



# What is Soil and Why Is It Important?

One of Earth's most important natural resources is soil. There are many different soil types. Illinois alone has over 700 different soil types. It takes, on average, 500 years to form one inch of topsoil. Although soil takes a long time to form, it can be destroyed very easily. Most life on Earth depends upon the soil for food. Plants are rooted in the soil and get nutrients (nourishing substances) from it. Animals also get nutrients from eating the plants that grow in the soil. Soil is home to many organisms such as seeds, spores, insects, and worms. We build sidewalks, roadways, and homes on the soil. Soils also help filter out pollutants that could contaminate our drinking water. Everyone must take an active role in improving and preserving our Earth's soil. Everyone must take an active role in improving and preserving our Earth's soil.



# Plants Keep It in Place



## At Home

Have you ever looked at the yard of a newly built home after a hard rain? Since there is no grass in the yard, gullies or small trenches form. This is called erosion. Erosion is the wearing away of soil by wind and water. When erosion occurs, the topsoil layer is washed or blown away. In the United States, erosion causes the loss of 6.43 billion tons of soil per year. This would be the equivalent of 320 million dump trucks. If you were to park these trucks end to end, they would extend to the moon and three quarters of the way back. In Illinois, the majority of our soil loss is caused by water erosion. The best way to prevent wind and water erosion is to protect the soil with healthy vegetation

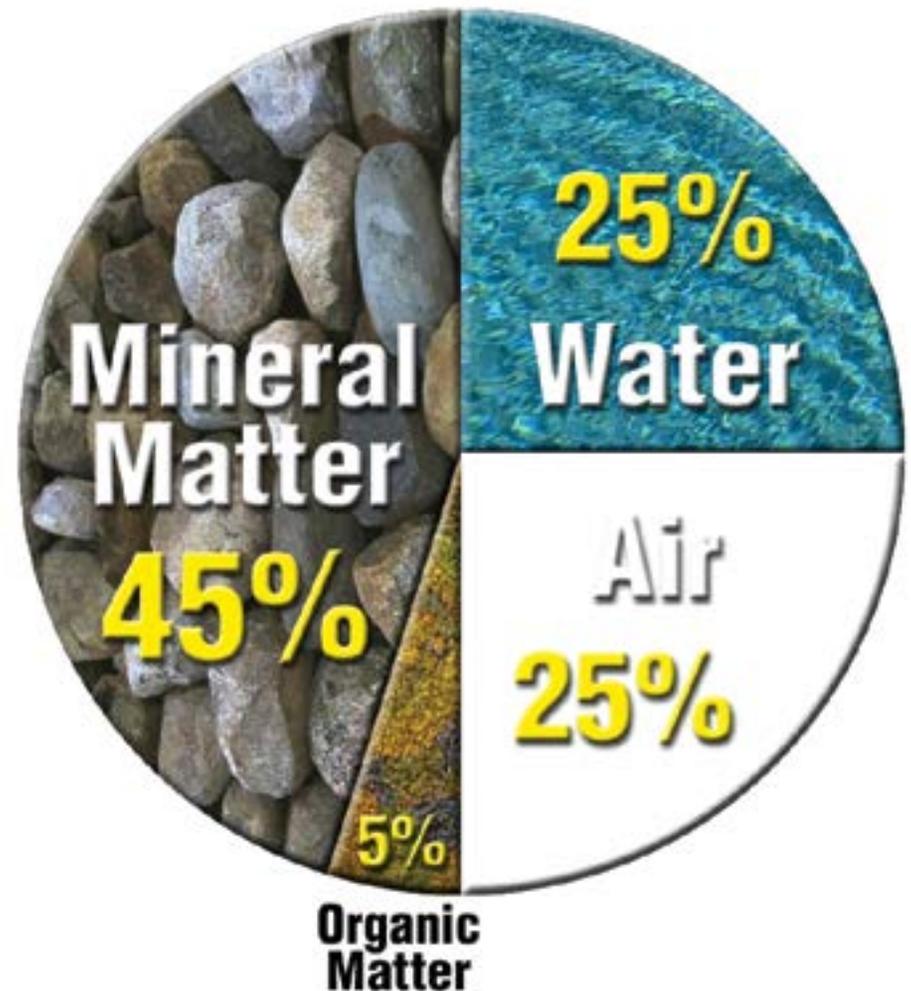
## On the Farm

Even dead plants help prevent soil erosion. In the past, farmers plowed their fields after harvest to mix the plant stems and leaves with the soil. This is called tilling. Today many farmers leave the stems on the ground to help keep the soil in place. This is called conservation tillage and includes no-till and strip till.



# Soil Parts

About one-half of soil is made up of pores full of air and water. Roots need oxygen from the air, and they need water since plants are made of mostly water. The other one-half of soil is minerals and organic matter (humus). Some of the nutrients in the humus and minerals dissolve in the water so plants can absorb them.



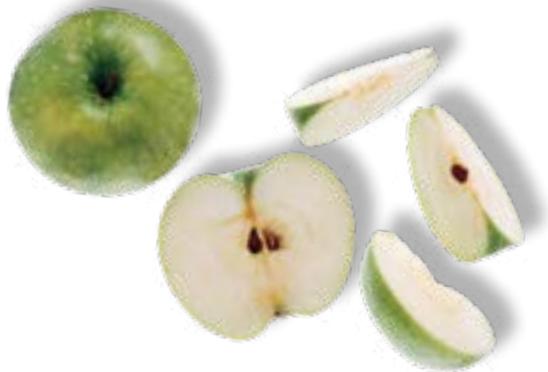
# A Slice of Soil

Soil is one of our most important natural resources on the earth's surface. Many living things depend on it for food. People do, too. Not all soil is good enough for plants to grow. Complete this activity to learn just how little soil we have to grow food.

An apple and paring knife are needed for this activity:

1. Cut an apple into four equal parts. Three parts represent the oceans of the world. The fourth part represents the land area.
2. Cut the land section in half lengthwise. Now you have two  $\frac{1}{8}$  pieces. One section represents land such as deserts, swamps, antarctic, arctic, and mountain regions. The other  $\frac{1}{8}$  section represents land where man can live and may or may not be able to grow food.
3. Slice this  $\frac{1}{8}$  section crosswise into four equal parts. Three of these  $\frac{1}{32}$  sections represent the areas of the world that are too rocky, too wet, too hot, or where soils are too poor to grow food. Plus, we can't grow food on some land because cities and other man-made structures are built on it.
4. Carefully peel the last  $\frac{1}{32}$  section. The peel on this small piece represents the amount of soil on which we have to grow food. This amount of soil will never get any bigger.

With so little soil and so many people on the earth, how are we able to grow enough food to feed everybody?



# Sensational Soil

Try to remember some times when you played in soil. Did it feel soft some times and gritty at other times? Soil can feel different from one time to another depending on what's in it.

Sandy soil is made up of mostly sand. Sandy soil feels gritty and allows water and air to move through it.

Silt feels like flour when dry and is very smooth and soft when moist. Silt particles keep the soil softer and easier to plow than soils with too much clay.

Clay soil has mostly clay, some organic matter, silt, and a little sand. Clay particles are very fine and are the smallest of the three types of soil particles. Clay is sticky when wet and hard like bricks when dry.

# How is Soil Formed?

Soil is formed from rocks and minerals very slowly breaking down and organic matter slowly accumulating as humus.

## Materials:

- 2 different kinds of rocks
- Paper bag

1. Using two different kinds of rocks, rub the two pieces together over a paper bag.
2. What happens when you rub the rocks together?
3. What do you notice about different types of rocks?
4. Where would you find rocks being worn away in nature?





# Nutrients Help Plants Grow

Farmers must take good care of the soil so they can grow the best food possible. Modern technologies allow the farmers to test the soil for adequate nutrients. By testing the soil, farmers use the exact amount of nutrients to maximize plant growth and maintain soil health.

**Nitrogen** – Nitrogen is found in the air and soil. Many crops use nitrogen. That means farmers and gardeners add more to the soil to replace what's been used. One way farmers add nitrogen to the soil is to plant different crops, at different times, in the same field. A farmer will grow corn in the field one year and plant soybeans in that field the next year. Growing corn takes nitrogen out of the soil, but growing soybeans puts nitrogen back into the soil.

**Phosphorus** – Phosphorus helps plants store and use energy from the sun to make food for themselves. This process is called photosynthesis. Plants need large amounts of phosphorus as they begin to grow and when the weather turns cold. Phosphorus comes from mined rock phosphate, which is then processed into a form that can be easily absorbed by plants. Plants need large amounts of phosphorus to store and use energy from the sun to make food. This process is called photosynthesis. Phosphorus also promotes root growth and winter hardiness.

**Potassium** – Potassium makes cotton from cotton plants stronger, helps fruit stay fresher longer, and helps grass stay greener. Potassium helps plants survive droughts, diseases, and very hot and cold temperatures. It also helps plants produce starches, controls root growth, and opens and closes pores for water. Potassium is found in the soil but only a small amount is available to plants. That's why farmers add potassium fertilizer to soil.



## Soil Has Three Main Layers

1. **Topsoil** – Here is where the plants grow. Wind or water erosion can wash away this valuable layer if farmers don't protect it. In fact, it takes nature over 500 years to replace one inch of soil. Most nutrients, organisms, and roots are in this layer.
2. **Subsoil Layer** – This layer is about one foot below the surface. Deeper tree roots and earthworms live here.
3. **Parent Material** – This is the bottom layer, about three feet below the surface in the Midwest. It is more compact and often has stones and rocks in it.

# Soil Sammy

## Materials Needed:

- Knee-High Stocking
- Grass Seeds
- Potting Soil
- Baby Food Jar
- Water
- Jiggle Eyes
- Fabric



1. Using a stocking, place some grass seeds in the toe where you want it to grow. The toe of the hose is the head of Soil Sammy and the grass looks like hair when it grows.
2. Pack a handful of soil in the end of the stocking on top of the seeds. Make sure the ball of soil is slightly bigger than the opening of the baby food jar.
3. Tie a knot in the stocking under the ball of soil.
4. Completely wet the head of Soil Sammy. Place the top of the hose (which is the bottom of Soil Sammy) in a baby food jar filled with water making sure the head is above the mouth of the jar. The end of the hose will absorb the water to feed the grass seeds, which will germinate through the hose. (You may have to cut a few small holes in the hose to help.)
5. Now you can decorate! Suggestions are a round piece of fabric to fit over the mouth of the jar for a shirt. You can add buttons to the shirt or jiggle eyes on the face and cut out felt for a mouth.
6. Water as needed and be sure to cut the grass “hair” and style as desired.

Will the grass hair grow better or faster with fertilizers? Try it and find out. Add different fertilizers to the soil and water and see which grows best.

### Add to the Water:

- Store-bought liquid fertilizer
- Soda Pop (It has phosphorus.)
- Apple juice (It has citric acid.)
- Lemon scented liquid soap (It has citric acid.)
- Ammonia (It has nitrogen.)

### Add to the Soil:

- Store-bought fertilizer stick
- Coffee grounds (The caffeine has nitrogen.)
- Baking Soda (It has nitrogen.)
- Epsom Salt (It has magnesium sulfate.)
- Cream of Tarter (It has potassium.)



# Say It With Soil

Do people really say things about soil? Check out these quotes and see if you can figure out why the authors said them. Research the authors and their connection to soil. What does it mean to you? For more ways to Say it With Soil, check out the Illinois Soil mAGic Kit!

A Nation  
that destroys  
its soil,  
destroys itself.

**Franklin D. Roosevelt, 1937**



We know more about  
the movement of  
celestial bodies  
than about the  
soil underfoot.

**Leonardo DaVinci, 1500s**



We are part of the  
earth and it is part of  
us.... What befalls the  
earth befalls all the  
sons of the earth.

**Chief Seattle, 1854**



The wealth of Illinois  
is in her soil and  
her strength lies in  
its intelligent  
development.

**Andrew Sloan Draper -  
President, University of Illinois  
1899**



# Nutrients Help Grow More Food

There are more than seven billion people in the world. That's more people on the earth than ever before. With so many more people and the same amount of land, how are we able to grow enough food for everyone? Crop nutrients help us grow more food on the same amount of land. That means there are more apples on each tree and more peas in each pod.



7,310,193,000

## Soil Conservation Techniques

Soil Conservation is the protection and careful use of soil to prevent it from being lost or wasted. There are many soil conservation techniques that farmers use.

### No-till:

A way of growing crops from year to year without disturbing the soil through tillage.

Benefits:

- Excellent erosion control
- Soil moisture conservation
- Minimum fuel and labor costs
- Builds soil structure and health



### Strip-till:

A conservation system that uses minimum tillage.

Benefits:

- Removes the residue from the row area allowing sunlight to hit the soil surface and warm the soil.
- Reduces soil erosion



### Contour farming:

The farming practice of plowing and planting rows across a slope instead of up and down a hill.

Benefits:

- Reduces soil erosion
- Promotes better water quality by reducing runoff



### Conservation Crop Rotation:

The practice of growing a series of different types of crops in the same area in sequential seasons.

Benefits:

- Reduces the risk of soil erosion
- Prevents soil depletion
- Maintains soil fertility
- Helps control weeds

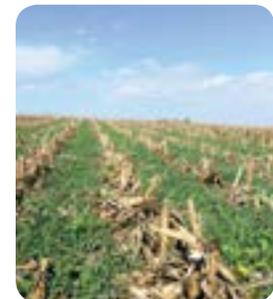


### Cover Crops:

A crop planted primarily to manage the soil.

Benefits:

- Reduces soil erosion
- Increases residue cover
- Increased water infiltration
- Improves soil by adding organic matter, nutrients, and stability
- Traps leftover nutrients



## Vocabulary

**Erosion:** The process by which the surface of the earth is worn away by the action of water, glaciers, winds, waves, etc.

**Tillage:** The preparation of land for growing crops.

**Conservation:** Protection of natural resources.

**Field Residue:** Materials left in an agricultural field or orchard after the crop has been harvested. This residue includes stalks and stubble (stems), leaves, and seed pods.

**Soil Fertility:** The ability to sustain plant growth. A fertile soil is rich in nutrients necessary for basic plant nutrition, including nitrogen, phosphorus and potassium.

**Organic Matter:** Matter composed of organic compounds that have come from the remains of organisms such as plants and animals and their waste products in the environment.



# Career Corner

**Caroline Wade**  
Nutrient Watershed Manager  
Illinois Corn



***What proactive measures are farmers taking to protect local watersheds?***

Farmers are proud stewards of the land and work hard to make sure the land will continue to be productive for many years to come. They also want to maintain and improve soil and water quality, so they are careful about where, when and how they apply nitrogen and phosphorus to their fields. They want to ensure those nutrients remain in the field to grow their corn and soybeans. One way farmers do this is by planting cover crops, which hold on to nutrients, keep soil in place and can help improve the health of the soil. Some farmers build grass waterways, buffers, wetlands and bioreactors as a way to keep even more nutrients from washing away in the water.

***What can students do to make sure soil remains healthy for future generations?***

There is still a lot to learn about what makes a “healthy soil.” Plants, earthworms, bugs and microbes that live in the soil help plants grow better. Farmers need more information about how these things work together to improve the soil in order to make it more productive. Students interested in science can look for a career involving the chemistry and biology of the soil in order to find ways to help farmers grow more food.

***What course of study helped prepare you for a career involving soil and water protection?***

Science courses were the most useful in preparing me for my career. Chemistry, physics, biology, ecology, geology and agriculture classes taught me how these natural systems work. Classes in history, geography and politics provided a good understanding of the practices and rules that affect soil and water quality. And finally, English and communications classes have helped me learn how to explain and communicate this information to others who need to learn more. Without all of this knowledge and the skills to educate others, I could not be a good water quality scientist.

# Career Corner (cont.)

**Ronald D. Collman**  
State Soil Scientist  
USDA NRCS



## *Describe how you became interested in working with soil.*

From an early age, I was always interested in rocks, fossils and the natural sciences. I had a section of the garden set aside for me to plant what I wanted. I did not understand so much depends on the soil. I learned our food comes from the plants that grow in the soil, our homes are built on the soil, many of our building materials come from the soil, much of our clothing comes from plants and animals that are tied to the soil, and the list goes on. If we don't take care of our soil, it will no longer be able to provide the plants and animals needed for the population to sustain itself. Soil science ties together many natural, physical and chemical sciences to bring an understanding to the complex nature of soil and the soil ecosystem. My job has variation, including field work, lab work and computer work. The knowledge I gain and share with others leads to the intelligent use of one of our most important resources.

## *What are the major factors that farmers and homeowners will have to consider with the nutrient management plan?*

We want farmers and landowners to use the land in a sustainable way so future generations will have the same, or better opportunities to use the land to live on and also produce food. A successful nutrient management plan helps farmers reduce the amount of nutrients a farmer needs to add to a field to maintain expected yield while also reducing the amount of nutrient loss through infiltration and runoff. Specific site tests give us more knowledge to allow us to make good management decisions. Farmers want to produce as much as the soil will allow under current conditions, and to maintain that productivity over time.

## *How can students become more involved with soil?*

Soil is all around us. It touches so many parts of our lives. Start by becoming educated on the soil in your area. Dig a small hole and start identifying all the things you find in just one shovelful of soil—it just might amaze you!

This issue of Ag Mag has been provided by:



**Debbie Ruff**  
Education Coordinator  
Livingston County Soil & Water  
Conservation District



## *What does the word sustainable mean to you, as it relates to soil in Illinois?*

To me, sustainable means we care for the soil, so it maintains, and even improves its productivity. This can be done in several ways. For example, we may use more types of plant foods that are safer for the soil and safer for our food supply. We can also use nature's own way to produce more soil by leaving more residue in the field after harvest rather than plowing it under. We continue to learn the importance of caring for the soil, because the soil will care for us.

## *People are often worried about the use of fertilizers. How do you explain where fertilizers come from?*

The main plant foods or fertilizers are Nitrogen (N), Phosphorous (P), and Potassium (K). To explain plant foods, I distribute a small packet of salt substitute, a balloon and a shark tooth. When you blow up the balloon, 78% of the air is Nitrogen, a naturally occurring element. Phosphorous comes from phosphate rock, which contains the remains of ancient marine life, like a shark tooth fossil. The salt substitute contains Potassium, and is used in homes and restaurants. This demonstration shows our fertilizers and plant foods come from nature around us and are put right back into the soil.

## *What is your favorite part of soil conservation education?*

I have always enjoyed my work with students. I bring the classroom to the students with our Earth Express trailer which showcases soil, agriculture, and conservation efforts. We live in the bread basket of the world where the food we grow is used to feed people all over the world. We use hands-on activities and photographs to help demonstrate that. I also work to show students a problem, help them discover the solution, and give them some ideas of how they can make a difference. This difference might be as easy as planting something to help stop erosion or shutting off the water when they brush their teeth. I encourage students to study science – general science, earth science, environmental science, and interconnections between man and the earth. I also encourage them to read.

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