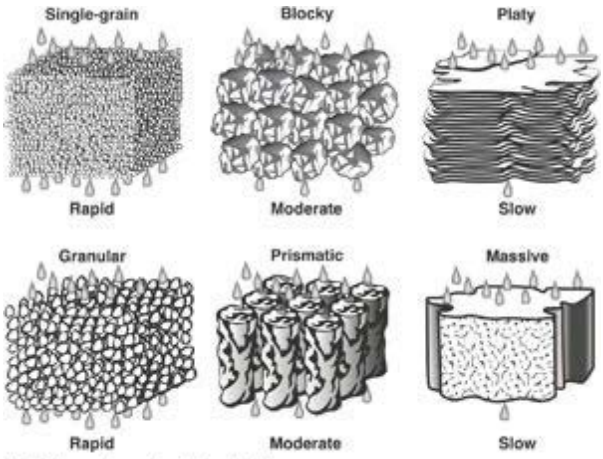
ENVIRONMENTAL EDUCATION IN THE COMMUNITY GARDEN

START WITH THE SOIL - LESSON 1

https://communitygarden.org/wp-content/uploads/2015/01/ACGA-Lesson-1.pdf

Teaching your gardeners how to understand and care for their soil will empower them to nurture healthy, productive plants. Your entire community garden's ecosystem will benefit from each gardener's stewardship of healthy soil.

By first understanding soil texture and structure, gardeners can actively work to preserve water retention and air circulation structures while increasing microbial activity and the availability of nutrients. Because the most fertile soil is alive with organisms that work in tandem with plants, soil structure and microbial balance is continually adapting to environmental conditions and nutrient availability. Gardeners will benefit from knowing how to work with the soil's evolution by respecting it as an ecosystem and disturbing it as little as possible. This lesson provides a foundational understanding of the physical properties of soil. By learning how to evaluate the soil in their plot, gardeners will be more informed about how to encourage nutrient retention and biological activity in their plots.



Examples of soil structure and the effect on drainage

HOW DO YOU GET TO KNOW YOUR SOIL?

COLOR

Dark brown, purplish-black,or redish:
Organic materials are dark coloring agents, so a healthy organic-rich soil will generally have a dark brown coffee color. Dark organic matter and humus provide nutrients for microorganisms to break down and feed to plant roots.Iron-rich soil rusts and provides a red or impart a purple-black shade. Each of these nutrients usually indicates good drainage and air circulation in the soil.

Gray or colorless:
Soil that remains light and gray, even when wet, indicates lack of organic material and poor drainage. This can lead to anaerobic activity and the disruption of microbial balance. If the soil color is light or colorless, gardeners will need to add organic material and encourage microbial activity to increase nutrient absorption, air exchange, and drainage.

SMELL

A good smelling soil indicates the presence of beneficial aerobic bacteria in balance with the rest of the soil's organisms. If the soil has an offensive or alcoholic scent, the soil might have inadequate drainage or be compacted in a way that encourages anaerobic (stinky) bacteria.

TEXTURE

Soil texture is created by the ratio of sand, silt, and clay particles. Texture influences how water, air, nutrients, roots, electrons, and microorganisms interact and move through the soil. Sand and silt are both composed of quartz and other rock materials, but silt particles are much smaller. Clay particles are made of hydrous aluminum silicates and are smaller than silt.

Sand promotes drainage, air movement, and rapid decomposition of organic matter. Silt supports a soil's water and nutrient holding capacity. Clay holds water while providing a large surface area to which nutrients can stick and small organisms can hide. Silty soil is susceptible to erosion. Heavily clay soil is easily compacted.

Loam is the ideal texture for garden soil and is composed of 30-50% sand, 30-50% silt, 20-30% clay, and 3-10% organic matter.

Rubbing soil between your finger and thumb reveals a lot about the texture. Sand is gritty and coarse. Silty soil leaves residue on the fingers and feels silky like flour. Clay soil feels slippery and plastic like.

Learning how to do a simple jar and water soil test is another way for gardeners to evaluate soil texture. Gardeners need to understand soil texture so they can make informed choices when working to improve soil structure for optimal aeration, drainage, moisture retention and microbial life.

STRUCTURE

Healthy soil structure is crumbly, loose, spongey and full of holes. As solid particles (sand, silt, clay, and organic matter) cling together in the soil, they create porous spaces that allow for the movement of water and air. Soil structure depends on the way soil particles bind together when influenced by multiple factors, including: texture, the amount of clay and humus; weather and water behavior (freezing/thawing, wetting/drying, shrinking/ swelling; root growth; biological activity in and above the soil (microorganisms, worms, small animals); and human intervention (digging, hoeing, and walking on soil).

To protect soil structure, gardeners should avoid double digging or walking on wet soil. Roots, earthworms, bacteria, fungi and other organisms extrete substances that reinforce good structure so should be disturbed as little as possible. Highly aggregated soil with various sized pores provides drainage, aeration, and capillary water retention that maintains moisture and oxygen for roots and microbes during fluxuations in rainfall and watering.

pH

While many plants and vegetables prefer specifc soil pH ranges, biological activity in the soil has a large influence on soil pH. Soil pH indicates the amount of hydrogen ions in a measured solution and ranges from 1 to 14 on a scale from very acidic to very alkaline (or basic). Roots receive nutrients from soil through electrical exchanges that involve hydrogen cations (positively charged ions). As the concentration of hydrogen cations increases, pH goes down. Knowing a soil's pH is a clue to the kind of bioactive energy exchange between bacteria, fungi, and plant roots.
In this regard, soil pH really reveals the type of biological activity in the soil that best supports each type of plant. Most vegetables prefer bacterially dominated soil, and an alkaline pH (around 7) best supports bacteria in their ability to turn nitrogen into a nitrite form that the plant can use.

LESSON PLAN 1

OBJECTIVES:

Teach gardeners that promoting soil health will nourish their plants more effectively than applying fertilizers. Show how the structure of the soil influences oxygen in the soil, water drainage and retention (capillary water), and sets the stage for microbial life and the availability of nutrients for plant roots.

MATERIALS NEEDED:

- Varieties of garden soil texture and structure
- Examples of rich humus and organic rich loam
- Three 1-quart glass jars (conduct two jar texture tests in advance to use one as an example and one to extract sand, silt, and clay examples for gardener to feel)
- A fine mesh collander or screen

ACTIVITIES:

1. Color: Show examples of rich garden soil and different colors of local soil from different locations.

2. Smell: Allow gardeners to smell samples of healthy garden soil and a sample of odorless sand.

3. Texture: Review particle size differences for sand, silt, and clay with gardeners and let them feel an example of each. Note plastic-like, slippery residue of clay on fingers and lack of residue with gritty sand. Silty soil will feel silky smooth and leave a like residue like flour.

4. Jar Soil Texture Test: Demonstrate how to add 2 T soil from the top 12 inches of soil to 2 cups of water in a 1 quart jar. Shake the jar vigorously, wait 24 hours for the particles to settle. Sand particles will settle to the bottom in a few minutes. Silt will distinguish itself in the next layer in a few hours, but the clay will need a day to separate from the water into the top layer. Mark the divisions of each layer on the jar and determine the percentages each component in the sampled soil.

5. Structure: Place examples of different soil structures in a fine mesh colander or screen and pour water over to show permeability as you discuss how surface area of the particles influence space available for organisms, roots, and nutrients. This is best illustrated with a large chunk of previously undisturbed soil, a clump of soil that has been broken up with a trowel, and a clump of soil with a high clay/low organic matter profile. You can also demonstrate wetting loamy soil and clay soil, then squeezing to show how each binds together differently and retains water. Explain that microbes, worms, and roots do a lot of the binding and pore-making work in the garden.

6. pH test: Show gardeners how to use an inexpensive soil pH test determine soil pH in different areas of their garden. Vegetables generally prefer more alkaline soil, while perennials and trees often prefer acidic soil. However, be sure to emphasize that nurturing biological activity in the soil will be the most effective way to give plants the benefits they need from their preferred pH level.

RESOURCES:

Lowenfels, Jeff and Wayne Lewis.*Teaming with Microbes*: *The Organic Gardener's Guide to the Soil Food Web.*
Timber Press, Portland and London, 2010.
Natural Resources Conservation Service www.nrcs.usda.gov
Soil Science Society of America www.soils4teachers.org