Soils & NGSS- Perfect Together!

A presentation for the
2018 NSTA Conference on Science Education
by
Soil Science Society of America (SSSA)

Who are we?

Introductions:
Missy, Jim, and Rachel

Soil Science Society of America:
International scientific society that fosters the transfer of knowledge and practices to sustain global soils

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NGSS: Sample Phenomena

https://www.ngssphenomena.com

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

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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

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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

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What are the 4 Requirements for Life?

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Without Them you Are…..

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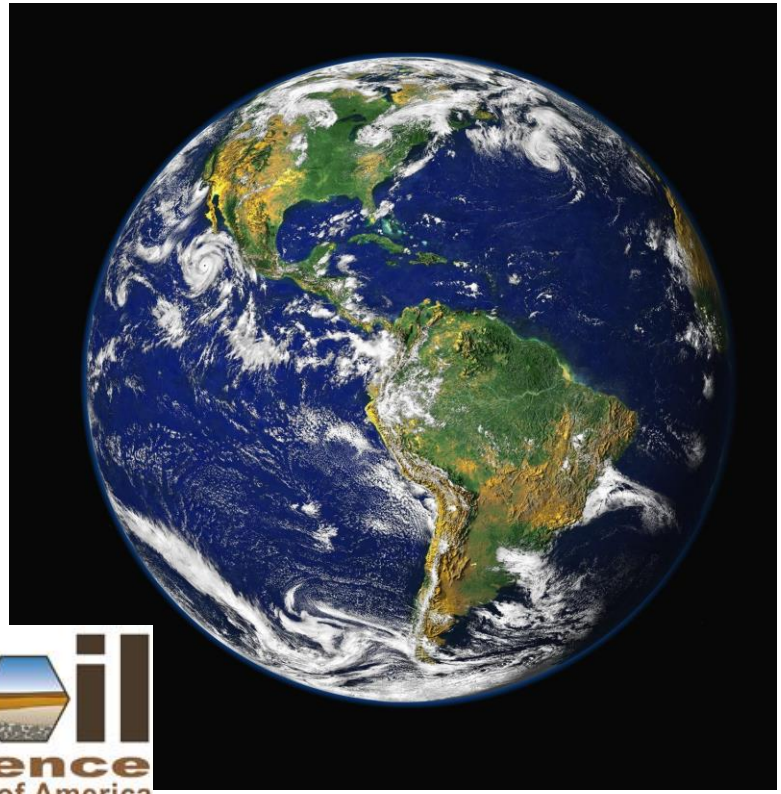
Earth as an Apple



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Soil Erosion

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Soil Health & Georgia's Land and its uses

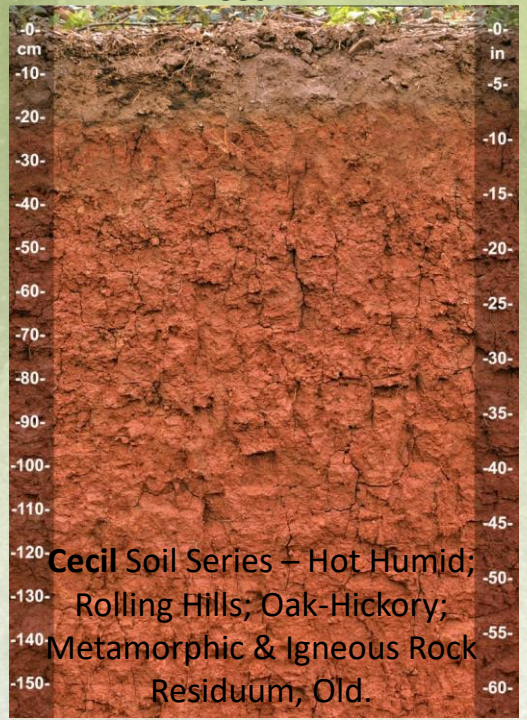
Jim Laitham

Soil Quality

- Inherent quality
  - Soils natural ability to function
    - i.e. sandy vs. clayey
    - Deep soils vs. shallow
- Dynamic quality
  - How soil changes depending upon management
  - Management choices affect:
    - O.M., structure, depth, water-nutrient holding capacity

Soil Inherent Limits = (F) Climate, Relief, Organisms, Parent Material, and Time

Cecil



Cecil Soil Series – Hot Humid; Rolling Hills; Oak-Hickory; Metamorphic & Igneous Rock Residuum, Old.

Sapelo

Sapelo Soil Series – Hot Humid; Flatwoods; Maritime Forest; Holocene Marine Sediments; Young.

- Inherent Properties:
  - Particle Size
  - Clay type
  - Natural pH
  - Density
  - Drainage and Permeability

- Dynamic Properties:
  - Erosion – currently and past
  - Topsoil Depth
  - Soil Organic Matter Content
  - Water Infiltration
  - Compaction
  - Nutrient Content
  - pH
  - Yield

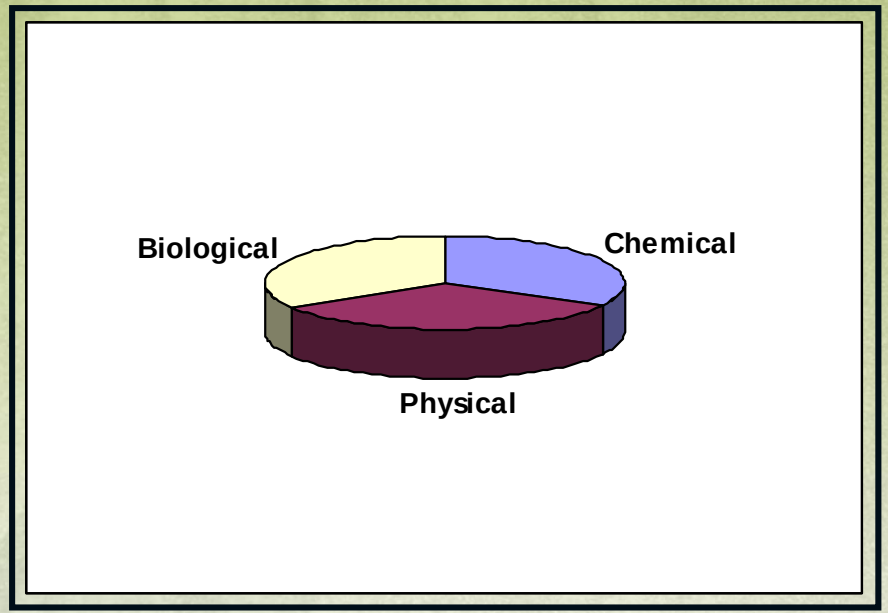
Soil Health - What is It?

- The current condition of the soil's inherent character:
- A person may be short or tall, but just knowing that wouldn't tell you whether they're healthy or sick.
- A soil can be deep or shallow, productive or barren but management determines its ability to function at any given moment - its health in other words.

Soil Health - What is It?

- The continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals, and humans.
  Functions:
  - Nutrient cycling
  - Water Infiltration & Availability
  - Filtering and Buffering Pollutants
  - Habitat for Plants and Animals
  - Productivity and Yield

Components of Soil Health



3 inter-related components

Soil Health -
How to do it?
4 Planning Principles:

- Manage more by Disturbing Soil Less
- Use Diversity of Plants to add diversity to Soil Micro-organisms
- Grow Living Roots Throughout the Year
- Keep the Soil Covered as Much as Possible

Ultimate Goal: To create the most favorable habitat possible for the soil food web

1. Soil Cover

- Erosion control
- Reduce evaporation
- Soil temperature regulation
- Reduce soil compaction
- Suppress weeds
- Enhanced microbial activity

2. Reduce Soil Disturbance

- Overgrazing
- Over application of chemicals
- Tillage

3. Enhance Plant Diversity

- Crop Rotations
- Variety of Cover Crops
  - Enhances soil carbon
  - Reduces weeds
  - Increases soil biodiversity
  - Erosion control

- Tillage radish
- Sun hemp
- Cereal rye
- Clover
- Vetch
- Buckwheat

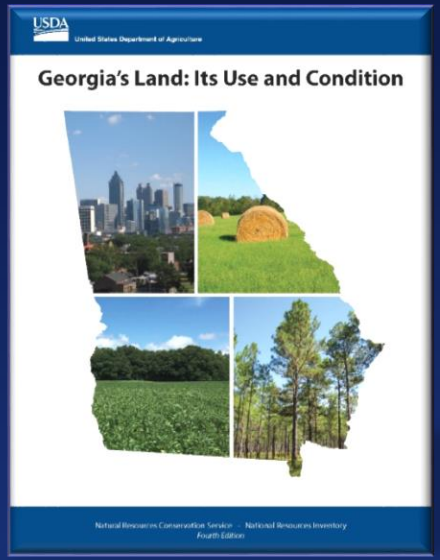
4. Add Livestock

- Recycling of OM
- Helps manage weeds
- Reduces waste from confinement

United States Department of Agriculture
Natural Resources Conservation Service

USDA NRCS

Georgia's Land: Its Use & Condition
Fourth Edition



"The history of every Nation is eventually written in the way in which it cares for its soil…" - FDR

National Resources Inventory (NRI)

Presentation Outline

Georgia Land and Surface Water Resource

Results Presented Today:

- Statewide
- Cropland
- Erosion
- Forest
- Developed Land
- Wetlands

Hay field in the Southern Appalachian Ridges and Valleys.

NRI Purpose & Procedures

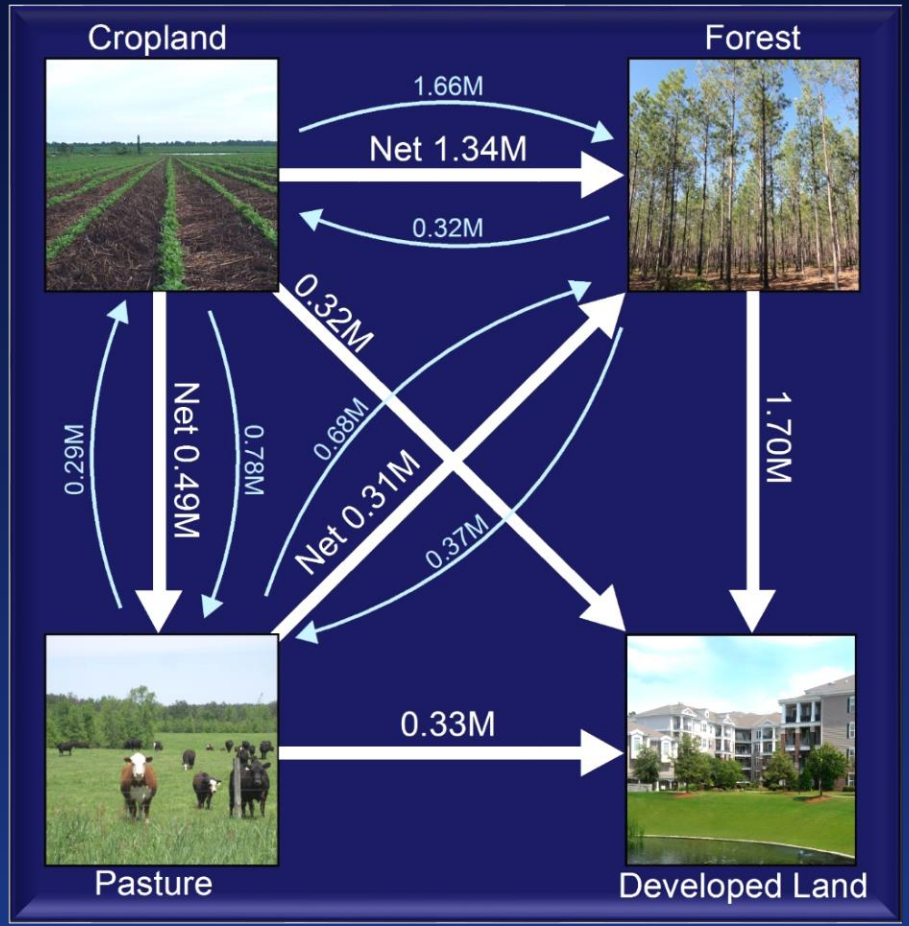
- **Purpose:** Statistically survey land use and resource condition change over time.

- **Mandate**: Soil & Water Resources Conservation Act, 1977 (RCA).

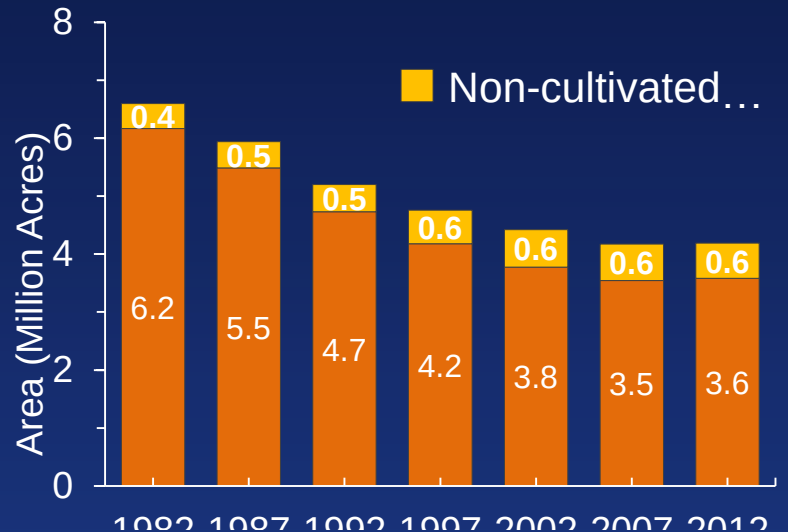
Example of 160 acre NRI sample segment containing three subsample points.

United States Department of Agriculture
Natural Resources Conservation Service

USDA NRCS



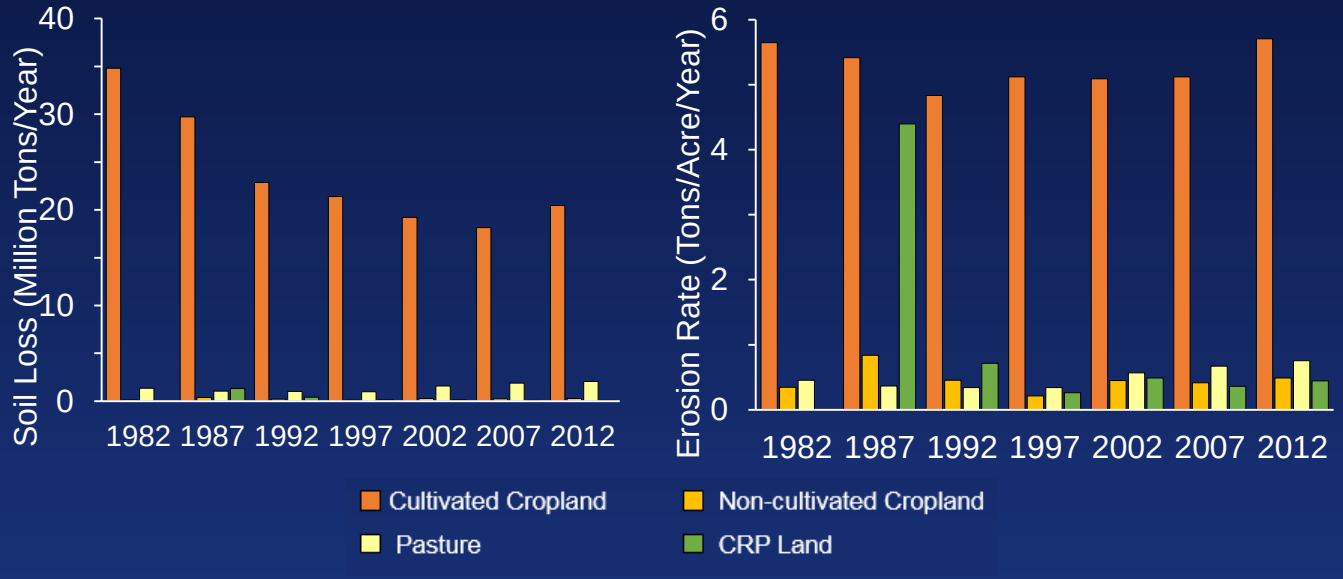
Cropland 1982 to 2012



Wheat on cultivated cropland in the Southern Piedmont.

Vineyard, an example of non-cultivated cropland, in the Southern Blue Ridge.

Erosion 1982 to 2012



Unite
Natur

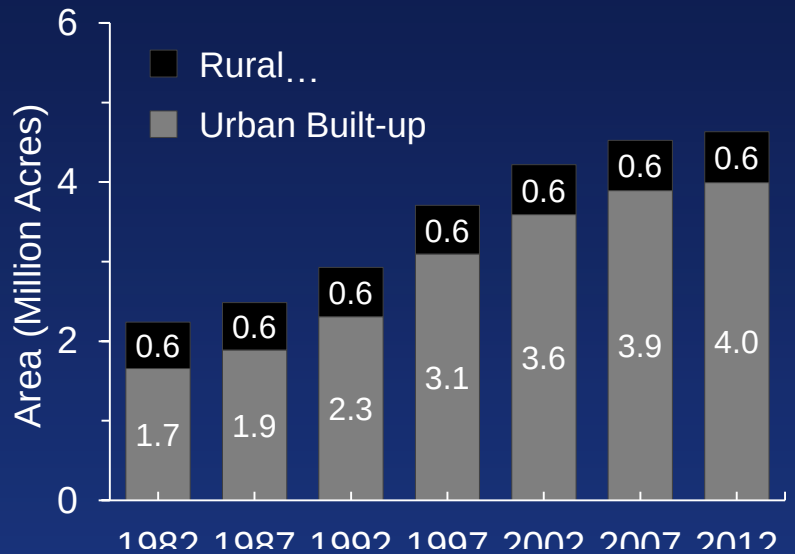
RCS

Irrigation has changed fields:

Before Center Pivot, 2009

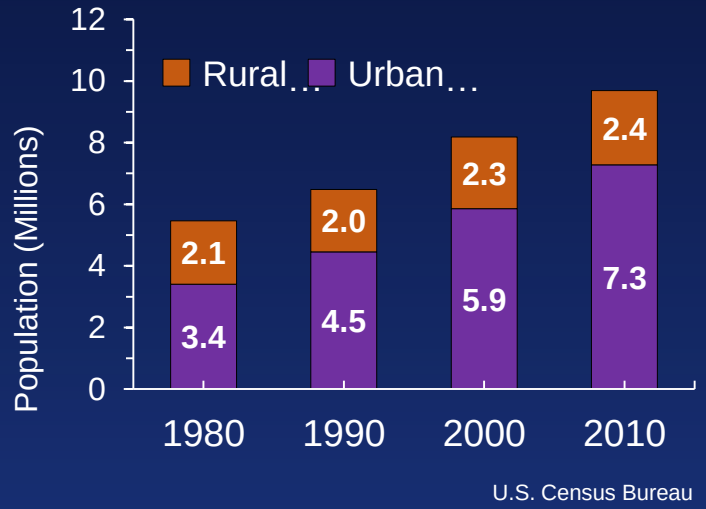
After Center Pivot, 2014

Developed Land 1982 to 2012



Atlanta skyline in the Southern Piedmont.

Population 1980 to 2010

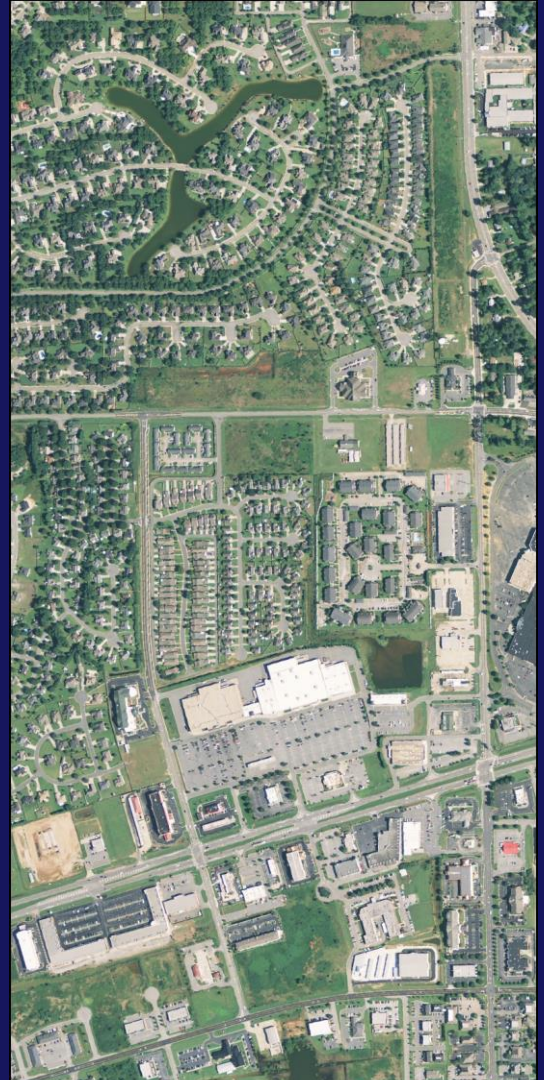


1980 Total: 5.5 Million (3.4M Urban = 62%)

2010 Total: 9.7 Million (7.3M Urban = 75%)

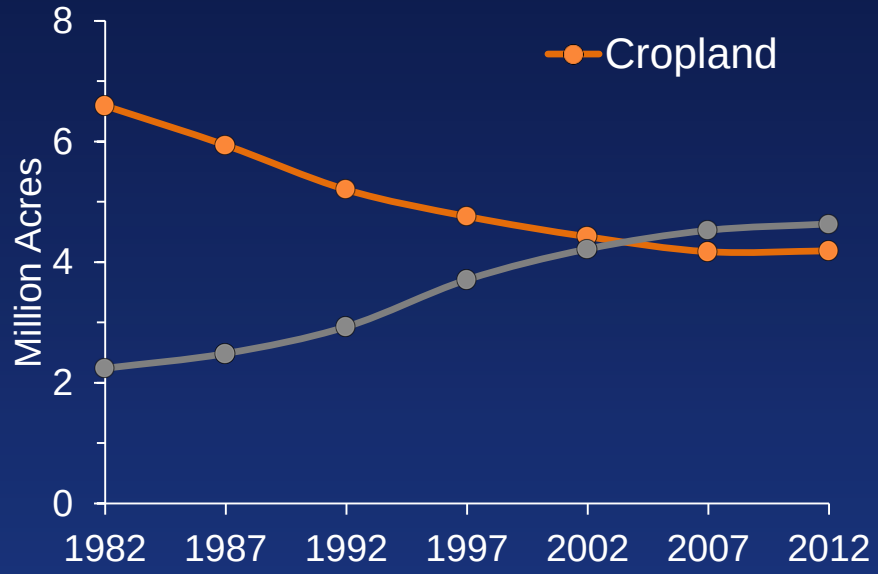
1982

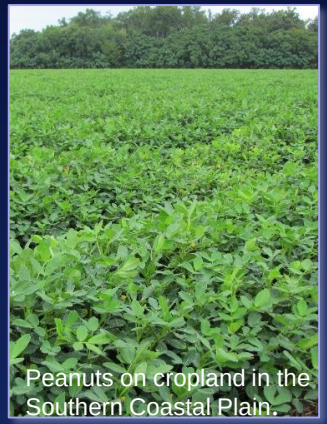
1982



2012

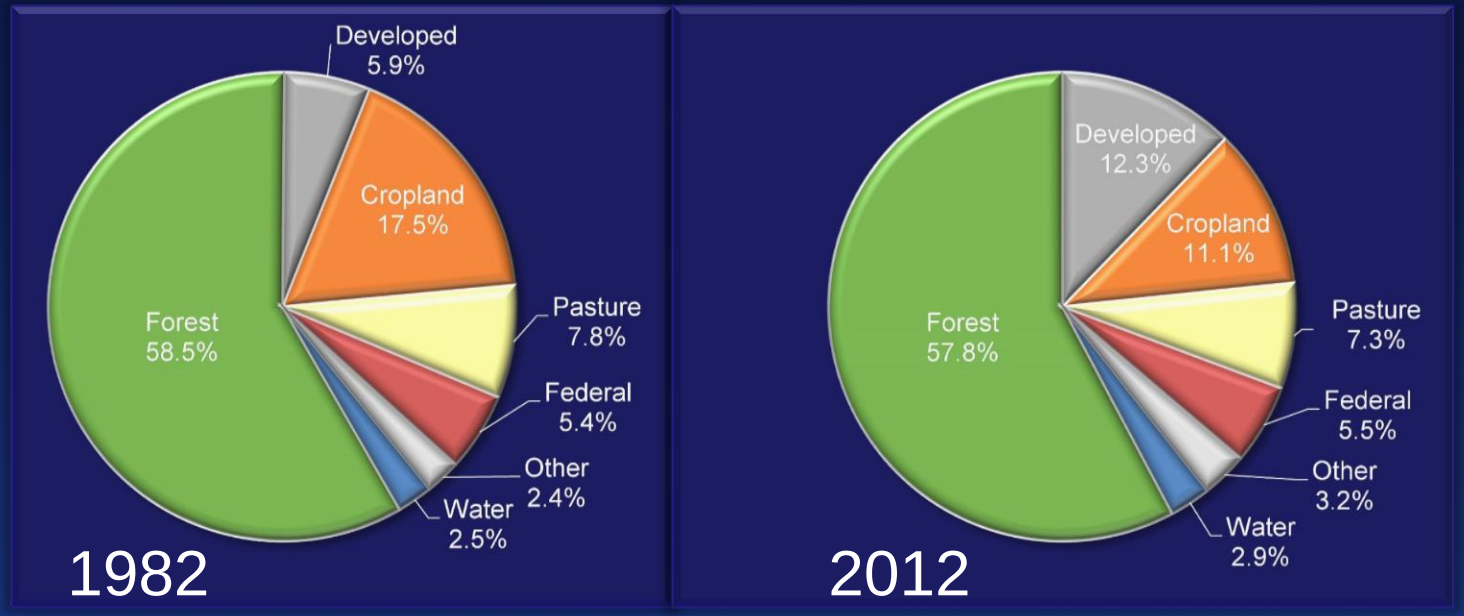
Most Active Change 1982 to 2012




Peanuts on cropland in the Southern Coastal Plain.


Developed land in the Southern Piedmont.

Overall Georgia Land Use 1982 & 2012



NRI data for the nation and information on data gathering procedures is available online at:

http://www.nrcs.usda.gov/technical/nri/

A useful compilation of NRI information and other agencies' data is at the Resources Conservation Act data viewer:

http://www.nrcs.usda.gov/technical/rca/

12 Months of Soils!

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

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2015 International Year of Soils

12 Months of Soils!

https://www.soils.org/IYS

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2015 International Year of Soils

12 Months of Soils!

January - Soils sustain life 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.	**July** - Soils are living 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.
February - Soils support urban living 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.	**August** - Soils and health 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.
March - Soils support agriculture 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.	**September** - Soils support the natural environment 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.
April - Soils clean and capture water 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.	**October** - Soils and the products we use 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.
May - Soils support buildings and infrastructure 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.	**November** - Soils and climate change 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.
June - Soils support recreation 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.	**December** - Soils and culture 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.

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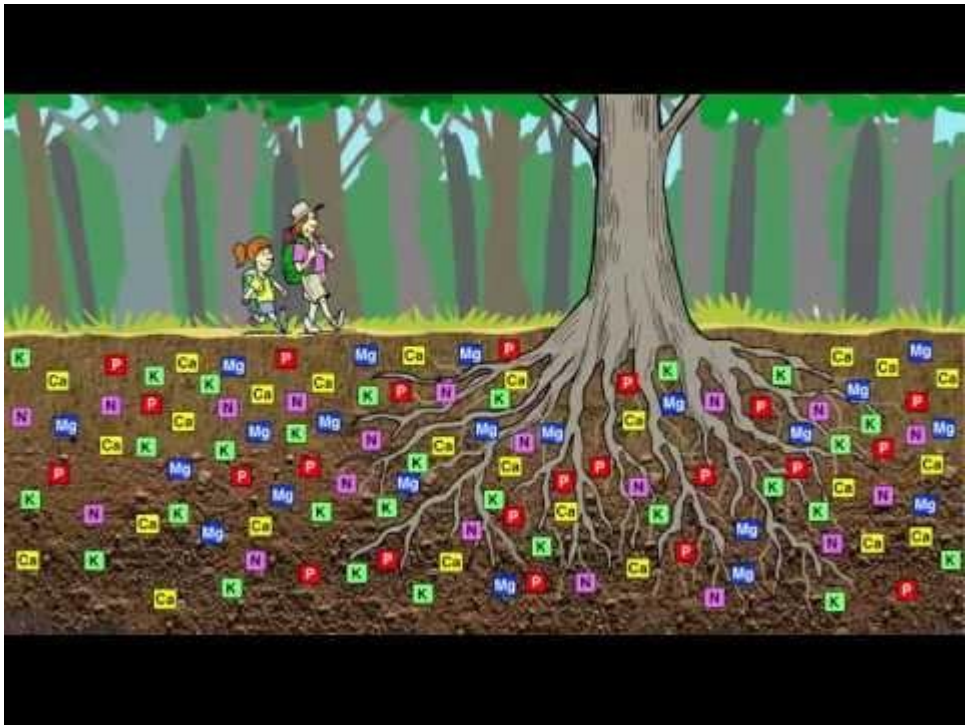
September - Soils Protect the Natural Environment



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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

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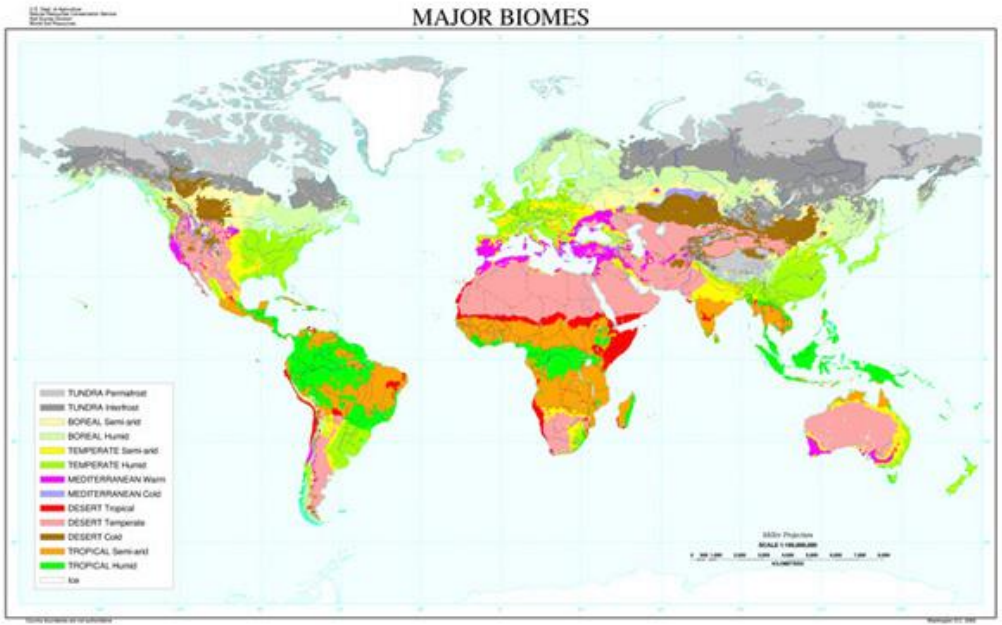
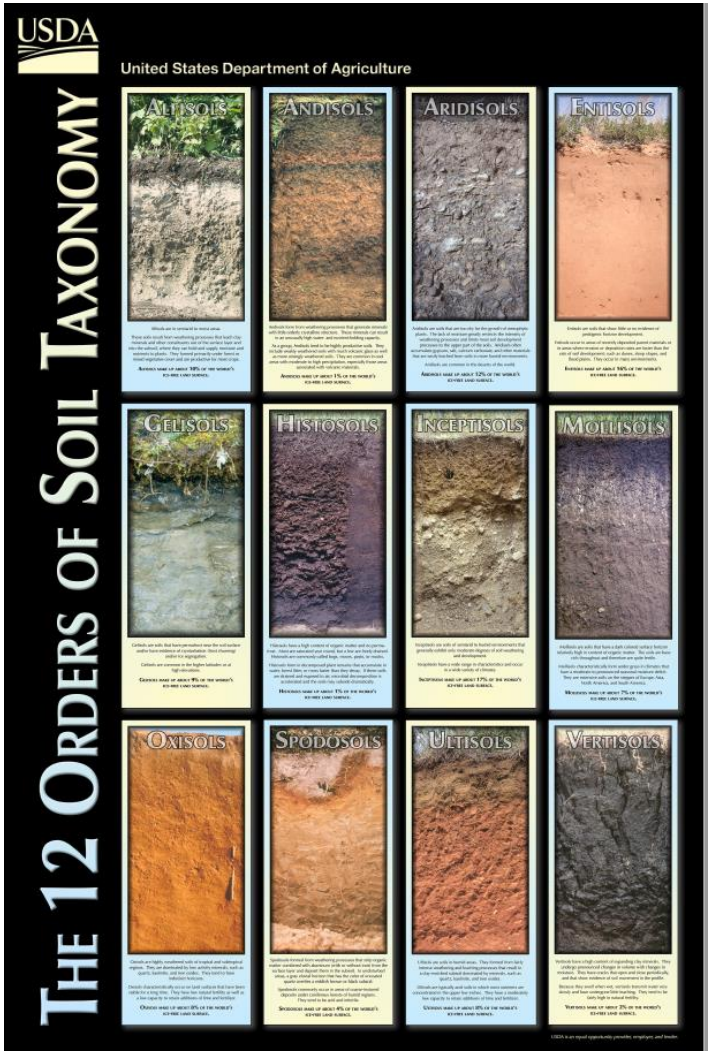
Soil Taxonomy - 12 Orders





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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 ClORPT factors are most important in soil formation?
    - Climate
    - Organisms
    - Relief
    - Parent material
    - Time

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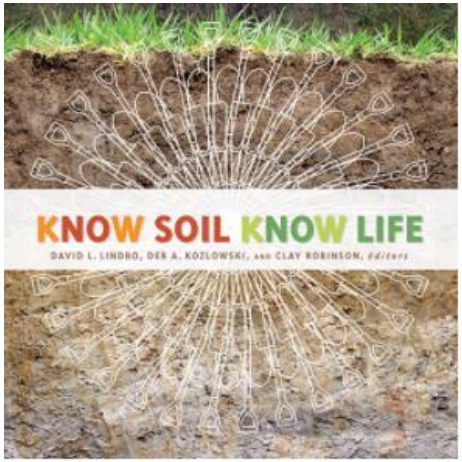
SSSA K-12 Resources

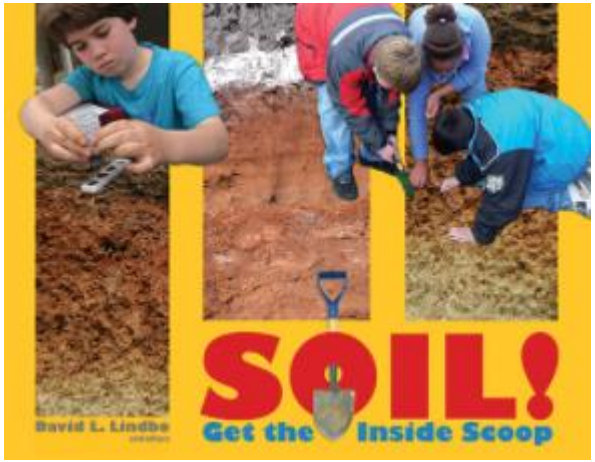
Websites:

Soils4kids.org

Soils4teachers.org

Soils.org/IYS





Highlights:

Ask a Soil Scientist

Lessons

Activities

Career Profiles

Interactive Games

Order Books

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Soils4kids.org

Soils4teachers.org

Questions?

Thank you!

Be sure to visit our booth- #943

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