COMMIT TO HEALTH

Community and Home Gardening
Kid Friendly Fun

Experiential Activities Grades 3-5

NRPA National Recreation and Park Association

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Different Types of Soil and Their Effect on Plant Growth

In this Earth science activity, students will plant seeds in different types of soil and observe which type is the best for plant growth.

Materials:

- Bean seeds or other seeds that germinate easily and quickly.
- Small pots or paper cups with holes in the bottom for drainage.
- Sand, pea gravel, and potting mix. If available, include other soil samples representing different soil types, such as clay and loam. ***Students may wish to bring in samples from their own yards to test.***

Method:

1. Prepare identical pots/cups containing the different types of soil.
2. Plant four bean seeds in each pot/cup.
3. Give each pot/cup the same amount of water, and expose them to the same amount of sunlight.
4. Every few days, make sure the children observe the germination and growth of the bean plants so they can see the changes over time, and differences between types of soils. If possible, have them record their observations on a sheet of paper they keep during the experiment.
5. In the end, ask the children to share their observations of the differences in the plants based on the different soils. (The seeds should grow poorly in the pea gravel and sand because these provide very few nutrients, while the potting soil is best suited for plant growth because it contains nutrients that plants need.)

Adapted from: http://www.brighthubeducation.com/lesson-plans-grades-3-5/51201-experiment-on-what-soil-is-best-for-plants/

Insect Safari

Overview: Gardens usually have more insect inhabitants than plants. In this lesson, students sharpen their observation skills by going on an insect safari to uncover the secret lives of these important garden residents.

Grade Level/Range: K – 12

Objectives: Students will hunt for insects in the garden and determine if they are beneficial or harmful to their plants.

Time: 30 minutes to an hour

Materials:

- Paper
- Pencils
- Clipboards or cardboard pieces
- Insect ID book or website
- Optional: hand lens, insect net

If you do not have a garden to explore, go into the woods, a field, or other place to find insects!

Talk about what their roles are in the area in which they live.

Background Information:

There are over one million known species of insects in our world, making up nearly 75% of the animal kingdom. Unfortunately, we often give insects a bad rap by focusing on those we consider pests - those that cause damage to our food crops (such as aphids, whiteflies, and potato beetles), our homes (such as termites) and our bodies (like mosquitoes and ticks). But these pests are a very small percentage of the overall insect population. Most insects play unseen but important roles in our ecosystem, and some provide us with very obvious benefits such as useful products (honey from bees and silk from silkworms), protection from pest insects through predation and parasitism of pest species (ladybugs and lacewings), pollination of food crops (about 30% of our food crops depend on insect pollinators such as bees) and decomposition of dead organic materials (blow flies, dung beetles). We often call these important six-legged creatures beneficial insects.

Advanced Preparation: None.

Laying the Groundwork:

Ask students to share their thoughts about insects. As individuals or as a class, write descriptions of insects, create word webs, and/or draw insects using their current conceptions. Ask questions that prompt students to reflect in greater detail. If they mention that insects have legs, for instance, ask them how many and where they're found. Have them brainstorm and list what they know about how insects interact with plants. This will give you and your students something to revisit as they later explore insects and plants up close.

Exploration:

1. Announce to students that they will be going on an insect safari in the school yard. Encourage them to wear comfortable clothing and shoes. For fun, younger students may enjoy crafting special safari hats.
2. Before going out on the safari, explain that their job is to observe, draw, and gather information about garden insects. They can work as individuals or in teams. To adapt the activity for younger students, you may want to provide flash cards of specific insects for them to search for. With older students, you may want to add equipment for more intense study such as hand lenses or insect collecting nets.
3. Remind them to look in the soil, under leaves, on flowers, and in the air. After all, many creatures carry on their lives out of sight. What is the largest insect they find? The smallest? The most interesting? Instruct them to write about and draw pictures of their findings. Encourage them to include as much detail as possible.

Making Connections:

After you return to the class, create a list of all the insects observed and their characteristics. Refer back to the students' reflections before the safari. Did they find any differences between their original ideas about insects and what they observed in real life? What preconceptions were accurate and which were false? What new things did they learn about insects?

Use guide books or internet sites to help positively identify all insects observed. Next challenge students to group the insects based on similarities and differences. Follow up by having students research how scientists classify insects, then compare those categories with their own. (Insects are grouped into orders according to physical characteristics and life cycles. Beetles, for instance, are in the order *Coleoptera*, the members of which are distinguished from other insects by their hardened outer wings that form two halves when folded, two pairs of wings, chewing mouthparts, and complete metamorphosis.)

Lastly, determine whether the insects observed are beneficial, harmful, or neither to plants. To help you identify common beneficial insects, check out online resources such as Beneficial Insects in the Yard and Garden (University of Nebraska Extension); Natural Enemies Gallery (University of California IPM); or Beneficial Insects – Nature's Pest Control (Cornell University). A good resource for identifying common garden pests is Twenty-five Pests You Don't Want in Your Garden (PA IPM Program).

Branching Out:

- Use the information collected during the safari and the follow up research to create an insect guide for your schoolyard to share with other classes. Make sure to identify which insects are garden pests and which are beneficial.
- Invite a local entomologist to speak to your class. Ask him/her to bring an insect collection to share with the students for further study.
- Middle school and high school students may be interested in starting a bug collection.
- Adopt garden methods and add design features to your garden to attract beneficial insects. To make sure your garden is hospitable to beneficial insects don't use any pesticides (organic or chemical). Although some target specific pests, many will harm both problem and beneficial insects.

Also make sure your landscape includes plants the beneficial insects need for food. Although many of these insects prey on other insects, they may also need nectar and pollen for a well balanced diet at different stages of their lives. To provide the appropriate food resources plant a diversity of plant species, especially ones native to your area. Many beneficial insect species are attracted to the flowers of plants in the cabbage, carrot, and sunflower families. Some examples of beneficial insect attracting plants are bee balm, borage, broccoli, buckwheat, columbine, calendula, candytuft, chervil, chives, cilantro, clover, daisy, dill, milkweed, Joe Pye weed, fennel, goldenrod, mint, parsley, Queen Anne's Lace, sunflower, sweet alyssum, tansy, thyme, and yarrow. The caterpillar or immature stage of butterflies and moths often has specific food plant requirements. For example, the caterpillars of monarch butterflies feed exclusively on milkweed plants.

Resources:

Beneficial Insects in the Yard and Garden
http://lancaster.unl.edu/pest/resources/339_beneficialbugs.pdf

Natural Enemies Gallery
http://ipm.ucanr.edu/PMG/NE/index.html

Beneficial Insects - Nature's Pest Control
http://idl.entomology.cornell.edu/files/2013/11/Beneficial-Insects-1sdvh6p.pdf

Twenty-Five Pests You Don't Want in Your Garden
http://extension.psu.edu/pests/ipm/pestproblemsolver/house/home-garden/insects/25pests

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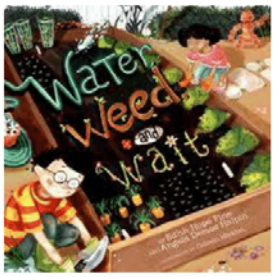
Farm to School

Garden Lesson: Introduction to Watering the Garden

Objectives:
Children will learn that plants need water just like people and animals need water. They will explore dry and wet soil and be able to describe the difference between them. Children will practice testing soil for dampness using their fingers. Children will be introduced to a rain gauge and its purpose.

Materials:
Garden soil
Two shallow buckets or containers
Water and watering cans
Rain Gauge

Preparation:
Put dry garden soil in each of the shallow buckets or containers. Add water to only one bucket and mix until the soil is very damp.



Books to Read
Water, Weed, and Wait
By: Edith Hope Vine &
Angela Demos Halpin

Lesson:
Review the things plants need to survive. Highlight that plants need water almost every day, just like people need water. How does nature provide water for plants? What do gardeners need to do if it hasn't rained? (Water the plants!) Tell students there are several things gardeners use when they are watering their plants: a watering can (hold one up) and their fingers: their fingers to test the soil, and the watering can to bring water to the plants.

Garden Activity:
Take students to the garden. Tell them they are going to learn how to do a soil test to determine if the garden needs to be watered each day. Bring your shallow buckets of soil. Guide students in taking turns feeling the dry soil and the wet soil. How does each of them feel? Cool, warm, crumbly, clumpy? How does each of them appear? Light, dark? Ask students to gently put their fingers in the soil of the garden bed without disturbing the plants. Does the soil feel wet or dry? Do they think it needs to be watered?

If the soil feels dry, demonstrate watering plants by "drawing" a circle around each plant multiple times with the stream of water. Let the children take turns watering with the watering can if the soil feels dry. Have students retest the soil with their fingers to feel the difference in how it feels after watering.

Tell students many gardeners and farmers use another tool to determine how much they need to water their crops—a rain gauge. Hold up the rain gauge and ask students if they know how it works. If not, explain how a rain gauge works and how to read it.

After teaching the watering lesson, select three students as "watering leaders" each week. Guide those students in testing the garden soil and watering the garden every day of their week. Rotate through the entire class.

Growing Minds is a program of ASAP (Appalachian Sustainable Agriculture Project)
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The Plant-Soil Relationship

Overview: Students investigate the relationship between plants and soil.

Grade Level/Range: Grades 3-5

Objective:

Students will learn:

- Soil helps anchor plants and provides them essential elements of water and nutrients.
- Plants prevent soil erosion and provide organic matter.

Time: 1 hour for discussion and to set up demonstration; 2 weeks to observe

Materials:

- Student observation journals
- Chalkboard or dry-erase board

Background Information:

Although many factors contribute to a thriving garden, any seasoned gardener will stress the importance of good soil. In addition to anchoring roots, soil provides life-sustaining water and nutrients. Plants in poor soils will struggle to grow, even if optimal water and light are available. In contrast, plants in good soils will grow to their fullest potential and experience fewer problems with insects and disease.

Soil is composed of minerals and organic matter. Sand, silt, and clay are the mineral particles derived from rock broken down over thousands of years by climatic and environmental conditions (rain, glaciers, wind, rivers, animals, etc). The largest, coarsest mineral particles are **sand**. These particles are 2.00-0.05 mm in diameter and feel gritty in your fingers. **Silt** particles are 0.05-0.002 mm and feel similar to flour. **Clay** particles are extremely fine – smaller than 0.002 mm – feel sticky in your fingers when wet, and clump to the point that you can't see an individual particle without a microscope. Organic matter is the decayed remains of once-living plants and animals. Good plant growth and development depends on the mineral and nutrient content of soil, as well as its structure.

Soil is teeming with life, including microorganisms like bacteria and fungi (billions in a single teaspoon!) and larger animals such as worms and sowbugs. Many of these underground inhabitants feed on remains of plants and animals, breaking down their tissues. In the process, they create pore space and release nutrients that plants need and the cycle begins again.

Pore space – the arrangement of soil particles in relationship to each other – is an important component of soil structure. In an optimal situation about 50 percent of the volume of the soil would be pore space, with half of that filled with water and half filled with air. The other 50 percent would be sand, silt, clay, and organic matter. Roots need air as much as they need water; plants can actually suffocate or drown if they are completely submerged in water for extended periods of time.

The proportion of these different-sized particles affects the amount of air, water, and nutrients available to plants, and how the soil 'behaves.' The smaller the soil particles, the more they stick together when wet. Thus clay soils can be sticky and difficult to work. Having fewer air spaces, they drain poorly and roots may suffer from a lack of oxygen, but clay soils can be rich in minerals. In contrast, sandy soils can drain water too quickly and be low in nutrients, but they are easier to work. Adding organic material can offset many of the problems associated with either extreme.

While there's no such thing as a perfect soil, particular plants grow best in particular soils. In general, common garden plants prefer **loam** – soils with a balance of different-sized mineral particles (approximately 40 percent sand, 40 percent silt, and 20 percent clay) and ample organic matter and pore space, but some common plants grow better in sandy conditions, while others are well adapted to clay soils.

Not only is soil important to plants, plants are also important to soil formation. Without plants, the earth would be barren, its surface unprotected from the effects of sun, wind, and rain, and its soil composition too poor to sustain life. Plant roots help to prevent erosion, and when plants die, they become the raw material for worms, insects, and microbes to build the nutrient-rich humus that supports robust food webs and promotes good soil strucutre. (Recently, researchers have discovered that living plants secrete excess carbohydrates through their roots to encourage growth of microbes!)

Advanced Preparation:

This lesson requires a soil sample. If your schoolyard does not have a place where you can dig or if you are concerned about possible lead contamination in your school's soil, bring in a sample from an alternate location.

Laying the Groundwork:

1. As a class, discuss whether and how soil is important for plants. Ask, *What do you think soil does for plants?* (Provides a place to anchor roots, nutrients, water, air.) Ask, *Have you ever seen plants growing without soil? Where?* Explain that some plants, including certain aquatic and parasitic plants, have particular adaptations that allow them to meet their basic needs without soil. Ask, *Do plants need soil?*
2. Delve deeper into the plant-soil relationship. Ask, *Other than mineral particles, what is an important part of soil?* Share the background information about microorganisms – fungi, bacteria, and other decomposers – and discuss the role they play.

Exploration:

1. Find out what your students know or assume about the plant-soil relationship. Ask, *Plants need soil, but does soil need plants? Why?* Record all answers and supporting reasoning; then visit the schoolyard or a nearby park to make observations. Have teams investigate the soil in different areas (e.g., garden beds, lawns, weedy patches, woods, a compacted area along the edge of a driveway or sidewalk) and record their observations in their journals. Make a second chart, summarizing these findings and take a vote. Ask, *Who thinks soil needs plants?*
2. Collect some soil from your schoolyard. Put it in a large zippered plastic bag along with some organic materials (vegetable scraps, plant clippings, old leaves). For comparison, add these same organic materials to a second bag, but do not add soil. Moisten the contents of the "compost" bags, seal them, punch a few air holes in them, and leave them in a warm part of the classroom for a week or two, while the class observes what happens. Then ask, *Are the contents changing? How? What do you think might be causing this change? Where have you seen examples of once-living things changing and decomposing outdoors?* (Rotting logs, moldy garbage, compost piles.) *Did some materials seem to decompose more quickly than others?*

Making Connections:

Discuss the explorations. **Ask:**

- *In what ways do you think plants depend on soil? Based on your observations, can you imagine how soil might depend on plants or animals? In what ways do animals – including humans! – depend on soil?*
- *Why do you think materials might break down quickly in soil? What do you think might happen to once-living things that decompose in soil? How might these once-living things help to support life?*

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Branching Out:

Science – Conduct a simple simulation to introduce students to the concept of erosion. Fill two trays with soil. Leave one tray unplanted and then plant a fast growing seeds such as ryegrass in the second. Wait two weeks as the grass grows. Then set the two pans up side by side, propping one end up about two inches at one end to create a slope. Set up a collecting basin below the pan for runoff. Holding a watering can a foot above the trays, sprinkle "rain" for a minute or two. If necessary, help students make connections between the simulation and what can happen outdoors; then discuss the techniques farmers and gardeners use to reduce or prevent erosion. (Mulching, terracing, cover crops, adding organic matter to improve a soil's water absorption.)

History – Research the Dust Bowl of the 1930's and investigate both its causes and the lessons learned by farmers and ranchers. Ask a farmer to come speak to the class about how he or she prepares soil for crops today.

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What Does a Plant Need to Grow?

What you'll need:

- Four small plants (plants that need full sun)
- Shoe box
- Scissors
- Four dishes or saucers (large enough for the pot to sit on)
- Clear plastic bag
- Paper
- Markers (4 different colors)
- Tape

Directions:

1. Label each plant by cutting 4 small strips of paper and writing:
   Plant 1 – Control; Plant 2 – No Water; Plant 3 – No Sun; Plant 4 – No Air
2. Decorate the labels and place one label on each plant.
3. Place each plant on a dish or saucer to catch water/spills.
4. Water each plant just until the soil is moist.
5. Place Plant 1 and Plant 2 in a sunny spot.
6. Take the shoe box and cut small squares into it so air can get into the box. Place Plant 3 into the shoe box, cover with the lid.
7. Place Plant 4 in the clear plastic bag and tie/seal the bag closed (keep the plant upright).
8. Place Plant 3 and 4 next to Plants 1 and 2.

Over the next week (or until you see changes in the plants):

1. Check plants every day to check whether the soil is dry. If the soil is becoming dry, water the plants ***except Plant 2***. Make sure to water Plants 1, 3, and 4. Remember to put Plant 3 back in the shoe box once you have watered it and place Plant 4 back in the plastic bag after watering.
2. Record what each of the plants look like every day. Write down all your observations.

What did you see?

Plant 1: This plant should have stayed healthy and green.
Plants 2, 3, and 4: You should have seen some changes in these plants. They may have droopy leaves, dry soil, dry leaves, yellow leaves, or other signs that they are not doing too well.

Discussion: Why did you see what you saw?

- When the plant doesn't get its basic needs, it will show signs of poor health.
- The sun provides energy the plant needs to perform photosynthesis. Photosynthesis is a process plants use to make their own food.
- Photosynthesis cannot occur without carbon dioxide, water, and sunlight. Did you know, oxygen is a waste product of plants?
- Just like plants, people show signs of poor health if they are deprived of their basic needs.
- People can survive for a long time without the right amount of carbohydrates, protein, fat, and other nutrients, but over time, you see the negative effects of a poor diet.
- So, go home, eat well, get moving and have fun!

Adapted from: www.superkidsnutrition.com