



Back to the Soil!

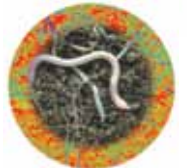
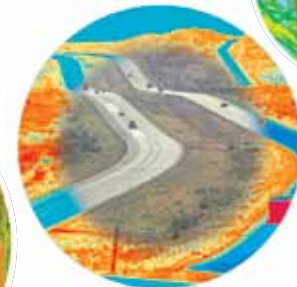
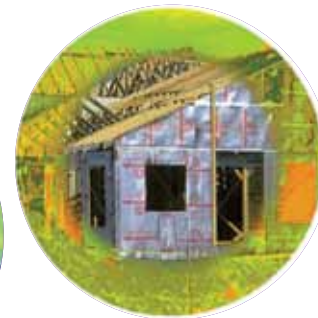
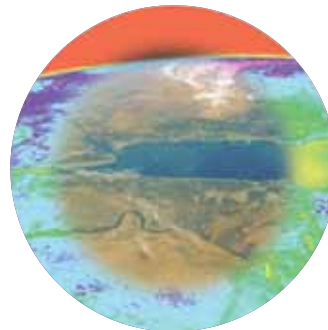
Take a look in your backpack. Chances are almost everything in it can be traced back to the soil! Your books and papers came from trees harvested from well-drained soil. Your pencils and the apple for your snack came from trees that have their roots extending deep into the soil as well! The water in your water bottle may have come from a natural spring deep within the soil. The tiny microchip in your electronic devices came from silicon processed from sand.

Illinois has over 700 different soil types. That is amazing because 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. What goes on in the soil? How does that soil impact you? Read on and discover more about the soil all around you!



Why Is Soil Important?

One of the most important natural resources is soil. 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.



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 has caused 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.

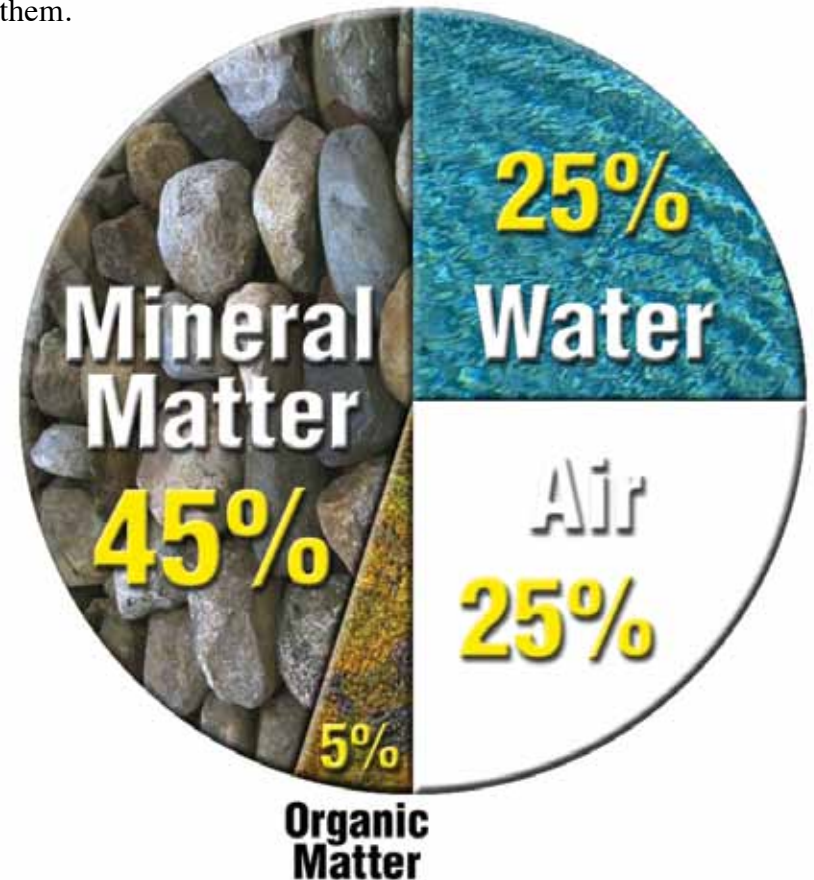
On the Farm

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 no-till farming. Illinois has more no-till acres than any other state. That makes us #1!



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 (humus) matter. 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? Read on to find out!



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.

Sand, silt, and clay particles are different sizes. Imagine a piece of sand the size of a basketball. That would make silt the size of a baseball and clay smaller than the size of a marble.



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?



Farmers Help Keep the Soil Healthy

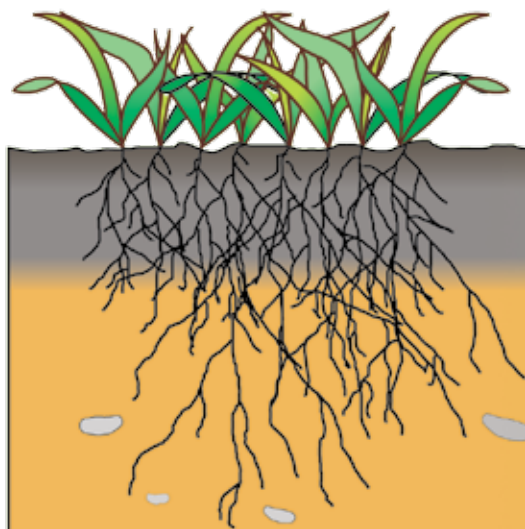
Farmers must take good care of the soil so they can grow the best food possible. Modern technologies allow farmer to test the soil for adequate nutrients.

By testing the soil, farmers use the exact amount of nutrients to maximize plant growth.

This insures that farmers are not overusing fertilizers.



**More than
30 million acres
of land in Illinois
is used for
agriculture.**



Soil Has Three 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.)
- Epson 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



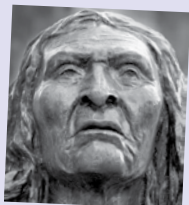
We know more about
the movement of
celestial bodies
than about the
soil underfoot.

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**



Fertilizers Help Grow More Food

There are more than six 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? Fertilizers 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.



6,336,304,199+

Fertilizers Help Plants Grow

You need to eat the right kinds of food to grow big and strong. Milk gives you calcium, oranges give you vitamin C, and hamburgers give you protein. What can you do if you are not getting enough nutrients from the food you eat? You can take vitamins!

Fertilizers are like vitamins for plants. They add different nutrients to the soil that plants need to grow stronger and healthier. The three most important nutrients needed for plant growth are nitrogen, phosphorus and potassium. Farmers typically add one or more of these as fertilizers to grow healthy food crops for us.

Nitrogen – Nitrogen is found in the air and soil. Many crops use nitrogen so fast that farmers and gardeners have to add some more to the ground. 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 put 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 is made from rock phosphate. Rock phosphate cannot be absorbed by plants, so it is processed to a form that farmers can apply to plants.

Potassium – Potassium makes cotton from cotton plants stronger, fruit stay fresher longer, and grass greener. Potassium helps plants survive droughts, diseases, and very hot and cold temperatures. It also helps plants produce starches, controls root growth, and open and close 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.

N - P - K



Make Your Own Soil Profile

Using breakfast cereal, you can make a mock soil profile showing the different layers you could see if you dug a deep hole in the earth. While soil texture varies from location to location, all soil types can be divided into layers. Large, light-colored cereals like Kix® make good parent material; smaller light- or medium-colored cereals like Rice Krispies® make good subsoil. Use a darker cereal like Cocoa Krispies® for the topsoil. Something with texture, like Raisin Bran, makes a good leaf litter layer.




- In a clear plastic cup, first place in a about 2-3 tablespoons of the Kix cereal. These represent the rocks in the ground.
- Next, add 1-2 tablespoons of Rice Krispies. This represents the subsoil, which is not as dark and rich as the topsoil.
- The topsoil comes next, so add an addition 1-2 tablespoons of Cocoa Krispies to represent topsoil.
- Sprinkle a little of the Raisin Bran on top to represent leaves and debris on the humus layer.

Now you have a cereal soil profile.

Got milk? Pour about one-third of a cup of milk in the cup. Watch the milk as it flows through the cracks to the bottom of the cup. This is called percolation. Percolation occurs when water fills up the spaces between the soil particles. If the space is all filled, the ground is soggy or even flooded. When the ground is frozen, like it is in late winter in Illinois, the water cannot go all the way to the aquifer (groundwater) beneath and within the parent material layer. When the ground thaws, this water goes into the ground. Percolation is not just important because it allows water to reach the roots of plants. It is also very important because the soil filters the water as it percolates through. But your profile isn't made of soil; it's cereal. So eat and enjoy.

Vocabulary: parent material, subsoil, topsoil, humus, percolation, aquifer,
(Adapted from Alaska Agriculture in the Classroom)

Suggested Reading

A Handfull of Dirt by Raymond Bial 
ISBN 0802786987

Life in a bucket of Soil by Alvin and Virginia Silverstein 
ISBN 0486410579

Soil! Get the Inside Scoop by David L Linbo 
ISBN 9780891188483

Earth's Water Supply

Oceans	97.3%
Ice	2.19%
Groundwater	0.5%
Soil Moisture	0.005%
Atmosphere	0.001%
Inland Lakes	0.018%
Rivers	0.000096%

To understand how much of the earth's water supply is available for our use, try this activity:

1. Fill a one-gallon container (such as an ice cream bucket) with water.
2. Pour a half-cup of water out of the one-gallon container and into a clear bowl. The water in the bowl represents all of the fresh water on earth, which is less than three percent of the total water on earth. Fresh water is found in lakes, rivers, groundwater, ice, and living things. The 1½ cups that are still in the one-gallon container represent salt water. We cannot use salt water.
3. With an eyedropper, drop one drop of water from the half-cup onto a small plate. This one drop represents the freshwater that is available for our use. This water is found in rivers and lakes. The rest of the water in the half-cup is deep groundwater, bound up as soil moisture, biomass water, or water in the atmosphere.

Career Corner

Robert McLeese
Part 2
Illinois State Soil Scientist
Champaign, IL



Describe your involvement in soil and water conservation.

I grew up in Towanda, McLean County. I liked working outside, science, and had an interest in maps. At Northern Illinois University I studied Geography and Soil Science. Soil Science is a mix of all the other sciences chemistry, physics, biology, and statistics. Many people don't have an understanding or appreciation for our planet's natural resources, especially our soil resources.

How did Illinois get a State Soil?

In the early 1980s the Illinois Soil Classifiers Association (ISCA) realized Illinois had many state symbols, but were missing the symbol all others depend upon: our soil. The ISCA examined more than 600 different soil series that are mapped in Illinois to find one that would best represent the resource. They identified Drummer silty clay loam as the candidate for the state symbol. After several attempts to name a state soil in the 1990's the State FFA, Monticello HS FFA and the Chicago High School for Agricultural Sciences FFA promoted Drummer as the official State Soil. Students worked with their state legislators and testified why it is important to have an official State Soil. Drummer silty clay loam was designated the official State Soil of Illinois in August, 2001.

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Illinois Department of Agriculture
and the IAA Foundation.



Debbie Ruff
Education Coordinator
Livingston County Soil & Water
Conservation District



Describe your background and interest in soil and agriculture.

I was raised on a dairy farm in north central Illinois. My father farmed with my grandfather, and as a child I always wanted to be outside with my dad. I took care of the cows and helped my grandmother in the garden. She believed in taking care of the garden and we utilized many advanced practices including composting and crop rotation.

What does the word sustainable mean to you related to soil in Illinois?

To me, sustainable means that we care for the soil, so that it maintains or improves its productivity. We can use nature's own way to produce more soil by leaving more field residue after harvest rather than plowing it under. It is very important that we care for the soil, because the soil will care for us.

What are fertilizers?

Fertilizers and plant foods come from nature. I use this activity to explain the importance of N, P and K. I distribute a balloon, a shark's tooth, and a pack of salt substitute. 78% of the air in a balloon you blow up is Nitrogen (N) a naturally occurring element. Phosphorous (P) comes from phosphate rock or the remains of ancient marine life, like a shark tooth fossil. The salt substitute, used in homes and restaurants, contains potassium (K). This activity shows students that fertilizers or plant foods come from nature.

To learn more about Agriculture, visit us at
www.agintheclassroom.org, or
contact your county Farm Bureau® office
or Agriculture in the Classroom, Illinois Farm Bureau®
1701 N. Towanda Avenue, Bloomington, IL 61701.