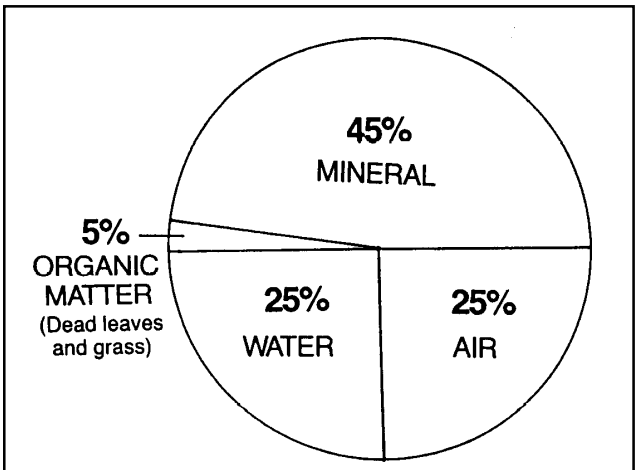
Virginia's Soil Resources

Every time you step outdoors and look to the horizon, you are gazing upon one of Virginia's greatest natural resources — soil. Soil is the "backbone" of life. At the base of every building, every highway, and every farm road, airport, and bridge, you will find soil. And just as the human backbone holds our frames in place, soil holds the nutrients and water needed to grow our crops, livestock, and timber.

What is Soil?

Have you ever stopped and looked at the soil beneath your feet? Have you ever thought of soil as a living, breathing thing? It really is! There are millions of small plants and animals in the soil, and you are walking on their homes (ouch!).

Soil is made of both living and dead plants and animals (organic matter), air, water, and mineral particles such as sand, silt, and clay. The diagram below shows the four main "ingredients" of ideal soil. Note that, except for doted-upon home gardens, most Virginia soils do not contain 5% organic matter.



General Ingredients of Soil

Soil features such as thickness, texture, and color can easily be observed and studied. While contemplating these features as you look at a soil sample, ask yourself the following questions:

1. Would this soil easily erode?
2. Can this soil hold water for plants?
3. What crops might grow in this soil?
4. Will this soil support a road or house?

The best way to observe how soils develop in layers is to visit a road cut, building site, or ditch. Each layer, or "horizon," looks different and has unique physical and chemical properties. A cross-section cutting down through these different horizons is called a soil profile.

The following information will help you identify the different layers, or horizons, in the soil profile.

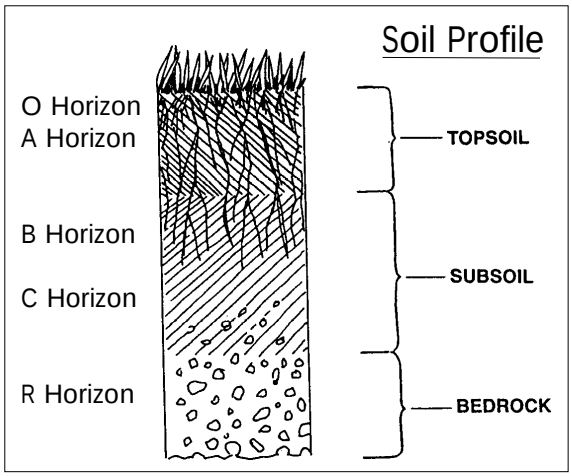
A layer of leaf litter (decaying leaves, bark, nuts, and twigs) is found on top of the soil. Layered below the leaf litter are the following four horizons, which make up the soil profile.

1. The **A Horizon**, or surface layer, is usually darker than the lower layers. It is most often loose and crumbly and contains more organic matter than deeper layers. In the A Horizon, water soaks or leaches into the soil with ease. Clay and other dense compounds are missing; they have been carried by water deeper into the soil profile.

2. The **B Horizon** is the subsoil. Subsoils are usually light colored and dense and contain little organic matter. Materials washed or "leached" from the A Horizon collect in the B Horizon. Therefore, this horizon holds more clay, iron and other mineral compounds.

3. The **C Horizon**, or parent material, is the layer of very little weathering. (This means that forces of weather, such as rain and wind that cause erosion, or ice that causes freezing and thawing, have little effect on this horizon.) The C Horizon has very few roots. It is usually low in clay content and often contains pieces of rock.

4. The **R Horizon**, or bedrock, contains layers of solid rock.



Soil Texture

Texture tells you a lot about soil. Texture affects the ability of soil to absorb and hold both water and plant nutrients. The texture, or feel, of soil is determined by the amounts of sand, silt, and clay it contains. Sand particles are the largest; silts are in-between sand and clay in size; and clay particles are the smallest — so small, in fact, that individual particles cannot be seen without a microscope!

With a little practice, most people can figure out the general texture of their soil quite easily. Sand makes a lump of soil feel gritty, silt makes it feel powdery, and clay makes it feel sticky.

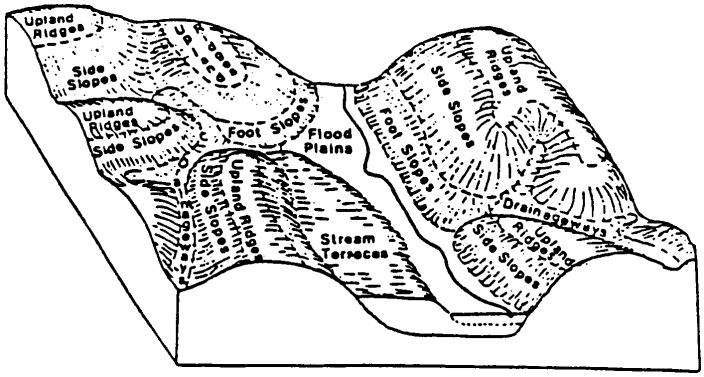
To understand the texture of a soil sample, place a small amount in the palm of your hand. Add a few drops of water to the soil and break apart the clumps. Next, work the soil into a ball and place the ball between your thumb and forefinger. Gently push the soil with your thumb and squeeze it upward, into a ribbon. Keep trying to make the ribbon longer until it breaks from its own weight!

The length of the ribbon that can be formed is used to determine the soil's texture. Measure the length of your ribbon. Use the chart below to decide the correct soil texture.

Length of Ribbon	Texture
0 inches	sands
0 to 1/2 inches	loams
1/2 to 1 inch	clay loams
more than 1 inch	clays

Landscape Factors: Slope, Erosion, Landscape

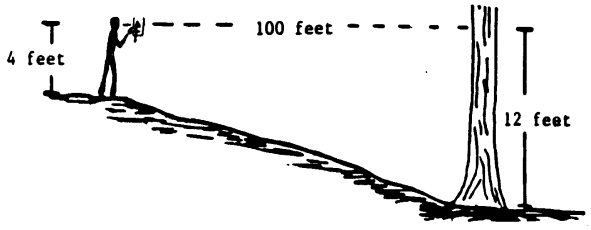
Slope "gradient," or steepness, is very important. It affects water runoff, erosion, and the use of farm machinery and lawn and garden equipment on the land.



Slope is defined as the number of feet the land rises or falls over a distance of 100 feet. Slope is read as a percent (%). The formula used to determine slope is: "rise over run times one hundred."

$$\% \text{ slope} = \frac{\text{feet in rise}}{\text{feet in run}} \times 100$$

A young soil scientist uses a line of sight, distance, and a tree to determine the grade or slope of the hill. First, she extends her arm to eye level and finds a mark on a distant tree that is in her line of sight. Then she walks down the hill toward the tree. She finds that the tree is 100 feet from where she started. Also, she discovers that her line of sight at eye level is now 8 feet lower than her original mark. This means she is 8 feet lower in elevation than the point where she started. Therefore, the slope of the hill is 8%.



Practice by placing two stakes 100 feet apart. The slope between the two stakes is the slope to be measured. You find that the land rises six feet from the bottom stake to the stake at the top of the hill. What is the slope?

$$X \text{ (\% slope)} = \frac{6'}{100'} \times 100 = 6\%$$

Answer = 6%

Descriptive Term	Percent Slope
u nearly level	0 - 2%
u gently sloping	3 - 7%
u sloping	8 - 15%
u moderately steep	16 - 25%
u steep	> 25%

Soil Structure

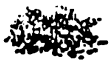
Soil structure is the arrangement of individual soil particles (sand, silt and clay) into larger pieces of soil, called "peds." Each ped has a particular shape or size and, together, determines the type of soil structure.

Different types of soil structures are shown in the chart below. The most common structures found in soils are granular and blocky.

Soil Loss

In nature, rain and wind washes or blows loose soil off construction sites, bare spots in the lawn, and plowed farm fields. Where water runs downhill over the ground surface, it carries with it loose soil and pollutants. During storms, water moves so fast it doesn't have time to penetrate into (percolate) the soil. Instead, it gathers strength and picks up more loose soil and pollutants along its path.

We call this process erosion. Eroded soil eventually ends up as "sediment" in waterways — a form of nonpoint source pollution. It clouds the water, chokes fish and other animals, blocks sunlight that underwater plants need to grow, and makes it harder to clean up our drinking water.

Name	Shape	Where Commonly Found and Description
Single Grain		Sandy or loamy textures, soil particles do not stick together
Granular		A Horizon, resembles crumbs
Blocky		B Horizon, angular blocks-usually higher in clay than other structures
Massive		C Horizon, large clods-hard to break apart, no visible structure

Soil Structures

The amount of loose soil "on the run" can be reduced through many actions that control erosion and sediment from leaving construction sites, road projects, and even our own backyards.

Additional Resources

Web Sites:

u USDA, Natural Resources Conservation Service; www.nhq.nrcs.usda.gov/ccs/squirm/skworm.html

u NASA; http://ltpwww.gsfc.nasa.gov/globe

u U.S. Environmental Protection Agency; www.epa.state.il.us/kids

u www.earthsciweek.org

Other Resources:

u VASWCD, 1998. *Watershed Connections, An Activity Book for Kids Who Care About Virginia's Waters.* To order, call (804) 559-0324.

u American Geological Institute. 1999. *Sustaining Our Soils and Society*. A 64-page booklet that describes soils, their importance, and the need to conserve them; includes educational poster. To order, call (703) 379-2480.

u *"In the Time it Took to Form an Inch of Soil…"* is an 18x25" poster listing hundreds of historic activities that have occurred in the U.S. during the past 500 years when one inch of soil was being formed. Available from your local USDA Natural Resources Conservation Service; call (804) 287-1681.

u *Soil and Water Conservation Puzzles.* Word brain teasers for kids who care about the planet earth. Includes glossary and information on conservation. Available from the Va. Department of Conservation and Recreation; call (804) 786-1712.

Fundamental Learnings Related to Soil Resources

R Plants and animals depend on soil for nutrients and support.

R Soil is formed from parent materials through a process called weathering.

R Proportions of sand, silt, and clay determine soil texture.

R Soil is a vital resource in Virginia that we need to conserve.

Nature's Water Filters

Background

Soil filters particles out of water passing through it. Various kinds of soil have different abilities to filter pollutants out of water. Soil that is fine, like fine sand, will be able to trap more sizes of pollutants than loosely formed soil made of large particles.

If the flow of water is slowed down, it is more likely to enter the ground's surface and pass through the soil. The slower the water passes through the soil profile, the more particles can be filtered out. The rate at which water passes through the soil is called the "percolation rate." As runoff and pollutants carried by water percolate through the soil, these particles are trapped within the soil. Many of the minerals in soil chemically bind to the introduced pollutants, and here they are stored or even "eaten" by bacteria, resulting in cleaner ground and surface water.

Preparation for the experiment

1. Punch a lot of small holes in the bottom of each plastic milk jug (one jug for each sample being collected). Cut off the top of each jug.
2. Collect soil samples: sand; clay; gravel; humus-rich organic soil found in the top few inches of the forest floor or garden, made of decomposed plants and animals
3. Fill each plastic bottle half-full with soil. Label each with the soil type.

Procedure

1. Place the soil-filled jug over an aluminum tray and pour a glass of water over the soil.
2. Collect the drainage in the aluminum tray. Use a funnel to transfer the drainage to a second glass container.

u Which soil filtered the water best?

u Why do you think some soils filtered better than others?

Answer:

A sample with fine particles that fit close together, and one with a tangle of roots throughout, should be better filters (capture more) than a loose sample with large particles and lots of pore spaces.

(over)

Grade Levels:
Demonstration K-3
Group Experiment 4-6

Science SOLs: 2.7, 3.7

Materials Needed:
- **bags or containers for collecting soil**
- **1/2 gallon samples of several soil types (sand, clay gravel, loam, humus)**
- **a nail**
- **large funnel**
- **several aluminum pans**
- **scissors**
- **water**
- **a one gallon plastic milk jug or plastic bottle for each soil sample collected**
- **two glass containers for each soil sample collected**
- **recording sheet (see back pg.)**

Vocabulary Words:
clay
erosion
humus
loam
nonpoint source pollution
percolation rate
sand
silt
soil horizon

3. Record your findings in the chart below:

	Water Clarity Rate Results			
	Soil Type	2nd Pour	3rd Pour	4th Pour
Sample I				
Sample 2				
Sample 3				
Sample 4				

NOTE: Rate water clarity from 1-5, where 1=cloudy and 5=clear

4. Pour the dirty water over each of the soil samples again. Record your findings. Does the water eventually become clear?

Picture This — Clean Water

Research ways that contractors, road builders, and home owners can prevent nonpoint source pollution. You'll find some of the answers in the book, *Watershed Connections*. Write your ideas down.

_____

_____

_____

_____

_____

Gutters and Downspouts — A Drawing Activity

Draw a picture of a house and yard. There are many things you can do to help take care of soil and water. Look at your drawing and answer these questions:

1. Does the house have gutters along the edge of the roof?

Gutters and downspouts help prevent soil erosion. If you didn't draw them on your building, add them now.

2. Draw some grass, flowers, and shrubs next to your house where the downspouts empty onto the ground. The plants will make the house pretty. They will also act like big sponges and help to keep soil from washing away when it rains.

3. Is there a sidewalk in your picture? What is it made of? Sidewalks made of stones, gravel, or bricks (uneven surfaces with air holes) let rain soak into the ground.

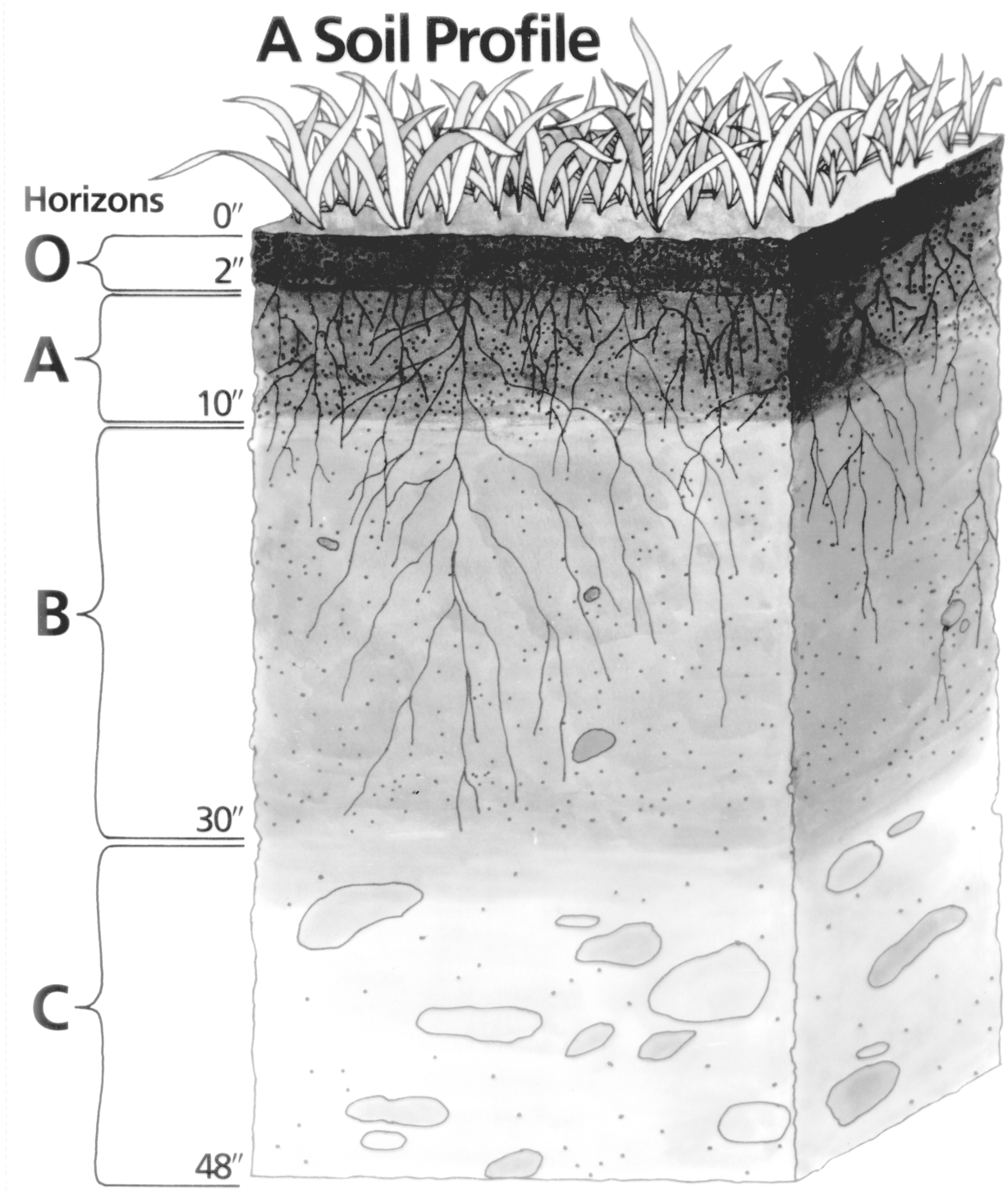
4. Is there a pet in your picture? Cleaning up after pets is important if you live in the city or suburbs. When it rains, animal waste washes from sidewalks into street storm drains. It could end up in your neighborhood creek or stream. If you were a fish, would you want that dumped in your living room? Be a pooper-scooper. Clean up after your pet.

Grade Levels: 1-6

Science SOLs: 1.8, 2.7, 6.11

Materials Needed:
- drawing paper
- markers or crayons
- Watershed Connections activity book

Vocabulary Words:
erosion
nonpoint source pollution



Source: USDA Natural Resources Conservation Service.