



SOILS-

THE GREAT CORE IDEA CONNECTOR!

Friday, April 12, 2:00 PM
2019 NSTA Conference, St. Louis
Soil Science Society of America (SSSA)

WHO ARE WE?



Introductions:

Missy: Teacher, Chatham High School

Clay: Assoc. Prof. of Soil Science, Illinois State Univ.

Ross: St. Louis Science Center

Rachel: Manager of Student Programs, SSSA

Soil Science Society of America:

International scientific society that fosters the transfer of knowledge and practices to sustain global soils

NGSS: CORE IDEA CONNECTIONS RELATED TO SOILS

Earth & Space Science:

ESS2.A, ESS2.B, ESS2.C, ESS2.D

ESS3.A, ESS3.B, ESS3.C

Life Science:

LS2.A, LS2.B, LS2.C

Physical Science:

PS1.A, PS1.B, PS3.D

NGSS: SEP & CCC CONNECTIONS RELATED TO SOILS

Crosscutting Concepts:

Systems & System Models

Structure & Function

Science & Engineering Practices:

Depends on how the activities are used in with students

NGSS: SAMPLE PHENOMENA



Anything phenomena related to food, clothing, shelter, infrastructure can link to soil science

<https://www.ngssphenomena.com>

WHAT'S SOIL GOT TO DO WITH
IT?

WHAT ARE THE 4 REQUIREMENTS FOR LIFE?



WITHOUT THEM YOU ARE....



EARTH AS AN APPLE

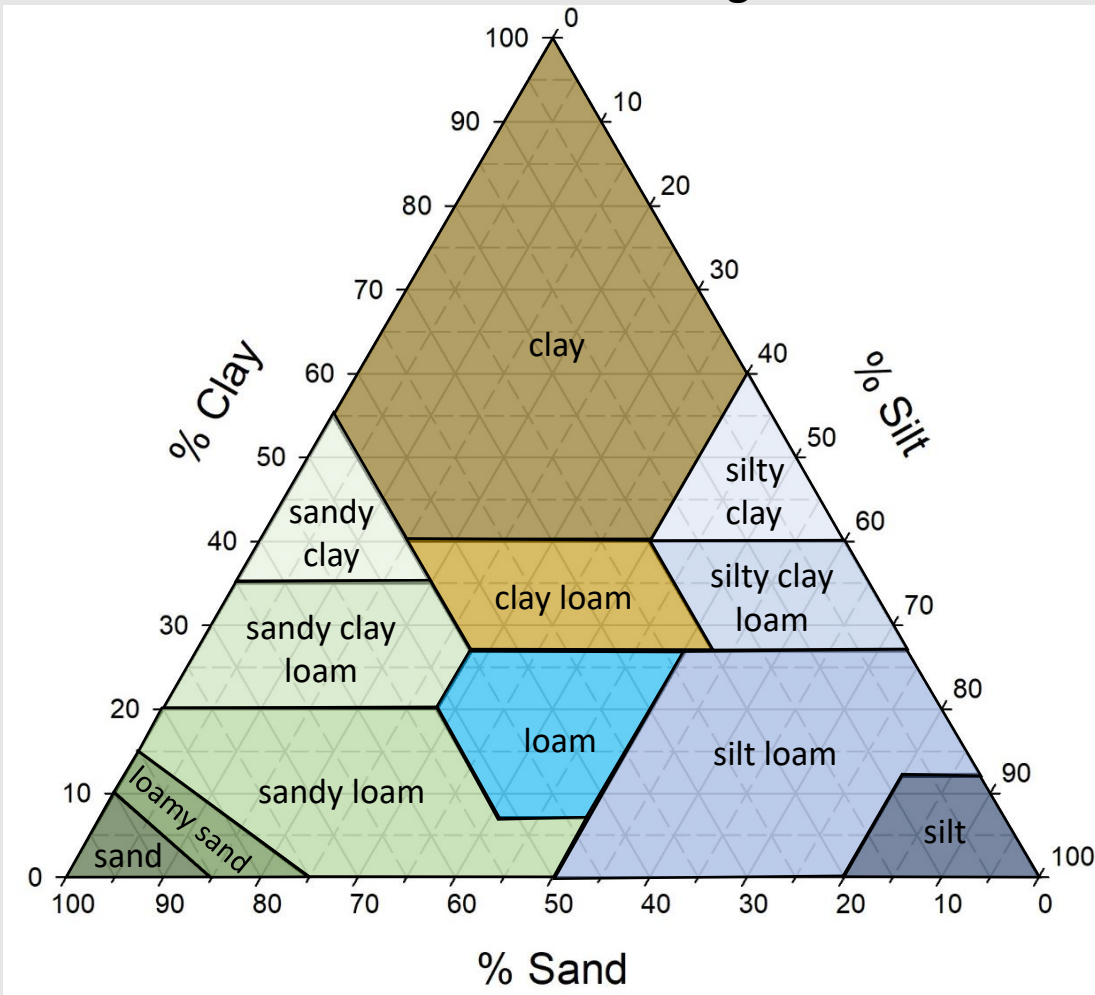


SOIL & PHYSICAL SCIENCE

USDA SOIL TEXTURE

- Relative proportion of particles < 2 mm diameter
 - Sand = 2.0 mm to 0.05 mm
 - Silt = 0.05 mm to 0.002 mm
 - Clay \leq 0.002 mm

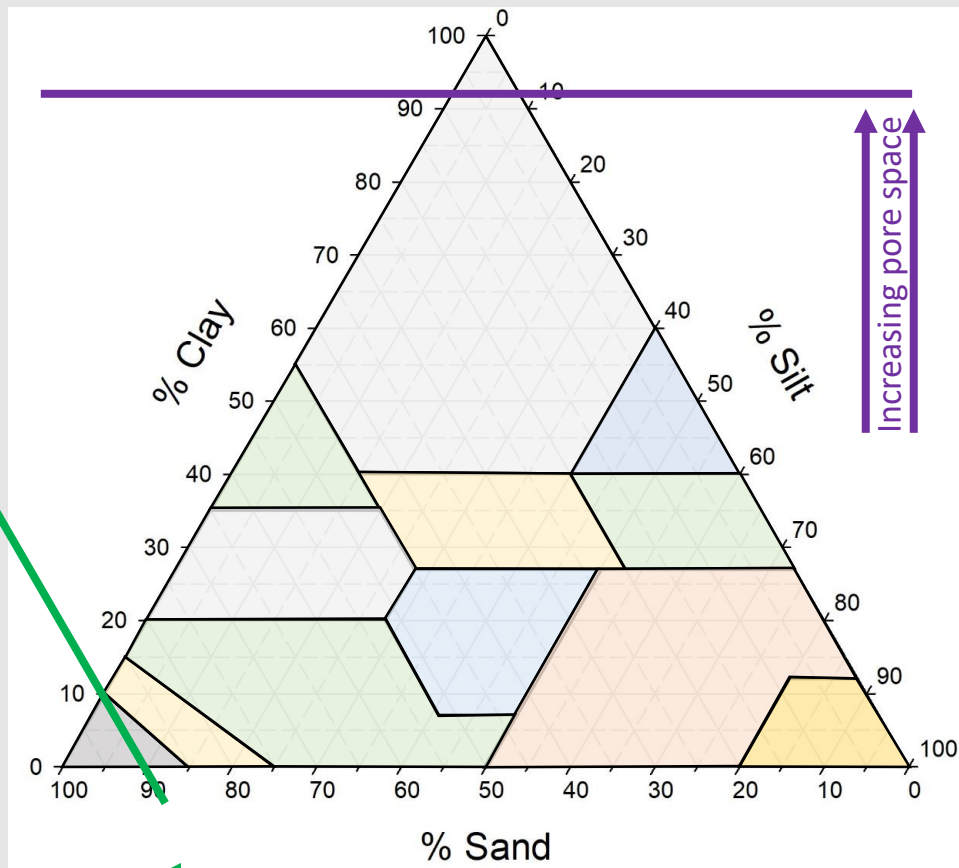
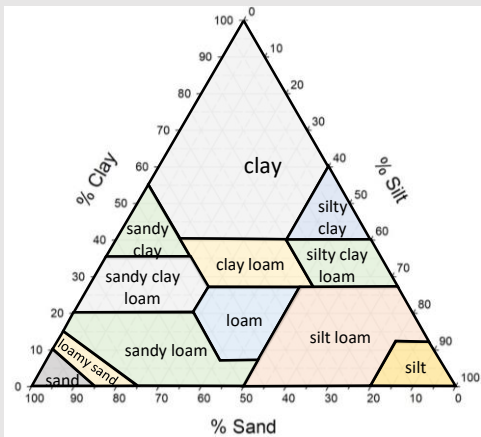
USDA Textural Triangle



TEXTURE BY SEDIMENTATION



Texture and Pores



Increasing pore size

Increasing pore space

Estimating Soil Texture Using the Feel Method

Figure 1. Texture-by-feel, Steps 1 and 2.

1. Does it form a ball?
2. Does the ball break if bounced gently in hand?

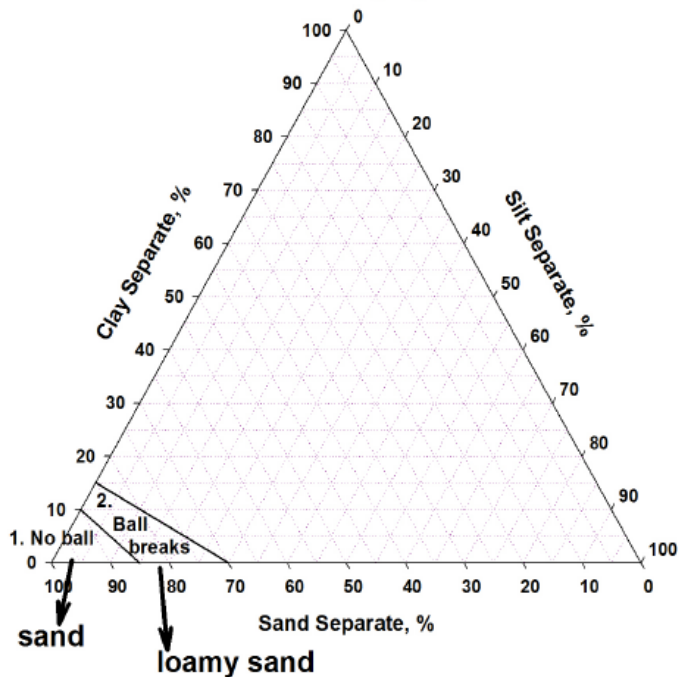


Figure 2. Texture-by-feel, Step 3

3. How long a ribbon can be formed?
This selects the main category: loam, clay loam, or clay.
Clay is cohesive (sticky) and allows the soil to form a ribbon.

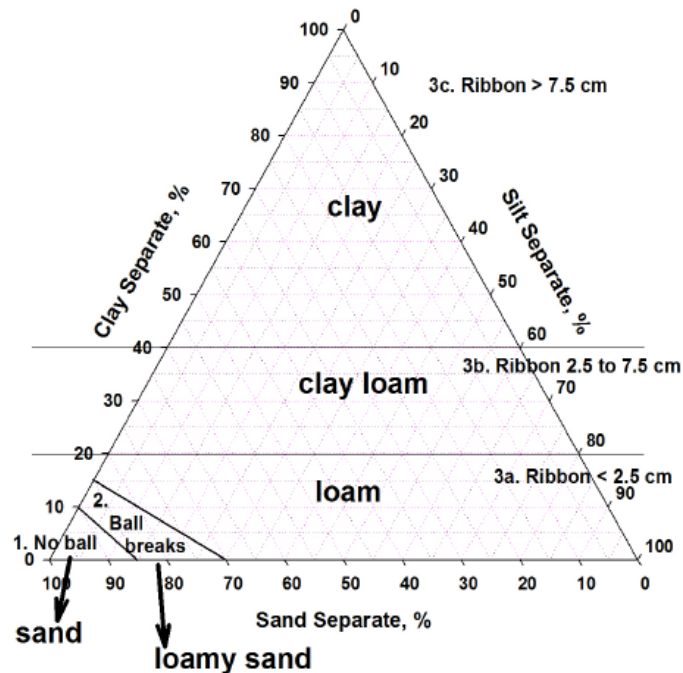
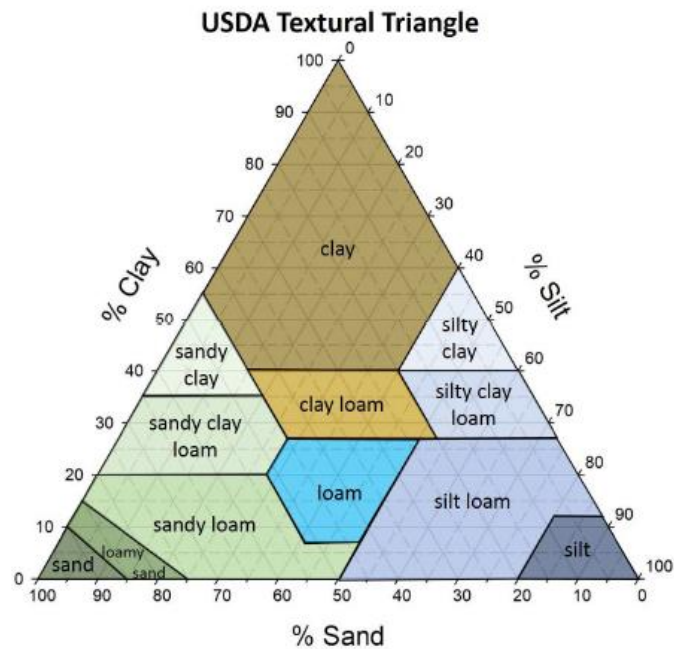
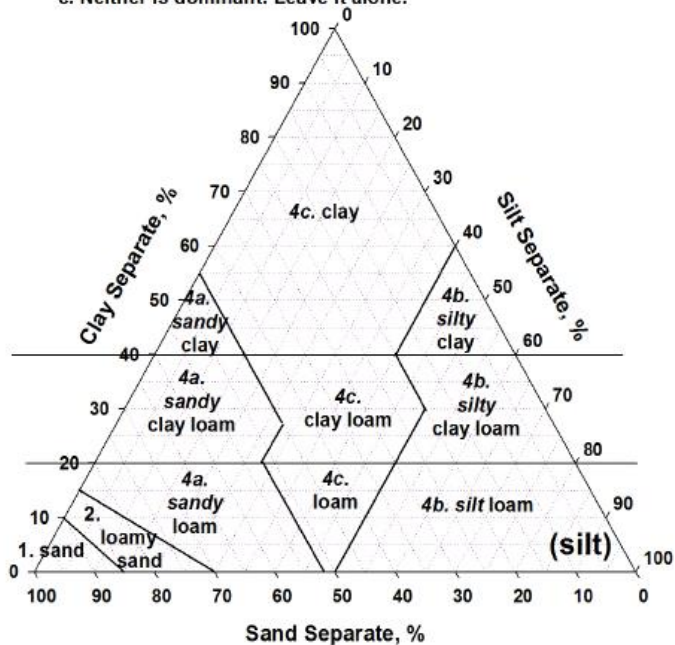


Figure 3. Texture-by-feel, Step 4

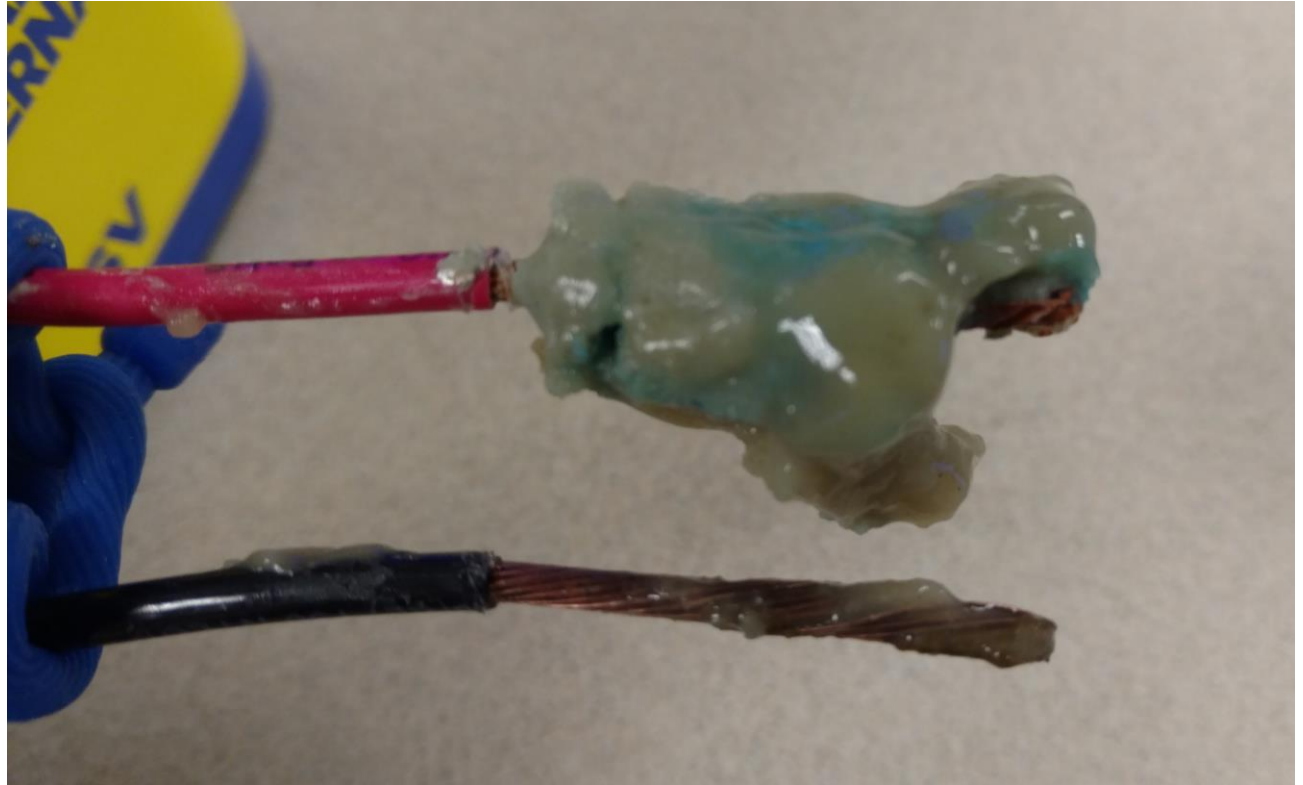
4. Work it between your fingers, feel and listen?
 a. If you hear grating and grinding, think "sandy"
 Supersaturate and feel: What dominates, grit or smooth?
 Grittiness dominates: Think "sandy".
 b. Smoothness dominates: Think "silty".
 c. Neither is dominant: Leave it alone.



SOIL IS A FILTER

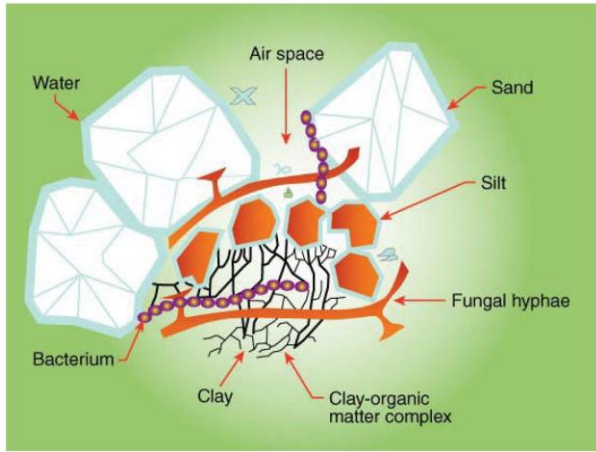


SOIL IS CHARGED

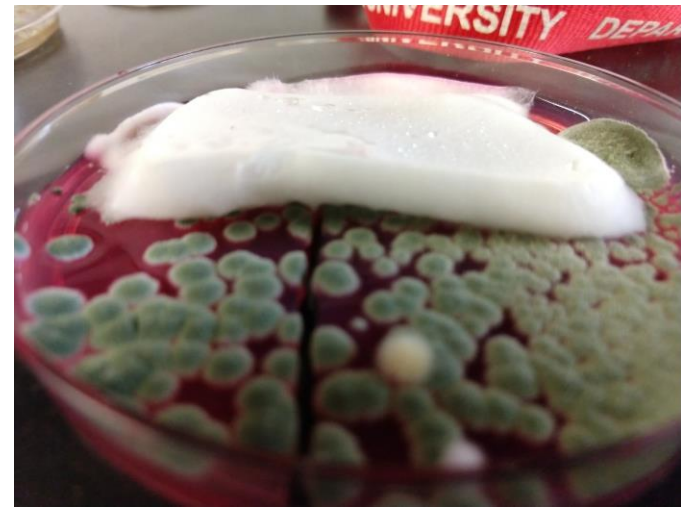


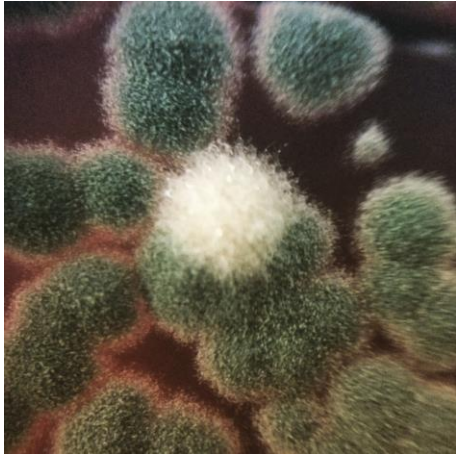
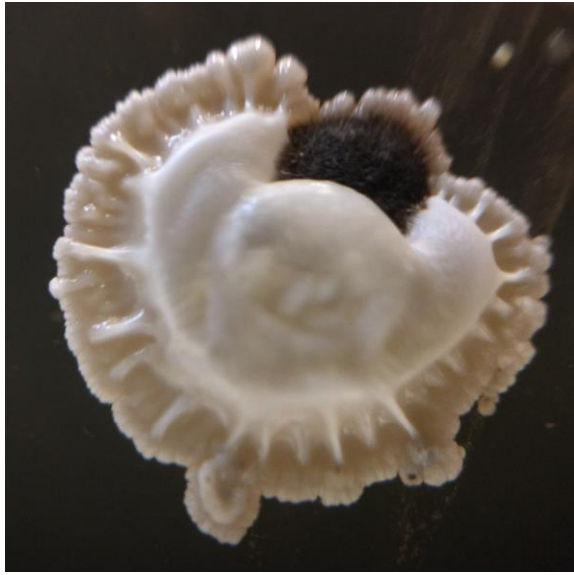
SOIL & LIFE SCIENCE: SOIL IS ALIVE!





● Figure 4, Urban Soils Primer

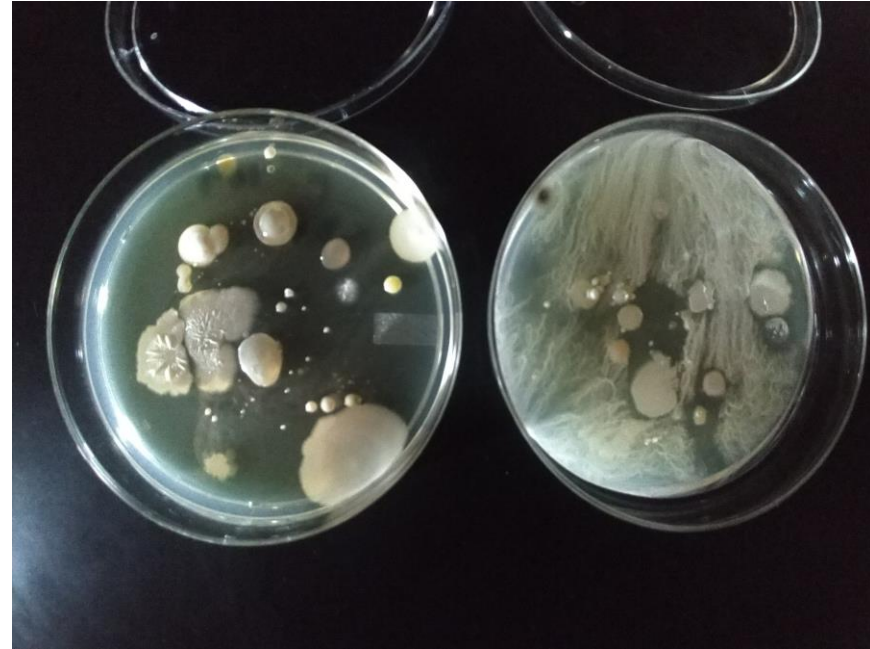




- Grassland soil community



- Forest Soil community



ESSENTIALS OF LIFE

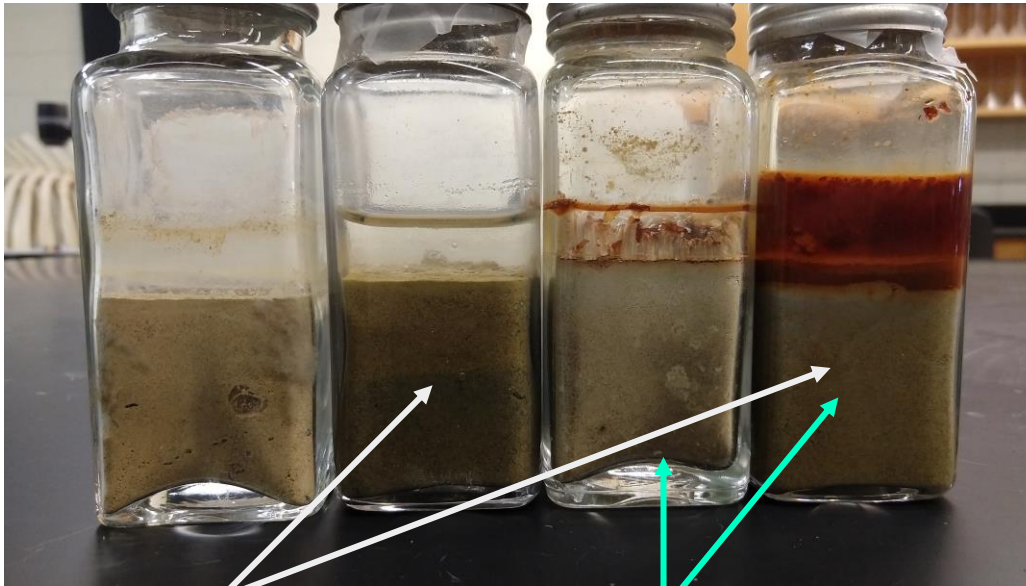
- Water
 - Electron donor
 - Electron acceptor
 - Carbon source
 - Essential elements
 - Growth factors
- Next page highlights the first four

MICROBES AT WORK: WHAT HAPPENS TO THE SAME SOIL WHEN

Water added to all, Sugar (energy source, electron donor)

Unsealed, Aerobic: electron acceptor = Oxygen

Sealed, Anaerobic: electron acceptor = Iron, Manganese, Sulfur



Sealed

Sugar added

BURLESE FUNNELS AND SOIL LIFE

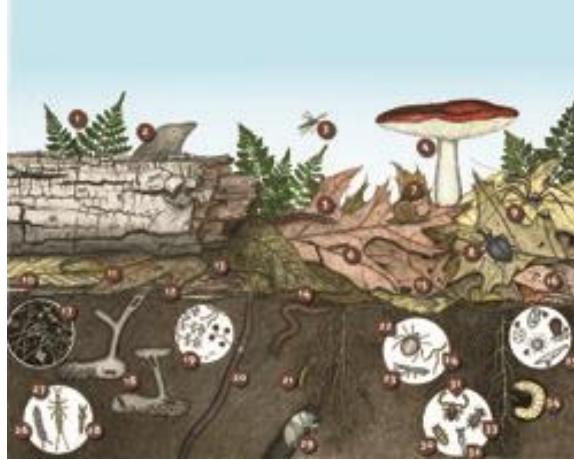
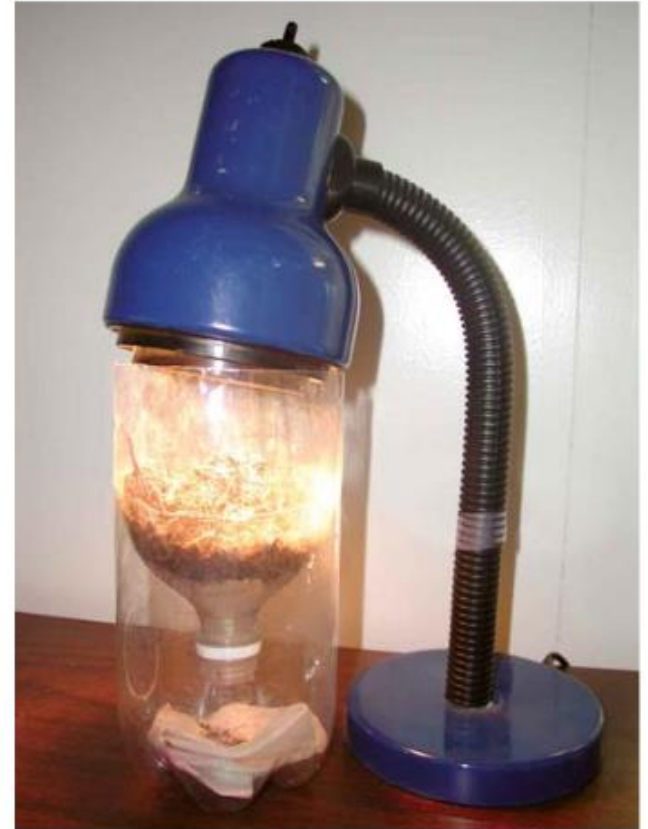


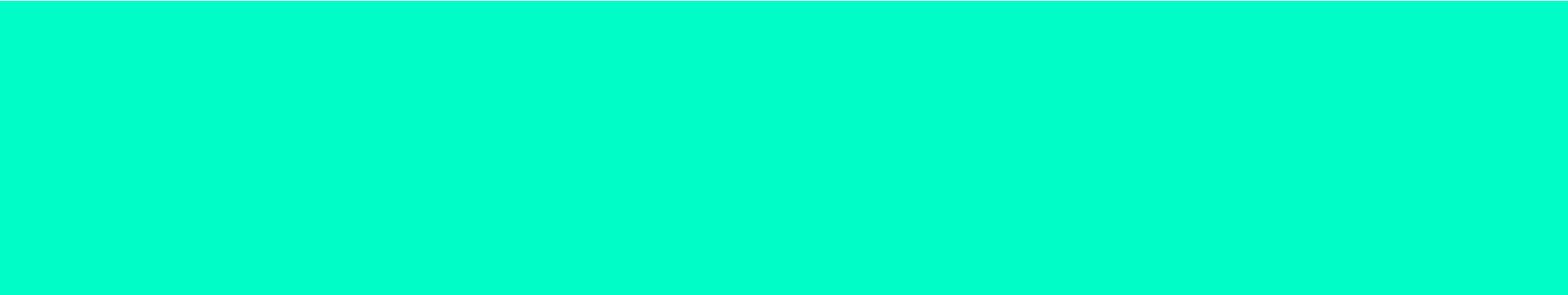
Image credit: James B. Nardi

Count the organisms and try to separate them into like groups such as worms, grubs (any wormlike organism with legs), snails or slugs, insects (3 pairs of legs) or spiders, mites and ticks (4 pairs of legs)



A Berlese Funnel can be easily constructed using a desk lamp, 2-liter pop bottle and hardware screen.

SOILS & EARTH & SPACE
SCIENCE



SOIL EROSION



12 MONTHS OF SOILS!

<http://www.fao.org/soils-2015/en/>

2015
International
Year of Soils

healthy soils for a healthy life

Google Custom Search

العربية 中文 English Français Русский Español

About News Events Resources Communications toolkit Blog FAQs

FAO Representation in Iran runs a nationwide media campaign to celebrate World Soil Day and the closure of the International Year of Soils
Media campaign to raise awareness and promote sustainable soil and land management in the country

PUBLICATION
Status of the World's Soil Resources

INFOGRAPHIC
Soils store and filter water

VIDEO
The International Year of Soils 2015 and beyond

Secretary-General's message on World Soil Day, 5 December 2015

Latest blog posts
Stone-filled landscapes: about soil erosion and places where stones grow
29/07/2016

12 MONTHS OF SOILS!

<https://www.soils.org/IYS>

The screenshot shows the website's header with the logo and navigation menu. The main content area features a banner for the International Year of Soils, a welcome message, and two featured images: one of a prairie dog and one of a man digging in the soil. A sidebar on the right contains a call to action for a photo campaign, a section for soil education email sign-ups, and a button to sign up for more information.

Soil Science Society of America

SEARCH LOG IN

Soils Sustain Life

Discover Soils Science Policy Publications Membership Certifications Meetings Education Newsroom Careers

Home > Discover Soils > I Heart Soil

THE INTERNATIONAL YEAR OF SOILS

Share Tweet

WELCOME TO SSSA'S INTERNATIONAL YEAR OF SOILS ACTIVITIES PAGE!

[Click here to see 2015 Activities](#)

[Check out our monthly videos](#)

DO YOU "HEART" SOIL? SAY IT IN PICTURES!

Participate in our fun, international "heart" Soil photo campaign! Request "heart" Soil stickers (in English or 13 other languages – even Klingon) and we'll send a few stickers to you. Learn more, request and/or download stickers, upload photos, view the photo map, and purchase "heart" Soil clothing on the [I Heart Soil Sticker webpage](#).

SOILS EDUCATION EMAIL

Yes, keep me updated!

Sign up today for periodic Soils education information, resources and materials (don't worry, we won't fill your email inbox or use your email for other purposes).

[Sign Up Here!](#)



The Celebration of Soils Continues - Announcing the International Decade of Soils!
The International Union of Soil Scientists has proclaimed 2015-2024 the International Decade of Soils and is a continuation of the efforts made during the International Year of the Soils 2015. It will be marked by a number of activities on the national and international levels.



2015
International
Year of Soils

12 MONTHS OF SOILS!

<p>January - Soils sustain life</p> <p>We all depend on 4 basic things - food, clothing, shelter and water – and they are all related to a single, often overlooked resource: Soil! Soils are complex mixtures of minerals, water, air, organic matter, and countless organisms that are the decaying remains of once-living things. It forms at the surface of land – it is the “skin of the earth.” Soil supports plant life and is vital to life on earth.</p>	<p>July - Soils are living</p> <p>Soil is alive. There are more species of organisms in the soil than there are aboveground. These organisms include everything from badgers and gophers to bacteria and viruses that are invisible to the naked eye. A single handful of soil contains millions of individual living organisms.</p>
<p>February - Soils support urban living</p> <p>Every bit of earth is covered in soil; some is just covered up. In the urban environment, the soil under buildings determined what can be built on it. Soil also supports home and community gardens, parks, recreational areas, and nature areas. Soil also protects us through filtering water and large amounts of rain.</p>	<p>August - Soils and health</p> <p>Soil stabilizes the environment so that the healthy living conditions we know today can continue. It cleans our water and protects us from environmental pollutants. And, it provides the nutrition and water plants need to become our food, shelter, or medicine.</p>
<p>March - Soils support agriculture</p> <p>Healthy soil results in a more stable food supply, which results in a strong community. Farmers use many practices and technologies, including precise applications of fertilizer and irrigation, to ensure that soil is conserved for sustainable food production and a healthy environment.</p>	<p>September - Soils support the natural environment</p> <p>There are many climates around the world and the soils in each of these are as different as the varying ecosystems. Soil is part of all of them and will have different microorganism and plant communities which in turn supports different animal communities.</p>
<p>April - Soils clean and capture water</p> <p>Soil plays an important role in capturing and cleaning water. Soil texture, structure, and land coverings all have roles in determining how easily water will move through the soil to filter, store, and distribute water to reduce runoff and flooding. The work of cleaning water is done by physical, chemical, and biological processes. Healthy soils are critical to ensure clean water for recreation, consumption, crop production, and more.</p>	<p>October - Soils and the products we use</p> <p>Soil provides many services and many products. For example, the plants that are grown in soil can be used for food, clothing, recreation, aesthetics, building materials, medicines, and more. And, the minerals that make up soil particles can be used for dyes, make-ups, and medicines, or shaped into bricks, plates, and vases.</p>
<p>May - Soils support buildings and infrastructure</p> <p>While a leaning building or a cracked foundation seems inconvenient, lack of soils knowledge can also result in catastrophic structural failures. There is soil under buildings and understanding soil and its properties is important in deciding where different types of structures can be built.</p>	<p>November - Soils and climate change</p> <p>Climate has an important role in soil formation. Soil profiles can give us clues to past climates and weather cycles. And, soil is an important part of the global carbon cycle. Different land management practices result in different amounts of carbon being released to the atmosphere. Understanding this may allow us to manage for a reduction in greenhouse gas emissions from soil and therefore manage soil's effect on climate.</p>
<p>June - Soils support recreation</p> <p>Like building sandcastles? Sand is a component of soil. Like playing soccer or baseball? Athletic fields, with natural grass surfaces, need healthy soils to support the grasses that support recreation. And, soil is important for golf courses, festival grounds, walking trails, forests, and any outdoor recreational area.</p>	<p>December - Soils and culture</p> <p>Clues within soil can be a guide to what has happened in history. Clues within art and literature can be a guide to how societies have viewed soil. Evidence indicates that soil has been important in deciding the success or failure of many societies through agricultural sustainability and events such as battles or political changes. Soil and people are bound to each other. If we care for the soil, the soil will care for us.</p>



SEPTEMBER - SOILS PROTECT THE NATURAL ENVIRONMENT

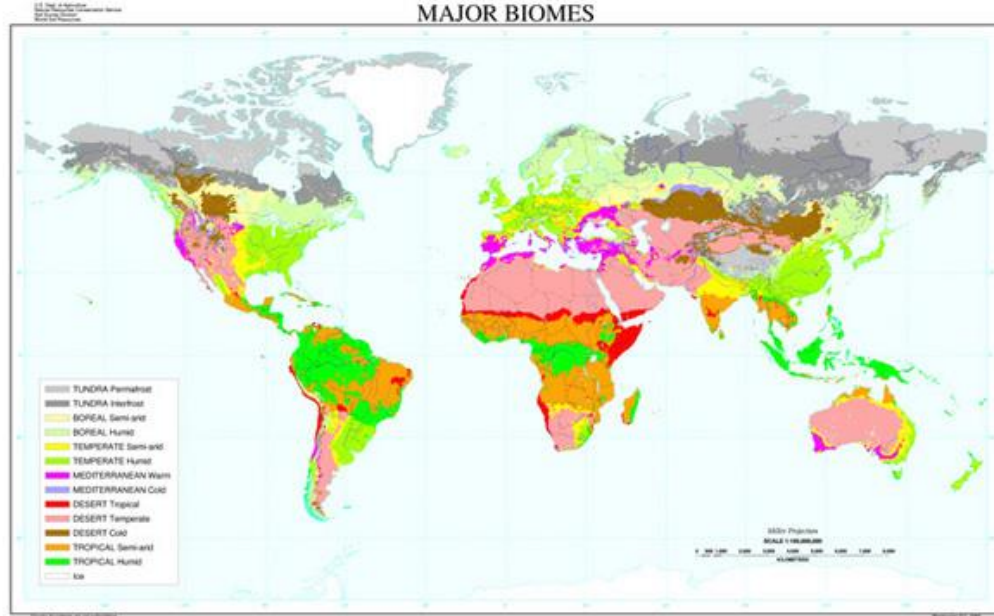


SEPTEMBER - SOILS PROTECT THE NATURAL ENVIRONMENT

Soil Types and Regions:

Match the soil type with the correct USA region. - while doing so consider the types of plants you may find in that region

SOIL TAXONOMY - 12 ORDERS



USDA

United States Department of Agriculture

THE 12 ORDERS OF SOIL TAXONOMY

<p>ALTISSOLS</p> <p>Think of Altissols as a very thin soil. They are the thinnest soils in the soil taxonomy, with a maximum thickness of only 10 centimeters. They are found in high mountain regions and are often found in very high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>	<p>ANDISOLS</p> <p>Andisols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>	<p>ARIDISOLS</p> <p>Aridisols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>	<p>ENTISOLS</p> <p>Entisols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>
<p>GELISOLS</p> <p>Gelisols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>	<p>HISTOSOLS</p> <p>Histosols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>	<p>INCEPTISOLS</p> <p>Inceptisols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>	<p>MOLLISOLS</p> <p>Mollisols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>
<p>OXISOLS</p> <p>Oxisols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>	<p>SPODOSOLS</p> <p>Spodosols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>	<p>ULTISOLS</p> <p>Ultisols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>	<p>VERTISOLS</p> <p>Vertisols are the most fertile soils in the soil taxonomy. They are formed from volcanic ash and are often found in high elevations. They are very young soils and are often found in very high elevations.</p> <p>Occurs over 10 percent (10%) of the world's surface area.</p>

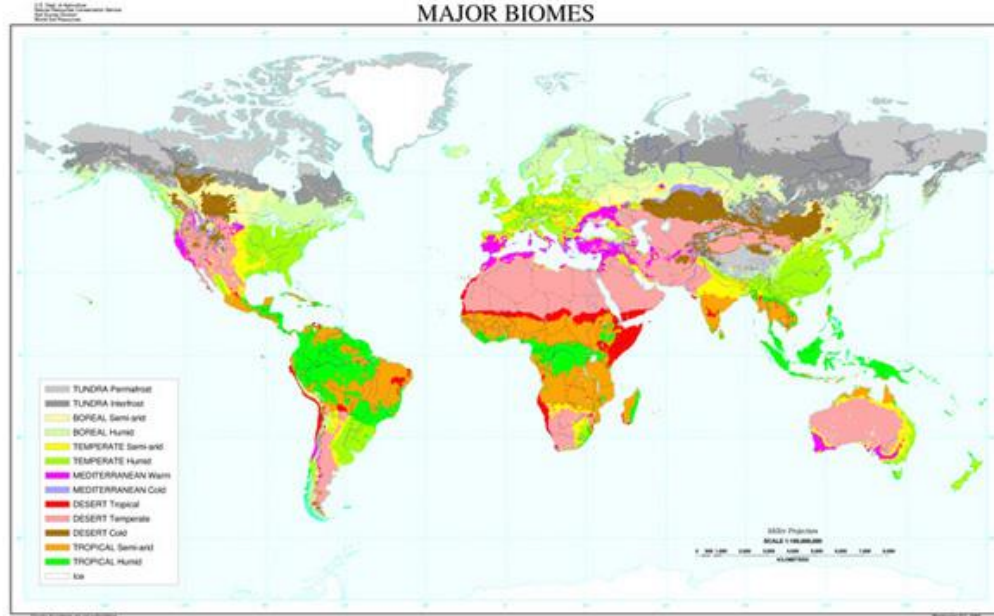
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SEPTEMBER - SOILS PROTECT THE NATURAL ENVIRONMENT

- How does the temperature and rainfall affect the vegetation present in a location? How does it affect the soil properties as well?
- Do you think rainfall or temperature is more important in determining the vegetation and soils in a biome? Why?
- Climate change is an important issue facing society. Because of increasing greenhouse gases in the atmosphere, the temperature is predicted to increase in some parts of the world and rainfall will decrease. What would happen to a deciduous forest biome if the rainfall were to decrease? What would happen to a tundra biome if the temperature were to increase?
- How do the activities of people affect biomes? What happens when a grassland is plowed and used for farming? What happens when a forest is cut and houses are built for people to live in?
- Select a biome, and identify which CIORPT factors are most important in soil formation?
 - Climate
 - Organisms
 - Relief
 - Parent material
 - Time



SOIL TAXONOMY - 12 ORDERS



USDA

United States Department of Agriculture

THE 12 ORDERS OF SOIL TAXONOMY

<p>ALFISOLS</p> <p>Think of alfisols as brown soils. They are soils that have weathered enough to give them a clay horizon, but not enough to give them a mollic epipedon. They are found in temperate regions with moderate rainfall. They are found in the eastern United States, Europe, and Asia.</p> <p>Occurs over about 30% of the world's surface area.</p>	<p>ANDISOLS</p> <p>Think of andisols as volcanic soils. They are soils that have formed from volcanic ash and other volcanic materials. They are found in volcanic regions around the world.</p> <p>Occurs over about 1% of the world's surface area.</p>	<p>ARIDISOLS</p> <p>Think of aridisols as desert soils. They are soils that have formed in arid and semi-arid regions. They are found in deserts and semi-deserts around the world.</p> <p>Occurs over about 20% of the world's surface area.</p>	<p>ENTISOLS</p> <p>Think of entisols as young soils. They are soils that have formed recently and have not had time to develop a horizon. They are found in a wide variety of environments around the world.</p> <p>Occurs over about 10% of the world's surface area.</p>
<p>GELISOLS</p> <p>Think of gelisols as permafrost soils. They are soils that have formed in cold regions where permafrost is present. They are found in the Arctic and Antarctic regions.</p> <p>Occurs over about 10% of the world's surface area.</p>	<p>HISTOSOLS</p> <p>Think of histosols as peat soils. They are soils that are composed primarily of organic matter. They are found in wetlands and other areas with high water tables.</p> <p>Occurs over about 1% of the world's surface area.</p>	<p>INCEPTISOLS</p> <p>Think of inceptisols as young soils with horizons. They are soils that have formed enough to have horizons, but not enough to have a mollic epipedon. They are found in a wide variety of environments around the world.</p> <p>Occurs over about 17% of the world's surface area.</p>	<p>MOLLISOLS</p> <p>Think of mollisols as grassland soils. They are soils that have formed under grasslands and have a mollic epipedon. They are found in grasslands around the world.</p> <p>Occurs over about 7% of the world's surface area.</p>
<p>OXISOLS</p> <p>Think of oxisols as highly weathered soils. They are soils that have been weathered for a long time and have a high degree of soil development. They are found in tropical and subtropical regions.</p> <p>Occurs over about 10% of the world's surface area.</p>	<p>SPODOSOLS</p> <p>Think of spodosols as forest soils. They are soils that have formed under forests and have a spodic horizon. They are found in temperate and boreal regions.</p> <p>Occurs over about 4% of the world's surface area.</p>	<p>ULTISOLS</p> <p>Think of ultisols as highly weathered soils with horizons. They are soils that have been weathered for a long time and have horizons, but not a mollic epipedon. They are found in temperate and subtropical regions.</p> <p>Occurs over about 10% of the world's surface area.</p>	<p>VERTISOLS</p> <p>Think of vertisols as clay soils. They are soils that are composed primarily of clay and have a unique cracking and swelling behavior. They are found in a wide variety of environments around the world.</p> <p>Occurs over about 2% of the world's surface area.</p>

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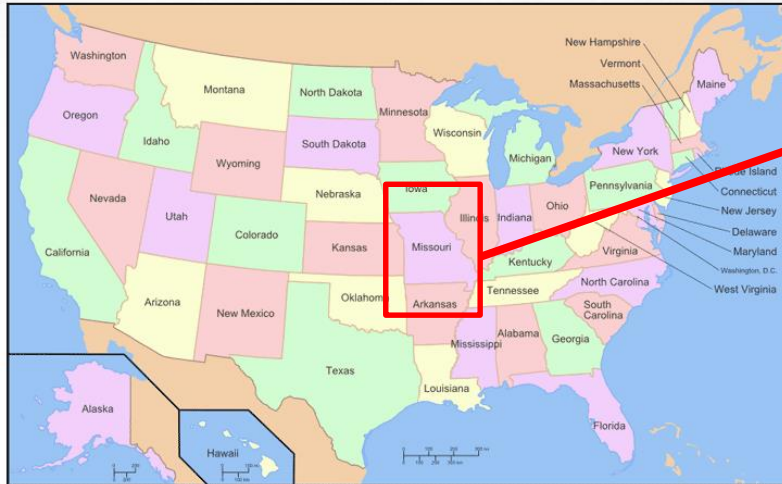
STATE SOIL BOOKLETS

NEW! STATE SOIL BOOKLETS

This interactive map features state soils booklets – developed and written by soil scientists to provide in-depth information on each state soil. The booklets include a brief history of how the state soil came to be, where the state soil is found, importance and uses, limitations, management, soil formation, ecoregions and land use, a glossary, and additional resources.

We are compiling these as quickly as possible. The following state soil booklets are currently available:

To access these booklets, please hover over the state and select it when highlighted.



MENFRO Missouri State Soil



SOIL SCIENCE SOCIETY OF AMERICA



Introduction

Many states have a designated state bird, flower, fish, tree, rock, etc. Also, many states have a state soil – a soil that has significance or is important to the state. The “Menfro” is the Missouri State Soil. Let’s explore how im-portant the Menfro is to Missouri.

History

The Menfro soil has a rich history in Missouri and for our nation. When Daniel Boone first settled west of the Mississippi River, it was on a Menfro soil. The first Missouri state capitol building in St. Charles, the present state capitol building in Jefferson City, and the governor’s mansion are all built on Menfro soils. Also, Hannibal, the home of Mark Twain and Hermann, a historic German community are on Menfro soils. Menfro soils were first described in Macoupin County, Illinois in 1939. Since then the soil has been mapped (that is, located and described) along the Mississippi and Missouri Rivers in Illinois and Missouri. The state legislature designated the Menfro as the Missouri State Soil in 2004.

What is Menfro Soil?

The Menfro series are deep, well drained, moderately permeable soils that were formed in thick loess (wind-blown) deposits on upland ridgetops, backslopes and benches adjacent to the Missouri and Mississippi Rivers and their major tributaries. Every soil can be separated into three size fractions called *sand*, *silt* and *clay*. They are present in all soils in different proportions and say a lot about the character of the soil. The combination of sand, silt and clay particles affect how the soil feels and determines many soil



K-12 RESOURCES FROM SSSA

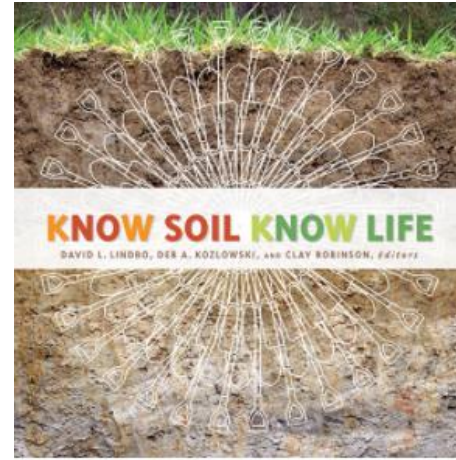
SSSA K-12 RESOURCES

Websites:

Soils4kids.org

Soils4teachers.org

Soils.org/IYS



Highlights:

- State Soil Booklets
- Ask a Soil Scientist
- Lessons & Activities
- Career Profiles
- Interactive Games
- Order Books



SOILS4KIDS.ORG

DIG DEEPER



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[Fun with Soil](#)

[Soil Experiments](#)

[Soil Games](#)

[Career Exploration](#)

[Soil In Your Community](#)



CHOOSE YOUR
**GRADE
LEVEL:**



**PLAY FUN
SOIL GAMES**

**EXPERIMENT
WITH SOIL**

**EXPLORE
CAREERS**

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K-12 Soil Science Teacher Resources

Soil
Science
Society of America

"We know more about the movement of celestial bodies than about the soil underfoot." *Leonardo daVinci*

DaVinci

Search

SOILS SUSTAIN LIFE

Soil is the reservoir on which most life on earth depends, as the primary source of food, feed, fuel, forage, fiber, and pharmaceuticals.

Ask A Scientist

QUESTIONS?

Thank you!

Be sure to visit our
booth- #1743