

Soils Support

Soils make our lives possible. Without soils we wouldn't have plants—so no food to eat or oxygen to breathe. We wouldn't have a place to build, a place to play, clothes to wear, or forests for wildlife.

What do we do in return? Our daily activities threaten soils with erosion, pollution and loss of nutrients and organic matter. Soils take hundreds and sometimes even thousands of years to form. They are difficult to replace.

So take some steps to support your soil before you step on it!

Recycle—it saves landfill space.

Use organic fertilizer—it recycles nutrients into soil and helps avoid entry into water.

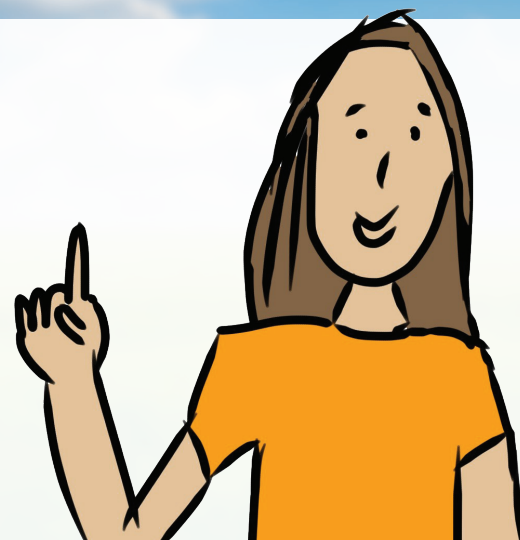
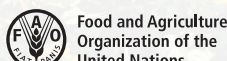
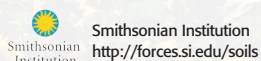
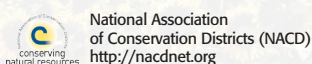
Never pour hazardous materials on the ground—soil and water will become contaminated.

Compost—it improves the organic matter and productivity of soils.

Recycle your used cell phones—they contain toxic substances that leak into soil and water when they are buried in landfills.

Come up with some of your own steps:

These DIG IT! education materials were developed by NACD based on an exhibition developed by the Smithsonian's National Museum of Natural History and sponsored by the Soil Science Society of America and the Nutrients for Life Foundation. This version of Dig it! was adapted by the Food and Agriculture Organization of the United Nations in the context of the International Year of Soils 2015.



Maxine is a 47-year employee of NACD.

Ask Maxine

Q: Where can I find out what soil type I live on?

A: It is important to know soil types, for building a home, planting trees and more. Visit your local conservation district to learn about your local soil survey. Your local library may have your area's soil survey in their reference section.

© NACD/FAO 2015
14766E11/06.15

Booklet designed by Willow Marketing • Content written by T.D. Southerland
Project Manager SM Schultz stewardship@nacdn.org
Special thanks to the Smithsonian Dig It! The Secrets of Soil exhibition team; SSSA K-12 Committee; NACD S&E Committee
Correlations to national standards, educators guide and answer key at <http://nacdn.org/education>
Booklet designed for use with ages 11 and up.

Answer to Quotation Excavation: "A cloak of loose, soft material, held to the earth's hard surface by gravity, is all that lies between life and lifelessness." - Wallace H. Fuller, in *Soils of the Desert Southwest*, 1975

DIG IT!

The Secrets of Soil





A Day Without Soils? Not on this Planet!

A day without dirt well, maybe. But soil is a different story. Life as we know it would cease to exist if we didn't have soils. You use soils several times every day and probably don't even know it. Think about it:

- Where are you sitting right now? Sleeping tonight? Unless it's a houseboat, it's **ON** soil. We build **ON** soils.
- Thrown anything away today? Went into a basement? Rode on a subway train? ...think landfills & basements... We build **IN** soils.
- Play any sports today? Go for a walk or a run? We play **ON** soils; baseball, tennis, football, track, parks.
- Go on a nature walk, hiked through a field or fished in the wetland? The forests, fields and wetlands we enjoy are all sustained **BY** soils.

What are you wearing right now? Jeans... t-shirt... socks... probably something made from cotton. We wear clothes made from plants grown **IN** soils.

What's your menu been like lately? Even junk food, like chips, comes from potatoes. Potatoes and other vegetables, along with fruits and grains are grown **IN** the soil.

Drink any water today? Every drop of water we drink has been filtered **THROUGH** soils.

Now you're THINKING. List some ways soils have made your life possible today:

The Big Secret



Now that you know you can't live without them you are probably wondering – what exactly are soils? First, soils are alive!!! Soils are bursting with countless living organisms. They are also full of minerals, air, water and decomposing dead plants, animals and microbes. There are thousands of different kinds of soils on Earth, because they are constantly being created and changing and even being destroyed. Remember...soils make our lives possible every day!



Organic: living or once living material.



Inorganic: non-living material.

© NACD/FAO 2015

TXT MSG FRM UNDR UR FT



What do **you**, **coltan** and **gorillas** in the Congo all have in common? Your **cell phone**! Let's start with the coltan. It's a metallic ore that is mined out of the soil and is then refined into a heat resistant powder. It does a great job of holding an electric charge in your cell phone. The mining isn't easy on the people who do it... or the soil. Workers dig large holes by hand in streambeds, scraping away surface soils to get to the coltan. Where do gorillas fit in? The main area where coltan is mined, in the eastern areas of the Congo, is also the home of the Mountain Gorilla. Clearing the soil to make mining coltan easier for the workers destroys the gorillas' food sources and homes. It is estimated that in some areas the gorilla population has been cut nearly in half. What can you do? **Recycle** or **donate** your used cell phone. Or work with a local organization in your community that recycles cell phones.



Quotation Excavation

The words in each column go into the spaces right under them, but you have to figure out the right order! When all of the words are in the right spot, you will be able to read a quote from left to right. Some of the words have been put in their spaces for you.

HARD A ALL AND MATERIAL,	CLOAK LIFELESSNESS. THAT HELD SURFACE	TO BY OF LIES	BETWEEN LOOSE, GRAVITY, THE	IS LIFE EARTH'S SOFT
	CLOAK			
				EARTH'S
HARD			GRAVITY,	
		LIES		

Answer on last page

© NACD/FAO 2015



I could have had a soil!

Plants absorb minerals that are on the surface of soil particles and dissolve in water in the soil. We digest these minerals when we eat the plants. That's one of the reasons fruits and vegetables are so healthy. Now you know why Popeye had bulging biceps and rock hard abs from eating spinach! Animals absorb these minerals also: from zebra grazing under the sun in South Africa to squirrels munching on acorns in a local park. These minerals become part of soils when rocks weather or break down into particles. Rocks are formed from eight elements found in abundance in the Earth's crust: oxygen, silicon, aluminium, iron, calcium, sodium, potassium and magnesium. Minerals are a mixture of these eight elements.

Have you had your soil today?

Form the eight elements found in minerals by rearranging the letters in each word on the left **AND** adding one of the groups of extra letters shown on the right to it. The first one has been done for you.

OXEN	+	G Y	=	OXYGEN
OXEN		C U C	=	_____
MUD		I O S	=	_____
MAIN		G Y	=	_____
COIN		M P S I U	=	_____
OATS		R O	=	_____
GAMES		M U U L	=	_____
MAIL		N U M I I	=	_____
IN		L I S	=	_____



© NACD/FAO 2015

Put on Your Boots & Go DIG IT!

It's time to take a closer look at the soils you have in your own back yard and see why they are important to you. One of the qualities scientists use to type soils is their texture.



Soil texture

A soil's texture depends on its particle size. There are three kinds of soil particles: **sand, silt and clay**. You are going to separate a soil sample into layers so that you can see if you have clay, sand or silt in your back yard!

You will need:

- 1 sheet scrap paper
- 3 cups/750 g soil
- ruler
- clear 2-litre bottle, or other large, clear bottle
- water
- 38 cm x 38 cm piece of window screen on a wood frame (optional)

What to do:

1. Rinse out the bottle and take off the label.
2. Fill the bottle with water until it is 12-13 cm from the top.
3. Gently rub the soil through the screen (optional).
4. Use the scrap paper to make a funnel and finish filling the bottle to the top with the screened soil.
5. Put the cap on the bottle and shake for 2-3 minutes, then let sit without moving for at least 72 hours.
6. Texture it!
 - measure the height of the total soil sample. _____ = A
 - measure the height of each layer of different particle sizes: sand (bottom layer), silt (middle layer), and clay (top layer).
_____ = B (sand)
_____ = B (silt)
_____ = B (clay)
 - divide the height of each layer by the total height of the whole soil sample. $B \div A = C$
 - multiply that number by 100 to get the percentage of sand, silt or clay in your soil.
 - $C \times 100 =$ percentage of SAND, SILT, or CLAY in soil sample.
 - decide what your soil's texture is by whether it has more sand, silt, clay or an even mixture of all three.

EXAMPLE:

Height of total soil sample - A = 19.05 cm

Height of silt layer - B = 5.715 cm

$5.715 \div 19.05 = 0.3$

$0.3 \times 100 = 30\%$ silt in this soil sample

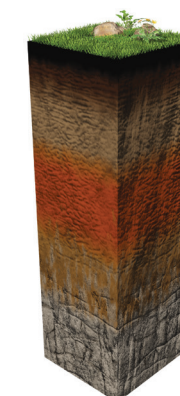


Photo provided by Soil Science Society of America

© NACD/FAO 2015

Why does soil type matter?

The types of soils you have in your area matters! Many things we do every day rely on soil type, such as:

- your next meal! Which fruits, vegetables and grains can be grown as crops where you live? The world's population is increasing, while suitable farming soils are decreasing.
- where you can build a basement or a superhighway.

- possible dangers! Could there be erosion, landslides or mudslides near you?
- the number and different kinds of organisms living in the soil. The more the merrier! Living organisms help keep soil healthy. Speaking of which... Ever been told you "bug" someone? Ever wanted to? ...
- The forests, fields and wetlands you enjoy would not be possible without the right types of soils!

Basic Soil Textures:

This marble, baseball and basketball represent the difference in size between particles of clay, silt and sand.

Clay

Particle Size: *Smaller than .002mm*

Compaction: *Tight, very little space between particles.*

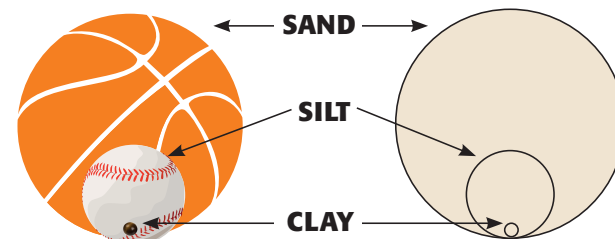
Description: *The smallest of the soil particles, it tends to hold water and feels slimy when it's wet. It is great for wetland plants, but there is not enough air or space for roots between the particles for most crop plants to grow well. Clay soils are more likely to be involved in landslides than other types of soils.*

Silt

Particle Size: *.002mm to .05mm*

Compaction: *Medium sized particles hold both air and water well.*

Description: *Good soil for growing crop plants because it holds nutrients, has plenty of air space and filters water.*



Sand

Particle Size: *.05mm to 2mm*

Compaction: *Loose with a lot of air space.*

Description: *It is gritty to the touch and prone to erosion. It is great for plants that can handle very little water, but often too dry for crop plants to grow well because it does not hold water.*

Loam

Loam is the most productive of all soil types. It contains a fairly even mixture of sand, silt and clay.

It provides enough nutrients, air and water for almost any plant to grow.

Put on your antennae & dig in to the Soil Food Web!

Think about the size of a teaspoon. If you have a big mouth it can take a few spoonfuls of corn flakes to fill it up in the morning! Now think about a teaspoonful of soil...don't worry, you don't have to put it in your mouth. Believe it or not, there are hundreds of thousands of life forms in that one teaspoon of soil. A single shovelful of soil has more organisms living in it than one teaspoon of soil. A single shovelful of soil has more organisms in it than all of the people living on planet Earth! These organisms range from single-celled bacteria to nematodes, earthworms, insects, small vertebrates and plants. They are part of the soil food web—a community of organisms that live their lives in the soil. So, what is life in this community like?

Life in the soil isn't easy. It's a constant cycle of **WHO EATS WHO** and who eats what. For you and me, it's a matter of life and death! Many of the organisms living in the soil are decomposers. Decomposers are microorganisms, insects and other animals that eat the remains of dead plants. They live by breaking apart dead plants and animals for energy. At the same time they release the nutrients the dead plants were built of and put them back into the soil. Plants have to have the nutrients to grow... we have to have the plants for food, fabrics, and wildlife. Some special microbes can even decompose pesticides so that a little less pollution gets into our water. As these organisms in the soil food web eat (sometimes each other) and live out their life cycles in soils, they make it possible for the Earth to have clean water, clean air, and healthy plants.

WHERE does all this happen? All of these organisms have their own "microscale environments" inside and in between soil particles just like those you looked at in the *Put on Your Boots & Go Dig It* activity. Every field, forest and back yard has a unique soil food web with its own mix of bacteria, fungi and other organisms. The ratio of fungi to bacteria depends on the **TYPE OF SOIL**, climate, vegetation and land management practices. Do you think you could dig into the "who eats who" world of the soil food web? Are you ready to put on your antennae and **MORPH** into a bug? Or worm? Or protozoa? Or centipede? Or mite? Or nematode? Or bacteria? Or fungi? You decide what you want to morph into, based upon **YOUR** soil type, climate, vegetation and land management practices.

See if your school has a photo morph software to make your creature! Start with a picture of you and be creative!

A few **MORPH** hints:

- 1) Agricultural soils have food webs dominated by bacteria.
- 2) Fungi dominate the food web in forests.
- 3) Research your food source! Some nematodes love to eat bacteria, while others prefer fungi.
- 4) Land management can change food webs. For example, reduced tillage leads to increased fungi, decreased bacteria, increased arthropods and earthworms.

