

Lesson Plans

The lessons in this guide are intended to bring a students' understanding of soil to life. To fully engage students in the topic, each lesson includes three activities (Laying the Groundwork, Exploration, Making Connections), ideas for follow-up projects and activities, and additional journal worksheets. Many activities can be conducted in either indoor or outdoor classrooms and with or without a school garden. (Note: A complete explanation of how to use the guide is included in the Download.) The lessons are sequenced so that the topics build on each other. However, the activities can be used independently, in any order. The *Digging into Soil* lesson plans include:

[DOWNLOAD GUIDE](#) ([/download-soil-science-garden-guide.html](#))

Lesson 1 The All on Soil



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Summary

What is soil? Why is it important? Through this lesson students will be given an overview of soil and discover that healthy soils are part of a larger system that is both complex and truly alive. They will explore why soils are critical to all life on Earth.

Objectives

Students will learn:

- Soil is the top, thin layer of earth.
- Soil is comprised of inorganic matter formed from the breakdown of rock, along with decomposing organic matter. It is also home to millions of living organisms.
- Soil is key for growing food, cleaning water and air, and providing a habitat for living organisms of all shapes and sizes.
- Disruption of soil life can lead to devastating results.

Link to Next Generation Science Standards Performance Expectations

HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

Lesson 2 It's ALIVE!

Summary



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Lesson 3 In the Beginning

What lives in soil? Healthy soils are teeming with life, from microscopic bacteria and fungi to large mammals like moles and voles. In this lesson, students will explore the many organisms that call soil home.

Objectives

Students will learn:

- There are millions of microbes, soil insects, worms, and soil fungi living in healthy soil.
- Soil organisms help break down the organic and inorganic matter in the soil, providing nutrients for plants. In some cases, they also help with the delivery of the nutrients to the plants.
- Soils that are treated with excessive amounts of fertilizers, insecticides, and weed killers may become lifeless, decreasing their ability to sustain healthy plant growth.

Link to Next Generation Science Standards Performance Expectations

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Summary

Where does soil come from? Students explore the origins of existing soil and how new soil is made.

Objectives

Students will learn:

- Soil is formed through the breakdown of bedrock and other earth materials via climate and decomposition by microbes, fungi, and plants.
- The kinds of plants and animals that contribute organic matter to the soil as they decay impact the composition and appearance of soil.

Link to Next Generation Science Standards Performance Expectations

HS-ESS1-6: Apply scientific reasoning and evidence from ancient Earth materials, meteorites and other planetary surfaces to construct an account of Earth's formation and early history.

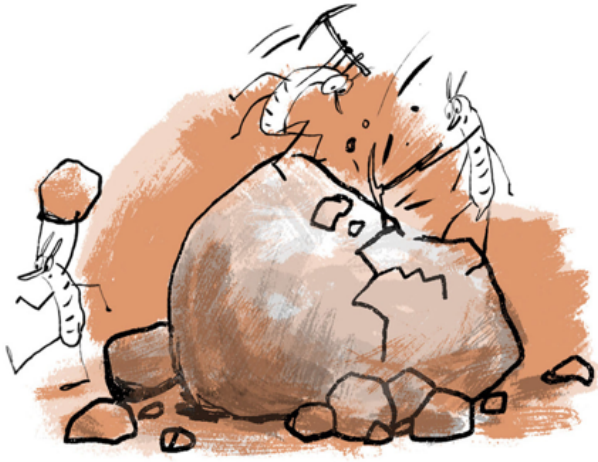


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Lesson 4 Texturally Speaking

Summary

Students will discover how soil texture is used to describe soils and group them into categories for practical application.

Objectives

Students will learn:

- Inorganic soil particles are defined by their size and are categorized as sand, silt, or clay.
- The proportion of sand, silt, and clay defines the soil texture and can tell us a lot about the soil.
- Different plants grow well in different types of soils.

Link to Next Generation Science Standards Performance Expectations

HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effect on Earth materials and surface process.

HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.



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Lesson 5 Sleuthing Soil Structure

Summary

What is soil structure? This lesson will provide an in-depth look at how soil structure impacts its functionality.

Objectives

Students will learn:

- Soil structure describes how all of the components in the soil are arranged.
- Soil structure is just as important as the materials contained in the soil.
- Healthy soil must also include adequate pore space, which can be filled with air and water.
- Human activity frequently disrupts soil structure, which impacts the soil's ability to absorb water and increases problems of stormwater runoff and erosion.

Link to Next Generation Science Standards Performance Expectations

HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth Systems.

HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effect on Earth materials and surface processes.



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Lesson 6 Horizons Happen

Summary

The movement of water, minerals, and organic matter within soil can lead to the formation of distinct layers with common properties. What can we learn from these soil layers, also known as soil horizons?

Objectives

Students will learn:

- Soils have different layers (horizons) and the layers vary in size and composition depending on the climate and vegetation present.
- Exploring soil horizons can tell you about the environmental conditions in the area and how the soil has been treated in the past.

Link to Next Generation Science Standards Performance Expectations

HS-ESS2-1: Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.



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Lesson 7 The Soil-Air Connection

Summary

What is the relationship between soil and the Earth's atmosphere? Students will explore the connection between what happens below and above the ground. They will learn about the vital role soil plays in the carbon cycle.

Objectives

Students will learn:

- Soil stores carbon and helps regulate atmospheric carbon.
- Soil provides nutrients and habitats to all life on land.

Link to Next Generation Science Standards Performance Expectations

HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

HS-ESS2-6: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

HS-ESS3-5: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.

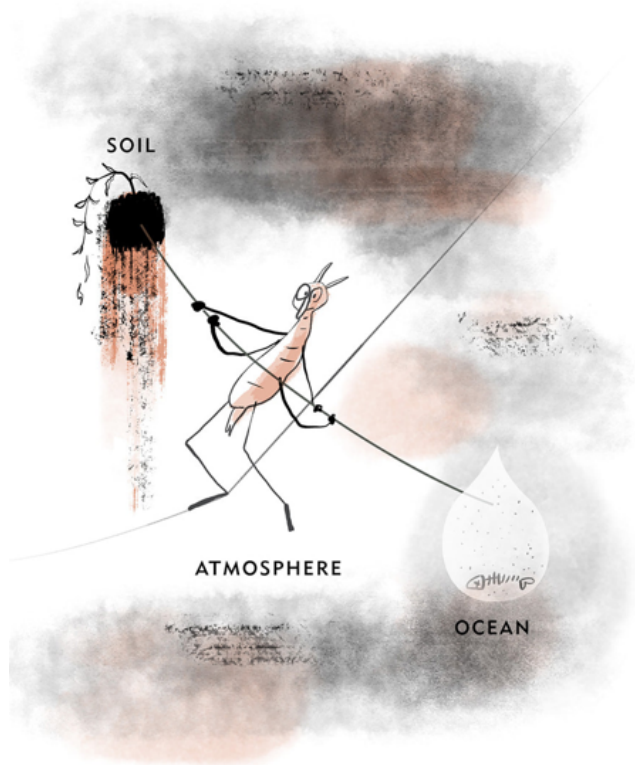


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Lesson 8 The Soil-Water Connection

HS-ESS3-6: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including costs, safety, reliability and aesthetics, as well as possible social, cultural and environmental impacts.

Summary

What is the relationship between soil and water? Students will learn about the vital role soil plays in the water cycle and its importance in keeping our water supply clean.

Objectives

Students will learn:

- Soil is an important part of the water cycle and helps clean our water supply.

Link to Next Generation Science Standards Performance Expectations

HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effect on Earth materials and surface processes.



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Lesson 9

Leaving Our Mark on Soils

Summary

How have humans impacted soils? Students will explore how human actions alter soil and investigate some of the negative impacts of human activity. They will also learn about ways we can remediate damaged soils and rebuild new soils.

Objectives

Students will learn:

- Throughout history, humans have not always considered how their actions impact local soils, resulting in damage to soil systems.
- Human actions can have significant impacts on soil health.

Link to Next Generation Science Standards Performance Expectations

HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.



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Lesson 10 Save Our Soil

HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Summary

How can humans protect existing healthy soils? How can humans improve soils? In this lesson, students will both learn about and find ways to share knowledge of how to protect this important natural resource.

Objectives

Students will learn:

- Spreading knowledge about soil is an important tool for protecting existing healthy soils.
- Soil experts are trying to improve soil throughout the world in a variety of ways.
- Think globally, but act locally, by finding ways to impact your local soil through a remediation project or educational outreach program.

Link to Next Generation Science Standards Performance Expectations

HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including costs, safety, reliability and aesthetics, as well as possible social, cultural and environmental impacts.



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