Unit 6: Soils and their Preservation

Content Area:	**Science**
Course(s):	
Time Period:	**Marking Period 3**
Length:	**2 weeks**
Status:	**Published**

Summary

This unit will introduce the students to soils, one of the most important environmental resources. This inquiry-based unit will give students the ability to develop and test hypotheses by spending most of the class time conducting hands-on experiments and lab components. Major topics include classification of soil particles, physical characteristics and identification of soils, soil pollution and soil conservation with regards to the agricultural practices discussed in the previous unit.

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CS.9-12.8.2.12.NT.1	Explain how different groups can contribute to the overall design of a product.
CS.9-12.8.2.12.NT.2	Redesign an existing product to improve form or function.
CS.9-12.8.2.12.ETW.1	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
CS.9-12.8.2.12.ETW.2	Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.
CS.9-12.8.2.12.ETW.3	Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.
LA.RI.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.RI.11-12.2	Determine two or more central ideas of a text, and analyze their development and how they interact to provide a complex analysis; provide an objective summary of the text.
LA.RI.11-12.3	Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
MA.S-IC.B.6	Evaluate reports based on data.
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
MA.S-MD.B.5	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.GCA.1	Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).

Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved.

Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).

Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).

Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms.

Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).

Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.

Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.

Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.

Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.

Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history.

Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.

Essential Questions and Enduring Understandings

Essential Questions:

In what ways is soil vital to the healthy functioning of our planet?

How is human survival on Earth connected to our understanding of soil resources?

How have humans impacted soils on Earth throughout our history?

How has our impact on soil resources impacted our ability to grow food for our increasing human population?

Enduring Understandings:

Soil is a vital natural resource for life on Earth and is the foundation for all land-based ecosystems.

Human influence on soil resources has been profound and has resulted in diminishing ability of our planet to continue producing food for our growing population.

Objectives

Students will know key terms: sand, silt, clay, soil texture, percolation rate, water holding capacity (WHC), erosion, soil nutrients, leaching, loam, and desertification.

Students will know the physical characteristics that create soil types.

Students will know the importance of soils in determining ecosystems and biomes

Students will know soil conservation techniques and how they can help to maintain soil fertility

Students will be skilled at identifying soil types by texture, color, percolation rate, water holding capacity, and relative percentages of sand, silt and clay

Students will be skilled at interpreting soil texture triangles

Students will be skilled at connecting soil types and characteristics with specific human uses.

Students will be skilled at calculating water holding capacity and percolation rates for different soil types

Students will be skilled at explaining the materials, methods and equipment used by field ecologists

Learning Plan

Complete homework assignments consisting of 3-5 textbook questions, web based assignments or using outside resources.

Conduct a laboratory measuring soil nutrients of various soil samples and make recommendations for improving the soil quality and assess what could be grown in the soil in the current state.

Take notes from a PowerPoint Presentation about soils and their properties.

Complete a quiz: Field Identification of soil horizons, WHC and Percolation Rate

Assess 2 different soil samples using texture by feel, soil textural triangle, WHC, Percolation rate, and color. Students will identify an unidentified sample answer analysis questions, and make recommendations for uses of all 3 soils.

Lab investigation: Soil Nutrient Lab

“Black Gold” Soils Power Point Presentation

Lab: Water Holding Capacity, Percolation Rate, Soil Textural Triangle, identification of an unknown soil type.

Field Investigation: Digging Soil Horizons.

Use of digital photos on whiteboard to serve as virtual field trip of various biomes with different soil types.

Assessment

Formative Assessments:

- Worksheets
- Do Nows
- Exit Tickets

- Class Discussions

Quiz:

- Soil formation and Physical Characteristics

Bench Marks:

Midterm and Final Exam

Alternative:

- PPT discussion: BLack Gold and soil formation
- Soil formation text worksheet
- Hands on lab: soil types, texture and charactersitics
- Hands on lab: testing soil nutrients
- Hands on lab: WHC and Percolation Rate
- Worksheet/ discussion: soil types and human uses

Summative:

Unit Tests:

- Soil Formation, Properties, Uses and Conservation

Materials

Raven & Berg Evnironment Textbooks (ISBN: 978-1-119-39341-2)

Guided note packets (teacher developed)

Technology (student & teacher laptops, SmartBoard)

PowerPoints

Workshets/notes

Youtube

Soils Samples: Loam, Sand, Clay

Digital Scale

Rulers

Filters

Water

Funnels

Water

Stopwatches

Soil Texture Triangles

Soil Nutrient Test Kits and Packets

Suggested Strategies for Modification

https://docs.google.com/spreadsheets/d/1P8BzKodtBsbWi4rQ0tunGWhZkCOg52IvbNO7yy-TFJI/edit?usp=sharing