

# Dena Marshall

United States Department of Agriculture (USDA)– Natural Resource Conservation Service (NRCS) Soil Scientist, IN



## Why is it important to learn about soils?

Soil is the foundation for EVERYTHING that we are and do. From the clothes we wear, the food we eat, to the houses we live in, it ALL has its start from the soil in some way! This is why we are so concerned with protecting and improving our soils because it can take thousands of years to create an inch of good topsoil, but if we are careless it can be washed or eroded away in minutes.

## Are there many girls who go into the soil science field?

Within the USDA-Natural Resources Conservation Service (NRCS) there are roughly 120 women soil scientists working in various roles of soils. From field mappers and soil classifiers to laboratory scientists and resource soil scientists helping the public utilize soil information to management positions in the cooperative soil survey.

## What are some of the most important things you do in your job?

Helping people make wise use decisions about their soils! Educating the public as to why our soil is important and how to find out more information about it. I help protect the environment by identifying wetlands and other environmentally sensitive areas. I think being an example for other girls thinking about a career in soils has been my greatest accomplishment. I truly love my job and my motto is "It's been a GOOD day when you come back dirty!"

# Dr. Patrick Megonigal

Dr. Patrick Megonigal, Senior Scientist, Deputy Director Smithsonian Environmental Research Center (SERC), MD



## Why are soils important to each citizen?

Clean water, fresh air, forests, grasslands, wetlands, wildlife, food, clothing and energy all emerge from soils. If we care for soils, then soils will care for us and the natural world we cherish.

## What kinds of subjects should kids study to become a scientist?

All subjects and all skills prepare a young mind to be a scientist. Science, math, art, history and wood shop are all important topics because science is full of creativity and tinkering.

## What do you love about your job the most?

I love being my own boss and doing different things every day. I especially like working outside and being around people who are excited by nature.



National Association of Conservation Districts (NACD)  
www.nacdnet.org



www.soils.org

## Ask Maxine

### Question:

Why do scientists study soil?  
Is it really that important?

### Answer:



YES! Almost all of the minerals and nutrients we need to live, to grow, to give us energy and to keep us healthy come from fields, gardens, trees and pastures. Almost all of the foods we eat get their nutrients from the soil. Only a small fraction of Earth's soil can be used for growing food, and we are already farming most of it. To help prevent world-wide hunger in the future, we must keep our soil healthy.



Maxine worked for NACD for 47 years.  
That's why we always ask Maxine.



Pg 6 Soil Matters: "The nation that destroys its soil destroys itself" Roosevelt 1937

4 organic, 6 unweathered.

Pg 4 Hello Horizons: A: ROSS: 5 horizons, 7 mineral; DOWN: 1 topsoil, 2 silt, 3 roots.

Pg 2 Life is Busy in the Soil: decomposers, infiltration, release, control, aerate, burrowing.

ANSWER KEY

## Thinking about a career in Soil?

Visit <http://www.soils4teachers.org/files/about-soils/soil-career-poster.pdf>

Special thanks to the NACD S&E Committee and reviewers

Contact: [stewardship@nacdnnet.org](mailto:stewardship@nacdnnet.org)

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Visit <http://www.nacdnet.org/general-resources/stewardship-and-education-materials/2019-life-in-the-soil-dig-deeper/> and [www.soils4teachers.org](http://www.soils4teachers.org) for additional education materials

Booklet designed for use with Grades 4-5



Level 3 Grades 4-5



Where Does Soil Come From?



Soil Matters!



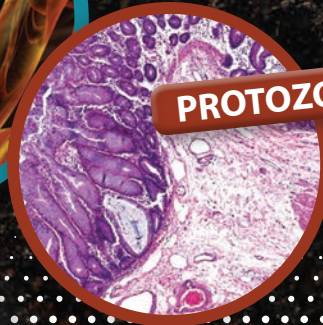
# There's Something Living



FUNGI



BACTERIA



PROTOZOA



NEMATODES



## Life is Busy in the Soil

Draw lines to connect the syllables on the left to the syllables on the right to discover just a few of the jobs that soil organisms do every day. Use the words you create to fill in the blanks.

INFIL  
RE  
CON  
DECOM  
AER  
BUR

LEASE  
TROL  
POSERS  
ROWING  
TRATION  
ATE



Most **bacteria** are

that convert the energy stored in the organic matter found in soil into forms useful to the rest of the organisms living in the soil. Some bacteria can even break down pesticides and pollutants in soil, making it healthier.

**Fungi** are microscopic cells that usually look like long threads as they grow. These threads are called hyphae. The length of a single hypha can range from a few cells to many yards. Hyphae join soil particles together which helps increase water



into the soil.



# Under My Feet!



**Did you know** that you are walking on living organisms every time you walk to the school bus, to the garage to get your bicycle or through the yard to get to the mailbox? **ONE TEASPOON of soil can hold between 100 million and 1 billion bacteria and other organisms.** A few of the organisms you might find living in the soil under **YOUR** feet are shown here:

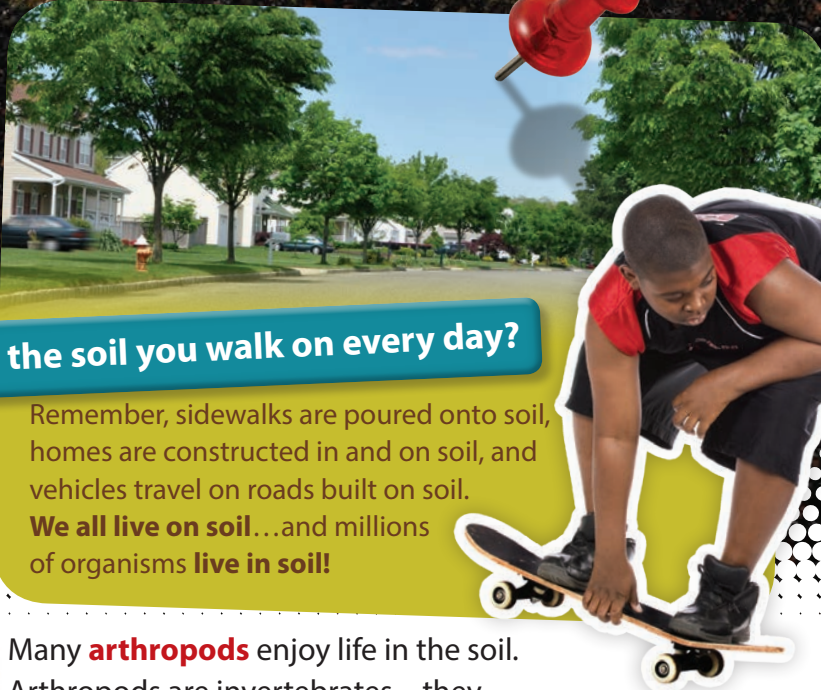


**EARTHWORMS**

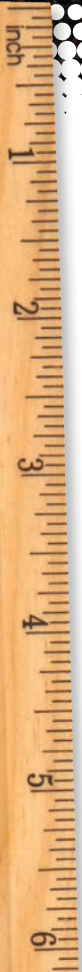


**ARTHROPODS**

## What is living in the soil you walk on every day?



Remember, sidewalks are poured onto soil, homes are constructed in and on soil, and vehicles travel on roads built on soil. **We all live on soil...**and millions of organisms **live in soil!**



**Protozoa** are single-celled organisms that like to eat bacteria. They are much bigger than bacteria ranging from 1/5000 to 1/50 of an inch in diameter (try to measure that with your ruler)! As they munch on bacteria, protozoa \_\_\_\_\_ excess nitrogen into the soil that can then be used by plants and other organisms.

A few species of **nematodes** that cause plant disease get a great deal of attention, but most nematodes work hard at keeping soil and the organisms that depend upon it healthy. These beneficial nematodes help \_\_\_\_\_ disease and make nutrients available to other organisms.



Many **arthropods** enjoy life in the soil. Arthropods are invertebrates – they have no backbone, but they do have an exoskeleton. As they eat, arthropods \_\_\_\_\_ and mix the soil, as well as shred organic matter found in the soil.

**Earthworms** are hermaphrodites, meaning that they exhibit both male and female characteristics. They do much of the recycling in the soil like the recycling of nutrients. Another important job carried out by earthworms is \_\_\_\_\_ which leads to tunnels lined with recycled nutrients. This makes it easier for roots to grow deep into the soil, keeping plants healthy.



# Skin of the Earth-Soil

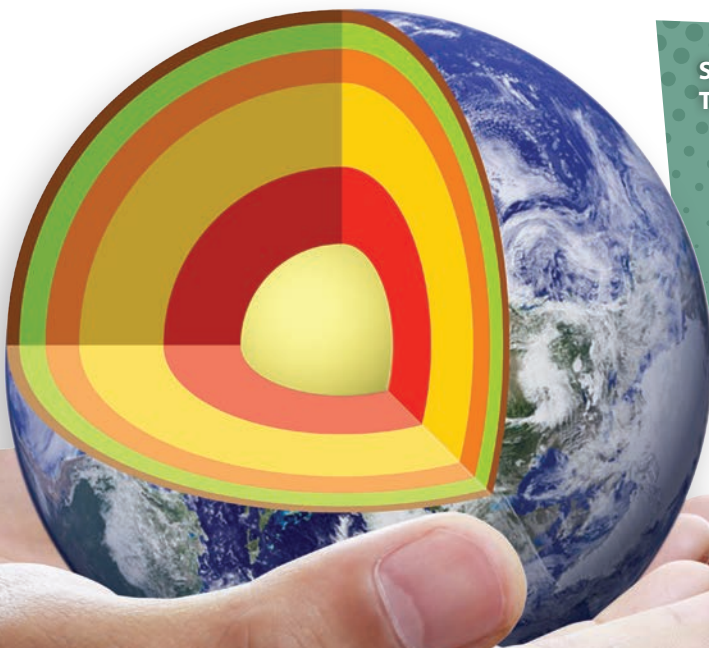
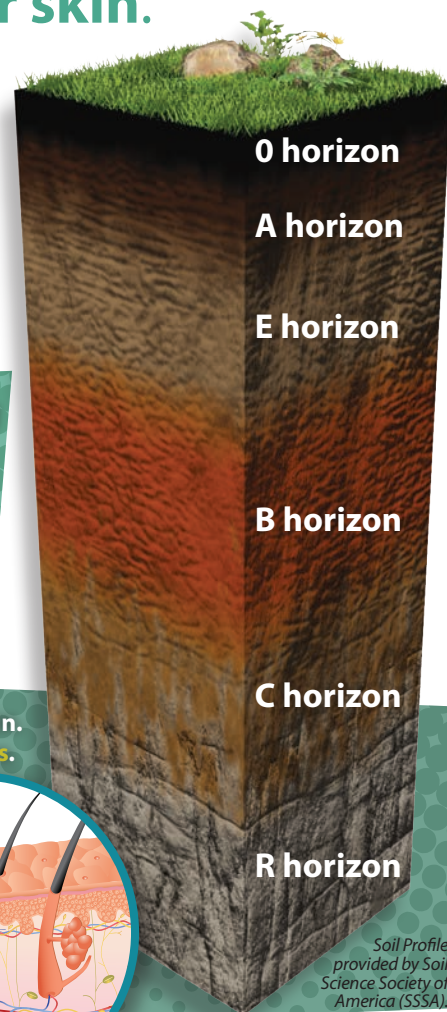
In some ways, soil is like our skin.



Soil is a thin **living** layer that covers planet Earth like our skin covers us. Soil is jam-packed with living organisms; some we can see but most we cannot. They range in size and variety from tiny bacteria to moles!

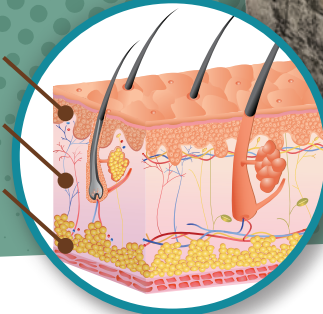


Soil comes in many **colors** just like our skin does. Organic matter, minerals and the amount of moisture in soil are a few of the things that affect its color. For example, the mineral manganese oxide causes a black color in soil and the mineral glauconite makes soil look green.



Soil is made up of **layers** like our skin. The layers of soil are called **horizons**.

Epidermis  
Dermis  
Subcutaneous Tissue



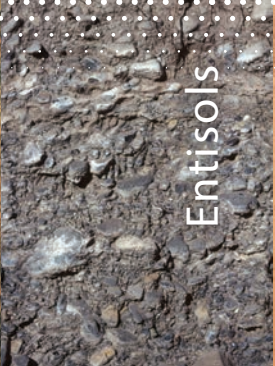
Soil **protects** against pollution like skin does. Our skin helps keep germs from entering our bodies. Soil filters pollutants, and this helps protect our drinking water.



Alfisols



Aridisols



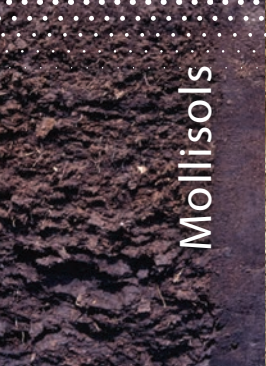
Entisols



Histosols



Inceptisols



Mollisols

## Hello Horizons!

Choose from these words to answer the clues and complete the puzzle. **Not all words will be used.**

LIVING	MINERAL	TOPSOIL
UNWEATHERED	ORGANIC	SILT
ORGANISMS	ROOTS	EARTH
OXIDE	HORIZONS	WATER
SKIN	POLLUTION	

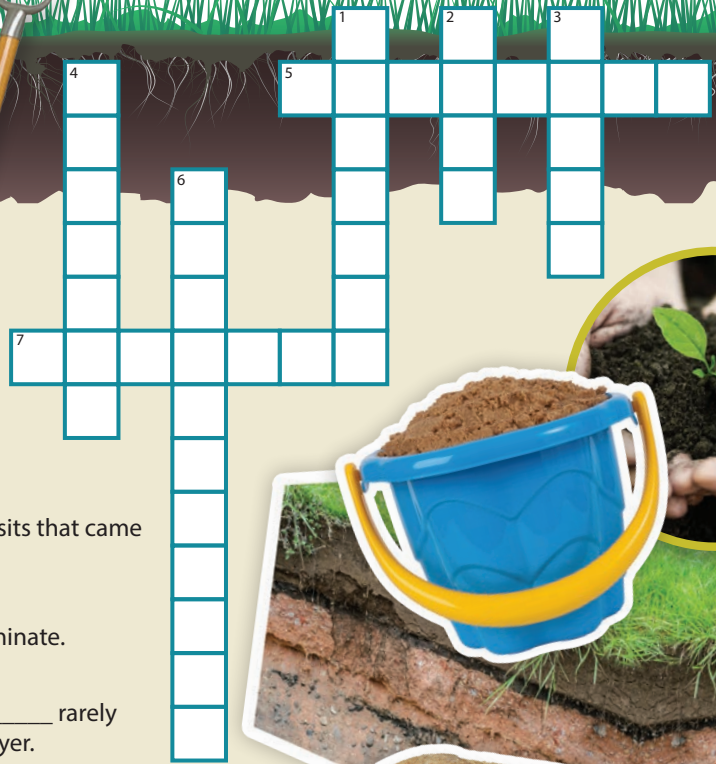
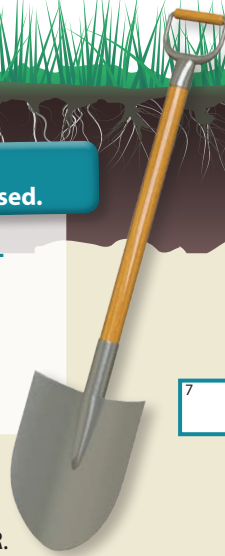
### CLUES

#### Across

5. The six soil \_\_\_\_\_ are: O, A, E, B, C, and R.  
 7. The B horizon, or subsoil, contains clay and \_\_\_\_\_ deposits that came from the layers above as water dripped through them.

#### Down

1. The A horizon is called \_\_\_\_\_ and it is where seeds germinate.  
 2. The E horizon is made up mostly of sand and \_\_\_\_\_.  
 3. The C horizon is made up of broken-up bedrock. Plant \_\_\_\_\_ rarely grow into this horizon and there is very little organic material in this layer.  
 4. The O horizon is the top layer of soil. It is rich in decomposed \_\_\_\_\_ matter.  
 6. The R horizon is a layer of \_\_\_\_\_ rock (bedrock) beneath all of the other horizons.



# Now That's My Type of SOIL!



**Soil is broken down into twelve different general categories.** Each one has its own characteristics such as depth, color, texture, structure and mineral content. It is helpful to know what kind of soil is in your area to enable your family to choose the best plants and trees to grow in your garden and yard.

**The twelve categories of soils are:** Alfisols, Aridisols, Entisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, Gelisols, Andisols and Vertisols.

Visit your local Soil and Water Conservation District office to find your soil type or go to: <http://websoilsurvey.nrcs.usda.gov> or [http://soils.usda.gov/survey/printed\\_surveys/](http://soils.usda.gov/survey/printed_surveys/) to investigate soil types online.

Oxisols

Spodosols

Ultisols

Gelisols

Andisols

Vertisols

Why Should

SOIL

Matter to Me?



Watch the clock and count how many breaths you take in one minute. Now multiply that amount

(shown below) to discover how many breaths you take in one day.

           X 60 =             
(number of breaths) (minutes in an hour) (breaths per hour)

           X 24 =             
(breaths per hour) (hours in a day) (breaths per day)

You (and your favorite animals) can take those breaths because the trees, plants and grasses living in the soil provide you with the oxygen that you must have to live.



Next question... What have you eaten today?

Make a list:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

In your list, **draw a circle around** each item of food that **grew** in soil (like potatoes), was **picked** from a tree or plant growing in soil (like oranges), **was** an animal that grew by eating plants grown in soil (like hamburger) or **came** from an animal eating food grown in soil (like eggs).

You and most of the animals you share the planet with have nutritious food to eat because of the soil from which it is grown.

# Soil Matters

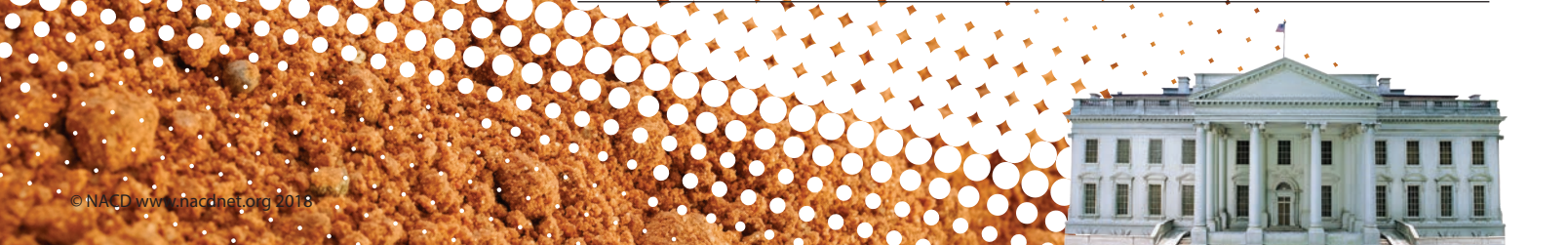
Place the letter tiles in the right order to reveal a quote made by the 32<sup>nd</sup> President of the United States.

T	S	E		S	E	"		S	O	I		R	O	Y		T	S		E	S	T		1	9			
R	O	Y		3	7		E	L	T		L	D		T	H	A		R	O	O		"	T	H		T	D
S		I		S		I		L	F.		E		N		O	N		A	T	I		E	S	T			

Write the quote here:

\_\_\_\_\_

\_\_\_\_\_



# Where Does Soil Come From?

**5 factors**  
play a part in  
soil formation:



**Geology**



**Climate**



**Topography**



**Biology**



**Time**

Let's take a look at each one.

## 1 Geology

In order for soil to form, the land has to be covered with regolith.



**Regolith:** the layer of loose rock particles that covers the bedrock of most land on the Earth and the Moon.

A solid surface made of stone will not form soil until it is broken down into smaller particles.

## 2 Climate

Warm temperatures and an abundance of water usually lead to faster soil formation. Cooler temperatures and low amounts of water from precipitation slow down the formation of soil.



### What is your climate like?

Go to [www.ncdc.noaa.gov/cag](http://www.ncdc.noaa.gov/cag) to find your own:

Average temperature

Average precipitation



**Climate**

### Hurricanes & Soil

Hurricanes not only cause a huge amount

of damage above ground, they also cause damage to the ground itself — the soil. Soil is carried by hurricane winds and can be put down in new locations where it can make changes to the environment. Sometimes the added soil can change the chemical or physical characteristics of its new location. This can cause harm if it is a sensitive area such as a coral reef.

## 3 Topography

Topographic features of land include both natural features (mountains and rivers) and those that are human-made (roads and ditches). Steep slopes tend to erode faster than level land; so soil has a better chance of forming on level land before it is eroded away.



Go to: [nationalmap.gov/ustopo/index.html](http://nationalmap.gov/ustopo/index.html) to see topographical maps for the United States.

## 4 Biology

Living organisms have a huge impact on soil. The roots from plant life make passages for water, air and animals. The animals loosen the soil as they move through it, as well as add nutrients in the form of waste products and decaying dead bodies.



## 5 Time

Soil can take thousands or even millions of years to form!



### Topography & Soil

The highest point on Earth is Mount Everest at 29,035 feet above sea level. According to a news release by the Soil Science Society of America in 2010:

- The results of the study of snow and soil samples collected on Mount Everest showed levels of arsenic and cadmium that exceed the EPA's drinking water standards.
- One-tenth of the world's population relies on mountain snowpack as its sole source of fresh water.
- Understanding the amount of pollutants in soil and snow is critical to maintaining the quality of alpine water sources.



**Topography**