uses of spreadsheets by entering the data into a spreadsheet program such as Microsoft Excel. Afterwards, they can create a more powerful chart by sorting according to planting date or other columns.

Create a visual graph of the chart by using graph paper following the sample provided.

Print out and explore the zone map of the entire United States at http://planthardiness.ars.usda.gov/PHZMWeb/Images/All_states_halfzones_poster_300dpi.jpg. What would happen to your planting dates if you lived in a different zone?
What is Plant Hardiness?

Plant hardiness describes how much cold a plant can take and thrive. Some plants enjoy cold, even freezing weather, while others cannot tolerate even a light frost. Common annual fruits and vegetables fall under four types of plant hardiness.

Hardy and Semi-Hardy vegetables are also known as cold season vegetables. Tender and Very tender vegetables are also known as warm season vegetables.

**Hardy**
Hardy vegetables grow with daytime temperatures as low as 40°F and can survive light frosts. They are often planted for a second crop mid summer. Examples include arugula, peas, lettuce, spinach, radish, broccoli, cabbage, and kohlrabi.

**Semi-Hardy**
Semi-Hardy vegetables grow with daytime temperatures of 40°F-50°F but are less tolerant of frosty nights. Examples include beets, carrots, cauliflower, parsley, woody herbs, artichokes, potatoes, and Swiss Chard.

**Tender**
Tender vegetables prefer daytime temperatures above 55°F and are not tolerant of frost. Examples include corn, beans, summer squash, cucumbers and New Zealand spinach.

**Very Tender**
Very tender vegetables must have evenings above 55°F to thrive and are not tolerant of frost. Examples include basil, tomatoes, peppers, eggplant, melons, winter squash and watermelon.
# Plant Cultivation Chart

<table>
<thead>
<tr>
<th>Name</th>
<th>Family</th>
<th>Edible Plant Part</th>
<th>Start Inside*</th>
<th>Hardiness†</th>
<th>Warming Mat?</th>
<th>Days until Harvest</th>
<th>Plant in Succession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artichoke</td>
<td>Sunflower</td>
<td>Flowers</td>
<td>8-10</td>
<td>SH</td>
<td>No</td>
<td>110-150</td>
<td>No</td>
</tr>
<tr>
<td>Arugula</td>
<td>Cabbage</td>
<td>Leaves</td>
<td>No</td>
<td>H</td>
<td>No</td>
<td>40-55</td>
<td>Yes</td>
</tr>
<tr>
<td>Asparagus</td>
<td>Lily</td>
<td>Stems</td>
<td>No</td>
<td>H</td>
<td>No</td>
<td>2nd yr</td>
<td>No</td>
</tr>
<tr>
<td>Beans, Dried</td>
<td>Legumes</td>
<td>Seeds</td>
<td>No</td>
<td>T</td>
<td>No</td>
<td>85-100</td>
<td>No</td>
</tr>
<tr>
<td>Beans, Green</td>
<td>Legumes</td>
<td>Fruit</td>
<td>No</td>
<td>T</td>
<td>No</td>
<td>50-70</td>
<td>Every 4 weeks</td>
</tr>
<tr>
<td>Beet</td>
<td>Beets</td>
<td>Roots</td>
<td>No</td>
<td>SH</td>
<td>No</td>
<td>50-70</td>
<td>Yes</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Cabbage</td>
<td>Flowers</td>
<td>6-8</td>
<td>H</td>
<td>No</td>
<td>50-65</td>
<td>85-100 days before 1st frost</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Cabbage</td>
<td>Leaves</td>
<td>6-8</td>
<td>H</td>
<td>No</td>
<td>60-90</td>
<td>85-100 days before 1st frost</td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>Cucumber</td>
<td>Fruit</td>
<td>2-4</td>
<td>VT</td>
<td>No</td>
<td>75-100</td>
<td>No</td>
</tr>
<tr>
<td>Cardoon</td>
<td>Sunflower</td>
<td>Leaves</td>
<td>8-12</td>
<td>H</td>
<td>No</td>
<td>110-150</td>
<td>No</td>
</tr>
<tr>
<td>Carrot</td>
<td>Parsley</td>
<td>Roots</td>
<td>No</td>
<td>SH</td>
<td>No</td>
<td>60-80</td>
<td>Every 3 weeks</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Cabbage</td>
<td>Flowers</td>
<td>6-8</td>
<td>SH</td>
<td>No</td>
<td>55-80</td>
<td>85-100 days before 1st frost</td>
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<tr>
<td>Celery</td>
<td>Parsley</td>
<td>Leaves</td>
<td>6-10</td>
<td>H</td>
<td>No</td>
<td>100</td>
<td>No</td>
</tr>
<tr>
<td>Corn</td>
<td>Grasses</td>
<td>Seeds</td>
<td>No</td>
<td>T</td>
<td>No</td>
<td>65-100</td>
<td>No</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Cucumber</td>
<td>Fruit</td>
<td>No</td>
<td>T</td>
<td>No</td>
<td>55-65</td>
<td>No</td>
</tr>
<tr>
<td>Eggplant</td>
<td>Nightshade</td>
<td>Fruit</td>
<td>8-12</td>
<td>VT</td>
<td>Yes</td>
<td>75-90</td>
<td>No</td>
</tr>
<tr>
<td>Fava bean</td>
<td>Legumes</td>
<td>Seeds</td>
<td>No</td>
<td>H</td>
<td>No</td>
<td>85-100</td>
<td>85-100 days before 1st frost</td>
</tr>
<tr>
<td>Fennel</td>
<td>Parsley</td>
<td>Leaves</td>
<td>6-8</td>
<td>H</td>
<td>No</td>
<td>90-115</td>
<td>No</td>
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<tr>
<td>Garlic</td>
<td>Lily</td>
<td>Roots</td>
<td>No</td>
<td>H</td>
<td>No</td>
<td>90-150</td>
<td>No</td>
</tr>
<tr>
<td>Kale</td>
<td>Cabbage</td>
<td>Leaves</td>
<td>6-8</td>
<td>H</td>
<td>No</td>
<td>50-85</td>
<td>60-80 days before 1st frost</td>
</tr>
<tr>
<td>Kohlrabi</td>
<td>Cabbage</td>
<td>Stem</td>
<td>6-8</td>
<td>H</td>
<td>No</td>
<td>55-70</td>
<td>85-100 days before 1st frost</td>
</tr>
<tr>
<td>Leek</td>
<td>Lily</td>
<td>Roots</td>
<td>6-10</td>
<td>H</td>
<td>No</td>
<td>100-120</td>
<td>No</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Sunflower</td>
<td>Leaves</td>
<td>No</td>
<td>H</td>
<td>No</td>
<td>45-60</td>
<td>60 days before last frost</td>
</tr>
<tr>
<td>Onion</td>
<td>Lily</td>
<td>Roots</td>
<td>6-8</td>
<td>H</td>
<td>No</td>
<td>100-120</td>
<td>No</td>
</tr>
<tr>
<td>Parsnip</td>
<td>Parsley</td>
<td>Roots</td>
<td>No</td>
<td>SH</td>
<td>No</td>
<td>110-130</td>
<td>No</td>
</tr>
<tr>
<td>Peanut</td>
<td>Legumes</td>
<td>Seeds</td>
<td>4-6</td>
<td>VT</td>
<td>Yes</td>
<td>120-150</td>
<td>No</td>
</tr>
<tr>
<td>Pea</td>
<td>Legumes</td>
<td>Seeds</td>
<td>No</td>
<td>H</td>
<td>No</td>
<td>55-85</td>
<td>60-80 days before 1st frost</td>
</tr>
<tr>
<td>Pepper</td>
<td>Nightshade</td>
<td>Fruit</td>
<td>8-12</td>
<td>VT</td>
<td>Yes</td>
<td>60-90</td>
<td>No</td>
</tr>
<tr>
<td>Potato</td>
<td>Nightshade</td>
<td>Tuber</td>
<td>No</td>
<td>SH</td>
<td>No</td>
<td>90-120</td>
<td>No</td>
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<td>Radish</td>
<td>Cabbage</td>
<td>Roots</td>
<td>No</td>
<td>H</td>
<td>No</td>
<td>22-70</td>
<td>Yes</td>
</tr>
<tr>
<td>Rhubarb</td>
<td>Buckwheat</td>
<td>Leaves</td>
<td>No</td>
<td>H</td>
<td>No</td>
<td>2nd yr</td>
<td>No</td>
</tr>
<tr>
<td>Rutabaga</td>
<td>Cabbage</td>
<td>Roots</td>
<td>No</td>
<td>SH</td>
<td>No</td>
<td>80-100</td>
<td>No</td>
</tr>
<tr>
<td>Shallot</td>
<td>Lily</td>
<td>Roots</td>
<td>6-8</td>
<td>H</td>
<td>No</td>
<td>60-75</td>
<td>No</td>
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<td>Spinach</td>
<td>Beets</td>
<td>Leaves</td>
<td>6-8</td>
<td>H</td>
<td>No</td>
<td>45-60</td>
<td>Yes</td>
</tr>
<tr>
<td>Squash, Winter</td>
<td>Cucumber</td>
<td>Fruit</td>
<td>No</td>
<td>T</td>
<td>No</td>
<td>85-120</td>
<td>No</td>
</tr>
<tr>
<td>Squash, Summer</td>
<td>Cucumber</td>
<td>Fruit</td>
<td>2-4</td>
<td>T</td>
<td>No</td>
<td>50-60</td>
<td>No</td>
</tr>
<tr>
<td>Strawberry</td>
<td>Rosacea</td>
<td>Fruit</td>
<td>No</td>
<td>H</td>
<td>No</td>
<td>2nd yr</td>
<td>No</td>
</tr>
<tr>
<td>Sweet Potato</td>
<td>Morning Glory</td>
<td>Tuber</td>
<td>No</td>
<td>VT</td>
<td>No</td>
<td>100-125</td>
<td>No</td>
</tr>
<tr>
<td>Swiss Chard</td>
<td>Beets</td>
<td>Leaves</td>
<td>6-8</td>
<td>SH</td>
<td>No</td>
<td>40-80</td>
<td>Yes</td>
</tr>
<tr>
<td>Tomatillo</td>
<td>Nightshade</td>
<td>Fruit</td>
<td>8-10</td>
<td>VT</td>
<td>Yes</td>
<td>85-90</td>
<td>No</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Nightshade</td>
<td>Fruit</td>
<td>8-12</td>
<td>VT</td>
<td>Yes</td>
<td>65-90</td>
<td>No</td>
</tr>
<tr>
<td>Turnip</td>
<td>Cabbage</td>
<td>Roots</td>
<td>No</td>
<td>SH</td>
<td>No</td>
<td>45-70</td>
<td>No</td>
</tr>
<tr>
<td>Watermelon</td>
<td>Cucumber</td>
<td>Fruit</td>
<td>2-4</td>
<td>VT</td>
<td>No</td>
<td>70-100</td>
<td>No</td>
</tr>
</tbody>
</table>

* Numbers indicate number of weeks before last frost date
† Key: H=Hardy (2-4 weeks before last frost), SH=Semi Hardy (0-2 weeks before last frost), T=Tender (after last frost), VT=Very Tender (2 weeks after last frost)
### Garden Planning Chart

What zone is your garden in? ____________________ What is your last average frost date? ____________________

<table>
<thead>
<tr>
<th>PLANT NAME</th>
<th>Start inside?</th>
<th>Heating Mat?</th>
<th>Hardiness</th>
<th>Plant outside?</th>
<th>Seed Depth</th>
<th>Seed Spacing</th>
<th>Days to Sprout</th>
<th>Days to Maturity</th>
<th>Replant</th>
<th>Estimated Harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Key:**
- **H=Hardy** (2-4 weeks before last frost),
- **SH=Semi Hardy** (0-2 weekd before last frost),
- **T=Tender** (after last frost),
- **VT=Very Tender** (2 weeks after last frost)
What zone is your garden in? Denver Zone 5b 
What is your last average frost date? April 30

<table>
<thead>
<tr>
<th>PLANT NAME</th>
<th>Start inside?</th>
<th>Heating Mat?</th>
<th>Hardiness</th>
<th>Plant outside?</th>
<th>Seed Depth</th>
<th>Seed Spacing</th>
<th>Days to Sprout</th>
<th>Days to Maturity</th>
<th>Replant</th>
<th>Estimated Harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ace Tomatoes</td>
<td>yes</td>
<td>VT</td>
<td>VT</td>
<td>14-May</td>
<td>1/4&quot;</td>
<td>2&quot;</td>
<td>5-10</td>
<td>80</td>
<td></td>
<td>3-Aug</td>
</tr>
<tr>
<td>Cascadia Snap Pea</td>
<td>no</td>
<td>n/a</td>
<td>H</td>
<td>23-Mar</td>
<td>1&quot;</td>
<td>2&quot;</td>
<td>5-10</td>
<td>58</td>
<td></td>
<td>9-May</td>
</tr>
<tr>
<td>Wando Shelling Pea</td>
<td>no</td>
<td>n/a</td>
<td>H</td>
<td>26-Jul</td>
<td>1&quot;</td>
<td>2&quot;</td>
<td>5-10</td>
<td>68</td>
<td></td>
<td>12-Sep</td>
</tr>
<tr>
<td>Nantes Carrots</td>
<td>no</td>
<td>n/a</td>
<td>SH</td>
<td>1-May</td>
<td>1/4&quot;</td>
<td>2&quot;</td>
<td>14-21</td>
<td>62</td>
<td>3 weeks</td>
<td>3-July</td>
</tr>
</tbody>
</table>

Key: H=Hardy (2-4 weeks before last frost), SH=Semi Hardy (0-2 weekd before last frost), T=Tender (after last frost), VT=Very Tender (2 weeks after last frost)
Visual Planning Chart Sample

<table>
<thead>
<tr>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APRIL</th>
<th>MAY</th>
<th>JUNE</th>
<th>JULY</th>
<th>AUG</th>
<th>SEPT</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cascadian Peas</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nantes Carrots</td>
<td></td>
<td></td>
<td>Every 3 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grow indoors</td>
<td>Ace Tomatoes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wando Shelling Peas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Learners will expand their knowledge of their local environment through observation and correlating plant growth to specific seasons. They will use this knowledge to develop a planting schedule.

All experienced farmers rely on past experience to judge the proper planting times. Starting with the first signs of spring, they look at trees, weeds, flowers, animals and local weather conditions to decide when is the best time to plant each crop. The study of periodic biological phenomena is called Phenology. Following these natural signs often provides more useful guidelines than relying on frost dates and USDA zone charts. The frost dates and zone charts are based on averages and statistics. They may not work for a particularly hot or cold season and do not rely on fixed dates. Local observations become folk sayings or “plant lore.” Some examples are “Plant beans when elm leaves are as big as a penny,” or “When daffodils bloom, it’s time to plant peas,” or “When dandelions are blooming, plant beets, lettuce, spinach and carrots.”

Most recorded phenology lore deals with climates where frost is an issue, in order to tell people when it is safe to plant tender crops. If your climate has only two seasons, look for plant signs that are relevant to your location. This observational activity takes place throughout the planting season. You will create your own phenology chart based on observation of your garden area. At the end of the season, you will have a planting guide to use as a schedule for planting hardy, semi-hardy, tender and very tender crops. Learners will sharpen their observational skills because they will be using natural signs as markers for planting events.

**Materials**
- Pencils
- Garden Journal
- "What did you see today?" worksheet
- Nature Signs Chart, one per table

**Preparation**
Look over the Nature Signs chart. Do some of these plants grow in your area? If not, are there other common plants which you might substitute to use as a guide to planting cool season and warm season crops?
Divide the class into groups of 8 learners
Make sure each table has the materials
Activity

Begin this activity 4 weeks before the last average frost date and continue through the year if possible.

1. Take a quick walk around your schoolyard or school garden. Look for some of the plants that are in the Nature Signs Chart on page TK. Do you see any of them sprouting or blooming?

2. Record the date and what you see in your garden journal. If you have time, draw a picture of the plants you see sprouting or blooming.

3. Each week take a similar walk and record your observations.

4. Use the chart to decide when to plant each type of crop.

Discussion

• What other plants do you notice in early and late spring? Add any more signs that you have observed on a new chart. Keep your chart for each year. Do the signs vary from year to year?

• Have you noticed if there are specific times when you see larvae or insects emerge to eat the plants?

• When do pollinators arrive?

Participate in the National Phenology Network by recording observations of plant cycles in your area. Create an account at: https://www.usanpn.org/nn/become-observer
## Follow the Signs Chart Sample

<table>
<thead>
<tr>
<th>TYPE OF VEGETABLE</th>
<th>WEEDS</th>
<th>TREE BLOSSOMS</th>
<th>BULBS</th>
<th>PERENNIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardy</td>
<td>Dandelion buds</td>
<td>Sweet Cherry, Plum, Peach, Forsythia blooming</td>
<td>Grape Hyacinth, Daffodil blooms</td>
<td>Asparagus sprouting</td>
</tr>
<tr>
<td>Semi Hardy</td>
<td>Lambs Quarters sprouting, Dandelion blooming</td>
<td>Sour Cherry blooms, Lilac in first leaf</td>
<td>Tulips blooming</td>
<td>Raspberry leafing, Strawberry blooming</td>
</tr>
<tr>
<td>Tender</td>
<td>Marigold sprouting</td>
<td>Apple blossoms, Lilac blossoms</td>
<td>Iris, Allium blooming</td>
<td>Grapes leafing out</td>
</tr>
<tr>
<td>Very Tender</td>
<td>Pigweed sprouting</td>
<td>Apple blooms complete, Dogwood peak bloom</td>
<td>Iris bloom complete, Daylilies and Lily of the Valley blooming</td>
<td>Grapes blossoming</td>
</tr>
</tbody>
</table>
Learners will use the blooming times of plants as guides to planting various vegetables. Create your own living schedule that will indicate planting times in your climate. You will be planting a series of bulbs or flowers whose bloom time match up with planting dates in your area. For northern climates, the blooming times of daffodils, tulips, iris and daylilies correspond to planting hardy, semi-hardy, tender and very tender crops, respectively. The planting timeline can also be incorporated into an herb garden. Plant herbs in the fall or spring as groundcovers on top of the bulbs. For areas that do not freeze in the winter, select bulbs that do not require an extended cold period. Examples of these types of bulbs include anemone, freesia, ranunculus, alstroemeria, iris, spraxis and day lilies. Use the materials list as a guideline for your area, but feel free to expand the choices based on your preferences. This activity should take place mid fall, at least three weeks before the soil freezes.

**Materials**

**Cold winters:**
- Hardy-1 dozen King Alfred daffodil bulbs
- Semi Hardy-1 dozen Darwin tulips
- Tender-6 German (bearded) Iris rhizomes or 6 allium
- Very tender-3 Early Isbel or Flava Major day lily plants roots

**Warm winters:**
- Hardy-18 anemone corms
- Semi Hardy-18 Freesia bulbs
- Tender-12 Dutch Iris bulbs
- Very Tender-6 alstroemeria (Peruvian Lily) bulbs

**Preparation**

Prepare a garden bed and turn in compost or soil conditioner.
Activity

1. Mark off 4 squares in the plot with string and wooden stakes.

2. Plant each type of bulb in a different square. Daffodils and tulips should be planted with the root side down, in a hole two to three times as deep as the bulb is tall. German iris should be planted so that they are just barely covered with soil, roots facing down.

3. Water bulbs thoroughly and wait until spring.

4. Watch the plants in the spring. As each group blooms, plant the corresponding vegetable in their appropriate plot. In areas without frost, the planting times are not as critical because the vegetables won’t be killed by frost. Instead, make sure to plant crops that like cooler weather first.

Discussion

Look up your average last frost date on the Farmer’s Almanac website: http://www.almanac.com/content/frost-chart-united-states.

Answer the following questions:

• Did your hardy bulbs bloom two weeks before the last frost date?
• Did the other bloom times match up with what you expected?
• Were any of your vegetables killed by frost?
• What can you plant next time to adjust your blooming timeline?
Learners will discover the animals that live in the garden from insects to small mammals and track their preferred habitats and food.

Many insects, arthropods, small mammals and birds call the garden home. You may not be able to see them, but you can find evidence of their presence. Their traces are distinctive and you may be able to identify who is in your garden by the clues they leave. Learners will look for specific clues in the garden to see if they can identify some of the creatures that live there. Some insects, such as spiders, are beneficial to the garden in that they eat insects that prey on plants. Other insects, such as aphids, may damage plants but do not usually kill them. Use the resources provided to create a web of life based on your garden.

Materials
- Pencil
- Color pencils
- Garden journals
- Digital camera (optional)
- Eye loupe magnifier
- Small trowel

Preparation
Before bringing the class outside, look in the garden and select areas where you can observe clear evidence of animal life. Examples could be damaged leaves or stems, insect eggs underneath leaves, holes or tunnels in the soil, piles of leaves or other detritus, areas under rocks, and areas near small puddles or standing water. Pick 4 or 5 of these activity areas so that you can send groups of learners to different sites in the garden.

Describe the garden rules to the learners while you are still inside the classroom. Explain that the garden is another kind of classroom and that the same behavior and attention is expected.

Divide the class into small groups of 4 or 5 learners, ideally with a volunteer or parent in charge of each group.

Activity
1. Explain to the class that they will be like explorers to a new world, searching for signs of life. Discuss some of the signs they might see. Send each group to a different area of the garden.
2. Have them write down in their journals all of the evidence that they find that animal life exists in their assigned area.
3. Learners should draw a picture of the evidence they find. Use the magnifying loups to observe small holes or eggs more closely. If they have a digital camera, they can also take a photo.
4. Learners should ask questions about the evidence. What do they notice? What do they wonder about it?
5. Are there any animals that they directly observed? What were they doing?

Gather the class together and discuss what they have found.
Were there similar types of animal traces found in different areas of the garden? Groups should compare their findings and see if they can expand their knowledge together. What types of animals could have created the various types of evidence?

Create a field guide to the various types of animal traces found in your garden. Use the following websites and books to try to determine the species of animals that are living there. What connections are there between the animals? What do they eat and where do they live?

Many of the animals you discover may be classified as pests. Which animals would you like to discourage? How would you do it? Are there any animals that eat the pests?

Garden Insects of North America by Whitney Cranshaw

The Secret Life of Backyard Bugs: Discover Amazing Butterflies, Moths, Spiders, Dragonflies, and Other Insects by Judy Burris

http://davesgarden.com/guides/articles/view/2287/#b

http://www.garden.org/pestlibrary/

http://www.ipm.ucdavis.edu/PMG/menu.vertebrate.html

http://www.ipm.ucdavis.edu/PMG/menu.invertebrate.html
## Compost World

### Objective
Learners will discover the organisms that live in a compost pile and be able to see those that are visible to the naked eye.

### Background
Decomposition is an important part of the life cycle of a garden. Carbon and nitrogen in the form of dried and green plant materials are converted by a host of bacteria, fungi, earthworms, insects and arthropods into nutritious compost, providing a good source of humic acid and nutrients to plants. Having a dedicated area to decomposition in the garden provides many hours of activities to learners. Using the guidelines in the Composting Appendix, build your own 3 bin composting system. Or, if you have less time to manage the compost, try pit composting or sheet mulching, as described on the next page. Both of these methods provide a good habitat for millipedes, spiders, slugs, fungus and other visible decomposers.

Each group will have a sample of compost from the garden and survey how many living things they can find in it. Some of the most visible elements will include fungus, mold, mites, earthworms, spiders, wood louse, and millipedes. If you have a large compost pile, take samples from different depths of the pile. Or compare a finished compost pile to one that is relatively new.

### Materials
- Pencil
- Color pencils
- Eye loupe magnifier
- Garden journals
- Small latex gloves

### Preparation
Before bringing the class outside, check your compost pile or sheet mulch to make sure that there are plenty of visible organisms to observe. If there is more than one area in your garden with decomposition present, use different habitats for different groups of learners.

Describe the garden rules to the learners while you are still inside the classroom. Explain that the garden is another kind of classroom and that the same behavior and attention is expected.

Divide the class into small groups of 4 or 5 learners, with a volunteer or parent in charge of each group.
**Activity**

1. Explain to the class that they will be looking at different compost samples to do a survey of fungus, insects, arthropods and earthworms. Send each group to a different area of the garden, or take samples from different parts of the compost bin.

2. Have them write down in their journals all of the living organisms that they can find in their compost sample.

3. Learners will draw a picture of the organisms they find. Use the magnifying loupe to observe small organisms more closely.

4. Learners should ask questions about the evidence. What do they notice? What do they wonder about it?

**Discussion**

Gather the class together and discuss what they have found. Were there similar types of organisms that lived in similar depths (habitats) of the compost pile? Groups should compare their findings and see if they can expand their knowledge together. Which samples had the most diversity? Which samples had the most earthworms?

Does the number of organisms increase or decrease as the composting process continues? Try the observation again in 2-3 weeks and compare results.

**Further Exploration**

For more composting activities, information and lessons, use this activity book from the Central Vermont Solid Waste Management District: http://www.cvswmd.org/uploads/6/1/2/6/6126179/do_the_rot_thing_cvswmd1.pdf.
If you have volunteers or staff to manage a composting system, the classic design is the 3 bin system. It will provide you with plenty of compost for your garden over a season. More information about building a compost pile and constructing a 3 bin system can be found on page TK. However, you can observe the decomposition process in other ways, which might require less labor. See the suggestions below.

**Pit Composting**

Dig a trench or large hole and fill it with kitchen scraps, leaves and weeds that have been pulled. Pile dirt on top to cover the hole. The advantage is that you don’t need a compost bin and the compost is hidden. The disadvantages are that you will not be able to plant in that area for 6-8 months, until the waste decomposes.

**Sheet Mulching**

This method is great for large areas where the soil needs improvement. Cover the area with a layer of weed free straw and aged manure. Then cover with cardboard or thick layers of newspaper and water well. Top off the cardboard with at least 6” of organic material and compost. Finish with a top layer of mulch. You can plant in the bed right away by making a hole and adding some potting soil, and then planting on top of the cardboard layer. The disadvantages are that you need to gather quite a bit of material. The advantages are that you can quickly improve a very large area with minimal labor. Sheet mulching kills many types of weeds but does not kill bindweed or other aggressive perennial weeds.

**Three Bin Composter**

Three large 3’x3’ open bins side by side can be formed from wood and wire or from a chain link fence. The 3-bin design allows for the convenient holding of a pile of organic materials while facilitating the flipping of a pile every several weeks. A pile is first made in bin #1 (left bin) and allowed to “cook” for 2 weeks. After the core temperature of the pile has hit its peak and is starting to decline (for full process, see “How to Build a Compost Pile” Appendix), the pile is then turned with a garden fork into bin #2 (center bin). A new pile can then be made in bin #1. Again, after several weeks, the pile in bin #2 is turned into bin #3 and the pile in bin #1 is turned into bin #2. Thus, using the 3-bin system, several piles can be maintained at a time at different stages, allowing the almost continual use of garden scraps throughout the summer.
Vermiculture uses earthworms to turn food scraps into worm castings, which can be used for fertilizer. The advantages are that it can be done indoors and, if managed properly, will not cause unpleasant odors. Learners love to investigate earthworms. The disadvantages are that the amount of food scraps can easily overwhelm the capacity of the worms to decompose them, causing the compost to be too wet. Also, fruit flies or other insects can invade the vermiculture system, making it less attractive to be kept inside.

Tumbler
Tumblers are enclosed bins that are less labor intensive than three bin systems. They are good for small areas, but fill up quickly. In school gardens, they may be too small for your needs. When they are full, you cannot add more scraps until the compost process is finished. They also do not become hot, therefore weed seeds will not be destroyed.
http://www.finegardening.com/
6-ways-make-great-compost
Plant Life Cycles
Seeds We Eat

Objective
Learners will explore the parts of a seed and taste common seeds.

Background
Seeds have proteins, fats and carbohydrates that sustain seedlings during plant growth and protect them from harsh environments. Those same nutrients provide nutritious foods for humans. Seed proteins provide more than half of global protein sources. Use this activity to demonstrate the wide variety of seeds we eat.

Materials
Garden Journals
Pencils
Small plates
Seed Words Worksheet on page TK
1 cup each edible seeds
(roasted soy nuts, sunflower seeds, pumpkin seeds, canned chickpeas, sugar snap peas)
8 oz. mung bean sprouts

Preparation
Place a sample of each seed on a plate.
Make one plate per learner.
Pass out journals and pencils to each learner.
Pass out a copy of the Seed Words Worksheet on page TK.

Activity
1. Discuss the functions of the parts of the seeds for plants as well for as humans.
2. Pass out the plates of seeds and sample them.
3. Pass out the mung bean sprouts and have the learners examine them. Compare the mung been sprouts to the illustration on the worksheet.
4. Have the learners choose one of the seeds to draw in the empty box. Have them label the parts of their seed.

Discussion
Discuss the following questions:
• Which seeds were your favorite and why?
• How do the legume seeds taste compared to the seeds?
• What are seeds for? What happens to them when they are planted?
• What do seeds need to grow?
## Create a Spread

### Objective
Learners will be able to make their own spread according to their flavor preference.

### Background
Seeds are nutrient dense foods that provide fiber, healthy fats, B vitamins and minerals. They are ideal snacks because they are filling as well as nutritious. Mixing beans or peas with nuts or seeds will give learners a good mixture of protein, carbohydrates and healthy fats. All of the legumes should be cooked. Use the equation on the following page to try spreads with different combinations of legumes and seeds or nuts.

### Materials
- 1 food processor or blender
- 1 spatula
- For each station:
  - 1 medium sized bowl
  - Pita bread cut into triangles or crackers for tasting
  - Spoon for serving
  - Plates for each learner
  - Container of water
  - Assortment of ingredients from Create a Spread (each group should have a different type of legume)

### Preparation

- **Young learners or short on time** — Prepare additional ingredients ahead of time and divide into the number of groups.

- **Older learners or more time available** — Have them prepare additional ingredients at each table.

Wash the ingredients. Make sure all of the desktops and/or counters are cleared of materials, cleaned and sanitized. Make sure everyone has washed his/her hands. Divide the class into groups of no more than 8 learners. Place the blender or food processor at the front of the room.

### Activity

1. Have each group assemble the ingredients for a spread using the Create a Spread guidelines on the next page.

2. After they have finished, one learner from each group will bring his bowl of ingredients to the front of the room and the instructor will blend them into a paste. The instructor may need to add water to create a spread consistency.

3. The instructor will use the spatula to scrape the spread back into the bowl. The learners will bring it back to their table and adjust the flavor with more salt, lemon or other seasonings if needed.

4. Learners will dip and compare.
**Discussion**

Have the learners compare the dips and explain why they like each one.
What was the main flavor of the beans before they added enough salt?
What does salt do to bitter flavors?
Do they feel full after eating these dips? How much could they eat?
Which ingredients are seeds? Are beans seeds?

**From the Garden**

Use freshly blanched: 1. Garden peas; 2. Shelled fava beans; 3. sugar snap peas; or 4. Fresh shelling beans. The legumes will not become creamy unless they are blanched or cooked first, softening the fiber. The translucent casing should be removed from the fava beans before puréeing.
Use the Spread equation and chart to create a delicious fresh spread. Choose a variety of ingredients from each category. If you like, you can structure the activity as a friendly competition between groups.

**Create a Spread**

Use the Spread equation and chart to create a delicious fresh spread. Choose a variety of ingredients from each category. If you like, you can structure the activity as a friendly competition between groups.

Spread = Beans + Seeds

Beans
- Canned chick peas
- Canned black beans
- Canned white beans
- Shelled Edamame
- Blanched, peeled fava

Seeds
- Sesame
- Sunflower
- Pumpkin
- Walnuts*

+ Liquid + Flavorings

Liquid
- Olive oil
- Water
- Lemon juice
- Orange juice

Flavorings
- Garlic
- Fresh herbs
- Olives, pitted
- Green onions
- Salt

*Nuts are common allergens. Often sunflower or pumpkin seeds are good alternatives.
Seed Windows

Objective
Learners will be able to explain seed germination and root growth during the first stages of plant growth, and the differences between monocot and dicot plants.

Background
This activity will allow learners to see inside the seed during the first stages of plant growth. They can also observe the root and cotyledon emerging from the seed coat. Learners will be able to clearly identify the two basic types of plants: monocots and dicots. Monocots only have one cotyledon (first leaf) and are often members of the grass family. In addition, they usually have fibrous root systems, without one main root. Dicots (most vegetable plants) have two cotyledons and usually have tap roots. Monocots take advantage of shallow surface water, while dicots prefer infrequent deep watering.

Note: These seedlings will not be useful for transplanting. Usually corn and beans are planted directly into the ground.

Materials
Garden journals
Pencils
1-2 packages of any kind of bean seeds
1-2 packages of any kind of corn seeds
1 clear plastic cup per learner
Black construction paper
Paper towels
Spray bottle filled with water per table

Preparation
Soak the seeds over night.

Measure the height of the cups. Cut the construction paper into strips that are as wide as the height of the cups.

Pass out materials so that each learner has a cup, two paper towels, one construction paper strip, two bean seeds and two corn seeds.

Activity
1. Line the inside of the cup with the black strip of paper. Dampen the paper towel and place in the middle of the cup.

2. Place the seeds between the cup and the paper, so that you can clearly see them against the black background. Each cup should have 2 corn seeds and 2 bean seeds.

3. Spray the paper towel with water so that it is wet, but there is no standing water in the cup.

4. Spray the paper towel as needed as the seed germinates and grows. Check the moisture level every day.
5. After the third day, remove one seed from each cup. Split it open and observe the embryo. Have learners identify the root and first leaves (cotyledon) and draw the embryo in their garden journal.

6. After 4-7 days, the root and leaves will emerge from the seed. Split open the seed (if it is not already) and observe the seedlings. Which seedling is a monocot? Which is a dicot?

**Note:** Learners may want to transplant these baby plants to the garden. Allow them to take them home to show their family what they have discovered.

**Further Exploration**

Use the **Seed to Plant Worksheet** on the next page to go over vocabulary words and learn the parts of the germinated seed.

Read *Bean and Plant* by B. Watts and compare the pictures to your seeds to the pictures in the book.
**Objective**
Learners will be able to plant a seed and describe how to care for the developing young plants.

**Materials**
- Light table (to make your own, see Light Table Appendix)
- 2 plastic dish tubs
- 8 qt. Soilless seed starting mix
- Seed packets
- 4 permanent markers
- 1 4-pack starting container per learner
- 2-3 plant trays without drainage holes
- 1 short plastic plant tag per learner
- 1 plastic dome for each tray
- Small watering can or water bottle with squirt type top
- Extra tub of water to wash off hands
- 2 towels

**Preparation**
Divide soilless seed starting mix between two tubs. Moisten each tub of soil to encourage seed germination. It should not be soggy or dripping with water, but damp like a wrung out wet sponge.

Set up two stations: one for “warm seeds” or those that need a warming mat and one for “cool seeds” or those do not need to be warm to germinate (see Plant Cultivation Chart on page 54).

**Each station should have:**
- Tub of moistened potting soil
- Selection of 3-5 types of warm or cool seeds
- 2 permanent markers
- 4-pack plastic containers
- 1-2 flats with plastic dome covers
- 1 short plant tag per learner
- 1-2 plastic dome covers

Set up a tub with water and paper towels so the learners can rinse their hands and minimize dirt in the classroom sink.

Divide the learners into two groups. Explain how to plant the seeds. Have them line up 3-4 at a time at each station. Those that are not planting can do other class work or reading.

**Activity**
1. Loosely fill the 4-cell tray with potting soil, almost up to the top.
2. Pour a few seeds into the learner’s hand. Have her place one seed into each cell.
3. Cover seed loosely with more potting soil, about 1/4”.
4. Label the plant tag with the learner’s name and classroom number on one side and the plant variety on the other. Place the tag in the 4-pack.

5. Place the planted container into a large plant tray. Make sure to group “warm seeds” and “cool seeds” together in separate trays.

6. When each group has finished, have them write down the date and type of seed they planted in their garden journals, so that they can note the number of days until germination.

7. If time permits, follow up with the *Seeds We Eat* on page TK.

8. Introduce the dome to the learners. Ask if they know what it is for. Discuss the water cycle, evaporation and condensation. Ask them what they might observe in a couple of days?
**Watering the trays:**

Once covered, the trays should not need water until the seeds germinate. If the domes get knocked off and the water evaporates, go ahead and lightly sprinkle the potting soil with water and replace the domes. Position each plant tray on light table shelf. Talk about “cool” seeds and “warm” seeds. Which trays require a heat pad? Why or why not?

Turn on the lights above the tray. The lights serve the role as the sun. Small seedlings can receive 24 hours of light until they are transplanted. Ask the learners if they know what purpose the light serves.

After germination, water them when they are dry with the water bottle with the squirt top. Do not leave the seedling containers in standing water.

**Dome:**

Leave the dome on in between watering to help conserve water. Remove the dome when the seedlings brush the top of the dome.

**Water:**

Water at the base of the plants with a gentle stream, using the water bottle with squirt top to minimize spills.

Over watering is a common cause of seedling failure. Water the seedlings only when the soil is dry on the top. Do not let seedlings sit in water.

If the seedlings wilt over the weekend, it is time to transplant them to a larger pot.

The weekend is a time when the seedlings can die. It is best to water extra heavy on Friday afternoon and then be sure to water first thing Monday morning.

If you have a fan available, leave it on about 5 feet away from the seedlings. It will help to promote air circulation and make the seedlings stronger.
Thinning and Transplanting

Objective
Learners continue basic gardening skills by learning how to transplant and thin plants.

They will also understand the difference between tender annuals and hardy annuals.

Six to eight weeks after your seeds have germinated, they will become crowded in the small 4-packs. At this point, you will transplant the tender annuals to 4” pots. These will remain inside until two weeks after the last frost date. The hardy annuals can be planted outside two weeks before the last frost date if they have been hardened off first. Hardening off means that you gradually get them used to the outside world, first in the shade, exposing them to more sunlight each day. If there is a heavy frost forecasted, bring them inside at night. The hardening off period should be about a week.

While you are transplanting the plants, you should also thin them. Often learners plant more that one seed in each cell. For the cold hardy plants, pull out the strongest seedlings. For the tender plants, you can separate the seedlings and plant each one into its own 4” pot. Save the discarded seedlings for the plant observation activity.

We recommend using a potting soil that has some nutrient amendment either in the form of worm castings, manure or fishmeal. The larger plants will need a balanced form of N-P-K in order to thrive.

Materials
Garden book from recommended list to read to the learners
2 plastic dish tubs
2 8-qt. bags of potting soil
Light table (to make your own, see Light Table Appendix)
30-40 4” pots
4 permanent markers
30-40 plant tags
3-4 plant trays

Preparation
Separate the cold hardy plants from the tender plants. Examples of cold hardy plants include broccoli, cabbage, kale, spinach, and lettuce. These will not be transplanted, but can be hardened off. Planting the hardy vegetables first will save you space in the classroom.

Tender annual vegetable plants include basil, tomatoes, eggplant, peppers, and squash. Any plant that must be planted after the last frost date will die if exposed to freezing temperatures. Only transplant these into larger pots unless you have plenty of indoor space for seedlings with a good light source. Windows often do not provide enough light for seedlings, they need supplemental grow or florescent lights.

Set up planting stations that include empty 4” pots, flats to be transplanted, moistened potting soil, plant tags and markers.
Activity

1. Have a tub of moistened potting soil ready to go and four 4” pots.

2. Fill 4” pots with potting soil about half way up and keep a small indentation the middle of the pot.

3. Transplant only the tender annuals unless you have plenty of indoor growing space. Take a 4-cell pack and loosen the dirt in one cell by pinching the outside of the cell. Gently turn the cell over and place the stem between your fingers, cupping the roots in your hand.

4. If there is more than one seedling in a cell, save the strongest ones and discard the rest. Save the discarded seedlings for the Plant Part Observation activity on page TK.

5. Place seedling into new pot and cover roots with more potting soil. Press down gently on soil and make sure that the seedling is standing tall.

6. If the plant is a tomato plant, place it in the bottom of an empty pot and fill the pot with soil to the top. The top two sets of leaves should still be showing. Tomatoes will make new roots along the stems, strengthening the plant.

7. Make new name tag and place into pot.

8. Place pot into plant tray and repeat with the rest of the cells.

9. Look over the cold hardy plants. If there is more than one seedling in a cell, remove the weakest and save them for the Plant Part Observation Activity. Top off the cells with fresh soil if needed.

10. While learners are waiting for their turn to transplant, have them do the Plant Part Observation activity on page TK.

If you would like each learner to take a plant home, then have them transplant one of their plants from the 4-pack into a 4” pot. They can use their original tag to put in their pot to bring home. Make sure they know when they can plant it outside and how to care for it.

Use a liquid fish/kelp or other organic fertilizer once a week to provide nutrients to the growing plants.

If you are planning a plant sale, make sure all of the plants are labeled, thinned, filled with soil and are fertilized so that they can look their best for the sale.
### Objective
Learners will observe the immature parts of the plant and learn simple botanical terms.

### Background
Using the thinned seedlings from the previous lesson, learners observe how the small plants grow. They will still be able to see the cotyledons (“seed” leaves), as well as the true leaves of the plant, the stem and immature root system. The flowers and fruit will not be visible until the plant matures outside in the garden. Most of the seedlings will be dicots (two first leaves) as opposed to monocots (one first leaf).

#### Each plant will have five basic parts with different functions:

<table>
<thead>
<tr>
<th>Roots</th>
<th>Stem</th>
<th>Leaves</th>
<th>Flowers</th>
<th>Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchor plants</td>
<td>Keeps plants upright,</td>
<td>Make food through</td>
<td>Pollination of fruit</td>
<td>Holds seeds, attracts animals to</td>
</tr>
<tr>
<td>in soil, provide</td>
<td>moves water and</td>
<td>photosynthesis</td>
<td></td>
<td>help spread seeds</td>
</tr>
<tr>
<td>nutrients to</td>
<td>nutrients to leaves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 1 : Basic Garden Skills & Knowledge

For each learner:
- Plant journals
- Seed to Plant worksheet on page 61
- 1 or 2 seedlings to observe
- Magnifying glass or loop for closer observation
- Pencils and/or colored pencils

Give each learner the materials above.

Place the discarded seedlings in the middle of the table.

Review plant vocabulary and the activity instructions.

Have each learner label the plant parts on the worksheet. Page 46 has the answers.

Learners will observe the seedling in front of them.
They will try to match the parts of their seedling to the worksheet.

Each learner will draw her own seedling and label the parts in her journal.
If the learner knows the name of the plant, add that as well.

Have the class answer the following questions as a group, or individually in their journals:

- How many seed leaves (first leaves) does the plant have? If there are two, it is a dicot (most plants, with a tap root). If there is one, it is a monocot (grass type plants with fibrous roots).
- Can you find all of the plant parts?
- What does each plant part do?
- Which parts are missing from the young seedling?
- When do you think that the missing parts will grow on the plant?
Seed to Plant Worksheet: Beans

Radicle
Cotyledon
Leaf
Seed Coat
Stem
Bean Pod
Seed
Flower
Hypocotyl
Nitrogen Capsule
Root
Foliage

Diagram of bean growth stages:
- Seed Coat
- Radicle
- Cotyledon
- Hypocotyl
- Foliage
- Leaf
- Stem
- Flower
- Seed
- Bean Pod
- Nitrogen Capsule

slowfoodusa.org
Learners will discover the differences between taproots and fibrous roots and be able to identify them.

Roots provide the anchor that keeps plants in the ground. Plants have different root structures that take advantage of local growing conditions. Root systems can be classified into two types: taproots and fibrous roots. A taproot consists of one main root that has smaller side roots. Most taproots are also dicots; that is they have two cotyledons such as beans or carrots. Taproots can search deep in the soil for water and nutrients. Fibrous roots consist of many thin, branching roots that form a mat near the soil surface. Plants with fibrous roots are monocots, with one cotyledon, such as corn or grass. They take advantage of rain or floods to quickly absorb water and nutrients.

Weeding provides an opportunity to compare different types of roots. Learners will weed the garden, save samples of each weed, and then identify whether they have tap roots or fibrous roots.

**Materials**
- Journals
- Pencils
- Ruler
- Hand trowels
- Dandelion weeders (optional)
- Children’s garden gloves (optional)

**Activity**
1. Pull weeds in the garden, making sure that students pull up the roots as well. Try different weeding techniques to see which is the most effective; pulling by hand, using a trowel, using a dandelion weeder.
2. Line up all of the roots. Measure which roots are the longest and which roots are the shortest.
3. Have learners draw a picture of one of the roots that they pulled.
4. Use the What Kind of Root illustration on page 48 to determine which type of root they have.

**Discussion**
Is their plant adapted to reaching for water deep into the soil? Is it adapted to take advantage of surface water and rain?

Are there any roots that are hard to classify? Why?

**Further Exploration**
Use the National Gardening Association Weed Library to identify the weeds you have pulled.
http://www.garden.org/weedlibrary/
What Kind of Root?

**Tap Roots**
- Have one main root (radicle)
- Are usually dicots (two first leaves), like carrots
- Have side (lateral) roots

**Fibrous Roots**
- Have many small roots and no radicle
- Are usually monocots (one first leaf), like corn
- Often have runners (adventitious roots)

ILLUSTRATIONS: Barbara Feige
Learners will observe the condition of their growing garden, research any problems, and design solutions for any issues.

Learners often get plenty of experience planting seeds but do not learn the entire life cycle of the plant and do not get practice cultivating gardens. Use this garden survey in the fall, or during the peak growing season, to determine how your plants are doing and identify any problems. Use the resources provided to devise a solution for the disease, insect damage or condition.

For each group of learners:

- Copy of Garden Survey on a clipboard
- Pencil

Before going outside, describe the garden rules to the learners. Explain that the garden is another kind of classroom. Engage them in a discussion about what rules would be best to promote respect of the living plants and animals in the garden as well as each other.

Clearly explain where they can walk and where they cannot.

Ask for help from parents and volunteers so that there is one adult with each group of learners.

1. Divide the learners into 4 groups and assign each group one section of the survey.

2. Have the learners observe and answer the questions in their part of the survey while they are walking around the garden and looking at the different plots.

3. Have them write down any questions or observations in the Notes section.

4. Return to the classroom and use the provided websites to look up any insects or plant diseases.

5. Discuss the actions suggested by the results of the survey. Create a plan to care for the garden based on the survey results and suggestions.

Discuss the following questions:

- Is the garden thriving? Is there a common problem that was present in many areas?
- Does the insect damage seem to be causing the plants to die, or is the infestation small?
- Can a thriving garden include some insect damage or disease?

Use the National Gardening Association Weed Library to identify the weeds you have pulled. http://www.garden.org/weedlibrary/
Harvest Time

**Objective**

Learners will be able to determine when the proper time is to harvest a wide variety of fresh produce.

**Background**

The plant life cycle begins with a seed and then progresses from root to sprout, to leaves, to stems, flowers, fruit, ending with mature seeds. This life cycle can be used as a guide to harvesting produce at its peak flavor. If the produce you are harvesting is from the leaves or stems of a plant, it is best to harvest them at the beginning of the cycle, before the flowers, fruit and seeds form. For example, kale is sweetest before it begins to flower. However if the produce is a fruit or seed, it will be harvested near the end of its life, later in the season. Mature fruits like tomatoes are at peak flavor when they have had a chance to ripen. Seeds must be mature and plump before they reach their peak.

Any produce that is a root, leaf or stem loses flavor and tenderness after the plant blooms and sets seeds. At that stage, the plant expends its energy forming the reproductive organs of flowers, fruit and seeds, so the rest of the plant suffers. If you are not planning on harvesting the flowers, fruit or seeds, it is best to remove them at the flowering stage, so that the leaves or roots will be viable longer. If the plant has reached the fruiting and seed stage, the leaves are often very bitter or tough. It is best to remove those plants and replant with a new crop.

Many plants can be eaten at different stages. For example beet greens can be harvested when the plants are small and the greens are still tender. Often gardeners will thin the beets at that time and eat the greens. Beet roots can be harvested after the roots have had a chance to form but before the plant sets blossoms or seeds. Caution, do not eat any leaves from plants in the nightshade family: peppers, potatoes, tomatoes, tomatillos and chiles. These leaves have compounds that may be poisonous to humans in large doses.

**Materials**

Clean plastic basket for harvesting
Scissors
Small Trowels

**Preparation**

Before going outside, describe the garden rules to the learners. Explain that the garden is another kind of classroom. Engage them in a discussion about what rules would be best to promote respect of the living plants and animals in the garden as well as each other.

Clearly explain where they can walk and where they cannot.

Divide the class into groups of 6 to 8. Ask for help from parents and volunteers so that there is one adult with each group of learners.
Activity

1. Send each group to a different garden plot.

2. Have them observe the plants. What plant life stages do they observe? Which plants have flowers? Which have fruits? Which have seeds?

3. Use the Harvest Time Chart to determine which plants may be ready for harvest. Use the scissors to harvest greens and the trowels to harvest root vegetables.

4. Remove any flowers or seeds that are on root vegetables or greens.
# Harvest Time Chart

<table>
<thead>
<tr>
<th>PART OF PLANT TO HARVEST</th>
<th>TOO SOON</th>
<th>TIME TO HARVEST</th>
<th>TOO LATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root</td>
<td>Leaves are small, root is thin. If thinning is needed, use young plants as greens.</td>
<td>Root is well formed. Root is showing above ground.</td>
<td>Plant is flowering or has seeds.</td>
</tr>
<tr>
<td>Leaf</td>
<td>Can always eat leaves, even as micro greens</td>
<td>Leaves are numerous, healthy and tender.</td>
<td>Plant is flowering or has seeds.</td>
</tr>
<tr>
<td>Stem</td>
<td>Stem is too thin.</td>
<td>Stem is formed but still tender.</td>
<td>Stem has lots of leaves, flowers or seeds.</td>
</tr>
<tr>
<td>Flower</td>
<td>Not formed</td>
<td>Depends, for broccoli should be buds</td>
<td>Flowers are fully opened or gone to seed.</td>
</tr>
<tr>
<td>Fruit</td>
<td>Hard or green</td>
<td>Yields slightly to the touch</td>
<td>Fruit is very soft, fallen on the ground or fermented.</td>
</tr>
<tr>
<td>Seed</td>
<td>Seed pod immature, seeds not fully formed</td>
<td>Seed pod is plumb and dried.</td>
<td>Seed pod has burst open or seeds have been eaten.</td>
</tr>
</tbody>
</table>
Scavenger Hunt Checklist

GK-2
Early Season Garden Scavenger Hunt

**Signs of new growth**
Find one of each kind of sprout:
- New grass
- Tree bud or new leaf
- New leaves on small plant
- Flowering bulb

**Comparing Seeds and Seed Pods**
Look for:
- Dried bean or pea pod
- Dried fruit with seeds
- Sticker or burr
- Seed from a tree

**Alive and Dead**
Some plants live over the winter and grow again in the spring (perennials), while others die. Can you tell the difference?
- Branch or stick that is dead
- Branch or stick that is alive

**Animal Traces**
Dig in the compost pile or a plot from last year and look for:
- Roly poly
- Worm
- Larvae
- Spider


Early Season Garden Scavenger Hunt

**Signs of new growth**
Find one of each kind of sprout:

- New grass
- Tree bud or new leaf
- New leaves on an herb plant
- Sprout with 2 cotyledons
- Sprout with one cotyledon
- Flowering bulb

**Comparing Seeds and Seed Pods**
Look for:

- Dried bean or pea pod
- Dried fruit with seeds
- Sticker or burr
- Seed from a tree

**Alive and Dead**
Some plants live over the winter and grow again in the spring (perennials), while others die.
Can you tell the difference?

- Branch or stick that is dead
- Branch or stick that is alive
- Plant that is a new sprout
- Old plant that has new leaves

**Animal Traces**
Dig in the compost pile or a plot from last year and look for:

- Roly poly
- Worm
- Larvae
- Spider
Comparing Leaves
Find one of each kind of leaf:
☐ Furry leaf
☐ Grey leaf
☐ Oval leaf
☐ Pointy leaf
☐ Grass
☐

Comparing Seeds and Seed Pods
Look for:
☐ Dried bean or pea pod
☐ Dried fruit with seeds
☐ Sticker or burr
☐ Grass seed
☐ Seed from a tree
☐

Comparing Flowers
Look for:
☐ Orange flower
☐ Yellow Flower
☐ Flower from the pea (legume) family
☐ Many small flowers
☐ Purple flower
☐

Animal Traces
Look for:
☐ Leaf that has a bite mark or hole
☐ Fruit that has a bite or hole
☐ Leaf with brown marks
☐
Scavenger Hunt Checklist

G3-5
Mature Garden Scavenger Hunt

Comparing Leaves
Find one of each kind of leaf:
☐ Furry leaf
☐ Grey leaf
☐ Serrated leaf
☐ Oval leaf
☐ Lobed leaf
☐ Leaves arranged opposite along the stem
☐

Comparing Seeds and Seed Pods
Find one of each kind of seed:
☐ Dried bean or pea pod
☐ Fruit with seeds
☐ Sticker or burr
☐ Grass seed
☐ Multiple seed (like a berry)
☐ Seed from a tree
☐

Comparing Flowers
Find one of each kind of flower:
☐ Orange flower
☐ Cruciform flower (4 petals)
☐ Flower from the pea (legume) family
☐ Composite flower
☐ Purple flower
☐ Flower that grows in a spiral
☐

Animal Traces
Find one of each. These are more difficult. Look closely!
☐ Leaf that has a round hole in the middle
☐ Leaf that has a bite taken out
☐ Fruit that has a bite taken out
☐ Fruit that has a hole
☐ Leaf with brown marks
☐ Leaf with insect trace marks
☐
# Soil Observation Sheet

<table>
<thead>
<tr>
<th>Soil Sample 1</th>
<th>Soil Sample 2</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Soil Sample 3</th>
<th>Soil Sample 4</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
Soil Layer Diagram

Using the soil layer diagram as a guide, select the phase(s) that matches your soil sample:

☐ Mostly sand and gravel, not much clay.
☐ Mostly silt, not much clay and sand.
☐ Mostly clay, not much sand.
☐ Lots of humus and organic matter.
<table>
<thead>
<tr>
<th>DAY</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Time hole takes to drain</td>
</tr>
<tr>
<td>2</td>
<td>(Dry, Moist, Wet, Muddy?)</td>
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<tr>
<td>3</td>
<td>(Dry, Moist, Wet, Muddy?)</td>
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<td>4</td>
<td>(Dry, Moist, Wet, Muddy?)</td>
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<tr>
<td>5</td>
<td>(Dry, Moist, Wet, Muddy?)</td>
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<tr>
<td>6</td>
<td>(Dry, Moist, Wet, Muddy?)</td>
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<tr>
<td>7</td>
<td>(Dry, Moist, Wet, Muddy?)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HOLE</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>1 liter water</td>
</tr>
<tr>
<td>2</td>
<td>1/4 liter water</td>
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<tr>
<td>3</td>
<td>w/gravel</td>
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<tr>
<td>4</td>
<td>w/mulch</td>
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<tr>
<td>5</td>
<td>w/compost</td>
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<tr>
<td>6</td>
<td>w/compost and mulch</td>
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</table>
Visual Planning Chart

<table>
<thead>
<tr>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APRIL</th>
<th>MAY</th>
<th>JUNE</th>
<th>JULY</th>
<th>AUG</th>
<th>SEPT</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
</table>

...
# Follow the Signs Chart

<table>
<thead>
<tr>
<th>TYPE OF VEGETABLE</th>
<th>WEEDS</th>
<th>TREE BLOOMS</th>
<th>BULBS</th>
<th>PERENNIALS</th>
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</table>
Seed to Plant Worksheet: Beans

Radicle
Cotyledon
Leaf
Seed Coat
Stem
Bean Pod
Seed
Flower
Hypocotyl
Nitrogen Capsule
Root
Foliage
Garden Survey Checklist

Leaves

Q: Are there any leaves that are yellow or drooping?
A: Check the soil to see if it is dry and water if necessary.
    Mulch around larger plants to retain moisture.

Q: Do you see any insects on your leaves? Are there any large holes? Are there any leaves that have brown spots or that are discolored?
A: Take a picture of any diseased or insect damaged leaves. Use the photos to identify the problem by looking up the pest or disease on the National Gardening Association website: http://www.garden.org/pestlibrary/.

Q: Are the leaves so crowded that they have no room to grow?
A: Plants should be thinned. Refer to seed packets for the best spacing between plants and pull up the weakest seedlings.

Notes:

Stems

Q: Are there any plants with drooping stems?
A: Check the soil to see if it is dry and water if necessary.

Q: Are there any plants that are floppy or seem like they need support?
A: If so, provide a trellis or other support so that the branches and fruit are not sprawled on the ground. Use this Wisconsin Extension website for ideas: http://fruit.wisc.edu/wp-content/uploads/2011/06/Trellising-Staking-and-Caging.pdf
Garden Survey Checklist

Fruit

Q: Are there any fruits that are lying on the ground like tomatoes or chiles? Are there any fruits that have holes or other insect damage?
A: If so, provide a trellis or other support to keep fruit away from the ground and insects. Use this Wisconsin Extension website for ideas: http://fruit.wisc.edu/wp-content/uploads/2011/06/Trellising-Staking-and-Caging.pdf

Q: Are there any tomatoes that have black or shriveled bottoms?
A: If so, they have blossom end rot, which can be caused by uneven watering. http://www.garden.org/pestlibrary/diseases.php?q=show&id=1793

Q: Are there any fruits that have fallen on the ground?
A: If so, pick them up and compost them to reduce diseases and insects.

Flowers and Seeds

Q: Are there any plants that are flowering?
A: If you normally eat the stems, roots or leaves (greens, basil, celery, garlic), then remove the flowers or the leaves will become bitter. If you normally eat the flowers (broccoli, cauliflower), make sure to pick them before the blossoms open.

Q: Are there any plants that have gone to seed?
A: If you normally eat the stems, roots or leaves (greens, basil, celery, garlic), then remove the seeds or the entire plant if the edible parts look unappetizing. If you would like to save or eat the seeds, wait until the seedpod is fully mature (plump and dried out) before harvesting them.

Notes:
Journal

Name of activity ____________________________________________

What did you do today?  First... Second... Third...

Favorite Verbs

________________________________________  ______________________________________  ______________________________________

________________________________________  ______________________________________  ______________________________________

Name __________________________  Date ________________________  Location ____________________
What do you see today?  I notice... I wonder... That reminds me of...

Favorite Nouns

____________________________  ____________________________  ____________________________

____________________________  ____________________________  ____________________________

Name ______________________  Date _______________________  Location ___________________