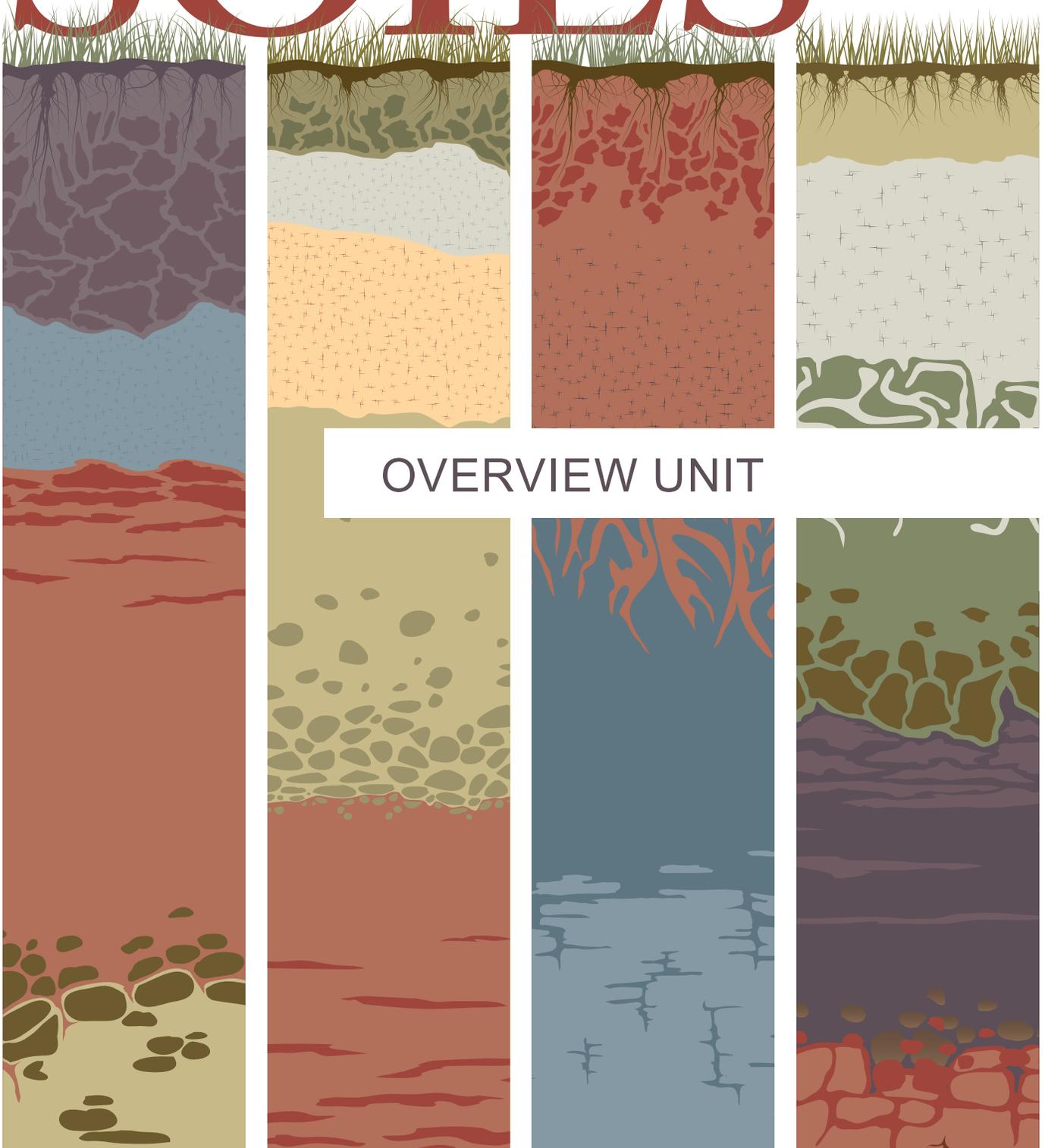


SOILS



OVERVIEW UNIT



Soil Science Society of America
www.soils.org

www.soils4teachers.org

Thank You

Thank you to our SSSA members and K-12 educators who worked diligently to develop this unit. This project was successful as a result of their efforts and dedication to tell the story and the science of soil!

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Overview

Goal: The lessons in this unit provide students with a basic understanding of the fundamentals of soil science through the integration of disciplinary core ideas, science and engineering practices, and crosscutting concepts in the lessons, investigations, and activities.

Grade Level: 6-8

Unit Layout: The lessons in this unit capitalize on the wealth of teaching resources found on the K-12 education websites of the Soil Science Society of America. The Soils 4 Kids (www.soils4kids.org/), Soils 4 Teachers (www.soils4teachers.org/), and International Year of Soils (www.soils.org/IYS) websites contain numerous resources that can be combined to create a unit focused on soils, or taken separately to enhance other sciences units to include soil science. The unit includes six “Parts” key to the field of soil science and to middle school science. Each Part includes learning objects, teacher background information, student information, and selected lesson resources to support learning. These parts, like the selected teaching resources, may be used individually or combined to create a unit. A Glossary of Terms can be found on the Soils 4 Teachers website (www.soils4teachers.org/).

Key Next Generation Science Standards (NGSS) Disciplinary Core Ideas: Soil science is a cross-disciplinary topic, and listed below are the key middle school (grades 6-8) disciplinary core ideas that include the topic of soils. Key science and engineering practices and crosscutting concepts addressed in the unit are identified in each component of the unit with the lessons and activities. Visit the Next Generation Science Standards website (nextgenscience.org/) for detailed information on the NGSS.

Earth & Space Science

- ESS2.A: Earth Materials and Systems
- ESS2.C: The Roles of Water in Earth’s Surface Processes
- ESS2.D: Weather and climate
- ESS3.A: Natural Resources
- ESS3.B: Natural Hazards
- ESS3.C: Human Impacts of Earth Systems

Life Science

- LS2.A: Interdependent Relationships in Ecosystems
- LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Physical Science

- PS1.A: Structure and Properties of Matter
- PS1.B: Chemical Reactions
- PS3.D: Energy in Chemical Processes and Everyday Life

Enduring Understandings:

- Soils are dynamic and always changing
- Soil is not dirt
- Soils play an essential role in ecosystems
- Soils are essential to life

Essential Questions:

- How do soils sustain life and influence life as abiotic and biotic factors in an ecosystem? (Part 1)
- What are the five soil formation factors (CIORPT) and how do they contribute to the formation of soil? (Part 2)
- What are the characteristics that differentiate a soil from other soils (i.e. particle size/texture, structure, color, profile) and how do these characteristics contribute to soil quality and function? (Part 3)
- What are the challenges of ensuring soils are sustained into the future, and how can we address those challenges? (Parts 4)
- How do soils contribute to society: the products we use, places we live? (interdisciplinary) (Part 5)



Part 1: Soils Sustain Life Overview/Introduction

Water, air, and soil are basic to life on this planet but of the three, soil is the least understood. It is a complex warehouse of matter and living things that are necessary for life whether it be microorganisms that decompose our wastes, clay for our buildings, nutrients for plants, mineral resources for industry, or just a solid footing for our feet and everything else. Besides, there is interplay of various scientific principles at work in the soil from water purification to heat transfer, from oxidation-reduction reactions to ion exchange, and so on. Of course, we must not forget that our breakfast, lunch and dinner derive from the soil in one way or the other. Soil truly sustains life.

Objective: To provide an overview of soils to begin to develop an understanding of what soil is and its connections to life.

Teacher Notes: This Part of the Unit provides an overview of soils and their role in sustaining life. The selected content includes the fundamental concepts related to soils, all of which will be developed in greater detail in other Parts of the Unit.

Teacher Background Document(s)/Reading:

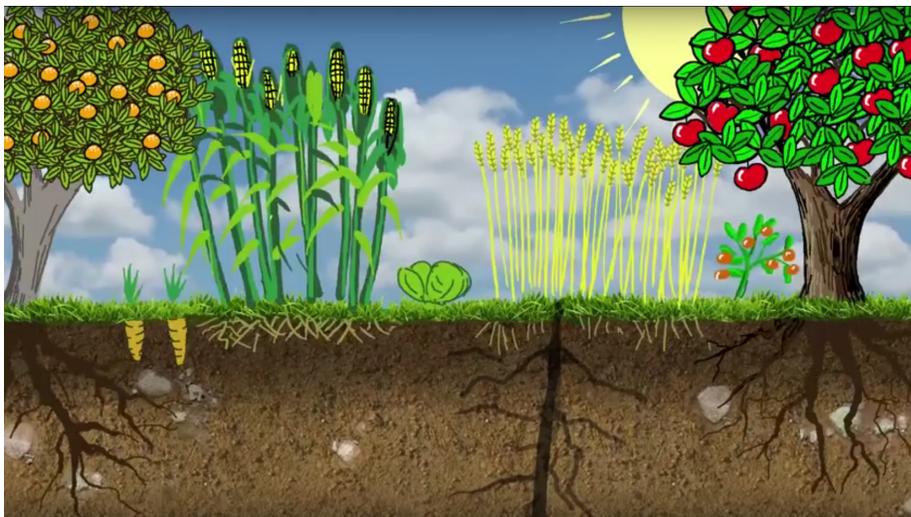
- Overview Document:
www.soils.org/files/about-soils/soils-overview.pdf
- Soil Basics webpage:
www.soils4teachers.org/soil-basics
- January IYS Video "Soils Sustain Life:"
<https://youtu.be/vDL6F6GkAzI>
- Soil Biology webpage:
www.soils4teachers.org/biology-life-soil
- NRCS Soil Health for Educators:
www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/health/assessment/?cid=nrcs142p2_053870

Student Background Document(s)/Reading:

- Overview Document:
www.soils.org/files/about-soils/soils-overview.pdf

Links to Activities:

- Down & Dirty from Discovery Education
http://school.discoveryeducation.com/schooladventures/soil/down_dirty.html
- Underground Adventure: Take a Virtual Tour:
http://archive.fieldmuseum.org/undergroundadventure/virtual_tour/index.shtml
- Tea4Science: www.soils4teachers.org/files/s4t/lessons/lesson-plan--tea4science.pdf
- Pitfall Traps: www.blm.gov/nstc/soil/Kids/collect.html



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Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Asking Questions & Defining Problems: Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.</p> <p>Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.</p> <p>Developing & Using Models: Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.</p> <p>Analyzing & Interpreting Data: Analyze and interpret data to determine similarities and differences in findings.</p> <p>Constructing Explanations and Designing Solutions: Construct an explanation using models or representations.</p>	<p>LS2.A: Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (Performance Expectation: MS-LS2-1)</p> <p>LS2.B: Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (Performance Expectation: MS-LS2-3)</p> <p>LS2.C: Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (Performance Expectation: MS-LS2-4)</p> <p>ESS3.A: Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (Performance Expectation: MS-ESS3-1)</p>	<p>Systems & System Models: Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.</p> <p>Structure & Function: Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.</p>



Part 2: Soil Formation – Introduction to CIORPT

(Climate, Organisms, Relief, Parent Material, Time)

Soil formation is a process that requires concurrent action of **climate**, **organisms**, **relief**, **parent material** and **time**, or CIORPT for short. CIORPT is responsible for the development of soil profiles and chemical properties that differentiate soils. Without CIORPT there will be no soil. Weathering takes place when environmental processes such as rainfall, freezing and thawing act on rocks causing them to dissolve, fracture or break into pieces. CIORPT then acts on the rock pieces, marine sediments and vegetative materials to form soils. The rocks and other base materials from which soil develops, referred to as parent materials, may have been transported from one place and deposited in another by glaciers, wind, water, or gravity. Temperature and precipitation influence the rate at which parent materials weather, dead plants and animals decompose, and affect the chemical, physical and biological relationships in the soil. Plants and animals influence the formation and differentiation of *soil horizons*, and together with soil organisms speed up the breakdown of large soil particles into smaller ones. Relief or landform position describes the shape of the land (hills and valleys), and the direction it faces makes a difference in how much sunlight the soil gets, how much water it keeps, and how deep or stable the soil is. All these factors act together over very long time to produce soils, as a result, soils vary in age. The length of time that soil material has been exposed to the soil-forming processes makes older soils different from younger soils.

Overall Objective: To understand the five factors responsible for soil formation.

Teacher Notes: This Part of the Unit could stand alone as a mini-unit given its detail into the five soil forming factors.

Teacher Background Document(s)/Reading:

- Soil Formation: www.soils4teachers.org/formation
- Soil Formation: www.missouricareereducation.org/doc/soilsci/SRLesson2.pdf
- NRCS Soil Formation & Classification: www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054278

Student Background Document(s)/Reading:

- Soil Formation: www.soils4teachers.org/formation
- All About Soil: www.eschooltoday.com/soils/factors-that-affect-soil-formation.html

Link to Activity:

- Chef's Challenge video: http://forces.si.edu/soils/ or forces.si.edu/soils/video/chefs_challenge.html

Activities for Each Factor

Climate

Objective: Understand how climate influences soil formation

Links to Activities:

- Introduction to Soils: <https://carbon.wr.usgs.gov/soilclass.html>
- PBS Learning: Breaking it Down (recommended for high school, but can be adapted to middle school) www.pbslearningmedia.org/resource/nat08.earth.geol.eros.lpbreakit/breaking-it-down-weathering-and-erosion/
- Climate and Temperature: www.earthsciweek.org/classroom-activities/climate-and-temperature

Organisms

Objective: Understand how organisms influence soil formation

Links to Activities:

- Tea 4 Science: www.soils4teachers.org/files/s4t/lessons/lesson-plan--tea4science.pdf
- Measuring Soil Microbial Activity: www.glbrc.org/education/classroom-materials/measuring-soil-microbial-activity
- Do the Rot Thing – A Teacher's Guide to Composting Activities: <http://cwmi.css.cornell.edu/compostingintheclassroom.pdf>
- Collect Soil Bugs using a Berlese Funnel: www.soils4teachers.org/files.s4t/berlese-funnel.pdf
- Winogradsky Column: (recommended for high school, but can be adapted to middle school): http://serc.carleton.edu/microbelife/topics/special_collections/winogradsky.html
www.hhmi.org/biointeractive/winogradsky-columns-microbial-ecology-classroom

Relief

Objective: Understand how landscape influences soil formation

Links to Activities:

- How do certain factors affect the erosion of soil by water: www.glencoe.com/sites/common_assets/science/virtual_labs/ES08/ES08.html

Parent Material

Objective: Understand how parent materials influence soil formation

Links to Activities:

- Making Sedimentary Rocks: www.windows2universe.org/teacher_resources/teach_makerock.html
- Weathering and Erosion: <http://209.7.198.36/geologyonline/lessons/6.3/lesson.pdf>

Time

Objective: Understand how time influences soil formation

Links to Activities:

- SSSA's Soil Formation (scroll down to Soil Formation): www.soils4teachers.org/lessons-and-activities/teachers-guide/soil-formation

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Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Asking Questions & Defining Problems: Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.</p> <p>Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.</p> <p>Developing & Using Models: Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.</p> <p>Analyzing & Interpreting Data: Analyze and interpret data to determine similarities and differences in findings.</p> <p>Constructing Explanations and Designing Solutions: Construct an explanation using models or representations.</p>	<p>Climate: ESS2.D: Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (Performance Expectation MS-ESS2-6)</p> <p>PS1.B: Some chemical reactions release energy, others store energy. (MS-PS1-6)</p> <p>Organisms: LS2.A: Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (Performance Expectation: MS-LS2-1)</p> <p>PS3.D: Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to Performance Expectation MS-LS1-7)</p> <p>Relief: ESS2.C: The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (Performance Expectation MESS2-5)</p> <p>Parent Material: ESS2.A: All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (Performance Expectation MS-ESS2-1)</p> <p>Time: ESS2.A: The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (Performance Expectation MS-ESS2-2)</p>	<p>Systems & System Models: Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.</p> <p>Structure & Function: Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.</p>

Part 3: Characteristics of Soil

There are trees and they are different -- there is the Oak, Maple, Birch, Spruce, etc. So also are soils. Each soil has an identity and they are determined by such characteristics as color, texture (proportions of sand, silt and clay particles), structure, profile, etc. that set them apart from each other. For example, sand is coarse while clay is fine, like powder, and there are dark-colored soils and red soils. These characteristics which give each soil its identity are inherited from the parent material (see Part 2) from which the soil developed and can also evolve through the impact of CIORPT, the five factors acting to produce soil. As a result of these characteristics, not all soils can perform the same function, for example, installation of on-site wastewater treatment or simply growing corn.

Soil Texture

Objective: Understanding sand, silt, and clay as properties that determine soil (textural) character and identify soil texture by feel.

Teacher Background Document(s)/Reading:

- Powerpoint presentation with basic information about soil texture: www.soils4teachers.org/files/s4t/lessons/texture.ppt
- Handout describing soil texture with information on how to use a soil triangle: www.soils4teachers.org/files/s4t/lessons/soil-texture.pdf

Links to Activities:

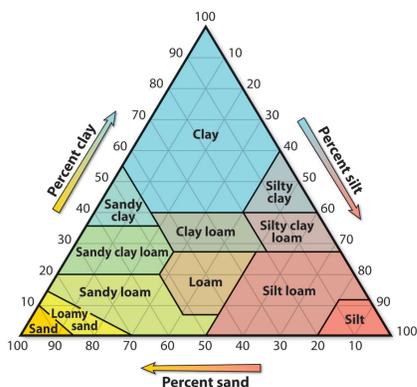
- Soil Texture – Jar Method (This is a demonstration that can be converted into a student activity.) www.soils4teachers.org/files/s4t/texture.pdf
- Soil Texture – Hand Method: www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054311

Soil Structure

Objective: Recognize that soils are made up of solids and spaces that ascribe “shapes” to soil. Understand the basics of different arrangements and aggregations of soils.

Links to Activities:

- Soil Glue (organic matter): www.nrcs.usda.gov/wps/PA_NRC-SCONSUMPTION/download?cid=nrcs142p2_051280&ext=pdf
- Ideal Soil - Soil Air and Composition - demonstration: www.doctordirt.org/teachingresources/idealsoil
- Slake: www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051287.pdf



Soil Color

Objective: To familiarize themselves with the typical colors of soils and the factors that lead to those colors.

Teacher Background Document(s)/Reading:

- Powerpoint presentation with basic information about soil color: www.soils4teachers.org/files/s4t/lessons/color.ppt
- The Color of Soil: www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054286

Links to Activities:

- M&Ms Are Just Like Soil - Understanding Soil Color: www.soils4teachers.org/files/s4t/mm-color.pdf
- Dirt Shirt - Can Soil be Used as a Natural Dye?: www.doctordirt.org/teachingresources/dirtshirts

Soil Profile

Objective: Recognize that soils have horizons and how the horizons are different from each other.

Links to Activities:

- A Soil Profile: www.soils4teachers.org/files/s4t/soilprofilelessonplan.pdf
- Dig Into Soil: www.earthsciweek.org/classroom-activities/dig-soil



Rhode Island State Soil: Naragansett

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Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Asking Questions & Defining Problems: Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.</p> <p>Developing & Using Models: Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.</p> <p>Analyzing & Interpreting Data: Analyze and interpret data to determine similarities and differences in findings.</p> <p>Constructing Explanations and Designing Solutions: Construct an explanation using models or representations.</p>	<p>Soil Texture ESS2.A: The planet’s systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth’s history and will determine its future. (Performance Expectation MS-ESS2-2)</p> <p>PS1.A: Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (Performance Expectations MS-PS1-2 and MS-PS1-3)</p> <p>Soil Structure PS1.A: Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (Performance Expectations MS-PS1-2 and MS-PS1-3)</p> <p>Soil Color PS1.A: Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (Performance Expectations MS-PS1-2 and MS-PS1-3)</p> <p>PS1.B: Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are re-grouped into different molecules, and these new substances have different properties from those of the reactants. (Performance Expectations MS-PS1-2 and MS-PS1-3 and MS-PS1-5)</p> <p>Soil Profile LS2.B: Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. (Performance Expectation MS-LS2-3)</p> <p>ESS2.A: The planet’s systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth’s history and will determine its future. (Performance Expectation MS-ESS2-2)</p>	<p>Systems & System Models: Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.</p> <p>Structure & Function: Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.</p>

Part 4: Soil Degradation & Environmental Sustainability

Soil is a natural resource and like all natural resources it can be misused, contaminated, or degraded. Soil degradation can be due to natural and/or human-induced processes. Degradation may be as simple as the creation of gullies due to surface water runoff or may be extensive as in industrial pollution resulting in massively contaminated soils such as those classified as Superfund sites. A soil contaminated with heavy metals or crude petroleum cannot be used for recreation or grow food. An overused recreation field subsequently washed away by erosion requires intervention and protection from future damage. So, whether on a small or large scale, soils need to be protected from degradation and environmental pollution so that they can provide their assigned services and functions now and long into the future. The consequences soil degradation and pollution are loss of productive topsoil, flooding, landslide, loss of wildlife that used to depend on the land, etc. To prevent these, there are many conservation practices available to protect soils from degradation and pollution.

Objective: Soil is susceptible to degradation and needs to be protected and managed using various methods of conservation to ensure environmental sustainability.

Teacher Background Document(s)/Reading:

- Human and Soil Interactions:
www.soils4teachers.org/human-soil-interactions
- What is desertification and what can be done to prevent it?:
<https://soilsmatter.wordpress.com/2015/11/01/what-is-desertification-and-what-can-be-done-to-prevent-it/>
- Erosion:
www.doctordirt.org/teachingresources/erosion

Student Background Document(s)/Reading:

- Desertification and the American Dust Bowl (discussion questions for the video "Black Blizzard"):
www.soils.org/files/sssaiys/dust-bowl-activity.pdf

Links to Activities:

- Erosion Model:
www.soils4teachers.org/files/s4t/erosion-model.pdf
- How much is Dirt Worth:
http://utah.agclassroom.org/matrix/lessonplan.cfm?lpid=550&state_only=UT&grade=6,7,8&search_term_lp=SoilgradeID=5&searchSub.subjectID=2
- Keeping Soil in its Place:
<https://utah.agclassroom.org/teachercenter/index.cfm?controller=main&action=lpsearch&lpID=497&searchGradegradeID=5&searchSub.subjectID=2>
- Soil Organic Matter (Aggregate Stability):
www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054302
- Liquefaction Activity: www.thetech.org/sites/default/files/pdfs/Science-Labs/EfE-Lab-Liquefaction.pdf
- Combating Desertification - Saving our Topsoil:
www.soils.org/files/sssaiys/unesco-desertification-activities.pdf
- Rain and Soil:
www.soils4teachers.org/files/s4t/rain-and-soil-lesson.pdf
- Fall of the Leaning Tower: www.pbs.org/wgbh/nova/education/activities/2611_pisa.html
- Soil Filter:
www.doctordirt.org/teachingresources/soilfilter
- Soils in the Amazon:
www.pbs.org/journeyintoamazonia/teacher_soil.html



Dust Bowl: USDA-NRCS



Erosion Model: soils4teachers.org

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Leaning Tower of Pisa

Part 5: Soil is Inter-disciplinary; Soil Science is an Applied Science

The soil has something for everyone. If you like chemistry, physics, biology, or ecology, you will find many applications in soil because the soil is complex and has many processes, reactions, and life interactions taking place in it. Discover how soil pH affects the concentrations (or availability for plant use) of elements like calcium, phosphorus, potassium, etc., or discover the amazing life of microorganisms, insects and animals in soil and the role they play in biodegradation. In addition, the soil holds carefully-preserved secrets waiting to be unearthed by the archeologist, provides clay for the artist, yielded the first antibiotic for medicine, and continues to support production of healthy food for exploding world population. For many cultures, their existence rests on soil for building mud houses, growing food, and producing great treasures of art.

Objective: Soils are foundational to many fields of science and serve many purposes for humans. Soils research requires the integration of many fields of science, the results of which have practical applications for many fields such as agriculture, manufacturing, and recreation, etc.

Teacher Notes: The content for this part of the unit reminds students how important soils are to so many aspects of our lives. The year 2015 was the International Year of Soils, and the year-long celebration included monthly themes. With each of these themes there is a video and a set of classroom activities selected to support the content of the videos. Use these links to explore the many applications of soils in our lives.



2015
International
Year of Soils

- International Year of Soils homepage: soils.org/iys
- International Year of Soils videos: www.soils.org/iys/monthly-videos
- International Year of Soils activities: www.soils.org/iys/12-month-resources/



NGSS Connections: The following elements of middle school NGSS disciplinary core ideas (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs) may be addressed in this Part of the Unit. Combined to create three-dimensional (DCI + SEP + CCC) learning builds proficiency in these elements, and the associated performance expectations.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Asking Questions & Defining Problems: Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.</p> <p>Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.</p> <p>Developing & Using Models: Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.</p> <p>Analyzing & Interpreting Data: Analyze and interpret data to determine similarities and differences in findings.</p> <p>Constructing Explanations and Designing Solutions: Construct an explanation using models or representations.</p>	<p>ESS3.A: Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (Performance Expectation: MS-ESS3-1)</p> <p>LS2.A: Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (Performance Expectation: MS-LS2-1)</p>	<p>Systems & System Models: Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.</p> <p>Structure & Function: Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.</p>



Soil
Science
Society of America

K-12 Soil Science Teacher Resources



Soil Facts

Ten Reasons We are Alive Because of Soil:

Oxygen: Oxygen is released by plants, which grow in soil.

Clean water: Water is filtered naturally by soil.

Food: The food that we eat gets nutrients from, and grows in, soil.

Shelter: Soil provides building materials and foundation support.

Pharmaceuticals: Soil chemicals contribute to drugs from antacids to antibiotics.

Clothing: Clothing is made from fiber grown in soil or from animals fed by crops.

Minerals: Minerals from soil are essential in manufacturing and a healthy diet.

Nutrient cycling: Nutrients are recycled through processes that occur in soil.

Clean environment: Soil breaks down pollutants.

Secure economy: U.S. agriculture contributes \$190 billion (Heinz Center, 2003) in products from the land annually, providing the basis for the country's economy, food security, and thriving communities

Soils sustain life, playing a vital role in sustaining human welfare and assuring future agricultural productivity and environmental stability. The study of soil as a science has provided us with a basic understanding of the physical, chemical, and biological properties and processes essential to our complex ecosystem.

The Soil Science Society of America (SSSA) is pleased to provide information and resources to educators in all grades to tell the story of soils.

Looking for Online Soil Resources?

You'll find a variety of information to help you teach your students about the wonderful world of soil!

- **Lessons & Activities**—Activities on soil texture and soil color have been developed for use in the classroom.
- **Resources**—To help you find and assess online soils education sites, we have reviewed many sites. The sites listed have high quality materials for lessons and activities at different grade levels.
- **Definitions**—Browse or search for over 2000 soil terms!
- **Ask a Soil Scientist**—If you have any question on soils, soil science, and careers in soil science, this is the place to get answers. And, you can request a soil scientist visit your classroom. Your question(s) will be sent to a Soil Science Society of America member, in your region.

The Soil Science Society of America is a progressive international scientific society, providing avenues for the transfer of knowledge and practices to sustain the world's soil resources. SSSA is the professional home for 6000+ members dedicated to advancing the discipline and practice of soil science by acquiring and disseminating information about soils in relation to crop production, environmental quality, ecosystem sustainability, bioremediation, waste management and recycling, and wise land use.



www.soils4teachers.org



Become a Friend of Soil Science!

Do you have an interest in soil science but may not be involved in the profession of soil science? Want to keep up-to-date on SSSA - with a bi-weekly email delivered to your inbox? Then become a "Friend of Soil Science."

The Friends of Soil Science is an opportunity for professionals and others who are interested in soils and soil science to get a snapshot of the science and SSSA. You'll receive a bi-weekly "Newsflash" with information on SSSA, our activities, and other items of interest to the soil science profession, around the world. We'll also send you occasional emails on activities of interest - such as the 2015 International Year of Soils and the associated monthly themes, activities and videos we have developed. But, not to fear, we won't be filling up your inbox! And, you can opt-out at any time. Sign-up today and join others who want to be a Friend of Soil Science.

*Note that the Friend of Soil Science is not a membership and there are no associated benefits other than the delivery of the Newsflash. If you would like to gain access to the many benefits of membership, view our Become a Member webpage and learn more.

Sign up at: www.soils.org/membership/friends-of-soil-science



SSSA Trial Membership

Would you like to gain a broader understanding of the Soil Science Society of America and how a membership will benefit your career, your research, and how it is valuable from an inter-disciplinary perspective? SSSA is pleased to now offer a trial membership – one that provides an in-depth look our membership and associated benefits, without the up-front commitment of member dues. The Trial Membership, while not a full membership, gives you the opportunity to take a tour, become familiar with SSSA, our members, and our benefits. If you like what you see and believe, as we do, that this is a valuable addition to your networking and research repertoire, join and become a member. The Trial Membership offers you the following:

- Electronic communications include the bi-weekly Newsflash with information on society activities and the Science Policy Report with an update on Capitol Hill activities, funding opportunities, agency news, and more;
- Access to Soil Horizons magazine,
- Electronic access to our member magazine, CSA News,
- Sign up for any of our 14 Divisions of Interest,
- Sign-up for a 30-day Digital Library trial subscription, (email soils.org to activate) and
- Receive specialized announcements of SSSA programs and services.

Of course, we'll also provide membership information along the way so that when you are ready to join, you'll have the information at your fingertips to do so.

*Note that the trial membership does not provide voting rights, nor eligibility to hold office or serve on committees, or nominate/be nominated for most awards and scholarships. In addition, trial memberships do not provide member discounts on subscriptions, publications, or meetings.

*You may try this trial membership one time, for 6 months (a great opportunity), and current/former members are not eligible.

Sign up at: www.soils.org/membership/become-a-member/trial



